SAN RAFAEL HIGH SCHOOL

MASTER FACILITIES LONG-RANGE PLAN AND STADIUM PROJECT DRAFT ENVIRONMENTAL IMPACT REPORT

STATE CLEARINGHOUSE NUMBER 2016082017

Prepared for

San Rafael City Schools

December 2016

Prepared by

Amy Skewes-Cox, AICP

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In conjunction with

BASELINE ENVIRONMENTAL CONSULTING
ENVIRONMENTAL COLLABORATIVE
INTERACTIVE RESOURCES
LSA ASSOCIATES
NATALIE MACRIS
PARISI TRANSPORTATION CONSULTING

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1. INTRODUCTION

This document is an Environmental Impact Report (EIR) for the San Rafael Master Facilities Long-Range Plan, including the Stadium Project, prepared in accordance with the California Environmental Quality Act of 1970 (CEQA), as amended. This EIR addresses one of the Master Facilities Long-Range Plan elements—the Stadium Project—at a project level of detail in accordance with CEQA Guidelines Section 15161. The remaining Master Facilities Long-Range Plan elements are less refined at this stage, and therefore this EIR addresses them at a programmatic level of detail in accordance with CEQA Guidelines Section 15168. San Rafael City Schools (also referred to as the "District") is the lead agency for the project evaluated in this EIR and is the public agency with the principal responsibility for approving and carrying out the project.

CEQA requires that, before a project with potentially significant environmental effects may be approved, an EIR must be prepared that fully describes the environmental effects of the project, identifies mitigation measures to lessen or eliminate adverse impacts, and examines feasible alternatives to the project (CEQA Guidelines, Section15121(a)). An EIR should be prepared with a sufficient degree of analysis to provide decision-makers with information that enables them to make a decision that intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure (CEQA Guidelines, Section 15151).

This EIR is intended to provide the information and environmental analyses necessary to help the public understand the project and its likely environmental consequences, and to assist public agency decision-makers in considering the approvals necessary to implement the proposed project. As stated in Section 15125(a) of the CEQA Guidelines, the EIR addresses "baseline" conditions, which are the physical environmental conditions at the project site and vicinity that exist at the time of publication of the Notice of Preparation (NOP) (see **Appendix A**). The project impacts are then evaluated in comparison to these baseline conditions. In identifying the significant impacts of the project, this EIR concentrates on the project's substantial physical effects and on mitigation measures to avoid, reduce, or otherwise alleviate those effects. This EIR also describes and analyzes a reasonable range of alternatives, including a "No Project" alternative as required under CEQA (CEQA Guidelines, Section 15126.6). The determinations of the lead agency concerning the feasibility, acceptance, or rejection of each and all alternatives considered in this EIR will be addressed and resolved in the District's findings when it considers approval of the project, as required by CEQA.

Pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to projects related to the provision of classroom facilities. For this project, the District adopted Resolution No. 169.1, dated June 27, 2016, pursuant to Government Code Section 53094 exempting the project and the campus from any zoning ordinances or regulations of the City of San Rafael (where the project is located), including, without limitation, the City's Municipal Code, the City's General Plan, and related ordinances and regulations that otherwise would be applicable.

1.1 PROJECT BACKGROUND

San Rafael City Schools proposes building demolitions, renovations, and new construction for the campus that would result in the addition of 48,222 gross square feet (gsf) of building square footage on the campus. About 84,015 gsf in 12 buildings (including bleachers and concession stands) would be removed and 132,237 gsf in 10 new buildings would be added to the site. Additionally, three buildings would be modernized. At completion, about 327,892 gross square feet of building area would be provided on the campus in buildings that would be one, two, or three stories in height. Total on-campus enrollment would increase by about 200 students. No new staff or faculty increases are projected.

The EIR will be a Program EIR for many of the proposed improvements because specific details and designs have not yet been completed, including proposed Building No. 1 (Science, to also house Madrone High Continuation School on first floor), Building No. 2 (Administration/ Kitchen/Student Commons/Classrooms), Building No. 3 (Career and Technical Education [CTE]/Art), Building No. 4 (Classrooms/Ceramics/Theater), Building No. 7 (Wrestling/Dance/ Classrooms), and Building No. 8 (Restroom/Changing Rooms). In addition, Building A (Administration/Theater/Classrooms), Building D (Classroom/Library), and Building K (Head Start) would be modernized. The main buildings proposed for demolition include Building F (Science), Building I (Madrone/Cafeteria), Building L (Photography/Ceramics), Building M (Auto Tech/Wood Shop), Building O (Academy), Building P1 (Gymnasium, partial), Building R (Art), and Building W (Daycare Shed). In addition, the Master Facilities Long-Range Plan program improvements would include overall site improvements such as new landscaping, new pathways, reconfiguration of parking lots, new utility lines and improvements (water, wastewater, gas, electricity, telecommunications, and storm drainage), new bicycle parking facilities, and new lighting.[1]

However, the proposed improvements for the Stadium Project will be addressed at a project level of detail in the EIR. The proposed Stadium Project is located in a central portion of the campus, south of the existing gymnasium and east of the Library and Classrooms building where the existing stadium is located. New synthetic turf would replace the existing grass turf that now exists, thus extending the seasonal use of the field, and a new nine-lane 400-meter all-weather track in a broken-back layout would replace the existing eight-lane track/nine-lane straight-away. A number of other improvements would occur at the stadium portion of the campus such as energy-efficient lighting to replace existing lighting (stadium lighting and other security lighting), a new announcer's booth and public address system to direct sound to bleachers and the field, a new scoreboard, new parking for up to 39 cars and 1 bus at the south end of the field (just north of 3rd Street) with a new exit driveway onto 3rd Street at this location, replacement of utilities, new furnishings, a new concessions stand (Building No. 5) and ticket booth (Building No. 17 in Figure 3-6), new restrooms (Building No. 10), replacement of existing bleachers/grandstand (Building V) with new bleachers/grandstand (Building No. 9), new changing rooms/restrooms (Building No. 6), and a new plaza. The main buildings proposed for demolition include Building V (Bleachers), Building X (Press Box), Building Y (Concession Stand), and Building Z (Ticket Booth). In addition, the Stadium

[1] Two figures, Figure 3-4 and 3-6, show proposed changes on the campus. The two figures use different numbering systems for campus buildings. This EIR generally uses the building numbering/lettering system from Figure 3-4. When the numbering system from Figure 3-6 is used, a cross-reference to Figure 3-6 is included.

Project would include overall site improvements such as new landscaping, fencing, storage, new pathways, new bicycle parking facilities, storm drain improvements, and new utilities.

1.2 NOTICE OF PREPARATION

San Rafael City Schools, as lead agency, determined during the preliminary review of the project that preparation of an EIR was necessary for the project. The Notice of Preparation (NOP) for the EIR was circulated from August 5, 2016, to September 6, 2016, and can be found in **Appendix A**. August 5, 2016, the date of the NOP, is the date assumed for the “baseline” conditions against which the environmental impacts of the proposed project are analyzed. Copies of the comments received in response to the NOP are included in Appendix A of this EIR.

As stated in the NOP (see **Appendix A**), the District determined that the following environmental factors would not warrant further discussion in the EIR because they are not applicable to the project or project site:

- Agriculture and Forestry
- Mineral Resources
- Population and Housing

This EIR was prepared based on the comments received on the NOP and the project information provided. The following topics were found to have potential environmental impacts and thus are addressed herein in this EIR:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Public Services
- Transportation/Traffic
- Utilities and Service Systems
- Energy
- Recreation

1.3 PUBLIC REVIEW

This Draft EIR will be circulated for review and comment by the public and other interested parties, agencies, and organizations for a 45-day period as indicated on the Public Notice of Availability of this document. During the public review period, written comments on the adequacy of the Draft EIR may be submitted to:

Mr. Dan Zaich

San Rafael City Schools
310 Nova Albion Way
San Rafael, CA 94903

Written comments via email can be sent to **dzaich@srcs.org.**

Responses to all substantive comments received on the adequacy of the Draft EIR and submitted within the specified review period will be prepared and included in the Responses to Comments/ Final EIR. Prior to approval of the project, the District must certify the Final EIR and adopt a Mitigation Monitoring and Reporting Program (MMRP) for mitigation measures identified in the EIR, in accordance with the requirements of California Public Resources Code (PRC), Section 21001.

1.4 ORGANIZATION OF THE EIR

This Draft EIR is organized into the following chapters:

Chapter 1, Introduction: Provides an introduction and overview that describes the intended use of this EIR, project background, the EIR process, and organization of the document.

Chapter 2, Summary: Briefly describes the project and concerns associated with it, identifies levels of significance for each impact addressed in the EIR, summarizes the project-specific effects of the project, identifies mitigation measures, and compares impacts of the project with those of alternatives to the project. Table 2-2, Summary of Environmental Impacts and Mitigation Measures, is provided at the end of Chapter 2.

Chapter 3, Project Description: Contains information on the project site, project objectives, and project characteristics.

Chapter 4, Environmental Setting, Impacts, and Mitigation Measures: Contains an analysis of environmental topics. Each topic is addressed in a separate section. Each section is divided into an *Introduction* that describes the general content and approach used for the topic; an *Environmental Setting* section that describes baseline environmental information; a *Regulatory Framework* section that describes federal, state, and local regulations applicable to the topic; and an *Environmental Impacts and Mitigation Measures* section that describes project-specific impacts and mitigation measures, along with cumulative impacts.

Chapter 5, Alternatives: Assesses impacts of two alternatives to the project, including a No Project Alternative and a Reduced Scale Alternative. The alternatives are compared to the proposed project and an “Environmentally Superior Alternative” is identified.

Chapter 6, CEQA Considerations: Contains sections required by CEQA, including a discussion of cumulative impacts, growth inducement, and significant unavoidable impacts.

Chapter 7, EIR Authors: Lists the persons directly involved in preparing this report.

Chapter 8, References: Lists the persons, agencies, and organizations contacted and documents used during preparation of this report.

Appendices: The following appendices are included on a disk at the back of the hard copies of the EIR:

Appendix A: Notice of Preparation, Response to Notice of Preparation, and Summary of Scoping Meeting Comments
Appendix B: Air Quality Background Data
Appendix C: Historic and Cultural Resources Studies
Appendix D: Noise Background Data
Appendix E: Greenhouse Gas Emissions Data
Appendix F: Transportation Background Data

1.5 REFERENCES

California Environmental Quality Act (CEQA), Public Resources Code Sections 21000 to 21189.3, as amended January 1, 2016.

CEQA Guidelines, 14 California Code of Regulations (CCR) Sections 15000-15387, as amended December 1, 2013.

California Government Code, Section 53094, effective January 1, 2002.

2. SUMMARY

This chapter briefly describes the proposed San Rafael High School Master Facilities Long-Range Plan and the proposed Stadium Project. It also summarizes the impacts and mitigation measures identified in this EIR (see **Table 2-1**), as well as alternatives considered in this EIR.

2.1 PROJECT UNDER REVIEW

OVERVIEW OF PROJECT

The action that the Trustees of San Rafael City Schools will take relevant to the subject of this EIR is the approval/adoption of the components of the San Rafael High School (SRHS) Master Facilities Long-Range Plan (including the Stadium Project), which can be reviewed on the District's website (http://www.srcs.org/). The Master Facilities Plan that was approved by the District on July 27, 2015, was prepared before the passage of the bond measure to allow the Measure B Bond Program to clarify the work that needed to be done at the SRHS campus. However, the actual final planning based on the success of the bond resulted in the conceptual plan for the San Rafael City High School District for the SRHS campus that was formally approved by the District Board on April 18, 2016. This EIR addresses the overall program improvements of the Master Facilities Long-Range Plan at a program-level, and includes an examination of the Stadium Project improvements at a project-level. Thus, this current project that is the subject of this EIR will be called the San Rafael High School Campus EIR (Master Facilities Long-Range Plan and Stadium Project).

This EIR addresses one of the Long-Range Plan elements—the Stadium Project—at a project level of detail in accordance with California Environmental Quality Act (CEQA) Guidelines Section 15161. The remaining Long-Range Plan elements are less refined at this stage, and therefore this EIR addresses them at a programmatic level of detail in accordance with CEQA Guidelines Section 15168.

Therefore, this EIR is both a program EIR on the Master Facilities Long-Range Plan program improvements and a project EIR for the Stadium Project. A program EIR addresses a series of actions that are related and part of one large project. This approach allows the EIR to address the cumulative impacts of these actions and to recommend program-wide mitigation measures. If a later activity would have impacts that are not addressed in the program EIR, additional environmental review may be needed at that time.

This EIR addresses the following proposed new SRHS buildings at the program level of detail:

- Science Building (to also house Madrone High Continuation School on first floor) (Building No. 1)
- Administration/Kitchen/Student Commons Building and Four Classrooms (Building No. 2)
- Career and Technical Education (CTE)/Art Building (Building No. 3)
- Classrooms/Ceramics/Theater (Building No. 4)
- Wrestling/Dance/Classrooms (Building No. 7)
- Restroom/Changing Rooms (Building No. 8)

In addition, Buildings A (Library), D, and K would be modernized.

The following proposed buildings are addressed at the project level because these are associated with the proposed Stadium project:

- Concessions (Building No. 5)
- Restrooms/Changing Rooms (Building No. 6)
- Bleachers (Building No. 9)
- Restrooms (Building No. 10)

These buildings are all shown in Figure 3-4 in Chapter 3, which also provides a summary of existing campus buildings and an overall site plan to show where certain buildings would be replaced by new buildings. The district proposes building demolitions, renovations, and new construction for the campus. A total of 84,015 gross square feet (gsf) of existing buildings would be removed and 132,237 gsf of new buildings would be constructed. At completion, the SRHS campus would have 327,892 gsf of campus buildings, an increase of 48,222 gsf on the campus compared to existing conditions.

Madrone High Continuation School is continuing on the campus but would be moving to a new building at the north end of the campus, closer to Mission Avenue (Building 1).

Total on-campus enrollment would increase by 200 students. No new staff or faculty increases are projected.

AREAS OF POTENTIAL CONTROVERSY

A Notice of Preparation (NOP) was prepared by San Rafael City Schools to obtain comments from agencies and the public regarding issues to be addressed in the EIR. The NOP can be viewed at the District's website, at the following address: https://srcs-ca.schoolloop.com/file/1217027460308/1424590922885/2958089123095427979.pdf?filename=2016%2B0803%2BFinal%2BNOP-SRHS.pdf.

The Initial Study was circulated for public review for over 30 days (the required circulation period) between August 5, 2016 and September 6, 2016. Copies of the comments received in response to the NOP are included in **Appendix A** of this EIR.

The EIR was prepared based on the comments received on the NOP and the project information provided. In addition, one scoping meeting was held at the San Rafael High School to address public concerns related to the project. Concerns raised at the meeting and in response to the NOP included the following:

- Increased traffic; traffic safety; and parking
- Lighting
- Cultural resources impacts to historic and archaeological resources
- Increased greenhouse gas emissions
- Fire hazard from eucalyptus groves
- On-site flooding and increase in runoff from the project
- Adequacy of infrastructure
- Recycling opportunities

- Water quality impacts
- Fire protection

The following CEQA topics were found to have potential impacts and thus are addressed in this EIR:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Public Services
- Transportation/Traffic
- Utilities and Service Systems
- Energy
- Recreation

2.2 IMPACTS AND MITIGATION MEASURES

Under CEQA, a significant effect on the environment is defined as a substantial or potentially substantial adverse change in any of the physical conditions within the area affected by a project, including effects on land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance (CEQA Guidelines Section 15382). In this EIR, the criteria used to determine whether or not effects are significant are included in the "Environmental Impacts and Mitigation Measures" section for each topic discussion.

All potential impacts identified for the project could be mitigated to a less-than-significant level except for impacts associated with traffic impacts that need to be mitigated in conjunction with the City of San Rafael, or that cannot be implemented within a known time period.

Prior to approval of the project, written findings regarding each of the identified environmental impacts must be prepared. Also, a monitoring program for the mitigation measures must be adopted. This monitoring program will be prepared as part of the Final EIR for this project.

2.3 ALTERNATIVES TO THE PROJECT

Chapter 5, Alternatives, of this EIR addresses two alternatives to the project. The No Project Alternative addresses no change from existing conditions. The second alternative, called "Relocated Madrone High Continuation School Alternative," addresses the Master Plan with a one-story Science Building adjacent to Mission Avenue (vs. the proposed two-story building in this location) and the relocation of the Madrone High Continuation School to the northwest corner of the SRHS campus.

In Chapter 5, the No Project Alternative is found to be the environmentally superior alternative. Under CEQA, when the No Project Alternative is considered the environmentally superior alternative, another alternative must also be designated as such. The Relocated Madrone High Continuation School Alternative would be the environmentally superior alternative because it would reduce the scale of one building on Mission Avenue adjacent to a residential area and would have fewer students/faculty using Mission Avenue to access the campus. Madrone students would access the campus from Union Street. However, this alternative would not meet the project objectives related to developing a project in conformance with the Master Facility Long-Range Plan approved by the District in 2015. In addition, this alternative would not improve campus facilities to meet objectives related to upgrading campus facilities.

2.4 SUMMARY TABLE

Table 2-1 summarizes project impacts and mitigation measures for both the overall Master Plan and the Stadium Project that is evaluated at the project level in this EIR. The mitigation measures that are identified for the Stadium Project would also apply to the Master Facilities Long-Range Plan insofar that this project is covered by the Master Facilities Long-Range Plan. The table identifies each impact's level of significance both before and after mitigation.

2.5 REFERENCES

Hibsert Yamauchi Architects, Inc., 2016. Site Plan for San Rafael High School Master Facilities Implementation Plan. July.

San Rafael City Schools, 2015. San Rafael City Schools Master Facilities Plan (with assistance from Hibser Yamauchi Architects, Inc.). July.

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
Aesthetics			
AESTHETICS-1: Development in accordance with the Master Facilities Long-Range Plan could substantially degrade the existing visual character or quality of the site and its surroundings if new buildings do not respect the overall design of the campus and surrounding residences, or include adequate landscaping.	PS	AESHETICS-1a: New buildings shall be designed to be both contemporary in appearance and compatible with the materiality, features, size, scale, and proportion, and massing of the existing historic building (Building A) on campus. The new work shall be differentiated from the old and shall not create a false sense of historical development. AESTHETICS-1b: Building heights shall be less than 36 feet to be within the limits established by the City of San Rafael for the Public/Quasi-Public zoning district and to respect the scale of nearby residences. AESTHETICS-1c: New buildings shall be designed in a color scheme that is compatible with the neutral and earth-tone colors of existing buildings, with accent colors used for specific detailing. AESTHETICS-1d: The District shall establish Project Site Design Committees for the new buildings on the campus prior to development of schematic designs for new buildings (except for the Stadium Project, which has already undergone schematic design), and shall ensure that at least one public hearing is held for each project prior to development of construction drawings. The Project Site Design Committees shall include at least two representatives of the neighborhood. AESTHETICS-1e: Large expanses of flat wall area along Mission Avenue shall be avoided in new buildings (especially Building 4, which has a long east/west axis), and windows and architectural detailing shall be added to provide a more aesthetically pleasing view of buildings as seen from Mission Avenue. AESTHETICS-1f: A landscape plan shall be developed for the entire campus prior to construction of any new campus buildings in the campus core. This plan shall be reviewed by the District Board of Trustees at one public hearing that shall allow comments from the public. Suggestions from this hearing shall be considered prior to developing the final landscape plans that shall be developed prior to any construction within the campus core. The new landscape plan shall include groundcover and shrubbery at the north end of the site adjacent to Mission Avenue, where a narrow setback would exist between new buildings and the sidewalk area. New evergreen tree plantings shall occur along Mission Avenue to screen campus buildings from view, and to screen parking areas from view. Additional tree plantings with evergreen trees shall be included for the main existing parking area adjoining 3rd Street as well as for the new parking lot for 39 cars at the south end of the Stadium Project site. A minimum of five evergreen trees that are at least 24 feet at maturity shall be planted on the south side of this new parking area. All trees shall be planted from 24-inch boxes and shall be monitored for the first 3 years so that any lost trees can be replaced.	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		The combination of the above measures would reduce this potential impact to a less-than-significant level.	
AESTHETICS-2: Development in accordance with the Master Facilities Long-Range Plan could result in increased light and glare for the surrounding residential neighborhood due to lighting of facilities and outdoor areas.	PS	AESTHETICS-2: All new lighting shall be shielded to reduce off-site light and glare. Pedestrian pathway lighting shall be of a uniform style and quality of illumination that aids in navigation without over-lighting the surroundings. Signage lighting shall be minimized to provide context for pedestrians and drivers. Parking lot lighting shall be shielded and cast downward to minimize “light spillage” to off-site locations and shall be placed on timers so that minimal lighting occurs after 11:00 PM. To the extent practicable, area lighting and security lighting shall be controlled by the use of timed switches and/or motion detector activation to reduce energy consumption and excess lighting.	LTS
AESTHETICS-3: Lighting for the Stadium Project could result in increased light and glare for the surrounding residential neighborhood.	PS	AESTHETICS-3: The District shall install outdoor lighting that is light-emitting diode (LED) but that is no greater than 3,000 Kelvin and that minimizes the “blue-rich” lighting as a means of reducing glare in the community and protecting public health. All outdoor lighting shall be shielded and directed downwards to minimize “light spillage” to off-site locations. Lighting shall be on timers so that no lighting of the Stadium Project fields occurs after 11:00 PM. Pedestrian and security lighting shall be strategically placed in the Stadium Project vicinity so that excessive lighting does not occur and shall also be shielded and directed downward. When possible, motion activated lighting shall be used to minimize overall lighting of the Stadium Project area.	LTS
Air Quality			
AIR-1: Construction for the Master Facilities Long-Range Plan could violate an air quality standard or contribute substantially to an existing or projected air quality violation; or result in a cumulatively considerable net increase of a criteria pollutant (including ozone precursors) for which the project region is non-attainment under an applicable federal or state ambient air quality standard.	PS	AIR-1a: During project construction, the contractor shall implement a dust control program that includes the following measures: ▪ All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day. ▪ All haul trucks transporting soil, sand, or other loose material off-site shall be covered. ▪ All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited. ▪ All vehicle speeds on unpaved roads shall be limited to 15 miles per hour. ▪ All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used. ▪ A publicly visible sign shall be posted with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Bay Area Air Quality Management District (BAAQMD) phone number shall also be visible to ensure compliance with applicable regulations.	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		The foregoing requirements shall be included in the appropriate contract documents with the contractor	
		AIR-1b: Prior to construction of an individual project under the Master Facilities Long-Range Plan, a project-level analysis of criteria pollutant emissions during construction shall be prepared in accordance with BAAQMD CEQA Air Quality Guidance. If emissions exceed the BAAQMD's project-level thresholds of significance, then exhaust-control measures shall be identified to reduce emissions below the thresholds of significance. Acceptable exhaust-control measures for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, oxidation catalysts, diesel particulate filters, and/or other options as such become available. The contractor shall submit a Certification Statement to the San Rafael City Schools stating that the contractor agrees to comply fully with the identified exhaust-control measures (if any) and acknowledges that a significant violation of these measure shall constitute a material breach of contract. The foregoing requirement shall be included in the appropriate contract documents with the contractor.	LTS
AIR-2: Construction of the Master Facilities Long-Range Plan could expose sensitive receptors to substantial pollutant concentrations.	PS	AIR-2: Prior to construction of an individual project under the Master Facilities Long-Range Plan, a project-level health risk analysis of DPM and $PM_{2.5}$ emissions during construction shall be prepared in accordance with BAAQMD and OEHHA guidance. If the health risks and hazards from DPM and $PM_{2.5}$ emissions exceed the BAAQMD's project-level thresholds of significance, then exhaust-control measures shall be identified to reduce emissions below the thresholds of significance. Acceptable exhaust-control measures for reducing DPM and $PM_{2.5}$ emissions include the use of late model engines, diesel particulate filters, and/or other options as such become available. The contractor shall submit a Certification Statement to the San Rafael City Schools stating that the contractor agrees to comply fully with the identified exhaust-control measures (if any) and acknowledges that a significant violation of these measure shall constitute a material breach of contract. The foregoing requirement shall be included in the appropriate contract documents with the contractor.	LTS
AIR-3: Construction of the Stadium Project could expose sensitive receptors to substantial pollutant concentrations.	PS	AIR-3: During Stadium Project construction, the contractor shall use off-road equipment that meets the California Air Resources Board's Tier 2 (or higher) certification requirements. The contractor shall submit a Certification Statement to the San Rafael City Schools stating that the contractor agrees to comply fully with the Tier 2 (or higher) engine requirements described above and acknowledges that a significant violation of the measure shall constitute a material breach of contract. The foregoing requirements shall be included in the appropriate contract documents with the contractor.	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
Biological Resources			
BIO-1: Development under the Master Facilities Long-Range Plan may result in adverse impacts on nesting birds, if present on the site.	PS	BIO-1: Adequate measures shall be taken to avoid inadvertent take of raptor nests and other nesting birds protected under the Migratory Bird Treaty Act when in active use. This shall be accomplished by taking the following steps: ▪ If construction is proposed during the nesting season (February through August), a focused survey for nesting raptors and other migratory birds shall be conducted by a qualified biologist within 14 days prior to the onset of vegetation removal or construction, in order to identify any active nests on the project site and in the vicinity of proposed construction. ▪ If no active nests are identified during the survey period, or if development is initiated during the non-breeding season (September through February), construction may proceed with no restrictions. ▪ If bird nests are found, an adequate setback shall be established around the nest location and construction activities restricted within this no-disturbance zone until the qualified biologist has confirmed that any young birds have fledged and are able to function outside the nest location. Required setback distances for the no-disturbance zone shall be based on input received from the California Department of Fish and Wildlife (CDFW), and may vary depending on species and sensitivity to disturbance. As necessary, the no-disturbance zone shall be fenced with temporary orange construction fencing if construction is to be initiated on the remainder of the development site. ▪ A report of findings shall be prepared by the qualified biologist and submitted to the District for review and approval prior to initiation of construction within the no-disturbance zone during the nesting season (February through August). The report either shall confirm absence of any active nests or shall confirm that any young within a designated no-disturbance zone have fledged and construction can proceed.	LTS
BIO-2: Implementation of the Stadium Project could result in adverse impacts on nesting birds, if present in existing trees and other vegetation in the vicinity.	PS	BIO-2: Implement Mitigation Measure BIO-1.	LTS
Cultural Resources			
CULT-1: The Master Facilities Long-Range Plan could cause a substantial adverse change in the significance of archaeological deposits that qualify as historical resources, as defined in CEQA Guidelines Section 15064.5. Archaeological deposits could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site.	PS	CULT-1: Should an archaeological deposit be encountered during project subsurface construction activities, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. If the deposit is found to be significant (i.e., eligible for listing in the California Register of Historical Resources), the District shall	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		be responsible for funding and implementing appropriate mitigation measures. Mitigation measures may include recordation of the archaeological deposit, data recovery and analysis, and public outreach regarding the scientific and cultural importance of the discovery. Upon completion of the selected mitigations, a report documenting methods, findings, and recommendations shall be prepared and submitted to the District for review, and the final report shall be submitted to the Northwest Information Center at Sonoma State University. Significant archaeological materials shall be submitted to an appropriate curation facility and used for public interpretive displays, as appropriate and in coordination with a local Native American tribal representative. The District shall inform its contractor(s) of the sensitivity of the project area for archaeological deposits and shall verify that the following directive has been included in the appropriate contract documents: "The subsurface of the construction site may be sensitive for Native American archaeological deposits and associated human remains. If archaeological deposits are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any archaeological materials. Archaeological deposits can include shellfish remains; bones; flakes of, and tools made from, obsidian, chert, and basalt; and mortars and pestles. Contractor acknowledges and understands that excavation or removal of archaeological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5."	
<u>CULT-2</u>: The Master Facilities Long-Range Plan could cause a substantial adverse change in the significance of an archaeological resource, as defined in CEQA Guidelines Section 15064.5. Archaeological resources could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site.	PS	<u>CULT-2</u>: Implement Mitigation Measure CULT-1.	LTS
<u>CULT-3</u>: The Master Facilities Long-Range Plan could directly or indirectly destroy a unique paleontological resource or site by unearthing or otherwise displacing fossils that may occur below Holocene landforms underlying the project site.	PS	<u>CULT-3</u>: Should paleontological resources be encountered during project subsurface construction activities, all ground-disturbing activities within 25 feet shall be redirected and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. For purposes of this mitigation, a "qualified paleontologist" shall be an individual with the following qualifications: 1) a graduate degree in paleontology or geology and/or a person with a demonstrated publication record in peer-reviewed paleontological journals; 2) at least two	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		years of professional experience related to paleontology; 3) proficiency in recognizing fossils in the field and determining their significance; 4) expertise in local geology, stratigraphy, and biostratigraphy; and 5) experience collecting vertebrate fossils in the field. If the paleontological resources are found to be significant and project activities cannot avoid them, measures shall be implemented to ensure that the project does not cause a substantial adverse change in the significance of the paleontological resource. Measures may include monitoring, recording the fossil locality, data recovery and analysis, a final report, and accessioning the fossil material and technical report to a paleontological repository. Upon completion of the assessment, a report documenting methods, findings, and recommendations shall be prepared and submitted to the District for review. If paleontological materials are recovered, this report also shall be submitted to a paleontological repository such as the University of California Museum of Paleontology, along with significant paleontological materials. Public educational outreach may also be appropriate. The District shall inform its contractor(s) of the sensitivity of the project site for paleontological resources and shall verify that the following directive has been included in the appropriate contract documents: "The subsurface of the construction site may be sensitive for fossils. If fossils are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any paleontological materials. Fossils can include plants and animals, and such trace fossil evidence of past life as tracks or plant imprints. Ancient marine sediments may contain invertebrate fossils such as snails, clam and oyster shells, sponges, and protozoa; and vertebrate fossils such as fish, whale, and sea lion bones. Vertebrate land mammals may include bones of mammoth, camel, saber tooth cat, horse, and bison. Contractor acknowledges and understands that excavation or removal of paleontological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5."	
CULT-4: Ground-disturbing activities associated with the Master Facilities Long-Range Plan have the potential to unearth Native American human remains.	PS	CULT-4: Any human remains encountered during project ground-disturbing activities shall be treated in accordance with California Health and Safety Code Section 7050.5 and Mitigation Measure CULT-1. In addition, if human remains are identified during construction and cannot be preserved in place, the District shall fund 1) the removal of human remains from the project site by a qualified archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology, 2) the scientific analysis and documentation of the remains by a	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		qualified archaeologist, and 3) the reburial of the remains, as appropriate. Excavation, analysis, and reburial of Native American human remains shall be done in consultation with the Native American Most Likely Descendent, as identified by the California Native American Heritage Commission.	
CULT-5: The Master Facilities Long-Range Plan includes the construction of projects (Buildings 1, 2, 3, and 4) that do not yet have finalized designs and would be located near or adjacent to the original San Rafael High School building (Building A), a historical resource. Therefore, the proposed development would have the potential to cause a substantial adverse change in the significance of a historical resource.	PS	CULT-5: Proposed Buildings 1, 2, 3, and 4, which are in the immediate vicinity of the historical resource (Building A), shall require review by an architectural historian or historic architect who meets the Secretary of the Interior's Qualification Standards and is retained by the District for the purpose of verifying compliance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (the Standards). Typically, if a project follows the Standards, impacts on a historical resource shall be considered mitigated to a less-than-significant level. Therefore, designs for proposed Buildings 1, 2, 3, and 4 shall comply with the Standards, in order to ensure that the construction would not indirectly alter the historical resource's (Building A's) physical characteristics, such as setting, that convey its historical significance such that it is no longer eligible for listing in the California Register of Historical Resources. In compliance with the applicable Standard (Standard 9), the new work shall be differentiated from the old and shall be compatible with massing, size, scale, and architectural features of the historical resource.	LTS
CULT-6: The Master Facilities Long-Range Plan includes the modernization of the original San Rafael High School building (Building A), a historical resource. The changes would be primarily on the interior and there would be no change in the footprint. The design is not yet finalized and the proposed modernization would have the potential to cause a substantial adverse change in the significance of a historical resource.	PS	CULT-6: The proposed modernization of the historical resource (Building A), shall require review by an architectural historian or historic architect who meets the Secretary of the Interior's Qualification Standards and is retained by the District for the purpose of verifying compliance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (the Standards). Typically, if a project follows the Standards, impacts on a historical resource shall be considered mitigated to a less-than-significant level. Therefore, designs for the modernization of Building A shall comply with the Standards, in order to ensure that the construction would not directly alter the historical resource's (Building A's) physical characteristics, such as setting, that convey its historical significance such that it is no longer eligible for listing in the California Register of Historical Resources.	LTS
CULT-7: The Stadium Project could cause a substantial adverse change in the significance of archaeological deposits that qualify as historical resources, as defined in CEQA Guidelines Section 15064.5. Archaeological deposits could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site.	PS	CULT-7: Implement Mitigation Measure CULT-1.	LTS
CULT-8: The Stadium Project could cause a substantial adverse change in the significance of an archaeological resource, as defined in CEQA Guidelines Section 15064.5. Archaeological resources could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site.	PS	CULT-8: Implement Mitigation Measure CULT-1.	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
CULT-9: The Stadium Project could directly or indirectly destroy a unique paleontological resource or site by unearthing or otherwise displacing fossils that may occur below Holocene landforms underlying the project site.	PS	CULT-9: Implement Mitigation Measure CULT-3.	LTS
CULT-10: Ground-disturbing activities associated with the Stadium Project have the potential to unearth Native American human remains.	PS	CULT-10: Implement Mitigation Measure CULT-4.	LTS
Geology and Soils			
GEO-1: During its design life, development under the Master Facilities Long-Range Plan would likely be subject to strong groundshaking from a seismic event, creating the potential for a significant risk to structures and human lives.	PS	GEO-1: The San Rafael City Schools Board of Trustees shall demonstrate that school building design and construction comply with applicable requirements of the Field Act, including design, oversight, and inspection provisions. This shall include incorporation of public school seismic design standards established by the Division of the State Architect (DSA), review of plans by DSA, and inspections throughout construction by independent qualified inspectors. Prior to occupancy of new development under the Master Facilities Long-Range Plan, San Rafael City Schools must receive a certification of compliance from DSA that oversight and inspection of construction was completed in accordance with Field Act and other DSA requirements in accordance with DSA Procedure 13-02.	LTS
GEO-2: The Master Facilities Long-Range Plan would have the potential to expose people or structures to substantial adverse effects involving seismic-related ground failure, including liquefaction.	PS	GEO-2: For each project under the Master Facilities Long-Range Plan, the District shall ensure compliance with Mitigation Measure GEO-1.	LTS
GEO-3: Expansive, potentially unstable, and corrosive soils at the project site could result in structural damage to Master Facilities Long-Range Plan project improvements, creating the potential for a significant risk to structures and human lives.	PS	GEO-3: For each project under the Master Facilities Long-Range Plan, the District shall ensure compliance with Mitigation Measure GEO-1.	LTS
GEO-4: During its design life, the Stadium Project would likely be subject to strong groundshaking from a seismic event, creating the potential for a significant risk to structures and human lives.	PS	GEO-4: For the Stadium Project, the District shall ensure compliance with Mitigation Measure GEO-1.	LTS
GEO-5: The Stadium Project would have the potential to expose people or structures to substantial adverse effects involving seismic-related ground failure, including liquefaction.	PS	GEO-5: For the Stadium Project, the District shall ensure compliance with Mitigation Measure GEO-1.	LTS
GEO-6: Potentially unstable soils at the Stadium Project site could result in structural damage to project improvements, creating the potential for a significant risk to structures and human lives.	PS	GEO-6: For the Stadium Project, the District shall ensure compliance with Mitigation Measure GEO-1.	LTS
Greenhouse Gas Emissions			
The project would not result in any potentially significant greenhouse gas impacts.			

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
Hazards and Hazardous Materials			
HAZARDS-1: Development of the Master Facilities Long-Range Plan could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions, as demolition of existing structures could expose students and other members of the general public to hazardous materials related to building materials.	PS	HAZARDS-1: The San Rafael City Schools shall comply with provisions of the Department of Toxic Substances Control (DTSC) School Property Evaluation and Cleanup Program for development under the Master Facilities Long-Range Plan. This compliance shall include evaluation of potential hazards related to building materials in accordance with DTSC's Preliminary Endangerment Assessment Guidance Manual (Guidance Manual) and DTSC's Interim Guidance for Evaluation of School Sites With Potential Soil Contamination as a Result of Lead from Lead-Based Paint, Organochlorine Pesticides from Termiticides, and Polychlorinated Biphenyls from Electrical Transformers (Interim Guidance). This compliance shall include an assessment of the potential for lighting fixtures and caulking in buildings constructed prior to 1977 to contain polychlorinated biphenyls (PCBs), and the abatement of any materials containing PCBs above risk-based thresholds in the Guidance Manual. This compliance shall also include soil sampling in accordance with methodology in the Interim Guidance. Any contaminants identified above concentrations in the Data Interpretation and Assessment section of the Interim Guidance shall require remedial action under DTSC oversight.	LTS
HAZARDS-2: Development of the Stadium Project could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions, as demolition of existing structures has the potential to expose students and other members of the general public to hazardous materials related to building materials.	PS	HAZARDS-2: Implement Mitigation Measure HAZARDS-1.	LTS
Hydrology and Water Quality			
The project would not result in any potentially significant hydrology or water quality impacts.			
Land Use and Planning			
The project would not result in any potentially significant land use impacts.			
Noise			
NOISE-1: Development under the Master Facilities Long-Range Plan could expose persons to or generate a permanent increase in ambient noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	PS	NOISE-1: San Rafael City Schools shall use mechanical equipment selection and acoustical shielding to ensure that noise levels from the installation/modification of heating, ventilation, and air conditioning (HVAC) systems do not exceed 45 dBA L_{eq} inside of the nearest on-campus buildings, and do not exceed 60 dBA L_{max}/50 dBA L_{eq} during the daytime and 50 dBA L_{max}/45 dBA L_{eq} during the nighttime at the nearest residential receptors. Controls that would typically be incorporated to attain this outcome include locating equipment indoors or in less noise-sensitive areas, when feasible; selecting quiet equipment; and providing sound attenuators on fans, sound attenuator packages for	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		cooling towers and emergency generators, acoustical screen walls, and equipment enclosures.	
NOISE-2: Development under the Master Facilities Long-Range Plan could generate periodic increases in ambient noise levels in the project vicinity and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	PS	NOISE-2: San Rafael City Schools shall consult a qualified acoustical engineer in the design and selection of the new public address (PA) system for the Stadium Project. The qualified acoustical engineer shall confirm that sound is directed toward the field in a manner that reduces noise levels generated by the use of the PA system at approximately 50 feet outside the fence line of the school to below 80 dBA L_{max} to the maximum extent practicable (but in no case shall the new PA system increase noise levels relative to the existing system).	LTS
NOISE-3: Construction of the facilities proposed under the Master Facilities Long-Range Plan could generate temporary increases in ambient noise levels in the project vicinity and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	PS	NOISE-3a: To the maximum extent practicable, San Rafael City Schools shall schedule construction activities during periods when classes are not in session, such as summer, school breaks, and after class dismissal. San Rafael City Schools shall not allow the use of heavy construction equipment during established testing periods (e.g., finals week). NOISE-3b: For each project under the Master Facilities Long-Range Plan, a Construction Noise Management Plan shall be prepared by a qualified acoustical consultant and included in all contractor specifications. The Construction Noise Management Plan shall contain a set of site-specific noise attenuation measures to further reduce construction noise impacts at the nearby on-campus buildings and off-site residential receptors. If appropriate based on the circumstances, multiple projects can be addressed under one Construction Noise Management Plan. The site-specific noise attenuation measures shall be designed to reduce noise levels at the nearest on-campus and off-site receptors to below 70 dBA L_{eq}, as practical. The nearest on-campus receptors may be located adjacent to construction and demolition locations. If it is not feasible to reduce noise at the nearest on-campus receptors to below 70 dBA L_{eq} due to their proximity to the nearest construction and demolition locations, the school shall relocate students to classrooms with interior noise levels below 45 dBA L_{eq}. At a minimum, the following measures shall be included in the Construction Noise Management Plan: ▪ Use jetting or partial jetting of piles into place using a water injection at the tip of the pile, if feasible. ▪ Construct or use temporary noise barriers, as needed, to shield on-campus construction and demolition noise from noise-sensitive areas to the extent feasible. To be most effective, the barrier should be placed as close as possible to the noise source or the sensitive receptor. Examples of barriers include portable acoustically lined enclosure/housing for specific equipment (e.g., jackhammer and pneumatic-air tools, which generate the loudest noise), temporary noise barriers (e.g., solid plywood fences or portable panel systems, minimum 8 feet in height), and/or acoustical blankets, as feasible. ▪ To the extent feasible, establish construction staging areas at locations that would	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction. ▪ Ensure that construction equipment and trucks use the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds) wherever feasible. ▪ Use "quiet" models of air compressors and other stationary noise sources where technology exists. ▪ Prohibit all unnecessary idling of internal combustion engines and equip all internal combustion engine-driven equipment with an operating muffler or baffling system that are in good condition and appropriate for the equipment. ▪ Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from noise-sensitive land uses. Muffle the stationary equipment, and enclose within temporary sheds or surround by insulation barriers, if feasible. <u>NOISE-3c</u>: San Rafael City Schools shall develop a set of procedures for responding to and tracking complaints received pertaining to construction noise, and shall implement the procedures during construction of projects implemented under the Master Facilities Long-Range Plan. Contractor specifications shall include these procedures. At a minimum, the procedures shall include: a) Designation of a construction complaint and enforcement manager for the project; b) Protocols specific to receiving, responding to, and tracking received complaints; and c) Maintenance of a complaint log that records received complaints and how complaints were addressed. *The contact information of the construction complaint and enforcement manager shall be posted in conspicuous locations at the construction site.* <u>NOISE-3d</u>: Residences located within 250 feet of a project implemented under the Master Facilities Long-Range Plan shall be provided with written notice of construction activity within at least 10 days before work begins, except in the case of an emergency. The notice shall state the date of planned construction activity in proximity to that residence and the range of hours during which maximum noise levels are anticipated. The notice shall also include the contact information of the construction complaint and enforcement manager identified in Mitigation Measure NOISE-3c. The combination of the above measures would reduce this impact to a less-than-significant level.	

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
NOISE-4: Development under the Master Facilities Long-Range Plan could expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.	PS	NOISE-4a: Mitigation Measures NOISE-3a through NOISE-3d shall be implemented. NOISE-4b: San Rafael City Schools shall retain a structural engineer or other qualified professional to evaluate and recommend alternative methods to impact pile driving for project components that require the installation of piles. If it is not feasible to avoid impact pile driving, the structural engineer or other qualified professional shall evaluate the potential for vibration generated by the use of a pile driver during construction of a project implemented under the Master Facilities Long-Range Plan to damage off-site buildings within 100 feet of any impact pile-driving activities. The evaluation shall take into account project-specific information such as the composition of the structures, locations of the piles, and the soil characteristics in the project area, to determine whether impact pile driving may cause damage to nearby structures. If the evaluation finds that the impact pile driving may cause damage to a structure, the structural engineer or other qualified professional shall recommend design means and methods of construction to avoid the potential damage. The combination of Mitigation Measures NOISE-4a and NOISE-4b would reduce this impact to a less-than-significant level.	LTS
NOISE-5: Development of the proposed Stadium Project could generate periodic increases in ambient noise levels in the project vicinity above levels existing without the project and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	PS	NOISE-5: Mitigation Measure NOISE-2 shall be implemented.	LTS
NOISE-6: Construction of the proposed Stadium Project could generate a temporary increase in ambient noise levels in the project vicinity above levels existing without the project and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	PS	NOISE-6: Mitigation Measures NOISE-3a through NOISE-3d shall be implemented.	LTS
NOISE-7: Development of the proposed Stadium Project could expose persons to or generate excessive ground-borne vibration or ground-borne noise levels.	PS	NOISE-7: Mitigation Measures NOISE-3a through NOISE-3d shall be implemented.	LTS
Public Services			
The project would not result in any potentially significant public services impacts.			
Transportation/Traffic			
TRANS-1: Assuming student travel mode shares and vehicle trip distribution patterns remain consistent with those under existing conditions, implementation of the Master Facilities Long-Range Plan	PS	TRANS-1a: San Rafael City Schools shall develop a Transportation Demand Management (TDM) program for San Rafael High School that focuses on reducing vehicle trips and improving traffic flow by implementing a series of measures including, but not limited to,	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
would increase single-occupancy vehicular travel as well as overall vehicular traffic levels along key access roadways, including Mission Avenue and 3rd Street. The addition of these Long-Range Plan-related vehicular trips would degrade traffic flows along these key access roadways. Maintaining the existing student travel mode shares and the resulting increase in single-occupancy vehicular travel would conflict with the city-wide policies and programs established to manage congestion and improve mobility as documented in the San Rafael General Plan. These Long-Range Plan-related conditions would particularly conflict with Program C-11e (Reduction of Single Occupant Vehicles) and Program C-13a (School Transportation).		the following: ▪ Updating and enforcing elements of the school's transportation measures in the School Handbook, such as requiring on-site parking permits; instructing parents and students on expected travel routes to use, drop-off/pick-up locations, and appropriate driver behaviors; and providing bus stop and bus route information. ▪ Working with the San Rafael High School Athletic Department to ensure that sports-related drop-offs and pick-ups are directed to use the school parking lots accessible via 3rd Street. ▪ Providing wayfinding signage and informational material (e.g., flyers, emails, etc.) to visitors prior to major sports and/or special events that would direct traffic to the 3rd Street driveways. ▪ Considering promotion of carpool trips, and designating specific on-site parking spaces for carpool use only. ▪ Enrolling and actively participating in Marin County's Safe Routes to School program to take advantage of resources focused on reducing single-student occupant vehicle trips and to promote walking, bicycling, use of public transit, and carpooling. ▪ Providing personnel (trained using the American Automobile Associate School Safety Patrol curriculum) to monitor and facilitate drop-off and pick-up activities along Mission Avenue. ▪ Conducting periodic monitoring of traffic, including single-student occupant vehicles and carpools, pedestrian and bicycle trips, and school trips made by public transit to gauge success and promote appropriate measures to reduce vehicle trips. <u>TRANS-1b</u>: To the extent feasible, San Rafael City Schools shall work with the City of San Rafael to update the listed address of San Rafael High School such that the school's main access point is identified with a 3rd Street address rather than its current designated 185 Mission Avenue address. The implementation of this mitigation measure would encourage some traffic, including sports events traffic and freight traffic, away from neighborhood streets north of the SRHS campus and onto 3rd Street. Successful implementation of a TDM program that retains current traffic levels, or reduces traffic levels, with the addition of up to 200 additional students would reduce Impact TRANS-1 to a less-than-significant level.	
<u>TRANS-2</u>: The addition of project-generated vehicular traffic onto local roadways would increase traffic congestion, particularly on Mission Avenue due to increased drop-off and pick-up activities. This would deteriorate traffic flow along Mission Avenue, which lacks adequate loading and unloading zones. This would also present a safety hazard as it would increase potential conflicts between vehicular traffic and	PS	<u>TRANS-2a</u>: San Rafael City Schools shall, as feasible, work with the City of San Rafael to extend westward the existing passenger loading zone by up to 300 feet, for a new passenger loading zone spanning the length of the south side of Mission Avenue between Alice Street and Park Street. The extension of the loading zone would be accomplished either by painting the adjacent	SU

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
pedestrian and bicycle traffic. These impacts would conflict with the San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow).		roadway curb white or moving the roadway's curb and sidewalk south, if feasible. Accompanying signage would also be installed that would designate the area as a passenger loading zone. The loading zone extension would result in the loss of about 12 vehicular parking spaces. However, the zone would enhance roadway safety by increasing the designated area of drop-off, allowing vehicles to pull over for drop-off and pick-up activities and avoid hindering traffic flow along Mission Avenue. TRANS-2b: The District shall consider the implementation of a remote drop-off and pick-up program. The program would designate off-site passenger loading location to divert school-related vehicle trips to locations within a one-quarter-mile radius of the site. This would reduce traffic congestion along neighborhood streets adjacent to the school site, and promote student health by allowing students to walk the distance between the off-site location and the school campus. The mitigation measure would support San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow) and Program C-13a (School Transportation). The roadway curb and potential remote drop-off and pick-up locations fall under the jurisdiction of the City of San Rafael, and therefore the changes recommended in this mitigation measure would be subject to approval by the City's Public Works Department. Implementation of this measure would reduce Impact TRANS-2 to a less-than-significant level, but because the mitigation measure requires coordination with the City of San Rafael, its implementation cannot be assured. The impact is therefore considered significant and unavoidable.	
TRANS-3: The addition of project-generated vehicular traffic would increase average vehicular delay by more than 5 seconds at two intersections—Union Street/Mission Avenue, and San Rafael High School Driveway (West)/3rd Street—under near-term (year 2020) plus Master Facilities Long-Range Plan conditions, and at two intersections—Union Street/Mission Avenue and San Rafael High School Driveway (West)/3rd Street—under cumulative (year 2040) plus Master Facilities Long-Range Plan conditions. The additional average vehicular delay under near-term (year 2020) plus Master Facilities Long-Range Plan conditions would degrade intersection operating conditions from level of service (LOS) D to LOS F at one intersection. The additional average vehicular delay and degradation of level of service operations would represent a significant impact as defined by City of San Rafael significance thresholds.	PS	TRANS-3a: As feasible, San Rafael City Schools shall work with the City of San Rafael to implement the reconfiguration of the Union Street/Mission Avenue intersection to provide two lanes in the westbound direction (a left-turn lane, and a shared through and right-turn lane) and two lanes in the northbound direction (a shared through and left-turn lane, and a right-turn lane). The additional lanes could be introduced by restriping the existing roadway to provide the additional lane markings within the existing right-of-way. The intersection reconfiguration would require use of the roadway's existing width to accommodate the additional lanes. This would be achieved by removing up to 160 feet of parking along both sides of westbound Mission Avenue, causing the loss of approximately eight parking spaces on both sides of the street, including the passenger loading zone on the south side of Mission Avenue. However, as detailed in the parking study (provided in Appendix F-7 of this EIR), the adjacent streets are operating at under 70 percent occupancy levels and could accommodate the parking demand from the displaced parking spaces. If feasible, and to the extent that California Department of Education (CDE)-mandated	SU

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		school site size requirements (CDE Guide to School Site Analysis and Development 2000 Report) would not be violated, an alternative roadway reconfiguration could include potentially moving the roadway curb and sidewalk southerly (onto District property) to provide the extra lane width and minimize the loss of parking along Mission Avenue. The new lane reconfiguration would potentially reduce vehicular queue lengths along the westbound direction of Mission Avenue to under 100 feet in near-term (year 2020) plus Master Facilities Long-Range Plan conditions and under 120 feet in cumulative (year 2040) plus Master Facilities Long-Range Plan conditions. <u>TRANS-3b</u>: There is no feasible measure to mitigate the intersection impacts at the two San Rafael High School driveway intersections along 3rd Street. Vehicles turning left from the driveway south of the San Rafael High School driveway (west)/3rd Street intersection would experience an increase of up to about 46 seconds of delay under the Cumulative (year 2040) plus Master Facilities Long-Range Plan conditions. Under this scenario, this movement is projected to be about 11 vehicles during the morning peak hour. These vehicles would have to wait for sufficient gaps in traffic to make the left turn. While the additional delay would inconvenience these vehicles, it would only occur during the very short peak hours of school-related vehicular trip generation and would dissipate thereafter. Implementation of Mitigation Measure TRANS-3a would reduce the impact at the Union Street/Mission Avenue intersection to a less-than-significant level. However, the improvement's design and construction would be subject to approval and implementation by the City of San Rafael Public Works Department, and therefore its implementation cannot be assured. There is no feasible mitigation for impacts at the two San Rafael High School driveway impacts on 3rd Street. Impact TRANS-3 would therefore remain significant and unavoidable.	
<u>TRANS-4</u>: Implementation of the Master Facilities Long-Range Plan would increase the number of students walking and bicycling along key routes, including roadways and sidewalks, and across curb ramps and crosswalks. Many of the existing pedestrian and bicycle facilities serving the San Rafael High School campus do not adequately accommodate the existing levels of pedestrian traffic and would be further degraded with the addition of pedestrian and bicycle traffic generated by the Long-Range Plan. The increased traffic would decrease the overall performance and safety of these facilities.	PS	<u>TRANS-4a</u>: As feasible, San Rafael City Schools shall work with the City of San Rafael to implement the design and construction of the following school-area improvements: ▪ Upgrading all school area traffic controls in accordance with Chapter 7 (Controls for School Areas) of the California Manual of Uniformed Traffic Control Devices (MUTCD). For the District, upgrades would include increasing school-related signage (e.g., School Ahead, School Crosswalk, etc.) and pavement markings (e.g., Slow School Xing), and refreshing crosswalks and pavement stencils along roadways serving the campus (i.e., Mission Avenue between Mary Street and Belle Avenue, Union Street between 3rd Street and Mission Avenue, and Mary Street Between 3rd Street and Mission Avenue). ▪ Constructing about 100 feet of sidewalk along the north side of Mission Avenue just east of Belle Avenue, to fill a sidewalk gap at a well-trafficked intersection.	SU

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
		▪ Reconstructing non-compliant curb ramps, as appropriate, to meet Americans with Disabilities Act (ADA) standards at intersection locations peripheral to the school i.e., San Rafael High School Driveway (East)/3rd Street, Embarcadero Way/3rd Street, Mission Avenue/Belle Avenue, Mission Avenue/Alice Street, Mission Avenue/Park Street, and Mission Avenue/Union Street. ▪ Providing enhanced crosswalks (e.g., rectangular rapid flashing beacons, pedestrian hybrid beacon, and/or lighting), if considered warranted by the City of San Rafael Public Works Department, at the 3rd Street's crosswalk at Embarcadero Way and at Union Street's crosswalk at 4th Street. ▪ Endorsing the City of San Rafael's efforts to improve pedestrian conditions along the south side of Mission Avenue between Belle Avenue and Embarcadero Way. Future improvements could include, but would not be limited to, providing earthwork and/or structural fill along the hillside, a continuous pedestrian walkway, and additional supply of on-street parking. TRANS-4b: As feasible, San Rafael City Schools shall work with the City of San Rafael to implement the design and construction of an enhanced crosswalk across 3rd Street at the San Rafael High School Driveway (West)/3rd Street intersection. As feasible and necessary, the crosswalk would include a pedestrian refuge island and rectangular rapid flashing beacons to facilitate pedestrian crossing at this intersection. TRANS-4c: San Rafael City Schools shall enroll and actively participate in Marin County's Safe Routes to School program and host educational programs that inform students of pedestrian behavior that would enhance safety when walking to and from school. These mitigation measures would improve pedestrian and bicyclist facilities serving the San Rafael High School campus. The measures would enhance pedestrian and bicyclist safety within the vicinity of the campus by increasing visibility and reducing potential points of conflict with vehicular traffic. The measures would comply with the City of San Rafael's Bicycle/Pedestrian Master Plan Policy C-1 (Complete missing connections to establish direct routes for walking), Policy C-2 (Identify and mitigate impediments and obstacles to walking to school, such as through a Safe Routes to School program), and Policy C-4 (Support the installation of appropriate pedestrian facilities as part of all new transportation improvements, development projects and transit facilities). Implementation of the above measures would reduce Impact TRANS-4 to a less-than-significant level. However, since the design and implementation of the above measures shall be subject to approval and implementation by the City of San Rafael Public Works Department, their implementation cannot be assured. Impact TRANS-4 would therefore remain significant and unavoidable.	

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
TRANS-5: Implementation of the Master Facilities Long-Range Plan would increase the number of students bicycling along key routes, including roadways and sidewalks, and across crosswalks. Since none of these roadways are wide enough to include separated bicycle lanes, cyclists would be required to share vehicular travel lanes or ride along sidewalks. These conditions would discourage the use of alternative modes of transportation and conflict with the San Rafael General Plan Policy C-11 (Alternative Transportation Mode Users).	PS	TRANS-5a: San Rafael City Schools shall increase the capacity of the on-campus bicycle parking facility to safely and securely accommodate up to 100 bicycles. TRANS-5b: San Rafael City Schools shall work with the City of San Rafael and Marin County's Safe Routes to Schools program in efforts to obtain a grant to conduct a study on the feasibility of implementing a new bicycle and pedestrian pathway to serve the San Rafael High School campus. The pathway could provide access to the school from either the intersection of Union Street/4th Street, along the south of Mission Avenue just east of Park Street, along the north side of 3rd Street, or at other locations to be identified upon further study. The intent of the path would be to directly link to campus walking paths and bicycle parking. The study shall identify potential pathway alignments, impacts, and connection details, as well as circulation along 4th Street to the west and Mission Avenue to the north. The feasibility study, funded by grant funds as available, shall be conducted in coordination with the City of San Rafael Public Works Department. If feasible, the pathway shall be constructed and shall be coordinated with implementation of the Master Facilities Long-Range Plan. TRANS-5c: San Rafael City Schools shall enroll and actively participate in Marin County's Safe Routes to School program and (among other activities) host educational and encouragement programs that inform students of the benefits of bicycling to and from school. The implementation of these measures (except the provision of additional bicycle parking recommended in Mitigation Measure TRANS-5a) requires the involvement of the City of San Rafael and Marin County's Safe Routes to Schools program. Furthermore, it is not known if this pathway can be constructed, or if grant money would be available. Therefore, implementation of Mitigation Measures TRANS-5b and TRANS-5c is not assured, and Impact TRANS-5 would be significant and unavoidable.	SU
TRANS-6: The construction of components of the Master Facilities Long-Range Plan would add construction-related vehicle trips to City of San Rafael and other jurisdictional roadways, creating temporary traffic hazards. These conditions would conflict with San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow).	PS	TRANS-6: Development under the Master Facilities Long-Range Plan shall abide by the City of San Rafael's provisions regarding transportation and parking management during demolition and construction activities. In addition, San Rafael City Schools shall develop a demolition/construction traffic management plan defining hours of operation, specified truck routes, and construction parking provisions. The District shall ensure that any parking losses associated with construction vehicles does not affect parking availability on campus. To the greatest extent possible, the District shall direct all construction truck traffic to travel to and from the campus via 3rd Street. Implementation of this measure would reduce Impact TRANS-6 to a less-than-significant level.	LTS
TRANS-7: The construction of components of the Stadium Project would add construction-related vehicle trips to City of San Rafael and other	PS	TRANS-7: The Stadium Project shall abide by the City of San Rafael's provisions regarding transportation and parking management during demolition and construction	LTS

TABLE 2-1 SUMMARY OF IMPACTS AND MITIGATION MEASURES

Impact	Level of Sig. Without Mitigation	Mitigation Measure	Level of Sig. After Mitigation
jurisdictional roadways, creating temporary traffic hazards. These conditions would conflict with San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow).		activities. In addition, San Rafael City Schools shall develop a demolition/ construction traffic management plan defining hours of operation, specified truck routes, and construction parking provisions. Implementation of this measure would reduce Impact TRANS-7 to a less-than-significant level.	
Utilities and Service Systems			
The project would not result in any potentially significant utilities and service systems impacts.			
Energy			
The project would not result in any potentially significant energy impacts.			
Recreation			
REC-1: The Master Facilities Long-Range Plan would include recreational facilities that might have an adverse physical effect on the environment.	PS	REC-1: San Rafael City Schools shall comply with all mitigation measures identified in this EIR. Compliance with these measures would ensure that the impact of recreational facilities included in the Master Facilities Long-Range Plan would be reduced to a less-than-significant level.	LTS
REC-2: The Stadium Project would consist of recreational facilities that might have an adverse physical effect on the environment.	PS	REC-2: San Rafael City Schools shall comply with all mitigation measures for the Stadium Project that are identified in this EIR. Compliance with these measures would ensure that the impact of Stadium Project would be reduced to a less-than-significant level.	LTS

3. PROJECT DESCRIPTION

3.1 INTRODUCTION

The San Rafael City Schools Board of Education, hereinafter referred to as the Trustees, will serve as the lead agency for the Environmental Impact Report (EIR) at the project level for the proposed Stadium Project at San Rafael High School, and at a program level for the Master Facilities Long-Range Plan for San Rafael High School and Madrone High Continuation School Campus.[1]

The San Rafael City Schools Master Facilities Plan (San Rafael City Schools, 2015)[2] covers all of the schools within the San Rafael City Schools' jurisdiction, and only a portion of that plan addresses the San Rafael High School and Madrone High Continuation School Campus.[3] This EIR does not cover any other parts of the Master Facilities Plan that are not related to the campus.

Measure B was passed by the City of San Rafael voters in 2015. It provides $161 million to fund updates to the San Rafael/Madrone and Terra Linda High School campuses as follows: update, renovate, and construct science, technology, engineering, and math/core academic classrooms; replace aging electrical, plumbing, and heating, ventilation, and air conditioning (HVAC) systems; make classrooms accessible for students with disabilities; and repair, construct, and equip classrooms, sites, and facilities (County of Marin, 2016). The San Rafael High School (SRHS) Master Facilities Long-Range Plan addresses the specific improvements on the Campus. This overall program, including the proposed Stadium Project, is the subject of this EIR. The Trustees will be responsible for certifying the EIR to ensure that the document meets all the requirements of the California Environmental Quality Act (CEQA). After the certification of the EIR, the Stadium Project can move forward, and the other development projects can move forward subject to CEQA review when final designs are complete.

The action that the Trustees will take relevant to the subject of this EIR is the approval/adoption of the components of the SRHS Master Facilities Long-Range Plan program (including the Stadium Project), which can be reviewed on the District's website (http://www.srcs.org/). The Master Facilities Plan that was approved by the District on July 27, 2015, was prepared before the passage of the bond measure to allow the Measure B Bond Program to clarify the work that

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[1] The term "District" is used later in this EIR when referring to actions associated with the campus improvements or the entity responsible for certain mitigation measures. While the Madrone High Continuation School is located on the site of San Rafael High School, the term "San Rafael High School campus", "SRHS campus" or "campus" will be used throughout this document when referring to the project site.

[2] The Master Facilities Plan addresses all schools within the District, whereas, the Master Facilities Long-Range Plan for the San Rafael High School campus addresses specific development on the SRHS campus only and in more detail than shown in the Master Facilities Plan. This Long-Range Plan includes primarily site plan drawings (see Figure 3-4) to show where specific changes would occur on the campus.

[3] San Rafael City Schools is a district that includes 11 elementary schools and three high schools. The Madrone High Continuation School is located on the San Rafael High School campus. The elementary schools cover 74.82 acres of land and the high schools cover 59.59 acres of land (San Rafael City Schools, 2015).

needed to be done at the SRHS campus. However, the actual final planning based on the success of the bond resulted in the conceptual plan for the SRHS campus that was formally approved by the District Board on April 18, 2016. This EIR addresses the overall program improvements of the Master Facilities Long-Range Plan at a program level (including projects that may not yet be funded), and includes an examination of the Stadium Project improvements at a project level. Thus, this EIR is called the San Rafael High School Campus EIR (Master Facilities Long-Range Plan Program Improvements & Stadium Project).

3.2 PROJECT LOCATION

The SRHS campus is located in central Marin County in the incorporated City of San Rafael. The main access to the 29.8-acre campus is provided via 3rd Street and Mission Avenue. Other roads abutting the campus include Belle Avenue, Park Street, and Embarcadero Way. A regional and project location map is provided in **Figure 3-1.** A map showing the existing site plan of the campus is provided in **Figure 3-2** and an aerial photograph is provided in **Figure 3-3.**

Major highway access to the project site is available from State Highway 101, about ¼ mile west of the campus. Mission Avenue and 2nd Street are main exit points from this highway for drivers coming from the north and south.

3.3 PROGRAM AND PROJECT EIR

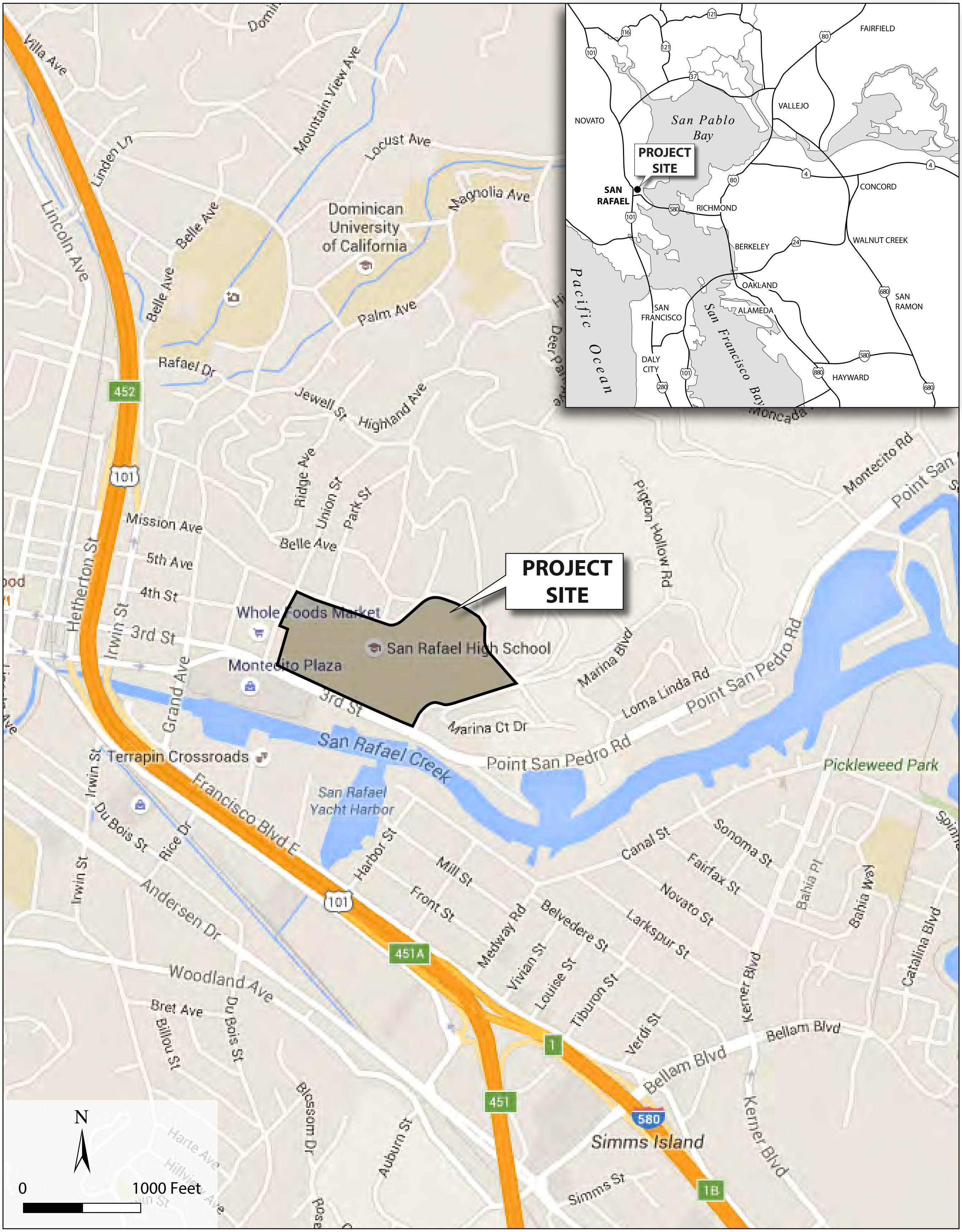
This EIR addresses one of the Master Facilities Long-Range Plan elements—the Stadium Project—at a project level of detail in accordance with CEQA Guidelines Section 15161. The remaining Master Facilities Long-Range Plan elements are less refined at this stage, and therefore this EIR addresses them at a programmatic level of detail in accordance with CEQA Guidelines Section 15168.

Therefore, this EIR is both a program EIR on the Master Facilities Long-Range Plan program improvements and a project EIR on the Stadium Project. A program EIR addresses a series of actions that are related and part of one large project. This approach allows the EIR to address the cumulative impacts of these actions and to recommend program-wide mitigation measures. If a later activity would have environmental impacts that are not addressed in the program EIR, additional environmental review may be needed at that time.

This EIR addresses the following proposed new SRHS buildings at the program level of detail:

- Science Building (to also house Madrone High Continuation School on first floor) (Building No. 1)
- Administration/Kitchen/Student Commons Building, Four Classrooms and Conference Space (Building No. 2)
- Career and Technical Education (CTE)/Art Building (Building No. 3)
- Classrooms/Ceramics/Theater (Building No. 4)
- Wrestling/Dance/Classrooms/Offices (Building No. 7)
- Restroom/Changing Rooms (Building No. 8)

In addition, Buildings A (Administration/Theater/Classrooms), D (classrooms/Library), and K (Head Start) would be modernized, and this modernization is addressed at a program level of detail.



SOURCE: Google Maps, 2016

Figure 3-1

PROJECT AND REGIONAL LOCATION

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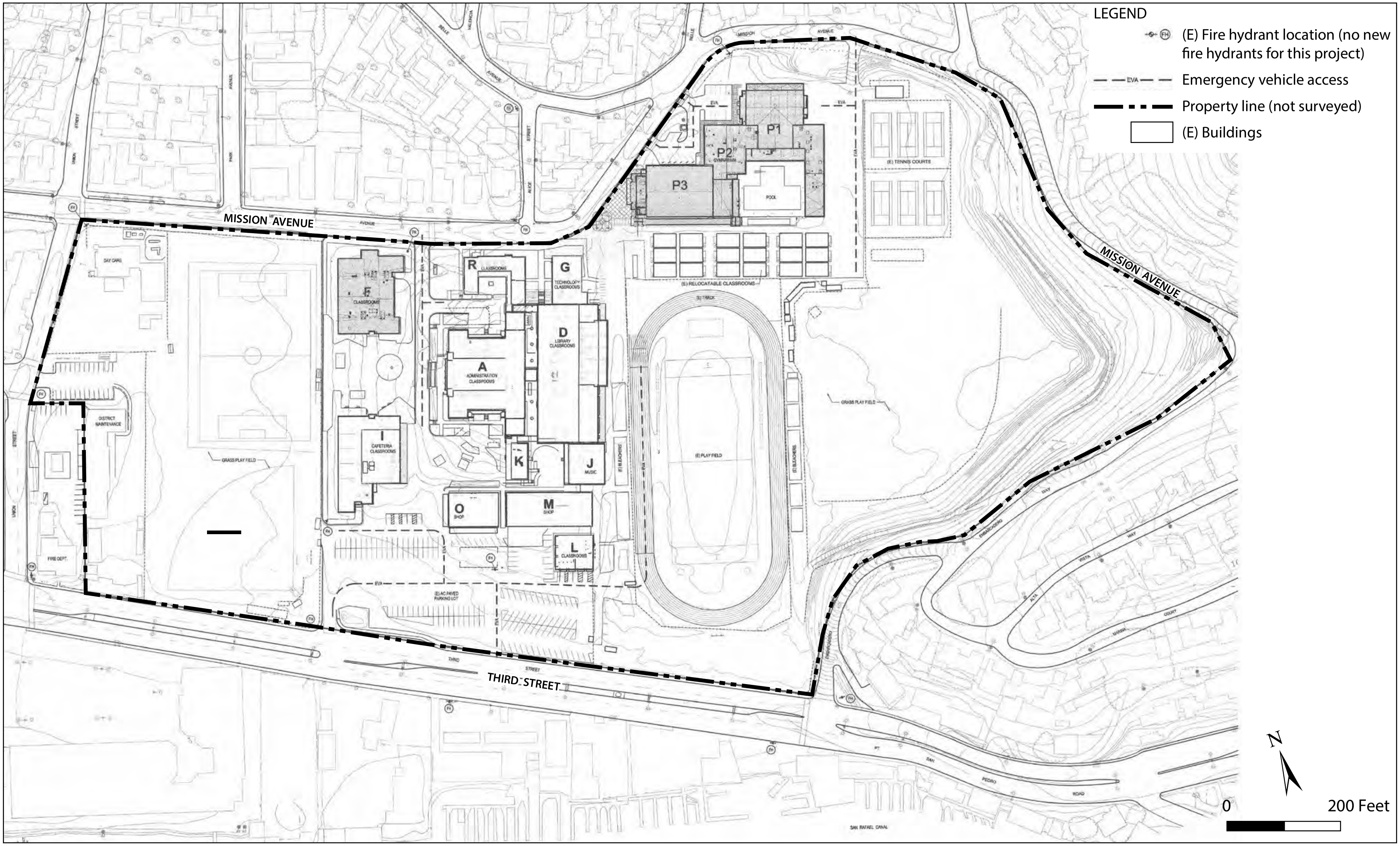

Figure 3-2

EXISTING SITE PLAN

SOURCE: TLCD Architecture, 2004

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ENVIRONMENTAL PLANNING

Figure 3-3

AERIAL PHOTOGRAPH OF SITE

SOURCE: Google Earth, 2016

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ENVIRONMENTAL PLANNING

The following proposed buildings and other improvements are addressed at the project level because these are associated with the proposed Stadium Project (**see Figure 3-4**):

- Concessions (Building No. 5)
- Restrooms/Changing Rooms (Building No. 6)
- Bleachers (Building No. 9)
- Restrooms (Building No. 10)
- Parking lot and new driveway
- Ticket booth
- Christmas tree sales lot concession (seasonal)[4]
- Various storage buildings
- Press box (announcer's booth)
- Associated Student Body (ASB) Concession Building

Buildings proposed for demolition as part of the Stadium Project consist of the following (see Figure 3-4):

- Bleachers (Building V)
- Press Box (Building X)
- Concession Stand (Building Y)
- Ticket Booth (Building Z)

These buildings are all shown in Figure 3-4, which also provides a summary of existing campus buildings and an overall site plan to show where certain buildings would be replaced by new buildings. As the figure shows, the District proposes building demolitions, renovations, and new construction for the campus. A total of 84,015 gross square feet (gsf) of existing buildings would be removed and 132,237 gsf of new buildings would be constructed. At completion, the SRHS campus would have 327,892 gsf of campus buildings, an increase of 48,222 gsf on the campus compared to existing conditions.

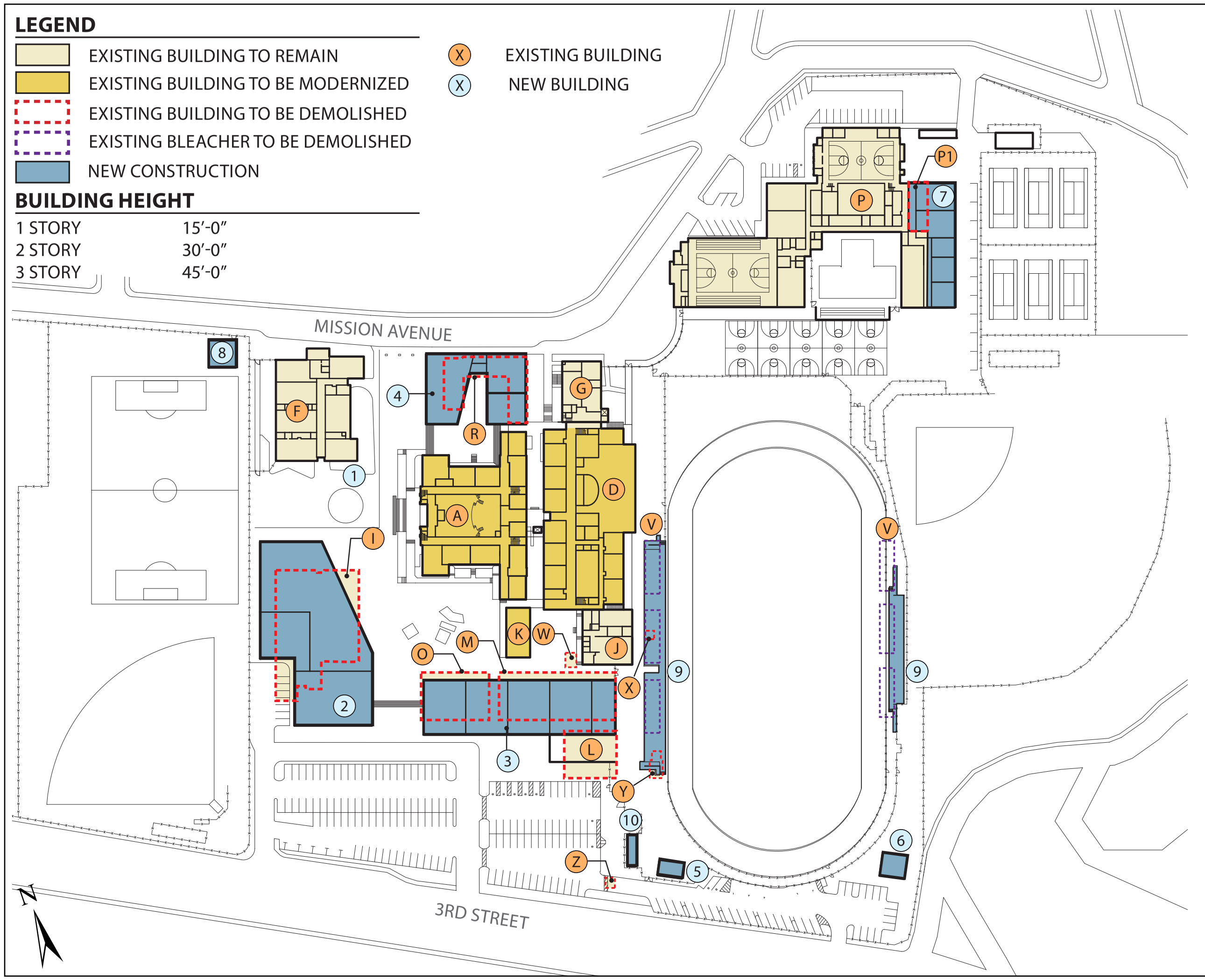
Madrone High Continuation School is continuing on the campus but would be moving to a new building at the north end of the campus, closer to Mission Avenue (Building 1).

3.4 PROJECT SITE CHARACTERISTICS

The project site, the 29.8-acre SRHS campus (see Figure 3-2), currently includes approximately 279,670 gross square feet (gsf) of building area in 18 buildings. Of the total campus acreage, about 15.87 acres are developed for the athletic outdoor area. The remaining 13.93 acres are used for campus buildings and landscaped areas. On the SRHS campus, a total of 46 classrooms are provided for SRHS and five classrooms are provided for the Madrone High Continuation School.

A total of 221 parking spaces are currently provided on the SRHS campus in three surface parking lots—one at the south end of the campus for students (with access from 3rd Street) and two at the north end of the campus (with access from Mission Avenue) (see Figure 3-2). An additional 9 Americans with Disabilities Act (ADA) parking spaces are provided in the south lot, and 3 ADA parking spaces are in the north lots.

[4] The Christmas tree lot is an annual 3-week major fund raiser for SRHS. This is a temporary event on the campus and is an existing condition that would not change.



EXISTING BUILDING TO REMAIN			
BLDG #	NAME	# OF STORIES	S.F.
A	ADMIN / THEATER / CLASSROOM	3	60,125
D	CLASSROOM / LIBRARY	3	42,911
G	MEDIA	2	8,121
J	MUSIC	1	4,515
K	DAYCARE	1	1,958
P	GYMNASIUM	2	78,025
			195,655

EXISTING BUILDING TO BE DEMOLISHED			
BLDG #	NAME	# OF STORIES	S.F.
F	SCIENCE	1	13,648
I	MADRONE / CAFETERIA	1	14,844
L	PHOTOGRAPHY / CERAMICS	2	8,102
M	AUTO TECH / WOOD SHOP	2	17,934
O	ACADEMY	2	10,466
P1	GYMNASIUM (PARTIAL)	1	1,641
R	ART	2	9,379
V	BLEACHERS	-	6,951
W	DAYCARE SHED	1	249
X	PRESS BOX	1	144
Y	CONCESSION STAND	1	513
Z	TICKET BOOTH	1	144
			84,015

NEW / REPLACEMENT BUILDING			
BLDG #	NAME	# OF STORIES	S.F.
1	SCIENCE	2	24,560
2	ADMIN / KITCHEN / STUDENT COMMONS	2	51,276
3	CTE / ART	1	17,220
4	CLASSROOMS / CERAMICS / THEATER	2	18,525
5	CONCESSIONS	1	640
6	RESTROOMS / CHANGING ROOMS	1	960
7	WRESTLING / DANCE / CLASSROOMS	1	6,195
8	RESTROOMS / CHANGING ROOMS	1	1,225
9	BLEACHERS	-	11,157
10	RESTROOMS	1	479
			132,237

TOTAL MASTER PLAN S.F. **327,892**

SOURCE: HY Architects, 2016

Figure 3-4

MASTER FACILITIES LONG-RANGE PLAN

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The stadium portion of the SRHS campus is located at the center of the campus to the east of the Library and west of playing fields. This area includes the stadium bleachers, the football field with a turf surface, and an all-weather eight-lane running track. Basketball courts are located just north of this stadium area.

No natural features such as creeks or other waterways are located on the SRHS campus. Most of the SRHS campus, including all currently developed areas, is relatively level, with an elevation of approximately 10 feet above mean sea level (msl) (USGS, 2015). However, relatively steep slopes are present near the eastern boundary of the campus, with elevations reaching 74 feet above msl near the intersection of Mission Avenue and Embarcadero Way (USGS, 2015). Mission Avenue and Embarcadero Way slope down from east to west from this high point. Slopes are present near the northeastern site boundary from the SRHS tennis courts to Embarcadero Way, and near the southeastern site boundary from Mission Avenue to the southeast corner of the stadium.

Historically, SRHS has been at this location since 1924. Madrone High Continuation School has been located on the campus since 1986.

3.5 PROJECT NEED

The District has undertaken a number of studies and community meetings to evaluate the existing condition of buildings at the SRHS campus and to determine what improvements are needed on the campus. Many of the SRHS campus buildings are in a state of disrepair and need upgrade or replacement. New buildings would allow the campus to provide expanded programs and modernized facilities for the students and provide permanent classrooms for those students currently located in temporary buildings.

3.6 PROJECT CHARACTERISTICS

The Master Facilities Long-Range Plan program improvements would be constructed over a 5-year period. (A portion of the Master Facilities Long-Range Plan is not currently funded and is therefore not included in the current construction schedule; however, these components are addressed in the EIR.) At completion, SRHS is expected to add about 200 new students and to have an enrollment of about 1,325 students, which is about a 17.7 percent increase over the 2015-2016 enrollment of 1,125 students. Madrone High Continuation School would have no change in enrollment. As explained in the table below, faculty and staffing would not increase from the 2016 level of 100 persons. **Table 3-1** presents existing and projected enrollment and building space. As can be seen in Table 3-1, the SRHS Master Facilities Long-Range Plan program improvements provide for a net increase in building square footage of 48,222 gsf. The Stadium Project is the first project that would be constructed and is described in more detail below.

STADIUM PROJECT (PROJECT-LEVEL REVIEW)

The proposed Stadium Project (also referred to as Miller Field) is located in a central portion of the SRHS campus, south of the existing gymnasium (Building P) and east of the Library and Classrooms building (Building D) where the existing stadium is located (see **Figures 3-5** and **3-6**). The stadium is separated from 3rd Street by a proposed narrow parking lot. The SRHS main parking lot is located at the southwest corner of the stadium. **Table 3-2** below provides a summary of the existing and proposed conditions for the stadium.

TABLE 3-1 EXISTING AND PROJECTED STUDENT ENROLLMENT, FACULTY/STAFF, AND BUILDING AREA

	Existing	Total at Completion of SRHS Master Facilities Long-Range Plan	Change
Number of Students	1,125	1,325	200
Number of Faculty and Staff	100	100	0
Gross Square Feet (gsf) of Building Area (Approximate)	279,670 gsf	327,892 gsf	48,222 gsf

Note: According to the District, no new faculty/staff are considered necessary because the new students can be accommodated by increasing some class sizes, and faculty/staff now supporting the campus are adequate to handle this increase.
Source: Glenn Dennis, Principal of SRHS, 2016.

New synthetic turf would replace the existing grass turf that now exists, thus extending the seasonal use of the field. The exact brand of material to be used has not been selected. No "crumb rubber" materials would be present in the synthetic turf. Such compounds have raised health concerns due to compounds that may affect players using such fields.

A number of other improvements would occur at the stadium portion of the campus, such as energy-efficient lighting to replace existing lighting, a new public address system to direct sound to bleachers and the field, new parking for up to 39 cars and team bus parking at the south end of the field (just north of 3rd Street) with an exit driveway at this location, replacement of utilities, and new furnishings, including a new scoreboard, a new concessions stand and ticket booth, a new announcer's booth, new restrooms, and a new plaza.

Building Demolition

Buildings proposed for demolition as part of the Stadium Project consist of the following (see Figure 3-4):

- Bleachers (Building V)
- Press Box (Building X)
- Concession Stand (Building Y)
- Ticket Booth (Building Z)

Building Construction

The Stadium Project includes construction of the following new buildings (see Figure 3-4 and 3-6):

- Concessions (Building No. 5)
- Restrooms/Changing Rooms (Building No. 6)
- Bleachers (Building No. 9 in Figure 3-4 and Buildings No. 3 and 22 in Figure 3-6)
- Restrooms (Building No. 10)
- Parking lot and new driveway
- Ticket booth

Figure 3-5

EXISTING STADIUM SITE PLAN

SOURCE: Carducci Associates, 2016

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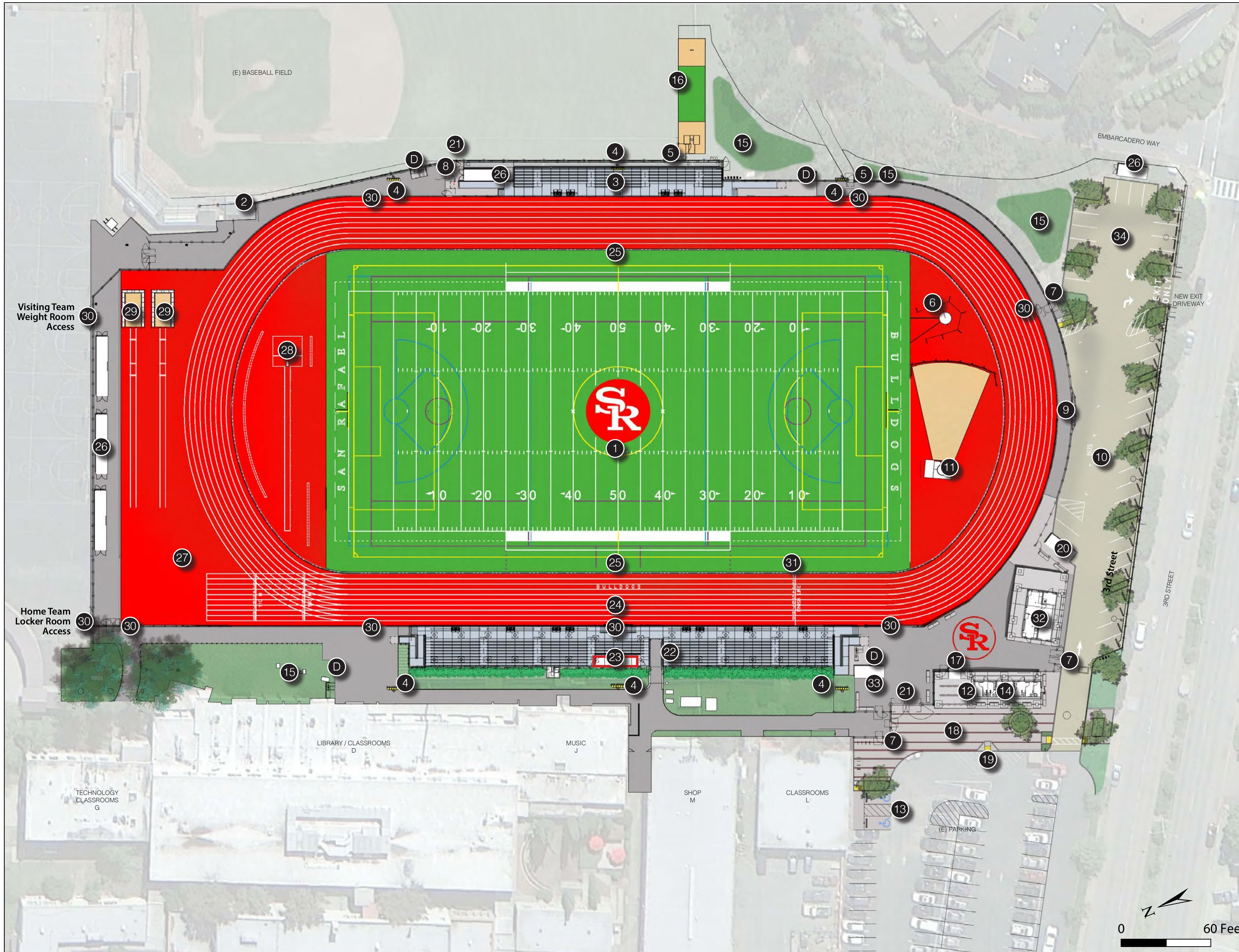

LEGEND

1. Multi-purpose field for football, soccer (110y x 65y) and boy's and girl's lacrosse
2. (E) Dugout to remain, fencing to be modified to control foul balls
3. Visitor bleachers (approximately 515 seats)
4. New efficient stadium lighting posts (Six poles)
5. Maintenance gate to access baseball field
6. Discus platform with net cage surrounded by rubber surface
7. Exit gate to open after sporting events
8. Flag pole
9. New scoreboard - located inside perimeter fence
10. New parking lot featuring approximately 40 additional parking spots with permeable paving surface
11. Shot put with QCV and shot put warm up space
12. Track record board
13. Accessible parking
14. **Restrooms - 10 new fixtures (4 male, 4 female, and 2 unisex)**
15. Biofiltration planting
16. Relocated visiting team bullpen
17. New ticket booth and entry gates
18. Welcome Plaza with donor pavers
19. Drop-off zone
20. Xmas Tree Lot concession stand
21. Maintenance and EVA gate
22. Home-team bleachers (approximately 1,310 seats)
23. Announcer's booth with public address system (Approximately 10' above field with roof deck 19' above field for cameras, etc)
24. 400-Meter rubberized track (Nine lanes)
25. Electrical outlet and conduits to announcers booth for soccer and lacrosse scorekeepers
26. Sports equipment storage units (four units 3+1)
27. High jump on rubber surface
28. Pole vault
29. Two long jump and triple jump with QCV
30. Field fence access gates
31. Common finish line with electrical outlet and conduits to announcer's booth
32. Concession stand
33. ASB concession stand
34. Team room (NIC - Future Improvement. Base bid includes utility stub-outs)

Figure 3-6

PROPOSED STADIUM SITE PLAN

SOURCE: Carducci Associates, 2016

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Table 3-2 Existing and Proposed Stadium Conditions

Factor	Existing	Proposed	Net Quantitative Change
Grandstand seating	2,550 bleacher seats (1,550 for home grandstand on west and 1,000 for visitors on east). Announcer's booth on west.	1,900 seats (1,400 for home grandstand on west and 500 for visitors on east). New announcer's booth on west grandstand and new scoreboard.	-650 total (-150 for home grandstand and -500 for visitors).
Number of events per year (see Table 3-3 for detailed usage information)	833	917	+84
Lighting	36 1,500-watt Metal Halide fixtures mounted on four poles, plus 19 lights in canopies.	Replacement of stadium lights with energy-efficient light-emitting diode (LED) stadium lights; new pedestrian, security, and emergency egress lighting.	80 597-watt LED fixtures, plus new LED pedestrian height poles and 18 86-watt LED fixtures on either field light poles or pedestrian light poles. Six light poles.
Public address system	Two utility poles with loudspeakers.	New public address system that would include pole-mounted speakers behind the bleachers and aimed to direct sound toward the bleachers and the field.	NA
Field and track	Grass field for high school football, eight-lane track and field, and physical education, lacrosse, and soccer.	Synthetic turf; new nine-lane 400-meter all-weather track; field inside track widened by 10 feet, and track changed to broken-back layout. Track and field widened by 17 feet. The use of the Broken-Back Curve design can allow for the wider field for soccer and maintain the necessary layout to meet all rules.	Existing track has a nine-lane straight-away for sprints and eight lanes for the remainder of the track. The new track would be a continuous nine-lane track to accommodate three-way relay races.
Parking, landscaping, and fencing	Mowed grass area.	Removal of 12 umbrella pines trees to allow expanded parking for 39 cars and team bus parking; planting of 14 new deciduous maples; fencing to be replaced; addition of ball netting to existing fence to shield stadium from foul balls from baseball field to east.	

TABLE 3-2 EXISTING AND PROPOSED STADIUM CONDITIONS

Factor	Existing	Proposed	Net Quantitative Change
Concession stand	Existing concession stand located south of existing home bleachers near the stadium entrance.	New concession stand at south end of field.	NA
Ticket booth and storage	Existing ticket booth and storage.	New ticket booth and new storage.	NA
Utilities	Water, wastewater, storm drainage, electrical, and data lines.	Replacements of all.	
Site furnishings	Flagpole, trash receptacles, drinking fountains, football goal posts, soccer goals, discus cage and signs.	All to be replaced.	NA
Walkways serving site	Existing walkways not Americans with Disabilities Act (ADA)-compliant.	New walkways that are ADA-compliant.	NA
Restrooms	None.	New restrooms at south end of site with four female, four male, and two unisex (gender-neutral or family) fixtures.	10 new fixtures.
Welcome plaza	None.	New welcome plaza at southern end of track.	
Future plans		New Visitor Team Room building to be located on the southern portion of the site near 3rd Street.	The building and location of a new Visitor Team Room would shift traffic and parking from Mission Avenue to the main stadium lot, thus reducing traffic congestion and parking demands on Mission Avenue.

Note: NA = Not applicable
Source: Galli, 2016 and Carducci & Associates, Inc., 2016.

- Christmas tree sales lot concession (seasonal)[5]
- Various storage buildings
- Press box (announcer's booth)
- ASB Concession Building

Daily and Seasonal Usage

Table 3-3 provides usage information for existing and proposed conditions at the stadium. As can be seen in Table 3-3, the number of annual events is expected to increase by 84; however, the 84 new events at the stadium would not be all new to the SRHS campus. All of the football practices take place currently on other fields at the campus. A portion of the new lacrosse practices would be associated with the new women's lacrosse team that is expected to be established on the campus. The new track and field meets would not occur on an annual basis. The total number of participants is expected to increase by about 144 participants per day of use due to the changed conditions at the stadium (see Table 3-3), primarily due to new lacrosse usage. Spectators would increase by about 112. The overlap of field usage by various teams is shown in **Table 3-4**.

Community use of the stadium occurs only when SRHS is not in session or using the field. Community use is generally from 4:00 PM to 10:00 PM and on weekends, but only when SRHS is not using the fields. Reservations for any use are always required for all parties (school and public groups). All outside user groups must have insurance and a use permit in place prior to field use. If no organized groups are using the field, members of the public may use the field as long as they are individuals (e.g., solo runners) and not an organized group. This community use is expected to continue in the same manner with the proposed stadium improvements.

One new sport use of the new Miller Field would be the women's lacrosse team, which practices from February through April with a maximum of 48 players. There would be a total of 30 new lacrosse games for the women's teams. The Stadium Project would also see additional use of the site for league finals for men's and women's soccer each year on a single Saturday between 3:00 PM and 9:30 PM. This single event can draw in 150 participants and 1,200 spectators (Galli, 2016). The other new use would be every 3 years for 1 or 2 days when men's and women's lacrosse would have league finals. In that period, the site would be used from 3:00 PM to 9:00 PM, with 75 participants and up to 800 spectators. Track and field would include four new contests per year, and every 3 years, the SRHS campus would host the league meet and the North Coast Section (NCS) Redwood Empire Meet.

For practices held during school days, the participants are SRHS students and are already on the campus. About 10 parents/friends might be spectators during practices. The school-day practice spectators are generally about 75 percent students who are also already on the campus. Contest participants are generally about 50 percent SRHS students who are already on the campus for school-day contests. Contest spectators for school-day events are generally about 50 percent students already on the campus (Galli, 2016). This percentage is an existing condition and the percentage of student spectators is expected to continue into the future.

[5] The Christmas tree lot is an annual 3-week major fund raiser for SRHS. This is a temporary event on the campus and is an existing condition that would not change.

TABLE 3-3 EXISTING AND PROPOSED USE OF STADIUM

Type of Event	Days of Week in Use	Season	Existing Events per Year	Proposed Events per Year	Net Change in Number of Events	Approximate Number of Participants/ Spectators per Day in Use	Proposed Participants/ Spectators per Day in Use	Net Change in Participants/ Spectators per Day in Use
Football Practices	Mon-Sat	July-Dec	75	125	+50	140/50	140/50	0
Soccer Practices	Mon-Sat	Nov –Mar	120	120	0	180/50	180/50	0
Lacrosse Practices	Mon-Sat	Feb-May	120	120	0	90/20	138/32	+48/+12
Football Games	Thur-Sat[a]	Aug-Dec.	22	22	0	130/1,500	130/1,500	0
Soccer Games	Tues-Sat	Nov-Mar	60	60	0	100/500	100/500[b]	0
Lacrosse Games[c]	Tues-Fri	Feb-May	30	60	+30	100/300	196/400	+96/+100
Community Use Turf Sports[d]	Every Day	All Year	NA	NA	NA	NA	NA	NA
Track Use (all other sports)	Mon-Sat	All year	313	313	0	150/5	150/5	0
Track and Field Practices	Mon-Sat	Feb-May	90	90	0	90/50	90/50	0
Track and Field Meets	Mon-Sat	Feb-May	3	7[e]	+4	150/500	150/500	0
Track and Field Community Use[d]	Every Day	All Year	NA	NA	NA	NA	NA	NA
Total			**833**	**917**	**+84[f]**			**+96 participants for lacrosse games, +48 participants for practices, +112 spectators for lacrosse**

Note: NA = Not applicable.
[a] For football games, there is one game per week for each level; for soccer, there are two days per week when games occur.
[b] A single event for soccer (women's and men's league finals) would occur each year for one Saturday, which could bring in 150 participants and 1,200 spectators.
[c] The other new use would be every 3 years for 1 or 2 days when men's and women's lacrosse would have league finals. In that period, the site would be used from 3:00 PM to 9:00 PM during the week, with 75 participants and up to 800 spectators.
[d] Numbers of turf sports/track and field community users cannot be calculated because these are walk-ons to the campus and vary day-by-day.
[e] Every 3 years, the SRHS campus would host the league meet and the North Coast Section (NCS) Redwood Empire Meet.
[f] The 84 new events at the stadium would not be all new to the SRHS campus. All of the football practices take place currently on other fields at the campus. A portion of the new lacrosse practices would be associated with the new women's lacrosse team that is expected to be established on the campus. The new track and field meets would not occur on an annual basis.
Source: Tim J. Galli, Athletic Director and Chief Athletic Consultant, San Rafael High School, 2016.

TABLE 3-4 PROPOSED SEASONAL STADIUM USAGE BY SRHS SPORTS (DAYS PER MONTH)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Football Practice	0	0	0	0	10	10	20	20	20	21	**12**	**12**
Soccer Practice	8	20	20	20	**10**	0	0	0	0	10	16	16
Lacrosse Practice	7	16	16	16	**10**	8	0	0	0	10	20	17
Football Games	0	0	0	0	0	0	0	4	5	**5**	**4**	**4**
Soccer Games	0	12	14	20	**14**	0	0	0	0	0	0	0
Lacrosse Games	0	12	14	20	**14**	0	0	0	0	0	0	0
Track and Field Practices	0	24	24	24	**18**	0	0	0	0	0	0	0
Track and Field Meets	0	0	2	4	1	0	0	0	0	0	0	0
Track Use (All Other Sports)	35	35	35	35	35	0	0	0	35	35	34	34

Note: The totals in **bold** reflect the maximum number of potential practices/contests if a team and/or group of individuals qualifies to the very last day of the State playoffs in that sport. In reality, this number is far lower based on historical data. The maximum number of practices/contests for Track and Field should reflect that the further into the post-Track season the number of participants becomes fewer and fewer. For example, a track team of 90 may be reduced to 10 to 15 athletes by mid-May because only this number have qualified to continue and in June that number is often 1 or 2 athletes. The shaded areas refer to the months of use for that sport and show the overlap of various sports throughout the year.
Source: Tim J. Galli, Athletic Director and Chief Athletic Consultant, San Rafael High School, 2016.

For the proposed track use, all of the participants would be SRHS students who are already on campus attending other athletic team practices; as such, they would not require additional parking or affect the traffic flow in the surrounding area. For example, for men’s basketball and women’s volleyball practices, participants are sent out on the track for conditioning runs.

Hours of Use

The hours of use for the stadium after school-hours would be 3:00 PM to 9:30 PM on school/practice days. Holiday and non-school practices would generally occur from 9:00 AM to 10:00 PM. During the school day, use of the fields takes place between 8 AM and 3 PM. Sports programs take place between 3 PM and 9:30 PM. Games most commonly occur from 3:00 PM to 9:30 PM. Non-school and holiday games are generally played between 11:00 AM and 8:00 PM. The stadium would not be used after 10:00 PM.

Vehicle and Bicycle Parking

A new parking area would be constructed as part of the Stadium Project (see Figure 3-6). This parking area would be located just south of the field and abutting 3rd Street. The parking area would result in spaces for 39 cars and team bus parking on the SRHS campus. Permeable paving would be used to reduce the amount of runoff from this parking area. Access would be available from the existing campus parking lot that has access from 3rd Street. However, a new exit driveway from the new parking area to 3rd Street is also proposed, requiring a curb cut **in** the existing sidewalk at this location. One-way traffic would be allowed in the new parking area, requiring that any entrance be from the existing campus parking lot to the west. These changes are intended to improve circulation and create a more dominant presence from the street, to bring traffic off of the street faster than the current layout.

As part of the Stadium Project, eight new bicycle racks would be installed, accommodating 16 bicycles.

Utilities

New utilities would replace existing utilities at the stadium site. These would include a new 2-inch water line, new 4-inch wastewater lines to serve the restrooms, concession and new Visitor Team Room building, storm drain that would drain to the San Rafael Canal to the south, new data lines, and new electrical connections to replace existing electrical lines.

Construction Schedule

The Stadium Project construction schedule is anticipated to be in one phase, with construction anticipated to begin in the late spring of 2017 and completing in late fall of 2017.

It would include demolition of the track and field, bleachers, fences, site furnishings, ticket booth, stadium lighting, concession building, and removal of storage containers.

Installation would include expansion of the track to nine lanes of all-weather material, and track striping, the synthetic turf field, scoreboard, new light-emitting diode (LED) stadium lighting and security lighting, fencing, storage, landscaping, installation of utilities, new parking area and driveway, visitor bleachers, home bleachers, public address system, restroom, concession, entry plaza, and site furnishings.

OTHER SRHS MASTER FACILITIES LONG-RANGE PLAN PROGRAM IMPROVEMENT COMPONENTS (PROGRAM-LEVEL REVIEW)

Demolition for Overall Development

Per the SRHS Master Facilities Long-Range Plan, a number of buildings on the SRHS campus would be demolished because the cost of repairing these buildings and bringing them up to current building standards would be far greater than replacing the buildings altogether.

The main buildings proposed for demolition include the following (see Figure 3-4) (for buildings to be demolished as part of the Stadium Project, see "Stadium Project (Project-Level Review)" above):

- Science (Building F)
- Madrone/Cafeteria (Building I)
- Photography/Ceramics (Building L)
- Auto Tech/Wood Shop (Building M)
- Academy (Building O)
- Gymnasium (partial) (Building P1)
- Art (Building R)
- Daycare Shed (Building W)

Modernization and Construction of New Buildings

The SRHS Master Facilities Long-Range Plan program improvements include construction of the following new buildings (see Figure 3-4):

- Science Building (Building No. 1)
- Administration/Kitchen/Student Commons Building, Four Classrooms and Conference Space (Building No. 2)
- CTE/Art Building (Building No. 3)
- Classrooms/Ceramics/Theater (Building No. 4)
- Wrestling/Dance/Classrooms/Offices (Building No. 7)
- Restroom/Changing Rooms (Building No. 8)

Some buildings, such as the Administration/Theater/Classrooms building (Building A), classroom/Library building (Building D), and Head Start (Building K) buildings, would undergo modernization without any demolition. Thus, no change in footprint would occur for these buildings and changes would be internal.

Site Improvements: Landscaping, Pathways, Lighting, Parking, and Utilities

In addition, the Master Facilities Long-Range Plan program improvements would include overall site improvements such as new landscaping, new pathways, reconfiguration of parking lots, and new utility lines (water, wastewater, gas, electricity, and telecommunications).

Landscaping and Pathways

The main areas proposed for landscape improvements would likely be the central campus quad. Currently this area is predominately asphalt pavement. These areas are to be leveled and landscaping would be added to enhance the area for gathering and outdoor learning. Existing trees would be preserved.

Additionally, bio-swales and other rainwater retention areas would be developed that would increase the amount of planting on the campus. These would generally be located adjacent to parking and driveways.

Outdoor lighting would be designed to maximize public safety and security while minimizing visual intrusion to adjacent residential areas. Outdoor light fixtures would include shrouds and other shielding as appropriate. Lighting along pedestrian corridors would be low-level lights. To the extent practicable, area lighting and security lighting would be controlled by the use of timed switches and/or motion detector activation to reduce energy consumption.

New pedestrian pathways would be created throughout the campus, with improvements for compliance with the ADA.

New Driveway, Emergency Access, and Vehicle/Bicycle Parking

A new driveway access point is proposed on 3rd Street about 450 feet east of the existing driveway as part of the Stadium Project (see **Figure 3-7**). Emergency access would be available throughout the campus as shown in Figure 3-7.

The overall project would result in a net gain of 15 parking spaces on the campus because some spaces would be removed for new buildings (e.g., near the existing gym). There are 221 existing parking spaces and 12 existing ADA parking spaces on the overall campus, and after the project is complete, there would be 231 spaces (see Parking Study in Appendix F-7).

New bicycle parking facilities would be provided throughout the campus and minor changes to the existing layout may occur as a result of the central courtyard modifications. Overall availability for bicycle parking would be increased.

Utility Lines

A number of utility improvements would be made on the SRHS campus for water, natural gas, wastewater, telecommunications (phone, fiber optics, and other signal systems), and storm drainage. No electrical service upgrades would be required.

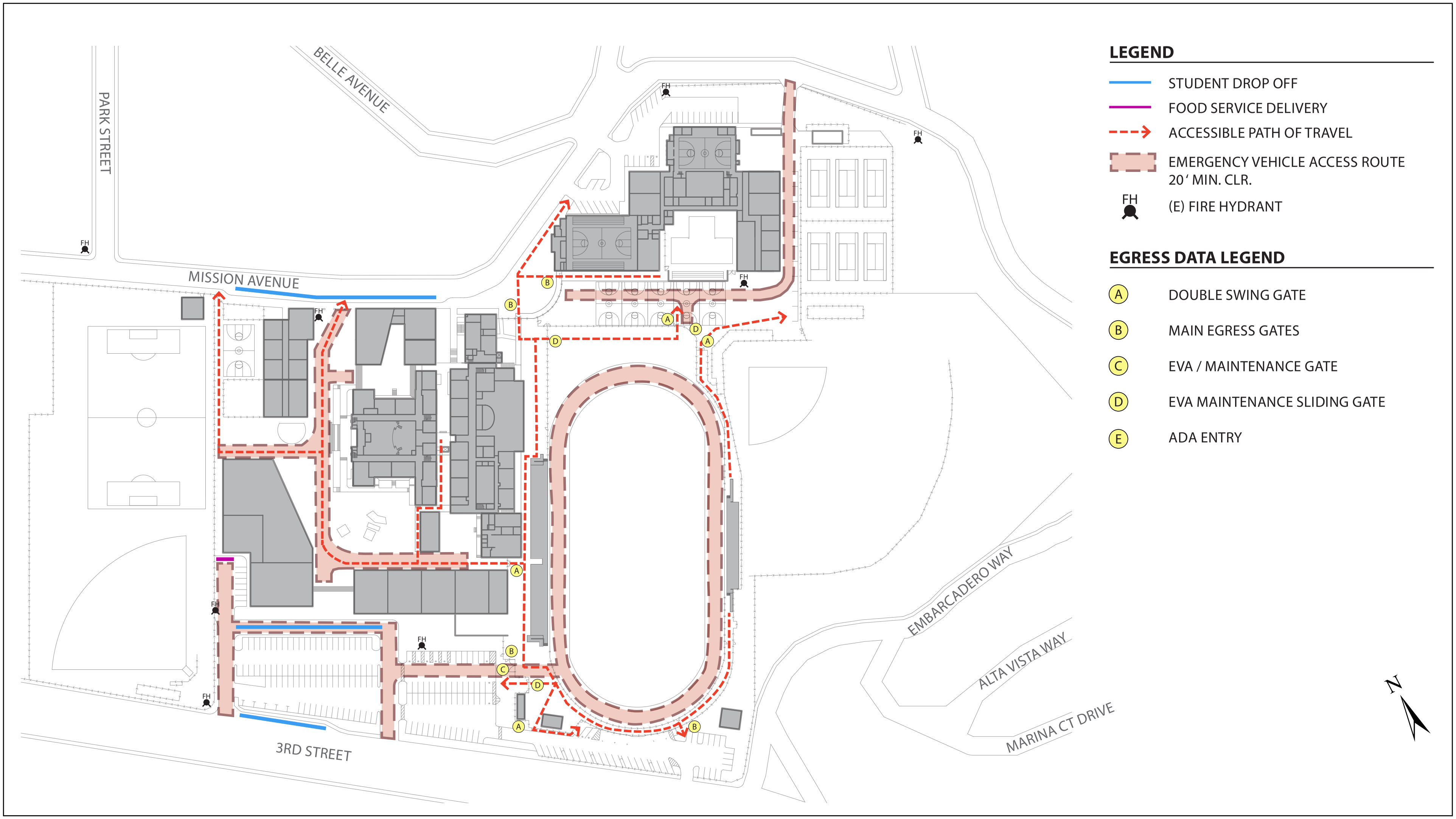
Existing water supply to the campus is from the Marin Municipal Water District. Existing piping and fire hydrants would be replaced if necessary in a phased manner as construction proceeds. Sanitary sewer service is provided by San Rafael Sanitation District. Existing on-site sewer lines would be replaced as necessary.

Natural gas lines would be upgraded as necessary to feed proposed buildings which would likely require additional gas to support the increased capacity.

All of the telecommunication services would be installed at the existing main point of entry and routed in a joint trench to the new and modernized buildings. This system would include data and clock and bell cables that would consist primarily of fiber optics between buildings and CAT6 or other cable within buildings.

Phasing of Facilities

The following is the expected phasing for new campus buildings that are proposed as part of the Master Facilities Long-Range Plan and that are currently funded (for phasing of the Stadium Project, see "Stadium Project (Project-Level Review)" above):



SOURCE: HY Architects, 2016

Figure 3-7

CIRCULATION AND EMERGENCY VEHICLE ACCESS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

- Building No. 1 (Madrone and Science): 2017-2018
- Building No. 2 (Administration, Kitchen, Student Commons and Services, Four Classrooms and Conference Space): 2019-2020
- Building No. 3 (CTE Classrooms, Advanced Placement [AP] Art): 2020-2021
- Building No. 7 (Wrestling, Dance, Classrooms/Offices): 2017-2018

PROVISIONS APPLICABLE TO ALL DEVELOPMENT (PROJECT LEVEL AND PROGRAM LEVEL)

Hazardous Materials

Hazardous material storage in the science labs would be minimal and would be limited to quantities allowed by the Uniform Building Code for Group E Occupancies as set forth by Table 7902.5A of the California Fire Code.

Asbestos removal would occur during the modernization and replacement of buildings.

Building Mass, Height, and Design

Campus buildings would be 1 to 2 stories in height and would be designed to harmonize with the scale of existing campus buildings. No specific designs, other than for the Stadium Project, had been completed as of the printing of the Draft EIR. Stadium bleachers would be generally the same height and width as existing bleachers.

Site Grading and Construction Staging

Site development would require moderate grading to raise the site where necessary to bring new building levels above the identified Federal Emergency Management Agency (FEMA) flood plain. Grading would also occur around buildings as necessary to provide wheelchair access to all new and modernized buildings on campus. In addition, grading would occur for the new field and parking lot.

Construction trailers are proposed to be located at the 3rd Street parking lot to house offices for contractors. Additional items that may be located at the 3rd Street parking lot include contractor staff parking and materials storage.

As individual buildings are constructed, specific staging areas in the immediate vicinity of new buildings would be identified. For example, the new Administration/Kitchen/Student Commons Building, Four Classrooms and Conference Space Building (Building 2) would likely have construction supplies and equipment stored at an adjacent area such as the paved area next to softball field.

Energy-Efficient Design

Facilities would be designed with efficient heating and cooling systems beginning with the orientation of the buildings on the site and the placement of the windows on the buildings to maximize natural winter heat gain and minimal summer heat gain. Furthermore, the structures would be constructed of building systems that provide appropriate levels of thermal protection. Skylights and clerestory windows would assist in providing required lighting. All new buildings would be designed with infrastructure for photovoltaic panels. In addition, photovoltaics are planned for other areas of the campus to provide additional power to the campus off the main power grid. All campus improvements would result in more efficient mechanical and electrical systems.

Hours of Operation and Construction

Hours of operation at the SRHS campus would be 8:00 AM to 5:00 PM, Monday through Friday, for classroom activities. There would be no weekend classes.

The hours of use for the stadium after school hours would be 3:00 PM to 9:30 PM on school/practice days. Holiday and non-school practices would generally occur from 9:00 AM to 10:00 PM. During the school day, use of the fields takes place between 8 AM and 3 PM. Sports programs take place between 3 PM and 9:30 PM. Games most commonly occur from 3:00 PM to 9:30 PM. Non-school and holiday games are generally played between 11:00 AM and 8:00 PM. The stadium would not be used after 10:00 PM. Some games may take place on Saturday if, for example, there is a rainout during the week.

During the construction period, construction would occur between 8:00 AM and 5:00 PM, Mondays through Fridays, and between 9:00 AM and 5:00 PM on Saturdays, with no Sunday or holiday work per the City of San Rafael Noise Ordinance.

PROJECT OBJECTIVES

The SRHS campus is the oldest campus in the District, with the original buildings built in 1939. This campus has seen several modernizations and expansions over the years, with buildings dating from 1957, 1958, 1964, and 1965. The most recent modernization program in 2004 included renovations for music and physical education and minor upgrades to the science wing. The SRHS campus is severely overcrowded in its current condition, with the recent addition of portable buildings and projected enrollment increases of nearly 200 students. Many of the older buildings are in good shape in terms of infrastructure, but others are in severe disrepair. The campus is complicated by the shared use of the site with Madrone High Continuation School and the severe traffic congestion along Mission Avenue (campus northern border).

As with many District schools, to accommodate additional capacity, expansion must occur vertically to maintain important outdoor space. For this reason, three buildings (Science, CTE, and Kitchen Cafeteria/Madrone) with infrastructure and operational issues are proposed for replacement, many with two-story buildings that incorporate additional classrooms. The administration area, currently housed in the theater building, is inefficient, undersized, and difficult to find and is therefore proposed to be moved to a new building. Finally, a stadium upgrade is included, to improve the overall usage of this facility.

Madrone High Continuation School currently shares the campus with SRHS, although it is fully contained within its own building. The building was modernized in 2004 and is in relatively good shape; however, administrative functions are separated and present a security issue. In addition, there is no dedicated outdoor space for Madrone students, which poses operational difficulties and complex coordination with SRHS. A replacement of the current building (Building 1 in Figure 3-4) is incorporated into the SRHS Master Facilities Long-Range Plan to house Madrone students.

The objectives specific to the work include the following:

1. Provide functional instructional and administrative space to meet program requirements;
2. Provide upgrades to the existing SRHS campus to serve the population in this area;
3. Improve campus facilities to accommodate a total campus population of approximately 1,325 students at completion of the SRHS Master Facilities Long-Range Plan program improvements;
4. Modernize classrooms, laboratories, and libraries to meet contemporary standards of education to ensure all students are well prepared for success in the 21st century;
5. Implement modern computer technology for the campus;
6. Replace outmoded teaching equipment;
7. Create new space for administration staff that is closer to school entrance;
8. Upgrade buildings for fire safety, energy conservation, seismic safety, ADA compliance, and campus security;
9. Provide an upgraded sports stadium, track and field to improve SRHS's physical education and athletic program for its students and other students in the District that utilize the stadium and field;
10. Address increasing enrollment while providing students and faculty with a learning environment that reflects the District's strategic plan for the future;
11. Meet the intent of the Master Facilities Plan that was approved by the District's Board on July 27, 2015, and phase projects under the SRHS Master Facilities Long-Range Plan;
12. Improve disabled access;
13. Implement "green building" practices in all capital improvement projects;
14. Provide permanent classrooms for students currently located in temporary buildings; and
15. For the Stadium Project, provide an enhanced learning environment for both physical education and after-school sports activities.

REQUIRED PROJECT APPROVALS

The San Rafael City Schools Board of Trustees is the lead agency for the project. Development under the SRHS Master Facilities Long-Range Plan would be subject to review and approval by the following agencies, many of whom may use the EIR in their review:

- **The Division of the State Architect (DSA**) reviews school project designs to determine compliance with the California Building Code, fire safety, and Americans with Disabilities Act (ADA) requirements and reviews and approves applications for new landscape irrigation systems and irrigation renovations.

- **The local Fire Marshal's Office** has delegated fire code regulatory responsibilities for access to the site and number and location of fire hydrants.
- **The County of Marin Health Department** reviews food preparation facilities and reviews for required equipment and finishes.
- **The Regional Water Quality Control Board (RWQCB)** oversees the permitting for projects that could affect water quality. The project would be covered under the State National Pollutant Discharge Elimination System (NPDES) General Construction Permit, which is accomplished by filing a Notice of Intent (NOI) with the RWQCB. A Storm Water Pollution Prevention Plan (SWPPP) may be required for the project.
- **The City of San Rafael** reviews and approves any improvements to the public roads (i.e., driveway curb-cut) surrounding the campus**.**
- **The Bay Area Air Quality Management District (BAAQMD)** would be notified about demolition activities.
- **Marin Municipal Water District (MMWD)** would be informed about any new tie-ins to existing water mains prior to construction and would review and approve permits for new landscape irrigation systems and irrigation renovations.
- **The San Rafael Sanitation District** would be contacted if there are tie-ins to existing lines.
- **Pacific Gas & Electric Company (PG&E)** would review and approve any new or upgraded electrical or gas service to the campus.

3.7 INTENDED USES OF THE EIR

This EIR provides the environmental information and evaluation necessary for the planning, construction, and operation of the proposed project. This EIR also provides the CEQA compliance documentation upon which the District's consideration of, and action on, all applicable approvals may be based. It is the intent of this EIR to enable the District's Board of Trustees, other responsible agencies, and interested parties to evaluate the environmental impacts of the proposed project, thereby enabling them to make informed decisions with respect to the requested entitlements, permits, or approvals. These include all approvals set forth in this EIR, as well as any additional approvals that may be necessary or useful to implement the project, including planning, construction, operation, and maintenance. In accordance with CEQA Guidelines Section 15124, the agencies expected to use this EIR and the approvals required for the project are as shown in Section 3.6 above.

3.8 REFERENCES

Carducci Associates, Inc., 2016. Ongoing emails with A. Garrett of Van Pelt Construction Services, July and November.

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San Rafael City Schools, 2015. San Rafael City Schools Master Facilities Plan (with assistance from Hibser Yamauchi Architects, Inc.), July.

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4. ENVIRONMENTAL SETTING, IMPACTS, AND MITIGATION MEASURES

This section addresses project-related impacts within the following 15 topic categories:

- Aesthetics
- Air Quality
- Biological Resources
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions
- Hazards and Hazardous Materials
- Hydrology and Water Quality
- Land Use and Planning
- Noise
- Public Services
- Transportation and Traffic
- Utilities and Service Systems
- Energy
- Recreation

Each of the 15 topic sections in this EIR presents information in four parts, as described below.

INTRODUCTION

This section addresses the overall issues covered for the topic and the approach used in the analysis.

ENVIRONMENTAL SETTING

This section briefly describes elements of the project setting relevant to a discussion of impacts in the topic category.

REGULATORY FRAMEWORK

This section describes federal, state, and local regulations applicable to the topic.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

This section identifies potential impacts based on the identified significance criteria. Specific impacts are numbered and summarized in **bolded** text, followed by text that describes the impact in more detail. The level of significance prior to mitigation is also identified as either less than significant (LTS) or potentially significant (PS). Mitigation measures (indented text) that can reduce such impacts follow this discussion; these measures are labeled with a number that corresponds to the number of the impact. A statement regarding the level of significance of each impact after mitigation follows the mitigation measure for that impact. The term “PS” stands for “potentially significant” and “LTS” stands for “less than significant.” The term “SU” stands for “significant and unavoidable.” Mitigation measures are identified for both the San Rafael High School Master Facilities Long-Range Plan as a whole (reviewed at a programmatic level) and for the Stadium Project that is evaluated at the project level. The project-specific impacts and mitigation measures would also apply to the Master Facilities Long-Range Plan insofar as the Stadium Project is covered by the Long-Range Plan.

4.1 AESTHETICS

4.1.1 INTRODUCTION

This section discusses the existing visual conditions at the San Rafael High School (SRHS) campus and vicinity and addresses the potential aesthetic impacts of the proposed Master Facilities Long-Range Plan, including the Stadium Project that is part of the Long-Range Plan. The potential impacts relate to the potential for increased light and glare, the visual compatibility of the proposed development with surroundings, and the potential impacts on viewsheds, with an emphasis on public viewing locations. Views from nearby residences to the north of the site are also addressed. This visual impact analysis is based on field observations at the project site and vicinity on October 23 and November 29, 2016, and a review of the project architectural plans developed to date.

4.1.2 ENVIRONMENTAL SETTING

REGIONAL SETTING

The SRHS campus is located within the City of San Rafael in the County of Marin, California. More specifically, the campus is set within the overall developed portion of San Rafael east of U.S. Highway 101, and is surrounded by a mixture of residential and commercial development. Specifically, single-family residential development within San Rafael is immediately east of the campus, and a mixture of single-family and multi-family residential development is located immediately north of the campus. To the west, the San Rafael City Schools Maintenance Facility (38 Union Street) abuts the campus. The immediate environs to the west of the campus also include the City of San Rafael's Fire Station No. 52, Whole Foods Market, senior housing, and a Salvation Army thrift store. Mission Street abuts the campus to the north, Embarcadero Way abuts the campus to the southeast, and Third Street abuts the campus to the south. A variety of commercial development is located to the south of the campus across Third Street, including the Montecito Plaza shopping center, 3rd Street Plaza offices and retail, and a boat yard. San Rafael Creek is located south of the campus, on the south side of 3rd Street (see Figure 3-3 in Chapter 3, Project Description, of this EIR).

PROJECT SITE SETTING

Existing Visual Features of Project Site

The SRHS campus is largely built out, with the center of the campus being the main location for campus classroom buildings, and the east and western edges of the campus holding sports fields (see Figure 3-3). Existing campus buildings are one and two stories in height except for Buildings A and D which are three stories (see Figure 3-4).

The campus includes a mixture of architectural styles in the existing buildings. The oldest building (Building A), dating back to 1925, was completed in the Neoclassical architectural style with specific features such as ionic columns, classical forms, strong symmetry, dominant entry porch, faux rustication and an overall monumentality. The original section of the gymnasium, constructed in 1930, also minimally maintains some influences of the Neoclassical style. The second period of campus development was executed in the 1930s and includes buildings designed in the Moderne architectural style featuring elements such as simple forms, flat roofs with coping, speed bands in the coping, an emphasis on horizontality, minimal decorative features and smooth exterior wall finishes. The newer buildings, built in the late-1950s and mid-1960s, are more modern in style and include concrete finishes and details such as simple forms, flat roofs with no coping, minimal ornament, and no decorative detailing at the doors and windows. Other than Building A, the other buildings on the campus that are over 50 years in age lack historical significance under the four criteria identified by the California Register of Historic Resources, as discussed in more detail in Section 4.4, Cultural Resources, of this EIR.

A large, unlandscaped parking area is located at the south central portion of the campus, with two access points to 3rd Street. Additional smaller parking areas are located on the north side of campus, with access from Mission Avenue. The San Rafael City Schools Maintenance Yard is located at the northwestern corner of the SRHS campus, with access from Union Street. A building in that area of the campus is leased to the Head Start program.

Landscaping on the campus includes a thick canopy of trees at the far eastern edge of the campus, east of the playing fields and separating the campus from nearby residential areas (see Figure 3-2 in Chapter 3, Project Description). Additional tree plantings occur on the north side of campus along Mission Avenue. Within the campus, tree plantings are primarily located along the central north-south pedestrian spine near Building A. Recently (October 2015), three major pine trees were removed from this central area after a student was injured from a falling pine cone and the trees were found to be diseased (Zaich, 2016).

Views of Site from 3rd Street, Within Campus, and from Mission Avenue and Embarcadero Way

From the 3rd Street entrance to the campus, one views the south end of the built area of the campus, as well as portions of playing fields on the east and west ends of the campus. **Figure 4.1-1** shows the location from which photographs of the campus were taken. As shown in Figure **4.1-2a**, views to the east side of the campus from the campus driveway entrance take in distance trees located at the far eastern campus edge and parked cars at the main parking lot. The Stadium Project location is just beyond the parked cars visible in this photograph. Looking north from this same location, the campus entrance portico is the dominant visual element (see **Figure 4.1-2b**, with the clear sign saying “San Rafael High School”). A one-story classroom building/cafeteria (Building I) for the Madrone High Continuation School is visible just beyond this entrance.

Another portion of this one-story building (Building I) also is visible to the west (see **Figure 4.1-2c**), just west of the main entrance portico. When standing within the central portion of the campus, Building A is a strong visual feature, with its massive ionic columns and classical forms (see **Figure 4.1-2d**). Shrubbery and tree landscaping frame the main stairway to this oldest building on the campus.

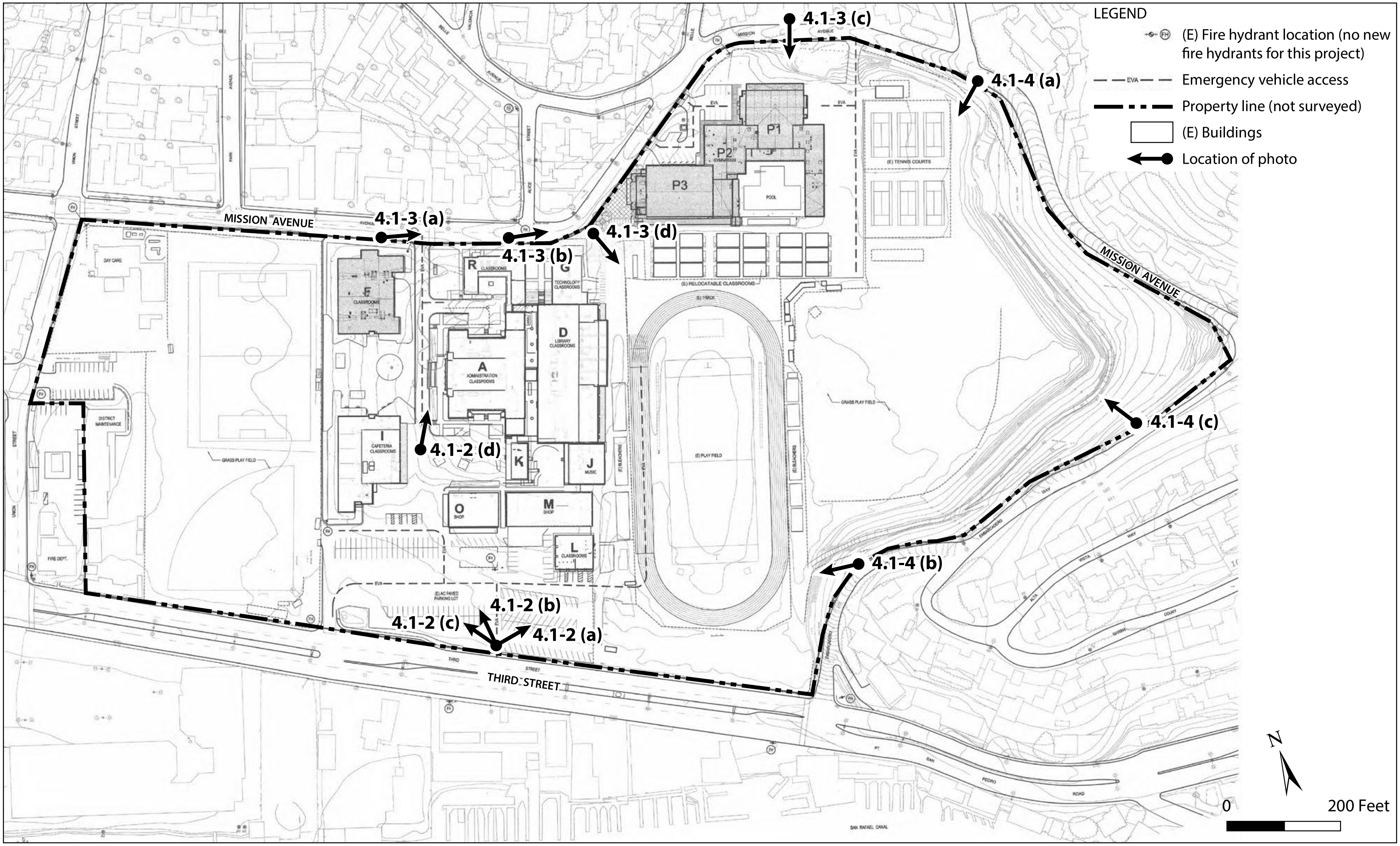

Figure 4.1-1

LOCATIONS OF VIEWS OF SITE

SOURCE: TLCD Architecture, 2004; A. Skewes-Cox, 2016

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ENVIRONMENTAL PLANNING

a) View northeast from entrance on 3rd Street across parking lot towards location of new Stadium Project, new restrooms, and concessions.

b) View north across parking lot from 3rd Street entrance towards main entry to campus and Madrone High Continuation/Cafeteria buildings (Building I in Fig. 3-4).

c) View northwest across parking lot from 3rd Street entrance towards Madrone High Continuation buildings (Building I).

d) View within campus to 1925 Building A (see Figure 3-4), looking north.

Figure 4.1-2

VIEWS OF SITE FROM 3rd STREET AND WITHIN CAMPUS

SOURCE: A. Skewes-Cox, 2016

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

From Mission Avenue, in proximity to nearby residences, one sees a variety of campus buildings and parking areas. Prominent visual features along this route include the gymnasium (Building P), the curved entry to the stadium area, small parking areas, and classroom buildings. As one heads east along Mission Avenue, much of the central campus where buildings are located is screened from view by vegetation and setbacks (see **Figure 4.1-3a**). Farther east along Mission Avenue, the campus gymnasium comes into view next to the entrance to the stadium area (right side of gymnasium) (**Figure 4.1-3b**). To the east of the gymnasium, one can see Indian Rock at the north end of the campus, surrounded by trees, and an area along Mission Avenue that does not include paved sidewalks (**Figure 4.1-3c**). From the entrance to the stadium at the north end of the campus, one looks across the field to the large grove of eucalyptus at the eastern boundary of the campus (**Figure 4.1-3d**).

From the eastern portion of Mission Avenue, one can see Mt. Tamalpais in the background with the tennis courts of the SRHS campus in the foreground (see **Figure 4.1-4a**). Trees screen views of much of the campus from this general area. From Embarcadero Way at the eastern edge of the campus, one can see the southern end of the stadium area (see **Figure 4.1-4b**). From this same roadway, some views of the campus are screened by the existing eucalyptus trees at the eastern edge of the campus (see **Figure 4.1-4c**).

Light and Glare

Sources of light and glare near and within the project site are primarily vehicles on public roadways, lighting from adjacent residential development, lighting in parking lots and along public streets, lighting from the existing stadium field at the campus, and campus building lighting. Vehicle headlights on public roadways, on adjacent properties, and on the project site emit temporary lighting in their direction of travel. Existing buildings on the SRHS campus include lighting visible during nighttime hours when the school buildings are occupied or campus buildings are being cleaned after sunset. Field lighting occurs during nighttime events, such as games and practices.

4.1.3 REGULATORY FRAMEWORK

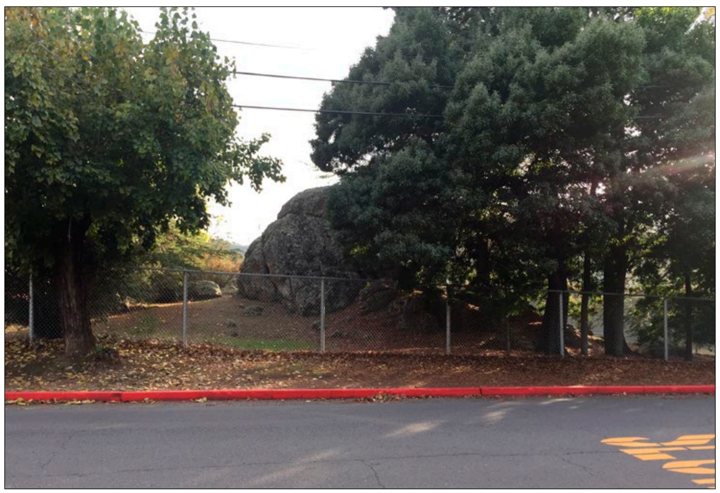
FEDERAL AND STATE REGULATIONS

No federal regulations related to visual quality would pertain to the project.

The State of California has a formal program related to scenic highways. The California Scenic Highway Program, established in 1963, identifies and designates certain highways along which adjoining land uses and features require special conservation treatment. The responsibility for the management of a program is left to local cities and counties. Highways shown as “eligible” for listing are believed to have outstanding scenic values. Once a highway is listed in California Streets and Highways Code Sections 263.1 through 263.8, it may be nominated for official designation by the local governing body with jurisdiction over the lands adjacent to the proposed scenic highway. A visual assessment is required and a number of other steps must be followed. No highways are located in the vicinity of the project site, and none of the roadways in the vicinity are included in the Streets and Highways Code list of eligible highways or are designated a scenic highway (California Department of Transportation, 2016).

a) View east along Mission Avenue with science building (Building F) on right screened by vegetation

b) View east along Mission Avenue towards SRHS gymnasium (Building P) and entrance to stadium (on right)



c) View of Indian Rock from Mission Avenue, looking south towards area where sidewalks are not paved

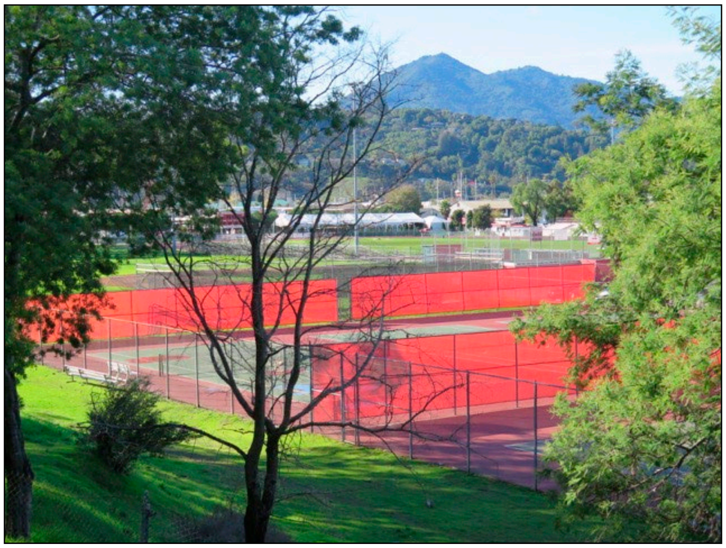
d) View into stadium area from north side of campus, with eucalyptus trees in the background that are located at east side of campus

Figure 4.1-3

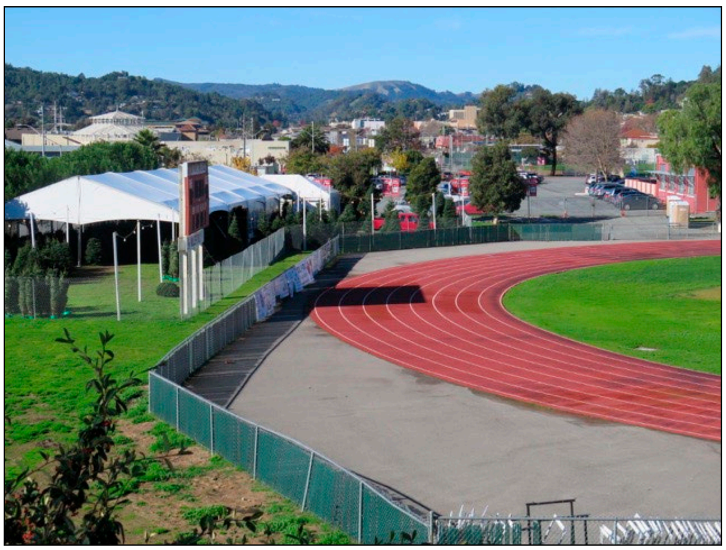
VIEWS OF SITE FROM MISSION AVENUE

SOURCE: A. Skewes-Cox, 2016

AMY SKEWES~COX
ENVIRONMENTAL PLANNING



a) View south from Mission Avenue at northeast edge of campus across campus tennis courts to stadium and Mt. Tamalpais in background.



b) View across south end of campus from southern end of Embarcadero Way, looking at south end of stadium area and undeveloped area proposed for new parking (where temporary tent for holiday tree lot located in November 2016).

c) View through eucalyptus trees at west side of campus, looking west. Playing fields visible but screened by trees.

Figure 4.1-4

SOURCE: A. Skewes-Cox, 2016

VIEWS OF SITE FROM MISSION AVENUE AND EMBARCADERO WAY

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ENVIRONMENTAL PLANNING

The California Division of the State Architect (DSA) also has design requirements. DSA reviews plans for public school construction to ensure that plans, specifications, and construction comply with California's building codes. DSA reviews projects for structural safety, fire and life safety, access compliance, and energy savings (California DSA, 2016).

LOCAL REGULATIONS AND POLICIES

As discussed in Chapter 1, Introduction, of this EIR, pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to a proposed classroom facilities project. Even though the District adopted Resolution No. 169.1, dated June 27, 2016, pursuant to Section 53094 exempting the Master Facilities Long-Range Plan, including the Stadium Project, and the SRHS campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City's Municipal Code, the City's General Plan, and related ordinances and regulations that otherwise would be applicable, this EIR evaluates the project's consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District's goal that local policies and regulations be acknowledged and adhered to as much as feasible. (SRCS, 2016).

City of San Rafael Zoning Code

The City of San Rafael zoning code designates the site as Public/Quasi-Public (P/QP) which allows a height limit of 36 feet (City of San Rafael, 2016)

San Rafael General Plan

The San Rafael General Plan includes the following policies that would relate to potential visual impacts of the project:

Policy CD-1d **Landscape Improvement.** Recognize that landscaping is a critical design component. Encourage maximum use of available landscape area to create visual interest and foster sense of the natural environment in new and existing developments. Encourage the use of a variety of site appropriate plant materials.

Policy CD-10a **Visual Compatibility.** Ensure that new structures are visually compatible with the neighborhood and encourage neighborhood gathering places. Guidelines may address screening of service functions, materials and detailing, screening of roof equipment, lighting, landscaping, outdoor café seating and pedestrian amenities.

Policy CD-16a **Code Enforcement.** Continue code enforcement efforts for trash and litter removal and other maintenance issues in all types of property.

Policy CD-18a **Zoning Regulations for Landscaping.** Evaluate and amend as necessary, the Zoning Ordinance's landscaping provisions to promote development with a strongly landscaped character. The intent is that individual neighborhood character be developed and maintained, architecture be softened by plant materials where appropriate, conflicting uses be buffered, parking areas be screened, comfortable outdoor living and walking spaces be created, air pollution be mitigated and developments be made water efficient through the use of a variety of site-appropriate plant material.

Policy CD-19a **Site Lighting.** Through the design review process, evaluate site lighting for safety and glare on proposed projects.

Policy CD-19b **Lighting Plan.** Require new development and projects making significant parking lot improvements or proposing new lighting to prepare a lighting plan consistent with the Design Guidelines for review by City planning staff.

Policy CD-21a **Parking Lot Landscaping Requirements.** Update parking lot landscape requirements to increase the screening of parking lots from the street and nearby properties. Requirements would address appropriate size and location of landscaping, necessary screening consistent with security considerations, tree protection measures, and appropriate percent of shade coverage required of parking lot trees. Include maintenance requirements in all approvals.

Policy CD-21b **Parking Lot Landscape Enforcement.** Require that newly installed parking lot landscaping be maintained and replaced as needed. Assure that landscaping is thriving prior to expiration of the required 2-year maintenance bond.

San Rafael City Schools Design Requirements

San Rafael City Schools does not have a set of design guidelines that address future development. The Master Facilities Plan (San Rafael City Schools, 2015) addresses many campuses throughout San Rafael, and it would be difficult to have a set of guidelines that would apply to all campuses. Each project is designed separately for each campus.

4.1.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on visual resources if it would:

a) Have a substantial adverse effect on a scenic vista;

b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway;

c) Substantially degrade the existing visual character or quality of the site and its surroundings; or

d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

The following significance criteria would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the plan and are therefore excluded from further discussion in this impact analysis:

- *Have a Substantial Adverse Effect on a Scenic Vista.* No scenic vistas are located in the vicinity of this urbanized portion of San Rafael. The SRHS campus is set in a lower elevation of the city, and views of the campus are limited to the immediate surroundings and nearby residences that are located above the campus at higher elevations.
- *Substantially Damage Scenic Resources, Including, but not Limited to, Trees, Rock Outcroppings, and Historic Buildings within a State Scenic Highway.* The SRHS campus is not in proximity to a state scenic highway. Potential impacts on historical resources are addressed in Section 4.4, Cultural Resources, of this EIR. The one main rock outcropping on the SRHS campus is "Indian Rock," which is located at the north end of the campus near Mission Boulevard (see photo in Figure 4.1-3), and no development is proposed in this area.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

No less-than-significant aesthetic impacts would result from the Master Facilities Long-Range Plan.

Potentially Significant Impacts

<u>Impact AESTHETICS-1</u>: Development in accordance with the Master Facilities Long-Range Plan could substantially degrade the existing visual character or quality of the site and its surroundings if new buildings do not respect the overall design of the campus and surrounding residences, or include adequate landscaping. (PS)

The Master Facilities Long-Range Plan includes demolition of a number of existing on-campus buildings such as Building F (Science), Building I (Madrone/Cafeteria), Building L (Photography/Ceramics), Building M (Auto Tech/Woodshop), Building O (Academy), Building R (Art), a portion of the existing gymnasium (Building P1), and many other campus facilities as shown in Figure 3-4 in Chapter 3, Project Description. New buildings would be constructed in the location of these removed buildings, including proposed Buildings No. 1, No. 2, No. 3, No. 4, and No. 7 (see Figure 3-4 in Chapter 3, Project Description).

Bleachers (Building V) in the stadium area would be demolished and new bleachers (Building No. 9) would be constructed as part of the Stadium Project, which is discussed in more detail under "Impacts of Proposed Stadium Project" below. Among other buildings, new restrooms (Buildings No. 6 and No. 10) and a new concessions facility (Building No. 5) would also be constructed as part of the Stadium Project (see Figures 3-4 and 3-6 in Chapter 3, Project Description). As further discussed under "Impacts of Proposed Stadium Project" below, a new parking area with parking for up to 39 cars and 1 bus and access from Third Street would also be constructed south of the stadium as part of the Stadium Project.

Designs for the new campus facilities have not been finalized. The following 10 new buildings would be constructed (see Figure 3-4 for locations):

- Science (two stories) (Building No. 1)
- Administration/Kitchen/Student Commons Building, Four Classrooms and Conference Space (two stories) (Building No. 2)
- Career and Technical Education (CTE)/Art (one story) (Building No. 3)
- Classrooms/Ceramics/Theater (two stories) (Building No. 4)
- Wrestling/Dance/Classrooms/Offices (one story) (Building No. 7)
- Restrooms/Changing Rooms (one story) (Building No. 8)

In addition, three existing buildings, Building A (Administration/Theater/Classrooms), Building D (Classroom/Library), and Building K (Head Start) would be modernized. Specific components of the Stadium Project (e.g., bleachers, restrooms, etc.) would also be constructed.

It is assumed that the modernized buildings would remain at their existing height, and all of the new buildings would be within the 36-foot height limit specified by City of San Rafael Zoning Code for this particular district. As shown in Figure 3-4, two-story buildings would be 30 feet in height. New buildings would be located in the campus core, which would allow the east and west sides of the SRHS campus to be maintained for existing and upgraded sports fields. New buildings would also generally be located with similar setbacks from Mission Avenue, where campus buildings are in proximity to residences on the north side of the street.

The three new buildings that would be located at the north end of the campus near Mission Avenue would be a new two-story science building (Building 1), a new two-story building to hold classrooms, space for ceramics, and theater space (Building 4), and a new one-story building for wrestling, dance and classrooms adjoining the existing gymnasium. No specific designs have yet been developed for these buildings. According to District consultants (Norgaard, 2016), public input regarding design would take place during the future Schematic Design Phase, when the general building design (e.g., scale, bulk, and exterior design) is developed and agreed upon prior to moving on to Design Development.

There would be "town hall" meetings for each phase of each project proposed for development at the SRHS campus. In addition, there would be District Board of Trustees approval at various stages of design, and these approval stages would allow additional public input. Generally, such approvals occur at the Schematic Design Phase and the 50 Percent Construction Documents stage. The District proposes to have individual Project Site Design Committees established for the SRHS campus composed of administration, staff, parents, and neighbors who could have substantial input during the Schematic Design Phase of each project.

No landscape plans for the campus have been developed. Therefore, it is difficult to determine how compatible the designs would be with the nearby residential neighborhood on the north side of Mission Avenue. Without this information, there is the potential that new buildings could result in degradation of the existing visual character or quality of the SRHS campus (including historic campus buildings that are proposed for retention) and its surroundings if new buildings do not respect the overall design of the campus and surrounding residences, or include adequate landscaping. For this reason, Mitigation Measures AESTHETICS-1a through 1f are recommended below.

Mitigation Measure AESHETICS-1a: New buildings shall be designed to be both contemporary in appearance and compatible with the materiality, features, size, scale, and proportion, and massing of the existing historic building (Building A) on campus. The new work shall be differentiated from the old and shall not create a false sense of historical development.

Mitigation Measure AESTHETICS-1b: Building heights shall be less than 36 feet to be within the limits established by the City of San Rafael for the Public/Quasi-Public zoning district and to respect the scale of nearby residences.

Mitigation Measure AESTHETICS-1c: New buildings shall be designed in a color scheme that is compatible with the neutral and earth-tone colors of existing buildings, with accent colors used for specific detailing.

Mitigation Measure AESTHETICS-1d: The District shall establish Project Site Design Committees for the new buildings on the campus prior to development of schematic designs for new buildings (except for the Stadium Project, which has already undergone schematic design), and shall ensure that at least one public hearing is held for each project prior to development of construction drawings. The Project Site Design Committees shall include at least two representatives of the neighborhood.

Mitigation Measure AESTHETICS-1e: Large expanses of flat wall area along Mission Avenue shall be avoided in new buildings (especially Building 4, which has a long east/west axis), and windows and architectural detailing shall be added to provide a more aesthetically pleasing view of buildings as seen from Mission Avenue.

Mitigation Measure AESTHETICS-1f: A landscape plan shall be developed for the entire campus prior to construction of any new campus buildings in the campus core. This plan shall be reviewed by the District Board of Trustees at one public hearing that shall allow comments from the public. Suggestions from this hearing shall be considered prior to developing the final landscape plans that shall be developed prior to any construction within the campus core. The new landscape plan shall include groundcover and shrubbery at the north end of the site adjacent to Mission Avenue, where a narrow setback would exist between new buildings and the sidewalk area. New evergreen tree plantings shall occur along Mission Avenue to screen campus buildings from view, and to screen parking areas from view. Additional tree plantings with evergreen trees shall be included for the main existing parking area adjoining 3rd Street as well as for the new parking lot for 39 cars (and one bus) at the south end of the Stadium Project site. A minimum of five evergreen trees that are at least 24 feet at maturity shall be planted on the south and east sides of this new parking area. All trees shall be planted from 24-inch boxes and shall be monitored for the first 3 years so that any lost trees can be replaced.

The combination of the above measures would reduce this potential impact to a less-than-significant level. (LTS)

Impact AESTHETICS-2: Development in accordance with the Master Facilities Long-Range Plan could result in increased light and glare for the surrounding residential neighborhood due to lighting of facilities and outdoor areas. (PS)

A lighting plan has not yet been prepared for the overall Master Facilities Long-Range Plan. However, it is anticipated that, for security and functional purposes, new lighting would be added within parking areas, at the edges of buildings, at campus entry points, and along internal pathways and corridors, including emergency egress lighting. In addition, all new classroom and administrative spaces would be lit. No new major lighting is proposed for the sports fields. Replacement lighting is proposed for the Stadium Project and this is discussed below under Impact AESTHETICS-3.

> *Mitigation Measure AESTHETICS-2: All new lighting shall be shielded to reduce off-site light and glare. Pedestrian pathway lighting shall be of a uniform style and quality of illumination that aids in navigation without over-lighting the surroundings. Signage lighting shall be minimized to provide context for pedestrians and drivers. Parking lot lighting shall be shielded and cast downward to minimize "light spillage" to off-site locations and shall be placed on timers so that minimal lighting occurs after 11:00 PM. To the extent practicable, area lighting and security lighting shall be controlled by the use of timed switches and/or motion detector activation to reduce energy consumption and excess lighting. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Impacts Regarding Visual Degradation

The new Stadium Project would not have the potential to substantially degrade the existing visual character or quality of the site and its surroundings.

This impact would be less than significant because of the types of changes proposed for the Stadium Project. New synthetic turf would replace the existing grass turf that now exists, thus extending the seasonal use of the field. The project would include a number of other improvements, such as energy-efficient lighting to replace existing lighting, a new public address system to direct sound to bleachers and the field, new parking for up to 39 cars at the south end of the field (just north of 3rd Street) with an exit driveway at this location, replacement of utilities, new furnishings, new bleachers (Building No. 9 in Figure 3-4), a new concession stand (Building No. 5 in Figure 3-4) and ticket booth (Building No. 17 in Figure 3-6), new restrooms (Buildings No. 6 and No. 10 in Figure 3-4), and a new plaza (see Figure 3-6). New plantings of trees near 3rd Street would be planted to replace trees removed for new construction.[1]

Buildings proposed for demolition as part of the Stadium Project consist of the following (see Figure 3-4 in Chapter 3, Project Description):

- Bleachers (Building V)
- Press Box (Building X)
- Concession Stand (Building Y)
- Ticket Booth (Building Z)

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[1] Figures 3-4 and 3-6 use different numbering systems for Stadium Project facilities. Therefore, the exact figure is called out for each reference.

The Stadium Project includes construction of the following main new buildings (see Figure 3-6):

- Concessions (Building No. 32)
- Restrooms/Changing Rooms (Building No. 14)
- Bleachers (Building No. 3)
- Restrooms (Building No. 14)
- Ticket booth (Building No. 17)

Other components of the Stadium Project include the new multi-access turf field, access gates, a welcome plaza, announcer's booth, temporary Christmas tree lot concession stand, and new scoreboard. The site plan for the Stadium Project (see Figure 3-6) shows new plantings adjacent to 3rd Street that would partially screen the new Stadium Project parking area from view. Mitigation Measure AESTHETICS-1f would ensure that adequate tree plantings are provided for this parking area.

The new bleachers that would be constructed would generally be similar in size and location to the existing bleachers; however, seating would be reduced overall from 2,550 seats to 1,900 seats (see Table 3-2).

With the implementation of Mitigation Measure AESTHETICS-1f, no significant impacts related to visual degradation would result from the Stadium Project.

Potentially Significant Impacts

<u>Impact AESTHETICS-3</u>: Lighting for the Stadium Project could result in increased light and glare for the surrounding residential neighborhood. (PS)

As shown in Table 3-2 in Chapter 3, Project Description, new lighting for the Stadium Project would replace existing lighting. The new lighting would be energy-efficient, light-emitting diode (LED) lights. In addition, pedestrian and security lighting and emergency egress lighting would be provided. Now, there are 36 1,500-watt Metal Halide fixtures mounted on four poles at the stadium site, plus 19 lights in canopies. The Stadium Project would include 80 597-watt LED fixtures. Thus, the overall wattage for lighting the fields would be reduced, even with an additional 18 86-watt LED fixtures on either field light poles or pedestrian light poles. New LED pedestrian height poles would be added but the exact wattage of these has not been identified.

Concerns have been raised by some members of the American Medical Association (AMA) regarding the problems with LED lighting and associated health problems due to glare (CNN, 2016). A concern relates to "white" LED street lighting, which can cause discomfort and glare. If there is a high blue content in the lighting, it can cause severe glare, resulting in pupillary constriction in the eyes. Blue light scatters more in the human eye than the longer wavelengths of yellow and red, and sufficient levels can damage the retina, resulting in sight problems at night. Another concern relates to impacts on human circadian rhythmicity, and suppression on melatonin. The AMA recommends minimizing the "blue-rich" lighting and using 3000 Kelvin (K) or lower lighting for outdoor installations, with shielding to minimize glare. The "K" refers to the color temperature (CT) which is a measure of the spectral content of light from a source, and how much blue, green, yellow and red there is. A higher CT rating means greater blue content and a more apparent white light.

Mitigation Measure AESTHETICS-3: The District shall install outdoor lighting that is light-emitting diode (LED) but that is no greater than 3,000 Kelvin and that minimizes the "blue-rich" lighting as a means of reducing glare in the community and protecting public health. All outdoor lighting shall be shielded and directed downwards to minimize "light spillage" to off-site locations. Lighting shall be on timers so that no lighting of the Stadium Project fields occurs after 11:00 PM. Pedestrian and security lighting shall be strategically placed in the Stadium Project vicinity so that excessive lighting does not occur and shall also be shielded and directed downward. When possible, motion activated lighting shall be used to minimize overall lighting of the Stadium Project area. (LTS)

CUMULATIVE IMPACTS

For aesthetics, the geographic scope for assessing cumulative impacts is the area within the campus environs and the immediate vicinity. The main project in the vicinity of the SRHS campus is the San Rafael Corporation Yard (Site No. 16 in Figure 6-2 in Chapter 6, CEQA Considerations, of this EIR) where, over the long term, up to 40 units of senior housing could be provided. This housing has been identified in the San Rafael General Plan but has not been approved. The Master Facilities Long-Range Plan, including the Stadium Project and in conjunction with this potential future housing project, could result in a cumulative increase in light and glare within the city; however, implementation of Mitigation Measures AESTHETICS-2 and AESTHETICS-3 above would ensure that the Master Facilities Long-Range Plan, including the Stadium Project, would not significantly contribute to this potential cumulative impact. No other cumulative aesthetic impacts would be likely. For these reasons, the Master Facilities Long-Range Plan, including the Stadium Project, would not result in or contribute to any significant cumulative aesthetic impacts.

4.1.5 REFERENCES

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San Rafael City Schools, 2016. Resolution No. 169.1, June 27.

Skewes-Cox, 2016. Preparation of Figure 4.1-1, 2, 3, and 4 based on site work undertaken October 23.

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4.2 AIR QUALITY

4.2.1 INTRODUCTION

This section of the EIR provides a summary of current air quality conditions and the regulatory setting, and analyzes potential air quality impacts that would result during construction activities and long-term operations associated with implementation of the Master Facilities Long-Range Plan, including the Stadium Project. This air quality impact analysis was prepared in accordance with the Bay Area Air Quality Management District (BAAQMD) *CEQA Air Quality Guidelines* (BAAQMD, 2011 and 2012a) on a program level for the Master Facilities Long-Range Plan as a whole and on a project level for the Stadium Project element of the Master Facilities Long-Range Plan. Air quality impacts that could result from implementation of the Master Facilities Long-Range Plan include increases in criteria air pollutant and toxic air contaminant (TAC) emissions during construction and operation. The significance of these impacts is evaluated and the impact analysis explains how application of mitigation measures would reduce or avoid potentially significant impacts, as necessary.

4.2.2 ENVIRONMENTAL SETTING

The San Rafael High School (SRHS) campus is located in the City of San Rafael in the County of Marin, which is located in the San Francisco Bay Area Air Basin (SFBAAB). Air basins have natural characteristics that limit the ability of natural processes to either dilute or transport air pollutants. The major determinants of air pollution transport and dilution are climatic and topographic factors such as wind, atmospheric stability, terrain that influences air movement, and sunshine. Winds and terrain can combine to transport pollutants away from upwind areas, while solar energy can chemically transform pollutants in the air to create secondary, photochemical pollutants such as ozone. The following discussion provides an overview of the environmental setting for air quality in the SFBAAB.

REGIONAL CLIMATE, METEOROLOGY, AND TOPOGRAPHY

The Bay Area has a Mediterranean climate characterized by wet winters and dry summers. During the summer, a high pressure cell centered over the northeastern Pacific Ocean results in stable meteorological conditions and a steady northwesterly wind flow that keep storms from affecting the California coast. During the winter, the Pacific high-pressure cell weakens resulting in increased precipitation and the occurrence of storms. The highest air pollutant concentrations in the Bay Area generally occur during inversions, when a surface layer of cooler air becomes trapped beneath a layer of warmer air. An inversion reduces the amount of vertical mixing and dilution of air pollutants in the cooler air near the surface (BAAQMD, 2012a).

Marin County is bounded on the west by the Pacific Ocean, on the east by San Pablo Bay, on the south by the Golden Gate, and on the north by the Petaluma Gap. San Rafael is located in the southeastern part of Marin County. The eastern side of Marin County has warmer weather than the western side because of its distance from the ocean and because the hills that separate eastern

Marin from western Marin occasionally block the flow of the marine air. The temperatures of cities next to the Bay are moderated by the cooling effect of the Bay in the summer and the warming effect of the Bay in the winter. For example, San Rafael experiences average maximum summer temperatures in the low 80 degrees Fahrenheit and average minimum winter temperatures in the low 40 degrees Fahrenheit.

While Marin County does not have many polluting industries, the air quality on its eastern side (especially along the U.S. 101 corridor) may be affected by emissions from increasing motor vehicle use within and through the county. The prevailing wind directions throughout Marin County are generally from the northwest. In southeast Marin County, the influence of marine air keeps pollution levels low (BAAQMD, 2012a).

AIR POLLUTANTS OF CONCERN

The California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA) currently focus on the following air pollutants as regional indicators of ambient air quality: ozone, suspended particulate matter (i.e., respirable particulate matter [PM_{10}] and fine particulate matter [$PM_{2.5}$]), nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), and lead. Because these are the most prevalent air pollutants known to be deleterious to human health and about which extensive health-effects criteria documents are available, they are referred to as “criteria air pollutants.”

In the SFBAAB, the primary criteria air pollutants of concern are CO, ground level ozone formed through reactions of oxides of nitrogen (NO_x) and reactive organic gases (ROG), PM_{10}, and $PM_{2.5}$. In addition to criteria air pollutants, local emissions of TACs, such as diesel particulate matter (DPM), are a concern for nearby receptors. These primary air pollutants of concern are discussed further below.

Carbon Monoxide (CO)

CO is a colorless, odorless gas produced by the incomplete combustion of fuels, and the primary source of CO in the SFBAAB is motor vehicles. CO impacts are generally localized as CO will disperse rapidly as distance increases from the source, but high concentrations can be a concern in areas with heavy traffic congestion. CO concentrations tend to be the highest during the winter morning, with little to no wind, when surface-based inversions trap the pollutant at ground levels. The highest ambient CO concentrations are generally found near highly congested transportation corridors and intersections. When inhaled at high concentrations, CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood. This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease, or anemia, as well as fetuses. Even healthy people exposed to high CO concentrations can experience headaches, dizziness, fatigue, unconsciousness, and even death.

Ozone

While ozone serves a beneficial purpose in the upper atmosphere (stratosphere) by reducing ultraviolet radiation potentially harmful to humans, it can be harmful to the human respiratory system and to sensitive species of plants when it reaches elevated concentrations in the lower atmosphere. Ozone is not emitted directly into the environment, but is formed in the atmosphere by complex chemical reactions between ROG and NO_x in the presence of sunlight. Ozone formation is greatest during periods of little or no wind, bright sunshine, and high temperatures. As a result, levels of ozone usually build up during the day and peak in the afternoon hours.

Sources of ROG and NO_x are vehicle tailpipe emissions; the evaporation of solvents, paints, and fuels; and biogenic sources.[1] Automobiles are the single largest source of ozone precursors in the SFBAAB. Short-term ozone exposure can reduce lung function in children, make persons susceptible to respiratory infection, and produce symptoms that cause people to seek medical treatment for respiratory distress. Long-term exposure can impair lung defense mechanisms and lead to emphysema and chronic bronchitis. Ozone can also damage plants and trees, and materials such as rubber and fabrics.

Particulate Matter (PM_{10} and $PM_{2.5}$)

PM_{10} and $PM_{2.5}$ consist of extremely small, suspended particles or droplets 10 microns and 2.5 microns or smaller in diameter, respectively. Some sources of particulate matter, like pollen, forest fires, and windblown dust, are naturally occurring. In populated areas, however, most particulate matter is caused by road dust, combustion products, abrasion of tires and brakes, and construction activities. Particulate matter can also be formed in the atmosphere by condensation of SO_2 and ROG.

Particulate matter exposure can affect breathing, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, and damage lung tissue, contributing to cancer and premature death. Individuals with chronic obstructive pulmonary or cardiovascular disease, asthmatics, the elderly, and children are most sensitive to the effects of particulate matter.

Toxic Air Contaminants

TACs include a diverse group of air pollutants that can adversely affect human health. Unlike criteria air pollutants, which are regionally regulated based on the California ambient air quality standards (CAAQS), TAC emissions are evaluated based on estimations of localized concentrations and risk assessments. The adverse health effects a person may experience following exposure to any chemical depend on several factors, including the amount to which one is exposed (dose), the duration of exposure, the form of the chemical, and if exposure to any other chemicals has occurred.

For risk assessment purposes, TACs are separated into carcinogens and non-carcinogens. Carcinogens are assumed to have no safe threshold below which health impacts would not occur and cancer risk is expressed as excess cancer cases per one million exposed individuals over a lifetime of exposure. Non-carcinogenic substances are generally assumed to have a safe threshold below which health impacts would not occur. Acute and chronic exposure to non-carcinogens is expressed as a hazard index (HI), which is the sum of expected exposure levels divided by the

[1] Biogenic sources include volatile organic compounds, which include ROG, from the decomposition of vegetative matter and certain plants, such as oak and pine trees.

corresponding acceptable exposure levels. In the SFBAAB, adverse air quality impacts on public health from TACs are predominantly from DPM.

DPM is generated when an engine burns diesel fuel. It is the particulate component of diesel exhaust, which includes diesel soot and aerosols such as ash particulates, metallic abrasion particles, sulfates, and silicates. DPM is of particular health concern as it can penetrate deeply into the lungs, where it can contribute to a range of health problems. In 1998, CARB identified particulate matter from diesel-powered engines as a TAC based on its potential to cause cancer and other adverse health effects (CARB, 1998). While diesel exhaust is a complex mixture that includes hundreds of individual constituents, under California regulatory guidelines DPM is used as a surrogate measure of exposure for the mixture of chemicals that make up diesel exhaust as a whole.

EXISTING SENSITIVE RECEPTORS

The term "sensitive receptor" refers to a location where individuals are more susceptible to poor air quality. Sensitive receptors include schools, convalescent homes, and hospitals because the very young, the old, and the infirm are more susceptible to air-quality-related health problems than the general public. Residential areas are also considered sensitive to poor air quality because people are often at home for extended periods, thereby increasing the duration of exposure to potential air contaminants (BAAQMD, 2012a).

Sensitive receptors on the SRHS campus include the 9th to 12th grade classrooms where children congregate throughout the school day. Other sensitive receptors near the SRHS campus include residences located immediately north and east of the campus.

4.2.3 REGULATORY FRAMEWORK

FEDERAL, STATE, AND REGIONAL REGULATIONS

The EPA is responsible for implementing the programs established under the federal Clean Air Act, such as establishing and reviewing the national ambient air quality standards (NAAQS) and judging the adequacy of State Implementation Plans (SIP) to attain the NAAQS. The SIP must integrate federal, state, and local plan components and regulations to identify specific measures to reduce pollution in nonattainment areas, using a combination of performance standards and market-based programs. If a state fails to enforce its SIP-approved regulations, or if the EPA determines that a state's SIP is inadequate, the EPA is required to prepare and enforce a Federal Implementation Plan to promulgate comprehensive control measures for a given SIP.

CARB is responsible for establishing and reviewing the CAAQS, developing and managing the California SIP, identifying TACs, and overseeing the activities of regional air quality management districts. In California, mobile emissions sources (e.g., construction equipment, trucks, and automobiles) are regulated by CARB, and stationary emissions sources (e.g., industrial facilities) are regulated by air quality management districts.

The CAAQS and NAAQS, which were developed for criteria air pollutants, are intended to incorporate an adequate margin of safety to protect the public health and welfare. California has also established ambient air quality standards for sulfates, visibility-reducing particles, hydrogen sulfide, and vinyl chloride. To achieve ambient air quality standards, criteria air pollutant emissions in California are managed through control measures described in regional air quality plans and emission limitations placed on permitted stationary sources.

In accordance with the federal Clean Air Act and California Clean Air Act, areas in California are classified as either in "attainment," "maintenance," or "non-attainment" of the NAAQS or CAAQS for each criteria air pollutant. To assess the regional attainment status, the BAAQMD collects ambient air quality data from over 30 monitoring sites within the SFBAAB. Based on the monitoring data, the SFBAAB is currently designated as a non-attainment area for ozone, PM_{10}, and $PM_{2.5}$, and is designated an attainment or unclassified area for all other pollutants (see **Table 4.2-1**).

Regulation of TACs, referred to as hazardous air pollutants (HAPs) under federal regulations, is achieved through federal, state, and local controls on individual sources. The air toxics provisions of the federal Clean Air Act require the EPA to establish National Emission Standards for Hazardous Air Pollutants (NESHAP) to identify HAPs that are known or suspected to cause cancer or other serious health effects to protect public health and welfare. California regulates TACs primarily through the Tanner Air Toxics Act (Assembly Bill 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (Assembly Bill 2588). The Tanner Act created California's program to identify and reduce exposure to TACs. To date, CARB has identified over 21 TACs and adopted the EPA's list of 187 HAPs as TACs. The Hot Spots Act supplements the Tanner Act by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and facility plans to reduce these risks.

Bay Area Air Quality Management District Responsibilities

The BAAQMD is primarily responsible for assuring that the NAAQS and CAAQS are attained and maintained in the SFBAAB. The BAAQMD fulfills this responsibility by adopting and enforcing rules and regulations concerning air pollutant sources, issuing permits, inspecting stationary sources of air pollutants, responding to citizen complaints, and monitoring ambient air quality and meteorological conditions. The BAAQMD also awards grants to reduce motor vehicle emissions and conducts public education campaigns and many other activities associated with improving air quality within the SFBAAB.

The demolition of existing buildings and structures are subject to BAAQMD's Regulation 11, Rule 2 (Asbestos Demolition, Renovation, and Manufacturing), which limits asbestos emissions from demolition or renovation of structures and the associated disturbance of asbestos-containing waste material generated or handled during these activities. The rule addresses the national emissions standards for asbestos along with some additional requirements. The rule requires the lead agency and its contractors to notify BAAQMD of any regulated renovation or demolition activity. This notification includes a description of structures and methods utilized to determine whether asbestos-containing materials are potentially present. All asbestos-containing material found on the site must be removed prior to demolition or renovation activity in accordance with BAAQMD Regulation 11, Rule 2, including specific requirements for surveying, notification, removal, and disposal of material containing asbestos. Therefore, projects that comply with Regulation 11, Rule 2 would ensure that asbestos-containing materials would be disposed of appropriately and safely.

TABLE 4.2-1 AIR QUALITY STANDARDS AND ATTAINMENT STATUS

		CAAQS		NAAQS	
Pollutant	**Averaging Time**	**Concentration**	**Attainment Status**	**Concentration**	**Attainment Status**
Ozone	8-Hour	0.070 ppm	N	0.070 ppm	N
	1-Hour	0.09 ppm	N	Revoked in 2005	---
Carbon Monoxide (CO)	8-Hour	9.0 ppm	A	9 ppm	A
	1-Hour	20 ppm	A	35 ppm	A
Nitrogen Dioxide (NO_2)	1-Hour	0.18 ppm	A	0.100 ppm	U
	Annual	0.030 ppm	A	0.053 ppm	A
Sulfur Dioxide (SO_2)	24-Hour	0.04 ppm	A	0.14 ppm	A
	1-Hour	0.25 ppm	A	0.075 ppm	A
	Annual	---	---	0.030 ppm	A
Respirable Particulate Matter (PM_{10})	Annual	20 µg/m^3	N	---	---
	24-Hour	50 µg/m^3	N	150 µg/m^3	U
Fine Particulate Matter ($PM_{2.5}$)	Annual	12 µg/m^3	N	12 µg/m^3	U/A
	24-Hour	---	---	35 µg/m^3	N
Sulfates	24-Hour	25 µg/m^3	A	---	---
Lead	30-Day	1.5 µg/m^3	A	---	---
	Calendar Quarter	---	---	1.5 µg/m^3	A
	Rolling 3-Month	---	---	0.15 µg/m^3	A
Hydrogen Sulfide	1-Hour	0.03 ppm	U	---	---
Vinyl Chloride	24-Hour	0.010 ppm	Unknown	---	---
Visibility Reducing Particles	8 Hour (10:00 to 18:00 PST)	---	U	---	---

Notes: A=Attainment; N=Non-attainment; U=Unclassified; "---"=Not Applicable; ppm=parts per million; µg/m^3=micrograms per cubic meter; CAAQS=California ambient air quality standards; NAAQS=national ambient air quality standards; PST=Pacific Standard Time.
Source: Bay Area Air Quality Management District (BAAQMD), 2016a. *Air Quality Standards and Attainment Status.* Website: http://www.baaqmd.gov/research-and-data/air-quality-standards-and-attainment-status, accessed November 10.

In June 2010, the BAAQMD adopted thresholds of significance to assist lead agencies in the evaluation and mitigation of air quality impacts under CEQA (BAAQMD, 2010a). The BAAQMD's thresholds established levels at which emissions of ozone precursors (ROG and NO_x), PM_{10}, $PM_{2.5}$, local CO, and TACs could cause significant air quality impacts. In 2010, the thresholds of significance were incorporated into the BAAQMD's *CEQA Air Quality Guidelines* to assist lead agencies in evaluating air quality impacts of projects and plans proposed in the SFBAAB (BAAQMD, 2011). However, the California Building Industry Association (CBIA) challenged the use of the BAAQMD's thresholds in *CEQA Air Quality Guidelines* in a lawsuit based, in part, on the claim that the thresholds are invalid under the California Environmental Quality Act (CEQA) because one of the thresholds would require the analysis of how existing environmental conditions will impact future residents or users (receptors) of a proposed project. Under mandate from the Alameda County Superior Court, the BAAQMD updated its *CEQA Air Quality Guidelines* in 2012 to exclude the thresholds of significance. Since the adoption process and scientific soundness of the BAAQMD's thresholds have not been challenged, the thresholds that relate to the analysis of the project's impacts on the environment are used in this CEQA analysis, as described in Section 4.2.4, below.

Bay Area Clean Air Plan

In accordance with the California Clean Air Act, the BAAQMD is required to prepare and update an air quality plan that outlines measures by which both stationary and mobile sources of pollutants can be controlled in order to achieve the NAAQS and CAAQS in areas designated as non-attainment. In September 2010, the BAAQMD adopted the *Bay Area 2010 Clean Air Plan* (CAP) (BAAQMD, 2010b). The 2010 CAP includes 55 control measures to reduce ozone precursors, particulate matter, TACs, and greenhouse gases. The 2010 CAP was developed based on computer modeling and analysis of existing air quality monitoring data and emissions inventories, and incorporated traffic and population growth projections prepared by the Metropolitan Transportation Commission and the Association of Bay Area Governments, respectively.

The traffic control measures identified in the 2010 CAP have been incorporated into the Transportation Authority of Marin's (TAM's) Congestion Management Program (CMP) (TAM, 2015). These measures promote alternate modes of transportation and thereby help reduce traffic congestion and improve air quality.

LOCAL REGULATIONS

The following San Rafael General Plan policies and programs are related to air quality (City of San Rafael, 2013):

Policy AW-1 **State and Federal Standards.** Continue to comply and strive to exceed state and federal standards for air quality for the benefit of the Bay Area.

Program AW-1a **Cooperation with Other Agencies.** Cooperate with the Bay Area Air Quality Management District (BAAQMD) and other agencies in their efforts to ensure compliance with existing air quality regulations.

Policy AW-2 **Land Use Compatibility.** To ensure excellent air quality, promote land use compatibility for new development by using buffering techniques such as landscaping, setbacks, and screening in areas where different land uses abut one another.

Program AW-2a **Sensitive Receptors.** Through development review, ensure that siting of any new sensitive receptors provides for adequate buffers from existing sources of toxic air contaminants or odors. If development of a sensitive receptor (a facility or land use that includes members of the population sensitive to the effects of air pollutants, such as children, the elderly and people with illnesses) is proposed within 500 feet of Highway 101 or I-580, an analysis of mobile source toxic air contaminant health risks should be performed. Development review should include an evaluation of the adequacy of the setback from the highway and, if necessary, identify design mitigation measures to reduce health risks to acceptable levels.

Program AW-2b **Buffers.** Through development review, ensure that any proposed new sources of toxic air contaminants or odors provide adequate buffers to protect sensitive receptors and comply with existing health standards.

Policy AW-3 **Air Quality Planning with Other Processes.** Integrate air quality considerations with the land use and transportation processes by mitigating air quality impacts through land use design measures, such as encouraging project design that will foster walking and biking.

Program AW-3a **Air Pollution Reduction Measures.** Consider revisions to zoning regulations to require developers to implement strategies for air quality improvement described in the BAAQMD/ABAG's guide "Design Strategies for Encouraging Alternatives to Auto Use Through Local Development Review" or subsequent standards.

Program AW-3b **Smart Growth and Livable Communities Programs.** Participate in and implement strategies of Metropolitan Transportation Commission's regional "Smart Growth Initiative" and "Transportation for Livable Communities Program."

Policy AW-4 **Particulate Matter Pollution Reduction.** Promote the reduction of particulate matter pollution from roads, parking lots, construction sites, agricultural lands and other activities.

Program AW-4a **Pollution Reduction.** Through development review, ensure that any proposed new sources of particulate matter use latest control technology (such as enclosures, paving unpaved areas, parking lot sweeping and landscaping) and provide adequate buffer setbacks to protect existing or future sensitive receptors.

Policy AW-5 **Circulation Alternatives.** Promote circulation alternatives that reduce air pollution.

Policy AW-6 **Education and Outreach.** Support public education regarding air pollution prevention and mitigation programs.

Program AW-6a **Air Quality Education Programs.** Support and participate in the air quality education programs of the BAAQMD, such as "Spare the Air" days.

Program AW-6b **Benefits of Transit-Oriented Development.** Assist in educating developers and the public on the benefits of pedestrian and transit-oriented development.

Program AW-6c **Landscaping.** Continue to implement Zoning Guideline for landscaping in order to absorb pollutants.

4.2.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this evaluation and based on Appendix G of the CEQA Guidelines, implementation of the Master Facilities Long-Range Plan, including the Stadium Project, would have a significant effect for air quality if it would:

a. Conflict with or obstruct implementation of the applicable air quality plan(s);

b. Violate any air quality standard or contribute substantially to an existing or projected air quality violation;

c. Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors);

d. Expose sensitive receptors to substantial pollutant concentrations; or

e. Create objectionable odors affecting a substantial number of people.

The following significance criterion would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the plan and is therefore excluded from further discussion in this impact analysis:

- Create Objectionable Odors Affecting a Substantial Number of People. Odor impacts can result from siting a new odor source near existing receptors. The BAAQMD has identified types of land uses that have the potential to generate considerable odors. The land uses include wastewater treatment plants, landfills, confined animal facilities, composting stations, food manufacturing plants, refineries, and chemical plants (BAAQMD, 2012a). The Master Facilities Long-Range Plan does not include any of these land uses or any other sources of odors and there are no existing sources of objectionable odors in the vicinity of the SRHS campus. Therefore, implementation of the Master Facilities Long-Range Plan, including the Stadium Project, would have no impact related to odors.

Plan-Level Thresholds of Significance

The BAAQMD's project-level thresholds that relate to the analysis of the individual project impacts under the Master Facilities Long-Range Plan on the environment are used in this CEQA analysis in conjunction with the BAAQMD's *CEQA Air Quality Guidelines* (BAAQMD, 2011 and 2012a). The project-level thresholds of significance used in this CEQA analysis are summarized in **Table 4.2-2**.

TABLE 4.2-2 BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD) PLAN-LEVEL THRESHOLDS OF SIGNIFICANCE

Impact Analysis	Pollutants	Threshold of Significance
Regional Air Quality (Operation)	Criteria Pollutants	▪ Consistency with Current Air Quality Plan control measures. ▪ Projected VMT or vehicle trip increase is less than or equal to projected population increase.
Local Community Risks and Hazards (Operation)	Toxic Air Contaminants (TACs)	▪ Overlay zones around existing and planned sources of TACs (including adopted Risk Reduction Plan areas). ▪ Overlay zones of at least 500 feet (or Air District-approved modeled distance) from all freeways and high volume roadways.

Notes: VMT = vehicle miles traveled.
The BAAQMD does not recommend plan-level thresholds of significance for criteria pollutants or TACs during construction.
Source: BAAQMD, 2010a.

Project-Level Thresholds of Significance

The BAAQMD's project-level thresholds that relate to the analysis of the individual project impacts under the Master Facilities Long-Range Plan on the environment are used in this CEQA analysis in conjunction with the BAAQMD's *CEQA Air Quality Guidelines* (BAAQMD, 2011 and 2012a). The project-level thresholds of significance used in this CEQA analysis are summarized in **Table 4.2-3**.

To evaluate the cumulative risks and hazards to sensitive receptors from emissions of TACs and exhaust $PM_{2.5}$, the BAAQMD recommends evaluating the potential health risks from the project, existing sources, and reasonably foreseeable future sources within 1,000 feet of the proposed project. Emissions of criteria pollutants and CO above the project-level thresholds of significance represent a cumulatively considerable contribution to regional air quality impacts (BAAQMD, 2009).

TABLE 4.2-3 BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD) PROJECT-LEVEL THRESHOLDS OF SIGNIFICANCE

Impact Analysis	Pollutant	Threshold of Significance
Regional Air Quality (Construction)	ROG	54 pounds/day (average daily emission)
	NO_x	54 pounds/day (average daily emission)
	Exhaust PM_{10}	82 pounds/day (average daily emission)
	Exhaust $PM_{2.5}$	54 pounds/day (average daily emission)
	Fugitive dust (PM_{10} and $PM_{2.5}$)	Best management practices
Regional Air Quality (Operation)	ROG	54 pounds/day (average daily emission) 10 tons/year (maximum annual emission)
	NO_x	54 pounds/day (average daily emission) 10 tons/year (maximum annual emission)
	Exhaust PM_{10}	82 pounds/day (average daily emission) 15 tons/year (maximum annual emission)
	Exhaust $PM_{2.5}$	54 pounds/day (average daily emission) 10 tons/year (maximum annual emission)
Local Community Risks and Hazards (Construction)	Exhaust $PM_{2.5}$	0.3 µg/m^3 (annual average)
	Toxic Air Contaminants	Cancer risk increase > 10 in 1 million Chronic of acute hazard index > 1.0
Local Community Risks and Hazards (Operation)	CO	9.0 ppm (8-hour average) 20.0 ppm (1-hour average)
	Exhaust $PM_{2.5}$	0.3 µg/m^3 (annual average)
	Toxic Air Contaminants	Cancer risk increase > 10 in 1 million Chronic or acute hazard index > 1.0
Local Community Risks and Hazards (Cumulative)	Exhaust $PM_{2.5}$	0.8 µg/m^3 (annual average)
	Toxic Air Contaminants	Cancer risk > 100 in 1 million Chronic hazard index > 10.0

Note: ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter; ppm = part per million; DPM = diesel particulate matter; µg/m^3 = micrograms per cubic meter.
Source: BAAQMD, 2010a.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Conflict with Clean Air Plan

Operation of the Master Facilities Long-Range Plan would not conflict with or obstruct implementation of the 2010 Clean Air Plan (CAP).

To evaluate the plan-level impacts for criteria pollutants, the BAAQMD recommends determining if the proposed plan is consistent with the 2010 CAP. Consistency may be determined by evaluating whether the plan supports the primary goals of the 2010 CAP, includes applicable control measures contained within the 2010 CAP, and would not disrupt or hinder implementation of any 2010 CAP control measures.

Under the Master Facilities Long-Range Plan, a new parking area would be constructed as part of the Stadium Project that would result in a net gain of 39 cars and team bus parking. One-way traffic would be allowed in the new parking area to improve circulation and bring traffic off of the street faster than the current layout. The Stadium Project also proposes to locate a new visitor team room building (Building 6) on the southern portion of the campus near 3rd Street, which would partially shift traffic and parking from Mission Avenue to the main stadium lot and thereby reduce traffic congestion and parking demands on Mission Avenue. New bicycle parking facilities would be provided throughout the campus, including eight new bicycle racks as part of the Stadium Project. By improving existing traffic circulation near the SRHS campus and providing additional bicycle parking, the Master Facilities Long-Range Plan would be consistent with the traffic control measures described in the 2010 CAP.

Facilities on the SRHS campus would be designed with efficient heating and cooling systems beginning with the orientation of the buildings on the site and the placement of the windows on the buildings to maximize natural winter heat gain and minimize summer heat gain. Furthermore, the structures would be constructed of building systems that provide appropriate levels of thermal protection. Skylights and clearstory windows would assist in providing required lighting. All new buildings would be designed with infrastructure for photovoltaic panels. In addition, photovoltaics are planned for other areas of the campus to provide additional power to the campus off the main power grid. The existing stadium lighting would be replaced with more energy-efficient light-emitting diode (LED) stadium lights. Overall, campus improvements would result in more efficient mechanical and electrical systems. By improving energy use on the SRHS campus, the Master Facilities Long-Range Plan would be consistent with the energy control measures described in the 2010 CAP. Likewise, the proposed project would not conflict with the latest clean air planning efforts, since project operations would have emissions below the BAAQMD thresholds (see "Violation of Air Quality Standards" below).

Based on the proposed improvements related to traffic and energy use, operation of the Master Facilities Long-Range Plan would be consistent with the control measures described in the 2010 CAP that are intended to reduce emissions of air pollutants. Therefore, this impact is considered less than significant.

Violation of Air Quality Standards

Operation of the Master Facilities Long-Range Plan would not violate any air quality standard or contribute substantially to an existing or projected air quality violation; or result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard.

The SFBAAB is designated as a non-attainment area for ozone, PM_{10}, and $PM_{2.5}$. Since transportation is the primary source of ozone precursors and particulate matter emissions in the Bay Area, the BAAQMD considers reductions in vehicle miles traveled or vehicle trips a key strategy for achieving the federal and state ambient air quality standards. As shown in **Table 4.2-4**, operation of the Master Facilities Long-Range Plan would increase the existing student population by 17.78 percent. Based on the traffic analysis for the Master Facilities Long-Range Plan (Parisi Transportation Consulting, 2016), operation of the Master Facilities Long-Range Plan would increase the existing weekday vehicle trips by 17.77 percent. Since the vehicle trips would not increase at a rate greater than the student population growth, operation of the Master Facilities Long-Range Plan would not exceed the BAAQMD's plan-level threshold of significance for criteria pollutant (including ozone precursors) emissions. Therefore, this impact is considered less than significant.

TABLE 4.2-4 SUMMARY OF EXISTING AND FUTURE VEHICLE TRIPS AND STUDENT POPULATION

Metric/Variable	Existing Conditions	Master Facilities Long-Range Plan	Percent Increase
Student Population	1,125	1,325	17.78%
Weekday Vehicle Trips	3,923	4,620	17.77%
BAAQMD's Plan-Level Threshold			**Trips < Population**
Exceed Threshold?			No

Note: BAAQMD = Bay Area Air Quality Management District.
Source: Parisi Transportation Consulting, 2016.

Impact on Sensitive Receptors

Operation of the Master Facilities Long-Range Plan would not expose sensitive receptors to substantial pollutant concentrations.

Operation of the Master Facilities Long-Range Plan is not expected to introduce any new stationary sources of TAC and/or $PM_{2.5}$ emissions that could pose substantial health risk or hazards to nearby sensitive receptors. Similarly, there are no reasonably foreseeable future projects near the SRHS campus that would introduce a new stationary source of TAC and/or $PM_{2.5}$ emissions. The vehicle trips generated by operation of the Master Facilities Long-Range Plan could potentially increase localized CO concentrations, also known as "hotspots," which can affect sensitive receptors in local communities. While the BAAQMD does not have a plan-level threshold of significance to evaluate impacts from local CO concentrations, the BAAQMD's project-level threshold of significance was used to provide a conservative plan-level analysis.

The source of local CO concentrations is often associated with heavy traffic congestion, which most frequently occurs at signalized intersections of high-volume roadways. The BAAQMD's threshold of significance for local CO concentrations is equivalent to the 1- and 8-hour CAAQS of 20.0 parts per million (ppm) and 9.0 ppm, respectively, because these represent levels that are protective of public health. The BAAQMD has developed conservative screening criteria that can be used to determine if a project would generate traffic congestion at intersections that could potentially cause or contribute to local CO levels above the CAAQS. According to the BAAQMD (2011), the Master Facilities Long-Range Plan would result in a less-than-significant impact related to localized CO concentrations if all of the following screening criteria are met:

- The project is consistent with an applicable CMP established by the County Congestion Management Agency for designated roads or highways, regional transportation plans, and local congestion management agency plans.
- The project traffic would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour.
- The project traffic would not increase traffic volumes at affected intersections to more than 24,000 vehicles per hour where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, below-grade roadway).

TAM serves as the County Congestion Management Agency for Marin County. The current CMP requires an analysis of any project that is expected to generate more than 100 weekday PM (afternoon) peak-hour vehicle trips (TAM, 2015). The Master Facilities Long-Range Plan is expected to generate 65 weekday PM peak-hour trips (Parisi Transportation Consulting, 2016). Since the Master Facilities Long-Range Plan would generate fewer than 100 weekday PM peak-hour vehicle trips, the plan is consistent with the current CMP. The existing traffic volumes at intersections near the SRHS campus are fewer than 5,000 vehicles per hour. Since the Master Facilities Long-Range Plan would comply with the BAAQMD's screening criteria, local CO concentrations associated with operation of the Master Facilities Long-Range Plan would have a less-than-significant impact on nearby sensitive receptors.

Operation of the Master Facilities Long-Range Plan would also introduce more sensitive receptors (additional 200 students) to the SRHS campus, who could be exposed to existing sources of TAC and/or $PM_{2.5}$ emissions. While CEQA does not require the analysis or mitigation of potential effects that the existing environment may have on a project (with certain exceptions) (*CBIA v. Bay Area Air Quality Management District* (2015) 62 Cal.4th 369), an analysis of the potential effects that existing TAC and $PM_{2.5}$ sources may have on the future receptors (i.e., students) at the SRHS campus was performed to provide information to the public and decision-makers.

The BAAQMD's *Planning Healthy Places Guidance* provides tools and recommendations to assist local governments in assessing and minimizing the potential air quality impacts on local communities from existing sources of TACs and $PM_{2.5}$ (BAAQMD, 2016b). The BAAQMD's guidance includes an interactive mapping tool of Bay Area communities that identifies locations characterized by elevated TAC and/or $PM_{2.5}$ concentrations. Based on a cumulative analysis of all mobile and stationary sources of TAC and $PM_{2.5}$ pollution in the region, the BAAQMD's map shows zones that exceed a cancer risk of 100 in a million and/or exceed $PM_{2.5}$ concentrations of 0.8 micrograms per cubic meter. The BAAQMD map also shows 500-foot zones around freeways and 175-foot zones around high-volume roadways.[2] The zones identified by the BAAQMD's map satisfy the requirements described under the BAAQMD's plan-level threshold of significance for TACs, except that the map shows a 175-foot zone around high-volume roadways instead of a 500-foot zone. However, this does not affect the analysis of existing TAC sources near the SRHS campus because there are no high-volume roadways within 500 feet of the campus.

[2] The BAAQMD defines a high-volume roadway as a freeway or arterial roadway with greater than 10,000 vehicles or 1,000 trucks per day (BAAQMD, 2012a).

Based on review of the BAAQMD's *Planning Healthy Places Guidance*, the SRHS campus is not included in a zone with elevated TAC or $PM_{2.5}$ levels from existing sources. Therefore, operation of the Master Facilities Long-Range Plan would not expose future sensitive receptors to substantial pollutant concentrations, and this impact is considered less than significant.

Potentially Significant Impacts

Impact AIR-1: Construction for the Master Facilities Long-Range Plan could violate an air quality standard or contribute substantially to an existing or projected air quality violation; or result in a cumulatively considerable net increase of a criteria pollutant (including ozone precursors) for which the project region is non-attainment under an applicable federal or state ambient air quality standard. (PS)

Construction activities for the Master Facilities Long-Range Plan would generate criteria pollutant emissions that could potentially affect regional air quality. The primary pollutant emissions of concern during project construction would be ozone precursors (ROG and NO_x), PM_{10}, and $PM_{2.5}$ from the exhaust of off-road construction equipment and on-road vehicles (worker vehicles, vendor trucks, and haul trucks). In addition, fugitive dust emissions of PM_{10} and $PM_{2.5}$ would be generated by soil disturbance activities.

The BAAQMD does not have plan-level thresholds of significance for construction, because the evaluation of construction air quality impacts at the plan level would be speculative in regards to the construction schedule, types of construction equipment to be used, and amount of materials to be moved (e.g., soil haul trips). Therefore, a project-level analysis of the individual projects under the Master Facilities Long-Range Plan is required to determine the potential impact of criteria pollutant emissions during construction.

Regardless of the estimated emissions, the BAAQMD considers implementation of best management practices (BMPs) to control fugitive dust PM_{10} and $PM_{2.5}$ during construction sufficient to reduce potential impacts from dust to a less-than-significant level. More specifically, the BAAQMD recommends that all construction projects implement the Basic Construction Mitigation Measures from the BAAQMD's *CEQA Air Quality Guidelines* (BAAQMD, 2012a) to reduce emissions of fugitive dust. The BAAQMD's Basic Construction Mitigation Measures for controlling dust are summarized under Mitigation Measure AIR-1a, below. Implementation of Mitigation Measure AIR-1a would reduce potentially significant impacts of fugitive dust emissions during construction for the Master Facilities Long-Range Plan to a less-than-significant level.

> *Mitigation Measure AIR-1a: During project construction, the contractor shall implement a dust control program that includes the following measures:*
>
> - *All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.*
> - *All haul trucks transporting soil, sand, or other loose material off-site shall be covered.*
> - *All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.*
> - *All vehicle speeds on unpaved roads shall be limited to 15 miles per hour.*

- *All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.*
- *A publicly visible sign shall be posted with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Bay Area Air Quality Management District (BAAQMD) phone number shall also be visible to ensure compliance with applicable regulations.*

The foregoing requirements shall be included in the appropriate contract documents with the contractor. (LTS)

Implementation of Mitigation Measures AIR-1b would reduce potentially significant impacts related to emissions of ROG, NO_x, PM_{10}, and $PM_{2.5}$ from equipment exhaust during construction for the Master Facilities Long-Range Plan to a less-than-significant level.

Mitigation Measure AIR-1b: Prior to construction of an individual project under the Master Facilities Long-Range Plan, a project-level analysis of criteria pollutant emissions during construction shall be prepared in accordance with BAAQMD CEQA Air Quality Guidance. If emissions exceed the BAAQMD's project-level thresholds of significance, then exhaust-control measures shall be identified to reduce emissions below the thresholds of significance. Acceptable exhaust-control measures for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, oxidation catalysts, diesel particulate filters, and/or other options as such become available. The contractor shall submit a Certification Statement to the San Rafael City Schools stating that the contractor agrees to comply fully with the identified exhaust-control measures (if any) and acknowledges that a significant violation of these measure shall constitute a material breach of contract. The foregoing requirement shall be included in the appropriate contract documents with the contractor. (LTS)

Impact AIR-2: Construction of the Master Facilities Long-Range Plan could expose sensitive receptors to substantial pollutant concentrations. (PS)

Construction for the Master Facilities Long-Range Plan would generate DPM and $PM_{2.5}$ emissions from the use of off-road diesel equipment required for site grading and excavation, paving, and other construction activities. As described above, the BAAQMD does not have plan-level thresholds of significance for construction, because the evaluation of construction air quality impacts at the plan level would be speculative. Therefore, a project-level analysis of the individual projects under the Master Facilities Long-Range Plan is required to determine the potential impact of DPM and $PM_{2.5}$ emissions during construction. Implementation of Mitigation Measures AIR-2 would reduce potentially significant impacts related to emissions of DPM and $PM_{2.5}$ during construction for the Master Facilities Long-Range Plan to a less-than-significant level.

Mitigation Measure AIR-2: Prior to construction of an individual project under the Master Facilities Long-Range Plan, a project-level health risk analysis of DPM and $PM_{2.5}$ emissions during construction shall be prepared in accordance with BAAQMD and OEHHA guidance. If the health risks and hazards from DPM and $PM_{2.5}$ emissions exceed the BAAQMD's project-level thresholds of significance, then exhaust-control measures shall be identified to reduce *emissions below the thresholds of significance. Acceptable exhaust-control measures for reducing DPM and $PM_{2.5}$ emissions include the use of late model engines, diesel particulate filters, and/or other options as such become available. The contractor shall submit a Certification Statement to the San Rafael City Schools stating that the contractor agrees to comply fully with the identified exhaust-control measures (if any) and acknowledges that a significant violation of these measure shall constitute a material breach of contract. The foregoing requirement shall be included in the appropriate contract documents with the contractor. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Conflict with Clean Air Plan

Operation of the Stadium Project would not conflict with or obstruct implementation of the 2010 CAP.

As discussed above, operation of proposed improvements related to traffic and energy use for the Master Facilities Long-Range Plan, which includes the Stadium Project, would be consistent with the control measures described in the 2010 CAP that are intended to reduce emissions of criteria pollutants. Therefore, this impact is considered less than significant.

Violation of Air Quality Standards

Construction and operation of the Stadium Project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation; or result in a cumulatively considerable net increase of any criteria pollutant (including ozone precursors) for which the project region is non-attainment under an applicable federal or state ambient air quality standard.

As discussed above, operation of the Master Facilities Long-Range Plan, which includes the Stadium Project, would not exceed the BAAQMD's plan-level threshold of significance for criteria pollutant emissions. However, to be conservative, a project-level analysis of the criteria pollutant emissions generated during operation of the Stadium Project is provided below.

The primary pollutant emissions of concern during project operation would be ozone precursors (ROG and NO_x) and exhaust PM_{10} and $PM_{2.5}$ from mobile sources, energy use, and area sources (e.g., consumer products, architectural coatings, and landscape maintenance equipment). The BAAQMD recommends using the most current version of the California Emissions Estimator Model (CalEEMod) to estimate pollutant emissions during project operation. CalEEMod uses widely accepted models for emission estimates combined with appropriate default data for a variety of land use projects that can be used if site-specific information is not available. The default data used in the model (e.g., vehicle emissions factors) are supported by substantial evidence provided by regulatory agencies and a combination of statewide and regional surveys of existing land uses. The primary input data used to estimate emissions associated with operation of the Stadium Project are summarized in **Table 4.2-5**. A copy of the CalEEMod report for the project, which summarizes the input parameters, assumptions, and findings, is included in **Appendix B.**

TABLE 4.2-5 SUMMARY OF CALEEMOD LAND USE INPUT PARAMETERS FOR CONSTRUCTION OF THE STADIUM PROJECT

Land Use Type	Land Use Subtype	Lot Acreage
Recreational	Arena	5

Note: Lot acreage is approximate.
Source: CalEEMod (Appendix B).

Based on the project description and proposed construction schedule for the Stadium Project set forth therein, operation was conservatively assumed to begin in 2018. Additional project-specific information used to calculate operation emissions in CalEEMod, including changes to default data, is summarized in **Table 4.2-6**.

TABLE 4.2-6 SUMMARY OF CALEEMOD INPUT PARAMETERS FOR OPERATION OF THE STADIUM PROJECT

CalEEMod Input Category	Operation Assumptions and Changes to Default Data
Vehicle Trips	According to the traffic analysis by Parisi Transportation Consulting (2016), the project would result in a net increase of 68 daily vehicle trips on weekdays (13.6 trips/acre/day).

Notes: ft^2 = square feet.
Default CalEEMod data used for all other parameters not described.
Source: CalEEMod (Appendix B).

The estimated maximum annual emissions and average daily emissions during the operational phase of the Stadium Project are compared to the BAAQMD's thresholds of significance in **Table 4.2-7**. The estimated unmitigated emissions for ROG, NO_x, and exhaust PM_{10} and $PM_{2.5}$ were below the BAAQMD's thresholds of significance and, therefore, would have a less-than-significant impact on air quality standards. As a result, operation of the Stadium Project would have a less-than-significant impact related to ambient air quality standards.

Construction activities for the Stadium Project would generate criteria pollutant emissions that could potentially affect regional air quality. Based on the project design, project construction activities would include demolition, site preparation, grading, building construction, paving, and applications of architectural coatings. The primary pollutant emissions of concern during project construction would be ROG, NO_x, PM_{10}, and $PM_{2.5}$ from the exhaust of off-road construction equipment and on-road vehicles (worker vehicles, vendor trucks, and haul trucks). In addition, fugitive dust emissions of PM_{10} and $PM_{2.5}$ would be generated by soil disturbance activities.

In accordance with Mitigation Measures AIR-1b, implementation of the BAAQMD's Basic Construction Mitigation Measures during construction of the Stadium Project would reduce impacts from fugitive dust emissions to a less-than-significant level. In accordance with Mitigation Measure AIR-1b, a project-level analysis of the criteria pollutant emissions generated during construction of the Stadium Project is provided below.

TABLE 4.2-7 ESTIMATED UNMITIGATED OPERATION EMISSIONS FOR THE STADIUM PROJECT

	Maximum Annual Emissions (Tons)				Average Daily Emissions (Pounds)			
Emissions Scenario	**ROG**	**NO_x**	**Exhaust PM_{10}**	**Exhaust $PM_{2.5}$**	**ROG**	**NO_x**	**Exhaust PM_{10}**	**Exhaust $PM_{2.5}$**
Area	0.96	<0.01	<0.01	<0.01	5.28	<0.01	<0.01	<0.01
Energy	0.03	0.27	0.02	0.02	0.16	1.45	0.11	0.11
Mobile	0.02	0.05	<0.01	<0.01	0.09	0.28	<0.01	<0.01
Total Operation Emissions	1.0	0.3	<0.1	<0.1	5.5	1.7	0.1	0.1
Thresholds of Significance	10	10	15	10	54	54	82	54
Exceed Threshold?	No	No	No	No	No	No	No	No

Notes: ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter.
Source: CalEEMod (Appendix B).

Criteria pollutant emissions during construction were estimated using CalEEMod and the primary input data summarized in Table 4.2-5. Based on the project description, construction was assumed to begin in late spring 2017. Additional project-specific information used to calculate construction emissions in CalEEMod, including changes to default data, is summarized in **Table 4.2-8**.

TABLE 4.2-8 SUMMARY OF CALEEMOD INPUT PARAMETERS FOR CONSTRUCTION OF STADIUM PROJECT

CalEEMod Input Category	**Construction Assumptions and Changes to Default Data**
Construction Phase	The default construction duration was modified to 180 work days based on detailed information provided by the project sponsor.
Off-Road Equipment	The default construction equipment list was modified based on detailed information provided by the project sponsor.
Material Movement	Approximately 4,000 cubic yards of soil import/export is anticipated.
Demolition	Demolition debris from about 13,500 square feet of existing structures is expected to be hauled off-site. This likely overestimates total haul trips, because most of the structures are bleachers and not buildings.

Note: Default CalEEMod data used for all other parameters not described.
Source: CalEEMod (Appendix B).

To analyze daily emission rates during project construction, the total estimated emissions were averaged over the total working days and compared to the BAAQMD's thresholds of significance in **Table 4.2-9**. The Stadium Project's estimated unmitigated emissions for ROG, NO_x, and exhaust PM_{10} and $PM_{2.5}$ were below the applicable thresholds; therefore, exhaust emissions during construction of the Stadium Project would have a less-than-significant impact related to ambient air quality standards.

TABLE 4.2-9 ESTIMATED UNMITIGATED CONSTRUCTION EMISSIONS FOR STADIUM PROJECT (POUNDS PER DAY)

			Exhaust		Fugitive Dust	
Emissions Scenario	**ROG**	**NO_x**	**PM_{10}**	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Construction Emissions	15	22	1.1	1.0	1.6	0.6
BAAQMD's Thresholds	54	54	82	54	BMPs	BMPs
Exceed Quantitative Threshold?	No	No	No	No	---	---

Notes: ROG = reactive organic gases; NO_x = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter; BMPs = best management practices; --- = not applicable; BAAQMD = Bay Area Air Quality Management District
Source: CalEEMod (Appendix B).

Impact on Sensitive Receptors

Operation of the Stadium Project would not expose sensitive receptors to substantial pollutant concentrations.

As discussed above under the impacts of the proposed Master Facilities Long-Range Plan, operation of the Master Facilities Long-Range Plan, which includes the Stadium Project, would not introduce any new sources of TAC and/or $PM_{2.5}$ emissions that could potentially pose substantial health risks or hazards to nearby sensitive receptors. Similarly, CO emissions from vehicle trips generated by operation of the Master Facilities Long-Range Plan, which includes the Stadium Project, would not pose substantial health risks or hazards to nearby sensitive receptors. Therefore, operation of the Stadium Project would have a less-than-significant impact related to the exposure of sensitive receptors to substantial pollutant concentrations.

Potentially Significant Impacts

Impact AIR-3: Construction of the Stadium Project could expose sensitive receptors to substantial pollutant concentrations. (PS)

TAC Emissions during Construction

In accordance with Mitigation Measure AIR-2, the annual average concentrations of DPM and exhaust $PM_{2.5}$ during construction of the Stadium Project were estimated within 1,000 feet of the proposed project using the EPA's Industrial Source Complex Short Term (ISCST3) air dispersion model. For this analysis, emissions of exhaust PM_{10} from off-road equipment were modeled to estimate concentrations of DPM at nearby sensitive receptors. The concentrations of DPM and exhaust $PM_{2.5}$ at nearby sensitive receptors were estimated based on emissions from off-road equipment on the Stadium Project site. While on-road vehicles accessing the Stadium Project site (worker vehicles, vendor trucks, and haul trucks) would also generate DPM and exhaust $PM_{2.5}$, these emissions account for less than one percent of the total emissions at the Stadium Project site and, therefore, were not included in the analysis. The input parameters and assumptions used for estimating on-site emission rates are included in **Appendix B**.

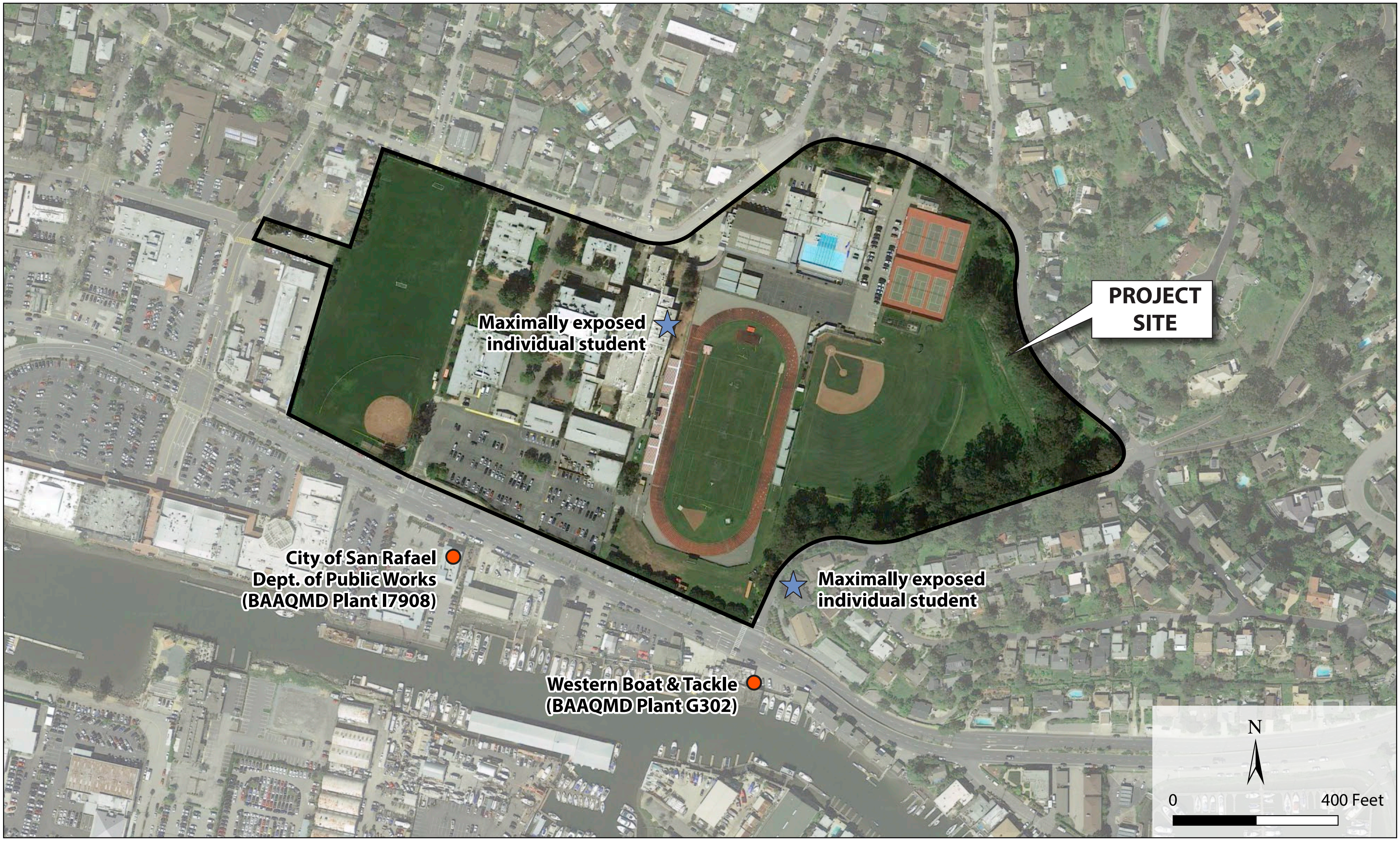
Daily emissions from off-road construction equipment were assumed to occur over an 8-hour period between 8:00 AM and 4:00 PM Monday through Friday during the spring, summer, and fall seasons. This assumption is conservative, because it results in an extension of the anticipated construction period by about 15 more work days. The exhaust from off-road equipment on the Stadium Project site was represented in the ISCST3 model as a series of volume sources with a release height of 5 meters to represent the mid-range of the expected plume rise from frequently used construction equipment.

A uniform grid of receptors spaced 10 meters apart with receptor heights of 1.5 meters was encompassed around the development area as a means of developing isopleths (i.e., concentration contours) that illustrate the dispersion pattern from the various emission sources. All receptor and source heights were adjusted based on local terrain data from the United States Geological Survey's National Elevation Dataset. The ISCST3 model input parameters included 1 year of BAAQMD meteorological data from the Mt. Tamalpais station located about 5 miles southwest of the Stadium Project site.

The air dispersion model was used to estimate both unmitigated and mitigated annual average concentrations of DPM and $PM_{2.5}$ near the Stadium Project. The mitigated concentrations account for the use of Tier 2 diesel engines during construction, as described further below. Based on the results of the air dispersion model (**Appendix B**), the annual average concentrations of DPM and $PM_{2.5}$ at the maximally exposed individual student (MEIS) and the maximally exposed individual resident (MEIR) are summarized in **Table 4.2-10**. The MEIS is a classroom located about 60 feet west of the Stadium Project and the MEIR is a single-unit home located about 185 feet southeast of the Stadium Project (see **Figure 4.2-1**).

In accordance with guidance from the BAAQMD (2012b) and the Office of Environmental Health Hazard Assessment (OEHHA, 2015), a health risk assessment was conducted to calculate the incremental increase in cancer risk and chronic HI to sensitive receptors from DPM emissions during construction. The acute HI for DPM was not calculated because an acute reference exposure level has not been approved by OEHHA and the CARB, and the BAAQMD does not recommend analysis of acute non-cancer health hazards from construction activity. The annual average concentration of DPM at the MEIS and MEIR was used to assess potential health risks to nearby sensitive receptors.

The incremental increase in cancer risk from exposure to DPM emissions during construction was assessed for a student between the ages of 2 and 16 at the MEIS location and an infant under the age of 2 at the MEIR location. These exposure scenarios represent the most sensitive individuals who could be exposed to adverse air quality conditions in the vicinity of the Stadium Project. It was also assumed that the student at the MEIS and the infant at the MEIR would be continuously



SOURCE: Google Earth, 2016

Figure 4.2-1

SOURCES OF LOCAL AIR POLLUTANT EMISSIONS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

TABLE 4.2-10 ANNUAL AVERAGE CONCENTRATIONS AT MAXIMALLY EXPOSED INDIVIDUAL STUDENT (MEIS) AND MAXIMALLY EXPOSED INDIVIDUAL RESIDENT (MEIR) DURING CONSTRUCTION OF STADIUM PROJECT

	Annual Average Concentration (μg/m^3)	
Emissions Scenario	**DPM**	**Exhaust $PM_{2.5}$**
Unmitigated Emissions		
Maximally Exposed Individual Student	0.081	0.076
Maximally Exposed Individual Resident	0.159	0.150
Mitigated Emissions*		
Maximally Exposed Individual Student	0.043	0.040
Maximally Exposed Individual Resident	0.084	0.079

Notes: μg/m^3 = micrograms per cubic meter; DPM = diesel particulate matter; $PM_{2.5}$ = fine particulate matter.
* As described in Mitigation Measure AIR-3, the mitigated emissions account for the use of Tier 2 diesel engines.
Source: See Appendix B.

exposed to DPM concentrations over the entire estimated duration of construction, which is about 180 work days; therefore, this analysis is conservative. The input parameters and results of the health risk assessment are included in **Appendix B**.

Estimates of both the unmitigated and mitigated health risks at the MEIS and MEIR from DPM and $PM_{2.5}$ concentrations during construction of the Stadium Project are summarized and compared to the BAAQMD's thresholds of significance in **Table 4.2-11**. Under the unmitigated construction scenario, all the health risks and hazards at the MEIS and MEIR were below the BAAQMD's thresholds of significance, except for the estimated excess cancer risk at the MEIR; therefore, the unmitigated emissions of DPM during construction of the Stadium Project could result in a potentially significant impact. The use of construction equipment with Tier 2 (or higher) diesel engines would reduce DPM emissions by at least 47 percent, which would lower the excess cancer risk at the MEIR below the BAAQMD's threshold of significance. Implementation of Mitigation Measure AIR-3 would reduce potentially significant impacts of DPM emissions during construction of the Stadium Project to a less-than-significant level.

> <u>*Mitigation Measure AIR-3*</u>*: During Stadium Project construction, the contractor shall use off-road equipment that meets the California Air Resources Board's Tier 2 (or higher) certification requirements. The contractor shall submit a Certification Statement to the San Rafael City Schools stating that the contractor agrees to comply fully with the Tier 2 (or higher) engine requirements described above and acknowledges that a significant violation of the measure shall constitute a material breach of contract. The foregoing requirements shall be included in the appropriate contract documents with the contractor. (LTS)*

TABLE 4.2-11 HEALTH RISKS AND HAZARDS AT MAXIMALLY EXPOSED INDIVIDUAL STUDENT (MEIS) AND MAXIMALLY EXPOSED INDIVIDUAL RESIDENT (MEIR) DURING CONSTRUCTION OF STADIUM PROJECT

	Diesel Particulate Matter		Exhaust $PM_{2.5}$
Emissions Scenario	**Cancer Risk (per million)**	**Chronic Hazard Index**	**Annual Average Concentration (μg/m³)**
Unmitigated Construction Emissions			
Maximally Exposed Individual Student	5.8	0.02	0.08
Maximally Exposed Individual Resident	**15.3**	0.03	0.15
Mitigated Construction Emissions*			
Maximally Exposed Individual Student	3.1	0.01	0.04
Maximally Exposed Individual Resident	8.1	0.02	0.08
BAAQMD's Thresholds of Significance	10	1	0.3

Notes: $\mu g/m^3$ = micrograms per cubic meter; $PM_{2.5}$ = fine particulate matter; BAAQMD = Bay Area Air Quality Management District.

Bold and shaded font indicates exceedance of threshold.

* As described in Mitigation Measure AIR-3, the mitigated construction emissions account for the use of Tier 2 diesel engines.

Source: See Appendix B.

Cumulative TAC Emissions during Construction

In addition to the individual TAC and $PM_{2.5}$ emissions during construction of the Stadium Project, the BAAQMD recommends evaluating the potential cumulative health risks to sensitive receptors from existing and reasonably foreseeable future sources of TAC and $PM_{2.5}$ emissions. The BAAQMD's online screening tools were used to provide conservative estimates of how much existing and foreseeable future air pollutant sources could contribute to cancer risk, HI, and $PM_{2.5}$ concentrations at the MEIS and MEIR.

Based on review of the BAAQMD's (2012c) *Stationary Source Screening Analysis Tool*, a permitted diesel generator and a permitted gas station facility were identified within 1,000 feet of the Stadium Project site (see **Table 4.2-12** and Figure 4.2-1). According to the BAAQMD, the gas station has been closed and does not pose potential health risks or hazards to nearby sensitive receptors. The preliminary health risk screening values reported for the diesel generator were refined using the BAAQMD's (2012d) *Diesel Internal Combustion Engine Distance Multiplier Tool* to represent the attenuated health risks that can be expected with increasing distance from diesel engines.

There are no highways or high-volume roadways within 1,000 feet of the Stadium Project. Based on information provided by the City of San Rafael Community Development Department, there are no reasonably foreseeable future projects within 1,000 feet of the Stadium Project that would introduce a new source of TAC and/or $PM_{2.5}$ emissions.

TABLE 4.2-12 SUMMARY OF CUMULATIVE HEALTH RISKS AND HAZARDS AT MAXIMALLY EXPOSED INDIVIDUAL STUDENT (MEIS) AND MAXIMALLY EXPOSED INDIVIDUAL RESIDENT (MEIR) DURING CONSTRUCTION OF STADIUM PROJECT

		Maximally Exposed Individual Student			Maximally Exposed Individual Resident		
Source	**Source Type**	**Cancer Risk (10^{-6})**	**Chronic Hazard Index**	**$PM_{2.5}$ (µg/m³)**	**Cancer Risk (10^{-6})**	**Chronic Hazard Index**	**$PM_{2.5}$ (µg/m³)**
Project Construction							
Unmitigated Emissions	Construction	5.8	0.02	0.08	15.3	0.03	0.15
Existing Stationary Sources							
City of San Rafael Dept. of Public Works (BAAQMD Plant 17908)	Diesel Engine	1.13	<0.01	<0.01	6.89	0.04	<0.01
Western Boat & Tackle (BAAQMD Plant G302)*	Gas Station	0.00	0.00	0.00	0.00	0.00	0.00
Unmitigated Cumulative Health Risks		6.9	<0.1	0.1	22.5	0.1	0.1
BAAQMD's Cumulative Threshold		100	10.0	0.8	100	10.0	0.8
Threshold Exceedance?		No	No	No	No	No	No

Notes: µg/m³ = micrograms per cubic meter; $PM_{2.5}$ = fine particulate matter; BAAQMD = Bay Area Air Quality Management District.
* According to the BAAQMD, the Western Boat & Tackle facility has been closed and does not pose any risk or hazards to nearby sensitive receptors (see Appendix B).
Source: Health risk screening values derived from the BAAQMD's online Tools and Methodologies (BAAQMD, 2012c and 2012d).

As shown in Table 4.2-12, the screening analysis, which is based on conservative assumptions, indicates that the unmitigated cumulative health risks and hazards at the MEIS and MEIR would be less than the BAAQMD's cumulative thresholds; therefore, the cumulative impact on nearby sensitive receptors from TAC and $PM_{2.5}$ emissions during construction of the Stadium Project would be less than significant.

CUMULATIVE IMPACTS

The BAAQMD's thresholds of significance for criteria air pollutants were designed to represent levels above which a project's individual emissions would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions (BAAQMD, 2009). Since construction and operation of the Master Facilities Long-Term Plan, including the Stadium Project, would not exceed the BAAQMD's thresholds of significance for criteria pollutants (including ozone precursors), the cumulative impact on regional air quality would be less than significant.

The BAAQMD's project-level thresholds of significance for TACs (e.g., DPM), $PM_{2.5}$, and CO were also designed to determine if a project's contribution to local air pollution would be cumulatively considerable. Since operation of the Master Facilities Long-Term Plan, including the Stadium Project, would not generate CO levels above the BAAQMD's thresholds of significance, the cumulative impact on local quality would be less than significant. While emissions of DPM during construction of the Stadium Project would not exceed the BAAQMD's cumulative thresholds of significance, emissions of DPM from other construction projects for the Master Facilities Long-Term Plan could potentially exceed the BAAQMD's cumulative thresholds of significance. Therefore, a project-level analysis of the other individual projects under the Master Facilities Long-Range Plan is required to determine the potential cumulative impact of DPM and $PM_{2.5}$ emissions to sensitive receptors during construction. Implementation of Mitigation Measures AIR-2 would reduce potentially significant cumulative impacts to sensitive receptors related to emissions of DPM and $PM_{2.5}$ during construction for the Master Facilities Long-Range Plan to a less-than-significant level.

4.2.5 REFERENCES

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4.3 BIOLOGICAL RESOURCES

4.3.1 INTRODUCTION

This section of the EIR addresses existing biological resources at the project site and provides an evaluation of the potential impacts on sensitive resources that could result from the Master Facilities Long-Range Plan, including the Stadium Project. Biological resources were identified by compiling and reviewing existing information and conducting a field reconnaissance survey of the project site. The field reconnaissance survey of the site was conducted by Environmental Collaborative for this Draft EIR on October 10, 2016, to determine existing conditions and assess potential impacts. The review provided information on general resources in the area, the extent of sensitive natural communities, jurisdictional wetlands, and the distribution and habitat requirements of special-status species that have been recorded from or are suspected to occur in the San Rafael vicinity maintained as part of the California Natural Diversity Data Base (CNDDB) by the California Department of Fish and Wildlife (CDFW).

4.3.2 ENVIRONMENTAL SETTING

The discussion below addresses existing biological resources on the San Rafael High School (SRHS) campus.

EXISTING VEGETATION AND WILDLIFE HABITAT

The SRHS campus is occupied by existing school facilities, including structures, paved parking and play areas, irrigated turf, scattered ornamental and native trees, and landscaping surrounding buildings and parking areas. No native habitat remains on the site, although non-native grasslands occur in the hillside at the eastern edge of the campus with introduced blue gum eucalyptus (*Eucalyptus globulus*) and a few native species such as coast live oak (*Quercus agrifolia*), poison oak (*Toxicodendron diversilobum*) and toyon shrubs (*Heteromales arbutifolia*). Highly invasive non-native French broom is spreading through the blue gum eucalyptus and grassland. Tree species in the developed portions of the campus consist of a combination of native and ornamental species bordering buildings, parking lots, lawns, and athletic fields. Tree species include coast live oak (*Quercus agrifolia*), coast redwood (*Seqouia sempervirens*), California buckeye (*Aesculus californica*), Fremont cottonwood (*Populus fremontii*), Monterey pine (*Pinus radiata*), other pine species (*Pinus* spp.), maple (*Acer* sp.), cherry plum (*Prunus cerisifera*), incense cedar (*Calocedrus decurrens*), camphor (*Cinnamomum camphora*), southern magnolia (*Magnolia grandiflora*), Deodar cedar (*Cedrus deodara*), and blue gum eucalyptus, among others. Sensitive natural communities and regulated wetlands are absent on the site.

The landscaped areas of the developed campus provide habitat for wildlife species that have adapted to human disturbance. Native and ornamental trees, shrubs, and structures provide nesting opportunities for birds such as house finch, English sparrow, scrub jay, brown towhee, America robin, and mourning dove, among others. Urbanized areas also support a range of introduced species that have become adapted to human disturbance. These include common non-native pest species such as house mouse, Norway rat, feral cat, opossum, and raccoon. The remaining non-native grasslands most likely continue to support common grassland-dependent species, such as Bottae pocket gopher, California vole, western fence lizard, and common gopher snake, among others.

SPECIAL-STATUS SPECIES

A record search conducted by the CNDDB and the other relevant information sources indicate that numerous plant and animal species with special status have either been recorded from or are suspected to occur in the San Rafael vicinity and eastern Marin County area. Special-status species[1] are plants and animals that are legally protected by the California Endangered Species Act (CESA) and/or Federal Endangered Species Act (FESA)[2] or other regulations, and other species that the scientific community and trustee agencies have identified as rare enough to warrant special consideration, particularly the protection of isolated populations, nesting or denning locations, communal roosts, and other essential habitat. Species protected by the CESA and FESA often represent major constraints to development, particularly when they are wide ranging or highly sensitive to habitat disturbance and where proposed development would result in a "take"[3] of these species.

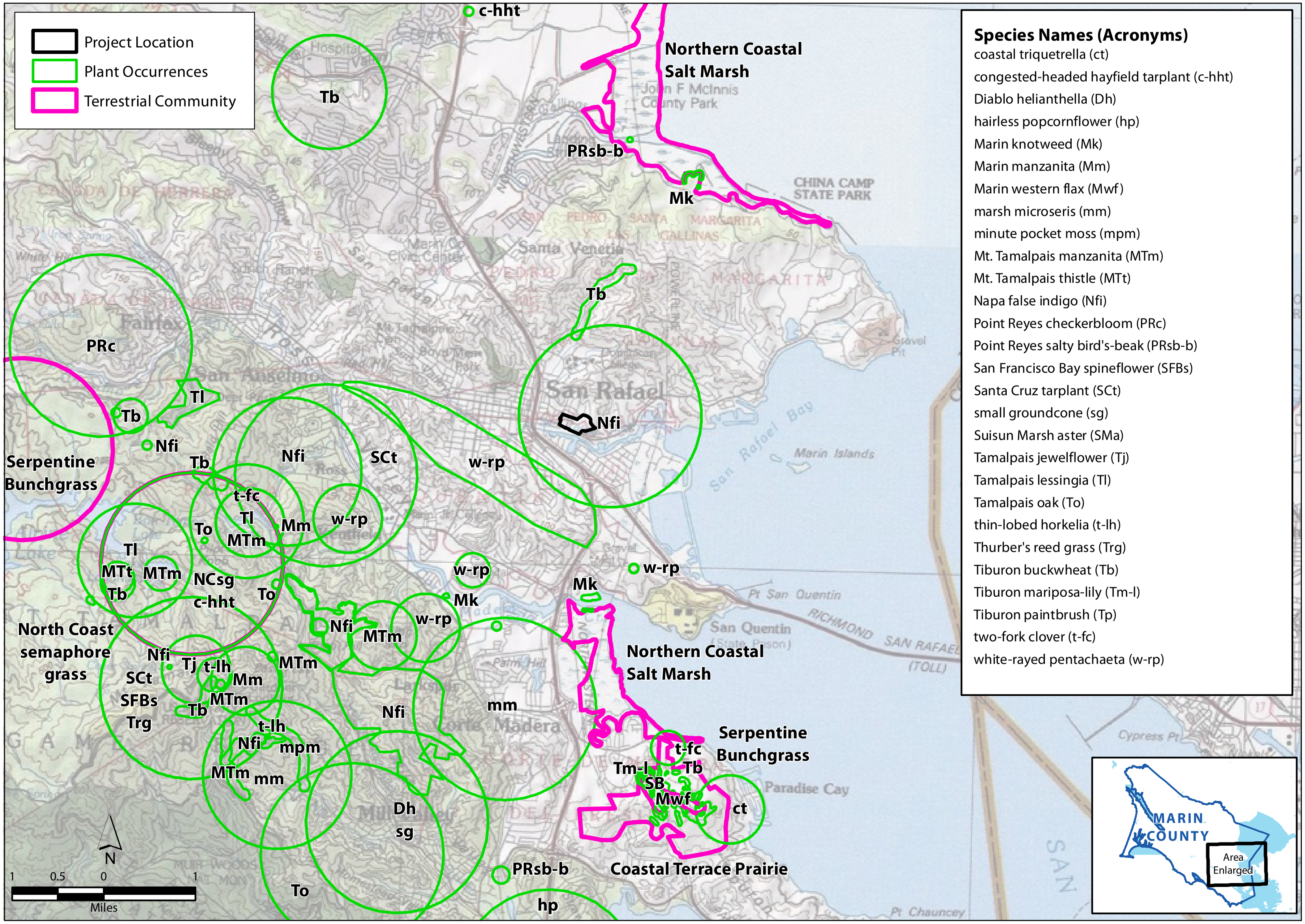
Figures 4.3-1 and **4.3-2** show the distribution of special-status plant and animal species, respectively, as reported by the CNDDB within approximately 5 miles of the site. According to CNDDB records, no special-status plant or animal species have been reported from the site, but general occurrences of Napa false indigo (*Amorpha californica* var. *napensis*), pallid bat (*Antrozous pallidus*), and western bumble bee (*Bombus caliginosus*) extend over the San Rafael vicinity based on vague records reported to the CNDDB. Napa false indigo has a rank of 1B (rare and endangered in California and elsewhere) according to the CNPS *Inventory*, and is known from

[1] Special-status species include:

- Officially designated (rare, threatened, or endangered) and candidate species for listing identified by the CDFW;
- Officially designated (threatened or endangered) and candidate species for listing identified by the U.S. Fish and Wildlife Service (USFWS);
- Species considered to be rare or endangered under the conditions of Section 15380 of the California Environmental Quality Act (CEQA) Guidelines, such as those with a rank of 1 or 2 in the *Inventory of Rare and Endangered Plants of California* maintained by the California Native Plant Society (CNPS); and
- Possibly other species that are considered sensitive or of special concern due to limited distribution or lack of adequate information to permit listing or rejection for state or federal status, such as those with a rank of 3 and 4 in the CNPS *Inventory* or identified as animal "Species of Special Concern" (SSC) by the CDFW. Species of Special Concern have no legal protective status under the CESA but are of concern to the CDFW because of severe decline in breeding populations in California.

[2] The Federal Endangered Species Act (FESA) of 1973 declares that all federal departments and agencies shall use their authority to conserve endangered and threatened plant and animal taxa. The California Endangered Species Act (CESA) of 1984 parallels the policies of the FESA and pertains to native California species.

[3] The FESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect" a threatened or endangered species. The USFWS further defines "harm" as including the killing or harming of wildlife due to significant obstruction of essential behavior patterns (i.e., breeding, feeding, or sheltering) through significant habitat modification or degradation. The CDFW also considers the loss of listed species habitat as "take," although this policy lacks statutory authority and case law support under the CESA.



SOURCE: California Natural Diversity Database accessed on October 11th, 2016;
Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed.

Figure 4.3-1

SPECIAL-STATUS PLANT SPECIES AND SENSITIVE NATURAL COMMUNITIES

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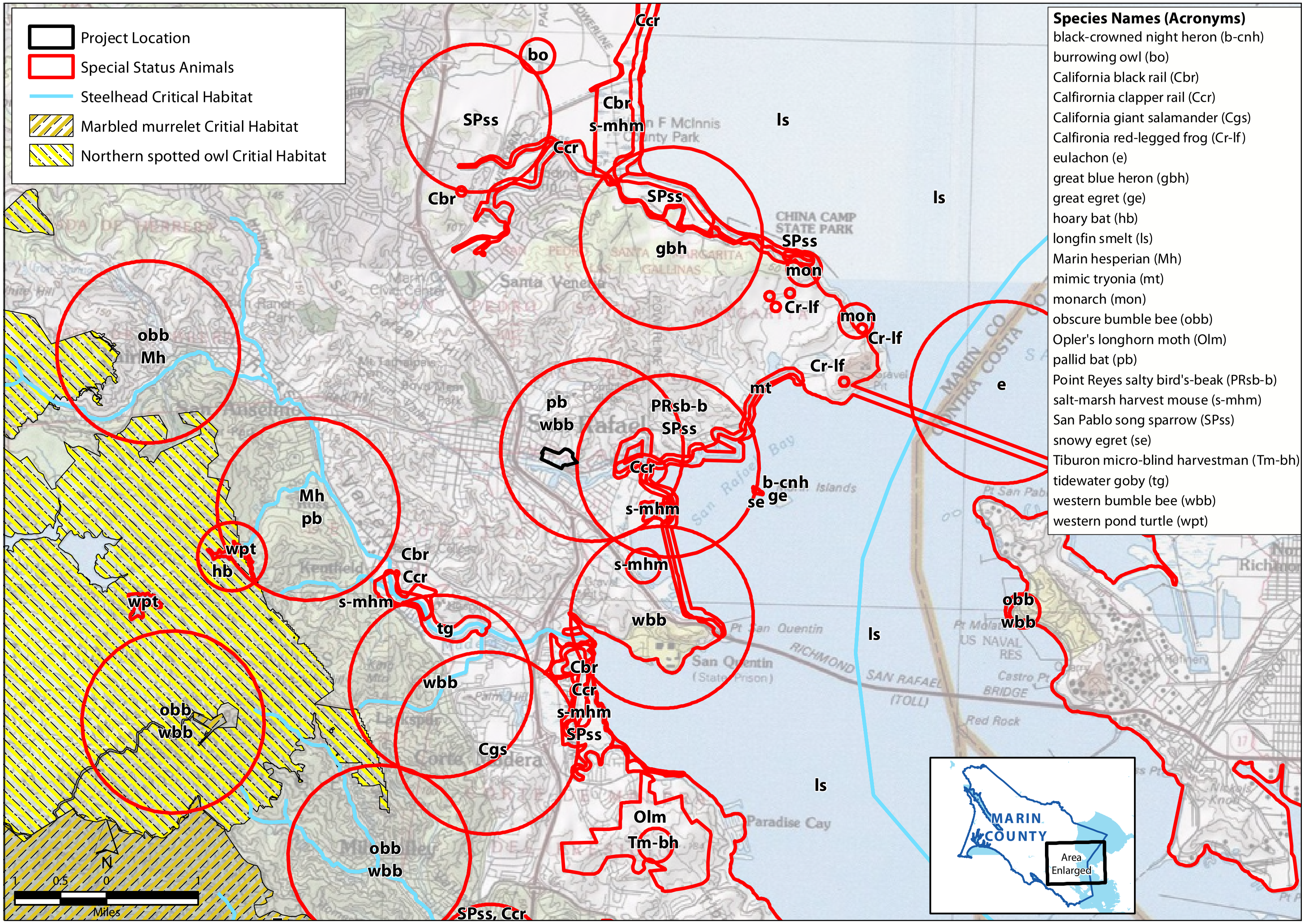

Figure 4.3-2

SPECIAL-STATUS ANIMAL SPECIES AND CRITICAL HABITAT

SOURCE: California Natural Diversity Database accessed on October 11th, 2016;
Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed.

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

woodland and forest habitat not found on the site. Pallid bat is one of several native bat species recognized as "Species of Special Concern" (SSC) by the CDFW. It is known to establish day roosts in rock outcrops, mines, caves, building, bridges, and tree cavities. Inspection of the exterior of the existing buildings on the SRHS campus during the field reconnaissance did not indicate any openings that would allow for access by pallid or other special-status bat species, which typically avoid areas of human activity. Western bumblebee, which has been reported from the San Rafael vicinity, is found in a variety of habitat types. It technically has no legal protective status under the CESA or FESA, but records on its distribution in the western United States are now being monitored by the CNDDB and other data bases because of dramatic decline in numbers and distribution over the past two decades. Its presence on the site, either foraging or nesting, would not be considered a significant constraint.

Most of the special-status species reported from the San Rafael vicinity occur in natural habitats such as coastal salt marsh, riparian woodlands, and forest habitats, all of which are absent from the project site. Suitable habitat for special-status species is absent from the largely developed SRHS campus, based on a habitat suitability analysis conducted during the field reconnaissance survey in October 2016. With the exception of possible presence of nesting birds that would be protected under state and federal regulations when the nests are in active use, no special-status species are suspected to occur on the site.

Nests of most bird species are protected under the federal Migratory Bird Treaty Act (MBTA) when the nests are in active use, and nests of raptors (birds-of-prey) are also protected under Section 3503 of the California Fish and Game Code (State of California, 1957) when the nests are in active use. No nesting or roosting locations have been identified by the CNDDB for the site or immediate vicinity, or were observed during the field reconnaissance survey in October 2016. However, mature trees on the site contain suitable nesting substrate for some bird species recognized as SSC by the CDFW, as well as more common species, and new nests could be established in the future. Species considered to have some potential for nesting on the site include Cooper's hawk (*Accipiter cooperi*), sharp-shinned hawk (*Accipiter striatus*), white-tailed kite (*Elanus caeruleus*), and loggerhead shrike (*Lanius ludovicianus*), as well as more common raptor species such as great horned owl (*Bubo virginianus*), red-tailed hawk (*Buteo jamaicensis*), and American kestrel (*Falco sparverius*). More common passerine bird species could also potentially nest on the site.

4.3.3 REGULATORY FRAMEWORK

Local, state, and federal regulations have been enacted to provide for the protection and management of sensitive biological and wetland resources. This section outlines the key local, state, and federal regulations that apply to these resources.

FEDERAL REGULATIONS

The U.S. Fish and Wildlife Service (USFWS) is responsible for protection of terrestrial and freshwater organisms through implementation of the FESA (16 U.S.C. Section 1531, *et seq.*) and the MBTA (16 U.S.C. Section 703, *et seq.*). The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations or pursuant to certain regulatory exceptions. The National Marine

Fisheries Service (NOAA Fisheries) is responsible for protection of anadromous fish and marine wildlife under the FESA and Marine Mammal Protection Act. The U.S. Army Corps of Engineers (Corps) has primary responsibility for protecting wetlands under Section 404 of the Clean Water Act (CWA). The Corps also regulates navigable waters under Section 10 (33 U.S.C. 403) of the Rivers and Harbors Act.

STATE REGULATIONS

The CDFW is responsible for administration of the CESA (California Fish and Game Code, Section 2050, *et seq.*) and for protection of streams and water bodies through the Streambed Alteration Agreement process under Section 1600, *et seq.,* of the California Fish and Game Code.

Certification from the Regional Water Quality Control Board (RWQCB) is also required when a proposed activity may result in discharge into navigable waters, pursuant to Section 401 of the CWA and Environmental Protection Agency (EPA) Section 404(b)(1) Guidelines. The RWQCB also has jurisdiction over waters of the state not regulated by the Corps under the Porter-Cologne Act. The following discusses in more detail how state and federal regulations address special-status species and wetlands.

Special-Status Species

Special-status species are plants and animals that are legally protected under the FESA and CESA, the MBTA, the California Fish and Game Code (Sections 3503, 3503.5, 3511, 3513, 3515, and 4700), or other regulations. In addition, pursuant to CEQA Guidelines Section 15380, special-status species also include other species that are considered rare enough by the scientific community and trustee agencies to warrant special consideration, particularly with regard to protection of isolated populations, nesting or denning locations, communal roosts, and other essential habitat. These include species recognized by the CDFW as SSC species, and plant species maintained on Lists 1A and 1B of the CNPS *Inventory*. As noted earlier, species with legal protection under the FESA and CESA often represent major constraints to development, particularly when the species are wide ranging or highly sensitive to habitat disturbance and where proposed development would result in a take of these species.

Wetlands and Other Waters of the United States

Although definitions vary to some degree, wetlands are generally considered to be areas that are periodically or permanently inundated by surface or ground water and support vegetation adapted to life in saturated soil. Wetlands are recognized as important features on a regional and national level due to their high inherent value to fish and wildlife, use as storage areas for storm and flood waters, and water recharge, filtration, and purification functions. The CDFW, Corps, and RWQCB have jurisdiction over modifications to riverbanks, lakes, stream channels, and other wetland features. Technical standards for delineating wetlands have been developed by the Corps and the USFWS. These standards generally define wetlands through consideration of three criteria: hydrology, soils, and vegetation.

The CWA was enacted to address water pollution, establishing regulations and permit requirements regarding construction activities that affect storm water, dredge, and fill material operations, and water quality standards. The regulatory program requires that discharges to surface waters be controlled under the National Pollutant Discharge Elimination System (NPDES) permit program, which applies to sources of water runoff, private developments, and public facilities.

Under Section 404 of the CWA, the Corps is responsible for regulating the discharge of fill material into waters of the United States. The term “waters” includes wetlands and non-wetland bodies of water that meet specific criteria as defined in Part 328 of Title 33 in the Code of Federal Regulations (U.S. Government, Federal Code of Regulations, 2016). All three of the identified technical criteria must be met for an area to be identified as a wetland under Corps jurisdiction, unless the area has been modified by human activity. In general, a permit must be obtained before fill can be placed in wetlands or other waters of the United States. The type of permit is determined by the Corps depending on the amount of acreage and the purpose of the proposed fill.

Jurisdictional authority of the CDFW over wetland areas is established under Section 1600 of the California Fish and Game Code, which pertains to activities that would disrupt the natural flow or alter the channel, bed, or bank of any lake, river, or stream. The Fish and Game Code stipulates that it is unlawful to substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake without notifying the CDFW, incorporating necessary mitigation, and obtaining a Streambed Alteration Agreement. The Wetlands Resources Policy of the CDFW states that the Fish and Wildlife Commission will strongly discourage development in or conversion of wetlands, unless, at a minimum, project mitigation assures there will be no net loss of either wetland habitat values or acreage. The CDFW is also responsible for commenting on projects requiring Corps permits under the Fish and Wildlife Coordination Act of 1958 (16 U.S.C. Section 661, *et seq.*).

In addition, the RWQCB is responsible for upholding state water quality standards. Pursuant to Section 401 of the CWA, projects that apply for a Corps permit for discharge of dredge or fill material, and projects that qualify for a Nationwide Permit, must obtain water quality certification from the RWQCB. The RWQCB is also responsible for regulating wetlands under the Porter-Cologne Water Quality Control Act (California Water Code, Section 13000, *et seq.*); these wetlands may include hydrologically isolated wetlands no longer regulated by the Corps under Section 404 of the CWA. Federal Supreme Court rulings have limited Corps jurisdiction, but the RWQCB in some cases continues to exercise jurisdiction over these features under the Porter-Cologne Water Quality Act (California Water Boards, 1969).

LOCAL REGULATIONS

San Rafael General Plan

The Conservation Element in the *City of San Rafael General Plan 2020* (City of San Rafael, 2013) includes policies related to the protection of sensitive habitat. Policy CON-9 (*Native and/or Sensitive Habitats*) calls for protection of habitats that are sensitive, rare, declining, unique or represent a valuable biological resource. Policy CON-10 (*Impact to Sensitive Habitats*) requires compliance with applicable laws and regulations pertaining to sensitive habitats. Policy CON-13 (*Threatened and Endangered Species*) requires preservation and protection of threatened and endangered species of plants and animals consistent with state and federal regulations. Policies CON-2 (*Wetland Preservation*), CON-4 (*Wetland Setbacks*), CON-6 (*Creek and Drainageway*

Setbacks), and CON-8 (*Enhancement of Creeks and Drainageways*) all relate to preservation and controls around wetlands and drainages. Policy CON-15 (*Invasive Non-Native Plant Species*) encourages the control of invasive non-native plant species.

San Rafael Municipal Code Provisions

Chapter 11.12 of the San Rafael Municipal Code pertains to the protection and management of street trees. The City has no specific policies related to tree protection, other than the provisions in the Municipal Code pertaining to street trees. However, Municipal Code Chapter 14.25 (Environmental and Design Review Permits) requires applications to include information on "natural features" including existing trees and other vegetation, and calls for providing information on the impact of proposed development on the existing site conditions. At the SRHS campus, trees are present within a landscaped area in front of the parking lot along 3rd Street that may be within the road right-of-way, but are absent along other street frontages.

Municipal Code Section 14.18.160 pertains to parking lot screening and landscaping, and defines minimum tree plantings to be installed in parking lots. A minimum of one canopy tree is to be provided for every four parking spaces, and trees are to be distributed throughout the parking area to shade cars and paved areas. Tree selection and distribution are intended to achieve maximum shading of paved surfaces.

4.3.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR, the project would have a significant impact on biological resources if it would:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the CDFW or USFWS;

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the CDFW or USFWS;

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means;

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites;

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance; or

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

The following significance criteria would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the Long-Range Plan and are therefore excluded from further discussion in this impact analysis:

- Have a Substantial Adverse Effect on Any Riparian Habitat or Other Sensitive Natural Community Types. Riparian habitats and sensitive natural community types are absent from the project site.
- Have a Substantial Adverse Effect on Regulated Waters. Regulated waters are absent from the project site.
- Conflict with Habitat Conservation Plans. No such plans encompassing the site or vicinity have been adopted.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Movement of Native Resident or Migratory Fish or Wildlife Species

The Master Facilities Long-Range Plan would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

The project site is largely developed with existing institutional uses, with only limited habitat value to wildlife species common in urbanized areas. Species common to urbanized areas would eventually continue to use the new and existing facilities following construction and establishment of new landscaping. Wildlife movement opportunities would not be substantially impeded on the site, and the impact of the Master Facilities Long-Range Plan would be less than significant.

Conformance with Local Plans and Policies

The Master Facilities Long-Range Plan would generally conform with local policies and ordinances protecting biological resources, and no major conflicts are anticipated.

In general, the proposed Master Facilities Long-Range Plan would not conflict with the few relevant policies in the Conservation Element of the San Rafael General Plan. Most of these relate to the protection of wetlands, drainages, and other sensitive biological resources not found on the site, and no conflicts would occur. The District periodically manages invasive vegetation such as French broom found in the undeveloped eastern edge of the site, primarily for fire fuel management, in conformance with Policy CON-15 (*Invasive Non-Native Plant Species*). This practice is not expected to change with the proposed Master Facilities Long-Range Plan.

There are a number of trees on the project site that would be removed or could be damaged as a result of construction during implementation of the Master Facilities Long-Range Plan. The City of San Rafael has no specific policies related to tree protection, other than the provisions in the Municipal Code pertaining to street trees. However, Chapter 14.25 of the City's Municipal Code (Environmental and Design Review Permits) requires applications to include information on "natural features" including existing trees and other vegetation, and calls for providing information on the impact of proposed development on the existing site conditions. Detailed landscape plans would be prepared as part of each project undertaken under the Master Facilities Long-Range Plan, and would include trees, shrubs, and groundcover species. Appropriate controls would be implemented to ensure that street trees and other landscape trees on the site to be retained in the vicinity of construction are adequately protected. The replacement landscaping provided as part of individual projects would serve to replace any trees and other landscaping removed to accommodate new structures and other improvements contemplated under the Master Facilities Long-Range Plan, and would serve to ensure that there are no major conflicts with the General Plan or Municipal Code. This would include conformance with parking lot landscaping, as defined in Section 14.18.160 of the Municipal Code. The District is exempt from requirements for full compliance with local regulations but would strive to meet the intent of this and other provisions in the City's Municipal Code.

Therefore, the Master Facilities Long-Range Plan would be considered to have a less-than-significant impact, and no mitigation measures are necessary.

Potentially Significant Impacts

Impact BIO-1: Development under the Master Facilities Long-Range Plan may result in adverse impacts on nesting birds, if present on the site. (PS)

No special-status species are suspected to occur in the developed areas of the site, but there remains a potential for new bird nests that could be inadvertently destroyed or abandoned during construction. The mature trees, landscaping, and even the exterior of the existing buildings to be demolished or rehabilitated could be used for nesting by birds, including raptors and more common species. The MBTA prohibits killing, possessing, or trading in migratory birds, except in accordance with regulations prescribed by the Secretary of the Interior; this prohibition includes whole birds, parts of birds, and bird nests and eggs. Tree removal, building demolition, and other construction activities during the breeding season could result in the incidental loss of fertile eggs or nestlings or nest abandonment. This would be considered a potentially significant impact.

A standard method to address the potential for nesting birds is either to initiate construction during the non-nesting season, which in Marin County is typically from September 1 to January 31, or to conduct a nesting survey within 14 days prior to initial tree removal, building demolition, and construction to determine whether any active nests are present that must be protected until any young have fledged and are no longer dependent on the nest. Protection of the nests, if present, would require that construction setbacks be provided during the nesting and fledging period, with the setback depending on the type of bird species, degree to which the individuals have already acclimated to other ongoing disturbance, and other factors. Without these controls, construction under the Master Facilities Long-Range Plan could have a potentially significant impact on nesting birds.

Mitigation Measure BIO-1: Adequate measures shall be taken to avoid inadvertent take of raptor nests and other nesting birds protected under the Migratory Bird Treaty Act when in active use. This shall be accomplished by taking the following steps:

- *If construction is proposed during the nesting season (February through August), a focused survey for nesting raptors and other migratory birds shall be conducted by a* *qualified biologist within 14 days prior to the onset of vegetation removal or construction, in order to identify any active nests on the project site and in the vicinity of proposed construction.*

- *If no active nests are identified during the survey period, or if development is initiated during the non-breeding season (September through January), construction may proceed with no restrictions.*
- *If bird nests are found, an adequate setback shall be established around the nest location and construction activities restricted within this no-disturbance zone until the qualified biologist has confirmed that any young birds have fledged and are able to function outside the nest location. Required setback distances for the no-disturbance zone shall be based on input received from the California Department of Fish and Wildlife (CDFW), and may vary depending on species and sensitivity to disturbance. As necessary, the no-disturbance zone shall be fenced with temporary orange construction fencing if construction is to be initiated on the remainder of the development site.*
- *A report of findings shall be prepared by the qualified biologist and submitted to the District for review and approval prior to initiation of construction within the no-disturbance zone during the nesting season (February through August). The report either shall confirm absence of any active nests or shall confirm that any young within a designated no-disturbance zone have fledged and construction can proceed. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Movement of Native Resident or Migratory Fish or Wildlife Species

The Stadium Project would not interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

This impact would be less than significant for the reasons explained under "Impacts of Proposed Master Facilities Long-Range Plan" above.

Conformance with Local Policies and Ordinances

The Stadium Project would generally conform with local policies and ordinances protecting biological resources, and no major conflicts are anticipated.

The Stadium Project would generally not conflict with any local policies or ordinances related to biological resources. This includes relevant goals and policies in the Conservation Element of the San Rafael General Plan (City of San Rafael, 2013). Given the lack of any sensitive biological resources on the site, no conflicts with these goals and policies are anticipated.

Based on Stadium Project plan, anumber of existing trees would be removed to accommodate the new vehicle access and parking off of 3rd Street and the new entrance to the stadium. These consist of 12 multi-trunk pines with trunk diameters ranging from about 4 to 18 inches diameter at breast height (DBH), three bottle brush plants with trunk diameters of 8 to 12 DBH, and three California pepper trees near the western bleachers with trunk diameters of 24 to 32 inches DBH. Chapter 14.25 of the San Rafael Municipal Code (Environmental and Design Review Permits) requires applications to include information on "natural features" including existing trees and other vegetation, and calls for providing information on the impact of proposed development on the existing site conditions. The replacement landscaping provided as part of the Stadium Project would serve to replace any trees and other landscaping removed to accommodate improvements, however, and would serve to ensure that there are no major conflicts with the Municipal Code. This includes provisions to provide for shading of paved parking lots as called for in Section 14.18.160 of the City's Municipal Code. Therefore, the Stadium Project would have a less-than-significant impact related to conformance with local plans and policies, and no mitigation measures are necessary.

Potentially Significant Impacts

Impact BIO-2: Implementation of the Stadium Project could result in adverse impacts on nesting birds, if present in existing trees and other vegetation in the vicinity. (PS)

The Stadium Project would be located in an area occupied by maintained turf and the existing bleachers, where no special-status species are suspected to occur. However, removal of existing trees and structures could result in loss of bird nests in active use, which are protected under the MBTA and California Fish and Game Code. Conformance with Mitigation Measure BIO-1 would be necessary to ensure that any nests in surrounding trees and structures would be adequately protected, in the remote instance that they are present in the vicinity. Implementation of Mitigation Measures BIO-1 would reduce this impact to a less-than-significant level.

Mitigation Measure BIO-2: Implement Mitigation Measure BIO-1. (LTS)

CUMULATIVE IMPACTS

The analysis for potential cumulative impacts on biological resources considered anticipated development in the surrounding area, including the pending or approved developments shown in Table 6-1 and Figures 6-1 and 6-2 in Chapter 6, CEQA Considerations, of this EIR. The potential impacts of development on biological resources tend to be site-specific, and the overall cumulative effect would be dependent on the degree to which significant vegetation and wildlife resources are protected on a particular site. Such protection includes preservation of well-developed native vegetation (native grasslands, oak woodlands, riparian woodland, etc.), populations of special-status plant or animal species, and wetland features (including freshwater marsh and seeps, and riparian corridors and drainages). Further environmental review of specific developments should serve to ensure that important biological resources are identified, protected, and properly managed, and to prevent any significant adverse development-related impacts, including from development of the remaining undeveloped lands in the project site vicinity and surrounding incorporated and unincorporated lands. Many of the projects shown in Figures 6-1 and 6-2 are in urbanized portions of San Rafael.

No cumulatively considerable impacts on biological resources are expected as a result of anticipated development on the site associated with the Master Facilities Long-Range Plan, including the

Stadium Project. The site is largely developed, with only limited biological resources. Compliance with Mitigation Measures BIO-1 and BIO-2 would serve to address potential impacts on nesting birds, and future landscaping would serve to replace any trees and other vegetation removed to accommodate new structures and other improvements. Thus, the Master Facilities Long-Range Plan would not contribute to significant cumulative impacts on biological resources, and no mitigation measures for cumulative impacts are necessary.

4.3.5 REFERENCES

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U.S. Government, Federal Code of Regulations, 2016, Title 33, Chapter II, Part 328, Definition of Waters of the United States. Current as of December 2, 2016.

U.S. Government, Federal Endangered Species Act of 1973, 16 U.S.C., Section 1531, et seq.

U.S. Migratory Bird Treaty Act, 16 U.S.C., Section 703, *et seq.*

U.S. Rivers & Harbors Act, 33 U.S.C. 403, Section 10.

4.4 CULTURAL RESOURCES

4.4.1 INTRODUCTION

This section of the EIR describes the potential impacts of the San Rafael High School (SRHS) Master Facilities Long-Range Plan, including the proposed Stadium Project, on cultural resources. Cultural resources are sites, buildings, structures, objects, and districts that may have traditional or cultural value due to their historical significance. The California Environmental Quality Act (CEQA) requires that agencies considering projects that are subject to discretionary action shall consider the potential impacts on cultural resources that may occur from project implementation (see Section 15064.5 and Appendix G of the CEQA Guidelines).

This section describes existing cultural resources conditions at the project site and the pertinent state and local agency laws and regulations related to cultural resources. Potentially significant adverse impacts that could result from the Long-Range Plan, including the Stadium Project, are described and mitigation measures to reduce these impacts to less-than-significant levels are identified, as appropriate.

In addition to the other references listed at the end of this section, the following report was used in the analysis and is provided in **Appendix C** of this EIR:

- Interactive Resources, Inc., 2016. San Rafael High School Historic Resource Evaluation.

4.4.2 ENVIRONMENTAL SETTING

The prehistoric, ethnographic, and historical contexts for the project site and vicinity are summarized below.

PREHISTORY AND ETHNOGRAPHY OF PROJECT SITE VICINITY

The Archaic-Emergent cultural sequence developed by Fredrickson (1974), recalibrated by Milliken et al. (2007), is commonly used to interpret the prehistoric occupation of the San Francisco Bay Area. The recalibrated sequence is broken into two broad periods: 1) the Archaic Period, consisting of the Early Holocene Lower Archaic (8000-3500 cal B.C.), Middle Archaic (3500-500 cal B.C.), Initial Upper Archaic (500 cal B.C.-cal A.D. 430), and Late Upper Archaic (cal. A.D. 430-1050); and 2) the Emergent Period, consisting of the Lower Emergent Period (cal A.D. 1050-1550) and Terminal Late (or Upper Emergent) Period (cal. A.D. 1550-historic).

The oldest archaeological deposits in the San Francisco Bay Area have been identified at Los Vaqueros Reservoir, east of Mount Diablo in Contra Costa County. At Los Vaqueros, an Early Holocene component was identified at archaeological site CA-CCO-696, where charcoal associated with a milling slab was dated to 7920 cal. B.C. The sparse archaeological data from Bay Area Early Holocene sites suggests a generalized, mobile hunter-gatherer adaptation characterized by milling stone equipment and wide-stemmed and leaf-shaped projectile points.

Beginning at around 3500 B.C., local archaeological assemblages include stylized shell beads (often associated with human burials), mortars and pestles, and structural remains. Collectively, these assemblages indicate increased sedentism, regional symbolic integration, and trade during the Middle Archaic. By the Initial Upper Archaic, a "major disruption in symbolic integration systems" occurred, as evidenced by stylistic changes in shell ornaments and mortuary patterns (Milliken et al., 2007:115). The use of mortars and pestles is widespread during this time, although milling slabs and hand stones persist in some areas. At around A.D. 430, at the onset of the Late Upper Archaic, archaeological data indicate a westward expansion of "Meganos culture" traits into the Bay Area from the San Joaquin Delta. The Meganos culture is characterized in the archaeological record by dorsally extended burials,[1] often associated with abundant shell beads. The Emergent Period is characterized by introduction of the bow-and-arrow (as evidenced by arrow-sized projectile points), increasing social stratification found in grave goods, and introduction of the Kuksu cult, which unified several language groups around the Bay Area.

Locally, prehistoric archaeological sites have been identified near the bay margin/tidal marshland and include midden deposits, black soil containing artifacts and subsistence debris indicative of intensive episodes of occupation. Nearby archaeological excavations at Native American sites provide evidence of occupation of southern Marin County dating from the Lower Archaic Period at De Silva Island, during the Upper Archaic and Emergent periods at sites in San Rafael and Larkspur (Bieling, 2000; Stewart, 1999), and during the Spanish colonization (Schneider, 2010).

Present-day San Rafael is in the ethnographic territory of the Coast Miwok, who occupied what are now Marin and southern Sonoma counties. The Coast Miwok language is subsumed under the Penutian language stock and includes two dialects: Western, or Bodega, and Southern, or Marin, with Southern being further divided into valley and coast (Barrett, 1908; Kelly, 1978).

Coast Miwok territories were comprised of one or more land-holding groups that anthropologists refer to as "tribelets." The tribelet, a nearly universal characteristic throughout native California, consists of a principal village occupied year-round and a series of smaller hamlets and resource gathering and processing locations occupied intermittently or seasonally (Kroeber, 1955). Tribelet population ranged between 50 and 500 persons and was largely determined by the carrying capacity of a tribelet's territory.

The traditional Coast Miwok lifeway was severely disrupted due to introduced diseases, a declining birth rate, and the impact of the mission system. Coast Miwok were transformed from hunters and gatherers into agricultural laborers who lived at the missions. Later, because of the secularization of the missions by Mexico in 1834, most of the aboriginal population gradually moved to ranchos to work as manual laborers.

Today, many Coast Miwok people still live in their ancestral territory in Marin County and continue to engage in traditional cultural practices. The Federated Indians of Graton Rancheria (FIGR) are a federally recognized tribe consisting of both Coast Miwok and Southern Pomo (whose ancestral tribal territory is in northern Sonoma County). FIGR, established in 1992, provides members with economic and educational opportunities, and seeks to preserve their traditional heritage.

[1] Dorsal extension is a common burial position in which an articulated skeleton is found on its back with the legs extended and the arms lying along the sides of the body.

HISTORY OF PROJECT SITE AND VICINITY

Summary History of San Rafael

In 1817, Mission San Rafael Arcangel, an adjunct of the Mission San Francisco de Dolores in San Francisco, was established in the region that would become the city of San Rafael. The mission was established as a hospital for ill Native American neophytes. Following the secularization of the Mexican missions, a land grant known as Rancho San Pablo that contained the former Mission San Rafael Arcangel was given to Timoteo (Timothy) Murphy. The town of San Rafael began to develop in the mid-1800s as an agricultural center for the region. After California achieved statehood in 1848, Marin County was established as one of the state's first 27 counties, and San Rafael was identified as one the county's four original townships and as the county seat. In 1866, the editor of the *Marin County Journal* published the following recollection of San Rafael circa 1851 (Miller, 1958):

> San Rafael boasted ten houses besides the Mission buildings; one store, one boarding house, and one whiskey mill. The buildings were all makeshifts except the residence of the late Timothy Murphy now owned and used by the county as a Court House; no fencing or other improvements were visible save a corral or two.

The first public school districts were established in Marin County in 1855. San Rafael was included in District 2 along with Sausalito, Corte Madera, Novato, Bolinas, and Punta de los Reyes. While schools opened in neighboring towns, a public school was not organized in San Rafael until 1861, at which time The San Rafael Institute was converted from a private school to a public school, serving only the primary grades.

Early on, San Rafael grew quite slowly due its lack of industry and isolation from San Francisco. The coming of the ferry and the railroad in the late 1800s changed the character of San Rafael, as commuting to San Francisco became a possibility. The area was no longer available to just a few wealthy residents and vacationers looking for good weather, but now to people of more moderate means who could work in San Francisco and permanently reside in Marin County. The population jumped from 841 people in 1870 to 2,276 in 1880 due to easier access across San Francisco Bay.

The development of San Rafael centered around Timothy Murphy's former adobe at 4th and C Streets, which would serve briefly as the county courthouse until a new courthouse was constructed in 1872. The town was laid out in a typical block pattern, and 4th Street became the primary commercial corridor. San Rafael was formally incorporated in 1874. The rail line via ferry continued to be the only way to travel between San Francisco and San Rafael until the construction of the Golden Gate Bridge in 1937 greatly improved access (Kyle, 2002; Miller, 1958; Spitz, 2006).

Summary History of San Rafael High School and Project Site

For the first few decades of public education in San Rafael, there was no high school available. Public education extended only through the 8th grade; after that point, parents sent their children to private boarding schools or to schools in San Francisco. San Rafael High School as an institution was established in 1888, following the approval of the school district and a special election of the residents. The first high school was established in a single room in the grammar school on 4th

Street. Once a school bond was passed by voters in 1898, funding was available to construct a building for the newly established high school. The first San Rafael High School building, constructed on a site at 4th and E Streets, opened in 1899. The two-story building contained 15 classrooms, a gymnasium, and an assembly hall and served as the only high school in Marin County until 1908 (Miller, 1958).

By 1920, the increase in the school population, as well as the significant changes in the required curriculum led to a need for a new high school facility. After looking to construct a joint school with San Anselmo, the residents of San Rafael moved forward with plans to construct a new high school for San Rafael only. After much debate and evaluation, the "Eagle Rock" site on Mission Street was selected for the new high school campus that would accommodate 500 students. The 29-acre undeveloped site in eastern San Rafael was located just north of the canal in an area with little development except for single-family homes to the north. The property was purchased in 1923 and the ground-breaking ceremony was held in December of the same year. In June 1924, the firm Shea and Shea of San Francisco was awarded the contract for the architectural design of the new school. The cornerstone of the building, originally known as "Old Main," was laid to much fanfare in December 1924. The building was dedicated on August 22, 1925, and the new building was officially open for the fall session. Constructed of reinforced concrete, "Old Main" contained 25 classrooms, a study hall, a gymnasium, and a little theater. The building was constructed for approximately $300,000 (Miller, 1958; Independent-Journal, 1963). The building still exists and is shown as Building A in Figure 3-4 in Chapter 3, Project Description, of this EIR.

Soon after the first building at the new San Rafael High School was completed, the school district hired architect N. W. Sexton, who had offices in both San Francisco and San Rafael, to begin designing additions and new buildings to expand the campus. The first project began in 1926 and consisted of a single-story addition that included two outdoor courtyards and a dining room and kitchen at the east side of the main building. (The addition was later demolished.) The next two projects designed by Sexton included the original gymnasium (the northern section of Building P shown in Figure 3-4 in Chapter 3) constructed in 1930 and the original shop building (Building M in Figure 3-4) constructed in 1934 (Sanborn, 1950). In 1938, Sexton took on the design of seven new buildings: a home economics building (Building G), a new cafeteria building (never constructed), two new shop buildings (Buildings O and L), a mechanical drawing building (Building K), a music building (Building J), and an arts building (Building R). The locations of these buildings can be seen in Figure 3-4 in Chapter 3 of this EIR. H. Engle served as the structural engineer for all of the San Rafael High School projects designed by Sexton.

In the late 1940s and early 1950s, the San Francisco architecture firm of Donald B. Kirby & Thomas B. Mulvin prepared several smaller projects, including alterations to the main building (Building A), the construction of the swimming pool, and the construction of the administration building on Union Street. (The latter building is not located on the project site and is outside the scope of this evaluation, because it is not part within the boundaries of the SRHS campus at 185 Mission Street.) Thomas Mulvin relocated to San Rafael and continued to design projects for the campus with the firm of Gromme, Mulvin & Priestly. In 1958, Gromme, Mulvin & Priestly designed an addition to the gymnasium (southern section of Building P), a science building (Building F), and a cafeteria and classroom building (Building I). The same firm, as only Carl Gromme and Ralph Priestly, also designed the new library building (Building D) in 1965 and alterations to the main building (Building A) in 1967. The construction of the new library building (Building D) required the demolition of the eastern 1926 addition on "Old Main" (Building A) (information attained from various drawings on file at the San Rafael City Schools, Map Room and Division of the State Architect Application Cards for San Rafael High School).

By the late 1960s, the campus essentially appeared much as it does today, with all the major buildings having been constructed. Numerous alterations and renovations to the existing buildings have occurred over the past four-and-one-half decades, but the overall campus layout has remained the same.

The standard metal prefabricated bleachers (Building V) and small structures associated with the athletic field appear to have been constructed during and after the later period of campus development. Aerial and archival yearbook photographs show the first bleachers (without a press box) in place at the west side of the field around 1958 (San Rafael High School, 1958). The bleachers have been altered several times with replacement sections, the addition of the press box (Building X) post-1968, the alteration or replacement of the western bleachers to include additional rows of seating and new benches in the 2000s, and the removal of northern and southern sections from the bleachers on the eastern side in 2010. No records have been found regarding the construction of Buildings Y and Z, the concession stand and ticket booth respectively; however, aerial photographs illustrate that the buildings were constructed post-1968. A visual inspection of Buildings Y and Z confirmed that the buildings were of more recent construction, likely from the 1980s. Finally, a survey of historic aerial photographs also indicates that Building W, a prefabricated shed located in the courtyard adjacent to Building J, appears to have been installed around 2010 (Nationwide Environmental Title Research, 1946, 1952, 1958, 1968, 1993, 2002, and 2012; Google Earth, 2009-2010).

Project Site Cultural Resources

Interactive Resources (IR) and LSA Associates, Inc. (LSA) completed cultural resources studies of the project site. IR completed background research and an architectural field survey in support of an historical evaluation of the SRHS campus; LSA conducted background research and a field survey to identify archaeological resources, paleontological resources, and human remains at the SRHS campus. The purpose of these studies was to 1) identify the proposed project's potentially significant impacts on historical, archaeological, and paleontological resources, and human remains; and 2) provide mitigation measures for potentially significant impacts on cultural resources, as appropriate. The results of the historical and archaeological studies are summarized below.

Historical Architectural Resources

Background

IR conducted archival research for the historical evaluation of the SRHS campus. Research was conducted at the San Rafael School District Map Room, the San Francisco Public Library, the California Room at the Marin County Library, and numerous online sources. The evaluation, which is summarized below and described in detail in the technical report (**Appendix C**), was conducted to determine if the SRHS campus or any of its individual buildings are eligible for listing in the National Register of Historic Places (NRHP) and/or California Register of Historical Resources (CRHR).

SRHS Campus Historical Evaluation Results

With the exception of the modular classroom units and Buildings W, X, Y, and Z all other 12 buildings and select portions of the bleacher structures (Building V) on the SRHS campus were constructed over 50 years ago. For purposes of listing in the CRHR, 50 years is generally considered to be the minimum age threshold "to obtain a scholarly perspective on the events or individuals associated with the resource" (California Code of Regulations [CCR] Title 14, Section 4852(d)(2)). Therefore, IR completed a historic resource evaluation of the campus in order to evaluate the potential historical significance of the campus and its buildings specific to CEQA and the CRHR (see **Appendix C**). The study was based on archival research and field surveys, and included historic contexts, building descriptions, background on the architects, an evaluation of historical significance pursuant to the CRHR, and an analysis of historic integrity. (Please see Section 4.4.3, Regulatory Framework, below for a description of the eligibility criteria for the CRHR.) The results of the evaluation are summarized below.

The SRHS campus is not currently listed in the NRHP or CRHR or as a City of San Rafael local landmark or historic district. The campus' address, 185 Mission Street, was identified in the *San Rafael Historical/Architectural Survey (Survey)* and was given a property classification ranking of "good" (Charles Hall Page & Associates, Inc., 1986). The *Survey* provides only the property address without any further description, and therefore it is not immediately clear if any of the campus buildings other than the original high school building (Building A) were intended for inclusion. However, the listing in the Office of Historic Preservation's (OHP's) Historic Property Database (2012), which is based off of the *Survey,* clearly is referring to only Building A by identifying a 1924 construct date and assigning the property a State Inventory Code of "3S," meaning the resource appears eligible for the NRHP as an individual property through a survey evaluation (OHP, 2004). Identifying the resource as an individual property indicates that only one building is included and that the building is not being considered as part of a district.

The evaluation completed by IR found that San Rafael High School is associated with development of secondary public education in the City of San Rafael and Marin County in the early 20th century. The development of the campus at Mission Street began with the completion of "Old Main" (Building A) in 1925, following the significant increase in the student population that made the original school building on 4th Street obsolete and the local residents' decision to maintain a high school dedicated solely to San Rafael. Building A is also associated with the architect Frank T. Shea and is an exceptional example of the Neoclassical style.

IR's technical study notes that the oldest building at San Rafael High School, Building A, appears to maintain significance under CRHR Criterion 1 as being associated with the development of secondary public education in San Rafael and under Criterion 3 as being an exceptional example of the Neoclassical style as designed by architect Frank T. Shea. Based on the report findings and the inclusion of the building in the *San Rafael Historical/Architectural Survey*, it appears that Building A, the original San Rafael High School building at the 185 Mission Street campus, would be considered a potential historical resource under CEQA.

All of the other major campus buildings were designed to be subordinate to the original Neoclassical building. The design of the northern section of the gymnasium, constructed in 1930, took some cues from the Neoclassical style with the minor decorative elements included on the east and west façades; however, by 1934 when the next building (Building M) was constructed, the

Neoclassical style was abandoned and a simple, utilitarian approach embracing aspects of the Modern and Moderne architectural styles became the language for new development on the campus. As analyzed in greater detail in the Historic Resource Evaluation attached as **Appendix C**, none of the other major buildings over 50 years old were found to meet any of the established significance criteria for eligibility for listing in the national, state, or local registers. While the buildings generally maintain some significance in terms of the overall expansion and development of the campus itself, none of the buildings are directly associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. Further, research has not shown any of the buildings to be directly associated with the lives of persons significant in our past within a local, state or national context. Nor does it appear that any of the buildings has yielded, or is likely to yield, information important to prehistory or history of the local area, California, or the nation.

In regards to Criterion 3, the styles of the buildings range from the minimal expression of the Neoclassical style to the minimal expression of the Moderne style to a modest interpretation of the Modern. None of the buildings offer a strong or exceptional example of their style within the broad architectural canon. Function appears to have been the driving factor behind the designs of each additional campus building. Other than Building A, no building on campus appears to maintain significance based on its design or planning qualities. Additionally, the primary architects of the expansion buildings on the San Rafael High School campus, N.W. Sexton and later Gromme and Preistly, have not been found to meet the status of master architect based on their lack of presence in scholarly journals and do not appear to have completed a body of work that would classify them as master architects, Therefore, no other building embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master or possesses high artistic value.

Additional structures identified as Buildings V, W, X, Y, and Z include prefabricated metal bleachers, a prefabricated shed, a press box, a concession stand and a ticket booth. Research indicates that the bleachers appear to have been originally sited over 50 years ago, while the other small structures appear to have been constructed less than 50 years ago, making them ineligible for listing. Over the past five decades, the bleachers have been altered and had sections replaced and section removed. The present configuration is not the original construction. Additionally, the bleachers do not appear to maintain any significance under any of the eligibility criteria. The bleacher structures are not directly associated with events that have made a significant contribution to the broad patterns of local or regional history or the cultural heritage of California or the United States. The bleachers are not directly associated with the lives of persons significant in our past within a local, state, or national context. Further, as standard prefabricated bleachers they do not possess the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Finally, the bleachers do not appear to have yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation.

Therefore, due to their lack of significance under any of the four CRHR criteria, none of the other campus buildings or structures appear to qualify as historical resources under CEQA. (See **Appendix C** for a complete discussion of building eligibilities.)

Archaeological Resources, Paleontological Resources, and Human Remains

Background

A cultural resource records search of the project site was conducted on July 22, 2016, at the Northwest Information Center (NWIC) of the California Historical Resources Information System to identify previous cultural resources studies and site records for the project site and vicinity. The NWIC, an affiliate of the OHP, is the official state repository of cultural resource records and reports for Marin County.

A review of the Sacred Lands File, on file at the Native American Heritage Commission (NAHC) in West Sacramento, was completed on August 12, 2016, for the project site and vicinity. The NAHC is a state agency responsible for maintaining the Sacred Lands File, which is a list of site locations that are of traditional, religious, and cultural importance to California Native American tribes.

Historical and geologic maps were reviewed. U.S. Geological Survey (USGS) and Sanborn Fire Insurance maps were reviewed to assess the potential for historic-period archaeological deposits (e.g., trash deposits with ceramics, bottles, and other miscellaneous debris associated with a farm, residence, or business) at the project site. Geologic maps were reviewed to assess the potential for buried prehistoric archaeological deposits and fossil-bearing deposits at the SRHS campus.

On August 2, 2016, a qualified archaeologist with LSA conducted a pedestrian survey of the SRHS campus. Visibility of native, exposed soil was limited due to the presence of paving, buildings, landscaping, and athletic fields. Exposed soil was visible in scattered places on the project site, including at the trails surrounding the softball field at the east end of the project site, in a small area south of the track/football field, and around landscaping. Exposed soil was inspected, and a trowel was used to occasionally scrape soils to remove overburden and obtain a better view of soil.

Results

Neither the NWIC database nor the NAHC's Sacred Lands File indicate that there are recorded cultural resources on or adjacent to the SRHS campus. Native American archaeological sites have been recorded in the vicinity, however, along the historic margin of bay tidal marshland and near creeks, indicating a general sensitivity of the area for pre-contact archaeological sites.

The 1897 USGS 15-minute *Tamalpais* quadrangle map does not depict buildings within the project site. The 1924 Sanborn Fire Insurance Map indicates that the project site was vacant at that time and is identified as the "Site for New Union High School" (Sanborn Map Company, 1924; USGS, 1897). This review indicates that, prior to development of the SRHS campus in the mid-1920s, the project site was unoccupied and, therefore, has a low potential for significant historic-period archaeological deposits (e.g., artifact-filled features, such as wells or privies, and structural remains).

Geologic maps indicate that the SRHS campus is situated on artificial fill overlying Holocene-age (~11,500 years B.P.) Bay Mud, which was deposited as a result of sea level rise beginning in the Late Pleistocene and Early Holocene; exposed Franciscan Complex material is at the northern edge of campus (Blake et al., 2000; Witter et al., 2006). Archaeological sites are not likely to be situated in Bay Mud, but Bay Mud may overlie stable, Holocene-age landforms that have a potential to contain prehistoric archaeological deposits. These buried surfaces predate the formation of tidal estuaries that were formed during the Middle and Late Holocene and have been identified at a depth of 11.5 to 13.1 feet below surface near the project site during recent geoarchaeological testing (Kaijankoski and Meyer, 2011).

The Holocene Bay Mud that underlies the project site is too recent to contain fossils of paleontological significance. Older Pleistocene surfaces and decomposing Franciscan Formation bedrock have been identified in the vicinity of the project site beneath Holocene Bay Mud (Kaijankoski and Meyer, 2011). These older surfaces have the potential to contain significant fossils.

The archaeological field survey of the SRHS campus did not identify archaeological deposits or features at any of the locations where exposed soil or rock was examined.

4.4.3 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

No federal regulations relative to cultural resources would be applicable to the proposed project.

STATE REGULATIONS

California Environmental Quality Act (CEQA)

CEQA applies to all discretionary projects undertaken or subject to approval by the state's public agencies (14 CCR Section 15002(i)). Under the provisions of CEQA, "A project with an effect that may cause a substantial adverse change in the significance of a historical resource is a project that may have a significant effect on the environment" (14 CCR Section 15064.5(b)).

CEQA Guidelines Section 15064.5(a) defines a "historical resource" as a resource that meets one or more of the following criteria:

- Listed in, or eligible for listing in, the California Register of Historical Resources (as defined under California Public Resources Code [PRC], Section 5024.1; 14 CCR Section 4850, *et seq.*);
- Listed in a local register of historical resources (as defined at PRC Section 5020.1(k));
- Identified as significant in a historical resource survey meeting the requirements of PRC Section 5024.1(g); or
- Determined to be a historical resource by a project's lead agency (14 CCR Section 15064.5(a)).

A historical resource consists of "Any object, building, structure, site, area, place, record, or manuscript which a lead agency determines to be historically significant or significant in the architectural, engineering, scientific, economic, agricultural, educational, social, political, military, or cultural annals of California…Generally, a resource shall be considered by the lead agency to be 'historically significant' if the resource meets the criteria for listing in the California Register of Historical Resources" (14 CCR Section 15064.5(a)(3)).

If an impact on a historical or archaeological resource is significant, CEQA requires feasible measures to minimize the impact (14 CCR Section 15126.4 (a)(1)). Mitigation of significant impacts must lessen or eliminate the physical impact that the project would have on the resource. Generally, a project that follows the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings (Weeks and Grimmer, 1995) shall be considered mitigated to a level of a less-than-significant impact on the historical resource (14 CCR Section 15064.5(b)(3)). The use of drawings, photographs, and/or displays does not typically mitigate the physical impact on the environment caused by demolition or destruction of a historical resource. However, CEQA requires that all feasible mitigation be undertaken even if it does not mitigate impacts to less-than-significant levels (14 CCR Section 15126.4(a)(1)).

California Register of Historical Resources

PRC Section 5024.1 established the CRHR. The requirements for listing in the CRHR, including the criterion for listing and integrity requirements, are similar to those of the National Register of Historic Places (NRHP). Generally, a resource is considered by the lead agency to be "historically significant" if the resource meets the criteria for listing in the CRHR (14 CCR Section 15064.5(a)(3)). For a cultural resource to qualify for listing in the CRHR, it must be significant under one or more of the following criteria:

Criterion 1: Associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;

Criterion 2: Associated with the lives of persons important in our past;

Criterion 3: Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or

Criterion 4: Has yielded, or may be likely to yield, information important in prehistory or history.

In addition to being significant under one or more of these criteria, a resource must retain enough of its historic character and appearance to be recognizable as a historical resource and be able to convey the reasons for its significance (14 CCR Section 4852(c)). Generally, a cultural resource must be 50 years or older to be eligible for the CRHR (14 CCR Section 4852(d)(2)).

In addition to meeting one or more of the significance criteria, a cultural resource must retain its historical integrity to be considered eligible for listing in the CRHR. Historical integrity is defined as "the authenticity of a historical resource's physical identity evidenced by the survival of characteristics that existed during the resource's period of significance" (OHP, n.d.). The evaluation of integrity must be grounded in an understanding of a resource's physical features and its environment, and how these relate to its significance. There are seven aspects of integrity to consider when evaluating a cultural resource—location, design, setting, materials, workmanship, feeling, and association (U.S. Department of the Interior, 1997:44-45)—that are described as follows:

- *Location* is the place where the historic property was constructed or the place where the historic event occurred. The actual location of a historic property, complemented by its setting, is particularly important in recapturing the sense of historic events and persons.
- *Design* is the combination of elements that create the form, plan, space, structure, and style of a property. Design includes such elements as organization of space, proportion, scale, technology, ornamentation, and materials.
- *Setting* is the physical environment of a historic property. Setting refers to the character of the place in which the property played its historical role. Physical features that constitute the setting of a historic property can be either natural or manmade, including topographic features, vegetation, paths or fences, or relationships between buildings and other features or open space.
- *Materials* are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
- *Workmanship* is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory. It is the evidence of the artisan's labor and skill in constructing or altering a building, structure, object, or site.
- *Feeling* is a property's expression of the aesthetic or historic sense of a particular period of time. It results from the presence of physical features that, taken together, convey the property's historic character.
- *Association* is the direct link between an important historic event or person and a historic property.

California Assembly Bill 52

Assembly Bill (AB) 52, which became law on January 1, 2015, provides for consultation with California Native American tribes during the CEQA process, and equates significant impacts to "tribal cultural resources" with significant environmental impacts. PRC Section 21074 states that "tribal cultural resources" are:

> Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe and are one of the following:
>
> - Included or determined to be eligible for inclusion in the California Register of Historical Resources.
> - Included in a local register of historical resources as defined in subdivision (k) of PRC Section 5020.1.
> - A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of PRC Section 5024.1. In applying the criteria set forth in subdivision (c) of PRC Section 5024.1, the lead

agency shall consider the significance of the resource to a California Native American tribe.

A "historical resource" (PRC Section 21084.1), a "unique archaeological resource" (PRC Section 21083.2(g)), or a "non-unique archaeological resource" (PRC Section 21083.2 (h)) may also be a tribal cultural resource if it is included or determined to be eligible for inclusion in the California Register.

The consultation provisions of the law require that a public agency consult with local Native American tribes that have requested placement on that agency's notification list for CEQA projects. Within 14 days of determining that a project application is complete, or a decision by a public agency to undertake a project, the lead agency must notify tribes of the opportunity to consult on the project, should a tribe have previously requested to be on the agency's notification list. California Native American tribes must be recognized by the NAHC as traditionally and culturally affiliated with the project site, and must have previously requested that the lead agency notify them of projects. Tribes have 30 days following notification of a project to request consultation with the lead agency.

The purpose of consultation is to inform the lead agency in its identification and determination of the significance of tribal cultural resources. If a project is determined to result in a significant impact on an identified tribal cultural resource, the consultation process must occur and conclude prior to adoption of a Negative Declaration or Mitigated Negative Declaration, or certification of an Environmental Impact Report (PRC Sections 21080.3.1, 21080.3.2, 21082.3).

To date, the District has not received a request from a tribe to be placed on the agency's consultation notification list for CEQA projects.

California Public Resources Code Section 5097.98

Section 5097.98 of the PRC states that the NAHC, upon notification of the discovery of Native American human remains pursuant to Health and Safety Code Section 7050.5 (discussed below), shall immediately notify those persons (i.e., the Most Likely Descendent or "MLD") it believes to be descended from the deceased. With permission of the landowner or a designated representative, the MLD may inspect the remains and any associated cultural materials and make recommendations for treatment or disposition of the remains and associated grave goods. The MLD shall provide recommendations or preferences for treatment of the remains and associated cultural materials within 48 hours of being granted access to the site.

California Health and Safety Code Section 7050.5

Section 7050.5 of the California Health and Safety Code states that, in the event of discovery or recognition of any human remains in any location other than a dedicated cemetery, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent remains until the coroner of the county in which the remains are discovered has determined whether or not the remains are subject to the coroner's authority. If the human remains are of Native American origin, the coroner must notify the NAHC within 24 hours of this identification. The NAHC will identify a Native American MLD to inspect the site and provide recommendations for the proper treatment of the remains and associated grave goods.

LOCAL REGULATIONS

San Rafael School District

The District's Master Facilities Plan (Hibser Yamauchi Architects, Inc. 2015) does not include goals or policies relevant to cultural resources. The District relies on CEQA for determining the historical significance of resources and regulating their protection.

City of San Rafael

San Rafael General Plan

Cultural resources are considered in the Culture and Arts Element of the San Rafael General Plan. Goal 26 of the General Plan is "to have protected and maintained historic buildings and archaeological resources as part of San Rafael's cultural heritage." General Plan policies related to cultural resources are as follows (City of San Rafael, 2013):

Policy CA-13 **Historic Buildings and Areas.** Preserve buildings and areas with special and recognized historic, architectural or aesthetic value including but not limited to those on the San Rafael Historical/Architectural Survey. New development and redevelopment should respect architecturally and historically significant buildings and areas.

Policy CA-14 **Reuse of Historical Buildings.** Encourage the adaptation and reuse of historic buildings, in order to preserve the historic resources that are a part of San Rafael's heritage.

Policy CA-15 **Protection of Archaeological Resources.** Recognize the importance of protecting significant archaeological resources by: (1) Identifying, when possible, archaeological resources and potential impacts on such resources; (2) providing information and direction to property owners in order to make them aware of these resources; and (3) implementing measures to preserve and protect archaeological resources.

San Rafael Municipal Code Chapter 2.19—Archaeological Resources Protection

The City of San Rafael maintains sections of its municipal code that are intended to protect archaeological resources within the city limits (Municipal Code Chapter 2.19—Archaeological Resources Protection). The municipal code includes maintenance of a citywide archaeological sensitivity map for planning-related purposes (2.19.020—Archaeological Sensitivity Map) and references "specific procedures and regulations [that] shall be implemented by the City to ensure the protection of archeological resources as adopted by council resolution" (2.19.030 Procedures and Regulations for Archeological Resource Protection).

Historic Preservation Ordinance and Historic Resources List

The City of San Rafael adopted a Historic Preservation Ordinance in 1978, establishing guidelines for the renovation, demolition and identification of historic buildings (Municipal Code Chapter 2.18 – Historic Preservation). The City also maintains a list of local historic resources that was first developed in 1976 and later updated in 1986. The *Survey* identifies and rates the historical significance of 305 buildings and structures in San Rafael. Structures included in the list are presumed significant resources unless evidence to the contrary is provided. The survey also provides ranking for the listed structures as “exceptional,” “excellent” or “good” (Charles Hall Page & Associates Inc., 1986). The original San Rafael High School building (Building A) on the 185 Mission Street site is included in the *Survey.*

The City’s Historic Preservation Ordinance outlines procedures and specific criteria for the designation of landmarks and of structures of merit. The criteria for the designation of historic landmarks and historic districts include specific findings of significance in one of the following four areas: historical, cultural importance; architectural, engineering importance; geographic importance; and archaeological importance (2.18.048 Criteria for Designation as Landmark). The ordinance also allows for the recognition of structures of merit, which may have historic, architectural, or aesthetic merit but have not been designated as landmarks and are not situated in historic districts (2.18.069 Recognition of Structures of Merit). Currently, San Rafael has 16 designated local landmarks, one site listed as a National Historic Landmark, and 10 sites on the NRHP (City of San Rafael, 2015). No SRHS campus buildings are designated as local landmarks, National Historic Landmarks or in the NRHP.

4.4.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

The proposed project would have a significant impact on cultural resources if it would:

a) Cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5;

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5;

c) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature (Appendix G); or

d) Disturb any human remains, including those interred outside of formal cemeteries pursuant to PRC 5097 and Health and Safety Code 70-50.5.

These significance criteria apply to the Master Facilities Long-Range Plan and the Stadium Project proposed under the Long-Range Plan. A discussion of these criteria is included in the impacts analysis below.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

No less-than-significant impacts on cultural resources would result from the Master Facilities Long-Range Plan.

Potentially Significant Impacts

Impact CULT-1: The Master Facilities Long-Range Plan could cause a substantial adverse change in the significance of archaeological deposits that qualify as historical resources, as defined in CEQA Guidelines Section 15064.5. Archaeological deposits could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site. (PS)

The Master Facilities Long-Range Plan includes actions that involve ground disturbance. These actions include grading and trenching for construction of several new buildings, and various site improvements for landscaping, pathways, lighting, parking, and utilities. These actions have the potential to unearth previously unidentified archaeological deposits.

A geo-archaeological investigation conducted south of the project site in Larkspur indicates that there is a potential for buried prehistoric archaeological resources in eastern Marin County beneath Holocene-age Bay Mud (Kaijankoski and Meyer, 2011). Deep ground-disturbing excavations conducted for the project below fill and Bay Mud may result in an adverse change to buried archaeological deposits that may be located at the project site. Ground-disturbing excavations could result in material impairment by destroying those qualities of a resource that qualify it for listing in the CRHR.

Under CEQA, when a project could potentially affect an archaeological site, the lead agency must first determine if that deposit qualifies as a historical resource, as defined in CEQA Guidelines Section 15064.5(a). Should archaeological historical resources be identified at the SRHS campus during construction permitted under the Master Facilities Long-Range Plan, implementation of Mitigation Measure CULT-1 would reduce impacts on historical resources to a less-than-significant level.

> *Mitigation Measure CULT-1: Should an archaeological deposit be encountered during project subsurface construction activities, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. If the deposit is found to be significant (i.e., eligible for listing in the California Register of Historical Resources), the District shall be responsible for funding and implementing appropriate mitigation measures. Mitigation measures may include recordation of the archaeological deposit, data recovery and analysis, and public outreach regarding the scientific and cultural importance of the discovery. Upon completion of the selected mitigations, a report documenting methods, findings, and recommendations shall be prepared and submitted to*

the District for review, and the final report shall be submitted to the Northwest Information Center at Sonoma State University. Significant archaeological materials shall be submitted to an appropriate curation facility and used for public interpretive displays, as appropriate and in coordination with a local Native American tribal representative.

The District shall inform its contractor(s) of the sensitivity of the project area for archaeological deposits and shall verify that the following directive has been included in the appropriate contract documents:

> *"The subsurface of the construction site may be sensitive for Native American archaeological deposits and associated human remains. If archaeological deposits are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified archaeologist contacted to assess the situation, determine if the deposit qualifies as a historical resource, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any archaeological materials. Archaeological deposits can include shellfish remains; bones; flakes of, and tools made from, obsidian, chert, and basalt; and mortars and pestles. Contractor acknowledges and understands that excavation or removal of archaeological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5." (LTS)*

Impact CULT-2: The Master Facilities Long-Range Plan could cause a substantial adverse change in the significance of an archaeological resource, as defined in CEQA Guidelines Section 15064.5. Archaeological resources could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site. (PS)

According to the CEQA Guidelines, "When a project will impact an archaeological site, a lead agency shall first determine whether the site is an historical resource" (CEQA Guidelines Section 15064.5(c)(1)). Those archaeological sites that do not qualify as historical resources shall be assessed by to determine if these qualify as "unique archaeological resources" (California PRC Section 21083.2). Archaeological deposits identified during project construction should be treated by the lead agency—in consultation with a qualified archaeologist meeting the *Secretary of the Interior's Professional Qualifications Standards for Archeology*—in accordance with Mitigation Measure CULT-1.

Mitigation Measure CULT-2: Implement Mitigation Measure CULT-1 (LTS).

Impact CULT-3: The Master Facilities Long-Range Plan could directly or indirectly destroy a unique paleontological resource or site by unearthing or otherwise displacing fossils that may occur below Holocene landforms underlying the project site. (PS)

Franciscan Formation bedrock is exposed at the SRHS campus and underlies the fill and Holocene Bay Mud at this location (Miller Pacific Engineering Group, 2015). The Franciscan Complex is known to be fossiliferous, most notably for the microscopic single-celled organisms known as radiolaria, which comprise the distinctive red and green radiolarian cherts associated with the Franciscan Complex. Although less common, extinct species of vertebrate marine fossils and shellfish have also been found in the Franciscan Complex (Bailey et al., 1964:116-117; Hilton, 2003:22).

The Master Facilities Long-Range Plan includes actions that involve ground disturbance. These actions include grading and trenching for construction of several new buildings, and various site improvements for landscaping, pathways, lighting, parking, and utilities. These actions have the potential to unearth previously unidentified paleontological resources associated with fossiliferous geologic formations that underlie project site fill and Holocene-age Bay Mud.

> *Mitigation Measure CULT-3: Should paleontological resources be encountered during project subsurface construction activities, all ground-disturbing activities within 25 feet shall be redirected and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. For purposes of this mitigation, a "qualified paleontologist" shall be an individual with the following qualifications: 1) a graduate degree in paleontology or geology and/or a person with a demonstrated publication record in peer-reviewed paleontological journals; 2) at least two years of professional experience related to paleontology; 3) proficiency in recognizing fossils in the field and determining their significance; 4) expertise in local geology, stratigraphy, and biostratigraphy; and 5) experience collecting vertebrate fossils in the field. If the paleontological resources are found to be significant and project activities cannot avoid them, measures shall be implemented to ensure that the project does not cause a substantial adverse change in the significance of the paleontological resource. Measures may include monitoring, recording the fossil locality, data recovery and analysis, a final report, and accessioning the fossil material and technical report to a paleontological repository. Upon completion of the assessment, a report documenting methods, findings, and recommendations shall be prepared and submitted to the District for review. If paleontological materials are recovered, this report also shall be submitted to a paleontological repository such as the University of California Museum of Paleontology, along with significant paleontological materials. Public educational outreach may also be appropriate.*
>
> *The District shall inform its contractor(s) of the sensitivity of the project site for paleontological resources and shall verify that the following directive has been included in the appropriate contract documents:*
>
> > *"The subsurface of the construction site may be sensitive for fossils. If fossils are encountered during project subsurface construction, all ground-disturbing activities within 25 feet shall be redirected and a qualified paleontologist contacted to assess the situation, consult with agencies as appropriate, and make recommendations for the treatment of the discovery. Project personnel shall not collect or move any paleontological materials. Fossils can include plants and animals, and such trace fossil evidence of past life as tracks or plant imprints. Ancient marine sediments may contain invertebrate fossils such as snails, clam and oyster shells, sponges, and protozoa; and vertebrate fossils such as fish, whale, and sea lion bones. Vertebrate land mammals may include bones of mammoth, camel, saber tooth cat, horse, and bison. Contractor acknowledges and understands that excavation or removal of paleontological material is prohibited by law and constitutes a misdemeanor under California Public Resources Code, Section 5097.5." (LTS)*

<u>Impact CULT-4</u>: Ground-disturbing activities associated with the Master Facilities Long-Range Plan have the potential to unearth Native American human remains. (PS)

Although Native American remains have not been identified within the project site, such remains are often found in association with prehistoric habitation sites in San Rafael and southern Marin County. Prehistoric archaeological deposits and associated human remains may underlie the project site (see Impact CULT-1 and Impact CULT-2).

> *<u>Mitigation Measure CULT-4</u>: Any human remains encountered during project ground-disturbing activities shall be treated in accordance with California Health and Safety Code Section 7050.5 and Mitigation Measure CULT-1.*
>
> *In addition, if human remains are identified during construction and cannot be preserved in place, the District shall fund 1) the removal of human remains from the project site by a qualified archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards for Archeology, 2) the scientific analysis and documentation of the remains by a qualified archaeologist, and 3) the reburial of the remains, as appropriate. Excavation, analysis, and reburial of Native American human remains shall be done in consultation with the Native American Most Likely Descendent, as identified by the California Native American Heritage Commission. (LTS)*

<u>Impact CULT-5</u>: The Master Facilities Long-Range Plan includes the construction of projects (Buildings 1, 2, 3, and 4) that do not yet have finalized designs and would be located near or adjacent to the original San Rafael High School building (Building A), a historical resource. Therefore, the proposed development would have the potential to cause a substantial adverse change in the significance of a historical resource. (PS)

The Master Facilities Long-Range Plan includes the construction of several buildings near or adjacent to the original San Rafael High School building (Building A in Figure 3-4 in Chapter 3, Project Description, of this EIR), which appears to be eligible for individual listing in the CRHR under Criteria 1 and 3. The construction of new buildings within the vicinity of the historic resource could result in indirect impacts on contributing features or its setting.

> *<u>Mitigation Measure CULT-5:</u> Proposed Buildings 1, 2, 3, and 4, which are in the immediate vicinity of the historical resource (Building A), shall require review by an architectural historian or historic architect who meets the Secretary of the Interior's Qualification Standards and is retained by the District for the purpose of verifying compliance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (the Standards). Typically, if a project follows the Standards, impacts on a historical resource shall be considered mitigated to a less-than-significant level. Therefore, designs for proposed Buildings 1, 2, 3, and 4 shall comply with the Standards, in order to ensure that the construction would not indirectly alter the historical resource's (Building A's) physical characteristics, such as setting, that convey its historical significance such that it is no longer eligible for listing in the California Register of Historical Resources. In compliance with the applicable Standard (Standard 9), the new work shall be differentiated from the old and shall be compatible with massing, size, scale, and architectural features of the historical resource. (LTS)*

Impact CULT-6: The Master Facilities Long-Range Plan includes the modernization of the original San Rafael High School building (Building A), a historical resource. The changes would be primarily on the interior and there would be no change in the footprint. The design is not yet finalized and the proposed modernization would have the potential to cause a substantial adverse change in the significance of a historical resource. (PS)

The Master Facilities Long-Range Plan includes the interior modernization of the original San Rafael High School building (Building A in Figure 3-4 in Chapter 3, Project Description, of this EIR), which appears to be eligible for individual listing in the CRHR under Criteria 1 and 3. While the majority of the work is intended to be on the interior, minor alterations to the exterior may be required and could result in direct impacts on character-defining features of a historical resource.

> *Mitigation Measure CULT-6: The proposed modernization of the historical resource (Building A) shall require review by an architectural historian or historic architect who meets the Secretary of the Interior's Qualification Standards and is retained by the District for the purpose of verifying compliance with the Secretary of the Interior's Standards for the Treatment of Historic Properties (the Standards). Typically, if a project follows the Standards, impacts on a historical resource shall be considered mitigated to a less-than-significant level. Therefore, designs for the modernization of Building A shall comply with the Standards, in order to ensure that the construction would not directly alter the historical resource's (Building A's) physical characteristics, such as setting, that convey its historical significance such that it is no longer eligible for listing in the California Register of Historical Resources. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

The Stadium Project would not cause a substantial adverse change in the significance of a built-environment historical resource as defined in CEQA Guidelines Section 15064.5.

The only historical resource identified on the campus is the original San Rafael High School building (Building A). The proposed Stadium Project would not physically affect the historical resource, as the project includes no work to the building and would not be located within the immediate vicinity of the historical resource. The Stadium Project therefore would not cause a substantial adverse change in the significance of a historical resource as defined in CEQA Guidelines Section 15064.5.

Potentially Significant Impacts

Impact CULT-7: The Stadium Project could cause a substantial adverse change in the significance of archaeological deposits that qualify as historical resources, as defined in CEQA Guidelines Section 15064.5. Archaeological deposits could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site. (PS)

The proposed Stadium Project includes actions that would involve ground disturbance. These actions include construction of new buildings and structures, including concessions, restrooms, changing rooms, and bleachers, as well as various site improvements that would require grading and trenching. These actions have the potential to unearth previously unidentified archaeological deposits.

> *Mitigation Measure CULT-7: Implement Mitigation Measure CULT-1. (LTS)*

Impact CULT-8: The Stadium Project could cause a substantial adverse change in the significance of an archaeological resource, as defined in CEQA Guidelines Section 15064.5. Archaeological resources could be unearthed or otherwise displaced during project ground disturbance below fill and the Holocene Bay Mud underlying the project site. (PS)

There are no identified archaeological resources within the footprint of the Stadium Project. As described above, however, project ground disturbance could unearth previously unidentified archaeological deposits.

> *Mitigation Measure CULT-8: Implement Mitigation Measure CULT-1. (LTS)*

Impact CULT-9: The Stadium Project could directly or indirectly destroy a unique paleontological resource or site by unearthing or otherwise displacing fossils that may occur below Holocene landforms underlying the project site. (PS)

There are no identified paleontological resources within the footprint of the Stadium Project. As described above, however, project ground disturbance could unearth previously unidentified fossils.

> *Mitigation Measure CULT-9: Implement Mitigation Measure CULT-3. (LTS)*

Impact CULT-10: Ground-disturbing activities associated with the Stadium Project have the potential to unearth Native American human remains. (PS)

There are no identified human remains within the footprint of the Stadium Project. As described above, however, project ground disturbance could unearth previously unidentified Native American remains.

> *Mitigation Measure CULT-10: Implement Mitigation Measure CULT-4. (LTS)*

CUMULATIVE IMPACTS

For cultural resources, the scope for assessing cumulative impacts encompasses other past, current, or probable future projects under review by San Rafael City Schools or the City of San Rafael. The Master Facilities Long-Range Plan, including the Stadium Project, would have a significant effect on the environment if these would contribute to a significant cumulative impact on cultural resources. For purposes of this analysis, a list approach was used to identify probable future projects within close proximity to the project site. Projects considered for this cumulative impact analysis are listed in Table 6-1 in Chapter 6 of this EIR.

Based on a review of project and CEQA documentation available on the City of San Rafael and County of Marin website, no recent past, current, or probable future projects under review by the City or County (see Table 6-1 for projects included as part of the cumulative analysis) include recorded archaeological historical resources, archaeological resources, paleontological resources, or human remains. Other approved or probable future projects near the project site, including the Lincoln and Missional Residential Condominium project, Whistlestop Mission Plaza project, San Rafael Corporate Center project, 2nd and B Streets Housing Development project, and Village at Loch Lomond Marina (see Figures 6-1 and 6-2), could result in potentially significant impacts on unidentified archaeological sites, paleontological resources, and human remains unearthed during ground disturbance. However, impacts on these resources accidentally discovered during implementation of these projects would be mitigated to less-than-significant levels through the use of appropriate mitigation measures adopted as conditions of approval. Collectively, recent past, approved, and probable future projects that may occur in the vicinity—including the current Master Facilities Long-Range Plan—would not result in a cumulative increase in impacts on archaeological historical resources, archaeological resources, paleontological resources, or human remains, as these resources would be avoided or otherwise removed, analyzed, and reported (i.e., by a qualified archaeologist or paleontologist).

Most of the recent past, current, or probable future projects under review by the City or County considered for this analysis do not include impacts on historical resources. However, two approved or probable future projects—the Lincoln and Missional Residential Condominium project and the 2nd and B Streets Housing Development project—include significant unavoidable impacts on historic resources. Both of these projects propose to demolish historical resources. Any potential impact of the Master Facilities Long-Range Plan on a historical resource would be mitigated to a less-than-significant level through the implementation of the Standards and would not result in a cumulative increase in impacts on built-environment historical resources.

When future development proposals are considered by the District, City, or County, these proposals would undergo environmental review pursuant to CEQA and, when necessary, mitigation measures would be adopted as appropriate. In most cases, this environmental review and compliance with project conditions of approval, relevant policies of the General Plan, and the City's Municipal Code (Chapter 2.19—Archaeological Resources Protection and Chapter 2.18—Historic Preservation) would ensure that significant impacts on cultural resources would be avoided or otherwise mitigated to less-than-significant levels.

For these reasons, the Master Facilities Long-Range Plan, including the Stadium Project, would not result in or contribute to any significant cumulative impacts on archaeological deposits, paleontological resources, human remains, or built-environment historical resources.

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4.5 GEOLOGY AND SOILS

4.5.1 INTRODUCTION

This section of the EIR describes the geologic and seismic setting of the San Rafael High School (SRHS) campus (project site), including the regional and local geology and seismicity settings and the relevant regulatory framework. The section also evaluates potential environmental impacts related to geology and soils on a program level for the Master Facilities Long-Range Plan as a whole, and on a project level for one of the Master Facilities Long-Range Plan elements, the proposed Stadium Project. The impacts examined include risks related to geologic hazards such as earthquakes, liquefaction, expansive soils, and structural settlement. This section identifies program-level, project-level, and cumulative environmental impacts and explains how application of mitigation measures would reduce or avoid the identified impacts.

The analysis relies on published regional geologic resources from agencies such as the United States Geological Survey (USGS) and California Geological Survey (CGS) as well as a site-specific geotechnical report (Miller Pacific Engineering Group, 2015) performed for the Stadium Project.

4.5.2 ENVIRONMENTAL SETTING

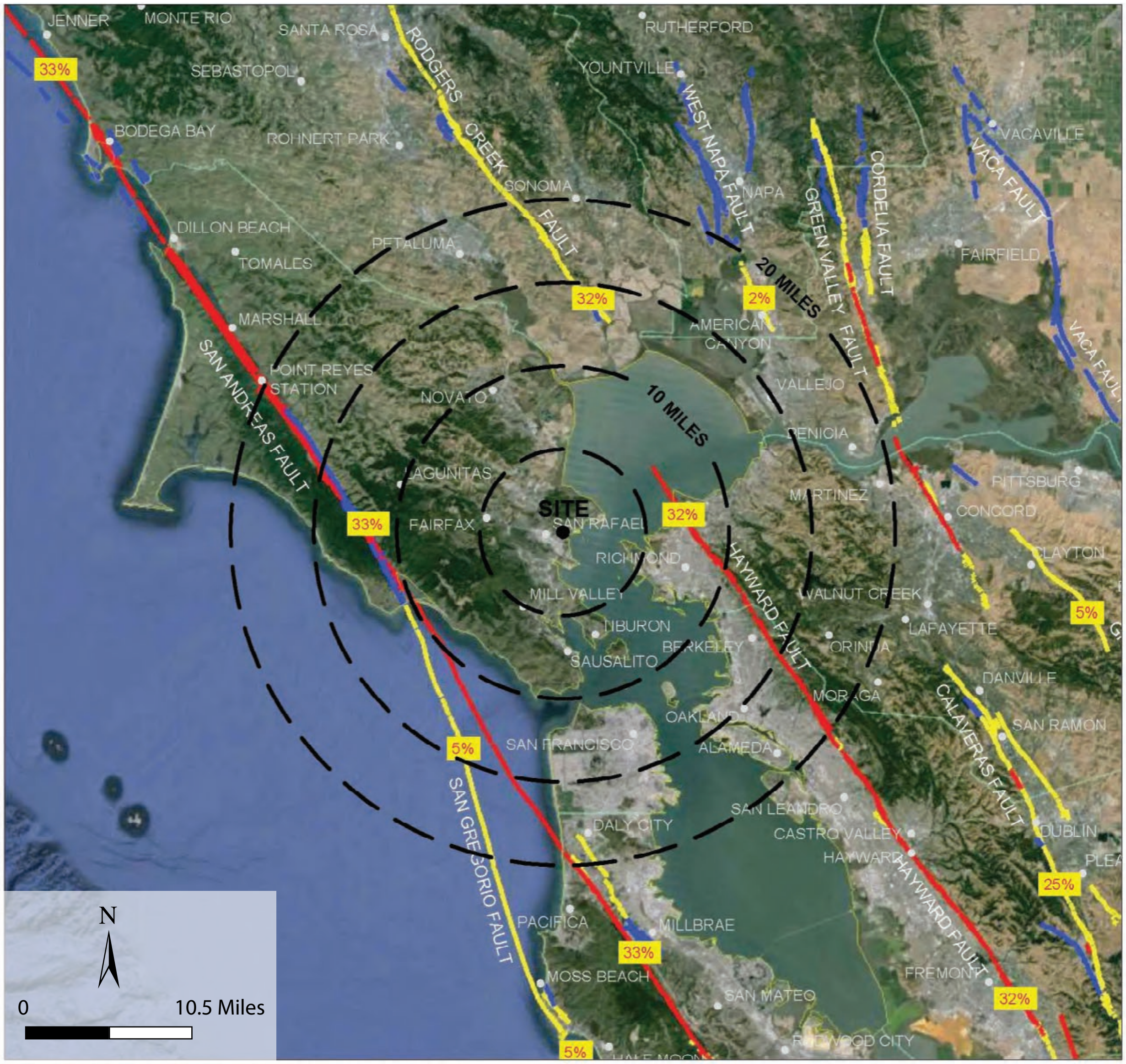
REGIONAL SETTING

Regional Geology

The SRHS campus is located within the Coast Ranges geomorphic province of California. The Coast Ranges stretch from the Oregon border south to Santa Barbara County. Movement on the San Andreas Fault system over the last 30 million years (discussed in more depth below) has produced the northwest-trending structural and topographic geologic features typifying the Coast Ranges. The Coast Ranges are underlain by the Cretaceous- and Jurassic-age (70- to 200-million-year-old) rocks of the Franciscan Complex, overlain by younger sedimentary and volcanic formations, which are in turn overlain by still younger surficial deposits laid down in the last million years.

Regional Seismicity

The San Francisco Bay Area is a seismically active region. Numerous earthquakes have been recorded in the region in the past, and significant earthquakes can be expected to occur in the future. A number of active regional faults in the SRHS campus vicinity have been found by CGS under the Alquist-Priolo Earthquake Fault Zoning Act (A-PEFZA) to be “active” (i.e., to have evidence of fault rupture in the past 11,000 years). The closest active faults to the SRHS campus are the Hayward Fault, located approximately 12 kilometers to the east, and the San Andreas Fault, located approximately 16 kilometers to the southwest (see **Figure 4.5-1**). Other faults in the



SITE COORDINATES: LAT. 37.9702°, LON. -122.5123°

Legend

(Color indicates age of most recent known movement)

Historic (movement in last 150 years)

Holocene-Latest to Pleistocene (less than 15,000 years old)

Late Quaternary (less 1.0 million years)

32% **Probability of at least one million less than 6.7 Earthquake between 2015 and 2045 for Faults Shown**

Data Source:

1) Working Group on California Earthquake Probabilities (WGCEP)(2014), "Long-Term Time-Dependent Probabilities for the Third Uniform California Earthquake Rupture Forecast (UCERF3), Bulletin of the Seismological Society of America (BSSA), Volume 105, No. 2A, 33pp, April 2015.

Figure 4.5-1

REGIONAL FAULTS

SOURCE: Miller Pacific Engineering Group, 2015

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ENVIRONMENTAL PLANNING

SRHS campus vicinity with the potential to produce a significant earthquake include the San Gregorio and Rodgers Creek faults (see Figure 4.5-1).

The main feature generating seismic activity in the region is the tectonic plate boundary between the North American and Pacific plates. Locally, this boundary is referred to as the San Andreas Fault Zone (SAFZ), and includes the fault as well as the area near the fault that could experience surface rupture during a seismic event.

The latest USGS Working Group on California Earthquake Probabilities (WGCEP) estimates a 72 percent chance of at least one magnitude 6.7 or greater earthquake in the San Francisco Bay Area over the next 30 years (USGS, 2015a), including a 33 percent chance on the San Andreas Fault and a 32 percent chance on the Hayward-Rogers Creek fault (USGS, 2015a).

Groundshaking is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake, and is normally the major cause of damage in seismic events. The extent of groundshaking is controlled by the magnitude and intensity of the earthquake. Magnitude is a measure of the energy released by an earthquake, and is reported as moment magnitude (Mw). The Modified Mercalli Intensity Scale (MMI), presented in **Table 4.5-1**, is a subjective measure of the perceptible effects of an earthquake at a given point and varies with distance from the epicenter and local geologic conditions. Intensity can also be quantitatively measured using accelerometers (strong motion seismographs) that record ground acceleration at a specific location. Acceleration is measured as a fraction or percentage of the acceleration of gravity (g).

SRHS CAMPUS SETTING

Site Topography

Most of the SRHS campus, including all currently developed areas, is relatively level, with an elevation of approximately 10 feet above mean sea level (msl) (USGS, 2015b). However, relatively steep slopes are present near the eastern boundary of the campus, with elevations reaching an elevation of 74 feet above msl near the intersection of Mission Avenue and Embarcadero Way (USGS, 2015b). Mission Avenue and Embarcadero Way slope down from east to west from this high point. Slopes are present near the northeastern site boundary, from north of the SRHS tennis courts to Embarcadero Way, and near the southeastern site boundary from Mission Avenue to the southeast corner of the stadium (USGS, 2015b).

Site Stratigraphy and Soils

Regional geologic mapping designates the level area of the SRHS campus as artificial fill over marine and marsh deposits, with areas to the north, west, and east mapped as Franciscan mélange (Blake et al, 2000). Soils in the eastern part of the SRHS campus were evaluated in a site-specific geotechnical investigation for the Stadium Project. The geotechnical investigation included installation of five shallow soil borings, one deep soil boring, and six cone penetrometer test (CPT) borings (Miller Pacific Engineering Group, 2015). Soils in this part of the campus consist of 3 to 8 feet of sandy and clayey fill materials on top of a 3- to 20-foot-thick layer of soft compressible marine clay deposits known as Bay Mud. Underlying the Bay Mud is a 7- to

TABLE 4.5-1 MODIFIED MERCALLI SCALE[a]

Moment Magnitude (M_w)[b]	Intensity	Effects	v,[c] cm/s	g[d]
3	I.	Not felt. Marginal and long-period effects of large earthquakes.		
	II.	Felt by persons at rest, on upper floors, or favorably placed.		
4	III.	Felt indoors. Hanging objects swing. Vibration—like passing of light trucks. Duration estimated. May not be recognized as an earthquake.		0.0035-0.007
	IV.	Hanging objects swing. Vibration--like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV wooden walls and frame creak.		0.007-0.015
	V.	Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.	1-3	0.015-0.035
5	VI.	Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken visibly, or heard to rustle.	3-7	0.035-0.07
6	VII.	Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices, unbraced parapets, and architectural ornaments. Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.	7-20	0.07-0.15
	VIII.	Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.	20-60	0.15-0.35
7	IX.	General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas sand and mud ejected, "earthquake fountains" of sand and water, sand craters.	60-200	0.35-0.7
8	X.	Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.	200-500	0.7-1.2
	XI.	Rails bent greatly. Underground pipelines completely out of service.		>1.2
	XII.	Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.		

Note: Masonry A, B, C, D. To avoid ambiguity of language, the quality of masonry, brick or otherwise, is specified by the following lettering (which has no connection with the conventional Class A, B, C construction).

Masonry A: Good workmanship, mortar, and design, reinforced, especially laterally, and bound together by using steel, concrete, etc.; designed to resist lateral forces.
Masonry B: Good workmanship and mortar, reinforced, but not designed to resist lateral forces.
Masonry C: Ordinary workmanship and mortar; no extreme weaknesses such as non-tied-in corners, but masonry is neither reinforced nor designed against horizontal forces.
Masonry D: Weak materials, such as adobe; poor mortar; low standards of workmanship; weak horizontally.

[a] Source: Based on Richter, 1958, *Elementary Seismology*.
[b] Richter magnitude correlation.
[c] Average peak ground velocity, centimeters per second (cm/s).
[d] Average peak acceleration (away from source).

10-foot-thick layer of sandy clay alluvium over weathered sandstone. The sandstone becomes significantly harder between 20 and 35 feet below the ground surface (Miller Pacific Engineering Group, 2015).

A 2012 soil and groundwater investigation in the western portion of the SRHS campus, at the Maintenance Facility at 38 Union Street, found similar soils: 3 to 7.5 feet of fill material, with some thin sand layers, over Bay Mud (Arcadis, 2015). Although soils in other parts of the campus have not been investigated, based on the similar regional geologic mapping, it is likely that soils in other parts of the SRHS campus are similar to those identified in these previous investigations.

Seismic Hazards

Fault Rupture

Fault rupture of the surface typically occurs along existing faults that have ruptured the surface in the past. The closest active regional faults are the Hayward and San Andreas faults, located approximately 12 and 16 kilometers from the SRHS campus (see Figure 4.5-1). No known active faults are located within the SRHS campus, so the potential for fault rupture is low (Miller Pacific Engineering Group, 2015).

Groundshaking Hazards

Groundshaking is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake, and is normally the major cause of damage during seismic events. The extent of groundshaking is controlled by the magnitude and intensity of the earthquake, distance from the epicenter, and local geologic conditions.

CGS has developed tools to determine the Peak Ground Acceleration (PGA) associated with earthquakes likely to affect a site over a 50-year period. The PGA analysis for the Stadium Project calculated the expected PGA at the Stadium Project site during a seismic event, with a 10 percent chance of being exceeded, of 0.44g (Miller Pacific Engineering Group, 2015). An earthquake of this magnitude would be expected at the project site once every 475 years (Miller Pacific Engineering Group, 2015). This corresponds to Violent shaking (IX) on the Modified Mercalli scale (see Table 4.5-1). Violent groundshaking can create considerable damage even in specially designed structures; well-designed frame structures may be thrown out of plumb; damage may be great in substantial buildings, with partial collapse; and smaller buildings may be shifted off foundations (see Table 4.5-1).

Liquefaction Hazards

During strong groundshaking, liquefaction may occur in areas where soils with high moisture content are present. Liquefaction occurs when groundshaking transforms the subsurface material temporarily from a solid state to a liquid state. Liquefaction can be a serious hazard because buildings in areas that experience liquefaction may sink or suffer major structural damage. The types of soils subject to liquefaction can also cause additional hazards during seismic events, such as lateral spreading or cyclical densification, where loose, granular soil above the water table densify, resulting in settlement.

Based on regional mapping, the SRHS campus is mapped as having high to very high liquefaction susceptibility (ABAG, 2016). Site-specific investigation of soil layers at the SRHS campus for the Stadium Project determined that only relatively thin layers of liquefiable soil, in lenses between fill material and Bay Mud, were present at the site. Based on these data, the report classified the risk of liquefaction as low to moderate (Miller Pacific Engineering Group, 2015).

Geotechnical Hazards

Settlement and Subsidence

Settlement may occur when loads, such as structures or fill, are placed on compressible subsurface materials. Where soils beneath a structure do not have uniform engineering properties, soils could respond differently when placed under the load of buildings or other improvements, which could potentially result in differential settlement. The resulting uniform or differential compaction of the subsurface materials can result in changes to the final ground surface, which may adversely affect buildings, pavement, and other improvements at a site.

Soft compressible materials were observed during the subsurface exploration for the Stadium Project, and could potentially be present at other portions of the SRHS campus (Miller Pacific Engineering Group, 2015). The report concluded that improvements on these soils could result in settlement requiring special foundation design elements to mitigate settlement and differential settlement hazards (Miller Pacific Engineering Group, 2015).

Subsidence is a form of settlement, resulting in the lowering of the land surface elevation due to groundwater pumping and subsequent consolidation of loose aquifer sediments. The geotechnical report for the Stadium Project indicates that subsidence is considered a geologic hazard at the SRHS campus (Miller Pacific Engineering Group, 2015).

Expansive Soils

Expansive soils expand and contract in response to changes in soil moisture, most notably when near-surface soils change from saturated to a low moisture content condition and back again. These changes can result in damage to building foundations, pavement, and other structural elements. Soils at the SRHS campus include clayey fill, which is a type of soil that may be classified as expansive. However, site-specific testing at the Stadium Project site determined that these clayey soils do not exhibit expansive behavior (Miller Pacific Engineering Group, 2015). Additional site-specific testing would be necessary to reach the same conclusion for other areas of the SRHS campus.

Corrosive Soils

Soils may be classified as corrosive to metals and/or concrete. This classification depends on a variety of variables, including moisture, electrical conductivity, chloride content, pH, and dissolved salt content. Testing of soils at the Stadium Project site showed that these soils would not be classified as corrosive (Miller Pacific Engineering Group, 2015). Additional site-specific testing would be necessary to reach the same conclusion for other areas of the SRHS campus.

Landslides and Slope Stability

Slope failure can occur as either rapid movement of large masses of soil (landslide) or imperceptibly slow movement of soils on slopes (creep). The primary factors influencing the stability of a slope are the nature of the underlying soil or bedrock, the geometry of the slope (height and steepness), and rainfall. The presence of historic landslide deposits is a good indicator of future landslides. Landslides are commonly triggered by unusually high rainfall and the resulting soil saturation, by earthquakes, or a combination of these conditions.

Most of the SRHS campus is level, with the exception of the undeveloped area near the eastern campus boundary. An evaluation of potential slope stability hazards for the Stadium Project did not identify any evidence suggestive of significant slope instability or landsliding on the slopes adjacent to the southeast corner of the SRHS campus (Miller Pacific Engineering Group, 2015). The slope in the southeast corner of the SRHS campus is inclined approximately 2:1 (2 feet horizontal per 1-foot vertical). This is similar to the inclination of slopes along other portions of the northern and eastern SRHS campus boundary. For example, the slope between the tennis courts and Mission Avenue, near the northern SRHS campus boundary, has an approximately 25-foot rise in elevation (from 12 to 37 feet above msl) over a 50-foot distance (USGS, 2015b) for a similar 2:1 inclination.

4.5.3 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

The National Earthquake Hazards Reduction Program (NEHRP) was established by the U.S. Congress when it passed the Earthquake Hazards Reduction Act of 1977, Public Law (PL) 95–124 (42 U.S. Code Section 7701, et seq.). In establishing NEHRP, Congress recognized that earthquake-related losses could be reduced through improved design and construction methods and practices, land use controls and redevelopment, prediction techniques and early-warning systems, coordinated emergency preparedness plans, and public education and involvement programs. The four basic NEHRP goals are:

- Develop effective practices and policies for earthquake loss reduction and accelerate their implementation.
- Improve techniques for reducing earthquake vulnerabilities of facilities and systems.
- Improve earthquake hazards identification and risk assessment methods, and their use.
- Improve the understanding of earthquakes and their effects.

Several key federal agencies contribute to earthquake mitigation efforts, with four primary NEHRP agencies as follows:

- National Institute of Standards and Technology (NIST) of the Department of Commerce
- National Science Foundation (NSF)
- USGS of the Department of the Interior
- Federal Emergency Management Agency (FEMA) of the Department of Homeland Security

Implementation of NEHRP priorities is accomplished primarily through original research, publications, and recommendations to assist and guide state, regional, and local agencies in the development of plans and policies to promote safety and emergency planning.

STATE REGULATIONS

Alquist-Priolo Earthquake Fault Zoning Act (A-PEFZA)

The A-PEFZA was passed in 1972 by the State of California legislature to mitigate the hazard of surface fault rupture by regulating structures designated for human occupancy near active faults. As required by the A-PEFZA, CGS has delineated Earthquake Fault Zones along known active faults in California (California Public Resources Code, Section 2621, et seq.).

California Building Code

The 2013 California Building Code (CBC), which refers to Part 2 of the California Building Standards Code in Title 24 of the California Code of Regulations, is based on the 2012 International Building Code. The 2013 CBC covers grading and other geotechnical issues, building specifications, and non-building structures. The CBC requires that a site-specific geotechnical investigation report be prepared by a licensed professional for proposed developments of one or more buildings greater than 4,000 square feet to evaluate geologic and seismic hazards. Geologic engineering reports are also required for buildings less than or equal to 4,000 square feet, except for one-story, wood-frame and light-steel-frame buildings of Type V construction that are located outside of the Alquist-Priolo Earthquake Fault Zones.

New construction must comply with the CBC, and existing buildings must also be brought up to code if remodeling changes the occupancy or use of the building (Title 24, Section 3408.4). This may include a change that intensifies the building use, such as increasing the number of occupants.

The purpose of a site-specific geotechnical investigation is to identify seismic and geologic conditions that require project mitigation, such as surface fault rupture, groundshaking, liquefaction, differential settlement, lateral spreading, expansive soils, and slope stability. Requirements for the geotechnical investigation are presented in Chapter 16 “Structural Design” and Chapter 18 “Soils and Foundation” of the 2013 CBC.

Seismic Hazards Mapping Act

In 1990, following the 1989 Loma Prieta earthquake, the California legislature enacted the Seismic Hazards Mapping Act (SHMA) to protect the public from the effects of strong groundshaking, liquefaction, landslides, and other seismic hazards. The SHMA established a state-wide mapping program to identify areas subject to violent shaking and ground failure; the program is intended to assist cities and counties in protecting public health and safety. CGS is mapping SHMA Zones and has completed seismic hazard mapping for the portions of California most susceptible to liquefaction, groundshaking, and landslides—primarily the San Francisco Bay area and Los Angeles basin. A geotechnical investigation for projects within seismic hazard zones must be conducted and appropriate mitigation measures incorporated into the project design before development permits will be granted. Mapping of hazard zones for the USGS San Rafael quadrangle, which includes the project site, is currently in preparation (CGS, 2016).

Field Act

The Field Act, contained in Education Code Sections 17280-17317 and 80030-81149, adds additional seismic safety requirements for California schools. The Field Act includes requirements for seismic design standards, plan review, construction inspections, and testing. The Division of the State Architect (DSA) oversees the implementation of the Field Act through plan review, permitting, and inspection of schools under construction. Among other provisions, the Field Act requires construction plans to be prepared by licensed structural engineers and architects, requires plans to be reviewed and approved by DSA, and requires continuous inspection during construction by qualified inspectors to verify compliance with the approved plans. Architects, engineers, inspectors, and contractors must certify that school construction complies with approved plans.

LOCAL REGULATIONS

San Rafael General Plan

The following policies and programs related to geologic and seismic safety are contained in the Safety Element of the San Rafael General Plan (City of San Rafael, 2013):

Policy S-2 **Location of Public Improvements.** Avoid locating public improvements and utilities in areas with identified flood, geologic and/or soil hazards to avoid any extraordinary maintenance and operating expenses. When the location of public improvements and utilities in such areas cannot be avoided, effective mitigation measures will be implemented.

Policy S-3 **Use of Maps in Development Review.** Review Slope Stability, Seismic Hazard, and Flood Hazard Maps at the time a development is proposed. Undertake appropriate studies to assure identification and implementation of mitigation measures for identified hazards.

Policy S-4 **Geotechnical Review.** Continue to require geotechnical investigations for development proposals as set forth in the City's Geotechnical Review Matrix (Appendix F). Such studies should determine the actual extent of geotechnical hazards, optimum design for structures, the advisability of special structural requirements, and the feasibility and desirability of a proposed facility in a specified location.

Program S-4a **Geotechnical Review of Proposed Development.** Require soils and geologic peer review of development proposals in accordance with the Geotechnical Review Matrix to assess such hazards as potential seismic hazards, liquefaction, landsliding, mudsliding, erosion, sedimentation and settlement in order to determine if these hazards can be adequately mitigated. Levels of exposure to seismic risk for land uses and structures are also outlined in the Geotechnical Review Matrix, which shall be considered in conjunction with development review.

Policy S-5 **Minimize Potential Effects of Geological Hazards.** Development proposed within areas of potential geological hazards shall not be endangered by, nor contribute to, the hazardous conditions on the site or on adjoining properties. Development in areas subject to soils and geologic hazards shall incorporate adequate mitigation measures. The City will only approve new development in areas of identified hazard if such hazard can be appropriately mitigated.

Policy S-6 **Seismic Safety of New Buildings.** Design and construct all new buildings to resist stresses produced by earthquakes. The minimum level of seismic design shall be in accordance with the most recently adopted building code as required by State law.

Program S-6a **Seismic Design.** The minimum seismic design of structures should be in accordance with the building code, as adopted in accordance with State law.

Policy S-7 **Minimize Potential Effects of Landslides.** Development proposed in areas with existing landslides or with the potential for landslides (as identified by a registered engineering geologist or geotechnical engineer) shall not be endangered by, nor contribute to, the hazardous conditions on the site or on adjoining properties. Development in areas subject to landslide hazards shall incorporate adequate mitigation measures that have a design factor of safety of at least 1.5 for static conditions and 1.0 for pseudo-static (earthquake) conditions. The landslide mitigation should consider multiple options in order to reduce the secondary impacts (loss of vegetation, site grading, traffic, visual) associated with landslide mitigation. The City will only approve new development in areas of identified landslide hazard if such hazard can be appropriately mitigated.

San Rafael Municipal Code

Section 12.12.010 of the San Rafael Municipal Code adopts the 2013 CBC in its entirety, consisting of Volumes 1 and Volume 2, in its entirety, except that only the following appendices are adopted: Appendices C, H, and I, Minor City-specific amendments to the CBC are contained in Municipal Code Section 12.12.020.

Section 15.06.110 of the San Rafael Municipal Code contains standards for grading:

(1) Grading shall be designed to create a natural appearance to the extent possible. Graded slopes shall be designed to transition to adjacent properties so as to limit abrupt changes in topography.

(2) Graded slopes shall not exceed two to one (2:1), unless the city engineer determines that a steeper slope is justified to minimize the amount of grading or to reduce potential tree removal and, where it is determined that the soil and geologic conditions are suitable for and capable of accommodating a steeper slope.

(3) The finished lot grading shall provide a building site and usable yard area that is compatible with the surrounding pattern of development.

(4) Retaining walls and/or stepped foundations shall be encouraged in areas to reduce grading and tree removal. Retaining walls shall not exceed eight feet (8') in height, unless approved by the city design review board.

4.5.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

Under the CEQA Guidelines (Appendix G), the proposed project would have a significant impact related to geology and soils if it would:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: (1) rupture of a known earthquake fault, as delineated on the most recent Alquist–Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault; (2) strong seismic ground shaking; (3) seismic-related ground failure, including liquefaction; and (4) landslides.

b) Result in substantial soil erosion or the loss of topsoil.

c) Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse.

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems in areas where sewers are not available for the disposal of wastewater.

The following significance criteria would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the Long-Range Plan and are, therefore, excluded from further discussion in this impact analysis:

- *Result in Substantial Soil Erosion or the Loss of Topsoil.* Potential soil erosion impacts of the Master Facilities Long-Range Plan, including the Stadium Project, would be related to stormwater runoff entraining soils exposed during construction, and are analyzed in Section 4.8, Hydrology and Water Quality.
- *Have Soils Incapable of Adequately Supporting the Use of Septic Tanks or Alternative Wastewater Disposal Systems in Areas Where Sewers are not Available for the Disposal of Wastewater.* As the SRHS campus is served by the San Rafael Sanitation District and no septic tanks or alternative wastewater disposal systems are proposed, the Master Facilities Long-Range Plan, including the Stadium Project, would have no impacts associated with septic tanks or alternative wastewater disposal systems, and this significance criterion is not discussed further in this impact analysis.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Impacts from Fault Rupture

The Master Facilities Long-Range Plan would not expose people or structures to substantial adverse effects involving rupture of a known earthquake fault.

Available mapping does not identify a fault at or near the SRHS campus that would have the potential to result in surface rupture. In a seismically active area such as the SRHS campus vicinity, a remote possibility exists for future faulting to occur in areas where no faults previously existed; however, the geotechnical report for the Stadium Project concluded that the potential for fault surface rupture in the SRHS campus vicinity was low (Miller Pacific Engineering Group, 2015).

Impacts from Landslides

The Master Facilities Long-Range Plan would not expose people or structures to substantial adverse effects involving landslides.

The SRHS campus is relatively level, except slopes near the eastern and northern site boundaries. With the exception of a restroom/changing room building proposed as part of the Stadium Project, no projects proposed under the Master Facilities Long-Range Plan would include construction near these slopes (see Figure 3-4 in Chapter 3, Project Description, of this EIR). The geotechnical report for the Stadium Project did not identify any potential slope stability or landslide hazards associated with the restroom/changing room or other components of the Stadium Project (Miller Pacific Engineering Group, 2015). Because there is no evidence suggestive of significant slope instability or landsliding, the potential for the Master Facilities Long-Range Plan to expose people or structures to substantial adverse effects involving landslides is less than significant.

Potentially Significant Impacts

Impact GEO-1: During its design life, development under the Master Facilities Long-Range Plan would likely be subject to strong groundshaking from a seismic event, creating the potential for a significant risk to structures and human lives. (PS)

The SRHS campus is located in a seismically active region, and there is a high chance for a significant seismic event to occur during the design life of projects developed under the Master Facilities Long-Range Plan. Groundshaking may be violent, with the potential for significant building damage (though not collapse), even in properly designed structures. Buildings at the SRHS campus must be constructed to minimize damage from an earthquake and protect the lives of future students and school workers.

Development at the SRHS campus would be subject to geotechnical review and inspections under the DSA School Facility Program in accordance with requirements of the Field Act. The DSA review process is intended to ensure that plans, specifications, and construction apply with all applicable requirements of the CBC. A design-level geotechnical report must be prepared in accordance with DSA Geohazard Report Requirements (DSA-4.13). Design plans must incorporate recommendations of the geotechnical report. A DSA-approved inspector must be present throughout construction to verifying the conformance of construction to the geotechnical recommendations.

Implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations, CBC seismic design criteria, and Field Act school seismic safety provisions, would reduce this potential impact to a less-than-significant level.

> *Mitigation Measure GEO-1: The San Rafael City Schools Board of Trustees shall demonstrate that school building design and construction comply with applicable requirements of the Field Act, including design, oversight, and inspection provisions. This shall include incorporation of public school seismic design standards established by the Division of the State Architect (DSA), review of plans by DSA, and inspections throughout construction by independent qualified inspectors. Prior to occupancy of new development under the Master Facilities Long-Range Plan, San Rafael City Schools must receive a certification of compliance from DSA that oversight and inspection of construction was completed in accordance with Field Act and other DSA requirements in accordance with DSA Procedure 13-02. (LTS)*

Impact GEO-2: The Master Facilities Long-Range Plan would have the potential to expose people or structures to substantial adverse effects involving seismic-related ground failure, including liquefaction. (PS)

The SRHS campus has been mapped as having high to very high potential for liquefaction hazards. A geotechnical report for the Stadium Project identified up to approximately 12 inches of potential post-liquefaction settlement during a seismic event of a magnitude 8.0 earthquake producing a peak ground acceleration of 0.45 g (Miller Pacific Engineering Group, 2015). Similar liquefaction settlement could be present at other Master Facilities Long-Range Plan sites. However, implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations, CBC seismic design criteria, and Field Act school seismic safety provisions, would reduce this potential impact to a less-than-significant level.

> *Mitigation Measure GEO-2: For each project under the Master Facilities Long-Range Plan, the District shall ensure compliance with Mitigation Measure GEO-1. (LTS)*

Impact GEO-3: Expansive, potentially unstable, and corrosive soils at the project site could result in structural damage to Master Facilities Long-Range Plan project improvements, creating the potential for a significant risk to structures and human lives. (PS)

The Stadium Project geotechnical report identified medium plasticity clays during exploration (Miller Pacific Engineering Group, 2015). This type of soil could also be present at other Master Facilities Long-Range Plan project locations on the site and be expansive. The Stadium Project geotechnical report also identified relatively thin liquefiable soils and thick deposits of compressible soils with the potential to result in differential settlement. Due to the close proximity, similar unstable soils could also be present in other Master Facilities Long-Range Plan project locations on the site. The geotechnical report did not identify the soil corrosivity in all locations of the SRHS campus, so it is unknown if corrosive soils could be present at other Master Facilities Long-Range Plan project locations on the site. This analysis conservatively considers this a potentially significant impact. The implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations, CBC seismic design criteria, and Field Act school seismic safety provisions, would reduce this potential impact to a less-than-significant level.

> <u>*Mitigation Measure GEO-3*</u>*: For each project under the Master Facilities Long-Range Plan, the District shall ensure compliance with Mitigation Measure GEO-1. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

<u>Impacts from Fault Rupture</u>

The Stadium Project would not expose people or structures to substantial adverse effects involving rupture of a known earthquake fault.

As noted under the Master Facilities Long-Range Plan impact analysis, above, no faults are present at or near the Stadium Project that would have the potential to result in a surface rupture. Therefore, the potential for the Stadium Project to expose people or structures to substantial adverse effects involving fault rupture is less than significant.

<u>Impacts from Landslides</u>

The Stadium Project would not expose people or structures to substantial adverse effects involving landslides.

As noted under the Master Facilities Long-Range Plan impact analysis above, the Stadium Project geotechnical report did not identify any potential slope instability or landsliding hazards (Miller Pacific Engineering Group, 2015). Therefore, the potential for the Stadium Project to expose people or structures to substantial adverse effects involving landslides is less than significant.

<u>Impacts from Expansive and Corrosive Soils</u>

The Stadium Project would not expose people or structures to substantial adverse effects involving expansive and corrosive soils

The Stadium Project geotechnical report investigation included the collection and analysis of soil samples at the Stadium Project site for expansion index and corrosivity. Although some of the clayey soils had a medium plasticity index, suggesting potential expansive soil, the expansion index testing indicated that these soils did not exhibit expansive behavior (Miller Pacific Engineering Group, 2015). Analysis of pH, electrical resistivity, chloride, and sulfate determined that soils at the Stadium Project site are not considered corrosive (Miller Pacific Engineering Group, 2015). Therefore, the Stadium Project's potential impacts related to expansive and corrosive soils are less than significant.

Potentially Significant Impacts

Impact GEO-4: During its design life, the Stadium Project would likely be subject to strong groundshaking from a seismic event, creating the potential for a significant risk to structures and human lives. (PS)

As noted under the Master Facilities Long-Range Plan impact analysis above, the Stadium Project site is located in a seismically active region, and there is a high chance for a significant seismic event to occur during the design life of the Stadium Project. Adherence to the CBC, DSA review and construction oversight requirements, and the Field Act would require project design and construction to incorporate measures to reduce these potential impacts to the extent possible. Implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations, CBC seismic design criteria, and Field Act school seismic safety provisions, would reduce this potential impact to a less-than-significant level.

> *Mitigation Measure GEO-4: For the Stadium Project, the District shall ensure compliance with Mitigation Measure GEO-1. (LTS)*

Impact GEO-5: The Stadium Project would have the potential to expose people or structures to substantial adverse effects involving seismic-related ground failure, including liquefaction. (PS)

The geotechnical report for the Stadium Project determined that liquefaction during a significant seismic event could result in settlement of structures of approximately 0.5 inch (Miller Pacific Engineering Group, 2015). The report provided recommendations for design of foundations and other project improvements to accommodate this settlement. Implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations, CBC seismic design criteria, and Field Act school seismic safety provisions, would reduce this potential project impact to a less-than-significant level.

> *Mitigation Measure GEO-5: For the Stadium Project, the District shall ensure compliance with Mitigation Measure GEO-1. (LTS)*

Impact GEO-6: Potentially unstable soils at the Stadium Project site could result in structural damage to project improvements, creating the potential for a significant risk to structures and human lives. (PS)

The geotechnical report for the Stadium Project concluded that settlement and subsidence at the Stadium Project site were potential geotechnical hazards. The geotechnical report provided recommendations for foundation design for the bleachers and small ancillary buildings, which would be expected to have long-term settlement of less than 1 inch, and recommendations for a deep foundation system to support stadium light standards (Miller Pacific Engineering Group, 2015). The implementation of the following mitigation measure, which would ensure adherence to geotechnical report recommendations, CBC seismic design criteria, and Field Act school seismic safety provisions, would reduce this potential impact to a less-than-significant level.

> *Mitigation Measure GEO-6: For the Stadium Project, the District shall ensure compliance with Mitigation Measure GEO-1. (LTS)*

CUMULATIVE IMPACTS

For geology and soils, the cumulative impact area considered is the SRHS campus and the sites for approved and proposed projects in the SRHS campus vicinity (see Table 6-1 in Chapter 6, CEQA Considerations, of this EIR). Impacts related to geologic hazards are generally site-specific, rather than cumulative in nature, because each project area has unique geologic considerations that would be subject to uniform site development and construction standards. Therefore, the potential for cumulative impacts is limited to the SRHS campus and adjacent sites. Impacts associated with potential geologic hazards related to soil or other conditions occur at individual building sites. These effects are site-specific, and impacts would not be compounded by additional development. Therefore, no significant cumulative impacts relating to geology and soils are occurring, or would be expected to occur, in the SRHS campus vicinity.

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4.6 GREENHOUSE GAS EMISSIONS

4.6.1 INTRODUCTION

This section of the EIR describes the existing environmental conditions and regulatory setting for greenhouse gas (GHG) emissions, and analyzes potential impacts from GHG emissions that would result during long-term operations on the San Rafael High School (SRHS) campus associated with implementation of the Master Facilities Long-Range Plan, including the Stadium Project. The section has been prepared in accordance with the most recent versions of the Bay Area Air Quality Management District (BAAQMD) *California Environmental Quality Act (CEQA) Air Quality Guidelines* (BAAQMD, 2011, 2012).

4.6.2 ENVIRONMENTAL SETTING

CLIMATE CHANGE AND GHG EMISSIONS

Existing GHGs allow about two-thirds of the visible and ultraviolet light from the sun to pass through the atmosphere and be absorbed by the Earth's surface. To balance the absorbed incoming energy, the surface radiates thermal energy back to space at longer wavelengths primarily in the infrared part of the spectrum. Much of the thermal radiation emitted from the surface is absorbed by the GHGs in the atmosphere and is re-radiated in all directions. Since part of the re-radiation is back toward the surface and the lower atmosphere, the global surface temperatures are elevated above what they would be in the absence of GHGs. This process of trapping heat in the lower atmosphere is known as the greenhouse effect.

An increase of GHGs in the atmosphere affects the energy balance of the Earth and results in a global warming trend. Increases in global average temperatures have been observed since the mid-20th century, and have been linked to observed increases in GHG emissions from anthropogenic sources. The primary GHG emissions of concern are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Other GHGs of concern include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6), but their contribution to climate change is less than 1 percent of the total by well-mixed[1] GHGs (Intergovernmental Panel on Climate Change [IPCC], 2013). Each GHG has a different global warming potential (GWP). For instance, CH_4 traps about 21 times more heat per molecule than CO_2. As a result, emissions of GHGs are reported in metric tons of "carbon dioxide equivalents" (CO_2e), where each GHG is weighted by its GWP relative to CO_2.

According to the IPCC, the atmospheric concentrations of CO_2, CH_4, and N_2O have increased to levels unprecedented in at least the last 800,000 years due to anthropogenic sources. In 2010, the concentrations of CO_2, CH_4, and N_2O exceeded the pre-industrial era (before 1750) by about 39, 158, and 18 percent, respectively (BAAQMD, 2015). The Earth's mean surface temperature in the

[1] GHGs that have atmospheric lifetimes long enough to be relatively homogeneously mixed in the troposphere.

Northern Hemisphere from 1983 to 2012 was likely the warmest 30-year period over the last 1,400 years (IPCC, 2013). 2014 ranks as Earth's warmest year since 1880 (NASA, 2015).

The global increases in CO_2 concentrations are due primarily to fossil fuel combustion, cement production, and land use change (e.g., deforestation). The dominant anthropogenic sources of CH_4 are from ruminant livestock, fossil fuel extraction and use, rice paddy agriculture, and landfills, while the dominant anthropogenic sources of N_2O are from ammonia for fertilizer and industry (IPCC, 2013). All emissions of HFCs, PFCs, and SF_6 are not naturally occurring and originate from industrial processes such as semiconductor manufacturing, use as refrigerants and other products, and electric power transmission and distribution (BAAQMD, 2015).

EXISTING GHG EMISSIONS AND PROJECTIONS

In 2011, the California Air Resources Board (CARB) estimated that transportation was responsible for about 37 percent of California's GHG emissions, followed by industrial sources and electrical power generation at about 20 percent each (CARB, 2015). In 2011, 86.6 million metric tons of CO_2e were emitted from anthropogenic sources within the San Francisco Bay Area Air Basin (SFBAAB). The CO_2 emissions dominate the GHG inventory in the SFBAAB, accounting for about 90 percent of the total CO_2e emissions reported (BAAQMD, 2010a). The 2011 GHG emissions in the SFBAAB are summarized in **Table 4.6-1**.

TABLE 4.6-1 SAN FRANCISCO BAY AREA 2011 GREENHOUSE GAS EMISSIONS INVENTORY

Pollutant	Percent	CO_2e (Million Metric Ton/Year)
CO_2	90.3	78.2
CH_4	3.0	2.6
N_2O	1.7	1.5
HFC, PFC, SF_6	4.9	4.3
Total	100	86.6

Notes: CO_2e = carbon dioxide equivalents; CO_2 = carbon dioxide; CH_4 = methane; N_2O = nitrous oxide; HFC = hydrofluorocarbons, PFC = perfluorocarbons, SF_6 = sulfur hexafluoride
Source: BAAQMD, 2015.

In the absence of policy changes (also referred to as a "business as usual" scenario), the BAAQMD estimated that the 2011 SFBAAB GHG emissions would increase at an average rate of approximately 0.5 percent per year based on projected population growth and economic expansion (see **Table 4.6-2**).

TABLE 4.6-2 SAN FRANCISCO BAY AREA GREENHOUSE GAS EMISSIONS TRENDS (MILLION METRIC TONS CARBON DIOXIDE EQUIVALENTS [CO_2E])

Category	2011	2014	2017	2020	2023	2026	2029
Transportation	34.3	33.9	32.5	30.4	30.8	30.8	31.2
Industrial/Commercial	31	32.6	34.3	36	37.6	39.3	40.8
Electricity/Co-Generation	12.1	12.9	12.6	12.3	12.4	12.5	12.7
Residential Fuel	6.6	6.7	6.8	6.9	7	7.1	7.2
Off-Road Equipment	1.3	1.3	1.4	1.3	1.4	1.5	1.6
Agriculture	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Total	**86.6**	**88.7**	**88.8**	**88.2**	**90.5**	**92.4**	**94.8**

Note: Emissions reported are based on a “business as usual” projection.
Source: BAAQMD, 2015.

EFFECTS OF GHG EMISSIONS

According to the BAAQMD’s *Bay Area 2010 Clean Air Plan* (CAP), some of the potential effects of increased GHG emissions and associated climate change may include loss in snow pack (affecting water supply), more frequent extreme weather events, more large forest fires, more drought years, and sea level rise. In addition, climate change may increase electricity demand for cooling, decrease the availability of hydroelectric power, and affect regional air quality and public health (BAAQMD, 2010a).

4.6.3 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

The United States participates in the United Nations Framework Convention on Climate Change (UNFCCC). While the United States signed the Kyoto Protocol, which would have required reductions in GHGs, Congress never ratified the protocol. The federal government chose voluntary and incentive-based programs to reduce emissions and has established programs to promote climate technology and science. In 2002, the United States announced a strategy to reduce the GHG intensity of the American economy by 18 percent over a 10-year period from 2002 to 2012. In 2015, the United States submitted its Intended Nationally Determined Contribution (INDC) to the UNFCCC, which targets to cut net GHG emissions by 26 to 28 percent below 2005 levels by 2025.

The U.S. Environmental Protection Agency (EPA) is responsible for enforcing the federal Clean Air Act and the 1990 amendments to it. The U.S. Supreme Court ruled on April 2, 2007, that CO_2 is an air pollutant as defined under the Clean Air Act, and that the EPA has the authority to regulate emissions of GHGs (*Massachusetts, et al. v. U.S. Envtl. Prot. Agency, et al.* (2007) 549 U.S. 497.) The EPA made two distinct findings regarding GHGs under Section 202(a) of the Clean Air Act:

- **Endangerment Finding:** The current and projected concentrations of the six key well-mixed GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) in the atmosphere threaten the public health and welfare of current and future generations.
- **Cause or Contribute Finding:** The combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare.

These findings do not themselves impose any requirements on industry or other entities. However, these findings were a prerequisite for implementing GHG emissions standards for vehicles. In collaboration with the National Highway Traffic Safety Administration, the EPA finalized emission standards for light-duty vehicles (2012-2016 model years) in May 2010 and heavy-duty vehicles (2014-2018 model years) in August 2011.

STATE REGULATIONS AND POLICIES

The State of California is concerned about GHG emissions and their effect on global climate change. The State of California recognizes that there appears to be a close relationship between the concentration of GHGs in the atmosphere and global temperatures and that the evidence for climate change is overwhelming. The State of California has many areas of concern regarding climate change with respect to global warming. According to the 2010 Climate Action Team Report, changes in snowpack, river flow, and sea level rise indicate that climate change is already affecting California's water resources (Cal/EPA, 2010). Average temperatures have increased and wildfires are becoming more frequent and intense.

Key state regulations involving GHGs and climate change are summarized below.

Pavley Regulations – Assembly Bill 1493

In 2002, the California Legislature adopted Assembly Bill (AB) 1493, referred to as the "Pavley regulations," which required the CARB to develop and adopt regulations that achieve the maximum feasible and cost-effective reductions in GHG emissions from new passenger vehicles. To meet the requirements of AB 1493, the CARB approved amendments to the California Code of Regulations in 2004 that added GHG emissions standards to California's existing standards for motor vehicle emissions. In 2009, the CARB adopted amendments to the Pavley regulations that reduce GHG emissions in new passenger vehicles from 2009 through 2016. These regulations are expected to reduce GHG emissions from California passenger vehicles by 30 percent through 2016.

Renewable Portfolio Standard – Senate Bills 1078, 107, X1-2, and 350

In 2002, under Senate Bill (SB) 1078, the State of California enacted the Renewable Portfolio Standard (RPS) program, which aims to increase the percentage of renewable energy in the state's electricity mix to 20 percent of retail sales by 2017. The RPS timeline was accelerated in 2006 under SB 107 and expanded in 2011 and 2015 under SB X1-2 and SB 350, respectively. The RPS program currently requires investor-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 33 percent by 2020 and 50 percent by 2030.

Executive Order S-3-05

In 2005, the governor of California issued Executive Order S-3-05, which states that California is vulnerable to the effects of climate change, including reduced snowpack in the Sierra Nevada Mountains, exacerbation of California's existing air quality problems, and sea level rise. To address these concerns, the executive order established the following statewide GHG emissions reduction targets:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

It should be noted that executive orders are legally binding only on state agencies and have no direct binding effect on local government or private actions.

California Global Warming Solutions Act of 2006 – Assembly Bill 32

In 2006, the governor of California signed AB 32, the California Global Warming Solutions Act of 2006, which requires California to reduce statewide GHG emissions to 1990 levels by 2020. In December 2008, the CARB adopted the AB 32 Scoping Plan which outlines a statewide strategy to achieve AB 32 goals. At the regional level, in response to SB 375, the Bay Area and other major metropolitan areas in California have developed Sustainable Communities Strategies to integrate land use and transportation planning in order to reduce future motor vehicle travel and decrease GHG emissions. In addition, the BAAQMD is implementing a wide range of programs that promote energy efficiency, reduce vehicle miles traveled (VMT), and develop alternative sources of energy.

Low-Carbon Fuel Standard – Executive Order S-1-07

In 2007, the governor of California issued Executive Order S-1-07 to enact a low-carbon fuel standard (LCFS). The LCFS calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020.

California Environmental Quality Act and Senate Bill 97

SB 97, signed in 2007, acknowledges that climate change is a prominent environmental issue requiring analysis under CEQA. SB 97 directed the Governor's Office of Planning and Research (OPR) to prepare, develop, and transmit to the California Natural Resources Agency (CNRA) guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions, as required by CEQA. In 2009, the CNRA adopted the state CEQA Guidelines amendments, which provide guidance to public agencies regarding the analysis and mitigation of the effects of GHG emissions in CEQA documents. The amendments became effective in March 2010. The amendments added Sections 15126.4(c) and 15064.4 (discussed further below) to the CEQA Guidelines, which specifically pertain to the significance of GHG emissions, and provide guidance on measures to mitigate GHG emissions when such emissions are found to be significant.

Sustainable Communities Strategy – Senate Bill 375

In 2008, the governor of California signed SB 375, which aligns regional transportation planning efforts, regional GHG reduction targets, and land use and housing allocations to reduce vehicle emissions and help California meet the GHG reduction goals established in AB 32. SB 375 requires metropolitan planning organizations to incorporate a Sustainable Communities Strategy into their Regional Transportation Plans. The goal of the Sustainable Communities Strategy is to reduce regional VMT, and associated GHG emissions, through land use planning strategies, such as promoting compact, mixed-use commercial and residential development near public transportation hubs. In accordance with SB 375, the Metropolitan Transportation Commission and Association of Bay Area Governments adopted *Plan Bay Area* in 2013. The plan incorporates the Sustainable Communities Strategy and the Regional Transportation Plan for the Bay Area.

Low-Emission Vehicle Program

In 2012, the CARB adopted amendments to the Low-Emission Vehicle regulations (LEV III), which established more stringent emission reduction standards for GHGs and criteria air pollutants from 2015 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles. The LEV III program essentially expands the scope of the GHG emission standards established under the Pavley regulations.

Executive Order B-30-15

In 2015, the governor of California issued Executive Order B-30-15, which set a statewide GHG emission reduction target of 40 percent below 1990 levels by 2030. This target is in addition to the previous GHG emissions reduction targets established in Executive Order S-3-05 for the years 2010, 2020, and 2050. The executive order also requires the CARB to update the AB 32 Scoping Plan to identify measures to meet the 2030 target. The CARB is currently in the process of drafting an update to the AB 32 Scoping Plan to reflect the 2030 target. The update to the AB 32 Scope Plan will continue to rely on the initiatives used for achieving 2020 targets, such as implementation of Sustainable Community Strategies, LCFS, and RPS.

Senate Bill 32

In September 2016, the governor of California signed SB 32, which expands on the mandate set forth by AB 32 to reduce statement emissions of GHGs to 1990 levels by 2020 by requiring California to reduce GHG emissions to 40 percent below 1990 levels by 2030.

Title 24 Building Efficiency Standards

The State of California regulates energy consumption under Title 24 Building Standards Code, Part 6 of the California Code of Regulations (also known as the California Energy Code). The Title 24 Building Energy Efficiency Standards were developed by the California Energy Commission (CEC) and apply to energy consumed for heating, cooling, ventilation, water heating, and lighting in new residential and nonresidential buildings. The CEC has estimated that the 2016 Building Energy Efficiency Standards, which will take effect on January 1, 2017, will reduce energy consumption by about 46 percent for residential buildings and 33.5 percent for nonresidential buildings on average compared to the 2008 Building Energy Efficiency Standards (CEC, 2014 and 2015).

Title 24 California Green Building Standards Code

Title 24 Building Standards Code, Part 11 of the California Code of Regulations is referred to as the California Green Building Standards Code (CALGreen Code). The purpose of the CALGreen Code is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a positive environmental impact and encouraging sustainable construction practices in the following categories: 1) planning and design, 2) energy efficiency, 3) water efficiency and conservation, 4) material conservation and resource efficiency, and 5) environmental air quality.

LOCAL REGULATIONS

Bay Area Air Quality Management District

The BAAQMD is the regional government agency that regulates sources of air pollution within the nine San Francisco Bay Area counties. The BAAQMD regulates GHG emissions through the following plans, programs, and guidelines.

Regional Clean Air Plans

The BAAQMD and other air districts prepare clean air plans in accordance with the state and federal Clean Air Acts. The Bay Area 2010 CAP is a comprehensive plan to improve Bay Area air quality and protect public health through implementation of a control strategy designed to reduce emissions and ambient concentrations of harmful pollutants. The most recent CAP also includes measures designed to reduce GHG emissions. The BAAQMD is updating the 2010 CAP into the 2016 Clean Air Plan/Regional climate Protection Strategy, and is currently in the midst of the environmental review process.

BAAQMD Climate Protection Program

The BAAQMD established a climate protection program to reduce pollutants that contribute to global climate change and affect air quality in the SFBAAB. The climate protection program includes measures that promote energy efficiency, reduce VMT, and develop alternative sources of energy, all of which assist in reducing emissions of GHGs and in reducing air pollutants that affect the health of residents. The BAAQMD also seeks to support current climate protection programs in the region and to stimulate additional efforts through public education and outreach, technical assistance to local governments and other interested parties, and promotion of collaborative efforts among stakeholders. In June 2010, the BAAQMD adopted revised CEQA significance thresholds for GHG emissions (BAAQMD, 2010b) that were incorporated into the BAAQMD's *CEQA Air Quality Guidelines* (BAAQMD, 2011) to assist lead agencies in evaluating air quality and GHG impacts of projects and plans proposed in the SFBAAB.

As discussed in Section 4.2, Air Quality, of this EIR, due to a legal challenge from the California Building Industry Association, the BAAQMD updated its *CEQA Air Quality Guidelines* in 2012 to exclude its recommended thresholds of significance. However, since the adoption process and scientific soundness of the BAAQMD's thresholds have not been challenged, the thresholds that relate to the analysis of the project's impacts on the environment are used in this CEQA analysis, as described in Section 4.6.4, below.

San Rafael Climate Action Plan

In 2009 the City of San Rafael adopted the *Climate Change Action Plan* (CCAP) in response to AB 32, the California Global Warming Solutions Act. The CCAP includes strategies for transportation, waste reduction, land use, energy conservation, and sequestration that aim to reduce GHG emissions 25 percent by 2020 and 80 percent by 2050 relative to GHG emission levels in 2005. The CCAP was updated in 2011 to allow the City to use the CCAP as a quantified GHG Reduction Strategy and streamline the analysis of future projects under CEQA. However, since the proposed improvements and student population growth under the Master Facilities Long-Range Plan were not accounted for in the future projections of GHG emissions analyzed in the CCAP, the City has requested that a project-level quantitative analysis be prepared for the Master Facilities Long-Range Plan (City of San Rafael, 2016).

San Rafael General Plan

The Sustainability Element of the San Rafael General Plan contains numerous policies that would either directly or indirectly help to reduce GHG emissions. The following San Rafael General Plan policies and programs are directly related to GHG emissions:

Policy SU-12 **Monitor Sustainability Objectives and Indicators.** Monitor success in achieving sustainability objectives and greenhouse gas reductions.

Program SU-12a **Monitor Sustainability Indicators and Greenhouse Gas Inventory.** Periodically update the community and municipal greenhouse gas inventories, monitor changes in the identified sustainability indicators and periodically update the Climate Change Action Plan to achieve greenhouse gas reduction goals.

Program SU-12b **Future Development and Capital Improvements.** Evaluate future development applications and the City's Capital Improvement Program against compliance with the Sustainability Element and the GHG Emissions Reduction Strategy.

Program SU-12c **Annual Reports.** Prepare an annual report to the Planning Commission and City Council assessing the implementation of sustainability programs and the GHG Emissions Reduction Strategy.

Program SU-12d **Sustainability Coordinator.** Hire a Sustainability Coordinator to advance sustainability efforts.

Program SU-12e **Sustainability Commission.** Appoint a Sustainability Commission to advance sustainability efforts.

Policy SU-13 **Municipal Programs.** Implement municipal programs to demonstrate the City's commitment to sustainability efforts and reducing greenhouse gases.

Program SU-13a **Alternative Transportation Options.** Provide transit and carpool incentives to City employees, including alternative work schedules and telecommuting opportunities.

Program SU-13b **Alternative Fuel for City Fleet.** Continue to implement existing City policy to purchase alternative fuel vehicles and increase the efficiency of the vehicle fleet.

Program SU-13c **Limit Idling of City Vehicles.** Adopt a policy to limit City vehicle idling where practical. Evaluate equipping trucks with an auxiliary electrical system for illumination and warning signs.

Program SU-13d **Green Purchasing.** Modify the City's purchasing practices and policies to become a model for other businesses and organizations.

Program SU-13e **Energy Audits Municipal Buildings.** Complete energy audits of major City facilities and implement audit recommendations for energy efficiency and renewable energy potential.

Program SU-13f **City Electricity.** Participate in the Marin Energy Authority by switching all City accounts over to the Light Green option in 2010 and the Deep Green option (100% renewable power) by 2020.

Program SU-13g **Streetlights and Traffic Signals.** Pursue funding to complete the retrofit of City traffic signals and retrofit streetlights with LED fixtures.

Program SU-13h **Employee Awareness.** Increase City employees' awareness of climate protection issues, and develop an internal committee to implement plans.

Program SU-13i **Local Government Agency Involvement.** Continue to provide a leadership role with other local governmental agencies to share best practices and successes.

Program SU-13j **Advancing GHG and Sustainability Efforts.** Advocate for state and federal legislation that advance greenhouse gas reductions and other sustainability efforts.

San Rafael City Schools Board Policy 3511

San Rafael City Schools (SRCS) recognizes the importance of minimizing the district's use of natural resources, providing a high-quality environment that promotes health and productivity, and effectively managing the district's fiscal resources. SRCS's conservation and management goals set forth in Board Policy (BP) 3511 include strategies for implementing effective and sustainable resource practices, exploring renewable and clean energy technologies, reducing energy and water consumption, minimizing utility costs, reducing the amount of waste of consumable materials, encouraging recycling and green procurement practices, and promoting conservation principles.

4.6.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of CEQA Guidelines, implementation of the Master Facilities Long-Range Plan, including the Stadium Project, would have a significant effect on climate change if it would:

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment, or

b) Conflict with an applicable plan, policy or regulation adopted for reducing the emissions of greenhouse gases.

Thresholds of Significance

The BAAQMD recommends that when assessing GHG impacts for plans other than regional plans (transportation and air quality plans) and general plans, such as specific plans and area plans, the BAAQMD's project-level thresholds of significance should be used to assess GHG impacts. Therefore, BAAQMD's project-level thresholds of significance are used in this CEQA analysis in conjunction with the BAAQMD's *CEQA Air Quality Guidelines* (BAAQMD, 2011 and 2012) to evaluate the potential impacts from long-term operations under the Master Facilities Long-Range Plan, which includes the Stadium Project. The BAAQMD's thresholds of significance for GHG emissions were developed to ensure compliance with the AB 32 GHG reduction goals.

The applicable project-level thresholds of significance used in this CEQA analysis are:

- An emissions threshold of 1,100 metric tons of CO_2e per year; or
- An emission efficiency standard of 4.6 metric tons of CO_2e per year per service population.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Generation of GHG Emissions

The Master Facilities Long-Range Plan would not generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

GHG Emissions from Construction

Implementation of the Master Facilities Long-Range Plan would result in short-term GHG emissions from construction activities associated with subsequent development, including demolition, site grading, asphalt paving, building construction, and architectural coatings. Sources of GHG emissions commonly associated with construction activities include fuel combustion from heavy-duty diesel- and gasoline-powered equipment, portable auxiliary equipment, truck trips, and worker commute trips.

The BAAQMD does not recommend a threshold of significance for GHG emissions during construction because there is not sufficient evidence to determine a level at which temporary construction emissions are significant (BAAQMD, 2009). As described in Section 4.14, Energy, of this EIR, a construction contractor has no incentive to waste fuel during construction and, therefore, it is generally assumed that GHG emissions during construction would be minimized to the maximum extent feasible. Furthermore, the idling times for off-road construction equipment would be limited to a maximum idling time to 5 minutes, as required by the CARB's Airborne Toxic Control Measure to reduce emissions from diesel-fueled vehicles (Title 13, Section 2485 of California Code of Regulations). Therefore, GHG emissions from construction of proposed improvements under the Master Facilities Long-Range Plan would have a less-than-significant impact on the environment.

GHG Emissions from Operation

The BAAQMD recommends using the most current version of the California Emissions Estimator Model (CalEEMod versions 2016.3.1) to estimate operational emissions of GHGs for a proposed project. CalEEMod uses widely accepted models for emission estimates combined with appropriate default data for a variety of land use projects that can be used if site-specific information is not available. The default data used in the model (e.g., vehicle emissions factors) are supported by substantial evidence provided by regulatory agencies and a combination of statewide and regional surveys of existing land uses. The following two scenarios were evaluated in CalEEMod for GHG emissions generated at a high school:

1. “Existing Conditions” (without implementation of Master Facilities Long-Range Plan); and
2. “Project Conditions” (with implementation of Master Facilities Long-Range Plan).

The primary input data used to estimate GHG emissions under each scenario are summarized in **Table 4.6-3**. A copy of the CalEEMod report, which summarizes the input parameters, assumptions, and findings, is included in **Appendix E**.

TABLE 4.6-3 SUMMARY OF CALEEMOD LAND USE INPUT PARAMETERS TO ESTIMATE GREENHOUSE GAS EMISSIONS

	Existing Conditions	Project Conditions
Number of Students	1,125	1,325
Number of Faculty and Staff	100	100
Gross Square Feet of Building Area	279,670	327,892

Note: GHG emissions estimated for operation of a high school.
Source: CalEEMod (Appendix E).

While improvements proposed under the Master Facilities Long-Range Plan would not be completed until about 2021, it was conservatively assumed that improvements would be completed in 2018 (the earliest completion date for the Stadium Project), because total GHG emissions are expected to decrease over time as vehicles become more fuel efficient (as required by the Pavley and LEV III regulations) and electric-utility providers increase their use of renewable energy sources (as required by SBs 1078, 107, X1-2, and 350). Additional project-specific information used to calculate emissions in CalEEMod, including changes to default data, is summarized in **Table 4.6-4**.

TABLE 4.6-4 SUMMARY OF CALEEMOD INPUT PARAMETERS TO ESTIMATE GREENHOUSE GAS EMISSIONS FROM OPERATION OF MASTER FACILITIES LONG-RANGE PLAN

CalEEMod Input Category	Operation Assumptions and Changes to Default Data
Carbon Dioxide (CO_2) Intensity Factor	Based on review of Pacific Gas & Electric's (2015) Greenhouse Gas Emission Factors: Guidance for PG&E Customers, the default CO2 intensity factor reported for 2008 was updated to the most recent CO2 intensity factor verified by a third party in 2013.
Vehicle Trips	According to the traffic analysis by Parisi Transportation Consulting (2016), existing school operations generate 3,923 average daily vehicle trips during the weekdays (3.49 trips/student/day). Implementation of the Master Facilities Long-Range Plan would increase the school population by 200 students and generate 4,620 average daily vehicle trips during the weekdays (3.49 trips/student/day).
Wastewater	Based on the design of the Central Marin Sanitation Agency's Wastewater Treatment Plant, emissions estimated from wastewater treatment assumed a process with 100 percent aerobic biodegradation and 100 percent anaerobic digestion with cogeneration.

Notes: Default CalEEMod data used for all other parameters not described.
Source: CalEEMod (Appendix E).

The estimated GHG emissions under the Project Conditions scenario did not account for potential GHG reductions associated with improved energy efficiency in buildings replaced under the Master Facilities Long-Range Plan, including the Stadium Project. For example, the CEC has estimated that the 2016 Building Energy Efficiency Standards, which will take effect on January 1, 2017, will reduce energy consumption by about 33.5 percent for nonresidential buildings on average compared to the 2008 Building Energy Efficiency Standards (CEC, 2014 and 2015). The estimated GHG emissions under the Project Conditions scenario also did not account for potential GHG reductions associated with implementation of the City of San Rafael's Green Building Ordinance, which meets the building requirements of the CALGreen Code. In accordance with the Green Building Ordinance, the Master Facilities Long-Range Plan must implement mandatory measures from the statewide CALGreen Code. Compliance with the mandatory measures described under the current CALGreen Code would reduce indoor water use by approximately 20 percent. Therefore, the analysis of GHG impacts for the Master Facilities Long-Range Plan is conservative.

The CO_2e emissions estimated under the Existing Conditions scenario were subtracted from the Project Conditions scenario to determine the net increase in CO_2e emissions that would result from implementation of the Master Facilities Long-Range Plan, including the Stadium Project. The total average annual CO_2e emissions and the total average annual CO_2e emissions per service population for the Master Facilities Long-Range Plan are compared to the BAAQMD's thresholds of significance in **Table 4.6-5.** The estimated net increase in average annual CO_2e emissions would not exceed the BAAQMD's annual emissions threshold or the BAAQMD's efficiency-based threshold. As a result, operation of the Master Facilities Long-Range Plan (including the Stadium Project) would have a less-than-significant impact on the environment from GHG emissions.

TABLE 4.6-5 SUMMARY OF AVERAGE NET INCREASE IN GREENHOUSE GAS EMISSIONS FROM OPERATION OF MASTER FACILITIES LONG-RANGE PLAN

Emission Source		Existing Conditions	Project Conditions	Project Net Increase	Project Net Increase
	Units	MT CO2e/year	MT CO2e/year	MT CO2e/year	MT CO2e/year/SP
Area		<0.1	<0.1	<0.1	<0.01
Energy		495.8	581.3	85.5	0.06
Mobile		2,996.4	3,529.1	532.7	0.37
Waste		103.3	121.6	18.4	0.01
Water		16.5	19.4	2.9	<0.01
			Total Net Increase in Emissions	639	0.5
			Thresholds of Significance	1,100	4.2
			Exceed Thresholds?	No	No

Notes: MT CO2e = metric tons carbon dioxide equivalent; SP = service population.
GHG emissions estimated for 2018.
"Existing Conditions" represents business-as-usual without implementation of the Master Facilities Long-Range Plan.
"Project Conditions" represents implementation of the Master Facilities Long-Range Plan.
Source: CalEEMod (Attachment E).

Conflict with Applicable Plans, Policies, or Regulations

The Master Facilities Long-Range Plan would not conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

As discussed above, implementation of the Master Facilities Long-Range Plan would not exceed the BAAQMD's thresholds of significance for GHG emissions and, therefore, would be consistent with GHG reduction goals of AB 32. Furthermore, since GHG emissions are more than 40 percent below the BAAQMD's thresholds of significance, implementation of the Master Facilities Long-Range Plan would also be consistent with the new GHG reduction goals of SB 32. As a result, the Master Facilities Long-Range Plan would not conflict with applicable plans, policies, or regulations related to GHG emission reductions in the SFBAAB, and the impact would be less than significant.

Potentially Significant Impacts

The Master Facilities Long-Range Plan would not have any potentially significant impacts related to GHG emissions.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Generation of GHG Emissions

The Stadium Project would not generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment.

The Stadium Project would construct a new parking area that would improve circulation and bring traffic off of the street faster than the current layout. The Stadium Project also proposes to locate a new visitor team room building on the southern portion of the campus near 3rd Street, which would shift traffic and parking from Mission Avenue to the main stadium lot and thereby reduce traffic congestion and parking demands on Mission Avenue. Since the Stadium Project would replace the existing grass field with synthetic turf, the project would be expected to reduce outdoor water use. The existing stadium lighting would also be replaced with more energy-efficient light-emitting diode (LED) stadium lights. Based on the proposed improvements related to traffic and water and energy use, the Stadium Project could potentially results in a net decrease in GHG emissions relative to existing conditions. Based on the analysis of GHG emissions generated by operation of all the individual projects under the Master Facilities Long-Range Plan, as discussed above, the Stadium Project would not generate GHG emissions above the BAAQMD's thresholds of significance. Therefore, this impact is considered less than significant.

Conflict with Applicable Plans, Policies, or Regulations

The Stadium Project would not conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

As discussed above, implementation of the Master Facilities Long-Range Plan (including the Stadium Project) would not exceed the BAAQMD's thresholds of significance for GHG emissions and, therefore, would be consistent with GHG reduction goals of AB 32. As a result, this impact is considered less than significant.

Potentially Significant Impacts

The Stadium Project would not have any potentially significant impacts related to GHG emissions.

CUMULATIVE IMPACTS

GHG emissions from a plan or project contribute to the significant adverse environmental impacts of global climate change on a cumulative basis. No single project is sufficient in size to result in climate change impacts by itself. The BAAQMD's thresholds of significance were developed to evaluate whether the GHG emissions of a plan or project would have a contribution that is cumulatively considerable. Therefore, based on the analysis presented above, the Master Facilities Long-Range Plan, including the Stadium Project, would not result in or contribute to any significant cumulative GHG impacts.

4.6.5 REFERENCES

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4.7 HAZARDS AND HAZARDOUS MATERIALS

4.7.1 INTRODUCTION

This section of the EIR describes hazardous materials[1] and other public health and safety issues associated with the San Rafael High School (SRHS) campus (project site) and summarizes the pertinent federal, state, and local agency laws, regulations, and programs related to these issues. This section also evaluates potential environmental impacts related to hazards and hazardous materials for the Master Facilities Long-Range Plan as a whole and on a project level for one of the Master Facilities Long-Range Plan elements, the proposed Stadium Project. The impacts examined include potential exposure to hazardous materials during construction and operation of Long-Range Plan projects, emergency response and evacuation plans, wildfire hazards, and aviation hazards. The significance of these impacts is evaluated and the impact analysis explains how application of mitigation measures and existing regulatory requirements would reduce or avoid potentially significant impacts.

4.7.2 ENVIRONMENTAL SETTING

HAZARDOUS MATERIALS

Hazardous Materials Use, Storage, Disposal, and Releases

SRHS was founded in 1888 at a site on B Street and moved to the current campus location in 1924. No other historical land uses are known for the project site. Adjoining land uses include commercial and light industrial uses to the south, across 3rd Street, and west, along Union Street, and residential uses to the north and east.

A review of available regulatory databases did not identify SRHS on any hazardous material site lists (SWRCB, 2016). Based on typical school uses, hazardous materials at the SRHS campus include maintenance, landscaping, and custodial supplies and small quantities of laboratory chemicals used in chemistry and biology classrooms. As San Rafael City Schools has a Maintenance Facility at 38 Union Street, immediately west of SRHS, it is likely that activities involving more significant quantities of hazardous materials, such as vehicle fueling and maintenance, would occur at that location and not the SRHS campus.

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[1] As used in this section, the term “hazardous materials” is defined by the California Health and Safety Code (H&SC) Section 25501 as: “... any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment. ‘Hazardous materials’ include, but are not limited to, hazardous substances, hazardous waste, and any material that a handler or the administering agency has a reasonable basis for believing that it would be injurious to the health and safety of persons or harmful to the environment if released into the workplace or the environment.”

Two active hazardous material release sites were identified within a 1,000-foot radius of the SRHS campus, including the adjoining Maintenance Facility site (SWRCB, 2016). Available information regarding the two sites is provided below.

San Rafael City Schools Maintenance Facility, 38 Union Street

The San Rafael City Schools Maintenance Facility is located immediately west of the SRHS campus. A 1,000-gallon gasoline underground storage tank (UST) was historically operated at the Maintenance Facility, with the UST located about 40 feet west of the SRHS campus (see **Figure 4.7-1**). In March 1997, fuel-affected soils and floating petroleum on top of the shallow groundwater were observed during excavation near the UST location. Later that month, approximately 175 cubic yards of gasoline-contaminated soil were removed from an area south of the UST location under oversight from the City of San Rafael Fire Department. The UST, piping, and surrounding soils were removed in November 1997 (Arcadis, 2015).

The site was placed under oversight of the San Francisco Bay Regional Water Quality Control Board (RWQCB) Leaking Underground Storage Tank program. Under RWQCB oversight, additional soil and groundwater investigations were conducted in April-May 1998, January 1999, April 2012, and January 2013. A second soil removal action, in November 1998, removed an additional 200 to 250 cubic yards of gasoline-contaminated soil from an area northwest of the former UST location (Arcadis, 2015).

In January 2013, case closure was requested from the RWQCB, but was denied because residual contamination of soils and groundwater in the vicinity of the UST exceeded RWQCB cleanup goals. The three contaminants of concern are gasoline related compounds: benzene, methyl tertiary-butyl ether (MTBE), and total petroleum hydrocarbons in the gasoline range (TPH-g).

In January 2015, a Conceptual Site Model/Corrective Action Plan was developed for the Maintenance Facility site to evaluate potential remedial options for the residual contamination. The chosen option, enhanced aerobic bioremediation, was implemented in October 2015. A hydraulic direct-push rig was used to inject 3,417 pounds of a calcium peroxide solution into shallow soils and groundwater at 25 locations in the Maintenance Facility parking lot (Arcadis, 2015). The calcium peroxide releases oxygen to soil and groundwater, which enhances the activity of naturally occurring bacteria. This speeds up the natural biological breakdown of the gasoline-related contaminants.

Groundwater monitoring has been conducted every three months, beginning in October 2015, to monitor the effectiveness of the remedial efforts. After the October 2016 groundwater monitoring results are available, a technical memorandum will be prepared to determine what additional measures may be needed at the site (Arcadis, 2015).

Data from the most recent available monitoring event report, from samples collected in June 2016, shows that groundwater contamination related to the former UST extends about 150 feet from the former UST location, with the longest plumes to the east and south. Figure 4.7-1 shows the extent of benzene contamination; MTBE and TPH-g contamination is similar in extent (Antea Group, 2016). This groundwater contamination has migrated to the SRHS campus and has affected groundwater underlying the athletic fields in the western part of the SRHS campus (Antea Group, 2016).

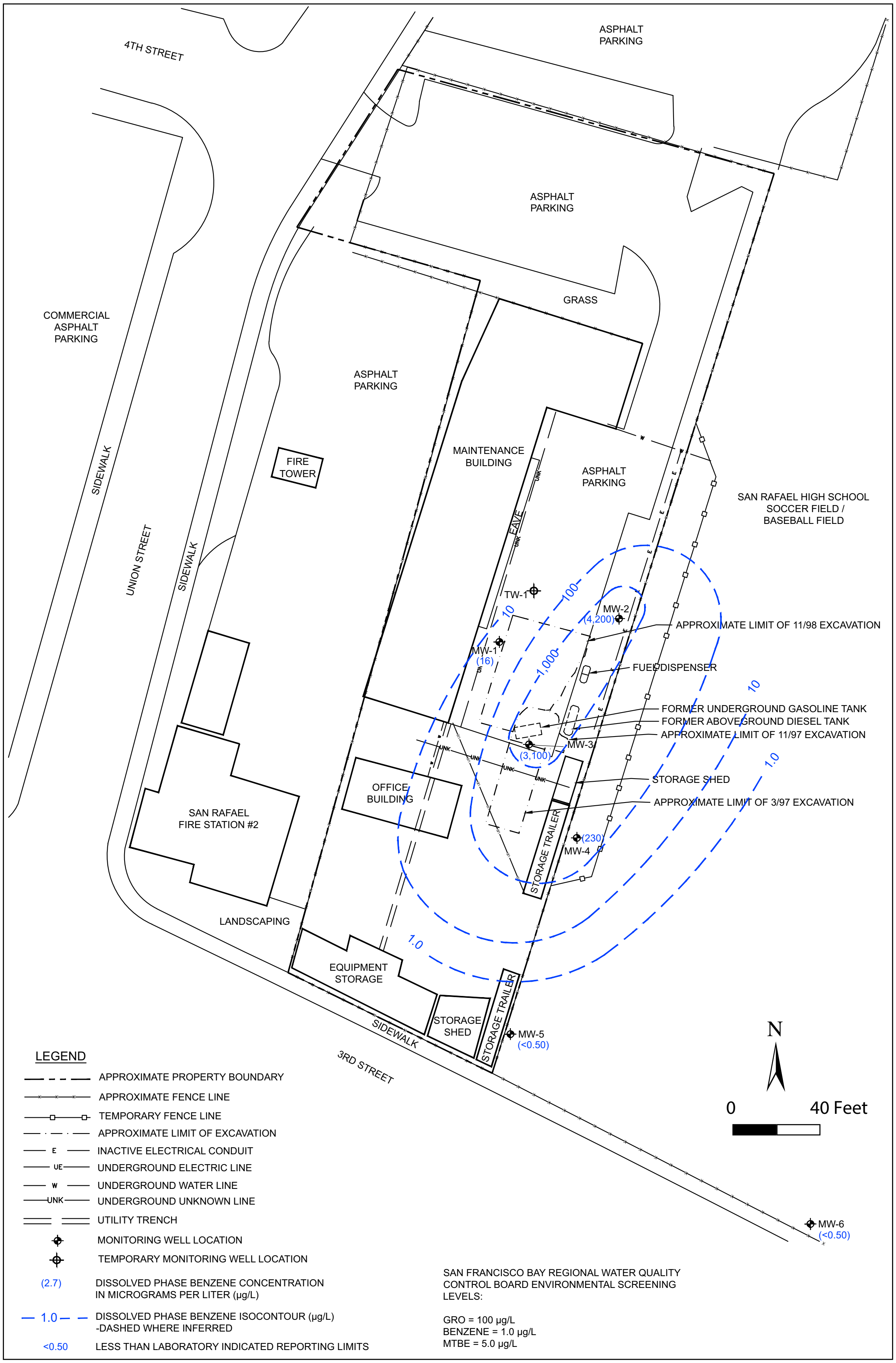

Figure 4.7-1

BENZENE IN GROUNDWATER
SAN RAFAEL CITY SCHOOLS MAINTENANCE FACILITY

SOURCE: Antea Group, 2016

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Marin/Sonoma Mosquito Abatement District, 201 3rd Street

The former Marin/Sonoma Mosquito Abatement District site is a 0.65-acre parcel located south of the SRHS campus, between 3rd Street and San Rafael Creek. From 1939 to 1981, various pesticides were used, mixed, and stored at this location (DTSC, 2003). Environmental investigations determined that elevated concentrations of pesticides, including DDT, as well as petroleum hydrocarbons in the diesel and motor oil were present in soil and groundwater at the site (DTSC, 2003). In April 1992, approximately 5,400 tons of pesticide- and petroleum-contaminated soils were removed from the site and replaced with clean backfill and an asphalt cap (HLA, 1995). A land use covenant that prohibits use of the site for residences, hospitals, schools, or day care centers was recorded for the property in 2003 (DTSC, 2003). Groundwater monitoring continues at the site; the most recent data from a July 2016 sampling showed total petroleum hydrocarbons in the diesel range (TPH-d) were present in groundwater at the site, but the contamination does not extend off the site (PES, 2016). Since this groundwater contamination is limited to the 201 3rd Street site and does not extend north to the SRHS campus, historic releases from this site would not be expected to affect soil or groundwater at the SRHS campus.

Hazardous Materials Related to SRHS Campus Buildings

Based on the date of development of the SRHS campus, buildings at the campus may contain asbestos-containing materials, lead-based paint, pesticides used for termite treatment, and polychlorinated biphenyls (PCBs) used in electrical equipment and caulking.

Asbestos-Containing Building Materials

Prior to the 1980s, building materials often contained asbestos fibers, which are a known human carcinogen. Asbestos, used to provide strength and fire resistance, was frequently incorporated into insulation, roofing, and siding, textured paint, and patching compounds used on wall and ceiling joints, vinyl floor tiles and adhesives, and water and steam pipes.

Lead-Based Paint

Prior to 1978, lead compounds were commonly used in exterior and interior paints. Lead is a suspected human carcinogen (i.e., may cause cancer), a known teratogen (i.e., causes birth defects), and a reproductive toxin (i.e., can cause sterility). In addition, exposure of children to lead may cause irreversible learning deficits and other neurological and physical disorders. Damaged exterior lead-based paint can flake off painted surfaces and contaminate nearby soils.

Pesticides from Termite Treatment

Chlordane, an organochlorine pesticide, was used for termite treatment of buildings from 1948 until 1988, when it was banned by the U.S. Environmental Protection Agency (EPA). Chlordane is a suspected carcinogen and may cause adverse effects on the liver, blood, lungs, and central nervous system. While chlordane use was legal, soils were often drenched with chlordane as a preventative measure prior to building construction, and additional chlordane was typically applied to building foundations and near surface soils for treatment following construction.

Polychlorinated Biphenyls

PCBs are heavy, oily liquids that were typically used as an insulator in electrical equipment and a plasticizer in other materials from 1927 to 1977, when their manufacture was banned by the EPA. PCBs may be present in many items manufactured prior to 1977, such as fluorescent lighting fixtures and caulking. PCBs are a suspected carcinogen and may cause adverse effects on the immune, reproductive, nervous, and endocrine system. Historic leaks or damage to transformers or other electrical equipment can result in PCB contamination in nearby soils. PCBs may also be released from other items, such as lighting fixtures and caulking, during demolition activities.

Mitigation of Hazardous Materials Related to Buildings

Under normal circumstances, hazardous materials in buildings would not be expected to create a significant health risk, but during building renovation and demolition, these materials can be exposed or dispersed into the air where they can affect construction workers and nearby members of the general public. Abatement of asbestos-containing materials is required prior to building demolition and abatement is highly regulated under state laws and regulations.

The remaining hazardous materials concerns (lead from lead-based paint, pesticides from termite treatment, and PCBs) are not as highly regulated. As these concerns are often present at school redevelopment sites, the Department of Toxic Substances Control (DTSC) has developed guidance for the evaluation of these hazards at school sites as part of its School Property Evaluation and Cleanup Program (DTSC, 2006), described in more detail in Section 4.7.3, Regulatory Framework, below. The guidance includes recommended sampling plans for each hazard, as well as screening concentrations for the laboratory data to determine if additional investigation or remediation is required (DTSC, 2006).

EMERGENCY RESPONSE

The Marin County Office of Emergency Services (OES) coordinates emergency operation activities among agencies and jurisdictions in Marin County, including the City of San Rafael Police and Fire Departments. OES has developed a Local Hazard Mitigation Plan including strategies and risk assessment for major and minor disasters, such as earthquakes, fires, floods, and terrorism (Marin County OES, 2012). The San Rafael Fire Department has developed a Transportation and Evacuation Plan for hillside high wildfire hazard areas as part of its Fire Management Plan.

AVIATION HAZARDS

The SRHS campus is not located within an airport land use plan. The nearest public use airport is Marin County Airport, also known as Gnoss Field, in Novato, approximately 12 miles north of the SRHS campus. The nearest private airport is the San Rafael Airport and Business Park, located approximately 3 miles north of the SRHS campus. No airstrips are located in the SRHS campus vicinity.

WILDFIRE HAZARDS

The SRHS campus is located in an urbanized area and is not located within wildlands or at the wildland-urban interface. Based on mapping by the California Department of Forestry and Fire Protection, the site is not located within a wildfire hazard zone (CalFIRE, 2008).

4.7.3 REGULATORY FRAMEWORK

The use, storage, and disposal of hazardous materials, including management of contaminated soils and groundwater, is regulated by numerous local, state, and federal laws and regulations. The EPA is the federal agency that administers hazardous materials and hazardous waste regulations. State and local agencies include the California Environmental Protection Agency (Cal/EPA), DTSC, State Water Resources Control Board (SWRCB), California Air Resources Board (CARB), RWQCB, Bay Area Air Quality Management District (BAAQMD), and Marin County Certified Unified Program Agency (CUPA). A brief description of federal, state, regional, and local agency jurisdiction and involvement in the management of hazardous materials and wastes is provided below.

FEDERAL

The EPA is the federal agency responsible for enforcement and implementation of federal laws and regulations pertaining to hazardous materials and hazardous waste. The federal regulations are primarily codified in Title 40 of the Code of Federal Regulations (40 CFR). The legislation includes the Resource Conservation and Recovery Act of 1976 (RCRA), the Superfund Amendments and Reauthorization Acts of 1986 (SARA), and the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The EPA provides oversight for site investigation and remediation projects, and has developed protocols for sampling, testing, and evaluation of solid wastes.

STATE

Four state agencies, described below, have roles in the regulation of hazardous materials and waste that may occur on or around the SRHS campus.

Department of Toxic Substances Control

In California, DTSC is authorized by the EPA to enforce and implement federal hazardous materials laws and regulations. California regulations pertaining to hazardous materials are equal to or exceed the federal regulation requirements. Most state hazardous materials regulations are contained in Title 22 of the California Code of Regulations (CCR). DTSC generally acts as the lead agency for soil and groundwater cleanup projects that affect public health, and establishes cleanup levels for subsurface contamination that are equal to, or more restrictive than, federal levels.

As required by Education Code 17213.1, DTSC's School Property Evaluation and Cleanup Division is responsible for oversight of hazardous materials investigation and remediation for proposed new school sites and school redevelopment projects. All proposed school projects that will receive state funding for acquisition or construction are required to go through a rigorous environmental review and cleanup process under DTSC's oversight.

DTSC oversight begins after a school district submits a Phase I environmental site assessment to the division for review. The division evaluates the Phase I to determine if hazardous materials at the school site could potentially present a risk to human health or the environment. If so, DTSC will require a Preliminary Environmental Assessment (PEA) be performed, including testing of soil, soil vapor, and/or groundwater, to evaluate the potential hazardous materials issues. DTSC has a PEA guidance manual (DTSC, 2015) and has provided specialized guidance for sampling and evaluating common hazardous materials issues at schools, including agricultural chemical residues (DTSC, 2008), naturally occurring asbestos (DTSC, 2004), and lead-based paint, termiticides, and electrical transformers (DTSC, 2006).

State Water Resources Control Board

The SWRCB enforces, among other regulations, those regulations pertaining to implementation of UST programs. It also allocates monies to eligible parties who request reimbursement of state funds to clean up soil and groundwater pollution from UST leaks. The SWRCB also enforces the Porter-Cologne Water Quality Act of 1969 through its nine regional boards, including the RWQCB, described below.

California Air Resources Board

This agency is responsible for coordination and oversight of state and local air pollution control programs in California, including implementation of the California Clean Air Act of 1988. CARB has developed state air quality standards, and is responsible for monitoring air quality in conjunction with the local air districts.

California Department of Education

The California Department of Education oversees school site selection for public school districts in California and requires review to address potential hazardous materials concerns. Prior to acquisition of a new school property, Education Code Section 17213(B) requires school district consultation with the local hazardous materials agency and air district to evaluate potential sources of hazardous materials that "emit hazardous air emissions, or to handle hazardous or extremely hazardous materials, substances, or waste" within ¼-mile. This applies to selection of a new school site, and does not apply to other school construction or redevelopment projects. Other parts of the school selection process related to hazardous materials are implemented by the DTSC School Property Evaluation and Cleanup Division, described above.

REGIONAL AND LOCAL

San Francisco Bay Regional Water Quality Control Board

The RWQCB can act as a responsible agency to provide oversight of sites where the quality of groundwater or surface waters is threatened, and has the authority to require investigations and remedial actions. For the San Rafael Schools Maintenance Facility, the RWQCB is the lead agency overseeing cleanup related to releases from the former gasoline UST.

Bay Area Air Quality Management District

The BAAQMD has primary responsibility for control of air pollution from sources other than motor vehicles and consumer products (which are the responsibility of the EPA and CARB). The BAAQMD is responsible for preparation of attainment plans for non-attainment criteria pollutants, control of stationary air pollutant sources, management of volatile organic compound- (VOC) containing soils (District Rule 8-40), and the issuance of permits for activities including asbestos demolition and renovation activities (District Rule 11-2).

Marin County Certified Unified Program Agency

The Marin County Department of Public Works is the Certified Unified Program Agency (CUPA) for Marin County and enforces state and local regulations pertaining to hazardous waste generators and risk management prevention programs. Programs administered under the CUPA program include the California Accidental Release Program (CalARP), Hazardous Materials Business Plans (HMBPs), Hazardous Waste and Hazardous Waste Treatment Programs, Underground Storage Tanks, and Medical Waste Programs.

City of San Rafael

The following San Rafael General Plan policies and programs are related to hazardous and hazardous materials and relevant to the proposed project:

Policy S-10 **Location of Public Improvements.** To minimize threat to human health or any extraordinary construction and monitoring expenses, avoid locating improvements and utilities in areas with dangerous levels of identified hazardous materials. When the location of public improvements and utilities in such areas cannot feasibly be avoided, effective mitigation measures will be implemented.

Policy S-11 **Restriction of Businesses.** Restrict siting of businesses or expansion of businesses that have the potential for a significant hazardous materials release within one-quarter mile of schools.

Program S-11a **Survey of Facilities.** Survey existing industrial facilities within one-quarter mile of the schools. The survey would be used to determine the presence of hazardous materials and evaluate the risk of an accidental release that could adversely affect the health and safety of students and school staff.

Policy S-12 **Use of Environmental Databases in Development Review.** When development is proposed, determine whether the site has been recorded as contaminated. Undertake appropriate studies to assure identification and implementation of mitigation measures for sites on or near identified hazards.

Program S-12a **Environmental Database.** Maintain environmental and hazardous materials-related databases, and update information on an ongoing basis. In addition, include the information in the State GeoTracker database (database of contaminated Underground Storage Tanks sites).

Program S-12b **Environmental History.** Through the environmental review process, provide information about available environmental history of a site and proposed mitigation measures if warranted.

Policy S-13 **Potential Hazardous Soils Conditions.** Where development is proposed on sites with known previous contamination, sites filled prior to 1974 or sites that were historically auto service, industrial or other land uses that may have involved hazardous materials, evaluate such sites for the presence of toxic or hazardous materials. The requirements for site-specific investigation are contained in the Geotechnical Review Matrix.

Program S-13b **Hazardous Soils Cleanup.** Require remediation and cleanup in accordance with regional and local standards in order to develop on sites where hazardous materials have impacted soil or groundwater. At a minimum, remediation and clean up of contaminated sites shall be in accordance with regional and local standards. The required level of remediation and clean-up shall be determined by the Certified Unified Program Agency (CUPA) based on the intended use of the site and health risk to the public.

Program S-13c **Local Implementing Agency.** The Certified Unified Program Agency (CUPA) shall oversee the investigation and closure of contaminated underground storage tank sites.

Policy S-14 **Hazardous Materials Storage, Use and Disposal.** Enforce regulations regarding proper storage, use and disposal of hazardous materials to prevent leakage, potential explosions, fires, or the escape of harmful gases, and to prevent individually innocuous materials from combining to form hazardous substances, especially at the time of disposal.

Policy S-16 **Transportation of Hazardous Materials.** Enforce Federal, State and Local requirements and standards regarding the transportation of hazardous materials. Support, as appropriate, legislation that strengthens safety requirements for the transportation of hazardous materials.

Policy S-32 **Safety Review of Development Projects.** Require crime prevention and fire prevention techniques in new development, including adequate access for emergency vehicles.

Policy S-33 **Disaster Preparedness Planning.** Ensure disaster preparedness in cooperation with other public agencies and appropriate public-interest organizations. Expand abilities of residents to assist in local responses to disasters.

Program S-33a **Disaster Preparedness Plan.** Update and publicize the City's emergency response (disaster) plan in conformance with State guidelines.

4.7.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, the project would have a significant impact related to hazards and hazardous materials if it would:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment;

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school;

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment;

e) Impair implementation of, or physically interfere with, an adopted emergency response plan or emergency evacuation plan;

f) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, result in a safety hazard for people residing or working in the project area;

g) For a project within the vicinity of a private airstrip, result in a safety hazard for people residing or working in the project area; or

h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires.

The following significance criteria would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the plan and are therefore excluded from further discussion in this impact analysis:

- *Emit Hazardous Emissions or Handle Hazardous or Acutely Hazardous Materials, Substances or Waste within ¼ Mile of an Existing or Proposed School.* Public Resources Code Section 21151.4 requires consultation with the local school district if a proposed project would be reasonably anticipated to emit hazardous air emissions or handle extremely hazardous substances within ¼ mile of a school. The Master Facilities Long-Range Plan does not include any components that would result in significant hazardous emissions or handle significant quantities hazardous or acutely hazardous materials, substances, or waste, and therefore this impact would be less than significant.
- *Impair Implementation of, or Physically Interfere With, an Adopted Emergency Response Plan or Emergency Evacuation Plan.* The Master Facilities Long-Range Plan includes development within the existing SRHS campus, and no components would restrict external vehicular or pedestrian traffic. Vehicular access within the SRHS campus would be improved through the addition of a new driveway access point on 3rd Street (Figure 3-7). Therefore, there would be no potential impairment or interference with emergency response or evacuation plans.
- *Result in an Aviation Safety Hazard Related to a Public Airport, Private Use Airport, or Private* Airstrip. San Rafael Airport is located approximately 3 miles to the north of the SRHS campus and a private heliport is located approximately 2 miles to the southeast. The SRHS campus is not located within an airport use plan, or near a public airport, public use airport, or private airstrip, and thus would not result in a safety hazard for people residing or working in the project area.
- *Expose People or Structures to Wildland Fire Hazards.* The SRHS campus is not located in a wildland hazard area.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Routine Hazardous Materials Transport, Use, or Disposal

Development in accordance with the Master Facilities Long-Range Plan would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

The Master Facilities Long-Range Plan includes a number of school improvements at the SRHS campus, including classroom buildings and athletic facilities. These would be anticipated to use hazardous materials in quantities and types similar to those currently used at the project site. These materials would include small quantities of maintenance, landscaping, and custodial supplies.

As noted in the Project Description, crumb rubber infill material would not be used in the new field for the Stadium Project, and there would therefore be no impacts related to use of that material. Recycled crumb rubber infill material is typically made of discarded vehicle tires, which contain a wide variety of metals and organic chemicals, including some known to cause cancer and other adverse health effects. Reflecting public concerns regarding the use of this material at school sites, Senate Bill 47 was passed in 2015, which requires California school districts to evaluate alternatives to recycled crumb rubber for all artificial turf fields constructed after January 1, 2016.

Any routine transport, use, or disposal of hazardous materials related to the Master Facilities Long-Range Plan would be subject to existing hazardous materials programs administered by Marin County CUPA at the SRHS campus. These existing regulatory programs would reduce any potential impacts to a less-than-significant level, and no mitigation is necessary.

Hazardous Materials Sites

Development in accordance with the Master Facilities Long-Range Plan would not create a significant hazard to the public or the environment as a result of being located on a site that is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5.

The SRHS campus is not located on any hazardous materials site lists or databases. An adjoining site, the San Rafael Schools Maintenance Facility, is on the RWQCB Leaking UST Program database due to releases from a former gasoline UST that have affected soil and groundwater quality. Although the San Rafael School Maintenance Facility property has a 38 Union Street address, it is located on Assessor's Parcel Number (APN) 14-101-09, the same legal parcel as the SRHS campus. Furthermore, contamination from the Maintenance Facility site has migrated to the SRHS campus and has affected groundwater near the western boundary of the baseball/soccer fields (see Figure 4.7-1). The source of the contamination (the leaking UST and contaminated soils) has been removed, and groundwater is being remediated under RWQCB oversight, so it is unlikely that this contamination would spread and affect other areas of the SRHS campus. As none of the development under the Master Facilities Long-Range Plan would be located near the area of affected groundwater and groundwater would not be used by the high school, the Master Facilities Long-Range Plan would not be affected by this hazardous materials site. Therefore, there would be no significant impact related to hazardous materials sites.

Potentially Significant Impacts

Reasonably Forseeable Hazardous Materials Releases

Impact HAZARDS-1: Development of the Master Facilities Long-Range Plan could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions, as demolition of existing structures could expose students and other members of the general public to hazardous materials related to building materials. (PS)

The Master Facilities Long-Range Plan would require demolition of 11 existing buildings and structures: the Science Building (Building F), Madrone/Cafeteria Building (Building I), Photography/Ceramics Building (Building L), Auto Tech/Wood Shop Building (Building M), Academy Building (Building O), Art Building (Building R), Stadium Bleachers (Building V), Daycare Shed (Building W), Press Box (Building X), Concession Stand (Building Y), and Ticket Booth (Building Z) (see Figure 3-4 in Chapter 3, Project Description, of this EIR). Partial demolition of a twelfth building, the Gymnasium (P1), would be required during development of the proposed Wrestling/Dance/Classroom building (Building No. 7) (see Figure 3-4).

As noted in Section 4.7.2, Environmental Setting, based on the age of buildings on the SRHS campus, these buildings could contain asbestos-containing materials, lead-based paint, chlordane (an organochlorine pesticide used for termite treatment), and/or PCBs from electrical equipment and/or caulking. These contaminants may have been released to soils near building foundations in the past or may be released during building demolition. Asbestos-containing materials are highly regulated and must be abated prior to building demolition in accordance with BAAQMD District Rule 11-2, but other hazardous materials could remain and pose a health risk to future workers and students at the SRHS campus.

The following mitigation measure would reduce this impact to a less-than-significant level.

> *Mitigation Measure HAZARDS-1: The San Rafael City Schools shall comply with provisions of the Department of Toxic Substances Control (DTSC) School Property Evaluation and Cleanup Program for development under the Master Facilities Long-Range Plan. This compliance shall include evaluation of potential hazards related to building materials in accordance with DTSC's Preliminary Endangerment Assessment Guidance Manual (Guidance Manual) and DTSC's Interim Guidance for Evaluation of School Sites With Potential Soil Contamination as a Result of Lead from Lead-Based Paint, Organochlorine Pesticides from Termiticides, and Polychlorinated Biphenyls from Electrical Transformers (Interim Guidance). This compliance shall include an assessment of the potential for lighting fixtures and caulking in buildings constructed prior to 1977 to contain polychlorinated biphenyls (PCBs), and the abatement of any materials containing PCBs above risk-based thresholds in the Guidance Manual. This compliance shall also include soil sampling in accordance with methodology in the Interim Guidance. Any contaminants identified above concentrations in the Data Interpretation and Assessment section of the Interim Guidance shall require remedial action under DTSC oversight. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Routine Hazardous Materials Transport, Use, or Disposal

The Stadium Project would not create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.

The Stadium Project would not be expected to use significant quantities of hazardous materials, and any hazardous materials transported, used, or disposed of at the Stadium Project site would be subject to existing hazardous material regulations. This impact would be less than significant for the reasons discussed above for the Master Facilities Long-Range Plan.

Hazardous Materials Sites

The Stadium Project would not be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would not create a significant hazard to the public or the environment.

The Stadium Project site is not located on any hazardous materials site lists or databases. Groundwater contamination from an adjoining site, the San Rafael Schools Maintenance Facility, while located on the same legal parcel as the Stadium Project site, does not extend onto the Stadium Project site and would not affect the Stadium Project or pose a potential hazard to the public or the environment. This impact would be less than significant for the reasons discussed above for the Master Facilities Long-Range Plan.

Potentially Significant Impacts

Reasonably Forseeable Hazardous Materials Releases

Impact HAZARDS-2: Development of the Stadium Project could create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions, as demolition of existing structures has the potential to expose students and other members of the general public to hazardous materials related to building materials. (PS)

The Stadium Project would require demolition of existing home and away stadium bleachers (Building V), a press box (Building X), a concession stand (Building Y), and a ticket booth (Building Z) (see Figure 3-4 in Chapter 3, Project Description, of this EIR). As noted in Section 4.7.2, Environmental Setting, above, based on the age of buildings on the SRHS campus, these existing buildings could contain asbestos-containing materials, lead-based paint, chlordane (an organochlorine pesticide used for termite treatment), and/or PCBs from electrical equipment and/or caulking. These contaminants may have been released to soils near building foundations in the past or may be released during building demolition. Asbestos-containing materials are highly regulated and must be abated prior to building demolition, but other hazardous materials could remain and pose a health risk to future workers and students at the Stadium Project site.

The following mitigation measure would reduce this impact to a less-than-significant level.

Mitigation Measure HAZARDS-2: Implement Mitigation Measure HAZARDS-1. (LTS)

CUMULATIVE IMPACTS

For hazards and hazardous materials, the cumulative impact area considered is the SRHS campus and the sites for approved and proposed projects in the SRHS campus vicinity (see Table 6-1 and Figures 6-1 and 6-2 in Chapter 6, CEQA Considerations, of this EIR). Hazards and hazardous materials impacts are generally site-specific and/or have limited mobility, and therefore cumulatively considerable effects beyond the SRHS campus would not be expected. Development of properties near the SRHS campus could increase the potential exposure of persons to hazardous materials, including hazardous building materials such as those potentially present at the SRHS campus; however, the use, storage, and disposal of hazardous materials are regulated by federal, state, and local laws and regulations. Implementation of Mitigation Measure HAZARDS-1 would ensure that lead, termiticides, and PCBs in soils near Master Facilities Long-Range Plan development are abated properly in accordance with applicable guidance, and as a result any contribution to cumulative hazardous materials risks would not be significant. For these reasons, the Master Facilities Long-Range Plan would not result in or contribute to any significant cumulative hazards or hazardous materials impacts.

4.7.5 REFERENCES

Antea Group, 2016. Quarterly Monitoring Report, Second Quarter 2016, San Rafael City Schools Maintenance Facility, 38 Union Street, San Rafael, California, August 1.

Arcadis, 2015. San Rafael City Schools Maintenance Facility, Conceptual Site Model/Corrective Action Plan, 38 Union Street, San Rafael, California, January 12.

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CEQA Guidelines, Appendix G.

Department of Toxic Substances Control (DTSC), 2015. Preliminary Endangerment Assessment Guidance Manual. January 1994 (Revised October 2015).

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Department of Toxic Substances Control (DTSC), 2004. Interim Guidance, Naturally Occurring Asbestos (NOA) at School Sites. Revised September 24.

Department of Toxic Substances Control (DTSC), 2003. Covenant to Restrict Use of Property, Environmental Restriction, 201 Third Street Site, Assessor's Parcel Number 14-151-11.

Harding Lawson Associates (HLA), 1995. Remedial Activities Report, 201 Third Street, San Rafael, California, January 13.

Marin County Office of Emergency Services (OES), 2012. Marin County Local Hazard Mitigation Plan.

PES Environmental (PES), 2016. Biennial Groundwater Monitoring and Maintenance Report, 2016 Monitoring Period, 201 Third Street, San Rafael, California, July 28.

Porter-Cologne Water Quality Control Act of 1969, California Water Code, Section 13000, *et seq.*

State Water Resources Control Board (SWRCB), 2016. Geotracker On-Line Regulatory Hazardous Materials Site Database, Website: https://geotracker.waterboards.ca.gov/map/?CMD=runreport&myaddress=185+Mission+Avenue%2C+San+Rafael%2C+CA, accessed October 14.

4.8 HYDROLOGY AND WATER QUALITY

4.8.1 INTRODUCTION

This section describes the hydrology and water quality setting of the San Rafael High School (SRHS) campus (project site), including conditions related to climate, water resources, hydrology, and water quality within the vicinity of the campus, the extent and quality of surface water and groundwater, and flood conditions. Potential environmental effects related to hydrology and water quality are identified on a program level for the Master Facilities Long-Range Plan as a whole and on a project level for the proposed Stadium Project. The impacts examined include potential surface water and groundwater quality degradation, changes in runoff and drainage patterns, and flood hazards. These effects are evaluated to identify significant program-level and project-level impacts, and the impact analysis explains how application of existing permits and regulatory requirements would reduce or avoid the identified impacts. Potential cumulative impacts, based on implementation of the SRHS Master Facilities Long-Range Plan and other projects in the SRHS campus vicinity, are also evaluated.

4.8.2 ENVIRONMENTAL SETTING

Existing conditions related to water resources, hydrology, and water quality are described below.

CLIMATE

The SRHS campus and vicinity have a mild Mediterranean climate with long, dry, warm summers and cooler, rainy winters. The vast majority of precipitation occurs between October and May. Based on historical weather data from 1894 through 2016, the mean annual precipitation in San Rafael is 35.6 inches (WRCC, 2016). The mean daily high temperature is around 70 degrees Fahrenheit (ºF) with the mean daily low temperature around 48 ºF (WRCC, 2016).

SURFACE WATER RESOURCES

The SRHS campus is located in the San Francisco Bay Central Hydrologic Planning Area, as defined in the San Francisco Bay Basin Water Quality Control Plan (Basin Plan) prepared by the San Francisco Bay Regional Water Quality Control Board (RWQCB) (RWQCB, 2015). The nearest surface water body to the SRHS campus is San Rafael Creek, located between 100 and 450 feet south of the campus. San Rafael Creek drains a watershed 11 square miles in area, extending west to the hills near Tamalpais Cemetery, approximately 2.5 miles west of the SRHS campus. San Rafael Creek drains to San Pablo Bay approximately 1 mile east of the SRHS campus.

GROUNDWATER RESOURCES

The SRHS campus is not located within a mapped groundwater basin, and therefore is assumed not to be underlain by a substantial groundwater aquifer (RWQCB, 2015). Previous environmental and geotechnical investigations indicate that shallow groundwater is present at the project site, within the fill material that overlies Bay Mud to a depth of around 8 feet below the ground surface (bgs). These investigations have identified groundwater at the project site at depths ranging from 1.7 to 6.0 feet bgs (Arcadis, 2015; Miller Pacific Engineering Group, 2015). This shallow groundwater would be expected to flow to the south, toward San Rafael Creek, based on surface topography. However, the measured shallow groundwater flow direction has ranged from northwest to east during monitoring at the San Rafael City Schools Maintenance site near the southwestern corner of the SRHS campus (Arcadis, 2016).

FLOOD HAZARDS

Mapped Flood Hazard Zones

The entire SRHS campus is located within flood hazard zones mapped by the Federal Emergency Management Agency (FEMA). Most of the campus has been mapped as having a 0.2 percent chance of a flood event per year, referred to as the 500-year flood zone, as flooding would be expected to occur every 500 years (see **Figure 4.8-1**). Some of the campus, including a parking lot along 3rd Street and athletic fields, has been mapped as having a 1 percent chance of a flood event per year, referred to as the 100-year flood zone (see Figure 4.8-1). The base flood elevation has been determined to be 10 feet above mean sea level (msl) (FEMA, 2016); portions of the campus with an elevation below 10 feet therefore have the potential to be inundated during the 100-year flood event.

Localized Flooding

Localized flooding has been reported in the northeastern portion of the SRHS campus, near the gymnasium building (see Figure 3-2). A drainage channel between two residences at 124 and 136 Mission Avenue, immediately north of the campus, discharges stormwater runoff to this part of the campus, which can result in ponding of water during severe storms. Approximately 7 years ago, stormwater entered the SRHS gymnasium through the gym doors (Zaich, 2016). As a precautionary measure, SRHS maintenance places sandbags near the gym doors prior to winter storm events (Zaich, 2016).

Sea Level Rise

A predicted rise in sea levels will exacerbate coastal flooding hazards in the SRHS campus vicinity over the next century. The San Francisco Bay Plan from the San Francisco Bay Conservation and Development Commission (BCDC) anticipates a rise in Bay waters of 16 inches by 2050 and 55 inches by 2100. Mapping by BCDC has indicated that flooding hazards at the SRHS campus could increase due to sea level rises of these magnitudes (BCDC, 2011). This mapping is based on elevation and existing flood hazard zone data, and does not predict specific flooding issues at the project site or the ability of federal, state, and local governments to address higher sea levels.

SOURCE: HY Architects and FEMA, 2016

Figure 4.8-1

FLOOD HAZARD ZONES

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

However, it does indicate that additional measures may be required in the SRHS campus vicinity to address flooding hazards in the future.

FEMA recently completed a San Francisco Bay Area Coastal (BAC) study to evaluate potential flood hazards in coastal areas based on the most recent data and projections (FEMA, 2014). As a result of the study, FEMA flood hazard maps were updated. While the 2009 FEMA flood maps had a base flood elevation of 9 feet above msl for flood-prone areas of San Rafael, the updated 2016 FEMA flood maps mapped base flood elevations of 10 and 12 feet above msl (FEMA, 2016).

In January 2014, the City of San Rafael prepared the "Climate Adaptation – Sea Level Rise" white paper to evaluate the challenges presented by sea level rise and develop a strategy to address this hazard through monitoring, vulnerability assessment, and coordination with other agencies (City of San Rafael, 2014). As noted in Section 4.8.3, Regulatory Framework, below, recommendations of this white paper have been incorporated into San Rafael General Plan policies.

Dam Inundation Areas

The project site is not located in a mapped dam inundation area (Clearwater Hydrology, 2005).

Seiche, Tsunami, and Mudflows

A seiche is the oscillation of a body of water, occurring most frequently in enclosed or semi-enclosed basins such as lakes, bays, or harbors. In an otherwise still body of water, a seiche can be triggered by strong winds, changes in atmospheric pressure, earthquakes, tsunamis, or tides. Seiches are not considered a hazard in San Francisco Bay because of physical characteristics of the Bay, which makes it unlikely that oscillations of the magnitude that would result in inundation hazards would occur (Borrero, 2006).

Tsunamis are long-period water waves caused by underwater seismic events, volcanic eruptions, or undersea landslides. Tsunamis entering San Francisco Bay through the relatively narrow Golden Gate would tend to dissipate as the energy of the wave spreads out as the Bay becomes wider and shallower (Borrero, 2006). The California Emergency Management Agency has produced tsunami inundation maps to aid emergency response planning for areas along the state's coastline, including San Rafael. The map for the San Rafael and San Quentin Quadrangle designates the area adjacent to San Rafael Creek, including the southern portion of the SRHS campus, as part of the tsunami planning area (CalEMA, 2009). However, evaluation of tsunami hazards as part of the San Rafael General Plan update determined that the predicted 100-year wave runup from a large earthquake would affect only portions of San Rafael at elevations below 7.5 to 8.0 feet above msl (City of San Rafael, 2004). As the entire SRHS campus is at an elevation of 10 to 74 feet above msl (USGS, 2015), no inundation from the 100-year tsunami event would be anticipated.

Mudflows are a type of landslide, which are discussed in Section 4.5, Geology and Soils, of this EIR. No significant landslide hazards have been identified for the SRHS campus.

WATER QUALITY

San Rafael Creek, along with 36 other Bay Area urban creeks, has been designated as an impaired water body under the federal Clean Water Act Section 303(d) due to diazinon and other pesticides (RWQCB, 2005). A Water Quality Attainment Strategy, including establishment of Total Maximum Daily Loads (TMDLs) for contaminants, has been established for these creeks (RWQCB, 2005).

San Rafael Creek discharges to San Pablo Bay, which is also listed as an impaired water body. In addition to pesticides, San Pablo Bay is affected by dioxins and furans, polychlorinated biphenyls (PCBs), mercury, selenium, and invasive species (EPA, 2012). TDMLs have been established for mercury and are in preparation for other causes of impairment (EPA, 2012).

Groundwater near a former underground gasoline storage tank at the San Rafael City Schools Maintenance Facility, at 38 Union Street near the southwestern corner of the SRHS campus, has been affected by historical releases of gasoline. The 38 Union Street site is located on Assessor's Parcel Number (APN) 14-101-09, the same legal parcel as the SRHS campus. The extent of the contamination and the cleanup activities at this site are discussed in Section 4.7, Hazards and Hazardous Materials, of this EIR.

4.8.3 REGULATORY FRAMEWORK

FEDERAL AND STATE

The federal Clean Water Act (CWA) is the primary federal law that protects the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. In general, the CWA prohibits discharges to surface waters unless specifically authorized by a permit. These permits are administered by federal and state agencies, including the U.S. Army Corps of Engineers, State Water Resources Control Board (SWRCB), and San Francisco Bay RWQCB.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1969 provides California legislative authority for the protection of water quality for the use and enjoyment of the people. The Act, which has been incorporated in Division 7 of the California Water Code, includes jurisdiction over streams, groundwater, isolated wetlands, and other bodies that are not under the federal jurisdiction of the CWA. The Act also authorizes the SWRCB and RWQCBs to issue and enforce waste discharge requirements (WDRs) and National Pollutant Discharge Elimination System (NPDES) permits, and other approvals.

Stormwater Discharge Requirements

Pursuant to Section 402 of the CWA and the California Porter-Cologne Water Quality Control Act, municipal stormwater discharges at the project site are regulated under the statewide National Pollutant Discharge Elimination System (NPDES) General Permit for the Discharge of Storm Water from Small Municipal Separate Storm Sewer Systems (MS4 Permit). Locally, the NPDES program is overseen by the RWQCB. Development projects in San Rafael are subject to compliance with requirements of the current MS4 Permit, issued in February 2013 by SWRCB Order 2013-0001-DWQ. The Marin County Stormwater Pollution Prevention Program (MCSTOPPP) assists cities, towns, and Marin County with coordination and consistency of approaches across the County in implementing the MS4 Permit requirements.

Section E.12 of the 2013 Phase MS4 Permit addresses requirements for retention and treatment of stormwater generated by development projects. If the project creates or replaces more than 2,500 square feet of impervious surfaces, the proposed project would be subject to these requirements. Section E.12 requires preparation of a Stormwater Control Plan (SCP). The SCP must include measures to capture and treat runoff from impervious surfaces. The SCP must incorporate site design measures to reduce project site runoff, such as porous pavement, green roofs, or vegetated swales. The Bay Area Stormwater Management Agencies Association (BASMAA), which includes MCSTOPPP, has developed Design Guidance for Stormwater Treatment and Control for Projects in Marin, Sonoma, Napa, and Solano Counties (BASMAA, 2014) to assist in compliance with Section E.12.

Additional stormwater requirements apply to construction sites. The SWRCB adopted an NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) (Order No. 2009-0009-DWQ, NPDES No. CAR000002) on September 2, 2009, as amended by Orders No. 2010-0014-DWQ and 2012-0006-DWQ. To obtain coverage under the Construction General Permit, a discharger must submit to the SWRCB, a Notice of Intent, a Storm Water Pollution Prevention Plan (SWPPP), and other documents required by Attachment B of the Construction General Permit.

Construction activities subject to the Construction General Permit include clearing, grading, and disturbances to the ground, such as grubbing or excavation, that result in soil disturbances of at least 1 acre of total land area (or smaller sites that are part of a common plan of development or sale that disturbs more than 1 acre of land surface). A SWPPP must be prepared by a Qualified SWPPP Practitioner (QSP) that meets the certification requirements in the Construction General Permit. The purpose of the SWPPP is 1) to help identify the sources of sediment and other pollutants that could affect the quality of stormwater discharges, and 2) to describe and ensure the implementation of best management practices (BMPs) to reduce or eliminate sediment and other pollutants in stormwater as well as non-stormwater discharges resulting from construction activity. The Construction General Permit mandates certain requirements based on the risk level of the project (Level 1, Level 2, or Level 3), which is based on the risk of sediment discharge and the receiving water risk.

The SWPPP must also include a Construction Site Monitoring Program. The monitoring program includes, depending on the project risk level, visual observations of site discharges, water quality monitoring of site discharges (pH, turbidity, and non-visible pollutants, if applicable), and receiving water monitoring (pH, turbidity, suspended sediment concentration, and bioassessment).

LOCAL

San Rafael Municipal Code

Section 9.30 of the San Rafael Municipal Code contains the City of San Rafael Urban Runoff Pollution Prevention Ordinance, which adopts requirements of the CWA, the Basin Plan, and the MS4 Permit (Section 9.30.050). BMPs are required for all construction within the city (Section 9.30.140). An erosion and sediment control plan is required for any construction subject to a grading permit or that may have the potential for significant erosion (Section 9.30.150). The sediment and erosion plan must follow most recent version of the MCSTOPPP Construction Erosion and Sediment Control Plan Applicant Package. New development must comply with land development standards in the MS4 Permit, including submission and development of a SCP where required by the MS4 Permit or otherwise required by the City (Section 9.30.151).

Section 18 of the San Rafael Municipal Code contains provisions for protection of flood hazard areas. It requires a development permit for construction within any flood hazard area (Section 18.40.010). Construction standards apply to all construction within flood hazard areas (Section 18.40.050) and are not permitted to unnaturally divert flood waters or increase flood hazards in other areas (Section 18.10.040). Residential buildings must be constructed so that the lowest floor is above the base flood elevation, taking into account predicted 30 years' settlement. Non-residential construction must meet similar standards or be certified to be watertight with structural components capable of resisting pressures from floodwaters and buoyancy effects.

San Rafael General Plan

The following policies and programs from the San Rafael General Plan would apply to the Master Facilities Long-Range Plan, including the Stadium Project.

Water Quality and Stormwater

Policy AW-7 **Local, State and Federal Standards.** Continue to comply with local, state and federal standards for water quality.

Program AW-7a **Countywide Stormwater Program.** Continue to participate in the countywide stormwater program and comply with its performance standards.

Program AW-7b **Stormwater Runoff Measures.** Continue to incorporate measures for stormwater runoff control and management in construction sites.

Program AW-7c **Water Quality Improvements in Canal and Other Waterways.** Support water quality improvement efforts in the San Rafael Canal, creeks, and drainageways in accordance with standards of the State Water Quality Control Board or any agencies with jurisdiction.

Policy AW-8 **Reduce Pollution from Urban Runoff.** Address non-point source pollution and protect receiving waters from pollutants discharged to the storm drain system by requiring Best Management Practices quality.

- Support alternatives to impervious surfaces in new development, redevelopment, or public improvement projects to reduce urban runoff into storm drain system, creeks, and the Bay.
- Require that site designs work with the natural topography and drainages to the extent practicable to reduce the amount of grading necessary and limit disturbance to natural water bodies and natural drainage systems.
- Where feasible, use vegetation to absorb and filter fertilizers, pesticides and other pollutants.

Program AW-8a **Proper Disposal of Pollutants.** Continue to promote proper disposal of pollutants to the sanitary sewer or hazardous waste facilities rather than to the storm drainage system.

Program AW-8b **Compliance by Contractors**. Continue to require contractors to comply with accepted stormwater pollution prevention planning practices for all projects subject to erosion potential. Also, continue to require the proper use, storage and disposal of on-site materials.

Program AW-8c **System Improvements.** Improve storm drainage performance by constructing new system improvements. Evaluate stormwater volumes when replacing undersized or otherwise inadequate lines with larger or parallel lines.

Policy AW-9 **Erosion and Sediment Control.** Establish development guidelines to protect areas that are particularly susceptible to erosion and sediment loss.

Policy S-22 **Erosion.** Require appropriate control measures in areas susceptible to erosion, in conjunction with proposed development. Erosion control measures and management practices should conform to the most recent editions of the Regional Water Quality Control Board's Erosion and Sediment Control Field Manual and the Association of Bay Area Governments' Manual of Standards for Erosion and Sediment Control or equivalent.

Program S-22a **Erosion Control Programs.** Review and approve erosion control programs for projects involving grading one acre or more or 5,000 square feet of built surface as required by Standard Urban Stormwater Management Plans (SUSUMP). Evaluate smaller projects on a case-by-case basis.

Program S-22b **Grading During the Wet Season.** Discourage grading during the wet season and require that development projects implement adequate erosion and/or sediment control and runoff discharge measures.

Policy S-25 **Regional Water Quality Control Board (RWQCB) Requirements.** Continue to work through the Marin County Stormwater Pollution Prevention Program to implement appropriate Watershed Management plans as dictated in the RWQCB general National Pollutant Discharge Elimination System permit for Marin County and the local stormwater plan.

Flooding

Policy S-17 **Flood Protection of New Development.** Design new development within the bay mud areas to minimum floor elevation that provides protection from potential impacts of flooding during the "100-year" flood. The final floor elevation (elevation of the first floor at completion of construction) shall account for the ultimate settlement of the site due to consolidation of the bay mud from existing and new loads, taking into account soils conditions and the type of structure proposed. Design for settlement over a 50-year period is typically considered sufficient.

Program S-17a **Title 18 Flood Protection Standards.** Evaluate and revise the City's Title 18 flood protection standards for new development based on Federal and regional criteria.

Policy S-18 **Storm Drainage Improvements.** Require new development to improve local storm drainage facilities to accommodate site runoff anticipated from a "100-year" storm.

Program S-18a **Storm Drainage Improvements.** Require that new development proposals which are likely to affect the limited capacity of downstream storm drainage facilities provide a hydrological analysis of the storm drain basin of the proposed development and evaluate the capacity of existing downstream storm drainage facilities and fund improvements to accommodate increased drainage from the project site resulting from a 100-year storm, where practical.

Sea Level Rise

Policy S-21 **Rise in Sea Level.** Support efforts to address rise in sea level by: a) continually monitoring changes in projection information, data and technology; b) utilizing the "Climate Adaptation – Sea Level Rise" San Rafael White Paper (January 2014) as a starting point for pursuing critical tasks and actions including the preparation of a vulnerability assessment; and c) coordinating with the County of Marin and other local, state, federal agencies in planning for long-term adaptation.

Program S-21a **Local Hazard Mitigation Plan.** Prepare and adopt a local/multi-hazard mitigation plan, which includes addressing rise in sea level and measures for disaster preparedness and adaptation.

Program S-21b **Vulnerability Assessment – BayWAVE Program.** Coordinate and work with the County of Marin and other local jurisdictions in the BayWAVE Program to prepare and adopt

Program SU-14d **Sea Level Monitoring and Planning.** Work with the Bay Conservation and Development Commission (BCDC) to monitor sea level rise and plan for shoreline defense.

4.8.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on hydrology and water quality if it would:

a) Violate any water quality standards or waste discharge requirements;

b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted);

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site;

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site;

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;

f) Otherwise substantially degrade water quality;

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map;

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows;

i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding of as a result of the failure of a levee or dam; or

j) Expose people or structures to a significant risk of loss, injury, or death involving inundation by seiche, tsunami, or mudflow.

The following significance criteria would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the plan and are therefore excluded from further discussion in this impact analysis:

- Substantially Deplete Groundwater Supplies or Interfere Substantially with Groundwater Recharge Such that There Would Be a Net Deficit in Aquifer Volume or a Lowering of the Local Groundwater Table Level. No significant groundwater resources are located at the project site. None of the Master Facilities Long-Range Plan development would use groundwater or significantly interfere with groundwater discharge.
- Place Housing within a 100-Year Flood Hazard Area as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map. No housing is proposed by the Master Facilities Long-Range Plan.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Water Quality Impacts

Development in accordance with the Master Facilities Long-Range Plan would not violate any water quality standards or waste discharge requirements or otherwise degrade water quality.

The primary water quality concern for the Master Facilities Long-Range Plan is stormwater runoff. San Rafael Creek, which receives runoff from the SRHS campus, as well as San Pablo Bay, which San Rafael Creek discharges to, have been classified as impaired water bodies under the federal CWA. Therefore, any discharges of pollutants via stormwater to those water bodies could affect water quality and violate water quality standards, as discussed in more detail below.

Construction-Phase Impacts

Hazardous materials such as fuels, lubricants, and construction chemicals would be used during construction of Master Facilities Long-Range Plan development and spills could occur, contaminating soils at the SRHS campus. During earthmoving activities, stormwater runoff could entrain exposed soils, creating erosion on the campus and potentially transporting hazardous materials used in construction to receiving waters.

Existing regulations protecting stormwater quality described in Section 4.8.3, Regulatory Framework, would apply to construction activities. The Construction General Permit would apply to projects disturbing more than 1 acre and would require preparation of a construction-phase SWPPP. The City of San Rafael specifies BMPs to be incorporated for construction activities, including erosion control BMPs (scheduling and timing of grading activities, timely revegetation of graded areas, the use of hydroseed and hydraulic mulches, installation of erosion control blankets); sediment control BMPs (properly sized detention basins, dams, or filters and installation of construction entrances to prevent tracking of sediment off-site); and pollution prevention BMPs (designated washout areas or facilities, control of trash and recycled materials, tarping of materials stored on-site, and proper location of and maintenance of temporary sanitary facilities) (Municipal Code Section 9.30.140). Implementation of the SWPPP consistent with City of San Rafael guidance would reduce potential water quality impacts during construction of Master Facilities Long-Range Plan projects to a less-than-significant level.[1]

Operational-Phase Impacts

Buildout of the Master Facilities Long-Range Plan would demolish 84,015 square feet of existing buildings and construct 132,237 square feet of new buildings. These changes would result in an increase of 48,222 square feet of impervious surfaces, plus additional areas of pavement. This increase in impervious surfaces has the potential to increase stormwater runoff from the SRHS campus. This increased runoff has the potential to capture urban pollutants, such as landscaping and maintenance chemicals used at the SRHS campus or motor oil leaking from vehicles parked at the campus, and adversely affect surface water quality of receiving waters.

Projects that create or replace more than 2,500 square feet of impervious surfaces must prepare a Stormwater Control Plan (SCP) in accordance with Section E.12 of the MS4 Permit. For small projects (between 2,500 and 5,000 square feet of impervious surfaces), the SCP must include site design measures limiting clearing, grading, and soil compaction; minimizing impervious surfaces; reducing runoff, such as by dispersing to landscape or using pervious pavements; conserving natural areas of the site as much as possible; complying with stream setback ordinances; and protecting slopes and channels against erosion.

“Regulated projects” (creating or replacing 5,000 square feet or more of impervious surfaces) must have an SCP including the above measures, plus runoff must be routed to bioretention or other facilities sized and designed using either volumetric or flow-based criteria specified in the MS4 Permit. Site design must reduce the amount of storm runoff to the extent technically feasible. Regulated projects must also identify potential sources of pollutants and implement source control measures, and provide for ongoing maintenance of bioretention facilities.

Implementation of these existing regulatory requirements would ensure that stormwater runoff from development of the Master Facilities Long-Range Plan would not result in significant stormwater quality impacts with the potential to affect surface water bodies, and would require stormwater infrastructure to be built and maintained to prevent an increase in volumes or rates of stormwater runoff from the SRHS campus. These measures would reduce potential water quality impacts during operation of Master Facilities Long-Range Plan development to a less-than-significant level.

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[1] As discussed in Section 1, Introduction, of this EIR, pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to a proposed classroom facilities project. Even though the District adopted Resolution No. 169.1, dated June 27, 2016, pursuant to Section 53094 exempting the Master Facilities Long-Range Plan and the SRHS campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City’s Municipal Code, the City’s General Plan, and related ordinances and regulations that otherwise would be applicable, this EIR evaluates the project’s consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District’s goal that local policies and regulations be acknowledged and adhered to as much as feasible. It should be noted that the Section 53094 exemption does not apply to drainage, road, or grading improvement or condition regulations; thus, stormwater control requirements must be met.

Erosion and Siltation

Development in accordance with the Master Facilities Long-Range Plan would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

Demolition, excavation, grading, and construction during for Master Facilities Long-Range Plan development would require temporary disturbance and exposure of shallow soils through removal of existing structures, pavements, and vegetative cover. During the construction period, excavation and grading activities would result in exposure of soil to runoff, potentially causing erosion and entrainment of sediment in the runoff. After construction, soils in development areas would be covered by buildings, pavement, and vegetation and no erosion would be anticipated.

Construction activities are subject to requirements of the Construction General Permit. Under the Construction General Permit, which applies to construction areas greater than 1 acre in area, a SWPPP for construction must ensure that all pollutants and their sources, including sources of sediment associated with construction, construction site erosion, and all other activities associated with construction activity, are controlled.

As noted above, the City of San Rafael requires that larger construction projects include an erosion and sediment control plan that incorporates the most recent guidance from the MCSTOPPP Construction Erosion and Sediment Control Plan Applicant Package (Municipal Code Section 9.30.150). The MCSTOPPP guidance is designed to ensure that construction activities comply with the Construction General Permit. Implementation of these permit requirements would reduce potential impacts from erosion or siltation to a less-than-significant level.

Flooding, Storm Drain Capacity, and Polluted Runoff

Development in accordance with the Master Facilities Long-Range Plan would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site, or create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

As noted above, compliance with existing regulatory requirements, including preparation and implementation of a SWPPP and erosion and sediment control plan during construction, and preparation and implementation of a SCP during operation, would ensure that runoff rates and volumes from Master Facilities Long-Range Plan development areas would not increase, and that no new sources of polluted runoff would be generated. Therefore, no additional runoff would be generated that could result in exceedances of storm drainage capacity, and no potential flooding impacts or sources of polluted runoff would be created.

Structures Impeding or Redirecting Flood Flows

Development in accordance with the Master Facilities Long-Range Plan would not place within a 100-year flood hazard area structures which would impede or redirect flood flows.

Portions of the SRHS campus are located within the 100-year flood hazard zone (see Figure 4.8-1). The proposed new administration/kitchen/student commons building (Building No. 2), and restrooms (Building No. 10), bleachers (Building No. 9), concession building (Building No. 5), and changing rooms (Building No. 8) for the Stadium Project and athletic fields, are located at least partially within the mapped flood hazard zone (see Figure 4.8-1).

A significant impact would occur if construction of the proposed new buildings would redirect flood waters to other areas. However, the structures and portions of structures that would be constructed within the 100-year flood hazard zone are relatively small in area, compared to the size of the hazard zone (see Figure 4.8-1). Division of State Architect (DSA) requirements for school construction design include procedures for construction in flood hazard zones. DSA PR 14-01 requires that flood hazards be addressed, either through compliance with local jurisdiction requirements or through DSA review. Section 18 of the San Rafael Municipal Code requires that development within the 100-year flood zone not adversely alter natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel flood waters (Section 18.10.040(C)) and forbid the construction of flood barriers that would unnaturally divert flood waters or that may increase flood hazards in other areas (Section 18.10.040(E)). The Municipal Code requires a development permit verifying adherence to these flood hazard zone design requirements to be submitted and approved prior to any construction within the 100-year flood hazard zone. Adherence to these existing flood hazard area construction requirements would reduce potential impacts from impeding or redirecting flood flows to a less-than-significant level.

Dam or Levee Failure/Inundation by Seiche, Tsunami, or Mudflow

Development in accordance with the Master Facilities Long-Range Plan would not expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam; or inundation by seiche, tsunami, or mudflow.

As noted above, Master Facilities Long-Range Plan development in those portions of the SRHS campus that are within the 100-year flood hazard area would comply with existing DSA and City requirements to protect people and structures from effects of flooding within mapped flood hazard zones. In the past, localized flooding due to discharges of stormwater runoff from an off-site source (a drainage channel located across Mission Avenue from the campus) has been noted near the proposed wrestling/dance/classroom building in the northern part of the SRHS campus. However, the impacts from this localized flooding are minor, would not be exacerbated by Master Facilities Long-Range Plan development, and have been addressed adequately through the placement of sandbags prior to winter storm events.

Based on available information presented in Section 4.8.2, Environmental Setting, above, the SRHS campus is not located in a dam inundation area or an area subject to significant risks of inundation from seiche, tsunami, or mudflow.

Potentially Significant Impacts

The Master Facilities Long-Range Plan would not have any potentially significant hydrology or water quality impacts.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Water Quality Degradation

The Stadium Project would not violate any water quality standards or waste discharge requirements or otherwise degrade water quality.

The primary water quality concern for the Stadium Project is stormwater runoff. As noted under the discussion of the Master Facilities Long-Range Plan impacts, any discharges of pollutants via stormwater could affect water quality in San Rafael Creek and San Pablo Bay and violate water quality standards.

The Stadium Project is subject to construction-phase and operation-phase stormwater regulations contained in the Construction General Permit and MS4 Permit.

The applicant has prepared a draft SWPPP for construction of the Stadium Project in accordance with these requirements (CSW/Stuber-Stroeh Engineering Group, 2016). The SWPPP includes a summary of regulatory requirements; project information including a site plan, pollutants likely to be present in stormwater discharges, and a list of toxic materials used during construction; a description of BMPs to be implemented during construction; recordkeeping requirements for BMP inspection and maintenance; a construction site monitoring program; and an erosion control plan. Implementation of the SWPPP would reduce potential construction-phase water quality impacts of the Stadium Project to a less-than-significant level.

The Stadium Project would also be subject to design and maintenance requirements of MS4 Permit Section E.12 and San Rafael Municipal Code Section 9.30.151. The existing stadium is split into two drainage management units, created by the ridge of the existing football field. Stormwater draining west of this ridge currently is collected in three existing large City of San Rafael storm drain lines that enter school property at Mission Avenue and Belle Avenue, pass through the stadium, under the existing home bleachers, exit the school property at 3rd Street, and empty to San Rafael Creek. Stormwater draining east of the football field ridge is collected in an existing large City of San Rafael storm drain line that enters the campus east of the gymnasium at Mission Avenue, flows through the school property east of the existing tennis courts, under the existing baseball field, skirts the southeast corner of the existing track, and exits the school property at 3rd Street before emptying to San Rafael Creek.

The Stadium Project would connect to these existing facilities and includes stormwater retention trenches under the new field to detain peak runoff from the project. As the Stadium Project is a "regulated project" under MS4 Permit Section E.12, a SCP must be prepared and implemented. Site design for the Stadium Project must reduce the amount of storm runoff to the extent technically feasible. Potential sources of pollutants must be identified and source control measures designed and implemented. The SCP must also provide for ongoing maintenance of bioretention facilities and other stormwater infrastructure. Compliance with these requirements would reduce potential operation-phase water quality impacts of the Stadium Project to a less-than-significant level.

Erosion and Siltation

The Stadium Project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

The Stadium Project would expose soils at the site during construction activities, which could result in erosion if soils are allowed to become entrained in stormwater runoff during development of the project. The draft SWPPP for the Stadium Project, required under the Construction General Permit, includes BMPs for erosion control, sediment control, and wind erosion/dust control (CSW/Stuber-Stroeh Engineering Group, 2016). The SWPPP also includes an erosion control plan consistent with City of San Rafael erosion and sediment control requirements. Implementation of the SWPPP would reduce potential erosion and siltation impacts of the Stadium Project to a less-than-significant level.

Flooding, Storm Drain Capacity, and Polluted Runoff

The Stadium Project would not substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site, or create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

As noted above, compliance with existing regulatory requirements, including preparation and implementation of the draft SWPPP during construction, and preparation and implementation of a SCP during operation, would ensure that runoff rates and volumes from the Stadium Project site would not increase, and that no new sources of polluted runoff would be generated. Therefore, no additional runoff would be generated that could result in exceedances of storm drainage capacity, and no potential flooding effects or sources of polluted runoff would be created.

Structures Impeding or Redirecting Flood Flows

The Stadium Project would not place within a 100-year flood hazard area structures which would impede or redirect flood flows.

The proposed new home and away bleachers (Building 9), concession stand (Building 5), and restroom building (Building 10) for the Stadium Project would be located at least partially within the 100-year flood hazard area (see Figure 4.8-1). The base flood elevation in this hazard area is 10 feet above msl (FEMA, 2016). The existing concession building (Building Y) and ticket booth (Building Z), which would be demolished, are at approximately 9 feet above msl. Finished floor elevations for the Stadium Project would be least 10.5 feet above msl, 0.5-foot above the FEMA base flood elevation. The new buildings would have slab on grade foundations without basements.

A significant impact would occur if construction of the proposed new Stadium Project structures would redirect flood waters to other areas. However, the structures and portions of structures that would be constructed within the 100-year flood hazard zone are relatively small in area compared to the size of the hazard zone (see Figure 4.8-1) and would not be expected to significantly impede or redirect flood waters. In addition, as noted above, DSA and City requirements for construction within flood hazard areas would prohibit any significant impedance or redirection of flood waters. Therefore, potential impacts from impeding or redirecting flood flows would be considered less than significant.

Dam or Levee Failure/Inundation by Seiche, Tsunami, or Mudflow

The Stadium Project would not expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding of as a result of the failure of a levee or dam; or inundation by seiche, tsunami, or mudflow.

Compliance with DSA and City requirements for construction in flood hazard zones would reduce impacts from flood events to a less-than-significant level. Based on available information presented in Section 4.8.2, Environmental Setting, above, the Stadium Project is not located in a dam inundation area or an area subject to significant risks of inundation from seiche, tsunami, or mudflow.

Potentially Significant Impacts

The Stadium Project would not have any potentially significant hydrology or water quality impacts.

CUMULATIVE IMPACTS

For hydrology and water quality, the cumulative impact area considered is the SRHS campus and the projects within the campus vicinity (Table 6-1 and Figures 6-1 and 6-2 in Chapter 6, CEQA Considerations, of this EIR). The Master Facilities Long-Range Plan could have the potential to contribute to cumulative water quality impacts related to stormwater runoff and cumulative flooding impacts related to sea level rise.

Stormwater discharged from past and existing projects within the Master Facilities Long-Range Plan vicinity has contained pollutants that have contributed to impairment of the water quality of receiving waters, including San Francisco Bay. Stormwater regulations have become progressively more stringent since the passing of the federal CWA, and current requirements now require new developments to manage and treat all significant sources of stormwater pollutants; in particular, stormwater runoff from past, present, and existing development is treated in accordance with Construction General Permit and MS4 Permit requirements. As such, a reduction in overall pollutant loads in stormwater is anticipated over time. Therefore, no significant adverse impacts would be expected from cumulative water quality conditions, as these conditions would be expected to cumulatively improve.

The SRHS campus is located in a low-lying coastal area that is expected to be subject to exacerbated flooding impacts as a result of sea level rise. The City of San Rafael has adopted General Plan policies designed to evaluate and assess potential vulnerabilities and to coordinate with Marin County and other local, state, and federal agencies in planning for long-term adaptation. Development of the Master Facilities Long-Range Plan would have no effect on the magnitude and extent of sea level rise, which is caused by global climate change, and adherence to DSA and City flood hazard zone construction requirements would ensure that developments under the SRHS Master Facilities Long-Range Plan do not impede flood water flows or otherwise contribute to potential cumulative flooding hazards created by sea level rise. Therefore, the Master Facilities Long-Range Plan would not result in or contribute to any significant cumulative flooding or other hydrology and water quality impacts.

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4.9 LAND USE AND PLANNING

4.9.1 INTRODUCTION

The analysis of land use and planning generally considers the compatibility of a proposed project with neighboring areas, change to or displacement of existing uses, and consistency of the project with relevant local land use policies that have been adopted with the intent to mitigate or avoid an environmental effect. With respect to land use conflicts or compatibility issues, the magnitude of these impacts depends on how a proposed project affects the existing development pattern, development intensity, traffic circulation, noise, air quality, and visual setting in the project site vicinity.

This section considers whether the Master Facilities Long-Range Plan for the San Rafael High School (SRHS) campus, including the Stadium Project, may conflict with applicable land use plans, policies, or regulations (including, but not limited to the general plan and zoning ordinance) that were adopted for the purpose of avoiding or mitigating an environmental effect (see Appendix G to the California Environmental Quality Act [CEQA] Guidelines).

CEQA also requires consideration of whether a proposed project could physically divide a community and whether a proposed project might conflict with an applicable habitat conservation plan or natural community conservation plan.

4.9.2 ENVIRONMENTAL SETTING

REGIONAL SETTING

The SRHS campus is located in the City of San Rafael in Marin County. Regional access to the campus is from U.S. Highway 101 located west of the campus. The site of the campus is generally in the "Central San Rafael" subarea as identified in the City's General Plan (City of San Rafael, 2013) in an area of mixed land uses, dominated by residences. Downtown San Rafael is west of the campus, on the west side of U.S. Highway 101.

PROJECT SITE SETTING AND SURROUNDING LAND USES

The 29.8-acre campus includes existing classroom and administrative buildings, sports facilities, playing fields, tennis courts, surface parking areas, and associated high school uses. Campus buildings are concentrated in the center of the site, with playing fields on the west and east sides. A swimming pool, gymnasium and tennis courts are located at the northeast end of the campus. The existing stadium area is just east of the built area of the campus. A thick grove of eucalyptus trees separates the campus from Embarcadero Way and nearby residences to the east.

Surrounding land uses include single- and multi-family residences to the north, northeast, and east. 3rd Street forms the southern boundary of the site and separates the campus from commercial uses as well as San Rafael Creek, which is located on the southern side of the narrow band of commercial uses. Montecito Plaza, a large shopping center with a mix of commercial businesses, is located to the southwest of the campus across 3rd Street. Whole Foods Market, San Rafael Fire Station No. 52, and multi-family residences are located to the west of the campus, just west of the San Rafael City Schools Maintenance Facility (38 Union Street), which is located at the western edge of the project site.

San Rafael Creek, located south of the campus, connects to San Rafael Bay and San Francisco Bay. A number of yacht harbors are located along this creek.

4.9.3 REGULATORY FRAMEWORK

FEDERAL AND STATE REGULATIONS

There are no federal or state land use regulations that may affect on-site development.

LOCAL REGULATIONS

San Rafael General Plan

The San Rafael General Plan was adopted in 2004 and amended and reprinted in 2013 (City of San Rafael, 2013). The General Plan provides a comprehensive statement of the City of San Rafael's development policies. It covers all lands located within the City limits as well as the City's Sphere of Influence area. The Sphere of Influence is the service area of a city or district as approved by the Local Agency Formation Commission of the county (Government Code Section 56076). The City limits and Sphere of Influence area are illustrated in the General Plan map, which can be seen in **Figure 4.9-1** (City of San Rafael, 2013).

Land Use Designations

The SRHS campus is designated in the City's General Plan as Low-Density Residential, 2 to 6.5 units per acre (see Figure 4.9-1). This same designation applies to lands to the north and east of the project site. The area used as the San Rafael City Schools Maintenance Facility (at west edge of site) is designated as High-Density Residential, 15 to 32 units per acre. Patches of Medium-Density Residential, 6.5 to 15 units per acre, are located north of the campus (see Figure 4.9-1).

Relevant Policies and Programs

The San Rafael General Plan contains the following relevant policies and programs.

Policies and Programs from Land Use Element

Policy LU-2 **Development Timing.** For health, safety and general welfare reasons, new development should only occur when adequate infrastructure is available consistent with the following findings:

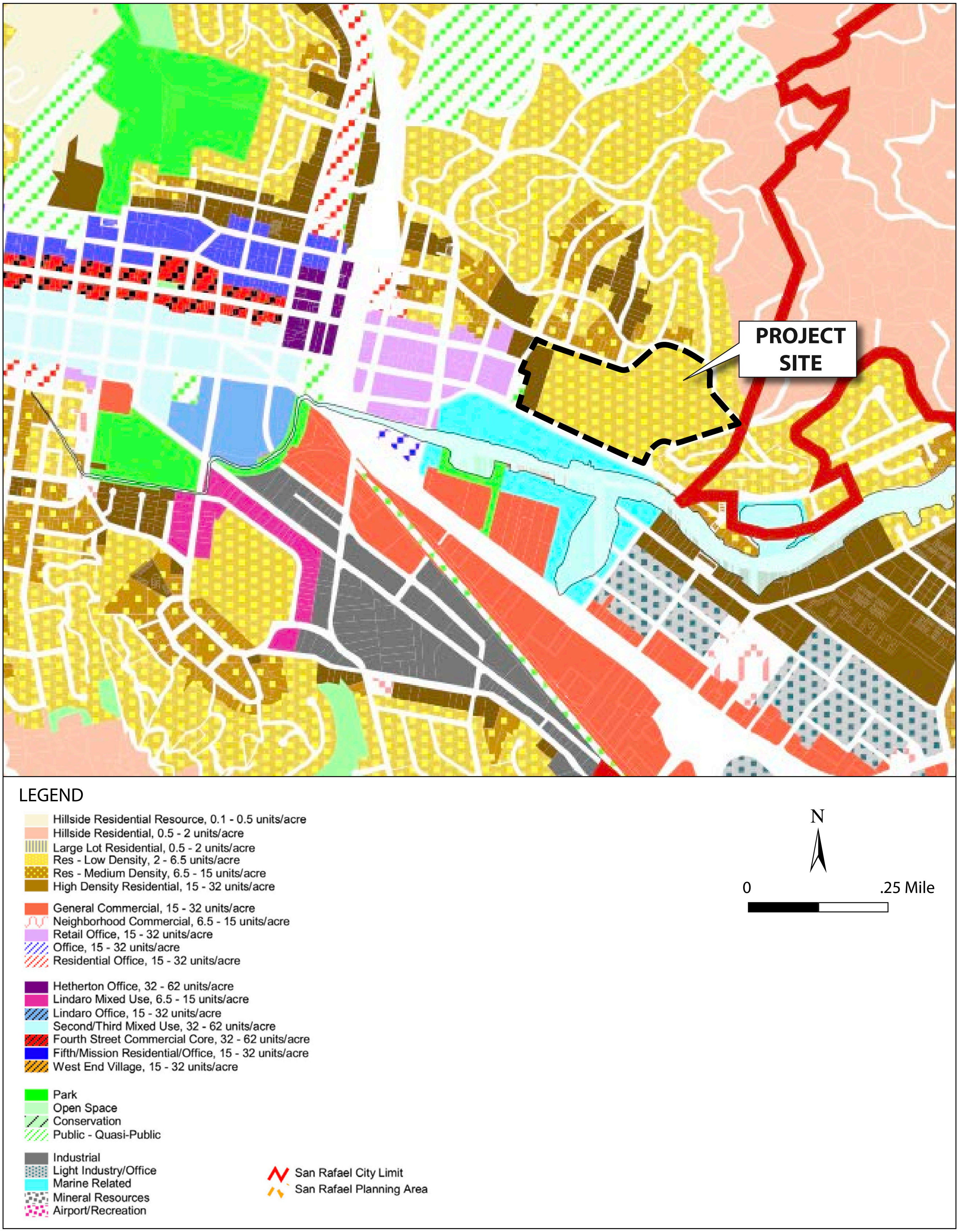

Figure 4.9-1

CITY OF SAN RAFAEL GENERAL PLAN

SOURCE: City of San Rafael, 2013

a. Project-related traffic will not cause the level of service established in the Circulation Element to be exceeded;

b. Any circulation improvements needed to maintain the level of service standard established in the Circulation Element have been programmed and funding has been committed;

c. Environmental review of needed circulation improvement projects has been completed;

d. The time frame for completion of the needed circulation improvements will not cause the level of service in the Circulation Element to be exceeded, or the findings set forth in Policy C-5 have been made; and

e. Sewer, water, and other infrastructure improvements will be available to serve new development by the time the development is constructed.

Program LU-2a **Development Review.** Through the development and environmental review processes, ensure that policy provisions are evaluated and implemented. The City may waive or modify any policy requirement contained herein if it determines that the effect of implementing the same in the issuance of a development condition or other approvals would be to preclude all economically viable use of a subject property.

Policy LU-9 **Intensity of Nonresidential Development.** Commercial and industrial areas have been assigned floor area ratios (FARs) to identify appropriate intensities (see Exhibits 4, 5 and 6). Maximum allowable FARs are not guaranteed, particularly in environmentally sensitive areas. Intensity of commercial and industrial development on any site shall respond to the following factors: site resources and constraints, traffic and access, potentially hazardous conditions, adequacy of infrastructure, and City design policies.

a. Where the existing building is larger than the FAR limit and no intensification or change of use is proposed, the property may be redeveloped at the same size as the existing building if parking and design requirements in effect at the time of the new application can be met.

b. FAR transfers between or among sites shall not be permitted except where the City Council finds the following:

    1. The development of the beneficiary parcel is consistent with the General Plan 2020, except that FARs or maximum densities may be exceeded, and

    2. The proposed development will comply with all applicable zoning and design parameters and criteria as well as traffic requirements; and one or both of the following:

        i) Unique or special circumstances are found to exist (e.g., preservation of wetlands or historic buildings) that would cause significant environmental impacts if the transfer is not allowed, and/or

ii) A significant public benefit will be provided, such as securing a new public facility site (e.g. park, school, library, fire station, police station).

Policy LU-11 **School Site Reuse or Redevelopment.** Where it is in the community's interest to retain public recreation facilities in accordance with Parks and Recreation policies, and/or the childcare policy, cluster development so that the public recreation or childcare use may be preserved. The following uses are allowed on school sites retained by the districts: housing and public and quasi-public uses, such as child care programs; adult day care programs; education, recreation, cultural programs and activities; and churches and religious institutions.

Program LU-11a **Zoning for School Sites.** Continue to implement school site reuse and redevelopment through zoning regulations and through the development review process.

Policy LU-23 **Land Use Map and Categories.** Land use categories are generalized groupings of land uses and titles that define a predominant land use type (See Exhibit 11). All proposed projects must meet density and FAR standards (See Exhibits 4, 5 and 6) for that type of use, and other applicable development standards. Some listed uses are conditional uses in the zoning ordinance and may be allowed only in limited areas or under limited circumstances. Maintain a Land Use Map that illustrates the distribution and location of land uses as envisioned by General Plan policies (see Exhibit 11).

General Policies and Programs from Neighborhoods Element

Policy NH-1 **Neighborhood Planning.** Engage neighborhood associations in preparing neighborhood plans for their area.

Program NH-1a **Neighborhood Planning Process.** Develop a neighborhood planning process where there is significant desire or need for a neighborhood plan. As of July, 2003, neighborhoods expressing a desire for a neighborhood plan are Bret Harte, Gerstle Park, Lincoln/San Rafael Hill, the Santa Margarita area in the Terra Linda neighborhood and the Canal.

Policy NH-2 **New Development in Residential Neighborhoods.** Preserve, enhance and maintain the residential character of neighborhoods to make them desirable places to live. New development should:

- Enhance neighborhood image and quality of life;
- Incorporate sensitive transitions in height and setbacks from adjacent properties to respect adjacent development character and privacy;

- Preserve historic and architecturally significant structures;
- Respect existing landforms and natural features;
- Maintain or enhance infrastructure service levels, and
- Provide adequate parking.

Program NH-2a **Zoning Ordinance.** Continue to implement and update the Zoning Ordinance as needed to include the criteria listed above.

Policy NH-6 **Bicycle- and Pedestrian-Friendly Streets.** Create bicycle-and pedestrian-friendly residential streets with large street trees, sidewalks and other appropriate amenities.

Program NH-6a **Narrow Streets.** In new streets, consider modifying street standards to allow narrower streets that promote bicycle and pedestrian activity and safety, while still providing for emergency and service access. Public streets must be designed to Caltrans and American Association of State Highway and Transportation Officials standards.

Policy NH-7 **Neighborhood Identity and Landmarks.** Enhance neighborhood identity and sense of community by retaining and creating gateways, landmarks, and landscape improvements that help to define neighborhood entries and focal points.

Policy NH-8 **Parking.** Maintain well-landscaped parking lots and front setbacks in commercial and institutional properties that are located in or adjacent to residential neighborhoods. Promote ways to encourage parking opportunities that are consistent with the design guidelines.

Program NH-8a **Restore Parking Spaces.** Continue Code Enforcement efforts to work with apartment owners to restore parking spaces being used for storage.

Program NH-8b **Additional On-Site Parking.** In neighborhoods with excessive on-street parking, work with property owners to add on-site parking where feasible as part of review of expansion or remodels.

Program NH-8c **Permit Parking.** In neighborhoods with excessive on-street parking, evaluate the benefits and drawbacks of a Permit Parking Program (i.e. to limit cars per unit and/or to limit nonresidential cars) where supported by a significant majority of neighborhood residents.

Program NH-8d **Zoning Ordinance Review.** Evaluate and amend as necessary zoning regulations to ensure adequate on-site parking, and sufficient screening of parking areas adjacent to residences.

Policy NH-11 **Needed Neighborhood Serving Uses.** Give priority to "needed neighborhood serving uses". Examples of needed neighborhood serving uses are: supermarkets; craft stores; cafes; restaurants; drug stores; neighborhood shopping centers which include uses such as dry cleaners, delis and markets, video stores, etc.; health and medical facilities and services; as well as improved public uses and services such as parks, schools, child care, and police services. Other similar uses that serve primarily neighborhood residents and/or employees and receive broad neighborhood support may also qualify.

Policy NH-12 **Schools.** Work with the school districts to use active school sites as neighborhood gathering places and recreational amenities. Retain local schools where possible, but when reuse is necessary, housing development at prevailing densities in the immediate area should be the appropriate land use. Where it is in the community's interest to retain public recreation, on-site density transfers will be allowed to the remaining school site acreage, provided the resulting housing design is compatible with the neighborhood character.

Policy NH-14 **Gathering Places and Events.** To spark social interaction and create a greater sense of community, encourage both daytime and nighttime gathering places and events in appropriate locations, such as cafes, restaurants, outdoor eating places, bookstores, shopping facilities, libraries, schools, churches, parks, recreation facilities, community gardens, farmers' markets, transit stops, parks, recreation facilities, commercial facilities, cultural facilities, teen facilities, and City-sanctioned street closures for festivals, parades, and block parties. Improve parks and their facilities to include active recreation and passive social interaction areas, and, where appropriate, incorporate areas that can accommodate group activities such as social events, picnics and concerts in a manner respectful of nearby residents.

Neighborhoods Element Policies and Programs Specific to Montecito/Happy Valley Neighborhood

Policy NH-122 **San Rafael City School's Corporation Yard on Union Street.** Encourage the redevelopment of the School District's bus/maintenance yard with attractive multifamily housing for seniors and/or school district staff. Neighborhood childcare should be retained on the site. The project should also include a children's playground designed for use by the residents and the neighborhood. Development of this site should improve and retain views from the end of Fourth Street to the façade of the San Rafael High School building.

Policy NH-124 **Improved Recreation.** Create and improve neighborhood recreational opportunities and facilities.

Program NH-124 **Neighborhood Park.** Provide a neighborhood park with appropriate play structures and activities for young children.

Potential park site locations include the School District's corporation yard and the San Rafael High School site, possibly at the south end of the football field along Third Street or by the tennis courts along Mission Avenue. Consistent with City recreation policies, should San Rafael High School ever be closed or sold, attempt to secure the continued public use of existing high school recreation facilities, and provide neighborhood park facilities.

Policy NH-125 **Design Blend.** Continue to provide a blend of architecture styles in the Montecito/Happy Valley Neighborhood compatible with and retaining the character of attractive older buildings. Newer buildings should be well designed, blend well with the existing homes and provide a "pedestrian friendly" street front.

Policy NH-126 **Traffic Control.** Enhance and design streets to provide for appropriate traffic control.

Program NH-126a **San Rafael High School Access.** Work with the school district to improve safety and effectiveness of drop-off areas at San Rafael High School. Review the design and implementation of an improved front entrance off Pt. San Pedro Road at San Rafael High School, as well as safer and more efficient pick-up and drop-off areas including but not limited to the area in front of the gym.

Policy NH-128 **Sidewalk Improvements.** Provide sidewalks that are safe and attractive to walk along.

Program NH-128a **Sidewalk Improvements.** Prepare a Pedestrian Plan, identifying pedestrian right-of-ways. Using information from the neighborhood, further develop a list of sidewalks and paths for parts of Park, Jewell, Belle, one side of Union, and along the perimeter of the High School. Add safe crosswalks and striping where needed for pedestrian safety, and posting of speed limits on streets such as Grand, Park and Union.

Policy NH-129 **Neighborhood Parking.** Provide street parking that is convenient and does not dominate the neighborhood. Require that all new residential developments provide for attractive and adequate off-street parking.

Program NH-129a **Neighborhood Parking.** To improve parking in the neighborhood, conduct a parking survey to further evaluate specific parking problems and identify possible solutions that allow for street parking that does not dominate the neighborhood, such as:

- Working with apartment owners to restore parking spaces being used for storage.
- Working with property owners to add on-site parking where feasible.
- Adding “no parking” signs where street clearance is too narrow for emergency vehicles to get through.
- Evaluating the benefits and drawbacks of a Permit Parking Program, i.e., to limit cars per unit or to limit nonresident cars.
- Considering time-limited parking areas.

City of San Rafael Municipal Code, Title 14 – Zoning Ordinance

The SRHS campus is zoned Public/Quasi-Public (P/QP). This zoning district applies to lands for governmental, educational, public safety, public utility, residential and public transportation facilities. This district also is to provide site opportunities for recreation and nonprofit community service facilities. Public schools are permitted by right in the P/QP District (City of San Rafael, 2016). The building height limit in this district is 36 feet..(City of San Rafael, 2016).

Marin Countywide Plan

While the SRHS campus is entirely within the City of San Rafael, unincorporated lands under the jurisdiction of Marin County are located just east of the campus (see Figure 4.9-1). The Marin Countywide Plan designates these lands for residential use, with lot sizes varying from 6,000 square feet to 1 acre (Marin County, 2016). Some areas nearest to the campus are designated for multi-family housing.

Marin County Zoning Ordinance

The County lands just east of the site are zoned R-1: Single-Family Residential (Marin County, 2016; Marin County, 2012).

4.9.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of the CEQA Guidelines, implementation of the proposed project would have a significant effect related to land use if it would:

a) Physically divide an established community;

b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan, specific plans, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect; or

c) Conflict with any applicable habitat conservation plan or natural community conservation plan.

The following significance criteria would not apply to the Master Facilities Long-Range Plan or the Stadium Project proposed under the plan and are therefore excluded from further discussion in this impact analysis:

- *Physically divide an established community.* The SRHS campus is an existing campus set within a residential and commercial area of the City of San Rafael. The proposed changes to the campus would not result in the physical division of an established community. The campus would remain a high school campus and facilities would be upgraded and replaced.
- *Conflict with any applicable habitat conservation plan or natural community conservation plan.* No habitat conservation plan or natural community conservation plan applies to the SRHS campus. Impacts on biological resources are addressed in Section 4.3, Biological Resources, of this EIR.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Development in accordance with the Master Facilities Long-Range Plan would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan, specific plans, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

Development in accordance with the Master Facilities Long-Range Plan would not conflict in any significant way with established policies of the San Rafael General Plan. As discussed in Chapter 1, Introduction, of this EIR, pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to a proposed classroom facilities project. Even though the District adopted Resolution No. 169.1, dated June 27, 2016, pursuant to Section 53094 exempting the Master Facilities Long-Range Plan, including the Stadium Project, and the SRHS campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City's Municipal Code, the City's General Plan, and related ordinances and regulations that otherwise would be applicable, this EIR evaluates the project's consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District's goal that local policies and regulations be acknowledged and adhered to as much as feasible.

Policy NH-8 of the San Rafael General Plan addresses the need for landscaping of parking areas, an issue that is addressed in Section 4.1, Aesthetics, of the Draft EIR. Refer to Mitigation Measure AESTHETICS-1f, which addresses landscaping of campus parking areas.

Policy/Program NH-124 of the San Rafael General Plan addresses the potential for a neighborhood park at the south end of the stadium area on the SRHS campus or in the area of the campus now used for the San Rafael City Schools Maintenance Facility. A neighborhood park is not currently proposed because the Maintenance Facility continues in use for the District, and the south end of the Stadium Project is proposed for a landscaped parking area. See further discussion in Section 4.15, Recreation, of this EIR.

Program NH-126a addresses new drop-off areas for San Rafael High School. Section 4.12, Transportation and Traffic, of this EIR addresses circulation and drop-off issues. Refer to Impact TRANS-1 and Mitigation Measure TRANS-1.

The project would not conflict with City zoning, and new buildings would be within the height limit of 36 feet allowed by the P/QP district.

Overall, policy conflicts would be less than significant.

Potentially Significant Impacts

Development in accordance with the Master Facilities Long-Range Plan would not result in any potentially significant impacts related to land use and planning.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

The Stadium Project would not conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to, the General Plan, specific plans, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

This impact would be less than significant for the reasons discussed above for the Master Facilities Long-Range Plan. New landscaping would be added to the parking area proposed for the Stadium Project. No mitigation measures would be necessary.

Potentially Significant Impacts

The Stadium Project would not have any potentially significant impacts related to land use and planning.

CUMULATIVE IMPACTS

For land use and planning, the geographic scope for assessing cumulative impacts is the area within the campus environs and the immediate vicinity. The main project in the vicinity of the SRHS campus is the San Rafael Corporation Yard (Site No. 16 in Figure 6-2 in Chapter 6, CEQA Considerations, of this EIR) where, over the long term, up to 40 units of senior housing could be provided. This housing has been identified in the San Rafael General Plan but has not been approved. The Master Facilities Long-Range Plan, including the Stadium Project, and in conjunction with this potential future housing project, would not result in any significant land use and planning impacts. Mitigation measures recommended in other sections of this EIR, such as Section 4.1, Aesthetics, and Section 4.12, Transportation and Traffic, would help to reduce the potential for the Long-Range Plan to create policy conflicts.

For these reasons, the SRHS Master Facilities Long-Range Plan, including the Stadium Project, would not result in or contribute to any significant cumulative land use impacts.

4.9.5 REFERENCES

California Government Code, Section 53094.

CEQA Guidelines, Appendix G.

City of San Rafael, 2016. Municipal Code of the City of San Rafael. Website: https://www.municode.com/library/ca/san_rafael/codes/code_of_ordinances?nodeId=TIT14ZO_DIVIIBADIRE_CH14.09PUQUBLDIPQP, accessed November 8.

City of San Rafael, 2013. *The City of San Rafael General Plan 2020*, amended and reprinted January 18.

Marin County, 2016. Website illustrating zoning and General Plan designations for County lands. Website: http://gis.marinpublic.com/Html5Viewer/Index.html?viewer=zonelookup, accessed November 8.

Marin County, 2012. Marin County Development Code, Title 22. Website: http://www.marincounty.org/~/media/files/departments/cd/planning/currentplanning/publications/marin-county-development-code/devcode_2013.pdf, accessed November 8.

San Rafael City Schools, 2016. Resolution No. 169.1, June 27.

4.10 NOISE

4.10.1 INTRODUCTION

This section provides a summary of noise and vibration terminology and describes the current noise setting in the vicinity of the San Rafael High School (SRHS) campus, relevant guidance, or rules for evaluating and regulating noise and vibration, and a noise and vibration impact assessment of the Master Facilities Long-Range Plan, including the Stadium Project. This noise and vibration impact analysis was performed on a program level for the Master Facilities Long-Range Plan as a whole and on a project level for one of the Master Facilities Long-Range Plan elements, the proposed Stadium Project. The impacts examined include temporary noise and vibration impacts during construction, noise generated during the use of the stadium, and noise generated during the operation of the school after construction of the Master Facilities Long-Range Plan is complete. The impact analysis identifies program-level, project-level, and cumulative environmental impacts, as well as feasible mitigation measures that would reduce or avoid the identified impacts.

4.10.2 ENVIRONMENTAL SETTING

NOISE AND VIBRATION TERMINOLOGY

Noise

Noise is commonly defined as unwanted sound that annoys or disturbs people and can have an adverse psychological or physiological effect on human health. The effects of noise on people can be grouped into three general categories: 1) subjective effects of annoyance, nuisance, and dissatisfaction; 2) interference with such activities as speech and sleeping; and 3) physiological effects, such as hearing loss.

Sound is measured in decibels (dB), which is a logarithmic scale. Decibels describe the purely physical intensity of sound based on changes in air pressure, but they cannot accurately describe sound as perceived by the human ear since the human ear is only capable of hearing sound within a limited frequency range. Therefore, the frequency of a sound must be taken into account when evaluating the potential human response to sound. For this reason, a frequency-dependent weighting system is used to account for the relative loudness perceived by the human ear. This system is referred to as A-weighted decibels (dBA). Decibels and other technical terms are defined in **Table 4.10-1**, below.

In unconfined space, such as outdoors, noise attenuates with distance according to the inverse square law. Noise levels at a known distance from point sources are reduced by 6 dBA for every doubling of that distance for hard surfaces, such as cement or asphalt surfaces, and 7.5 dBA for every doubling of distance for soft surfaces, such as undeveloped or vegetative surfaces (Caltrans,

TABLE 4.10-1 DEFINITION OF ACOUSTICAL TERMS

Term	Definitions
Decibel (dB)	A unit describing the amplitude of sound on a logarithmic scale. Sound described in decibels is usually referred to as sound or noise "level." This unit is not used in this analysis because it includes frequencies that the human ear cannot detect.
Vibration Decibel (VdB)	A unit describing the amplitude of vibration on a logarithmic scale.
Frequency (Hz)	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Noise	Unwanted sound.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level during the measurement period. For this California Environmental Quality Act (CEQA) evaluation, L_{eq} refers to a one-hour period unless otherwise stated.
L_{max}	The maximum A-weighted sound level during the measurement period.
L_n	The sound pressure level exceeded for n percent of the time. For n percent of the time, the fluctuating sound pressure levels are higher than the Ln level.
Day/Night Noise Level (L_{dn})	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured during the night between 10:00 PM and 7:00 AM.
Community Noise Equivalent Level (CNEL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 to 10:00 PM and after addition of 10 decibels to sound levels during the night between 10:00 PM and 7:00 AM.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Peak Particle Velocity (PPV)	The maximum instantaneous peak of a vibration signal.
Root Mean Square (RMS) Velocity	The average of the squared amplitude of a vibration signal.

Source: Charles M. Salter Associates, 1998. Acoustics – Architecture, Engineering, the Environment. Federal Transit Administration, 2006. Transit Noise and Vibration Impact Assessment (FTA-VA-90-1003-06).

1998). Noise levels at a known distance from line sources (such as traffic noise) theoretically decrease at a rate of 3 dBA for every doubling of the distance for hard surfaces and 4.5 dBA for every doubling of distance for soft surfaces (Caltrans, 1998). Greater decreases in noise levels can result from the presence of intervening structures, buffers, or topography. Typical A-weighted noise levels at specific distances are shown for different noise sources in **Table 4.10-2**.

TABLE 4.10-2 TYPICAL SOUND LEVELS MEASURED IN THE ENVIRONMENT AND INDUSTRY

Noise Source (Distance in Feet)	A-Weighted Sound Level (dBA)
Jet Takeoff (200)	112
Subway Train (30)	100
Truck/Bus (50)	85
Vacuum Cleaner (10)	70
Automobile (50)	65
Normal Conversation (3)	65
Whisper (3)	42

Source: Charles M. Salter Associates, 1998. Acoustics – Architecture, Engineering, the Environment.

A typical method for determining a person's subjective reaction to a new noise is by comparing it to existing conditions. The following describes the general effects of noise on people (Charles M. Salter Associates, 1998):

- A change of 1 dBA cannot typically be perceived, except in carefully controlled laboratory experiments;
- A 3-dBA change is considered a just-perceivable difference;
- A minimum of a 5-dBA change is required before any noticeable change in community response is expected; and
- A 10-dBA increase is subjectively perceived as approximately a doubling in loudness.

It should be noted that because decibels are based on a logarithmic scale, they cannot be added or subtracted in the usual arithmetical way. For instance, if one noise source emits a sound level of 90 dBA, and a second source, placed beside the first, emits a sound level of 90 dBA, the combined sound level is 93 dBA, not 180 dBA. When the difference between two co-located sources of noise is 10 dBA or more, the higher noise source dominates and the lower noise source makes no perceptible difference in what can be heard or measured. For example, if the noise level is 95 dBA, and another noise source is added that produces a noise level of 80 dBA, the noise level will still be 95 dBA.

Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Several different methods are used to quantify vibration. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Sensitive receptors to vibration include structures (especially older masonry structures), people (especially residents, the elderly, and sick), and vibration-sensitive equipment. Vibration amplitudes are usually expressed as either peak particle velocity (PPV) or the root mean square (RMS) velocity. The PPV is defined as the maximum instantaneous peak of the vibration signal. PPV is appropriate for evaluating potential damage to buildings, but it is not suitable for evaluating human response to vibration because it takes the human body time to respond to vibration signals. The response of the human body to vibration is dependent on the average amplitude of a vibration. The RMS of a signal is the average of the squared amplitude of the signal and is more appropriate for evaluating human response to vibration. PPV and RMS are normally described in units of inches per second (in/sec), and RMS is also often described in vibration decibels (VdB).

SRHS CAMPUS SETTING

Sensitive Receptors

Sensitive receptors are defined as land uses where noise-sensitive people may be present or where noise-sensitive activities may occur. Examples of noise-sensitive land uses include residences, schools, hospitals, and retirement homes. Examples of noise-sensitive activities are those that occur in locations such as churches and libraries. There are potential sensitive receptors located both on-campus and off-site. On-campus sensitive receptors are SRHS classrooms. Off-site sensitive receptors include: 1) residences along Mission Avenue and Embarcadero Way, located approximately 40 feet at the closest distance to the north and east of the SRHS campus; and 2) retirement homes on 4th Street (San Rafael Commons), located approximately 60 feet at the closest distance to the west of the SRHS campus. Commercial land uses are located approximately 90 feet south of the SRHS campus on 3rd Street and approximately 60 feet west on Union Street but are not considered noise-sensitive receptors because noise-sensitive activities do not occur at these locations.

Ambient Noise and Vibration

General Conditions

The primary sources of noise in San Rafael are traffic on highways and local roadways, the Sonoma-Marin Area Rail Transit (SMART) corridor, airports/heliports, and the San Rafael Rock Quarry. The primary sources of noise at the SRHS campus are: 1) traffic on Mission Avenue, which runs east to west adjacent to the northern boundary of the SRHS campus; 2) traffic on 3rd Street, which runs east to west adjacent to the southern boundary of the SRHS campus; and 3) traffic on Highway 101, which runs north to south, located approximately 1,600 feet west of the SRHS campus. There are no identified sources of perceptible vibration on or near the SRHS campus.

Based on the estimated 2001 and 2020 traffic noise level contours presented in Appendices G and H of the San Rafael General Plan (City of San Rafael, 2013), both current and future noise levels at the SRHS campus from traffic on Highway 101 range from between 60 dBA L_{dn} at the northern and eastern portions of the SRHS campus (those farthest from Highway 101) to 65 dBA L_{dn} at the southern and western portions of the SRHS campus (those closest to Highway 101). Current and estimated future noise levels from traffic on 3rd Street are approximately 75 dBA L_{dn} within 40 feet of 3rd Street; current and future noise levels from traffic on 3rd street at the nearest classroom to 3rd Street (Building L in Figure 3-4 in Chapter 3, Project Description, of this EIR) are approximately 65 dBA L_{dn}. Mission Avenue east of Mary Street borders the SRHS campus to the north, and

Embarcadero Way borders the SRHS campus to the east; these roads are not considered major roadways, and therefore noise contours are not provided for them in the San Rafael General Plan.

The ambient noise environment surrounding the SRHS campus is dominated by traffic along local roadways and Highway 101, except during the periods when the stadium is used for events that draw crowds and require the use of the public address (PA) system. During these events, the stadium is the dominant noise source in the vicinity of the SRHS campus. The noise generated by a typical stadium event that draws crowds and requires the use of the PA system is described under “Noise Monitoring Survey” below. Outside of these events, the activities at the SRHS campus consist of students travelling to and from the campus by foot, bike, car, and bus; students attending classes; and students participating in after-school programs. These activities are not a substantial source of noise outside of the SRHS campus because the number of students that travel to and from school by car or bus make up only a small fraction of vehicular and bus traffic on surrounding roadways, particularly 3rd Street, which is a major roadway and the access road to the largest SRHS parking lot. In addition, most school activities take place indoors and are not audible outside of the buildings in which they occur. Lastly, outdoor activities that do not require the use of the PA system or draw large crowds, such as students moving between buildings and students participating in sports practices, are dominated by people talking, with some yelling and the use of whistles, and these are not sources of noise that would make a substantial contribution to the noise environment outside of the SRHS campus, particularly relative to the surrounding traffic-generated noise levels.

The SMART corridor is not a primary source of noise at the SRHS campus because the SRHS campus is located approximately 0.3 mile east of the SMART corridor and is separated from the SMART corridor by Highway 101, as well as multiple rows of buildings. The San Rafael Airport is located approximately 3 miles north of the SRHS campus, and a heliport is located approximately 2 miles southeast of the SRHS campus. The SRHS campus is located outside of the 60 dBA L_{dn} contour line of both San Rafael Airport and the heliport (City of San Rafael, 2013). The San Rafael Rock Quarry is located approximately 3 miles northeast of the SRHS campus. According to the San Rafael Rock Quarry EIR (ESA, 2009), quarry operations were not audible at Point San Pablo Yacht Harbor, which is located 2 miles east of the quarry; there are no structures or topographic features shielding the Point San Pablo Yacht Harbor from noise generated by quarry operations. Because the SRHS campus is more than 2 miles from the quarry, and because existing topographical features could potentially serve to attenuate noise generated by quarry operations, quarry operations are not expected to be audible at the SRHS campus.

Noise Monitoring Survey

An ambient noise monitoring survey was conducted in the vicinity of the SRHS campus by BASELINE Environmental Consulting on Friday October 21, 2016, to characterize the noise levels generated by a varsity football game (considered the activity type likely to generate highest noise levels) held at the stadium. The measurements were collected at the nearest residential and commercial receptors to the stadium (see “Residential” and “Commercial” markers in **Figure 4.10-1**). The residential location was adjacent to Embarcadero Way, approximately 50 feet east of the fence line of the campus and approximately 75 feet east of the fence line of the stadium. The commercial location was in a parking lot south of Embarcadero Way, approximately 125 feet south of the fence line of the school and approximately 215 feet south of the fence line of the stadium. The weather was clear throughout the game. At the start of the game at 7:00 PM, the temperature

Figure 4.10-1

NOISE MEASUREMENT LOCATIONS

SOURCE: Google Earth, 2016; BASELINE Environmental Consulting, Inc., 2016

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

was 68 degrees Fahrenheit, with humidity of 67 percent, northwest wind at 9 miles per hour, and pressure of 29.9 inches. At the end of the game at 9:00 PM, the temperature was 63 degrees Fahrenheit, with humidity of 73 percent, northwest wind at 4 miles per hour, and pressure of 29.9 inches.

One 34-minute measurement was collected at the residential location, encompassing the first quarter of play. Another 52-minute measurement was collected at the residential location, encompassing the second quarter of play and the half-time period, when a show was performed by the cheerleading teams to amplified music. A final 30-minute measurement was collected at the commercial location, encompassing the final quarter of play. Throughout the measurement periods, notes were taken on the sources of noise and when they occurred in order to be able to isolate the sources of the maximum noise levels. Sources of noise during the game were the announcer on the PA system, music played over the PA system, crowd cheering, air horns, whistles, and the school band playing. The results are summarized in **Table 4.10-3**.

TABLE 4.10-3 SUMMARY OF FOOTBALL GAME MEASUREMENT DATA

Noise Measurement Location: Time Period	Measured Noise Level, dBA			
	L_{eq}	L_{101}	L_{max}	L_{max} Source of Noise
Residential: First-Quarter	63.7	67.0	75.4	Announcer over PA system
Residential: Second-Quarter and Half-Time	65.4	68.0	81.7	Touchdown – Announcer over PA system and crowd cheers
Commercial: Fourth-Quarter	57.3	61.5	70.8	Touchdown – Announcer over PA system, crowd cheers, air horns

Note: For 10 percent of the time, the fluctuating sound pressure levels were higher than the L10 level.
Source: BASELINE, 2016.

4.10.3 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

Federal regulations establish noise limits for medium and heavy trucks weighing more than 4.5 tons (gross vehicle weight rating) under 40 Code of Federal Regulations (CFR), Part 205(B). Under this regulation, the truck pass-by noise standard is 80 dBA at 15 meters from the vehicle pathway center line. These controls are implemented through regulatory controls on truck manufacturers.

STATE REGULATIONS

California Noise Control Act

Sections 46000 to 46080 of the California Health and Safety Code codify the California Noise Control Act (CNCA) of 1973. The CNCA established the Office of Noise Control under the California Department of Health Services. The CNCA required that the Office of Noise Control adopt, in coordination with the Office of Planning and Research, guidelines for the preparation and content of noise elements for general plans. The most recent guidelines are contained in General Plan Guidelines, published by the California Office of Planning and Research in 2003 (OPR, 2003). The document provides guidelines for cities and counties to use in their general plans to reduce conflicts between land use and noise.

California Occupational Safety and Health Administration (Cal/OSHA)

Noise exposure of construction workers is regulated by the California Occupational Safety and Health Administration (Cal/OSHA). Title 8, Subchapter 7, Group 15, Article 105 of the California Code of Regulations (Control of Noise Exposure) sets noise exposure limits for workers and requires employers who have workers who may be exposed to noise levels above these limits to establish a hearing conservation program, make hearing protectors available, and keep records of employee noise exposure measurements.

LOCAL REGULATIONS

San Rafael General Plan

The following relevant policies and programs are contained within the San Rafael General Plan Noise Element (City of San Rafael, 2013):

Policy N-1 **Noise Impacts on New Development.** Protect people in new development from excessive noise by applying noise standards in land use decisions. Apply the Land Use Compatibility Standards (see **Table 4.10-4**) to the siting of new uses in existing noise environments. These standards identify the acceptability of a project based on noise exposure. If a project exceeds the standards in **Table 4.10-4,** an acoustical analysis shall be required to identify noise impacts and potential noise mitigations. Mitigation should include the research and use of state-of-the-art abating materials and technology.

Policy N-3 **Planning and Design of New Development.** Encourage new development to be planned and designed to minimize noise impacts from outside noise sources.

Program N-3a **Noise Mitigation.** Require, where appropriate, the following mitigation measures to minimize noise impacts on proposed development projects:

1. *Site Planning.* Proper site planning is the first mitigation measure that should be investigated to reduce noise impacts. By taking advantage of the natural shape and terrain of the site, it often is possible to arrange the buildings and other uses in a manner that will reduce and possibly eliminate noise impacts. Specific site planning techniques include:

TABLE 4.10-4 LAND USE COMPATIBILITY STANDARDS FOR NEW DEVELOPMENT

	Exterior Noise Exposure to the Site L_{dn} (Db)						
Land Use	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**75-80**	**80+**
Residential, Hotels, Motels							
Schools, Libraries, Churches, Hospitals, Nursing Homes							
Auditoriums, Concert Halls, Amphitheaters							
Sports Arena, Outdoor Spectator Sports							
Playgrounds, Neighborhood Parks							
Other Outdoor Recreation and Cemeteries							
Office and Other Commercial Uses							
Industrial, Manufacturing, Utilities, Agriculture							
	Interior Noise Exposure to the Site L_{dn} (Db)						
	35-40	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65+**
Bedrooms in Residential units not in Downtown							
Other Rooms in Residential Units not in Downtown							
Bedrooms in Residential units in Downtown							
Hotels, Motels, Downtown Multifamily							

Key:

Normally Acceptable – Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable – Specific land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design.

Clearly Unacceptable – New construction of development clearly should not be undertaken.

Source: City of San Rafael, 2013.

a. Increasing the distance between the noise source and the receiver;

b. Placing non-noise sensitive land uses such as parking lots, maintenance facilities, and utility areas between the source and the receiver;

c. Using non-noise sensitive structures such as garages to shield noise-sensitive areas; and

d. Orienting buildings to shield outdoor spaces from a noise source.

3. *Architectural Layout of Buildings.* In many cases, noise reduction can be attained by careful layout of noise-sensitive spaces. Bedrooms, for example, should be placed away from freeways. Quiet outdoor spaces can be provided next to a noisy highway by creating a U-shaped development, which faces away from the highway.

4. *Noise Barriers.* Absorptive types of noise barriers or walls should be used to reduce noise levels from ground transportation noise sources and industrial sources. A barrier must interrupt the line of sight between the noise source and the receiver in order to reduce noise level both outdoors and indoors. A barrier should provide at least L_{dn} 5 dB of noise reduction to achieve a noticeable change in noise levels.

5. *Construction Modifications.* If site planning, architectural layout, noise barriers, or a combination of these measures does not achieve the required noise reduction, then mitigation should be facilitated through construction modification to walls, roofs, ceilings, doors, windows.

6. *Alternatives to Sound Walls.* Encourage new development to identify alternatives to the use of sound walls to ease noise impacts.

Policy N-4 **Noise from New Nonresidential Development.** Design nonresidential development to minimize noise impacts on neighboring uses.

a. *Performance Standards for Uses Affecting Residential Districts.* New nonresidential development shall not increase noise levels in a residential district by more than 3 dB L_{dn}, or create noise impacts that would increase noise levels to more than 60 dB L_{dn} at the property line of the noise receiving use, whichever is the more restrictive standard.

b. *Performance Standards for Uses Affecting Nonresidential and Mixed Use Districts.* New nonresidential projects shall not increase noise levels in a nonresidential or mixed-use district by more than 5 dB L_{dn}, or create noise impacts that would increase noise levels to more than 65 dB L_{dn} (Office, Retail) or 70 dB L_{dn} (Industrial), at the property line of the noise receiving use, whichever is the more restrictive standard.

c. *Waiver.* These standards may be waived if, as determined by an acoustical study, there are mitigating circumstances (such as higher existing noise levels), and no uses would be adversely affected.

Program N-4a **Require Acoustical Study.** Identify through an acoustical study noise mitigation measures to be designed and built into new nonresidential and mixed-use development, and encourage absorptive types of mitigation measures between noise sources and residential districts.

Policy N-5 **Traffic Noise from New Development.** Minimize noise impacts of increased off-site traffic caused by new development. Where the exterior L_{dn} is 65 dB or greater at a residential building or outdoor use area, and a plan, program, or project increases traffic noise levels by more than L_{dn} 3 dB, reasonable noise mitigation measures shall be included in the plan, program or project.

Program N-5a **Traffic Noise Studies.** Require acoustical studies to evaluate potential off-site noise impacts resulting from traffic generated by new development.

Policy N-9 **Nuisance Noise.** Minimize impacts from noise levels that exceed community sound levels.

Program N-9b **Mitigation for Construction Activity Noise.** Through environmental review, identify mitigation measures to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity.

San Rafael Municipal Code

The San Rafael Municipal Code contains the following relevant requirements (presented in summary form here):

Chapter 8.13 – Noise

Section 8.13.040 – General Noise Limits. Subject to the exceptions and exemptions set forth in Sections 8.13.050 and 8.13.060, the general noise limits set forth in this section shall apply. A summary of the general noise limits not to be exceeded at the property plane of the receiving property types or zones is presented in **Table 4.10-5.**

TABLE 4.10-5 GENERAL NOISE LIMITS ESTABLISHED BY SAN RAFAEL MUNICIPAL CODE

Property Type or Zone	Daytime Limits	Nighttime Limits
Residential	60 dBA Intermittent 50 dBA Constant	50 dBA Intermittent 40 dBA Constant
Mixed-use	65 dBA Intermittent 55 dBA Constant	55 dBA Intermittent 45 dBA Constant
Multifamily residential (interior sound source)	40 dBA Intermittent 35 dBA Constant	35 dBA Intermittent 30 dBA Constant
Commercial	65 dBA Intermittent 55 dBA Constant	65 dBA Intermittent 55 dBA Constant
Public Property	Most restrictive noise limit applicable to adjoining private property	Most restrictive noise limit applicable to adjoining private property

Note: "Daytime" means the period between 7:00 AM and 9:00 PM Sunday through Thursday and between 7:00 AM and 10:00 PM on Friday and Saturday. "Nighttime" means the period between 9:00 PM and 7:00 AM Sunday through Thursday and between 10:00 PM and 7:00 AM on Friday and Saturday.
Intermittent sound is defined as L_{max} and constant sound is defined as L_{eq}.
Source: San Rafael Municipal Code Section 8.13.040.

Section 8.13.050 – Standard exceptions to general noise limits. A summary of the standard exceptions applicable to the proposed project provided in this section is set forth in **Table 4.10-6.**

TABLE 4.10-6 STANDARD EXCEPTIONS TO GENERAL NOISE LIMITS ESTABLISHED BY SAN RAFAEL MUNICIPAL CODE

Type of Activity	Maximum Noise Level	Days/Hours Permitted
Construction	90 dBA (at any point outside of the construction property plane)[a]	Monday-Friday 7:00 AM-6:00 PM Saturday 9:00 AM-6:00 PM Sunday, Holiday—prohibited or as otherwise set by city approval
Sound performances	80 dBA measured 50 feet or more from property plane, or as excepted by permit approval	Every day 10:00 AM-10:00 PM, or as excepted by permit approval

[a] Property plane means a vertical plane including the property line that determines the property boundaries in space.
Source: San Rafael Municipal Code Section 8.13.050.

Section 8.13.060 – Exceptions allowed with permit. In addition to the standard exceptions permitted pursuant to Section 8.13.050, the director of community development or his designee may grant a permit allowing an exception from any or all provisions of this chapter where the applicant can show that a diligent investigation of available noise abatement techniques indicates that immediate compliance with the requirements of this chapter would be impractical or unreasonable, or that no public detriment will result from the proposed exception.

Section 8.13.070 – Exemptions. Uses established through any applicable discretionary review process containing specific noise conditions of approval and/or mitigation measures.

Chapter 14.16 – Site and Use Regulations

Section 14.16.260 – Noise standards. Any new development located in a “conditionally acceptable” or “normally unacceptable” noise exposure area, based on the land use compatibility chart standards in the general plan, shall require an acoustical analysis. Noise mitigation features shall be incorporated where needed to assure consistency with general plan standards. New construction is prohibited in noise exposure areas where the land use compatibility chart indicates the noise exposure is “clearly unacceptable.”

Section 14.16.260 also provides performance standards for noise from new nonresidential development consistent with General Plan Policy N-4, and traffic noise standards consistent with General Plan Policy N-5, which requires projects that are located in residential areas where ambient noise levels are 65 dBA Ldn or greater, and that have the potential to increase traffic noise levels by more than 3 dBA Ldn, to implement reasonable noise mitigation measures.

Applicability of Local Regulations

As discussed in Chapter 1, Introduction, of this EIR, pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to a proposed classroom facilities project. Even though the District adopted Resolution No. 169.1, dated June 27, 2016, pursuant to Section 53094 exempting the Master Facilities Long-Range Plan, including the Stadium Project, and the SRHS campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City’s Municipal Code, the City’s General Plan, and related ordinances and regulations that otherwise would be applicable, this EIR evaluates the project’s consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District’s goal that local policies and regulations be acknowledged and adhered to as much as feasible.

4.10.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this evaluation and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a potentially significant noise or vibration impact if it would:

a) Expose persons to or generate noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

b) Expose persons to or generate excessive ground-borne vibration or ground-borne noise levels;

c) Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

d) Result in a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels; or

f) For a project within the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

THRESHOLDS OF SIGNIFICANCE

The CEQA significance criteria above are qualitative guidelines and do not provide quantitative thresholds against which noise and vibration impacts can be evaluated. Although San Rafael City Schools is exempt from local standards pursuant to Resolution No. 169.1, dated June 27, 2016, quantitative thresholds based on the limits and performance standards of the San Rafael General Plan and the San Rafael Municipal Code were applied in this analysis to evaluate whether development under the Master Facilities Long-Range Plan, including the Stadium Project, would generate noise and vibration levels that are inconsistent with the surrounding community's character. The following thresholds were used to evaluate the significance of environmental noise and vibration resulting from the implementation of the Master Facilities Long-Range Plan, including the Stadium Project:

- **Construction Noise:** A significant noise impact would be identified if construction occurred outside of the hours specified in the San Rafael Municipal Code or if exterior noise levels at the SRHS campus (on-campus receptors) would 1) exceed 90 dBA L_{max} at any point outside of the construction property plane, and 2) exceed 70 dBA L_{eq} at noise-sensitive land uses.[1]
- **Vibration:** A significant vibration impact would be identified if the project would generate vibration levels that exceed the following Federal Transit Administration (FTA) recommended vibration thresholds to prevent disturbance to people and damage to buildings (FTA, 2006):
  - 83 VdB at any SRHS campus classrooms and off-site commercial receptors;
  - 80 VdB at any off-site sensitive receptors; or
  - 0.3 in/sec PPV because of the potential to result in cosmetic damage to buildings of normal conventional construction.

[1] In this analysis, interior noise levels of 45 dBA L_{eq} are considered normally acceptable for school buildings and residential rooms. A typical building facade with windows closed provides a noise level reduction of approximately 25 dBA (Charles M. Salter Associates, 1998). Therefore, exterior construction-generated noise levels of 70 dBA L_{eq} are considered normally acceptable for school buildings and residential rooms.

- **Land Use Compatibility:** A significant land use compatibility impact would be identified if exterior noise would exceed 75 dBA L_{dn} at outdoor spectator sport facilities, or if exterior noise would 1) exceed 60 dBA L_{dn} levels at SRHS campus classrooms, and (2) interior noise would exceed 45 dBA L_{dn} inside of classrooms.
- **Sound Performances:** A significant noise impact to nearby receptors would be identified if sound-generating devices or instruments used in outdoor events would exceed a noise level of 80 dBA at a distance of 50 feet or more from the property plane, or are used between the hours of 10:00 PM and 10:00 AM.
- **Operational Noise:** Based on the results of the noise level survey and the noise levels contours presented in the San Rafael General Plan, ambient noise levels in the vicinity of the SRHS campus meet or exceed both the constant and intermittent noise level threshold in Table 4.10-5. Noise levels are equal to approximately 60 dBA L_{dn} at existing residential areas to the north and east of the SRHS campus and approximately 65 dBA L_{dn} at commercial and mixed use areas to the south and west of the SRHS campus. San Rafael Municipal Chapter 8.13 indicates that nonresidential development should not increase noise levels to more than 60 dBA L_{dn} at residential areas or more than 65 dBA L_{dn} at commercial or mixed use areas. Therefore, a significant noise impact would be identified if the proposed project would generate a perceptible increase in noise levels.
- **Traffic Noise:** Where exterior noise levels are 65 dBA L_{dn} or greater, a significant noise impact would be identified if the proposed project would increase traffic noise levels by more than 3 dBA L_{dn}.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Airport/Airstrip Noise

The Master Facilities Long-Range Plan would not result in any noise impacts from airports or private airstrips.

San Rafael Airport is located approximately 3 miles north of the SRHS campus and a heliport is located approximately 2 miles southeast of the SRHS campus. As described above, the SRHS campus is located outside of the 60 dBA L_{dn} contour line of both San Rafael Airport and the heliport (City of San Rafael, 2013). Noise from San Rafael Airport and the heliport was not audible during the noise monitoring survey. Therefore, the potential for implementation of the Master Facilities Long-Range Plan to expose people residing or working in the project area to excessive noise levels from airports or private airstrips is less than significant.

Potentially Significant Impacts

Generation of or Exposure to Permanent Noise Increases

Impact NOISE-1: Development under the Master Facilities Long-Range Plan could expose persons to or generate a permanent increase in ambient noise levels in excess of standards

established in the local general plan or noise ordinance, or applicable standards of other agencies. (PS)

As described in Chapter 3, Project Description, of this EIR, implementation of the Master Facilities Long-Range Plan would add about 200 new students to the current enrollment of 1,125 students, which would be an increase of about 17.7 percent. In addition, the Master Facilities Long-Range Plan would demolish 12 buildings, and develop the following new facilities:

Elements that are addressed at the program level of detail:

- Science Building (to also house Madrone High Continuation School on first floor) (Building No. 1)
- Administration/Kitchen/Student Commons Building, Four Classrooms and Conference Space (Building No. 2)
- Career and Technical Education (CTE)/Art Building (Building No. 3)
- Classrooms/Ceramics/Theater (Building No. 4)
- Wrestling/Dance/Classrooms/Offices (Building No. 7)
- Restroom/Changing Rooms (Building No. 8)

In addition, Buildings A (Administration/Theater/Classrooms), D (classrooms/Library), and K (Head Start) would be modernized, and this modernization is addressed at a program level of detail.

Elements associated with the proposed Stadium Project, which is addressed at the project level of detail:

- Concessions (Building No. 5)
- Christmas tree sales lot concession (seasonal)[2]
- ASB Concession Stand
- Restrooms/Changing Rooms (Building No. 6)
- Bleachers (Building No. 9)
- Restrooms (Building No. 10)
- Parking lot and new driveway
- Ticket booth
- Various storage buildings
- Press box (announcer's booth)
- Welcome plaza

The existing bleachers (Building V), announcer's box (Building X), Concession Stand (Building Y), and Ticket Booth (Building Z) would be demolished under the proposed Stadium Project.

With the exception of the Stadium Project, the primary use of the facilities that would be constructed under the Master Facilities Long-Range Plan would be indoors and would not have the potential to increase ambient noise levels. Sports games held in the stadium would generate the highest noise levels relative to the new facilities proposed. However, because sports games are held intermittently and are limited in duration, the Stadium Project would not contribute to a sustained permanent increase in ambient noise levels. The long-term periodic noise impact from

[2] The Christmas tree lot is an on-going annual 3-week major fund raiser for SRHS.

the Stadium Project is discussed under Impact NOISE-5 (see "Impacts of Proposed Stadium Project," below).

Three potential permanent noise impacts could result from implementation of the Master Facilities Long-Range Plan:

1. Traffic-generated noise could increase due to increased student population;
2. The new facilities proposed under the Master Facilities Long-Range Plan could be located in an area that exceeds the land use compatibility standards described in the San Rafael General Plan; and
3. The installation of new mechanical heating, ventilation, and air conditioning (HVAC) systems could increase ambient noise levels.

Although San Rafael City Schools is exempt from local standards pursuant to Resolution No. 169.1, dated June 27, 2016, this EIR evaluates the project's consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District's goal that local policies and regulations be acknowledged and adhered to as much as feasible. Accordingly, these three potential impacts are discussed below.

Traffic Noise Impact

3rd Street is the only roadway near the SRHS campus where traffic noise levels are 65 dBA Ldn or greater. Based on the additive properties of noise discussed under Section 4.10.2, Environmental Setting, above, a doubling in traffic volumes along 3rd Street would be required to result in a perceptible increase in noise levels, i.e., a doubling of traffic would result in a 3 dBA increase in traffic noise levels. The proposed 17.7 percent increase in the number of students attending the school under the Master Facilities Long-Range Plan would generate up to 200 new peak-hour vehicle trips traveling to and from the school; this trip increase would represent less than a 17.7 percent increase in peak-hour trips along 3rd Street when added to non SRHS-related traffic (Parisi Transportation Consulting, 2016), and consequently would not have the potential to generate a perceptible increase in traffic noise. Similarly, peak-hour traffic to and from the Stadium Project is anticipated to increase by approximately 38 percent, which would not have the potential to generate a perceptible increase in traffic noise. Therefore, the noise from an increase in traffic due to implementation of the Master Facilities Long-Range Plan would be less than significant.

Conflict with Land Use Compatibility Standards

Based on the San Rafael General Plan noise level contours, noise levels across the SRHS campus range from approximately 60 to 65 dBA L_{dn}. This is a conditionally acceptable noise environment under the City of San Rafael's land use compatibility standards (see Table 4.10-4). Noise levels exceed 65 dBA L_{dn} in close proximity to 3rd Street; however, they are approximately 65 dBA L_{dn} at the nearest existing classroom, and the Master Facilities Long-Range Plan would not result in development of new classrooms nearer to 3rd Street than existing classrooms. On a school campus, noise levels inside of classrooms are of primary concern to ensure that students, teachers, and staff have an appropriate environment for learning and teaching. A typical building façade with windows closed provides a noise level reduction of approximately 25 dBA (Charles M. Salter Associates, 1998). Therefore, noise levels inside of the proposed new buildings would range from approximately 35 to 40 dBA L_{dn}. This is an acceptable interior noise environment for even the most sensitive land uses in San Rafael, including bedrooms (see Table 4.10-4). Furthermore, the proposed new buildings are consistent with the current use of the campus. Therefore, the potential of development under the Master Facilities Long-Range Plan to conflict with the City of San Rafael's land use compatibility standards is less than significant.

Mechanical Equipment Noise Impact

The operation of new buildings proposed under the Master Facilities Long-Range Plan would include the use of new and/or modified HVAC systems. Information regarding the noise-generating characteristics and locations of these HVAC systems was not available at the time this analysis was conducted. Without standard controls in place, mechanical equipment noise could potentially affect off-site and on-campus noise-sensitive receptors, and could exceed the general noise limits of the San Rafael Municipal Code (see Table 4.10-5). This is a potentially significant impact. To ensure that appropriate controls on mechanical equipment are implemented, Mitigation Measure NOISE-1 is recommended to reduce this potential impact to a less-than-significant level.

> *Mitigation Measure NOISE-1: San Rafael City Schools shall use mechanical equipment selection and acoustical shielding to ensure that noise levels from the installation/ modification of heating, ventilation, and air conditioning (HVAC) systems do not exceed 45 dBA L_{eq} inside of the nearest on-campus buildings, and do not exceed 60 dBA L_{max}/50 dBA L_{eq} during the daytime and 50 dBA L_{max}/45 dBA L_{eq} during the nighttime at the nearest residential receptors. Controls that would typically be incorporated to attain this outcome include locating equipment indoors or in less noise-sensitive areas, when feasible; selecting quiet equipment; and providing sound attenuators on fans, sound attenuator packages for cooling towers and emergency generators, acoustical screen walls, and equipment enclosures. (LTS)*

Periodic Noise Increases

Impact NOISE-2: Development under the Master Facilities Long-Range Plan could generate periodic increases in ambient noise levels in the project vicinity and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. (PS)

With the exception of the Stadium Project, the primary use of the facilities that would be constructed under the Master Facilities Long-Range Plan would be indoors and would not generate substantial periodic increases in ambient noise levels. Events held at the stadium would have the potential to generate substantial periodic increases in ambient noise level in excess of standards.[3]

As described under the noise monitoring survey discussion in Section 4.10.2, Environmental Setting, above, existing noise generated by a varsity football game inside of the stadium was measured by BASELINE on October 21, 2016 (see Table 4.10-3). The value, timing, and noise source for each exceedance of the 80 dBA standard for sound performances in the San Rafael Municipal Code is presented in **Table 4.10-7** below. This table indicates that noise levels exceeded

[3] Although San Rafael City Schools is exempt from local standards pursuant to Resolution No. 169.1, dated June 27, 2016, this EIR evaluates the project's consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District's goal that local policies and regulations be acknowledged and adhered to as much as feasible.

the 80 dBA standard for 5 seconds of the approximately 80 minutes of noise level measurements collected at the residential location; noise levels did not exceed the 80 dBA standard during the 30 minutes of noise level measurements collected at the commercial location. The use of the PA system and crowd cheers were the primary source of the highest noise levels generated during the football game and were the source of the 5 seconds of threshold exceedance during the game. Based on the results of the noise monitoring survey, it appears that the existing stadium uses have the potential to occasionally and for short durations exceed the sound performance standard.

TABLE 4.10-7 L_{MAX} GREATER THAN 80 DBA MEASURED AT EXISTING STADIUM (OCTOBER 21, 2016)

L_{max} (dBA)	Time (Hour:Minute:Second)	L_{max} Source of Noise
81.7	19:45:50	Touchdown – Announcer over PA system and crowd cheers
80.1	19:45:51	Touchdown – Announcer over PA system and crowd cheers
80.0	19:45:52	Touchdown – Announcer over PA system and crowd cheers
80.0	19:38:23	Crowd cheer
80.7	19:38:25	Crowd cheer

Note: All of the readings that exceeded the 80 dBA L_{max} standard of the San Rafael Municipal Code were collected at the residential measurement location. Exceedances did not occur during the measurement period at the commercial location.
Source: BASELINE, 2016.

Stadium Components

The development of the proposed Stadium Project would include, among other improvements, a parking lot expansion and associated new driveway, new changing rooms/restrooms (Buildings No. 6 and No. 10), bleachers (Building No. 9), track and field (including other improvements, such as replacement of the existing PA system, scoreboard, and lighting), press box, welcome plaza, ticket booth, storage buildings, and concessions stands (Building No. 5, and the smaller ASB concession and Christmas tree lot concession stands). The use of the stadium would continue to be prohibited after 10:00 PM.

The primary use of the new changing room/restroom facilities (Building No. 6 and No. 10), press box, and storage buildings would be indoors and would not have the potential to increase ambient noise levels. The new ticket booth would replace an existing ticket booth (Building Z), and therefore would not be a new use. The new welcome plaza would not contain new activities or uses that would constitute a new source of noise, but would simply create a more pleasant space for people to enter and leave the stadium. Currently, people enter and leave the stadium at the southwest end of the stadium, and the new welcome plaza would also be located at the southwest end of the stadium, and therefore would not substantially alter the movement of people to and from the stadium during events. The new concessions stand (Building No. 5) would replace an existing concessions stand (Building Y), and therefore also would not be a new use. The ASB concession stand and Christmas tree lot concessions stand would not replace existing stands. However, the annual Christmas tree sale is an existing use at the southern end of the stadium, and therefore adding a concession stand to support this existing use would not create a new source of noise.

Further, the primary noise from the new concessions stands, ticket booth, and welcome plaza would be conversations between people, and conversations between people who are outside in a public space are generally not considered a potential noise nuisance. The development of the new bleachers (Building No. 9) in place of the existing bleachers (Building V) would decrease the seating capacity of the stadium from 2,550 to 1,900 seats. The reduced seating capacity would be expected to reduce maximum crowd-generated noise levels at stadium events. The new PA system would replace the existing PA system and would include pole-mounted speakers behind the bleachers, aimed to direct sound toward the bleachers and sidelines of the playing field. The speakers would use advanced electronic and physical audio/acoustic steering technology to direct the sound to the areas where the sound coverage is needed (Monitto, 2016). The use of these advanced PA systems has been found to successfully reduce noise levels generated off-site by 1 to 12 dBA L_{max} (RGD Acoustics, 2016).

The noise monitoring study identified crowd cheering and PA announcements as the most significant sources of noise at the existing stadium. The Stadium Project proposes a reduction in the stadium seating capacity, which would reduce potential crowd-generated noise levels. In addition, the installation of a new more acoustically sophisticated PA system would potentially further decrease noise levels at off-site areas. This is a potentially beneficial impact related to the project. However, if installed improperly, the installation of the proposed PA system could potentially not provide the expected off-site noise benefits. Therefore, the potential impact related to stadium noise is conservatively found to be significant requiring mitigation. To ensure that the speakers are set up appropriately, Mitigation Measure NOISE-2 is recommended to reduce this potential impact to a less-than-significant level.

> *Mitigation Measure NOISE-2: San Rafael City Schools shall consult a qualified acoustical engineer in the design and selection of the new public address (PA) system for the Stadium Project. The qualified acoustical engineer shall confirm that sound is directed toward the field in a manner that reduces noise levels generated by the use of the PA system at approximately 50 feet outside the fence line of the school to below 80 dBA L_{max} to the maximum extent practicable (but in no case shall the new PA system increase noise levels relative to the existing system). (LTS)*

Parking Lot Expansion

The proposed Stadium Project would expand the main parking lot adjacent to 3rd Street by the addition of 39 car spaces and a team bus parking in a grassy area located south of the stadium. The use of the new parking area would not result in a perceptible change in ambient noise levels because cars moving across the new parking area would be required to maintain a low speed. Noise from the interaction of wheels/tires is a significant component of vehicular noise, and the noise generated by this interaction decreases with decreased speed (FTA, 2006, pp 2-6). Vehicles moving at low speeds in the proposed new parking area would generate relatively low levels of noise that would not be audible at either on-campus or off-site receptors relative to the noise levels generated by vehicles moving at higher speeds along 3rd Street. Once parked and turned off, the cars would not generate any noise. Therefore, the potential of the expansion of the proposed parking area to increase ambient noise levels is less than significant.

Change in Number of Annual Stadium Events

The main existing types of events held at the stadium are football, soccer, lacrosse, and track and field practices; football, soccer, lacrosse, and track and field games/meets; special community events; general use of the track and turf for other SRHS sports training; and general use of the track and field by the community when SRHS is not in session or not using the fields. The number of times that the track and field is used for other SRHS sports training (i.e., not football, soccer, lacrosse, or track and field), and community use of the track and field when SRHS is not in session or using the fields, is not anticipated to change as a result of the implementation of the Master Facilities Long-Range Plan. Therefore, these uses would not contribute to a change in ambient noise levels relative to existing conditions.

The number of football practices held at the stadium would increase by 50 events per year, lacrosse games would increase by 30 games per year due to the addition of the SRHS women's lacrosse team program to SRHS's athletic program, and track and field meets would increase by four per year (see Table 3-3 in Chapter 3, Project Description, of this EIR). In addition, the following new special events (school-based) would be held at the stadium under the Master Facilities Long-Range Plan: 1) men's and women's soccer league finals each year on a single Saturday between 3:00 PM and 9:30 PM, 2) men's and women's lacrosse league finals once every 3 years for 1 to 2 days between 3:00 PM and 9:00 PM, and 3) the North Coast Section Redwood Empire track and field meet once every 3 years. The 50 new football practices that would be held at the stadium currently take place on existing fields on the SRHS campus, and the practices held at the stadium would be of similar magnitude and expected to generate similar noise levels as existing football practices. All of the other new events that would be held at the stadium currently do not take place on the SRHS campus, The new lacrosse games could draw in 196 participants and 400 spectators, which is 66 more participants and 1,100 fewer spectators than football games draw. The lacrosse league finals could draw in 75 participants and 800 spectators, which is 55 fewer participants and 700 fewer spectators than football games. Track and field meets, including the North Coast Section Redwood Empire track and field meet, could draw in 150 participants and 500 spectators, which is 20 more participants and 1,000 fewer spectators than football games draw. The soccer league finals could draw in 150 participants and 1,200 spectators, which is 20 more participants and 300 fewer spectators than football games draw.

The noise level measurements collected during the varsity football game on October 21, 2016 exceeded the 80 dBA standard for 5 seconds of the nearly 2 hours of noise level measurements collected (see Table 4.10-7). These exceedances were generated by crowd cheering and by the use of the PA system. The new events held at the stadium would not have the potential to generate greater crowd and PA system noise than existing events held at the stadium. The total number of participants and spectators attending the new lacrosse games, lacrosse league finals, and track and field meets would be approximately one-third to one-half of the total number of participants and spectators attending football games and therefore would generate substantially less crowd noise than existing events held at the stadium. The total number of participants and spectators attending the soccer league finals would be slightly less than the total number of participants and spectators attending football games and therefore would generate similar crowd noise to existing events held at the stadium. Furthermore, the proposed reduction in the stadium seating capacity would reduce the maximum potential crowd-generated noise levels of any future events held at the stadium. In addition, the use of the PA system can also be a source of exceedance of the 80 dBA standard, and the installation of a new PA system would potentially decrease the frequency and magnitude of exceedance events if properly installed. The implementation of Mitigation Measure NOISE-2 above would ensure that the new PA system is installed so as to minimize noise generated outside of the school fence line. This would reduce the potential of the new events held at the stadium to cause substantial periodic increases in noise levels to a less-than-significant level.

The stadium would continue to be periodically used for special community events, which could generate periodic increases in noise levels that could exceed the 80 dBA standard for athletic and special events in the San Rafael Municipal Code. However, special community events held at the stadium after implementation of the Master Facilities Long-Range Plan are anticipated to be of similar magnitude, duration, and frequency, and are expected to generate similar noise levels, as under existing conditions. Consequently, these events would not constitute a new source of noise with the potential to increase ambient noise levels in the vicinity of the stadium, and the potential impact of these events would be less than significant.

Change in Numbers of Spectators and Participants at Stadium

Under the proposed Master Facilities Long-Range Plan, because of the addition of the SRHS women's lacrosse team to SRHS's athletic program, the number of participants and spectators in lacrosse practices would increase from 90 and 20 to 138 and 32, respectively (+48/+12), and the number of participants and spectators in lacrosse games would increase from 100 and 300 to 196 and 400, respectively (+96/+100) (see Table 3-3 in Chapter 3, Project Description, of this EIR). Practices do not draw large cheering crowds or require the use of the PA system, and therefore do not have the potential to exceed the 80 dBA standard for athletic and special events in the San Rafael Municipal Code or to increase ambient noise levels. In addition, based on the additive properties of noise discussed in Section 4.10.2, Environmental Setting, above, the numbers of spectators and participants at an event must nearly double for a perceptible increase in noise from the event to occur. The anticipated increase in the number of spectators and participants at lacrosse practices and games would increase by approximately 65 percent, and therefore would not generate a perceptible increase in noise levels. Furthermore, the noise level measurements collected during the varsity football game on October 21, 2016, exceeded the 80 dBA standard for 5 seconds of the nearly 2 hours of noise level measurements collected (see Table 4.10-7). Because lacrosse games would have nearly three times fewer participants and spectators than football games (see Table 3-3), the potential of increased participants and spectators attending lacrosse games to generate noise levels that exceed the 80 dBA standard is less than significant. No other increases in participants or spectators are anticipated for other existing annual events.

Temporary Noise Increases

Impact NOISE-3: Construction of the facilities proposed under the Master Facilities Long-Range Plan could generate temporary increases in ambient noise levels in the project vicinity and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. (PS)

Implementation of the Master Facilities Long-Range Plan would result in demolition of a number of existing buildings, modernization and construction of new buildings, and site improvements. The Master Facilities Long-Range Plan would be constructed between approximately 2017 and 2021, with the exception of Buildings No. 4 and No. 8, which would be constructed at a later time, if funding is secured. The modernization of the Administration/Theater/Classrooms building (Building

A), classroom/Library building (Building D), and Head Start (Building K) building would involve internal changes. Students and staff would not be present in rooms undergoing work. For these reasons, both on-site and off-site receptors would be shielded from noise generated during modernization activities, and the potential for modernization of SRHS buildings to generate increases in ambient noise levels in excess of standards is less than significant.

The demolition of existing buildings and structures, and the construction of new buildings and structures, under the Master Facilities Long-Range Plan would result in a temporary increase in ambient noise levels in the immediate vicinity of each construction site. Equipment typically used during construction includes bulldozers, rippers, excavators, graders, tractors, backhoes, compactors, rollers, loaders, and trucks. Noise generated during construction varies greatly depending on the construction activity performed, type and specific model of equipment, and the condition of equipment used. Demolition and grading are typically the noisiest phases of construction. The later phases of construction include activities that are typically quieter and that occur within the building under construction, providing a barrier for noise between the construction activity and any nearby receptors. Typical construction noise levels at a distance of 50 feet are shown in **Table 4.10-8** below.

TABLE 4.10-8 TYPICAL RANGES OF CONSTRUCTION NOISE LEVELS AT 50 FEET, dBA L_{EQ}

	Office Building, Hotel, Hospital, School, Public Works	
Equipment	**I**	**II**
Ground Clearing	84	84
Excavation	89	79
Foundations	78	78
Erection	87	75
Finishing	89	75

Notes: I – All pertinent equipment present at site
II – Minimum required equipment present at site.
Ground clearing includes demolition and removal of prior structures.
Source: EPA, 1973. Legal Compilation on Noise, Volume 1, Table 2-15.

Impact on Construction Workers

Construction workers could be exposed to excessive noise from the heavy equipment used during construction of the facilities proposed under the Master Facilities Long-Range Plan. However, as described in Section 4.10.3, Regulatory Framework, above, noise exposure of construction workers is regulated by the Cal/OSHA. The construction contractor for the proposed project would be subject to these regulations, and compliance with Cal/OSHA regulations would ensure that the potential of construction workers to be exposed to excessive noise is less than significant.

Impact on On-Campus and Off-Site Receptors

The 3rd Street parking lot would be used to house offices for contractors and to provide contractor parking and materials storage. Trucks bringing in materials for storage could generate noise, but their time in this area each day would be limited to loading and unloading periods; therefore, the use of the 3rd Street parking lot for materials storage would not have the potential to disturb nearby receptors, and this impact would be less than significant.

The retirement homes on 4th Street (San Rafael Commons) would be located more than 400 feet from the nearest proposed demolition and construction locations, and would be shielded from construction noise by the buildings located between the retirement homes and the construction and demolition locations. As a result, construction noise would not have the potential to generate noise levels above 70 dBA L_{eq} at the retirement homes. Although the commercial receptors are located within 90 feet of the SRHS campus, these receptors are located adjacent to a major roadway (3rd Street) that generates noise levels of 75 dBA L_{dn} at 40 feet; in this environment, construction noise 90 feet away would be audible, but not disruptive because the commercial land uses do not contain noise-sensitive people or activities. Furthermore, the majority of construction and demolition activities under the Master Facilities Long-Range Plan, with the exception of elements of the Stadium Project, such as the concessions stands, changing rooms/restrooms (Buildings No. 6 and No. 10), and parking lot, would be located between 250 feet to more than 1,000 feet from the nearest commercial receptors. The construction of the proposed Stadium Project would start in approximately the spring of 2017 and be completed in approximately the fall of 2017, and consequently the potential of exposure of the commercial receptors to the highest possible construction noise levels would be limited to a small fraction of the complete 5-year construction period of the Master Facilities Long-Range Plan. For these reasons, the potential of construction noise under the Master Facilities Long-Range plan to disturb residents of the retirement home or occupants of the nearest commercial receptors would be less than significant.

Several of the demolition and construction locations proposed under the Master Facilities Long-Range Plan are located just within the SRHS campus boundaries and therefore have the potential to exceed 90 dBA L_{max} at the construction property plane. Table 4.10-8 indicates that noise levels during construction would range from approximately 75 to 89 dBA L_{eq} at 50 feet. With the exception of a few components of the Stadium Project, all of the proposed demolition and construction locations under the Master Facilities Long-Range Plan would be located at distances ranging from approximately 1 to 50 feet of the nearest on-campus buildings. In addition, the nearest off-site noise sensitive receptors (i.e., the residences on Mission Avenue and Embarcadero Way) are located within 50 to 70 feet of the nearest proposed demolition and construction locations. Therefore, both on-campus and off-site sensitive receptors could be exposed to noise levels that exceed 70 dBA L_{eq}. The demolition and construction activities implemented under the Master Facilities Long-Range Plan would occur between 8:00 AM and 5:00 PM, Monday through Friday, and between 9:00 AM and 5:00 PM, Saturday, and therefore would not conflict with the construction days and hours permitted under the San Rafael Municipal Code, which permits construction between 7:00 AM and 6:00 PM, Monday through Friday, and between 9:00 AM and 6:00 PM on Saturdays. (San Rafael Municipal Code, Section 8.13.050; see Table 4.10-6). This would also partially reduce the potential construction noise impacts on nearby residential receptors by preventing their exposure to high levels of construction noise during evening hours when people are typically resting or sleeping. Furthermore, the exposure of a given receptor to construction-generated noise levels would be limited in duration because it would vary throughout the day depending on the location where the noise-generating equipment is being used, and would also vary over the 5-year period of construction of the Master Facilities Long-Range Plan depending on which specific element of the Master Facilities Long-Range Plan is being constructed.

The implementation of Mitigation Measures NOISE-3a through 3d below would require construction to be scheduled to avoid disrupting classroom activities, the development of Construction Noise Management Plans to reduce noise generated by construction to the maximum extent feasible, the development of a compliance tracking system, and notification of nearby residents of planned construction activities. The implementation of these mitigation measures would reduce potential temporary construction noise impacts to both on-campus and off-site receptors to a less-than-significant level.

Mitigation Measure NOISE-3a: To the maximum extent practicable, San Rafael City Schools shall schedule construction activities during periods when classes are not in session, such as summer, school breaks, and after class dismissal. San Rafael City Schools shall not allow the use of heavy construction equipment during established testing periods (e.g., finals week).

Mitigation Measure NOISE-3b: For each project under the Master Facilities Long-Range Plan, a Construction Noise Management Plan shall be prepared by a qualified acoustical consultant and included in all contractor specifications. The Construction Noise Management Plan shall contain a set of site-specific noise attenuation measures to further reduce construction noise impacts at the nearby on-campus buildings and off-site residential receptors. If appropriate based on the circumstances, multiple projects can be addressed under one Construction Noise Management Plan. The site-specific noise attenuation measures shall be designed to reduce noise levels at the nearest on-campus and off-site receptors to below 70 dBA L_{eq}, as practical. The nearest on-campus receptors may be located adjacent to construction and demolition locations. If it is not feasible to reduce noise at the nearest on-campus receptors to below 70 dBA L_{eq} due to their proximity to the nearest construction and demolition locations, the school shall relocate students to classrooms with interior noise levels below 45 dBA L_{eq}. At a minimum, the following measures shall be included in the Construction Noise Management Plan:

- *Use jetting or partial jetting of piles into place using a water injection at the tip of the pile, if feasible.*
- *Construct or use temporary noise barriers, as needed, to shield on-campus construction and demolition noise from noise-sensitive areas to the extent feasible. To be most effective, the barrier should be placed as close as possible to the noise source or the sensitive receptor. Examples of barriers include portable acoustically lined enclosure/housing for specific equipment (e.g., jackhammer and pneumatic-air tools, which generate the loudest noise), temporary noise barriers (e.g., solid plywood fences or portable panel systems, minimum 8 feet in height), and/or acoustical blankets, as feasible.*
- *To the extent feasible, establish construction staging areas at locations that would create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.*

- *Ensure that construction equipment and trucks use the best available noise control techniques (e.g., improved mufflers, equipment redesign, use of intake silencers, ducts, engine enclosures and acoustically-attenuating shields or shrouds) wherever feasible.*
- *Use "quiet" models of air compressors and other stationary noise sources where technology exists.*
- *Prohibit all unnecessary idling of internal combustion engines and equip all internal combustion engine-driven equipment with an operating muffler or baffling system that are in good condition and appropriate for the equipment.*
- *Locate all stationary noise-generating equipment, such as air compressors and portable power generators, as far away as possible from noise-sensitive land uses, as feasible. Muffle the stationary equipment, and enclose within temporary sheds or surround by insulation barriers, if feasible.*

Mitigation Measure NOISE-3c: San Rafael City Schools shall develop a set of procedures for responding to and tracking complaints received pertaining to construction noise, and shall implement the procedures during construction of projects implemented under the Master Facilities Long-Range Plan. Contractor specifications shall include these procedures. At a minimum, the procedures shall include:

a) Designation of a construction complaint and enforcement manager for the project;

b) Protocols specific to receiving, responding to, and tracking received complaints; and

c) Maintenance of a complaint log that records received complaints and how complaints were addressed.

The contact information of the construction complaint and enforcement manager shall be posted in conspicuous locations at the construction site.

Mitigation Measure NOISE-3d: Residences located within 250 feet of a project implemented under the Master Facilities Long-Range Plan shall be provided with written notice of construction activity within at least 10 days before work begins, except in the case of an emergency. The notice shall state the date of planned construction activity in proximity to that residence and the range of hours during which maximum noise levels are anticipated. The notice shall also include the contact information of the construction complaint and enforcement manager identified in Mitigation Measure NOISE-3c.

The combination of the above measures would reduce this impact to a less-than-significant level. (LTS)

Ground-Borne Vibration and Noise

Impact NOISE-4: Development under the Master Facilities Long-Range Plan could expose persons to or generate excessive ground-borne vibration or ground-borne noise levels. (PS)

Construction activities associated with the implementation of the Master Facilities Long-Range Plan would result in varying degrees of ground-borne vibration, depending on the equipment being used and the activity being performed. Once constructed, none of the elements of the Master Facilities Long-Range Plan would be expected to cause any vibration or result in excessive vibration impacts.

Construction activities such as pile-driving or drilling, caisson drilling, the use of vibratory rollers, jackhammers or other high-power or vibratory tools, and mobile construction equipment can generate vibration in the immediate vicinity of the work area. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. **Table 4.10-9** presents published vibration levels at 25 feet from the types of construction equipment that could be used during construction of projects implemented under the Master Facilities Long-Range Plan. Table 4.10-9 also presents the buffer distance that would be required to reduce vibration levels to below the 83 VdB threshold for on-campus receptors and off-site commercial receptors, the 80 VdB threshold for off-site residential receptors, and the 0.3 in/sec PPV for both on-campus and off-site buildings.

Vibration Disturbance

Table 4.10-9 indicates that vibration levels during construction could disturb receptors within approximately 300 feet of construction and demolition locations proposed under the Master Facilities Long-Range Plan if a pile driver were used and within approximately 75 feet of the stadium site if non-pile driving construction equipment were used. Both on-campus and off-site receptors are located within 75 feet of demolition and construction locations proposed under the Master Facilities Long-Range Plan, and therefore could be exposed to vibration levels that exceed both the 80 VdB and 83 VdB disturbance thresholds for residential and on-campus/commercial receptors, respectively. The exposure of a given receptor to vibration in excess of these thresholds would be limited in duration because the location of construction equipment would vary throughout the day depending on the location where the vibration-generating equipment is being used, and would also vary over the 5-year period of construction of the Master Facilities Long-Range Plan depending on which specific element of the Master Facilities Long-Range Plan is being constructed. The demolition and construction activities implemented under the Master Facilities Long-Range Plan would occur between 8:00 AM and 5:00 PM, Monday through Friday, and between 9:00 AM and 5:00 PM, Saturday, which would also partially reduce potential construction vibration impacts on nearby residential receptors by preventing their exposure to high levels of construction vibration during evening hours when people are typically resting or sleeping. Any remaining vibration impacts on both on-campus and off-site receptors would be reduced to a less-than-significant level by the implementation of Mitigation Measure NOISE-4a, which would require construction to be scheduled to avoid disrupting classroom activities; the development of Construction Noise Management Plans to reduce noise generated by construction to the maximum extent feasible (high noise-generating construction activities often generate high vibration levels) and to avoid the use of impact pile driving where feasible; the development of a compliance tracking system; and notification of nearby residents of planned construction activities.

> <u>*Mitigation Measure NOISE-4a*</u>*: Mitigation Measures NOISE-3a through NOISE-3d shall be implemented.*

Vibration Damage

Development under the Master Facilities Long-Range Plan may have the potential to generate vibration that could damage off-site buildings. Table 4.10-9 indicates that buildings located within

TABLE 4.10-9 VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment		Reference PPV at 25 Feet[a] (in/sec)	Reference RMS at 25 Feet[b] (VdB)	Required Buffer Distance – On-Campus Threshold 83 VdB (Feet)	Required Buffer Distance – Off-Site Threshold 80 VdB (Feet)	Required Buffer Distance – On-Campus and Off-Site Threshold 0.3 in/sec (Feet)
Pile Driver (Impact)	upper range	1.518	112	232	291	74
	typical	0.644	104	125	158	42
Pile Driver (Sonic)	upper range	0.734	105	135	170	45
	typical	0.170	93	54	68	17
Vibratory Roller		0.210	94	58	73	20
Hoe Ram		0.089	87	34	43	11
Large Bulldozer		0.089	87	34	43	11
Caisson Drilling		0.089	87	34	43	11
Loaded Trucks		0.076	86	31	40	10
Jackhammer		0.035	79	18	23	6
Small bulldozer		0.003	58	4	5	1

Notes: Receptors within the buffer distance could be impacted by construction-generated vibration. Receptors outside of the buffer distance would not be expected to be impacted by construction-generated vibration.
[a] PPV = peak particle velocity, in/sec = inches per second,
[b] RMS = root mean square, VdB = vibration decibel

PPV2 = PPV1 x (D1/D2)^1.5
Where:
PPV1 is the reference vibration level at a specified distance.
PPV2 is the calculated vibration level.
D1 is the reference distance (in this case 25 feet).
D2 is the distance from the equipment to the receiver.

RMS2 = RMS1 – 30 Log10 (D2/D1)
Where:
RMS1 is the reference vibration level at a specified distance.
RMS2 is the calculated vibration level.
D1 is the reference distance (in this case 25 feet).
D2 is the distance from the equipment to the receiver.

Source of Equations: FTA, 2006. Chapter 12.
Source: FTA, 2006.

approximately 74 feet of an impact pile driver could be exposed to vibration levels in excess of the 0.3 in/sec threshold for damage to buildings of conventional construction. Buildings located within 20 feet of non-pile-driving construction equipment could also be exposed to vibration levels in excess of this threshold. The residences along Mission Avenue and Embarcadero Way are located approximately 50 feet and 70 feet away, respectively from the nearest construction locations proposed under the Master Facilities Long-Range Plan. Based on this proximity, vibration levels would not exceed 0.3 in/sec at off-site receptors unless an impact pile driver is used. The implementation of Mitigation Measure NOISE-4b below would reduce the impacts of potential building damage as a result of pile driving-generated vibration to a less-than-significant level. If pile driving is not used, no mitigation is required.

> *<u>Mitigation Measure NOISE-4b</u>: San Rafael City Schools shall retain a structural engineer or other qualified professional to evaluate and recommend alternative methods to impact pile driving for project components that require the installation of piles. If it is not feasible to avoid impact pile driving, the structural engineer or other qualified professional shall evaluate the potential for vibration generated by the use of a pile driver during construction of a project implemented under the Master Facilities Long-Range Plan to damage off-site buildings within 100 feet of any impact pile-driving activities. The evaluation shall take into account project-specific information such as the composition of the structures, locations of the piles, and the soil characteristics in the project area, to determine whether impact pile driving may cause damage to nearby structures. If the evaluation finds that the impact pile driving may cause damage to a structure, the structural engineer or other qualified professional shall recommend design means and methods of construction to avoid the potential damage.*
>
> *The combination of Mitigation Measures NOISE-4a and NOISE-4b would reduce this impact to a less-than-significant level. (LTS)*

On-campus buildings would be located adjacent to many of the demolition and construction locations proposed under the Master Facilities Long-Range Plan, and therefore could be subject potentially damaging levels of vibration during construction of the projects proposed under the Master Facilities Long-Range Plan. However, consideration of damage to buildings on the developer's own property is a standard part of the design and review process for a development. This process would ensure that existing buildings remain in good condition both during and after the implementation of the Master Facilities Long-Range Plan. Therefore, the potential of construction-generated vibration to result in damage to on-campus buildings is less than significant.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

<u>Airport/Airstrip Noise</u>

The proposed Stadium Project would not result in any noise impacts from airports or private airstrips.

The impact would be less than significant for the reasons discussed above for the Master Facilities Long-Range Plan.

<u>Generation of or Exposure to Permanent Noise Increases</u>

The proposed Stadium Project would not result in any permanent noise increases.

For the reasons discussed under Impact NOISE-1 above, the Stadium Project would not contribute to a sustained permanent increase in ambient noise levels. The potential long-term periodic noise impacts that could result from development of the Stadium Project are discussed under Impact NOISE-5 below.

Potentially Significant Impacts

Periodic Noise Increases

Impact NOISE-5: Development of the proposed Stadium Project could generate periodic increases in ambient noise levels in the project vicinity above levels existing without the project and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. (PS)

Based on the results of the noise monitoring survey, it appears that the existing stadium uses have the potential to occasionally and for short durations exceed the 80 dBA standard for sound performances in the San Rafael Municipal Code (see Tables 4.10-3 and 4.10-4). Events held at the stadium after the development of the proposed Stadium Project would also have the potential to generate substantial periodic increases in ambient noise levels in excess of standards.

The development of the proposed Stadium Project would include, among other improvements, a parking lot expansion and associated new driveway, new changing rooms/restrooms (Buildings No. 6 and No. 10), bleachers (Building No. 9), track and field (including other improvements, such as replacement of the existing PA system, scoreboard, and lighting), press box, welcome plaza, ticket booth, storage buildings, and concessions stands (Building No. 5, and the smaller ASB concession and Christmas tree lot concession stands). For the reasons discussed under Impact NOISE-2 above, the development of the new changing room/ restroom facilities (Buildings No. 6 and No. 10), press box, storage buildings, ticket booth, welcome plaza, and concessions stands, and the expansion of the main parking lot adjacent to 3rd Street, would not have the potential to cause perceptible increases in ambient noise levels.

Likewise, as discussed above under Impact NOISE-2, the proposed Stadium Project would also reduce the stadium seating capacity from 2,550 (existing Building V) to 1,900 seats (proposed Building No. 9) and install a new PA system with advanced electronic and physical audio/acoustic steering technology to direct the sound to the areas where the sound coverage is needed (Monitto, 2016). The use of these advanced PA systems has been found to successfully reduce noise levels generated off-site by 1 to 12 dBA L_{max} (RGD Acoustics, 2016). The noise monitoring study identified crowd cheering and PA announcements as the most significant sources of noise at the stadium. The proposed reduction in stadium seating capacity would reduce potential crowd-generated noise levels. In addition, the installation of a new more acoustically sophisticated PA system would potentially further decrease noise levels at off-site areas. This is a potentially beneficial impact related to the project. However, if installed improperly, the installation of the proposed PA system could potentially not provide the expected off-site noise benefits. Therefore, the potential impact related to stadium noise is conservatively found to be significant requiring mitigation. To ensure that the speakers are set up appropriately, Mitigation Measure NOISE-5 is recommended to reduce this potential impact to a less-than-significant level.

Mitigation Measure NOISE-5: Mitigation Measure NOISE-2 shall be implemented. (LTS)

After construction of the proposed Stadium Project is complete, the number of football practices held at the stadium would increase by 50 events per year, lacrosse games would increase by 30 games per year due to the addition of the SRHS women's lacrosse team program to SRHS's athletic program, and track and field meets would increase by 4 per year (see Table 3-3 in Chapter 3, Project Description, of this EIR), and the number of spectators and participants attending lacrosse games and practices would increase by approximately 65 percent (again, due to the addition of the SRHS women's lacrosse team program). In addition, the following new special events (school-based) would be held at the stadium under the Master Facilities Long-Range Plan: 1) men's and women's soccer league finals each year on a single Saturday between 3:00 PM and 9:30 PM, 2) men's and women's lacrosse league finals once every 3 years for 1 to 2 days between 3:00 PM and 9:00 PM, and 3) the North Coast Section Redwood Empire track and field meet once every 3 years. For the reasons discussed under Impact NOISE-2 above, these changes in use would not have the potential to result in perceptible increases in periodic noise generated from the stadium during events. No other increases in participants, spectators, or events are anticipated.

The stadium would continue to be periodically used for special community events. In addition, the general use of the track and field for other SRHS sports training, and by the community when SRHS is not using the fields, would continue. As discussed under Impact NOISE-2 above, these uses are an existing condition, and the magnitude, frequency, and duration of the noise levels generated by these after implementation of the Master Facilities Long-Range Plan are anticipated to be similar to existing conditions. Consequently, these uses would not constitute a new source of noise with the potential to increase ambient noise levels in the vicinity of the stadium, and the potential impact of these events would be less than significant.

Temporary Noise Increases

Impact NOISE-6: Construction of the proposed Stadium Project could generate a temporary increase in ambient noise levels in the project vicinity above levels existing without the project and in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies. (PS)

Construction of the proposed Stadium Project would start in approximately the spring of 2017 and be completed in approximately the fall of 2017. Construction activities would result in a temporary increase in ambient noise levels in the immediate vicinity of the stadium site. For the reasons discussed under Impact NOISE-3 above, the potential of construction workers to be exposed to excessive noise from heavy construction equipment, and the potential for the use of the 3rd Street parking as a materials storage location to generate a substantial temporary increase in ambient noise levels, would be less than significant.

Equipment typically used during construction includes bulldozers, rippers, excavators, graders, tractors, backhoes, compactors, rollers, loaders, and trucks. Noise generated during construction varies greatly depending on the construction activity performed, type and specific model of equipment, and the condition of equipment used. Typical construction noise levels at a distance of 50 feet are shown in Table 4.10-8. Several elements of the proposed Stadium Project would be located just within the SRHS fence line and therefore have the potential to exceed 90 dBA L_{max} at the construction property plane. The retirement homes on 4th Street (San Rafael Commons) are located approximately 1,000 feet from the Stadium Project site, and would be shielded from construction noise by the buildings located between the retirement homes and the stadium. The commercial receptors are located approximately 90 feet from the nearest components of the proposed Stadium Project (i.e., demolition of the existing ticket booth and concessions stand, and construction new concessions stands, changing rooms/restrooms, and parking lot), but these receptors are separated from the Stadium Project site by a major roadway (3rd Street) that generates noise levels of 75 dBA L_{dn} at 40 feet; in this environment, construction noise 90 feet away would be audible, but not disruptive because the commercial land uses do not contain noise-sensitive people or activities. For these reasons, the potential of construction noise from the Stadium Project to disturb residents of the retirement home or occupants of the nearest commercial receptors would be less than significant.

Table 4.10-8 indicates that noise levels during construction would range from approximately 75 to 89 dBA L_{eq} at 50 feet. Demolition of the existing press box and concessions stand and construction of the bleachers on the west side of the stadium would occur within 50 feet of the nearest on-campus buildings. In addition, the nearest off-site noise sensitive receptors (i.e., the residences on Embarcadero Way) are located within approximately 70 feet of the changing rooms/restrooms (Building No. 6) proposed to be developed in the southeast corner of the stadium. Therefore, both on-campus and off-site sensitive receptors could be exposed to noise levels that exceed 70 dBA L_{eq}. The demolition and construction activities implemented under the proposed Stadium Project would occur between 8:00 AM and 5:00 PM, Monday through Friday, and between 9:00 AM and 5:00 PM, Saturday, and therefore would not conflict with the construction days and hours permitted under the San Rafael Municipal Code, which permits construction between 7:00 AM and 6:00 PM, Monday through Friday, and between 9:00 AM and 6:00 PM on Saturdays. (San Rafael Municipal Code, Section 8.13.050; see Table 4.10-6). This would also partially reduce the potential construction noise impacts on nearby residential receptors by preventing their exposure to high levels of construction noise during evening hours when people are typically resting or sleeping. Furthermore, the exposure of a given receptor to construction-generated noise levels would be limited in duration because it would vary throughout the day depending on the location where the noise-generating equipment is being used, and would also vary over the approximately 6-month construction period of the proposed Stadium Project depending on which specific element of the proposed Stadium Project is being constructed. The implementation of Mitigation Measure NOISE-6 below would require construction to be scheduled to avoid disrupting classroom activities, the development of Construction Noise Management Plans to reduce noise generated by construction to the maximum extent feasible, the development of a compliance tracking system, and notification of nearby residents of planned construction activities. The implementation of these measures would reduce potential temporary construction noise impacts on both on-campus and off-site receptors to a less-than-significant level.

> *Mitigation Measure NOISE-6: Mitigation Measures NOISE-3a through NOISE-3d shall be implemented. (LTS)*

Ground-Borne Vibration and Noise

Impact NOISE-7: Development of the proposed Stadium Project could expose persons to or generate excessive ground-borne vibration or ground-borne noise levels. (PS)

Construction activities associated with the proposed Stadium Project would result in varying degrees of ground-borne vibration, depending on the equipment being used and activity being performed. Once constructed, none of the elements of the proposed Stadium Project would be expected to cause any vibration or result in excessive vibration impacts.

Construction activities such as pile-driving or drilling, caisson drilling, the use of vibratory rollers, jackhammers or other high-power or vibratory tools, and mobile construction equipment can generate vibration in the immediate vicinity of the work area. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Table 4.10-9 presents published vibration levels at 25 feet from the types of construction equipment that could be used during construction of proposed Stadium Project. Table 4.10-9 also presents the buffer distance that would be required to reduce vibration levels to below the 83 VdB threshold for on-campus receptors and off-site commercial receptors, the 80 VdB threshold for off-site residential receptors, and the 0.3 in/sec PPV for both on-campus and off-site buildings.

Vibration Disturbance

Table 4.10-9 indicates that vibration levels during construction could disturb receptors within approximately 300 feet of construction and demolition locations proposed under the Master Facilities Long-Range Plan if a pile driver is used and within approximately 75 feet of the stadium site if non-pile driving construction equipment is used. Demolition of the existing press box and concessions stand and construction of the bleachers on the west side of the stadium would occur within 50 feet of the nearest on-campus buildings. In addition, the nearest off-site noise-sensitive receptors (i.e., the residences on Embarcadero Way) are located approximately 70 feet from the bathrooms proposed to be developed in the southeast corner of the stadium. Due to this proximity to elements of the proposed Stadium Project, it is anticipated that construction vibration could exceed both the 80 VdB and 83 VdB disturbance thresholds for residential and on-campus/ commercial receptors, respectively. The exposure to vibration in excess of these thresholds would be limited in duration because the location of construction equipment would vary throughout the day depending on the location where the vibration-generating equipment is being used, and would also vary over the approximately half-year construction period of the proposed Stadium Project depending on which specific element of the proposed Stadium Project is being constructed. The demolition and construction activities implemented under the proposed Stadium Project would occur between 8:00 AM and 5:00 PM, Monday through Friday, and between 9:00 AM and 5:00 PM, Saturday, which would also partially reduce potential construction vibration impacts on nearby residential receptors by preventing their exposure to high levels of construction vibration during evening hours when people are typically resting or sleeping. Any remaining vibration impacts on both on-campus and off-site receptors would be reduced to a less-than-significant level by the implementation of Mitigation Measure NOISE-7, which would require construction to be scheduled to avoid disrupting classroom activities; the development of Construction Noise Management Plans to reduce noise generated by construction to the maximum extent feasible (high noise-generating construction activities often generate high vibration levels) and to avoid the use of impact pile driving where feasible; the development of a compliance tracking system; and notification of nearby residents of planned construction activities.

> *<u>Mitigation Measure NOISE-7</u>: Mitigation Measures NOISE-3a through NOISE-3d shall be implemented. (LTS)*

Vibration Damage

The proposed Stadium Project would require the use of heavy construction equipment with the potential to generate vibration that could result in damage to nearby buildings. Table 4.10-9 indicates that buildings located within approximately 74 feet of an impact pile driver could be exposed to vibration levels in excess of the 0.3 in/sec threshold for damage to buildings of conventional construction. Buildings located within 20 feet of non-pile-driving construction equipment could also be exposed to vibration levels in excess of this threshold. The residences along Embarcadero Way are located approximately 70 feet from the restrooms proposed to be developed in the southeast corner of the stadium. However, pile driving would not need to be used to construct a restroom. Therefore, construction of the restrooms would not have the potential to cause vibration damage to these buildings. Pile driving could be used in the construction of the proposed new bleachers. The proposed new bleachers would be located over 100 feet from the nearest off-site buildings, and consequently would not have the potential to generate vibration levels of over 0.3 in/sec at these buildings. Therefore, the potential of the proposed Stadium Project to result in damage to off-site buildings is less than significant.

On-campus buildings are located adjacent to the bleachers proposed along the west side of the stadium, and therefore could be subject potentially damaging levels of vibration during construction of the proposed Stadium Project. However, consideration of damage to buildings on the developer's own property is a standard part of the design and review process for a development. This process would ensure that existing buildings remain in good condition both during the after construction of the proposed project. Therefore, the potential of construction-generated vibration to result in damage to on-campus buildings is less than significant.

CUMULATIVE IMPACTS

For noise, the geographic scope for assessing cumulative impacts is the near vicinity of the SRHS campus. Noise and vibration dissipate with increased distance from the source; therefore, cumulative noise and vibration impacts would not be expected unless new sources of noise are located in close proximity to each other.

In Table 6-1 in Chapter 6, CEQA Considerations, of this EIR, the cumulative projects generally west of Highway 101 (Project Nos. 1 through 15) are located at distances of at least 1,600 feet from the nearest demolition and construction locations under the Master Facilities Long-Range Plan and would be separated from these locations by the highway and/or multiple blocks of buildings. At these distances, and with the shielding provided by the multiple rows of buildings between construction sites, construction noise from the build-out of the elements proposed under Master Facilities Long-Range Plan would not be audible at the cumulative projects generally west of Highway 101, and vibration would not be perceptible. Therefore, there would be no potential cumulative noise impact generated from construction under the Master Facilities Long-Range Plan, including the Stadium Project, and construction of the cumulative projects generally west of Highway 101.

Similarly, Project Nos. 17 and 18 would be located approximately 800 feet and 1,500 feet from the nearest demolition and construction locations under the Master Facilities Long-Range Plan and would be separated from these locations by multiple blocks of buildings. Project Nos. 19 and 20 would be located over a mile from the SRHS campus and are shielded from the campus by topographic features, such as hills, as well as by buildings. At these distances, and with the shielding provided by the multiple rows of buildings and/or topographic features between construction sites, construction noise from the build-out of the elements proposed under Master Facilities Long-Range Plan would not be audible at Projects Nos. 17 through 20, and vibration would not be perceptible. Therefore, there would be no potential cumulative noise impact generated from construction under the Master Facilities Long-Range Plan, including the Stadium Project, and construction of Projects Nos. 17 through 20.

Project No. 16, which would involve construction of 100 multi-family units, would be located approximately 200 feet from the nearest demolition and construction locations under the Master Facilities Long-Range Plan. At this distance, cumulative construction noise and vibration could affect the residences along Mission Avenue located between the two project sites. Because Project No. 16 is considered in the San Rafael General Plan but is not approved, it is unlikely that construction of this project would overlap with construction of the Master Facilities Long-Range Plan, which would begin in the spring of 2017. However, if construction of Project No. 16 were to begin before construction of the Master Facilities Long-Range Plan is complete, both projects would be subject to San Rafael Municipal Code requirements to limit construction to daytime hours and to limit construction noise to 90 dBA L_{max} at any point outside of the construction property plane. Project No. 16, which would involve construction at the fence line of the site, would have the potential to generate noise levels that exceed the City of San Rafael's construction noise standard, and would consequently be required to go through a development review process that would require potential noise impacts of construction to be analyzed and mitigated. Therefore, compliance with the San Rafael Municipal Code requirements for construction noise would reduce the potential cumulative noise impact of Project No. 16 and the Master Facilities Long-Range Plan, including the Stadium Project, to a less-than-significant level.

With the exception of the Stadium Project proposed under the Master Facilities Long-Range Plan, the cumulative projects involve the construction of parking lots and land uses with primarily indoor uses (office space, residences). Therefore, the primary source of permanent noise from the cumulative projects would be HVAC systems, which would be subject to the noise limits specified in the San Rafael Municipal Code. Compliance with the San Rafael Municipal Code requirements would reduce potential cumulative permanent noise impacts to a less-than-significant level. None of the cumulative projects would have the potential to generated periodic increases in event noise, and therefore there would be no cumulative periodic noise impact.

The development of the cumulative projects would create residences and offices that would result in increased traffic along local roadways, which could increase traffic noise levels by 3 dBA in locations where exterior noise levels are 65 dBA L_{dn} or greater. Under the Master Facilities Long-Range Plan, the number of students attending the school would increase by 200. Conservatively assuming that all 200 students drive to school along the same segment of roadway within 1 hour at 35 miles per hour, the traffic noise generated would be approximately 57 dBA L_{eq}.[4] The addition of 57 dBA to existing noise levels of 65 dBA would result in a 0.6 dBA increase in noise levels. Such an increase would not be perceptible even in a carefully controlled lab environment. Therefore, the build-out of the Master Facilities Long-Range Plan, including the Stadium Project, would not make a cumulatively considerable contribution to the cumulative noise impact.

[4] Traffic noise model outputs are included in the Appendix D. FHWA TNM Version 2.5 model was used for these results.

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4.11 PUBLIC SERVICES

4.11.1 INTRODUCTION

This section of the EIR describes the existing setting and potential impacts on fire protection and police services that could result from implementation of the Master Facilities Long-Range Plan, including the Stadium Project that is part of the Long-Range Plan.

4.11.2 ENVIRONMENTAL SETTING

FIRE PROTECTION AND EMERGENCY MEDICAL SERVICES

The San Rafael Fire Department (Fire Department) provides fire protection and emergency services within the San Rafael city limits.

Facilities

The Fire Department operates seven fire stations. The closest fire station to the San Rafael High School (SRHS) campus is Station 52, located at 210 3rd Street at Union Street about 0.3 mile west of the campus. This station houses a Type 1 engine, a Type 3 wildland engine, a training tower, and a training classroom. Station 52 is scheduled to be torn down and replaced. During the demolition and construction project, the engine company will be temporarily relocated to a temporary facility at 519 4th Street about 0.4-mile west of the SRHS campus. Other stations serving the campus include Station 54 at 46 Castro Avenue, which houses a Type 1 engine and aerial ladder truck and is located about 1.7 miles southeast of the campus; and Station 55 at 955 Point San Pedro Avenue, which houses a Type 1 engine, ambulance, hose tender, and medical supply trailer and is located about 3 miles northeast of the campus (San Rafael Fire Department, 2016a; Sinnott, 2016).

The City of San Rafael is currently considering plans for a new 44,000-square-foot Public Safety Center that would be located at 1313 5th Avenue and would house Fire Department and Police Department operations (see Table 6-1 and Figure 6-1 in Chapter 6, CEQA Considerations, of this EIR). This facility will house the Fire Department's main station (Sinnott, 2016).

Staffing

The Fire Department maintains a staff of 66 full-time firefighters, 27 of whom are certified paramedics. Six to nine paramedics are on duty at all times. The Fire Department seeks to maintain an on-duty paramedic on every fire engine company. Approximately 70 percent of all calls for Fire Department service require emergency medical services (San Rafael Fire Department, 2016b).

The City of San Rafael partners with the City of Larkspur to allow the sharing of chief fire department officers across jurisdictional lines. The Fire Unified Command Agreement with the City of Larkspur permits the respective fire chiefs to assist each other's agencies (City of San Rafael, 2015).

Response Times

The Fire Department's current response time to the SRHS campus is about 1 minute. There are no response time problems or other issues related to fire protection service for the campus (Sinnott, 2016).

Emergency Vehicle Access and Fire Hydrants on Project Site

Emergency vehicle access to the SRHS campus is currently provided off Mission Avenue and through the parking lot off 3rd Street. Three fire hydrants are located in the vicinity of the 3rd Street parking lot, one hydrant is located near the baseball field, and three hydrants are located on Mission Avenue along the perimeter of the site (see Figure 3-7 in Chapter 3, Project Description, of this EIR).

POLICE SERVICES

The San Rafael Police Department (Police Department) provides crime prevention and law enforcement services within the San Rafael city limits.

Facilities and Staffing

The Police Department operates one police station, located at 1400 5th Avenue in San Rafael approximately about 1 mile west of the SRHS campus. The Police Department also operates a substation at the Northgate shopping mall in northern San Rafael (San Rafael Police Department, 2016). As noted under "Fire Protection and Emergency Medical Services" above, the City of San Rafael is currently considering plans for a new 44,000-square-foot Public Safety Center that would be located at 1313 5th Avenue and would house Police Department and Fire Department operations (see Table 6-1 and Figure 6-1 in Chapter 6, CEQA Considerations, of this EIR).

The Police Department employs 89 personnel comprised of 65 sworn officers and 24 civilian employees. This staffing level translates to 1.2 officers per 1,000 residents, based on San Rafael's resident population of 53,363 (San Rafael Police Department, 2016; Correa, 2016).

Response Times

The Police Department has response time goals of 3 minutes for Priority One calls (emergency calls, such as robbery or assault in progress), 7 minutes for Priority Two calls (primarily calls about property, car, and home burglaries), and 30 minutes for Priority Three calls (requests for information, theft reports). The Police Department currently meets service standard goals for Priority One and Priority Two calls (Nichols-Berman, 2004; Correa, 2016).

4.11.3 REGULATORY FRAMEWORK

FEDERAL AND STATE REGULATIONS

No federal regulations related to fire protection or police services would apply to the Master Facilities Long-Range Plan. Development allowed by the Long-Range Plan would be required to comply with applicable California Fire Code regulations.

LOCAL REGULATIONS

San Rafael General Plan

The San Rafael General Plan contains the following relevant policies and programs regarding fire protection services and police services (City of San Rafael, 2013).

Policy S-26 **Fire and Police Services.** Maintain adequate cost-effective fire protection, paramedic and police services. Minimize increases in service needs from new development through fire prevention and community policing programs.

Program S-26c **Fire Prevention and Safe Design.** Through the development review process, require review by Fire Department and Police Department for fire prevention and safe design.

Policy S-32 **Safety Review of Development Projects.** Require crime prevention and fire prevention techniques in new development, including adequate access for emergency vehicles.

Program S-32a **Safe Buildings.** Continue to review development applications to insure that landscaping, lighting, building siting and design, emergency access, adequate water pressure and peak load storage capacity, and building construction materials reduce the opportunity for crime and fire hazards.

Policy S-33 **Disaster Preparedness Planning.** Ensure disaster preparedness in cooperation with other public agencies and appropriate public-interest organizations.

San Rafael Fire Department Standard Conditions of Approval

In its review of development proposals (including the proposed Long-Range Plan), the San Rafael Fire Department recommends standard conditions of approval that address site design and building construction, emergency access, and fire hydrant types and locations. Among other requirements, the standard conditions of approval require that the design and construction of all site alterations comply with the 2013 California Fire Code and City of San Rafael Ordinances and

Amendments. The Fire Department recommends the standard conditions to ensure that projects comply with the California Code of Regulations, Title 24 (Jensen, 2016).

4.11.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on public services if it would:

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services: fire protection; police protection; …

For fire protection and police services, Appendix G further provides that a project would have a significant impact if it would:

b) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan; or

c) Result in inadequate emergency access.

Emergency response/evacuation and emergency access issues are addressed in Section 4.7, Hazards and Hazardous Materials, and Section 4.12, Transportation/Traffic, of this EIR.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Impacts on Fire Protection Services

Development in accordance with the Master Facilities Long-Range Plan would increase the demand for fire protection services, but not to the extent that new or physically altered fire stations would be needed.

As discussed in Chapter 3, Project Description, completion of the Long-Range Plan would result in an approximately 48,222-square-foot net increase in building area on the SRHS campus, as well as a 200-student increase in enrollment (from the current enrollment of approximately 1,125 students to approximately 1,325 students). The number of faculty and staff at the high school would not change. In addition, approximately 84 additional events per year would be held at the stadium, which is proposed for renovation; however, the stadium's grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats) (see further discussion under "Impacts of Proposed Stadium Project" below).

The 200-student increase and increase in stadium events resulting from the Long-Range Plan could generate new demand for fire protection services, including increased calls for service. This new demand would not be large enough to require new or physically altered fire protection facilities or equipment, however. Development in accordance with the Long-Range Plan would not require the hiring of any additional firefighters, and no new or upgraded facilities would be necessary (Sinnott, 2016).

As part of the standard development review process that applies to all projects, development in accordance with the Long-Range Plan would be required to conform to Fire Department requirements for features such as building construction, emergency access, and fire hydrants. The Long-Range Plan includes provisions for fire safety upgrades in buildings, as well as a new driveway on 3rd Street east of the existing driveway. Emergency access would be provided through the parking area on 3rd Street and from Mission Avenue, extending through the main campus and through the area north of the stadium (see Figure 3-7). Existing fire hydrants would be replaced if necessary in a phased manner as construction proceeds. (See Chapter 3, Project Description, of this EIR.) These provisions would help ensure consistency with San Rafael General Plan policies and programs regarding fire protection service (see Section 4.11.3, Regulatory Framework, above).

For these reasons, the Long-Range Plan's impact on fire protection services would be less than significant, and no mitigation is necessary.

Impacts on Police Services

Development in accordance with the Master Facilities Long-Range Plan would increase the demand for police services, but not to the extent that new or physically altered police stations would be needed.

As discussed above and in Chapter 3, Project Description, completion of the Long-Range Plan would result in an approximately 48,222-square-foot net increase in building area on the SRHS campus, as well as a 200-student increase in enrollment (from the current enrollment of approximately 1,125 students to approximately 1,325 students). The number of faculty and staff at the high school would not change. In addition, approximately 84 additional events per year would be held at the stadium, which is proposed for renovation; however, the stadium's grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats) (see further discussion under "Impacts of Proposed Stadium Project" below).

The 200-student increase and increase in stadium events resulting from the Long-Range Plan could generate new demand for police services, including increased calls for service and response to traffic-related issues. This new demand would not be large enough to require new or physically altered police facilities or equipment, however. Development in accordance with the Long-Range Plan would not require the hiring of any additional officers, and no new or upgraded police facilities would be necessary.

As part of the standard development review process that applies to all projects, development in accordance with the Long-Range Plan would be required to conform to Police Department requirements for features such as emergency access, building security, and address visibility. The Long-Range Plan includes provisions for building security upgrades, outdoor lighting designed to maximize public safety and security, and a new driveway on 3rd Street east of the existing driveway. Emergency access would be provided through the parking area on 3rd Street and from Mission Avenue, extending through the main campus and through the area north of the stadium. (See Chapter 3, Project Description, of this EIR.) These provisions would help ensure consistency with San Rafael General Plan policies and programs regarding police service (see Section 4.11.3, Regulatory Framework, above).

For these reasons, the Long-Range Plan's impact on police services would be less than significant, and no mitigation is necessary.

Potentially Significant Impacts

The Long-Range Plan would not have any potentially significant impacts on fire protection or police services.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Impacts on Fire Protection Services

The Stadium Project would increase the demand for fire protection services, but not to the extent that new or physically altered fire stations would be needed.

This impact would be less than significant for the reasons discussed above for the Long-Range Plan. As noted above, with the Stadium Project, approximately 84 additional events per year would be held at the stadium, but grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats). As part of the Stadium Project, emergency vehicle access would be provided from the existing 3rd Street parking lot and would include an emergency vehicle access loop on the running track (see Figure 3-7) (Fee, 2016).

Impacts on Police Services

The Stadium Project would increase the demand for police services, but not to the extent that new or physically altered police stations would be needed.

This impact would be less than significant for the reasons discussed above for the Long-Range Plan. As noted above, with the Stadium Project, approximately 84 additional events per year would be held at the stadium, but grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats). As part of the Stadium Project, emergency vehicle access would be provided from the existing 3rd Street parking lot and would include an emergency vehicle access loop on the running track (Fee, 2016).

Potentially Significant Impacts

The Stadium Project would not have any potentially significant impacts on fire protection or police services.

CUMULATIVE IMPACTS

For fire protection and police services, the geographic scope for assessing cumulative impacts is the area within the San Rafael city limits, which is served by the San Rafael Fire Department and the San Rafael Police Department. Approved or currently pending development in San Rafael includes approximately 530 housing units, 277,000 square feet of office space, and 2,000 square feet of retail space, along with the previously mentioned 44,000-square-foot Public Safety Center (see Table 6-1 and Figures 6-1 and 6-2 of Chapter 6, CEQA Considerations, of this EIR).

The Master Facilities Long-Range Plan, including the Stadium Project and in conjunction with other past, present, and probable future projects, could result in a cumulative increase in demand for fire protection and police services. As discussed in the above analysis, however, service demands from the Long-Range Plan would not affect these services enough to create the need for new or expanded facilities. Development under the Long-Range Plan would be subject to Fire Code requirements and other standard requirements for features such as emergency access, signage, lighting, and security. Other projects in the San Rafael city limits would also be subject to these standard requirements, along with development impact fees that are used by the City to cover the cost of project impacts on public facilities and services. In addition, citywide voter approval of Measure E in 2013 has provided additional funds to preserve essential City services for a period of 20 years. Measure E funds, which are collected through sales tax, are instrumental in ensuring earthquake-safe police and fire stations and maintaining police and fire staffing and response times (City of San Rafael, 2015).

For these reasons, the Long-Range Plan would not result in or contribute to any significant cumulative fire protection or police service impacts.

4.11.5 REFERENCES

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4.12 TRANSPORTATION AND TRAFFIC

4.12.1 INTRODUCTION

This section describes existing transportation conditions near the San Rafael High School (SRHS) campus, summarizes applicable jurisdictional laws and regulations associated with transportation, and presents the significance criteria for transportation-related environmental impacts. This section also describes analysis methodologies and identifies the potential transportation effects of the Master Facilities Long-Range Plan, including the Stadium Project. The transportation evaluation includes estimates of vehicle trip generation and distribution, and an assessment of potential traffic impacts related to the Master Facilities Long-Range Plan, including the Stadium Project, under existing, near-term, and cumulative growth conditions. Potential effects on pedestrians and bicycles, and public transit, and the transportation effects of construction, are also evaluated. Potential parking effects are addressed in **Appendix F**. Measures to mitigate potential transportation impacts are recommended, as appropriate.

4.12.2 ENVIRONMENTAL SETTING

ROADWAYS

The SRHS campus is located within the City of San Rafael. The campus encompasses the city block bounded by Mission Avenue to the north, 3rd Street to the south, Embarcadero Way to the east, and Union Street to the west.

Several key roadways provide access to the site. These roadways are as follows (see **Figure 4.12-1**):

- U.S. Highway 101 (Highway 101 or US 101) is an eight-lane freeway that runs in the north-south direction and bisects San Rafael. Several interchanges with Highway 101 provide access to the city, including the southbound on- and off-ramps at the Irwin Street/Mission Avenue and Hetherton Street/Mission Avenue intersections, and northbound on- and off-ramps at the Irwin Street/2nd Street and Hetherton Street/2nd Street intersections respectively.
- Mission Avenue is a minor arterial roadway that operates as a two-way street oriented in an east-west direction from its intersection with Embarcadero Way/East Mission Avenue in the east to its intersection with B Street in downtown San Rafael. Near the SRHS campus, Mission Avenue has one travel lane in each direction with parking intermittently provided on both sides of the street.
- 3rd Street is a major arterial roadway that runs in the east west direction. East of Union Street, 3rd Street operates as a two-way street with two through travel lanes in each direction and turning lanes provided at major intersections. Approximately 300 feet west of Grand Avenue, 3rd Street transitions into a one-way street running in the westbound direction. Along this segment, 3rd Street operates as a one-way couplet with 2nd Street. Near the SRHS campus, on-street parking is provided on both sides of the street between Union Street and Embarcadero Way.

SOURCE: Parisi Transportation Consulting, 2016

Figure 4.12-1

PROJECT STUDY INTERSECTIONS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

- 2nd Street is a major arterial roadway that pairs as a one-way couplet with 3rd Street. 2nd Street runs in the eastbound direction from the Marquad Avenue/4th Street/West End Avenue intersection to approximately 300 feet west of Grand Avenue, where it merges with 3rd Street. Some parking is provided along the segment of 2nd Street between Irwin Street and Grand Avenue.
- Grand Avenue is a major arterial roadway that is oriented in a north-south direction from Francisco Boulevard East in the south to its intersection with Villa Avenue in the north. Grand Avenue functions as a two-way street with one travel lane in each direction. Parking is generally provided on both sides of the street.
- Union Street is a local roadway that runs in the north-south direction from 3rd Street in the south to Jewell Street in the north. Union Street has one travel lane in each direction. South of Mission Avenue, parking is only provided on the west side of the street. North of Mission Avenue, parking is generally provided on both sides of the street.
- Hetherton Street is a one-way roadway in downtown San Rafael. Hetherton Street, under the jurisdiction of Caltrans, runs in the southbound direction from its intersection with the Mission Avenue/Highway 101 off-ramp to the north to the 2nd Street/Highway 101 northbound on-ramp intersection to the south. Hetherton Street has three southbound through travel lanes with additional turn lanes provided at major intersections. There is no parking provided along Hetherton Street.
- Irwin Street, also under the jurisdiction of Caltrans, is a one-way roadway in downtown San Rafael oriented in the northbound direction from the 2nd Street/Frontage Road intersection to the Mission Avenue/Highway 101 southbound on-ramp. Irwin Street has three northbound through travel lanes with additional turn lanes provided at major intersections. Parking is provided on both sides of the street but is prohibited during the evening peak commute period to accommodate heavier traffic flows.
- Embarcadero Way is a local roadway generally running in the north-south direction. Embarcadero Way functions as a two-way roadway; however, it is a narrow roadway, and that presents a challenge for vehicles traveling in opposing directions as they pass one another. Parking is prohibited along the roadway.

Figure 4.12-1 illustrates the key roadways in the project site vicinity. The figure also shows study intersections, which are discussed later in this section.

PEDESTRIAN AND BICYCLE FACILITIES

Pedestrian Facilities

Pedestrian facilities in the area generally include sidewalks, curb ramps, crosswalks, and pedestrian signals. Along 3rd Street, Union Street, and Mission Avenue west of Belle Avenue, sidewalks are provided on both sides of the roadways.

On Mission Avenue east of Belle Avenue, a paved sidewalk is only provided to Jewell Street. East of Jewell Street, no sidewalk is provided on either side of the street, although small segments of the north side of the street include narrow sidewalks adjacent to individual property parcels. There is a narrow dirt path along the south side of the roadway between Belle Avenue and Embarcadero Way.

Along Embarcadero Way there is no sidewalk provided, and there is limited to no shoulder width available along either side of the street. This requires pedestrians to walk onto the roadway and creates potential conflict with vehicular traffic. The roadway curvature also limits pedestrian visibility for vehicles travelling along the roadway.

On the roadways surrounding the SRHS campus (i.e., 3rd Street, Mission Avenue, Union Street, and Embarcadero Way), most of the pedestrian crosswalks include curb ramps; however, some of the ramps are not compliant with Americans with Disabilities Act (ADA) design guidelines, and in some cases there are no curb ramps serving crosswalks.

Peripheral to the SRHS campus (along Mission Avenue, Union Street and 3rd Street), there are marked crosswalks, including crosswalks controlled with traffic and pedestrian signals (e.g., Union Street/3rd Street), crosswalks controlled with all-way stop signs (e.g., Union Street/Mission Avenue), and uncontrolled crosswalks (across 3rd Street at Embarcadero Way, across Union Street at 4th Street, and across Mission Avenue at Park Street, Alice Street, and Belle Avenue).

Bicycle Routes and Parking

Bicycle circulation in the SRHS campus vicinity is provided by a limited network of bicycle routes. Along roadways adjacent to the SRHS campus, the bicycle network primarily consists of Class III routes, i.e., roadways that are shared between vehicular and bicycle traffic. Some of the routes are designated with shared roadway bicycle marking stencils ("sharrows") and intermittent signage. The following roadways near the SRHS campus have sharrows and accompanying signage:

- 3rd Street in both directions from Grand Avenue to Embarcadero Way, and continuing onward along Point San Pedro Road toward the San Rafael Bay. This segment of 3rd Street (as well as the segment between Hetherton Street and Grand Avenue) is designated as a planned section of the San Francisco Bay Trail.
- Grand Avenue in both directions from 3rd Street to Newhall Drive/Belle Avenue.
- 4th Street from the western city limits to Union Street.

There are two bicycle parking racks located within the SRHS campus that can accommodate a total of up to 24 bicycles.

PUBLIC TRANSIT

Local and Regional Transit

The SRHS campus is located less than 1 mile from the San Rafael Transit Center located in downtown San Rafael. Local and regional transit operators provide service to and from the center. The center will also accommodate an active station for the future Sonoma-Marin Area Rail Transit (SMART) commuter rail line once it begins operation in 2017.

Local bus service to and from the SRHS campus is provided by Marin Transit. Bus lines serving the area are accessible via the four bus stop locations that are closest to the SRHS campus:

- At the southeast corner of the Union Street/Mission Avenue intersection, providing service to transit vehicles travelling in the northbound direction.
- At the west side of Union Street, mid-block between Mission Avenue and 4th Street, providing service to transit vehicles travelling in the southbound direction.
- At the northwest corner of the Grand Avenue/3rd Street intersection, providing service to transit vehicles travelling in the westbound direction.
- At the south side of 2nd Street mid-block between Irwin Street and Grand Avenue, providing service to transit vehicles traveling in the eastbound direction.

The bus stops serve the following key bus routes near the SRHS campus:

- Route 23, Shoreline Parkway (San Rafael) – Sir Francis Drake Boulevard and Claus Drive (Fairfax). Service to the area is provided approximately once every hour between 6:00 AM and 10:30 PM during weekdays and between 8:00 AM and 9:30 PM on weekends and holidays.
- Route 23X/Route 29, San Rafael Transit Center (San Rafael) – Marin General Hospital (Larkspur). This route operates as Route 29 except between Medway Road and East Francisco Boulevard and the San Rafael Transit Center, where it continues as Route 23X. Route 23X service to the area is provided approximately once every hour between 6:30 AM and 6:30 PM on Mondays through Fridays. Route 29 service to the area is provided approximately once every hour between 6:30 AM and 8:00 PM on Mondays through Fridays.
- Route 35, Kerner Boulevard & Larkspur Street (San Rafael) – Redwood Boulevard and Olive Avenue (Novato). Service to the area is provided approximately once every 30 minutes, between 5:30 AM and 2:30 AM every day of the week.
- Route 36, Kerner Boulevard & Larkspur Street (San Rafael) – Donahue Street and Terners Drive (Marin City). Service to the area is provided approximately once every 30 minutes, between 6:30 AM to 8:10 PM Monday through Friday, and 7:30 AM to 8:00 PM on weekends and holidays.
- Route 233, San Rafael Transit Center (San Rafael) – Venodola Drive and Estancia Way (Santa Venetia). Service to the area is provided approximately once every hour between 7:00 AM and 7:00 PM Mondays through Fridays, and 8:00 AM and 6:00 PM on weekends and holidays.
- Route 257 San Rafael Transit Center (San Rafael) – Indian Valley Campus (Ignacio). Service to the area is provided approximately once every hour between 6:00 AM and 10:30 PM on Mondays through Fridays.

School Bus Service

Typically two passenger vans/buses pick up and drop off students with special needs on campus. The school does not provide campus-wide bus service for student commute trips.

PARKING

A total of 221 standard parking spaces and 12 spaces compliant with the ADA currently exist on the SRHS campus, with 42 standard spaces and 2 ADA-compliant spaces in the parking lot with access from Mission Avenue east of Belle Avenue, 17 standard spaces and 1 ADA-compliant space in the parking lot accessible via the Mission Avenue/Belle Avenue intersection, and 162 standard spaces and 9 ADA-compliant spaces in the parking lot with access from 3rd Street. On-street parking in the SRHS campus vicinity is discussed above under "Roadways." Existing parking conditions within and surrounding the project site were assessed and documented in a detailed parking study provided in Appendix F-7.

4.12.3 REGULATORY FRAMEWORK

Applicable state, regional, and local agency laws, regulations, and orders that could pertain to project-related transportation issues are presented below.

STATE REGULATIONS

The California Department of Transportation (Caltrans) is responsible for planning, designing, building, operating, and maintaining California's State Highway System. Highway 101 is managed by Caltrans and is part of the California Freeway and Expressway System.

The Caltrans *Guide for the Preparation of Traffic Impact Studies* (Caltrans, 2002) provides guidance on the analysis of the potential impacts of a project on the State Highway System. A traffic analysis is warranted if:

- The project would generate 100 peak hour trips assigned to a State Highway System;
- The project would generate 50 to 100 peak hour trips assigned to a state highway facility, and the affected highway facilities are experiencing a noticeable delay approaching unstable traffic flow (level of service [LOS] C or D) conditions; or
- The project would generate 1 to 49 peak hour trips assigned to a state highway facility, and the affected highway facilities are experiencing significant delay; unstable or forced traffic flow (LOS E or F conditions) (Caltrans, 2002).

REGIONAL REGULATIONS

The Metropolitan Transportation Commission (MTC) is the transportation planning, coordinating, and financing agency for the nine-county San Francisco Bay Area. The MTC prepares a 25-year Regional Transportation Plan that guides funding priorities for regional development of mass transit, highway, airport, seaport, railroad, bicycle and pedestrian facilities.

LOCAL REGULATIONS

Transportation Authority of Marin

The Transportation Authority of Marin (TAM) is a Joint Powers Agency established between Marin County and all cities within the county, including the City of San Rafael, to address Marin's unique transportation issues and to fulfill the legislative requirements of California Propositions 111 and

116 (approved in June 1990). As the Congestion Management Agency (CMA) for Marin County, TAM maintains the Congestion Management Plan (CMP) (Transportation Authority of Marin, 2015).

As identified by TAM in the *Final Report 2015 CMP Update Marin County,* (Transportation Authority of Marin, 2015), regional roadways within the SRHS campus vicinity identified as part of the CMP network include both 2nd Street and 3rd Street between Highway 101 and Marquard Street. Two of the project's study intersections (Hetherton Street/2nd Street and Hetherton Street/3rd Street) are included in this segment of the CMP network. The CMP arterial level of service thresholds are consistent with those provided in the Highway Capacity Manual. Local cities and towns must consider the impacts of land use changes on the arterial level of service within the designated CMP network. (Transportation Authority of Marin, 2015)

TAM funds and manages the Marin County Safe Routes to School program, designed to reduce congestion around schools by encouraging and facilitating the use of "green trips" (e.g.., walking, bicycling, transit, and carpooling) for travel to and from schools. Since the countywide program was established in 2000, San Rafael High School has only intermittently participated (Marin Safe Routes to School program, 2016).

City of San Rafael

San Rafael General Plan

The San Rafael General Plan contains goals, policies, and programs that guide the City's land use and development policy. The plan addresses various state-mandated elements including, but not limited to, Circulation and Infrastructure; and Land Use, Community Design and Neighborhoods (City of San Rafael, 2013).

The Circulation Element of the San Rafael General Plan contains a range of policies and implementation programs designed to maintain or improve transportation circulation within the city. Relevant policies and programs provided by the Circulation Element include the following:

Policy C-4 **Safe Roadway Design.** Design of roadways should be safe and convenient for motor vehicles, transit, bicycles and pedestrians. Place highest priority on safety. In order to maximize safety and multimodal mobility, the City Council may determine that an intersection is exempt from the applicable intersection level of service standard where it is determined that a circulation improvement is needed for public safety considerations, including bicycle and pedestrian safety, and/or transit use improvements.

Program C-4a **Street Pattern and Traffic Flow.** Support efforts by the City Traffic Engineer to configure or re-configure street patterns so as to improve traffic flow and turning movements in balance with safety considerations and the desire not to widen roads.

Program C-4b **Street Design Criteria to Support Alternative Modes**. Establish street design criteria to the extent permitted by State law to support alternative transportation modes to better meet user needs and minimize conflicts between competing modes.

Program C-4c **Appropriate LOS Standards**. At the time City Council approves a roadway improvement and safety exemption from the applicable LOS standard, the appropriate LOS will be established for the intersection.

Policy C-5 **Traffic Level of Service Standards.**

A. **Intersection LOS**. In order to ensure an effective roadway network, maintain adequate traffic levels of service (LOS) consistent with standards for signalized intersections in the AM and PM peak hours, i.e., LOS D Citywide except as noted for the Mission Avenue/Irwin Street (LOS F), and 3rd Street/Union Street (LOS E).

C. **Exemptions**. Signalized intersections at Highway 101 and Interstate 580 on-ramps and off-ramps are exempt from LOS standards because delay at these locations is affected by regional traffic and not significantly impacted by local measures.

D. **Evaluation of Project Merits**. In order to balance the City's objectives to provide affordable housing, maintain a vital economy and provide desired community services with the need to manage traffic congestion, projects that would exceed the level of service standards set forth above may be approved if the City Council finds that the benefits of the project to the community outweigh the resulting traffic impacts.

Program C-5a **LOS Methodology.** Use appropriate methodologies for calculating traffic Levels of Service, as determined by the City Traffic Engineer.

Program C-5c **Exception Review.** When the City Council finds that a project provides significant community benefits yet would result in a deviation from the LOS standards, the City Council may approve such a project through adoption of findings, based on substantial evidence, that the specific economic, social, technological and/or other benefits of the project to the community substantially outweigh the project's impacts on circulation, and that all feasible mitigation measures have been required of the project.

Policy C-7 **Circulation Improvements Funding.** Take a strong advocacy role in securing funding for planned circulation improvements. Continue to seek comprehensive funding that includes Federal, State, County, and Redevelopment funding, Local Traffic Mitigation Fees, and Assessment Districts. The local development projects' share of responsibility to fund improvements is based on: (1) the generation of additional traffic that creates the need for the improvement; (2) the improvement's role in the overall traffic network; (3) the probability of securing funding from alternative sources; and (4) the timing of the improvement.

Program C-7a **Traffic Mitigation Fees.** Continue to implement and periodically update the City's Traffic Mitigation Program.

Program C-7b **Circulation Improvements**. Seek funding for and construct circulation improvements needed for safety, to improve circulation, or to maintain traffic level of service.

Policy C-11 **Alternative Transportation Mode Users.** Encourage and promote individuals to use alternative modes of transportation, such as regional and local transit, carpooling, bicycling, walking and use of low-impact alternative vehicles. Support development of programs that provide incentives for individuals to choose alternative modes.

Program C-11e **Reduction of Single Occupancy Vehicles**. Encourage developers of new projects in San Rafael, including City projects, to provide improvements that reduce the use of single occupancy vehicles. These improvements could include preferential parking spaces for carpools, bicycle storage and parking facilities, and bus stop shelters.

Policy C-13 **School-Related Automobile Traffic.** Actively encourage public and private schools to implement trip reduction programs and reduce congestion caused by commuting students and staff.

Program C-13a **School Transportation.** Actively support efforts to improve transportation options for students and reduce school-related traffic congestion. Examples include advocating for funding for the Safe Routes to Schools program, encouraging transit providers to offer free passes or awards to students to use transit, supporting increased funding of school buses and crossing guards, and staggering school hours.

Policy C-21 **Residential Traffic Calming.** Protect residential areas from the effects of traffic from outside the neighborhood by continuing to evaluate and construct neighborhood traffic calming solutions as appropriate such as speed humps, bulb outs, speed limits, stop signs and roundabouts. Ensure that traffic calming approaches do not conflict with emergency response.

Program C-21a **Traffic Calming Program.** Maintain a neighborhood traffic calming program under the direction of the City Traffic Engineer, and seek funding for its implementation. Ensure neighborhood participation in the development and evaluation of potential traffic calming solutions.

Bicycle/Pedestrian Master Plan

The City of San Rafael's Bicycle/Pedestrian Master Plan (adopted April 2011) outlines goals, objectives, and policy actions to guide and facilitate the City in the implementation, maintenance, and upgrade of the bicycle and pedestrian infrastructure in San Rafael (City of San Rafael, 2011a). Relevant policies provided by the Bicycle/Pedestrian Master Plan include the following:

Policy C-1 Complete missing connections to establish direct routes for walking.

Policy C-2 Identify and mitigate impediments and obstacles to walking to school, such as through a Safe Routes to Schools program.

Policy C-4 Support the installation of appropriate pedestrian facilities as part of all new transportation improvements, development projects and transit facilities.

San Rafael Municipal Code

As discussed later in this section, the San Rafael Municipal Code, which includes the Zoning Code, contains sections related to transportation, bicycle facilities, and parking. The City's parking standards, set forth in Chapter 14.18 of the Zoning Code, outlines requirements for off-street vehicle parking for new construction, additions, and change in occupancy. The City's bicycle parking requirements, set forth in Section 14.18.090 of the Zoning Code, require the provision of certain short-term and long-term bicycle parking spaces. Chapter 5.8.1 of the Municipal Code sets forth trip reduction and travel demand requirements for large employers (100 or more employees) at the site (City of San Rafael, 2016).

Even though the District has adopted a resolution pursuant to Government Code Section 53094 exempting the project and the campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City's Municipal Code, the City's General Plan, the City's Bicycle and Pedestrian Plan, and related ordinances and regulations that otherwise would be applicable, this EIR (and the Parking Study in Appendix F-7) evaluates the project's consistency with such regulations and policies for the purposes of California Environmental Quality Act (CEQA) compliance, and also because it is the District's goal that such policies and regulations be acknowledged and adhered to as much as feasible.

4.12.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

CEQA Guidelines Significance Criteria

For the purposes of this EIR and based on Appendix G of the CEQA Guidelines, implementation of the proposed project would have a significant effect on transportation and traffic if it would:

a) Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, including mass transit and nonmotorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit;

b) Conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the congestion management agency for designated roads or highways;

c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks;

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment);

e) Result in inadequate emergency access; or

f) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities.

City of San Rafael Significance Thresholds

The City of San Rafael has established significance criteria that determine what would constitute a significant impact on intersection operations.[1] A description of intersection level of service methodology is provided later in this section.

According to the City, and as related to criterion "a" of the CEQA Guidelines above, impacts at signalized intersections would be significant if they satisfy either of the following criteria:

- If a signalized intersection with baseline traffic volumes is operating at an acceptable level of service and deteriorates to an unacceptable operation (LOS E or LOS F), this impact would be significant.
- If a signalized intersection with baseline traffic volumes is operating at an unacceptable level of service or already operating at level of service and there is an increase in the delay of 5 seconds or more, this impact would be significant.

Impacts at an unsignalized intersection would be significant if they satisfy either of the following criteria:

- If an unsignalized intersection with baseline traffic volumes is operating at an acceptable level of service and deteriorates to an unacceptable operation (LOS F) with the addition of project traffic, this impact would be significant.
- If an unsignalized intersection with baseline traffic volumes is already operating at LOS F and project traffic causes an increase in delay of 5 seconds or more, this impact would be significant (City of San Rafael, 2016).

[1] Per direction from the City of San Rafael in 2016, the intersection level of service significance thresholds for San Rafael were referenced from the *San Rafael Target Draft Environmental Impact Report* SCH No. 2007082125 (September 2008), and the *San Rafael Airport Recreational Facility Draft Environmental Impact Report* SCH No. 2006012125 (August 2011) which were provided by the City of San Rafael.

METHODOLOGY

Study Approach

To identify potential transportation impacts related to the implementation of the Master Facilities Long-Range Plan, the study conducted for this EIR developed student trip generation estimates for the peak hour (consisting of the highest traffic volumes during four consecutive 15-minute intervals) of traffic occurring during the morning (one hour between 7:00 AM and 9:00 AM), afternoon peak hour (one hour between 2:00 PM and 4:00 PM), and evening (one hour occurring between 4:00 PM and 6:00 PM).

The peak hours for vehicular traffic generally correspond with drop-off, pick-up, and parking trips made to or from the SRHS campus. SRHS operates on a block schedule, i.e., the class periods and corresponding bell schedule vary daily. The schedule variation influences the school's start and end times and related drop-off and pick-up activities. A review was conducted of the various full-day schedule times observed during the 2016-2017 school year. The start and end times of each schedule day and the average occurrence of each throughout the 2016-2017 school year are summarized as follows:

- The Traditional Day schedule begins at 7:05 AM (zero period) and ends at 3:15 PM (Period 7), and occurs during less than 1 percent of the school year.
- Schedule A days begin at 7:00 AM (zero period) and end at 1:50 PM (Period 7), and make up about 6 percent of the school year.
- Schedule A (a/t) days begin at 7:00 AM (zero period) and end at 2:40 PM (Period 3), and occur about 40 percent of the school year.
- Schedule B days begin at 7:00 AM (zero period) and end at 3:30 PM (Period 7), and happen about 48 percent of the school year.

During all bell schedules, the first period begins at 8:00 AM, and this is when the majority of students begin their school day (San Rafael High School, 2016).[2]

For this study, the peak hours were defined as the highest volume peak 1-hour periods influenced by school-related traffic, and it is acknowledged that the peak hour during the afternoon and evening peak period varies daily based on the final school bell schedule. This study estimated vehicular trip generation for the following three peak hours:

- Morning peak hour (weekday AM peak period) – representing peak traffic levels within a 1-hour window (four consecutive 15-minute intervals) of the first school bell (8:00 AM). At the school's 3rd Street driveways, the peak hour for total intersection traffic volumes typically occurs between 7:30 AM and 8:30 PM.

[2] Madrone High Continuation School, which currently shares a campus with SRHS, has a student enrollment of 75 students. Madrone High Continuation School also operates on a block schedule with two varying schedule days, i.e., Schedule A and Schedule B. The class periods held on each day vary, but on both days the first period of the day begins at 8:30 AM and the last period ends at 2:00 PM. As the school begins one-half hour after SRHS, traffic generated by Madrone High Continuation School would generally fall outside of the morning peak period for adjacent street traffic.

- Afternoon peak hour – representing peak traffic levels within a 1-hour window (four consecutive 15-minute intervals) of the last school bell. The last school bell varies daily, and therefore the corresponding start and end of the afternoon peak hour also vary daily.
- Evening peak hour (weekday PM peak period) – representing the peak 1 hour of vehicular traffic levels occurring between 4:00 PM and 6:00 PM, i.e., the traditional evening commute period. School-related traffic added to local roadways during this period generally consists of trips made by students participating in after-school activities. The last school bell varies daily, and therefore the corresponding start and end of the evening peak hour also vary daily.

The analysis was performed consistent with City of San Rafael level of service standards. The following scenarios were evaluated for the weekday AM and weekday PM peak periods, except when noted otherwise:

- Existing conditions – representing baseline conditions along study roadways when traffic volume data was last collected.[3]
- Existing plus Stadium Project conditions – representing conditions along study roadways with the addition of trips generated by the proposed Stadium Project (PM peak hour only; no new vehicle trips associated with the Stadium Project are expected during the AM peak hour).
- Near-term (2020) conditions – representing conditions along study roadways with estimated background growth and development up to the 2020 forecast year.
- Near-term (2020) plus Master Facilities Long-Range Plan conditions – representing 2020 forecast year conditions along study roadways with the addition of trips that would be generated by the proposed Stadium Project and increased student enrollment (200 students).[4]
- Cumulative (2040) conditions – representing conditions along study roadways with estimated background growth and development up to the 2040 forecast year.
- Cumulative (2040) plus Master Facilities Long-Range Plan conditions – representing 2020 forecast year conditions along study roadways with the addition of trips that would be generated by the proposed Stadium Project and increased student enrollment (200 students).

Roadway intersections are generally the focus of traffic assessments since intersections, rather than the roadway segments between them, typically control the operation and capacity of street networks.

The traffic evaluation focuses on 24 key intersections that serve the SRHS campus. These intersections, selected by the City of San Rafael for analysis, and their corresponding traffic controls are listed in **Table 4.12-1** and depicted in Figure 4.12-1.

[3] Baseline conditions apply to the time of the Notice of Preparation, which was August 5, 2016. Traffic volume data for the study intersections are based on turning movement counts collected for this study in May and October 2016, as well as volume information provided by the City of San Rafael. Traffic volume count data for each intersection are included in Appendix F-2. The traffic counts were validated for consistency and are considered representative of baseline conditions when school is in session.

[4] The future year 2020 conditions, as well as year 2040 conditions, include the Stadium Project because it is part of the overall Master Facilities Long-Range Plan.

TABLE 4.12-1 STUDY INTERSECTIONS AND TRAFFIC CONTROLS

Intersection		Control	Intersection		Control
1	SRHS Driveway (W)/ 3rd St.	TWSC	13	Grand Ave./ 2nd St.	Signal
2	SRHS Driveway (E)/ 3rd St.	OWSC	14	Irwin St./Mission Ave.	Signal
3	Embarcadero Way/3rd St.	OWSC	15	Irwin St./5th Ave.	Signal
4	Embarcadero Way/Mission/ Marina/E. Mission/Sea View	AWSC	16	Irwin St./4th St.	Signal
5a	Belle Ave./Mission Ave./ SRHS Driveway	TWSC	17	Irwin St./3rd St.	Signal
5b	Belle Ave./Mission Ave.	OWSC	18	Irwin St./ 2nd St.	Signal
6	Alice St./Mission Ave.	OWSC	19	Hetherton St./Mission Ave.	Signal
7	Park St./Mission Ave	OWSC	20	Hetherton St./5th Ave.	Signal
8	Union St./Mission Ave.	AWSC	21	Hetherton St./4th St.	Signal
9	Union St./4th St.	TWSC	22	Hetherton St./3rd St.	Signal
10	Union St./3rd St.	Signal	23	Hetherton St./2nd St.	Signal
11	Grand Ave./Mission Ave.	AWSC	24	New SRHS Driveway/3rd St.	OWSC
12	Grand Ave./ 3rd St.	Signal			

Notes: Signal = signalized intersection. AWSC = all-way stop-controlled; TWSC= two-way stop-controlled. OWSC = one-way stop-controlled.
Source: City of San Rafael, 2016; Parisi Transportation Consulting, 2016.

The peak hour volumes of vehicular, pedestrian, and bicycle traffic were based on turning movement counts collected at the 24 study intersections. Vehicular traffic volumes during the weekday AM and weekday PM peak periods were used to evaluate study intersection operations under existing conditions. The peak hour traffic volumes were based on the highest total intersection traffic volume at each intersection.[5]

The number of student vehicle trips generated by the existing and future school enrollment was estimated using student travel survey data (Appendix F-3), vehicle traffic counts (Appendix F-2), and parking occupancy and duration counts (Appendix F-7) (all of which were conducted in May 2016 and in October 2016). The existing student travel modes to and from SHRS were estimated through comprehensive travel surveys developed for this study based on a methodology used by the National Center for Safe Routes to Schools (NCSRTS, 2016). The survey results were compared to the traffic counts collected at school driveways and through the adjacent neighborhood streets (Appendix F-2). In addition, parking survey data (detailed in Appendix F-7) were also considered.

[5] Baseline turning movement volumes at Intersections 1 through 13 (as identified in Table 4.12-1) are based on counts in May and October 2016. The counts were collected for a continuous two-hour period in the morning (7:00 AM to 9:00 AM), and evening (4:00 PM to 6:00PM). The data were analyzed and peak hour traffic volumes were identified on an intersection-by-intersection basis. The intersection turning movement volumes during the peak 1 hour (four consecutive 15-minute intervals) within each 2-hour period were assigned as the peak hour volume for the study intersections. Peak hour traffic volumes at Intersections 14 through 24 were provided by the City of San Rafael during a meeting held on October 6, 2016.

Table 4.12-2 summarizes the average travel mode share splits for school commute trips made by existing students at the SRHS campus.[6] The values shown in the table represent all morning and afternoon trips, respectively. Mode splits vary by the hour within each period.

TABLE 4.12-2 SAN RAFAEL HIGH SCHOOL CAMPUS STUDENT COMMUTE TRIPS – TRAVEL MODE SHARE

Period	Walk	Bike	Transit	Other	Carpool	Single-Student Vehicle	Total
AM	12%	4%	25%	1%	15%	43%	100%
PM	17%	3%	24%	1%	14%	41%	100%

Notes: Single-student vehicle trips include students dropped off/picked up by parents and/or guardians, as well as students who drive themselves to school.
Source: San Rafael City Schools (District), 2016; Parisi Transportation Consulting, 2016.

The San Rafael General Plan (City of San Rafael, 2013) states as follows: "City studies have estimated that 21 percent of a.m. peak traffic is caused by school-related traffic. Studies also show that 10 percent of students use a school bus for transport to school, while 75 percent arrive by car. Many parents feel it is unsafe for students to ride the bus or bike or walk to school. The countywide Safe Routes to School program is addressing these issues." However, the student travel survey revealed that the share of students taking public transit (24 to 25 percent) to and from SRHS is more than double the City estimates. Additionally, the share of students traveling to school by private vehicle (carpool and single-student vehicle trips) is lower than City estimates by about 17 to 20 percent.

San Rafael City Schools (also referred to as "the District") also provided stadium usage data for the existing and proposed changes to the school's stadium. (Appendix F-5). The information provided included the number of events hosted annually, the number of participants and spectators for each event, and various assumptions regarding the arrival and departure patterns associated with the stadium activities. These assumptions, which are further detailed later in this section, were used to estimate the number of vehicle trips generated by the existing and proposed stadium usage.

Traffic operation performance was then evaluated for each of the study intersections (Appendix F-6). This analysis provides estimates of increased motorist delays that could result at the study intersections, as well as a level of service grade. If an intersection's level of service would degrade below an acceptable standard (described above under "Significance Criteria"), measures to mitigate the intersection's operation back to an acceptable level of service are provided, as appropriate.

Expected pedestrian and bicycle access and circulation with the implementation of the Master Facilities Long-Range Plan were qualitatively assessed as they relate to the project study area and the Master Facilities Long-Range Plan's proposed amenities, including the Stadium Project. Any

[6] As stated in Chapter 3, Project Description, of this EIR, the Master Facilities Long-Range Plan does not project an increase in faculty serving the SRHS campus. As such, the transportation analysis focuses on the existing and future school commute trips generated by students travelling to and from school. Faculty trips generated by the campus are captured in the baseline turning movement counts.

potential safety concerns, right-of-way issues, or conflicts resulting from the Master Facilities Long-Range Plan, including the Stadium Project, were identified and assessed.

Level of Service

Signalized intersection level of service is defined in terms of the average total vehicle delay of all movements through an intersection. Vehicle delay is a method of quantifying several intangible factors, including driver discomfort, frustration, and lost travel time. Specifically, level of service criteria are stated in terms of average delay per vehicle during a specified time period. Vehicle delay is based on many variables, including signal phasing (i.e., the order of movements through the intersection), signal cycle length, and traffic volumes with respect to intersection capacity. **Table 4.12-3** shows level of service criteria for signalized intersections, which apply to the 13 signalized intersections listed in Table 4.12-1.

TABLE 4.12-3 LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTIONS

Level of Service	Average Control Delay Per Vehicle (Seconds)	Description
A	≤ 10	Free flow
B	>1 0 – 20	Stable flow (slight delays)
C	> 20 – 35	Stable flow (slight delays)
D	> 35 – 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	> 55 – 80	Unstable flow (intolerable delay)
F	> 80	Forced flow (jammed)

Source: Transportation Research Board, 2000.

Unsignalized intersection level of service criteria can be further reduced to three intersection types: all-way stop sign-controlled, two-way stop sign-controlled, and one-way stop sign-controlled. All-way stop sign-controlled intersection level of service is expressed in terms of the average vehicle delay of all of the movements, much like that of a signalized intersection.

Two-way and one-way stop-sign controlled intersection level of service is defined in terms of the average vehicle delay for an individual movement(s). This is because the performance of the stop-controlled approach is more closely reflected in terms of its specific movements, rather than its performance overall. With this in mind, intersection average vehicle delay (i.e., average delay of all movements) for a one-way and two-way stop sign-controlled intersection should be viewed with discretion. **Table 4.12-4**

TABLE 4.12-4 LEVEL OF SERVICE DEFINITIONS FOR UNSIGNALIZED INTERSECTIONS

Level of Service	Average Control Delay Per Vehicle (Seconds)
A	≤ 10
B	> 10 – 15
C	>1 5 – 25
D	> 25 – 35
E	> 35 – 50
F	> 50

Source: Transportation Research Board, 2000.

shows level of service criteria for unsignalized intersections (all-way, two-way, and one-way stop sign-controlled), which apply to the unsignalized intersections identified in Table 4.12-1.

Existing Travel Patterns

Field reviews were conducted to assess existing circulation patterns associated with school-related travel. This section provides a brief overview of the existing vehicular, pedestrian, and bicycle traffic circulation patterns for school-related travel within the SRHS campus vicinity.

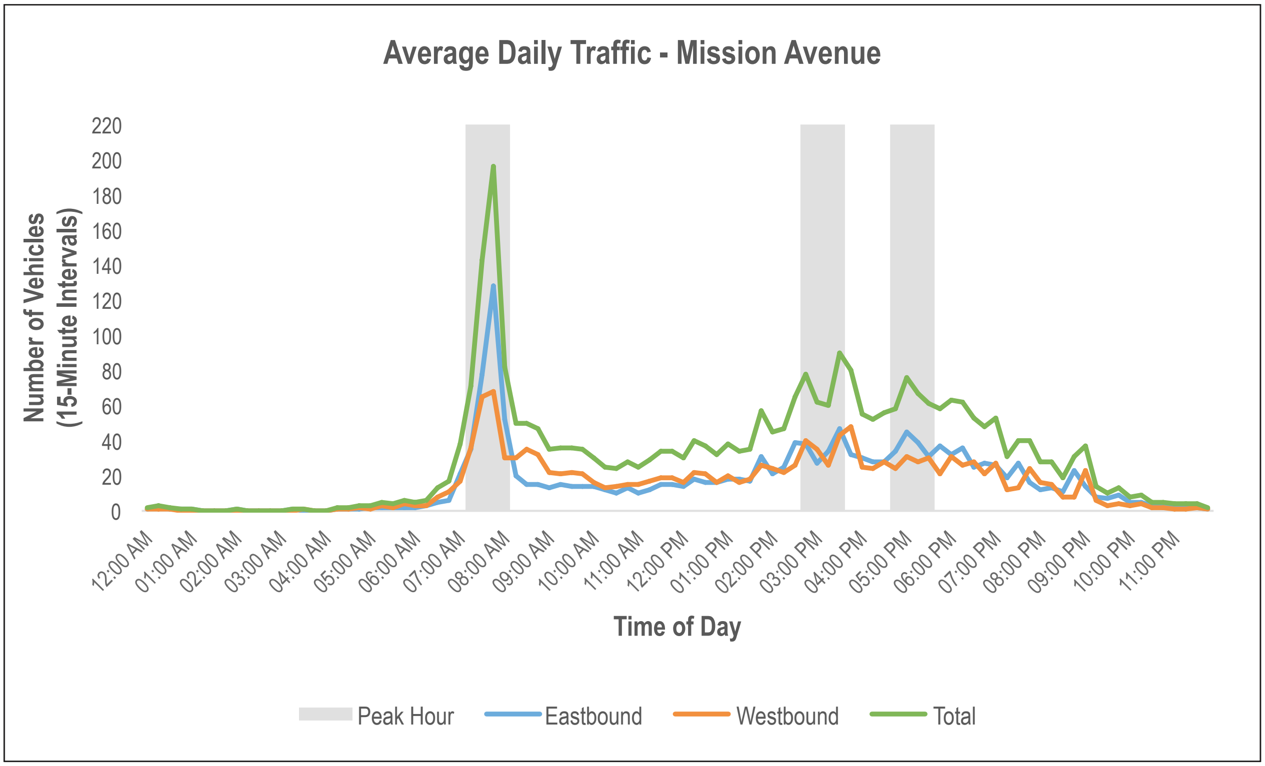
Vehicular Traffic Circulation

As discussed earlier, over the course of a school day about 55 to 58 percent of students arrive or depart school by motor vehicle (see Table 4.12-2). Vehicular traffic generally uses Mission Avenue and 3rd Street for direct access to the SRHS campus. As detailed later in this section, typically about 60 percent of the school's vehicular traffic uses Mission Avenue and other local streets, and about 40 percent uses one of the school's driveways along 3rd Street.

The average daily traffic volume along Mission Avenue is presented in **Figure 4.12-2**. During school commute periods (morning and afternoon peak periods), traffic levels on Mission Street between Union Street and Belle Avenue can reach up to 500 vehicles per hour, with a substantial portion of this traffic consisting of school drop-off or pick-up trips, each characterized as two vehicle trips (one inbound trip and one outbound trip). As can be seen in Figure 4.12-2, a significant portion of daily traffic occurs during the morning drop-off period between 7:30 AM to 8:30 AM, corresponding with the school start time of 8:00 AM for first period classes. Some school trips are one-way, e.g., motorists drive to school and park within a school lot that has access via Mission Street or along local streets.

Mission Avenue can experience short periods of traffic congestion, with vehicles queuing in both directions. There is a 135-foot passenger loading zone along the south side of Mission Avenue just west of Alice Street. This area, designated with a white painted curb, is intended to be used for school drop-offs and pick-ups; however, during peak times, such as the morning drop-off period between 7:30 and 8:30 AM, this drop-off zone usually functions at capacity. This leads to drop-offs occurring along the length of both sides of Mission Avenue between Belle Avenue and Union Street. In some cases, motorists drop off and pick up students within one of the through travel lanes, hindering traffic flow. Motorists often circulate through other neighborhood streets, including Belle Avenue, Alice Street, Park Street and Union Street. During school commute periods, this often results in large numbers of left- and U-turns occurring, particularly at the Mission Avenue/Belle Avenue intersection (see Appendix F-2). For example, after dropping off a student along Mission Avenue, many motorists travel eastbound and turn left at Belle Avenue to continue westbound.

School traffic also accesses the SRHS campus via its two driveways along 3rd Street. This traffic includes two-way drop-off and two-way pick-up trips, as well as one-way trips (i.e., students and staff parking). Both high school driveways on 3rd Street serve outbound movements, but only the eastern driveway accommodates inbound traffic. A graph illustrating the average daily traffic volumes at the school driveways is presented in Figure 4.12-2.



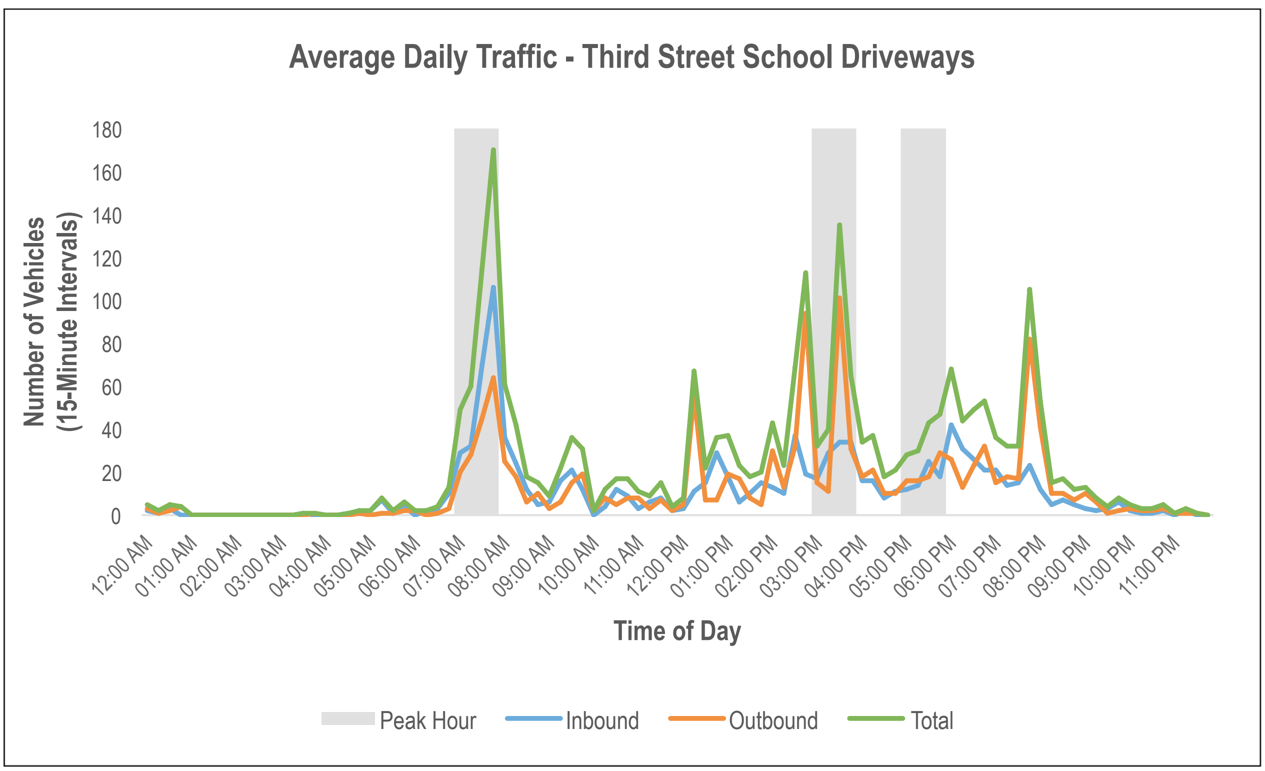


Figure 4.12-2

AVERAGE DAILY TRAFFIC VOLUMES

SOURCE: Parisi Transportation Consulting, 2016

Traffic congestion on 3rd Street near the high school's driveways often intensifies during school commute periods, with the eastbound left-turn pocket along 3rd Street occasionally operating at over-flow conditions. Motorists turning left into the eastern driveway must yield to oncoming westbound traffic, including motorists turning right into the driveway from 3rd Street's outside travel lane. At its peak, this backup spills over onto the through eastbound lanes of 3rd Street. During school commute periods, two-way traffic levels along 3rd Street can reach about 2,000 vehicles per hour.

During the afternoon peak period, vehicles making pick-up trips arrive along Mission Avenue about 10 to 15 minutes before the final school bell rings. These vehicles fill up the passenger loading zone and any available parking spaces along Mission Avenue. During several field visits, vehicles were observed illegally parked along the no-parking zone (designated by red painted curb and accompanying signage). These vehicles impede sight lines along the blind curve at the Mission Avenue/Belle Avenue intersection. Other vehicles arriving when the last school bell rings are not able to be accommodated along the curb. Vehicles were observed either waiting within the travel lane or circling around the neighborhood streets (i.e., making a left turn on Belle Avenue and returning southbound along Alice Street and Park Street).

Along 3rd Street, the majority of the vehicles exiting the 3rd Street driveway make right turns onto 3rd Street. However, due to the high traffic volumes travelling westbound on 3rd Street, exiting vehicles must wait for sufficient gaps in traffic to make the turn. This results in a long vehicular queue, but it is contained within the school parking lot.

Pedestrian and Bicycle Circulation

Over the course of a school day, between 12 and 17 percent of student trips to and from the SRHS campus are made via walking. Most student walking trips originate in nearby neighborhoods, including the Canal, Country Club, Dominican/Black Canyon, Lincoln/San Rafael Hill, and Montecito/Happy Valley neighborhoods. Students use sidewalks and crosswalks along adjacent streets including 3rd Street, Union Street, and Mission Avenue. Many of the sidewalks are narrow, and at some intersection corners, the curb ramps are obsolete (i.e., not in conformance with the ADA guidelines) or non-existent. Several of the marked crosswalks used by students are uncontrolled, and others are controlled with all-way stop signs or with traffic signals. Often drop-off and pick-up activities along neighborhood streets result in students walking across roadways between intersections and marked crosswalks.

About 3 to 4 percent of student trips are made by bicycle. Student bicyclists tend to ride along sidewalks or within shared travel lanes along roadways serving the SRHS campus. The SRHS bike parking area is located within the interior of the campus and has access via Mission Avenue. This secure bicycle parking area provides bicycle parking for about 24 bicycles and is usually at or over capacity during school hours (see Appendix F-7).

Public Transit

About one-quarter of all student trips to and from the SRHS campus are made by public transit. As described previously, seven Marin Transit bus routes serve four bus stops in the vicinity of SRHS. Almost all of the student bus riders walk to and from the campus between the bus stop and the high school, using available sidewalks and crosswalks. Some students cycle to the bus, attach their bicycles for the bus trip (on buses that are equipped with bike racks), and then ride their bikes along local streets to school.

Vehicle Trip Generation

This section details the vehicle trip generation estimates for the SRHS campus under both existing conditions and for the proposed Master Facilities Long-Range Plan, including the proposed Stadium Project.

Student Enrollment

As explained under "Study Approach" above, weekday peak hour trip generation was estimated using student travel survey data (Appendix F-3), vehicle traffic counts (Appendix F-2), and parking occupancy and duration surveys (Appendix F-7). This assessment was used to estimate the share of students that travel to or from school by private vehicle (including drop-off/pick-up trips and student driver trips), including both single-student trips and carpool trips with multiple students per vehicle.

Vehicle trip generation estimates are provided for the peak hour during the morning, afternoon, and evening peak period (as defined under "Study Approach" above). The peak hour is defined as the peak four consecutive 15-minute periods when the level of school-generated traffic is expected to be highest.

The existing vehicle trip generation rates and trip ends are summarized in **Table 4.12-5**. As shown in Table 4.12-5, the SRHS campus currently generates about 986 student vehicle trips during the morning peak hour, 681 vehicle trips during the afternoon peak hour, and 368 vehicle trips during the evening peak hour.

TABLE 4.12-5 STUDENT VEHICLE TRIP GENERATION – EXISTING CONDITIONS

Enrollment	Vehicle Trip Generation	Morning Peak Hour In	Morning Peak Hour Out	Morning Peak Hour Total	Afternoon Peak Hour In	Afternoon Peak Hour Out	Afternoon Peak Hour Total	Evening Peak Hour In	Evening Peak Hour Out	Evening Peak Hour Total
1,125 Students	Rate	0.53	0.35	0.88	0.25	0.35	0.60	0.15	0.17	0.33
	Vehicle Trips	592	395	986	286	395	681	173	195	368

Source: Parisi Transportation Consulting, 2016.

Vehicle trip end estimates were based on a review of traffic volumes at the school driveways and along surrounding neighborhood streets, at which student drop-offs and pickups occur. **Table 4.12-6** summarizes the vehicle trip generation by location. The on-site student vehicle trips comprise vehicle trip ends at the school parking lot and drop-offs/pick-ups along 3rd Street, and off-site student vehicle trips comprise traffic along surrounding neighborhood streets (i.e., Mission Avenue and streets north of the SRHS campus).

TABLE 4.12-6 STUDENT VEHICLE TRIP GENERATION – EXISTING TRIPS BY LOCATION (1,125 STUDENTS)

Vehicle Trip Generation	Morning Peak Hour			Afternoon Peak Hour			Evening Peak Hour		
	In	Out	Total	In	Out	Total	In	Out	Total
On-Site	269	126	395	91	181	272	67	80	147
Off-Site	319	272	591	192	217	409	106	115	221
Total	**588**	**398**	**986**	**283**	**398**	**681**	**173**	**195**	**368**

Source: Parisi Transportation Consulting, 2016.

During the morning peak hour when the highest level of school-related vehicle trips occur, approximately 40 percent of student arrivals and departures occur at the on-site school driveway along 3rd Street and 60 percent occur off-site along neighborhood streets north of the SRHS campus. During the morning peak hour, about 395 vehicle trips (269 inbound and 126 outbound) are made to and/or from the SRHS campus via the 3rd Street parking lot. About 143 of these consist of vehicles driven by students who park in the lot, and 126 vehicles whose drivers travel to the school to drop off a student and then drive away from the school after dropping off the student (i.e., 252 total vehicle trips).

About 591 vehicle trips (319 inbound and 272 outbound) are made to and/or from the SRHS campus via neighborhood streets, including Mission Avenue. About 47 vehicles park either at the two school parking lots (with access via Mission Avenue between Belle Avenue and Jewell Street) at the north side of the campus, or along neighborhood streets. About 136 vehicles travel to the lot to drop off a student and then drive away after dropping off the student (i.e., about 272 total vehicle trips).

The location-based vehicle trip generation rates were applied to the estimated future increase of 200 students to predict the increased vehicle trip generation associated with the Master Facilities Long-Range Plan. The estimated vehicle trips for the Master Facilities Long-Range Plan, categorized as on-site and off-site trips, are summarized in **Table 4.12-7**.

TABLE 4.12-7 STUDENT VEHICLE TRIP GENERATION – MASTER FACILITIES LONG-RANGE PLAN TRIPS BY LOCATION (INCREASE OF 200 STUDENTS)

Vehicle Trip Generation	Morning Peak Hour			Afternoon Peak Hour			Evening Peak Hour		
	In	Out	Total	In	Out	Total	In	Out	Total
On-Site	48	22	70	16	32	48	12	14	26
Off-Site	57	48	105	34	38	73	19	20	39
Total	**105**	**71**	**175**	**50**	**71**	**121**	**31**	**35**	**65**

Source: Parisi Transportation Consulting, 2016.

The projected 200-student increase would generate about 175 student vehicle trips during the weekday morning peak hour, 121 vehicle trips during the afternoon peak hour, and 65 vehicle trips during the evening peak hour. During the morning peak hour, the added students would generate about 105 vehicle trips along local streets, including Mission Avenue. About 96 of these trips would be two-way drop-off trips (48 vehicles driving to and then from the school), and nine additional vehicles would park along local streets. An additional 70 vehicle trips would be estimated to travel to and from the school's parking lot access from 3rd Street, with 44 of these trips being two-way drop-off trips (22 vehicles), and 26 additional vehicles parking within the school parking lot during this 1-hour period (see Appendix F-7).

Stadium Usage

The vehicle trip generation estimates for the proposed Stadium Project were based on a review of information provided by the District regarding the existing and proposed usage of the stadium (Appendix F-5). This section summarizes additional stadium usage information used to estimate the vehicle trip generation resulting from the proposed Stadium Project.

Under the proposed Stadium Project conditions, the stadium would continue to be a facility shared by various on-campus sports teams and community members. Community use of the stadium occurs after school sports use is done, i.e., community use of the stadium does not and would not occur concurrently with any school usage (practice or competitive games) of the stadium. Community use is expected to continue in the same manner with the proposed stadium improvements (see Chapter 3, Project Description, of this EIR). The stadium is not available for any use after 10:00 PM daily.

As SRHS's bell schedule varies daily, commencement and conclusion of after-school activities also change in tandem with each day's school bell schedule. In general, after-school sports practice begins about 15 to 20 minutes after the final school bell rings, and rarely lasts longer than 3 hours.

The District provided attendance estimates for after-school practice activities (summarized in Table 3-3 and Table 3-4 in Chapter 3, Project Description). These estimates include both practice participants and spectators. Approximately 75 percent of practice participants and spectators consist of students already on campus. About 10 parents/friends might be spectators during practice. About 50 percent of practice spectators arrive an hour before practice ends and 75 percent of participants and spectators generate pick-up vehicle trips.

On game days, about one-half of participants are from the home team (i.e., SRHS), and the other half are from the visiting team. For most activities, approximately 80 percent of participants from the visiting teams arrive by school bus. Of the total number of spectators in attendance, about one-half are students already on the campus.

As discussed previously, SRHS/Madrone students travel to and from school using a variety of modes of travel (walking, bicycling, public transit, etc.). The results of the travel survey indicated that about 55 to 58 percent of students travel to school by car. However, stadium-related activities conclude later than the regular school schedule. To provide a conservative (i.e., high) estimate of vehicle trip generation, the estimates developed for the Stadium Project do not take any discounts for students who travel by walking, bicycling, transit, and other miscellaneous modes. That is, the study assumes that all new stadium-related trips would be made by vehicle, which is a conservative assumption.

Since school bell schedules at the SRHS campus vary daily, the Stadium Project analysis scenario represents the highest number of vehicle trips that could be added to the roadway network during the evening peak hour and should be considered a conservative analysis.

A comparison of school stadium activity start and end times under the varying school bell schedules was conducted. During a Schedule B day, the last school bell rings at 3:30 PM. Schedule B days represent approximately 48 percent of the school days during the 2016-2017 year. Therefore, any potential traffic impacts related to the Stadium Project would likely occur more frequently under the Schedule B day scenario.

As shown in Table 3-3 in Chapter 3, Project Description, the proposed changes to the stadium would accommodate additional events and activities at the stadium. This study developed vehicle trip generation estimates for events that are projected to have either an increase in the number of events per year (football practices, lacrosse games, and track and field meets) or an increase in the number of participants and/or spectators per event (lacrosse practices and lacrosse games) (Appendix F-5).

Under existing and future conditions, vehicle trip generation at the stadium is/would be dependent on the number of spectators and participants attending individual events. Of the events with anticipated changes, lacrosse games would have the highest increase in event attendance (96 additional participants and 100 additional spectators). It was estimated that the stadium usage changes resulting from the increase in the number of lacrosse games would potentially generate the highest number of vehicle trips during the evening peak hour. On such days, the arrival trips for lacrosse games (which begin at 6:00 PM) would likely occur during the evening peak hour. This study assumes the student vehicle trips resulting from lacrosse games during a Schedule B day as the analysis scenario for the Stadium Project.

It should be noted that the lacrosse games only occur during the Spring semester (February to May), and only a fraction of the estimated 60 games per season would occur during a Schedule B day. Therefore, the stadium-usage vehicle trip generation estimates summarized in **Table 4.12-8** would not occur every school day of the year.

TABLE 4.12-8 VEHICLE TRIP GENERATION – STADIUM PROJECT

	Morning Peak Hour			Afternoon Peak Hour			Evening Peak Hour		
Vehicle Trip Generation	**In**	**Out**	**Total**	**In**	**Out**	**Total**	**In**	**Out**	**Total**
Existing Stadium Usage	0	0	0	0	0	0	80	0	80
Project-Proposed Usage	0	0	0	0	0	0	30	0	30
Future-Stadium Usage	0	0	0	0	0	0	110	0	110

Source: Parisi Transportation Consulting, 2016.

The proposed Stadium Project would result in new vehicle trips generated during after-school hours. The proposed changes to the stadium's usage would result in a potential increase of about 30 vehicle trips during the evening peak hour on Schedule B days between February and May. During other days, traffic associated with the proposed changes would likely be lower.

Vehicle Trip Distribution and Assignment

San Rafael City Schools student enrollment is not based on neighborhood boundaries, but rather is based on an open-enrollment policy that allows students to enroll at any of San Rafael's schools. Vehicle trip distribution and assignment were estimated based on a review of the home origins of the existing student body at SRHS (2016-2017 school year), as well as the existing and forecasted travel patterns along city streets.

The estimated distribution for trips to and from the SRHS campus is presented in **Table 4.12-9**. **Figure 4.12-3** illustrates the existing traffic volumes at the existing study intersections. (Intersection numbers in Figure 4.12-3 correspond to intersection numbers set forth in Table 4.12-1.)

The estimated new vehicle trips detailed previously were distributed and assigned to the project's study intersections and surrounding roadway network based on the trip distribution rates shown in Table 4.12-9.

KEY FINDINGS

This section reviews the key findings from the analysis described above. These findings provide the basis for the Master Facilities Long-Range Plan impacts and Stadium Project impacts identified in the sections that follow.

Vehicle Traffic Increases

This section describes the potential changes to study roadway operating conditions associated with the increases in traffic volumes resulting from the Master Facilities Long-Range Plan, including the Stadium Project. Separate assessments were conducted for the "Existing plus Stadium Project," "Near-Term plus Master Facilities Long-Range Plan," and "Cumulative plus Master Facilities Long-Range Plan" conditions.

Level of Service – Existing and Existing plus Stadium Project

Table 4.12-10 shows the intersection service levels under existing conditions during the weekday morning and evening peak hours, as well as the Existing plus Stadium Project conditions. As previously discussed, the proposed Stadium Project would generally result only in new vehicle trips generated after school hours (i.e., during the evening peak hour). The table compares the estimated changes to intersection level of service resulting from the addition of new stadium-generated trips during this peak hour.

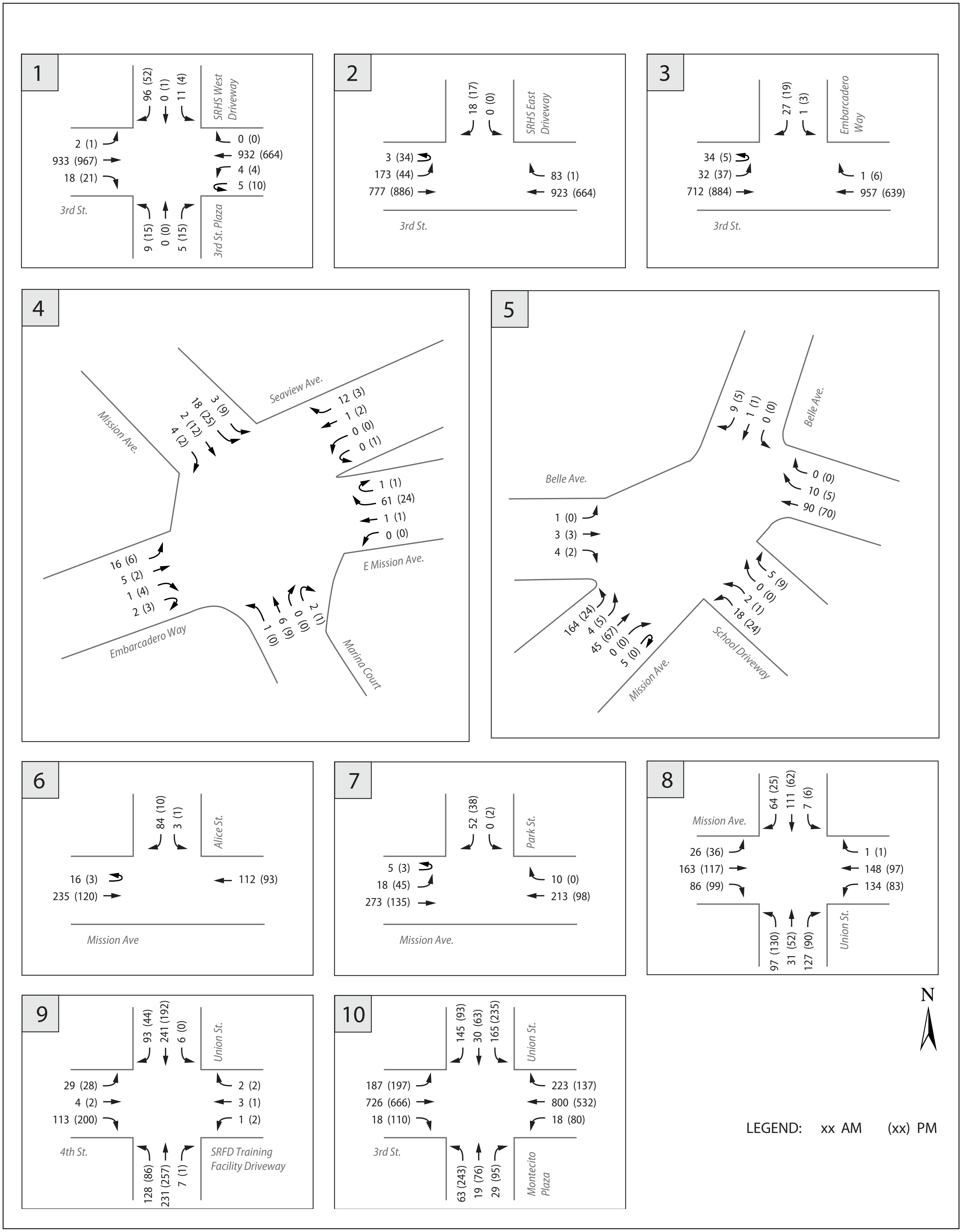


Figure 4.12-3A

SOURCE: Parisi Transportation Consulting, 2016

VEHICULAR TRAFFIC VOLUMES - EXISTING CONDITIONS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

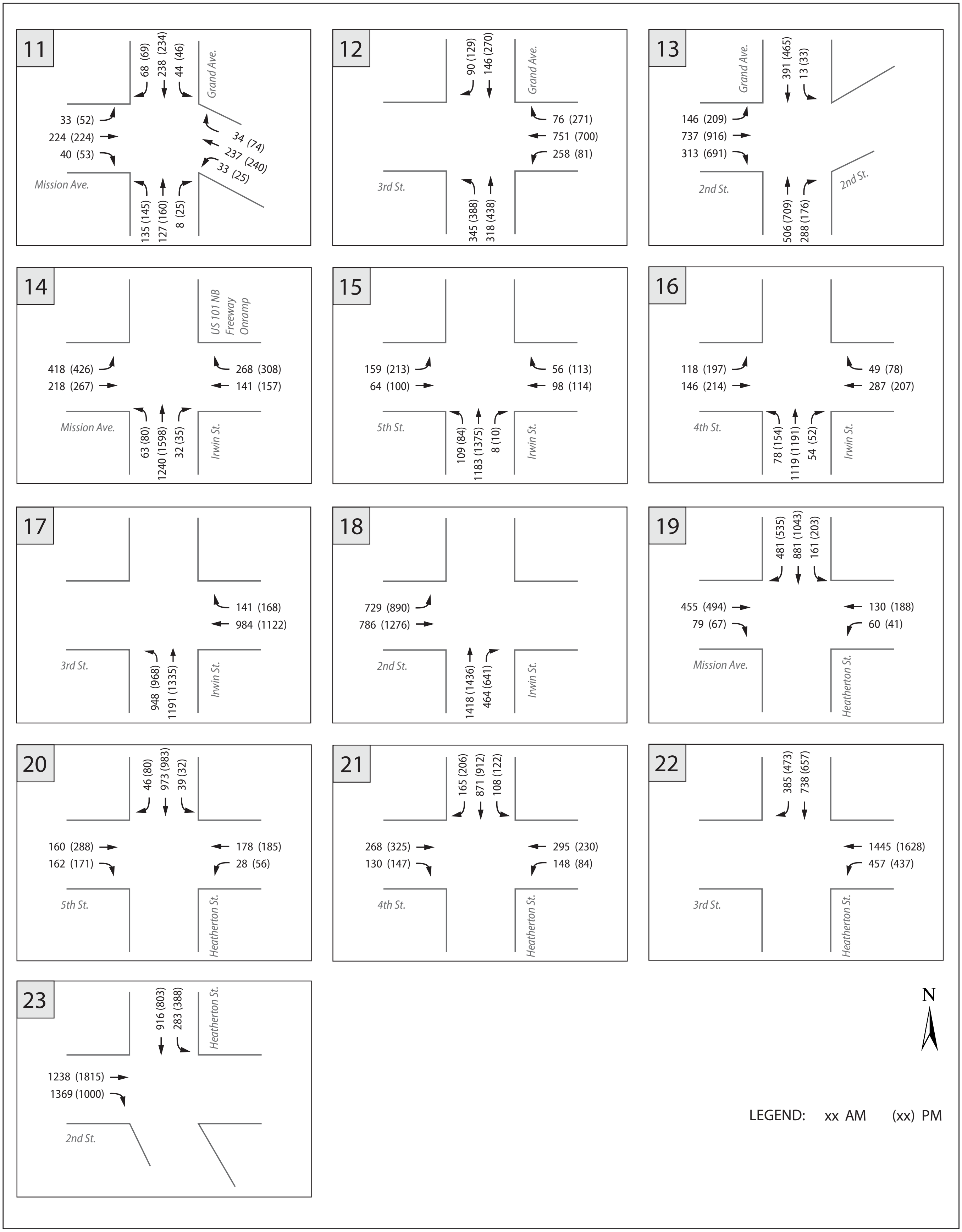


Figure 4.12-3B

SOURCE: Parisi Transportation Consulting, 2016

VEHICULAR TRAFFIC VOLUMES - EXISTING CONDITIONS

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

TABLE 4.12-9 EXISTING SAN RAFAEL HIGH SCHOOL STUDENT VEHICLE TRIP DISTRIBUTION

Origin/Destination		Percent of Total
1	Canal Neighborhood (South of San Rafael Creek and East of US 101)	36%
2	Southwest San Rafael (South of San Rafael Creek and West of US 101)	19%
3	North San Rafael (North of Belle Avenue/Irwin Street)	16%
4	West San Rafael (North of San Rafael Creek and West of US 101)	13%
5	East of San Rafael High School (North of Point San Pedro Road and east of Embarcadero Way/ Mission Avenue)	10%
6	North of San Rafael High School (North of Mission Avenue and South of Palm Avenue)	5%
7	Point San Pedro (North of San Rafael Creek and south of Point San Pedro Road)	1%
	Total	**100%**

Source: San Rafael City Schools, 2016; Parisi Transportation Consulting, 2016.

Under existing conditions, the SRHS Driveway (West)/3rd Street and the Grand Avenue/Mission Avenue intersections operate at unacceptable levels of service (LOS F) during the morning and evening peak hours respectively. All other intersections operate at acceptable level of service conditions.

The addition of about 30 new vehicle trips generated by the Stadium Project would result in negligible increases in delay (i.e., under 1 second) at ten of the study intersections. Therefore, the Stadium Project would not significantly affect any of the 24 study intersections.

Level of Service – Near-Term and Near-Term plus Master Facilities Long-Range Plan

Near-term roadway conditions consider traffic projections along area roadways for the San Rafael General Plan's 2020 forecast year. These conditions were developed after consultation with City of San Rafael staff regarding the status of proposed development projects within the SRHS campus vicinity.[7] The General Plan's traffic projections include development projects that were under consideration when the General Plan was first developed in 2002 and later revised in 2013. However, several of these projects have yet to be developed. As such, the study included the City's General Plan year traffic projection increases to the cumulative year (2040) projections discussed later in this section.

This study assessed the growth from the existing traffic volumes to the 2040 forecast year traffic projections at each study intersection. The corresponding 24-year growth rates were applied to the existing traffic volumes over a 4-year period to develop revised near-term (year 2020) traffic projections for each study intersection. The 2040 traffic models also assumed an annual

[7] The project study team met with representatives from the City of San Rafael Department of Public Works and Community Development Department to review transportation and traffic data and evaluation methods and assumptions on July 26, 2016, August 8, 2016, and October 6, 2016.

TABLE 4.12-10 ESTIMATED INTERSECTION LEVEL OF SERVICE: EXISTING AND EXISTING PLUS STADIUM PROJECT

			Existing Conditions						Existing-plus-Stadium Project		
			AM			PM			PM		
Intersection		Control	Move-ment	LOS	Delay (s/veh)	Move-ment	LOS	Delay (s/veh)	Move-ment	LOS	Delay (s/veh)
1	SRHS Driveway (W)/3rd St.	TWSC	NB	**F**	**55**	NB	C	24	NB	C	24
2	SRHS Driveway (E)/ 3rd St.	OWSC	EB	B	15	SB	B	11	SB	B	11
3	Embarcadero Way/3rd St.	OWSC	SB	B	14	SB	B	13	SB	B	13
4	Embarcadero Way/Mission/ Marina/E. Mission/Sea View	AWSC	N/A	A	7	N/A	A	7	N/A	A	7
5a	Belle Ave./Mission Ave./ SRHS Driveway	TWSC	SB	C	24	NB	B	10	NB	B	11
5b	Belle Ave./Mission Ave.	OWSC	SB	A	9	SB	A	9	SB	A	9
6	Alice St./Mission Ave.	OWSC	SB	B	11	SB	A	9	SB	A	9
7	Park St./Mission Ave.	OWSC	SB	B	11	SB	A	9	SB	A	9
8	Union St./Mission Ave.	AWSC	N/A	D	25	N/A	B	13	N/A	B	13
9	Union St./4th St.	TWSC	WB	C	22	WB	C	17	WB	C	18
10	Union St./3rd St.	Signal	N/A	C	33	N/A	D	41	N/A	D	42
11	Grand Ave./Mission Ave.	AWSC	N/A	**F**	**59**	N/A	**F**	**76**	N/A	**F***	**76**
12	Grand Ave./3rd St.	Signal	N/A	C	29	N/A	**E**	**61**	N/A	**E***	**61**
13	Grand Ave./2nd St.	Signal	N/A	C	22	N/A	**E**	**74**	N/A	**E***	**75**
14	Irwin St./Mission Ave.	Signal	N/A	D	52	N/A	**E**	**65**	N/A	**E***	**65**
15	Irwin St./5th Ave.	Signal	N/A	B	10	N/A	C	21	N/A	C	21
16	Irwin St./4th St.	Signal	N/A	B	18	N/A	C	21	N/A	C	21
17	Irwin St./3rd St.	Signal	N/A	D	45	N/A	**E**	**59**	N/A	**E***	**59**
18	Irwin St./ 2nd St.	Signal	N/A	C	23	N/A	**E**	**68**	N/A	**E***	**69**
19	Hetherton St./Mission Ave.	Signal	N/A	D	40	N/A	C	34	N/A	C	34
20	Hetherton St./5th Ave.	Signal	N/A	B	11	N/A	B	11	N/A	B	11
21	Hetherton St./4th St.	Signal	N/A	B	12	N/A	B	11	N/A	B	12
22	Hetherton St./3rd St.	Signal	N/A	**E**	**56**	N/A	**E**	**56**	N/A	**E***	**56**
23	Hetherton St./ 2nd St.	Signal	N/A	D	49	N/A	D	39	N/A	D	39
24	New SRHS Driveway	OWSC	N/A	N/A	N/A	N/A	N/A	N/A	SB	B	11

Notes: SRHS = San Rafael High School; s = seconds; veh = vehicle; LOS = Level of Service; TWSC = two-way stop-controlled; AWSC = all-way stop-controlled; OWSC = one-way stop-controlled; W = west; E = east; NB = northbound; SB = southbound; WB = westbound; N/A = not applicable.
Delay is measured in average seconds per vehicle. For stop sign-controlled intersections the movement associated with the reported level of service is also presented. **Bold** indicates intersections operating at unacceptable conditions.
* Intersection operates at unacceptable conditions under the baseline scenario and the project does not add five or more seconds of delay. The baseline scenario signal timing, lane settings, and volume settings at intersections in/near Downtown San Rafael (Intersection 11 through 23) were calibrated as appropriate to match model provided by the City of San Rafael on December 7, 2016.
Source: Parisi Transportation Consulting, 2016.

background traffic growth rate of up to 1 percent growth per year at study intersections along key arterial roadways, compared to existing conditions. At study intersections along neighborhood streets, a lower growth rate of up to 0.5 percent per year was assumed. These assumed growth rates are higher than historical long-term traffic increases, and therefore represent a conservative assessment.

The traffic analysis model used in this study was updated to reflect roadway improvements proposed and included in the San Rafael General Plan. The roadway network was updated to include:

- Signalization of the 4th Street/Union Street intersection. The signalization includes the provision of a northbound left-turn lane.
- Signalization of the Grand Avenue/Mission Avenue intersection. The signalization includes the provision of a left-turn lane in all directions.

These modifications to lane geometry and intersection controls were applied to both the near-term (Year 2020) and cumulative (Year 2040) analysis scenarios (San Rafael General Plan, 2013).

Table 4.12-11 shows expected intersection level of service under the projected near-term conditions and compares them to the levels of service at these intersections after the addition of vehicle trips generated by the Master Facilities Long-Range Plan (both the projected increased student enrollment of up to 200 students and the proposed Stadium Project) during the morning and evening peak hour.

Under near-term (year 2020) conditions, the additional traffic generated under the Master Facilities Long-Range Plan would result in substantial increases in delay at the following two intersections:

- SRHS Driveway (W)/ 3rd Street – increase of about 15 seconds of delay per northbound left-turning vehicle (from driveway on south side of 3rd Street) during the morning peak hour, resulting in a potential significant impact.
- Union Street/Mission Avenue – increase of about 32 seconds of delay per vehicle during the morning peak hour, resulting in a potential significant impact.

During the weekday morning peak hour, the addition of traffic resulting from the implementation of the Master Facilities Long-Range Plan would add delays to northbound left-turning traffic exiting the driveway across from the high school's western exit on 3rd Street. The outbound left-turning traffic volume at the driveway is less than 10 vehicles per hour, which would represent less than 1 percent of the intersection's overall traffic volume under near-term (year 2020) conditions.

The implementation of the Master Facilities Long-Range Plan would degrade weekday morning peak hour operations at the Union Street/Mission Street intersection from LOS D to LOS F conditions. Traffic delays through the all-way stop sign-controlled intersection would average over 1 minute per vehicle, resulting in recurring back-ups along each of the intersection's roadway approaches.

TABLE 4.12-11 ESTIMATED INTERSECTION LEVEL OF SERVICE: NEAR-TERM (2020) AND NEAR-TERM (2020) PLUS MASTER FACILITIES LONG-RANGE PLAN

			Near-Term (2020)						Near-Term (2020) plus Master Facilities Long-Range Plan					
			AM			PM			AM			PM		
Intersection		Control	Move-ment	LOS	Delay (s/veh)	Move-ment	LOS	Delay (s/veh)	Move-ment	LOS	Delay (s/veh)	Move-ment	LOS	Delay (s/veh)
1	SRHS Driveway (W)/3rd St.	TWSC	NB	**F**	**62**	NB	D	25	NB	**F**	**77**	NB	D	27
2	SRHS Driveway (E)/3rd St.	OWSC	EB	C	15	SB	B	11	SB	C	17	SB	B	12
3	Embarcadero Way/3rd St.	OWSC	SB	B	14	SB	B	13	SB	B	14	SB	B	13
4	Embarcadero Way/Mission/ Marina/E. Mission/Sea View	AWSC	--	A	7	--	A	7	--	A	7	--	A	7
5a	Belle Ave./Mission Ave./ SRHS Driveway	TWSC	SB	B	15	SB	B	11	SB	C	16	SB	B	11
5b	Belle Ave./Mission Ave.	OWSC	SB	A	9	SB	A	9	SB	A	9	SB	A	9
6	Alice St./Mission Ave.	OWSC	SB	B	11	SB	A	9	SB	B	11	SB	A	9
7	Park St./Mission Ave.	OWSC	SB	B	11	SB	A	9	SB	B	12	SB	A	9
8	Union St./Mission Ave.	AWSC	N/A	D	31	N/A	B	13	N/A	**F**	**63**	N/A	B	14
9	Union St./4th St.	Signal	N/A	A	6	N/A	A	7	N/A	A	6	N/A	A	7
10	Union St./3rd St.	Signal	N/A	C	29	N/A	D	36	N/A	C	31	N/A	D	37
11	Grand Ave./Mission Ave.	Signal	N/A	B	16	N/A	B	13	N/A	B	17	N/A	B	13
12	Grand Ave./3rd St.	Signal	N/A	C	30	N/A	C	35	N/A	C	33	N/A	D	37
13	Grand Ave./2nd St.	Signal	N/A	D	37	N/A	**E**	**73**	N/A	D	45	N/A	**E***	**74**
14	Irwin St./Mission Ave.	Signal	N/A	**F**	**>80**	N/A	**E**	**73**	N/A	**F***	83	N/A	**E***	**74**
15	Irwin St./5th Ave.	Signal	N/A	B	15	N/A	**E**	**69**	N/A	B	15	N/A	**E***	**70**
16	Irwin St./4th St.	Signal	N/A	C	26	N/A	C	24	N/A	C	28	N/A	C	24
17	Irwin St./3rd St.	Signal	N/A	**E**	**60**	N/A	**F**	**>80**	N/A	**E***	**61**	N/A	**F***	**>80**
18	Irwin St./ 2nd St.	Signal	N/A	C	30	N/A	**F**	**>80**	N/A	C	31	N/A	**F***	**>80**
19	Hetherton St./Mission Ave.	Signal	N/A	D	41	N/A	D	47	N/A	D	41	N/A	D*	47
20	Hetherton St./5th Ave.	Signal	N/A	B	11	N/A	B	10	N/A	B	11	N/A	B	10
21	Hetherton St./4th St.	Signal	N/A	B	11	N/A	B	11	N/A	B	11	N/A	B	11
22	Hetherton St./3rd St.	Signal	N/A	**F**	**>80**	N/A	**F**	**>80**	N/A	**F***	**>80**	N/A	**F***	**>80**
23	Hetherton St./2nd St.	Signal	N/A	**E**	**58**	N/A	D	39	N/A	**E***	**58**	N/A	D	39
24	New SRHS Driveway	OWSC	N/A	N/A	N/A	N/A	N/A	N/A	SB	A	<5	SB	B	11

Notes: SRHS = San Rafael High School; s = seconds; veh = vehicle; LOS = Level of Service; TWSC = two-way stop-controlled; AWSC = all-way stop-controlled; OWSC = one-way stop-controlled; W = west; E = east; NB = northbound; SB = southbound; WB = westbound; N/A = not applicable. Delay is measured in average seconds per vehicle. For stop sign-controlled intersections the movement associated with the reported level of service is also presented. **Bold** indicates intersections operating at unacceptable conditions.
* Intersection operates at unacceptable conditions under the baseline scenario and the project does not add five or more seconds of delay. The baseline scenario signal timing, lane settings, and volume settings at intersections in/near Downtown San Rafael (Intersection 11 through 23) were calibrated as appropriate to match model provided by the City of San Rafael on December 7, 2016.
Source: Parisi Transportation Consulting, 2016

Level of Service – Cumulative and Cumulative plus Master Facilities Long-Range Plan

Table 4.12-12 shows the estimated level of service for study intersections under the projected cumulative year conditions and compares them to the levels of service at these intersections after the addition of vehicle trips generated by the Master Facilities Long-Range Plan (both the projected increased student enrollment of up to 200 students and the proposed Stadium Project) during the morning and evening peak hour.

Under cumulative (year 2040) conditions, the additional traffic generated under the Master Facilities Long-Range Plan would substantially increase vehicular delay at the following two intersections:

- SRHS Driveway (W)/3rd Street – increase of about 46 seconds of delay per northbound left-turning vehicle (from driveway on south side of 3rd Street) during the morning peak hour, resulting in a significant impact.
- Union Street/Mission Avenue – increase of about 32 seconds of delay per vehicle during the morning peak hour, resulting in a significant impact.

During the weekday morning peak hour, northbound left-turning traffic exiting the driveway across from the high school's western exit on 3rd Street, which is expected to operate at LOS F conditions under cumulative baseline conditions, would experience added delays with the project. The outbound left-turning traffic volume at the school's eastern driveway is less than 10 vehicles per hour, which would represent less than 1 percent of the intersection's overall traffic volume under cumulative conditions.

By 2040, under baseline conditions without the project, the Union Street/Mission Street intersection is expected to operate at LOS F conditions. Under Cumulative plus Master Facilities Long-Range Plan conditions, the intersection would continue to operate at LOS F, but the added vehicular traffic would increase average traffic delays through the all-way stop sign-controlled intersection by more than 5 seconds per vehicle, resulting in a significant impact.

Roadway Segment Traffic Volume Increase

The expected traffic volume increases along regional roadways resulting from the implementation of the Master Facilities Long-Range Plan were estimated. Potential added traffic along the two segments of 2nd Street and 3rd Street that are part of the CMP network was estimated as shown in **Table 4.12-13**.

The traffic added to 2nd Street and 3rd Street by the Master Facilities Long-Range Plan would be minimal (less than 20 vehicles during the peak hour) and would not result in a change to the service levels along these CMP roadways.

The Stadium Project, as well as the rest of the Master Facilities Long-Range Plan, would add traffic to the on- and off-ramps serving Highway 101. The estimated traffic volume increases are summarized in **Table 4.12-14**.

As shown in Table 4.12-14, the implementation of the Master Facilities Long-Range Plan would add 5 to 17 vehicles during the morning and afternoon peak hour to segments of Highway 101. Since Highway 101 is not operating or expected to operate at unstable or forced traffic flow

TABLE 4.12-12 ESTIMATED INTERSECTION LEVEL OF SERVICE: CUMULATIVE AND CUMULATIVE PLUS MASTER FACILITIES LONG-RANGE PLAN

			Cumulative (2040)						Cumulative plus Master Facilities Long-Range Plan					
			AM			PM			AM			PM		
Intersection		Control	Movement	LOS	Delay (s/veh)	Movement	LOS	Delay (s/veh)	Movement	LOS	Delay (s/veh)	Movement	LOS	Delay (s/veh)
1	SRHS Driveway (W)/3rd St.	TWSC	NB	**F**	**>80**	NB	**E**	**37**	NB	**F***	**>80**	NB	**E***	**42**
2	SRHS Driveway (E)/3rd St.	OWSC	SB	C	21	SB	B	11	SB	D	25	SB	B	13
3	Embarcadero Way/3rd St.	OWSC	SB	C	16	SB	C	15	SB	C	16	SB	B	15
4	Embarcadero Way/Mission/ Marina/E. Mission/Sea View	AWSC	--	A	7	--	A	7	--	A	7	--	A	7
5a	Belle Ave./Mission Ave./ SRHS Driveway	TWSC	SB	A	9	SB	B	11	SB	C	18	SB	B	11
5b	Belle Ave./Mission Ave.	OWSC	SB	A	9	SB	A	9	SB	A	9	SB	A	9
6	Alice St./Mission Ave.	OWSC	SB	B	12	SB	A	9	SB	B	12	SB	A	9
7	Park St./Mission Ave	OWSC	SB	B	12	SB	A	9	SB	B	13	SB	A	9
8	Union St./Mission Ave.	AWSC	N/A	**F**	**>80**	N/A	C	16	N/A	**F***	**>80**	N/A	C	17
9	Union St./4th St.	Signal	N/A	A	6	N/A	A	8	N/A	A	7	N/A	A	7
10	Union St./3rd St.	Signal	N/A	D	41	N/A	D	40	N/A	D	46	N/A	D	42
11	Grand Ave./Mission Ave.	Signal	N/A	C	25	N/A	B	14	N/A	C	28	N/A	B	14
12	Grand Ave./3rd St.	Signal	N/A	**E**	**62**	N/A	**E**	**59**	N/A	**E***	**65**	N/A	**E***	**63**
13	Grand Ave./ 2nd St.	Signal	N/A	**E**	**63**	N/A	**F**	**>80**	N/A	**E***	**66**	N/A	**F***	**>80**
14	Irwin St./Mission Ave.	Signal	N/A	**F**	**>80**	N/A	**F**	**>80**	N/A	**F***	**>80**	N/A	**F***	**>80**
15	Irwin St./5th Ave.	Signal	N/A	D	50	N/A	**F**	**>80**	N/A	D	50	N/A	**F***	**>80**
16	Irwin St./4th St.	Signal	N/A	**E**	**67**	N/A	**E**	**65**	N/A	**E***	**69**	N/A	**E***	**65**
17	Irwin St./3rd St.	Signal	N/A	**F**	**>80**	N/A	**F**	**>80**	N/A	**F***	**>80**	N/A	**F***	**>80**
18	Irwin St./ 2nd St.	Signal	N/A	**E**	**59**	N/A	**F**	**>80**	N/A	**E***	**60**	N/A	**F***	**>80**
19	Hetherton St./Mission Ave.	Signal	N/A	**F**	**>80**	N/A	**F**	**95**	N/A	**F***	**>80**	N/A	**F***	**>80**
20	Hetherton St./5th Ave.	Signal	N/A	B	15	N/A	B	14	N/A	B	15	N/A	B	14
21	Hetherton St./4th St.	Signal	N/A	B	13	N/A	B	11	N/A	B	13	N/A	B	11
22	Hetherton St./3rd St.	Signal	N/A	**F**	**>80**	N/A	**F**	**>80**	N/A	**F***	**>80**	N/A	**F***	**>80**
23	Hetherton St./ 2nd St.	Signal	N/A	**F**	**>80**	N/A	**E**	**74**	N/A	**F***	**>80**	N/A	**E***	**75**
24	New SRHS Driveway	OWSC	N/A	N/A	N/A	N/A	N/A	N/A	SB	A	<5	SB	A	7

Notes: SRHS = San Rafael High School; s = seconds; veh = vehicle; LOS = Level of Service; TWSC = two-way stop-controlled; AWSC = all-way stop-controlled; OWSC = one-way stop-controlled; W = west; E = east; NB = northbound; SB = southbound; WB = westbound; N/A = not applicable.
Delay is measured in average seconds per vehicle. For stop sign-controlled intersections the movement associated with the reported level of service is also presented. **Bold** indicates intersections operating at unacceptable conditions.
* Intersection operates at unacceptable conditions under the baseline scenario and the project does not add five or more seconds of delay. The baseline scenario signal timing, lane settings, and volume settings at intersections in/near Downtown San Rafael (Intersection 11 through 23) were calibrated as appropriate to match model provided by the City of San Rafael on December 7, 2016.
Source: Parisi Transportation Consulting, 2016.

TABLE 4.12-13 ESTIMATED TRAFFIC VOLUME INCREASES ON CONGESTION MANAGEMENT PLAN (CMP) ROADWAY SEGMENTS

	Stadium Project	Enrollment Increase		Total Master Facilities Long-Range Plan	
Location	**PM**	**AM**	**PM**	**AM**	**PM**
2nd Street (West of US 101)	3	16	5	16	8
3rd Street (West of US 101)	0	15	7	15	7

Source: Parisi Transportation Consulting, 2016.

TABLE 4.12-14 ESTIMATED TRAFFIC VOLUME INCREASES ON HIGHWAY 101 RAMPS

	Stadium Project	Enrollment Increase		Master Facilities Long-Range Plan	
Location	**PM**	**AM**	**PM**	**AM**	**PM**
Highway 101 Northbound					
To Irwin St./Mission Ave./US 101 NB On-Ramp	0	12	5	12	5
From Heatherton St./Mission Ave./US 101 SB Off-Ramp	5	17	5	17	10
Highway 101 Southbound					
To Heatherton St./ 2nd St.	0	4	2	4	2
From Irwin St./ 2nd St.	5	9	2	9	7

Notes: NB = northbound; SB = southbound.
Source: Parisi Transportation Consulting, 2016.

conditions, the addition of this traffic would not significantly affect the highway, and a detailed highway traffic analysis was not warranted.

Public Transit

Students would continue to be able to use the various Marin Transit routes that serve the bus stops along Union Street, Mission Avenue, Grand Avenue, 2nd Street, and 3rd Street (see discussion in Section 4.12.2, Environmental Setting, above), as well as routes accessible at the San Rafael Transit Center. The Master Facilities Long-Range Plan does not propose any changes to the existing public transit facilities serving the SRHS campus.

Student travel survey data collected as part of this study in October 2016 as part of this analysis (and detailed in Appendix F-3) show that about one-quarter of SRHS students travel to and/or from school by public transit. Assuming these levels remain the same with the implementation of the Master Facilities Long-Range Plan, about 50 of the students would be added to the public transit network serving the SRHS campus. These additional student trips would be accommodated by existing bus routes serving the SRHS campus.

Pedestrian and Bicycle Facilities

Development under the Master Facilities Long-Range Plan would generate additional pedestrian trips compared to current conditions. Many pedestrians would walk to and from households in the immediate vicinity of the SRHS campus. Pedestrians would continue to have primary access to the campus from 3rd Street and Mission Avenue. The Master Facilities Long-Range Plan would add pedestrian traffic along 3rd Street, Mission Avenue, Union Street, Grand Avenue, and other streets providing access to the school.

Student travel survey data collected in October 2016 show that between 12 and 17 percent of students travel to and/or from SRHS by walking. Assuming these levels would remain the same with the implementation of the Master Facilities Long-Range Plan, up to 35 additional students would be added to the pedestrian facilities providing access to the school.

As described in Section 4.12.2, Environmental Setting, above, the existing pedestrian facilities serving the SRHS campus do not adequately accommodate the existing and future levels of pedestrian traffic. Some of the ramps do not comply with ADA design guidelines, and in some cases, there are no curb ramps serving crosswalks. On Mission Avenue, east of Belle Avenue, a paved sidewalk is only provided to Jewell Street. East of Jewell Street, no sidewalk is provided on either side of the street, although small segments of the north side of the street include narrow sidewalks adjacent to individual parcels. This would result in potential conflict between pedestrian and vehicular traffic. In addition, several of the marked crosswalks serving pedestrians walking to and from the high school are uncontrolled. The addition of new pedestrian trips to these facilities would further exacerbate these existing conditions and increase the potential for safety impacts for pedestrians.

Around 3 to 4 percent of students travel to and/or from school by bicycle. Assuming these levels remain the same, the implementation of the Master Facilities Long-Range Plan would add up to eight additional bicycle trips to adjacent bicycle facilities. As described in Section 4.12.2, Environmental Setting, above, there is a limited network of bicycle routes serving the SRHS campus. Marked bicycle routes are present along 3rd Street, 4th Street, and Grand Avenue. Along these roadways, bicyclists share the right-of-way with vehicular traffic. The addition of bicycle traffic along these roadways would increase the potential for conflicts between bicyclists and vehicular traffic.

Additionally, there is a bicycle parking area on campus that can accommodate about 24 bicycles. However, this parking area currently operates above capacity and would be unable to accommodate additional bicycle parkers. As part of the Stadium Project, eight new bicycle racks would be installed, accommodating 16 additional bicycles. The adequacy of project-proposed bicycled parking is addressed in the detailed Parking Study (Appendix F-7).

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Conflict with Applicable Congestion Management Program

Development associated with the Master Facilities Long-Range Plan would not conflict with the Transportation Authority of Marin's Congestion Management Plan (CMP), including but not limited to level of service standards and travel demand measures, or other standards established by the Transportation Authority of Marin for designated roads or highways.

The CMP roadway network includes the segments of 2nd Street and 3rd Street between Highway 101 and Marquad Street. These segments are part of the roadway network that provides access to the SRHS campus. The implementation of the Master Facilities Long-Range Plan would result in an increase in traffic volumes of less than 16 vehicles per peak hour along these roadways. These increases would not result in a change to the service levels along these CMP roadways.

The impact would be less than significant, and no mitigation is necessary.

Change in Air Traffic Patterns

Implementation of the Master Facilities Long-Range Plan would not result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks.

The Master Facilities Long-Range Plan does not propose any features relating to air traffic.

The impact would be less than significant, and no mitigation is necessary.

Adequacy of Emergency Access

The Master Facilities Long-Range Plan does not propose any features that would result in inadequate emergency access.

Emergency vehicle access to the site would be provided via the two project driveways along 3rd Street and eastern project driveway along Mission Avenue. As depicted in Figure 3-7, on-site circulation would be provided via emergency vehicle routes that allow for direct access to all on-campus buildings and facilities. The Master Facilities Long-Range Plan proposes to provide adequate emergency access travelways within the modified campus (see Figure 3-7).

The impact would be less than significant, and no mitigation is necessary.

Public Transit Impacts

The Master Facilities Long-Range Plan would not conflict with any adopted policies, plans, or programs regarding public transit facilities, and would not otherwise decrease the performance or safety of these facilities.

The Master Facilities Long-Range Plan does not propose any changes to the existing public transit facilities serving the SRHS campus. These additional student trips would be accommodated by existing bus routes serving the SRHS campus.

The impact on public transit facilities would be less than significant, and no mitigation is necessary.

Parking Impacts

Under the CEQA Guidelines, the adequacy of project parking is not in and of itself a CEQA issue.[8] However, existing and future parking supply and demand were assessed to estimate any project-related impacts associated with parking. The results of this analysis and corresponding recommendations are provided as a detailed report in Appendix F-7.

Potentially Significant Impacts

Conflict with Policies for Congestion Management and Improved Mobility

Impact TRANS-1: Assuming student travel mode shares and vehicle trip distribution patterns remain consistent with those under existing conditions, implementation of the Master Facilities Long-Range Plan would increase single-occupancy vehicular travel as well as overall vehicular traffic levels along key access roadways, including Mission Avenue and 3rd Street. The addition of these Long-Range Plan-related vehicular trips would degrade traffic flows along these key access roadways. Maintaining the existing student travel mode shares and the resulting increase in single-occupancy vehicular travel would conflict with the city-wide policies and programs established to manage congestion and improve mobility as documented in the San Rafael General Plan. These Long-Range Plan-related conditions would particularly conflict with Program C-11e (Reduction of Single Occupant Vehicles) and Program C-13a (School Transportation). (PS)

The projected 200-student enrollment increase would generate about 175 student vehicle trips during the weekday morning peak hour,121 vehicle trips during the afternoon peak hour, and 65 vehicle trips during the evening peak hour (see Table 4.12-7). These added vehicle trips would increase vehicular traffic along Mission Avenue, 3rd Street, and other roadways, increasing traffic congestion and vehicular turns and creating the potential for increased conflicts.

[8] In San Franciscans Upholding the Downtown Plan v. City & County of San Francisco, the Court of Appeal, First District, held that a project's impacts on parking is a social impact and not a significant physical impact on the environment under CEQA. ((2002) 102 Cal.App.4th 656, 697.) An EIR need only address the secondary physical impacts on the environment that could be triggered by a social impact, such as safety hazards, etc. (Id.; CEQA Guidelines, Section15131(a).) Following the SFUDP v. San Francisco case, the significance criterion concerning whether a project would result in inadequate parking capacity was removed from the CEQA Guidelines Appendix G checklist. In Taxpayers for Accountable School Bond Spending v. San Diego Unified School District, the Court of Appeal, Fourth District, found substantial evidence supported a fair argument that the project at issue might have a significant impact on off-campus parking and thus the environment because no attempt was made to analyze the number of available, off-site parking spaces or resulting potential safety hazards when the project was expected to create a significant on-site parking shortage. ((2013) 215 Cal.App.4th 1013, 1053.) Accordingly, based on applicable law, a parking study was conducted by the District's traffic consultant to evaluate existing and future parking conditions at the SRHS campus and neighboring streets, as detailed in Appendix F-7.

Mitigation Measure TRANS-1a: San Rafael City Schools shall develop a Transportation Demand Management (TDM) program for San Rafael High School that focuses on reducing vehicle trips and improving traffic flow by implementing a series of measures including, but not limited to, the following:

- *Updating and enforcing elements of the school's transportation measures in the School Handbook, such as requiring on-site parking permits; instructing parents and students on expected travel routes to use, drop-off/pick-up locations, and appropriate driver behaviors; and providing bus stop and bus route information.*
- *Working with the San Rafael High School Athletic Department to ensure that sports-related drop-offs and pick-ups are directed to use the school parking lots accessible via 3rd Street.*
- *Providing wayfinding signage and informational material (e.g., flyers, emails, etc.) to visitors prior to major sports and/or special events that would direct traffic to the 3rd Street driveways.*
- *Considering promotion of carpool trips, and designating specific on-site parking spaces for carpool use only.*
- *Enrolling and actively participating in Marin County's Safe Routes to School program to take advantage of resources focused on reducing single-student occupant vehicle trips and to promote walking, bicycling, use of public transit, and carpooling.*
- *Providing personnel (trained using the American Automobile Associate School Safety Patrol curriculum) to monitor and facilitate drop-off and pick-up activities along Mission Avenue.*
- *Conducting periodic monitoring of traffic, including single-student occupant vehicles and carpools, pedestrian and bicycle trips, and school trips made by public transit to gauge success and promote appropriate measures to reduce vehicle trips.*

Mitigation Measure TRANS-1b: To the extent feasible, San Rafael City Schools shall work with the City of San Rafael to update the listed address of San Rafael High School such that the school's main access point is identified with a 3rd Street address rather than its current designated 185 Mission Avenue address. The implementation of this mitigation measure would encourage some traffic, including sports events traffic and freight traffic, away from neighborhood streets north of the SRHS campus and onto 3rd Street.

Successful implementation of a TDM program that retains current traffic levels, or reduces traffic levels, with the addition of up to 200 additional students would reduce Impact TRANS-1 to a less-than-significant level. (LTS)

Increased Traffic and Safety Hazard on Mission Avenue

Impact TRANS-2: The addition of project-generated vehicular traffic onto local roadways would increase traffic congestion, particularly on Mission Avenue due to increased drop-off and pick-up activities. This would deteriorate traffic flow along Mission Avenue, which lacks adequate loading and unloading zones. This would also present a safety hazard as it would increase potential conflicts between vehicular traffic and pedestrian and bicycle traffic.

These impacts would conflict with the San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow). (PS)

Under existing conditions, the 135-foot passenger loading zone along the south side of Mission Avenue (just west of Alice Street) does not adequately accommodate drop-off and pick-up activities, leading to double-parking along the narrow roadway and hindrance of traffic flow. The addition of future off-site vehicle trips (i.e., about 105 morning, 73 afternoon and 39 evening peak hour trips, as summarized in Table 4.12-7) would further exacerbate the traffic flow along Mission Avenue and increase potential conflict between pedestrian, bicycle and vehicular traffic.

> *<u>Mitigation Measure TRANS-2a</u>: San Rafael City Schools shall, as feasible, work with the City of San Rafael to extend westward the existing passenger loading zone by up to 300 feet, for a new passenger loading zone spanning the length of the south side of Mission Avenue between Alice Street and Park Street.*
>
> *The extension of the loading zone would be accomplished either by painting the adjacent roadway curb white or moving the roadway's curb and sidewalk south, if feasible. Accompanying signage would also be installed that would designate the area as a passenger loading zone. The loading zone extension would result in the loss of about 12 vehicular parking spaces. However, the zone would enhance roadway safety by increasing the designated area of drop-off, allowing vehicles to pull over for drop-off and pick-up activities and avoid hindering traffic flow along Mission Avenue.*
>
> *<u>Mitigation Measure TRANS-2b</u>: The District shall consider the implementation of a remote drop-off and pick-up program. The program would designate off-site passenger loading location to divert school-related vehicle trips to locations within a one-quarter-mile radius of the site. This would reduce traffic congestion along neighborhood streets adjacent to the school site, and promote student health by allowing students to walk the distance between the off-site location and the school campus. The mitigation measure would support San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow) and Program C-13a (School Transportation).*
>
> *The roadway curb and potential remote drop-off and pick-up locations fall under the jurisdiction of the City of San Rafael, and therefore the changes recommended in this mitigation measure would be subject to approval by the City's Public Works Department. Implementation of this measure would reduce Impact TRANS-2 to a less-than-significant level, but because the mitigation measure requires coordination with the City of San Rafael, its implementation cannot be assured. The impact is therefore considered significant and unavoidable. (SU)*

<u>Vehicular Delay at Intersections</u>

<u>Impact TRANS-3</u>: The addition of project-generated vehicular traffic would increase average vehicular delay by more than 5 seconds at two intersections—Union Street/Mission Avenue, and San Rafael High School Driveway (West)/3rd Street—under near-term (year 2020) plus Master Facilities Long-Range Plan conditions, and at two intersections— Union Street/Mission Avenue and San Rafael High School Driveway (West)/3rd Street—under cumulative (year 2040) plus Master Facilities Long-Range Plan conditions. The additional average vehicular delay under near-term (year 2020) plus Master Facilities Long-Range Plan

conditions would degrade intersection operating conditions from level of service (LOS) D to LOS F at one intersection. The additional average vehicular delay and degradation of level of service operations would represent a significant impact as defined by City of San Rafael significance thresholds. (PS)

At two intersections, the additional average vehicular delay and degradation of level of service operations would represent a significant impact as defined by City of San Rafael significance thresholds summarized in Section 4.12.3, Regulatory Framework, above.

At the Union Street/Mission Avenue intersection, the addition of project-generated traffic would increase average vehicular delay by about 32 seconds under both near-term (year 2020) plus and cumulative (year 2040) plus Master Facilities Long-Range Plan conditions during the morning peak hour. The all-way stop sign-controlled Union Street/Mission Avenue intersection is currently configured with one travel lane approaching each leg of intersection, with left, through, and right-turning movements made from each approaches' single lane. During the morning peak hour, the implementation of the Master Facilities Long-Range Plan would result in an increase of about 38 vehicles traveling in the westbound direction and 32 vehicles making a right turn from northbound Union Street onto eastbound Mission Avenue. As the intersection only provides one travel lane in each direction, the Long-Range Plan-related increase would result in increased vehicular queue lengths and backups in the westbound and northbound direction.

At the SRHS Driveway(W)/3rd Street intersection, the addition of project-generated traffic would increase average vehicular delay by about 15 seconds under the near-term (year 2020) plus Master Facilities Long-Range Plan conditions, and about 46 seconds under the cumulative (year 2040) plus Master Facilities Long-Range Plan conditions. The additional delay would be added to the northbound left-turning vehicles (traveling from the driveway on the south side of 3rd Street).

> *Mitigation Measure TRANS-3a: As feasible, San Rafael City Schools shall work with the City of San Rafael to implement the reconfiguration of the Union Street/Mission Avenue intersection to provide two lanes in the westbound direction (a left-turn lane, and a shared through and right-turn lane) and two lanes in the northbound direction (a shared through and left-turn lane, and a right-turn lane). The additional lanes could be introduced by restriping the existing roadway to provide the additional lane markings within the existing right-of-way.*
>
> *The intersection reconfiguration would require use of the roadway's existing width to accommodate the additional lanes. This would be achieved by removing up to 160 feet of parking along both sides of westbound Mission Avenue, causing the loss of approximately eight parking spaces on both sides of the street, including the passenger loading zone on the south side of Mission Avenue. However, as detailed in the parking study (provided in Appendix F-7 of this EIR), the adjacent streets are operating at under 70 percent occupancy levels and could accommodate the parking demand from the displaced parking spaces.*
>
> *If feasible, and to the extent that California Department of Education (CDE)-mandated school site size requirements (CDE Guide to School Site Analysis and Development 2000 Report) would not be violated, an alternative roadway reconfiguration could include potentially moving the roadway curb and sidewalk southerly (onto District property) to provide the extra lane width and minimize the loss of parking along Mission Avenue.*

The new lane reconfiguration would potentially reduce vehicular queue lengths along the westbound direction of Mission Avenue to under 100 feet in near-term (year 2020) plus Master Facilities Long-Range Plan conditions and under 120 feet in cumulative (year 2040) plus Master Facilities Long-Range Plan conditions.

Mitigation Measure TRANS-3b: There is no feasible measure to mitigate the intersection impacts at the two San Rafael High School driveway intersections along 3rd Street.

Vehicles turning left from the driveway south of the San Rafael High School driveway (west)/3rd Street intersection would experience an increase of up to about 46 seconds of delay under the Cumulative (year 2040) plus Master Facilities Long-Range Plan conditions. Under this scenario, this movement is projected to be about 11 vehicles during the morning peak hour. These vehicles would have to wait for sufficient gaps in traffic to make the left turn. While the additional delay would inconvenience these vehicles, it would only occur during the very short peak hours of school-related vehicular trip generation and would dissipate thereafter.

Implementation of Mitigation Measure TRANS-3a would reduce the impact at the Union Street/Mission Avenue intersection to a less-than-significant level. However, the improvement's design and construction would be subject to approval and implementation by the City of San Rafael Public Works Department, and therefore its implementation cannot be assured. There is no feasible mitigation for impacts at the two San Rafael High School driveway impacts on 3rd Street. Impact TRANS-3 would therefore remain significant and unavoidable. (SU)

Impact on Pedestrian and Bicycle Facilities and Safety

Impact TRANS-4: Implementation of the Master Facilities Long-Range Plan would increase the number of students walking and bicycling along key routes, including roadways and sidewalks, and across curb ramps and crosswalks. Many of the existing pedestrian and bicycle facilities serving the San Rafael High School campus do not adequately accommodate the existing levels of pedestrian traffic and would be further degraded with the addition of pedestrian and bicycle traffic generated by the Long-Range Plan. The increased traffic would decrease the overall performance and safety of these facilities. (PS)

In the vicinity of the SRHS campus, some of the school area traffic controls (e.g., yellow school signs, crosswalk signs, etc.) are obsolete. Some of the curb ramps along Mission Avenue, Union Street and 3rd Street do not comply with ADA design guidelines. In some cases, there are no curb ramps serving crosswalks. Several of the marked crosswalks serving pedestrians walking to and from the SRHS campus are uncontrolled.

There are several gaps in the sidewalk system. On Mission Avenue just east of Belle Avenue, there is no sidewalk provided on either side of the street for about 100 feet between that point and Jewell Street, after which a paved sidewalk is only provided on the north side of Mission Street to Jewell Street. East of Jewell Street, no sidewalk is provided on either side of the street, although small segments of the north side of the street include narrow sidewalks adjacent to individual parcels. These sidewalk gaps increase the potential for conflict between pedestrian and vehicular traffic, as pedestrians are forced to walk within the vehicular right-of-way.

Assuming student travel mode shares remain consistent with those under existing conditions, the implementation of the Master Facilities Long-Range Plan would add pedestrian traffic (about 35 additional walking trips) and bicycle traffic (about eight bike trips) along area roadways. Existing facilities do not adequately accommodate the pedestrian and bicycle traffic generated by the school, and the addition of Long-Range Plan-generated traffic would further degrade the existing facilities.

Mitigation Measure TRANS-4a: As feasible, San Rafael City Schools shall work with the City of San Rafael to implement the design and construction of the following school-area improvements:

- *Upgrading all school area traffic controls in accordance with Chapter 7 (Controls for School Areas) of the California Manual of Uniformed Traffic Control Devices (MUTCD). For the District, upgrades would include increasing school-related signage (e.g., School Ahead, School Crosswalk, etc.) and pavement markings (e.g., Slow School Xing), and refreshing crosswalks and pavement stencils along roadways serving the campus (i.e., Mission Avenue between Mary Street and Belle Avenue, Union Street between 3rd Street and Mission Avenue, and Mary Street Between 3rd Street and Mission Avenue).*
- *Constructing about 100 feet of sidewalk along the north side of Mission Avenue just east of Belle Avenue, to fill a sidewalk gap at a well-trafficked intersection.*
- *Reconstructing non-compliant curb ramps, as appropriate, to meet Americans with Disabilities Act (ADA) standards at intersection locations peripheral to the school i.e., San Rafael High School Driveway (East)/3rd Street, Embarcadero Way/3rd Street, Mission Avenue/Belle Avenue, Mission Avenue/Alice Street, Mission Avenue/Park Street, and Mission Avenue/Union Street.*
- *Providing enhanced crosswalks (e.g., rectangular rapid flashing beacons, pedestrian hybrid beacon, and/or lighting), if considered warranted by the City of San Rafael Public Works Department, at the 3rd Street's crosswalk at Embarcadero Way and at Union Street's crosswalk at 4th Street.*
- *Endorsing the City of San Rafael's efforts to improve pedestrian conditions along the south side of Mission Avenue between Belle Avenue and Embarcadero Way. Future improvements could include, but would not be limited to, providing earthwork and/or structural fill along the hillside, a continuous pedestrian walkway, and additional supply of on-street parking.*

Mitigation Measure TRANS-4b: As feasible, San Rafael City Schools shall work with the City of San Rafael to implement the design and construction of an enhanced crosswalk across 3rd Street at the San Rafael High School Driveway (West)/3rd Street intersection. As feasible and necessary, the crosswalk would include a pedestrian refuge island and rectangular rapid flashing beacons to facilitate pedestrian crossing at this intersection.

Mitigation Measure TRANS-4c: San Rafael City Schools shall enroll and actively participate in Marin County's Safe Routes to School program and host educational programs that inform students of pedestrian behavior that would enhance safety when walking to and from school.

These mitigation measures would improve pedestrian and bicyclist facilities serving the San Rafael High School campus. The measures would enhance pedestrian and bicyclist safety within the vicinity of the campus by increasing visibility and reducing potential points of conflict with vehicular traffic. The measures would comply with the City of San Rafael's Bicycle/Pedestrian Master Plan Policy C-1 (Complete missing connections to establish direct routes for walking), Policy C-2 (Identify and mitigate impediments and obstacles to walking to school, such as through a Safe Routes to School program), and Policy C-4 (Support the installation of appropriate pedestrian facilities as part of all new transportation improvements, development projects and transit facilities).

Implementation of the above measures would reduce Impact TRANS-4 to a less-than-significant level. However, since the design and implementation of the above measures shall be subject to approval and implementation by the City of San Rafael Public Works Department, their implementation cannot be assured. Impact TRANS-4 would therefore remain significant and unavoidable. (SU)

Conflict with Policy Encouraging Use of Alternative Transportation

Impact TRANS-5: Implementation of the Master Facilities Long-Range Plan would increase the number of students bicycling along key routes, including roadways and sidewalks, and across crosswalks. Since none of these roadways are wide enough to include separated bicycle lanes, cyclists would be required to share vehicular travel lanes or ride along sidewalks. These conditions would discourage the use of alternative modes of transportation and conflict with the San Rafael General Plan Policy C-11 (Alternative Transportation Mode Users). (PS)

There is a limited network of bicycle routes serving the SRHS campus. Bicyclists traveling to and from the SRHS campus have limited travel route options; there are no separated bicycle facilities along key roadways, and cyclists on Mission Avenue and 2nd and 3rd Streets have to travel in shared and congested traffic lanes or along narrow sidewalks that include pedestrians. The addition of bicycle traffic along these roadways would increase the potential for conflicts between bicyclists and vehicular traffic.

As discussed in the parking study (Appendix F-7), bicycle parking demand exceeds the parking supply on the SRHS campus. The bicycle parking facility on the campus operates above capacity and would be unable to accommodate additional bicycle parkers.

Mitigation Measure TRANS-5a: San Rafael City Schools shall increase the capacity of the on-campus bicycle parking facility to safely and securely accommodate up to 100 bicycles.

Mitigation Measure TRANS-5b: San Rafael City Schools shall work with the City of San Rafael and Marin County's Safe Routes to Schools program in efforts to obtain a grant to conduct a study on the feasibility of implementing a new bicycle and pedestrian pathway to serve the San Rafael High School campus. The pathway could provide access to the school from either the intersection of Union Street/4th Street, along the south of Mission Avenue just east of Park Street, along the north side of 3rd Street, or at other locations to be identified upon further study. The intent of the path would be to directly link to campus walking paths and bicycle parking. The study shall identify potential pathway alignments, impacts, and *connection details, as well as circulation along 4th Street to the west and Mission Avenue to the north. The feasibility study, funded by grant funds as available, shall be conducted in coordination with the City of San Rafael Public Works Department. If feasible, the pathway shall be constructed and shall be coordinated with implementation of the Master Facilities Long-Range Plan.*

<u>Mitigation Measure TRANS-5c</u>: San Rafael City Schools shall enroll and actively participate in Marin County's Safe Routes to School program and (among other activities) host educational and encouragement programs that inform students of the benefits of bicycling to and from school.

The implementation of these measures (except the provision of additional bicycle parking recommended in Mitigation Measure TRANS-5a) requires the involvement of the City of San Rafael and Marin County's Safe Routes to Schools program. Furthermore, it is not known if this pathway can be constructed, or if grant money would be available. Therefore, implementation of Mitigation Measures TRANS-5b and TRANS-5c is not assured, and Impact TRANS-5 would be significant and unavoidable. (SU)

Construction Traffic Impacts

<u>Impact TRANS-6</u>: The construction of components of the Master Facilities Long-Range Plan would add construction-related vehicle trips to City of San Rafael and other jurisdictional roadways, creating temporary traffic hazards. These conditions would conflict with San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow). (PS)

Construction of the facilities proposed in the Master Facilities Long-Range Plan would generate truck trips and other construction-related vehicles. Over time, the demolition of eight buildings and the construction of six buildings would occur. Some buildings would undergo modernization without any demolition. During the construction period, construction would occur between 8:00 AM and 5:00 PM, Mondays through Fridays, and between 9:00 AM and 5:00 PM on Saturdays, and based upon City of San Rafael restrictions.

<u>Mitigation Measure TRANS-6</u>: Development under the Master Facilities Long-Range Plan shall abide by the City of San Rafael's provisions regarding transportation and parking management during demolition and construction activities. In addition, San Rafael City Schools shall develop a demolition/construction traffic management plan defining hours of operation, specified truck routes, and construction parking provisions. The District shall ensure that any parking losses associated with construction vehicles does not affect parking availability on campus. To the greatest extent possible, the District shall direct all construction truck traffic to travel to and from the campus via 3rd Street. Implementation of this measure would reduce Impact TRANS-6 to a less-than-significant level. (LTS)

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Impact on Circulation System Performance

Provision of the Stadium Project would not conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation, including mass transit and nonmotorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.

The expected traffic volume increases from implementation of the Stadium Project along segments of 2nd Street and 3rd Street that are part of the CMP network were estimated. These increases—up to three vehicles per hour per roadway—would not result in a change to the service levels along these CMP roadways.

The impact would be less than significant, and no mitigation is necessary.

Conflict with Applicable Congestion Management Program

Development of the Stadium Project would not conflict with the Transportation Authority of Marin's Congestion Management Program, including but not limited to level of service standards and travel demand measures, or other standards established by the Transportation Authority of Marin for designated roads or highways.

The impact would be less than significant, and no mitigation is necessary.

Change in Air Traffic Patterns

Implementation of the Stadium Project would not result in a change in air traffic patterns, including either an increase in traffic or a change in location that results in substantial safety risks.

The Stadium Project does not propose any features relating to air traffic.

The impact would be less than significant, and no mitigation is necessary.

Adequacy of Emergency Access

None of the features of the Stadium Project would result in inadequate emergency access.

The Stadium Project proposes to provide adequate emergency access travelways within the campus.

The impact would be less than significant, and no mitigation is necessary.

<u>Public Transit, Bicycle, and Pedestrian Impacts</u>

The Stadium Project would not conflict with any adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, and would not otherwise decrease the performance or safety of these facilities.

The Stadium Project does not propose any changes to the existing public transit facilities serving the SRHS campus.

The impact on public transit, bicycle, and pedestrian facilities would be less than significant, and no mitigation is necessary.

Potentially Significant Impacts

<u>Impact TRANS-7</u>: The construction of components of the Stadium Project would add construction-related vehicle trips to City of San Rafael and other jurisdictional roadways, creating temporary traffic hazards. These conditions would conflict with San Rafael General Plan Program C-4a (Street Pattern and Traffic Flow). (PS)

Construction of the Stadium Project, including the addition of a 39-space parking lot to the south of the stadium, would generate truck trips and other construction-related vehicles starting in the late spring of 2017 and concluding in September 2018. Three phases of work would be completed, as discussed in Chapter 3, Project Description, of this EIR. During the construction period, construction would occur between 8:00 AM and 5:00 PM, Mondays through Fridays, and between 9:00 AM and 5:00 PM on Saturdays, and based upon City of San Rafael restrictions.

> *<u>Mitigation Measure TRANS-7</u>: The Stadium Project shall abide by the City of San Rafael's provisions regarding transportation and parking management during demolition and construction activities. In addition, San Rafael City Schools shall develop a demolition/ construction traffic management plan defining hours of operation, specified truck routes, and construction parking provisions. Implementation of this measure would reduce Impact TRANS-7 to a less-than-significant level. (LTS)*

CUMULATIVE IMPACTS

Potential cumulative transportation and traffic impacts resulting from the proposed Master Facilities Long-Range Plan, including the proposed Stadium Project, as well as recommended mitigation measures to reduce impacts to less-than-significant levels, were described in the previous section. The 2020 and 2040 traffic conditions address cumulative growth in San Rafael.

4.12.5 REFERENCES

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4.13 UTILITIES AND SERVICE SYSTEMS

4.13.1 INTRODUCTION

This section describes the existing setting and impacts on water, wastewater, and solid waste disposal services that could result from development under the Master Facilities Long-Range Plan, including the Stadium Project that is part of the Long-Range Plan.

4.13.2 ENVIRONMENTAL SETTING

WATER

The City of San Rafael obtains its water supply from the Marin Municipal Water District (MMWD), which provides potable water to the eastern corridor of Marin County from the Golden Gate Bridge up to but not including Novato. The incorporated cities and towns of San Rafael, Corte Madera, Mill Valley, Fairfax, San Anselmo, Ross, Larkspur, Belvedere, and Sausalito are within the MMWD service area (MMWD, 2015).

Water Supply and Demand

The MMWD potable water supplies come from a combination of local surface water supplies and water imported from the Russian River and purchased from the Sonoma County Water Agency (SCWA). MMWD operates seven surface water storage reservoirs with a total capacity of 79,566 acre-feet (25,927 million gallons), but MMWD estimates that operational yield of the reservoirs is about 20,000 acre-feet per year. The reservoir supply is supplemented with SCWA water through a contract that allows MMWD to take deliveries of up to 14,300 acre-feet per year (MMWD, 2015).

Current demand for potable and raw water is 22,610 acre-feet per year. Demand is expected to increase to roughly 25,860 acre-feet per year by 2040 (MMWD, 2015).

Through its commitment to water conservation, MMWD expects that water supplies will be sufficient to meet demands during normal and dry water years through 2040. However, the MMWD water rationing plan includes provisions that require MMWD customers to reduce their water usage by up to 25 percent during periods of severe drought (MMWD, 2015).

Water Treatment

To treat its water supply, MMWD operate three water treatment plants: the Bon Tempe Treatment Plant, the San Geronimo Treatment Plant, and the Ignacio treatment facility. Together, these facilities have a combined design capacity of 71 million gallons per day (mgd). Observed high flows have reached 58 mgd; however, the average daily maximum flow is approximately 25 mgd. In 2015, the total production of the three plants averaged 20.4 mgd (MMWD, 2015).

Water Distribution

Because of Marin County's hilly terrain, about 90 percent of the water must be pumped at least once before it reaches the customer's tap. The MMWD potable water distribution system includes approximately 886 miles of water mains, 94 pumping stations, and 127 treated water storage tanks with a total storage capacity of approximately 82 million gallons (MMWD, 2015).

Recycled Water System

In addition to its potable water system, MMWD owns and operates a recycled water system, which consists of nearly 25 miles of pipeline and delivers about 520 acre-feet per year through 342 service connections. MMWD produces its own recycled water by treating secondary effluent provided by the Las Gallinas Valley Sanitary District (MMWD, 2015).

Water Facilities Serving Project Site

On the San Rafael High School (SRHS) campus, an MMWD easement runs west to east through the 3rd Street parking lot parallel to 3rd Street and terminates inside the stadium. From the terminus of this easement, a water line continues north behind the home bleachers and terminates at an MMWD water meter. Immediately downstream of the water meter, there are several backflow prevention devices that distribute water for the stadium and baseball irrigation system and various potable water connections (Fee, 2016).

Existing Water Entitlement at Project Site

MMWD uses formulas to determine the necessary water entitlement for different types of users. If, at a later date, it is determined that actual consumption is exceeding the current entitlement, additional water must be purchased to increase the property's entitlement, or the consumption must be reduced to the level consistent with the existing entitlement.

MMWD records show that the total existing water entitlement for the project site is 57.72 acre-feet per year (Anderson, 2016).

Existing Water Consumption at Project Site

SRHS staff estimate that existing total water demand at the high school is up to approximately 29,172 gallons per day. This total accounts for all water uses on the site, including restroom uses, food service and cleaning, water fountains, irrigation, swimming pool, and gym showers (Pedroli, 2016). This estimate translates to up to approximately 0.09 acre-feet per day. If the school used this amount of water every day during the course of a 180-day school year, the total water demand would be about 16 acre-feet per year. If the high school were in operation every day of the year (365 days), the water demand estimate would translate to about 33 acre-feet per year. This estimate can be considered high, however, since the school does not operate 365 days a year.

Table 4.13-1 shows estimated annual water consumption for the existing uses on the campus, calculated using MMWD's current formula for determining water entitlements. As shown in the table, the formula produces a water consumption estimate of 13.95 acre-feet per year for the existing uses. This estimate does not include landscape irrigation (Anderson, 2016).

TABLE 4.13-1 ESTIMATED ANNUAL WATER CONSUMPTION FOR EXISTING PROJECT SITE LAND USES BASED ON MARIN MUNICIPAL WATER DISTRICT (MMWD) WATER ENTITLEMENT FORMULAS

Element	MMWD Formula (Acre-Feet per Year)	Water Consumption Estimate (Acre-Feet per Year)
1,125 Students (Existing Enrollment)	0.0124 per student	13.95

Note: Estimates do not include landscape irrigation.
Source: Anderson, 2016.

Table 4.13-2 shows estimated actual water consumption by the existing uses on the campus, based on MMWD records. As shown in the table, total actual water consumption is estimated at 4.21 acre-feet per year.

TABLE 4.13-2 ESTIMATED ACTUAL WATER CONSUMPTION BY EXISTING PROJECT SITE LAND USES

Year	Actual Water Use Estimate (Acre-Feet per Year)
2015	4.21

Note: Estimates do not include landscape irrigation.
Source: Anderson, 2016.

WASTEWATER

The San Rafael Sanitation District, a member of the Central Marin Sanitation Agency (CMSA), provides wastewater services in San Rafael. CMSA, formed in 1979, is a public joint powers agency of the San Rafael Sanitation District, Sanitary District No. 2, the Ross Valley Sanitary District, and the City of Larkspur. The San Rafael Sanitation District has an eight-person crew that maintains 32 pump stations, 13 miles of force main, and 132 miles of sewer pipelines. This collection and transportation system delivers wastewater to CMSA for treatment (CMSA, 2016; San Rafael Sanitation District, 2016a).

Wastewater Treatment Plant

CMSA owns and operates the CMSA Wastewater Treatment Plant, located off Interstate 580 in San Rafael. The treatment plant treats wastewater and biosolids from member districts and the San Quentin State Prison via conveyance from several remote pump stations. The treatment plant produces clean effluent, which is treated to an advanced secondary treatment level and then discharged into San Francisco Bay through an outfall structure owned and maintained by CMSA. Biosolids from the treatment process are either applied as soil enhancement for agriculture in Sonoma County or Solano County or taken to Redwood Landfill in Novato where they are processed for compost, used for alternative daily cover, or directly disposed to the landfill. Some of the treated wastewater is recycled and used for washdown and irrigation at the plant site.

The treatment plant is capable of processing more than 125 mgd of wastewater during peak rainfall periods. The average dry weather flow is 7 mgd, and permitted dry weather flow is 10 mgd. The maximum peak wet weather flow has reached 116 mgd. The treatment plant has an additional hydraulic capacity of more than 10 mgd during maximum peak wet weather flow periods (Dow, 2016b).

Wastewater Facilities in Project Site Vicinity

Existing wastewater facilities serving the project site include on-site sewer lines, along with a sanitary sewer lift station and 6-inch force main in 3rd Street adjoining the site. There is no sanitary sewer connection at the existing stadium on the site (Fee, 2016; Toy, 2016).

Wastewater Generation at Project Site

Existing total sewage generation at the project site consists of approximately 1,200 pounds per day in solids and approximately 11,033 gallons per day in liquids (Pedroli, 2016).

SOLID WASTE DISPOSAL

Solid Waste Collection

Marin Sanitary Service, a privately owned waste hauler, provides solid waste collection service in San Rafael and other areas of central Marin County. Marin Sanitary Service operates a resource recovery and recycling plant, as well as a transfer station where waste is accepted and then hauled by transfer truck to Redwood Landfill (Nichols-Berman, 2004).

Landfill Capacity

Redwood Landfill, a fully permitted Class III disposal site located approximately 3.5 miles north of Novato, is the main landfill used for residential and commercial wastes generated in the San Rafael area. Redwood Landfill has a current maximum permitted capacity of 19.1 million cubic yards. According to the State of California's database, as of December 2008, the landfill had a remaining capacity of 26 million cubic yards, which is different from the permitted capacity. The landfill has a permitted throughput of 2,300 tons per day and currently is expected to cease operation in 2024 (CalRecycle, 2016).

Solid Waste Generation at Project Site

SRHS staff estimate that the high school currently recycles approximately 63.8 cubic yards of paper/cardboard per month and landfills approximately 39 cubic yards of waste per month (Pedroli, 2016).

4.13.3 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

No federal regulations related to utilities and service systems would apply to the Master Facilities Long-Range Plan or the Stadium Project that is part of the Long-Range Plan.

STATE REGULATIONS

State Requirements for Water Supply Assessment

In 2001, the California legislature enacted Senate Bill (SB) 610, designed to achieve greater coordination between water suppliers and local land use agencies when considering certain large-scale development proposals. SB 610 requires preparation of a Water Supply Assessment for any development that involves an approval subject to the California Environmental Quality Act (CEQA) and that meets the definition of "project" under Water Code Section 10912(a)(7)—i.e., a residential development project of more than 500 housing units or other types of development expected to use an equivalent amount of water (California Department of Water Resources, 2016).

Under SB 610, the Water Supply Assessment must describe the proposed project's water demand over a 20-year period, identify the sources of water available to meet that demand, and assess whether those water supplies are or will be sufficient to meet the demand for water associated with the proposed project, in addition to the demand of existing customers and other planned future development. If the assessment concludes that water supplies are or will be insufficient, the assessment must describe plans (if any) for acquiring additional water supplies, and the measures that are being undertaken to acquire and develop those supplies.

Development in accordance with the Master Facilities Long-Range Plan would use less water than 500 housing units, and therefore a Water Supply Assessment is not required for the Long-Range Plan (Anderson, 2016).

State CALGreen Code Requirements

The Division of the State Architect (DSA) reviews school project designs to determine compliance with State of California requirements, including the California Green Building Standards Code (CALGreen Code). All new buildings (new construction) submitted to DSA for review, as a single project or in a series of increments, on or after January 1, 2014 must comply with the 2013 CALGreen Code. The CALGreen Code includes requirements for water efficiency and conservation, including indoor plumbing and landscape irrigation systems. The CALGreen Code also includes requirements for waste reduction and recycling; these include requirements that a minimum of 50 percent of nonhazardous construction and demolition waste be recycled and/or salvaged for reuse, that a construction waste management plan be prepared, and that readily accessible areas be provided to allow recycling by project occupants (DSA, 2016).

California Integrated Waste Management Act

The California Integrated Waste Management Act of 1989 ("CIWMA") (Public Resources Code, Division 30, enacted through State Assembly Bill [AB] 939 and modified by subsequent legislation) was enacted to reduce, recycle, and reuse solid waste generated in the state to the maximum extent feasible. Specifically, the CIWMA requires city and county jurisdictions to plan and implement programs to divert 50 percent of the total waste stream from landfill disposal by the year 2000 (Public Resources Code, Section 41780). The CIWMA also requires each city and county to promote source reduction, recycling, and safe disposal or transformation. California cities and counties are required to submit annual reports to the state on their progress toward AB 939 goals.

Assembly Bill 341

In 2011, Assembly Bill 341 (Chesbro) was signed by Governor Brown and became law (Public Resources Code Sections 41730, *et seq.*, 42649, *et seq.*). The law implements a policy goal of the state that not less than 75 percent of solid waste generated be source reduced, recycled, or composted by 2020.

LOCAL REGULATIONS

San Rafael General Plan

The San Rafael General Plan contains the following relevant policies and programs regarding water, wastewater, and solid waste services (City of San Rafael, 2013):

Policy LU-2 **Development Timing.** For health, safety and general welfare reasons, new development should only occur when adequate infrastructure is available consistent with the following findings: …

e. Sewer, water, and other infrastructure improvements will be available to serve new development by the time the development is constructed.

Program LU-2a **Development Review.** Through the development and environmental review processes, ensure that policy provisions are evaluated and implemented. The City may waive or modify any policy requirement contained herein if it determines that the effect of implementing the same in the issuance of a development condition or other approvals would be to preclude all economically viable use of a subject property.

Policy I-3 **Availability of Utilities.** Promote the availability of reliable and reasonably priced utilities necessary for businesses and residences to prosper.

Program I-3a **Capacity Management.** Work with the Central Marin Sanitation Agency and San Rafael Sanitation District to ensure completion of a Capacity Management Alternative

Study to determine the scope of needed improvements, costs, and expected benefits to avoid excess of water treatment capacity.

Program I-3b **Water Supply Impacts.** Work with Marin Municipal Water District to meet the projected water demand and to ensure reduction of existing and projected water supply impacts.

Policy I-10 **Sewer Facilities.** Existing and future development needs should be coordinated with responsible districts and agencies to assure that facility expansion and/or improvement meets Federal and State standards and occurs in a timely fashion.

Policy SU-5 **Reduce Use of Non-Renewable Resources.** Reduce dependency on non-renewal resources.

Program SU-5c **Water Efficiency Programs.** Develop and implement water efficiency and conservation programs to achieve a 30% reduction in water use by 2020, including water efficient landscape regulations, PACE financing, water audits, upgrades upon resale, education and outreach.

Policy SU-9 **Zero Waste.** Reduce material consumption and waste generation, increase resource re-use and composting of organic waste, and recycle to significantly reduce and ultimately eliminate landfill disposal.

Program SU-9a **Zero Waste.** Adopt a Zero Waste Goal and a Zero Waste Strategic Plan to achieve this goal.

Program SU-9f **Construction Debris.** Adopt construction debris and re-use ordinance.

Policy S-32 **Safety Review of Development Projects.** Require…fire prevention techniques in new development…

Program S-32a **Safe Buildings.** Continue to review development applications to insure that…adequate water pressure and peak load storage capacity…reduce the opportunity for…fire hazards.

Policy CON-20 **Water Conservation.** Encourage water-conserving practices in businesses, homes and institutions and increase the use of recycled water.

Program CON-20a **Water Conserving Landscaping.** Make available to property managers, designers and homeowners information about water-conserving landscaping and water-recycling methods and resources.

Program CON-20b **Water Recycling.** Support the extension of recycled water distribution infrastructure. Require the use of recycled water where available.

Policy CON-21 **Waste Reduction/Recycling.** Encourage waste reduction practices. Encourage recycling through provision of recycling containers, and developing and promoting both existing and new program.

Program CON-21a **Recycling.** Encourage efforts to promote recycling, such as encouraging businesses to recycle building and other materials, promoting composting by restaurants, institutions and residences, and supporting Marin Conservation Corps' work to promote recycling.

Program CON-21c **Recycling for Apartments and Nonresidential Buildings.** Encourage recycling facilities and programs for apartment and nonresidential buildings. Consider the cost and benefits of expanding recycling facilities and programs for apartment and nonresidential buildings.

San Rafael Climate Change Action Plan

The *City of San Rafael Climate Change Action Plan* contains the following program related to water service (City of San Rafael, 2009):

Program BU6 Develop a program to achieve water conservation in existing buildings and landscaping, with a goal of reducing water use by 30% by the year 2020.

Water Conservation Requirements (MMWD and San Rafael Municipal Code)

San Rafael Municipal Code Section 14.16.370 requires that certain new construction and rehabilitation projects comply with water-efficient landscape requirements. In accordance with this Municipal Code section, the City adopts by reference MMWD's water conservation ordinance and designates MMWD to implement, enforce, and monitor the requirements of that ordinance (City of San Rafael, 2016).

Title 13, Water Service Conditions and Water Conservation Measures, of the MMWD Code sets standards for water use in all new construction as well as certain remodels and landscape rehabilitations. Effective December 16, 2015, in response to Governor Brown's Drought Executive Order and new state requirements, MMWD's Ordinance No. 430 sets standards for water-efficient landscapes, landscape review requirements, and kitchen and lavatory faucets (MMWD, 2016a).

Utility Connection Fees

For water service, MMWD charges connection fees that apply to new development, changes in use, and excessive water consumption. The current connection fee is $29,260 per acre-foot of estimated annual consumption (MMWD, 2016b).

The San Rafael Sanitation District levies sewer connection fees, which are charged by the number of fixture units. Additional administrative/inspection fees are charged for the relocation of existing sewer laterals for an additional sewer lateral or for any new cut into a sewer main line (San Rafael Sanitation District, 2016b).

San Rafael City Schools Energy and Water Management Policy

San Rafael City Schools has an energy and water management policy (BP 3511) that "recognizes the importance of minimizing the district's use of natural resources, providing a high-quality environment that promotes health and productivity, and effectively managing the district's fiscal resources." The policy provides as follows (San Rafael City Schools, 2016):

- The Superintendent or designee shall develop a resource management program which includes strategies for implementing effective and sustainable resource practices, exploring renewable and clean energy technologies, reducing energy and water consumption, minimizing utility costs, reducing the amount of waste of consumable materials, encouraging recycling and green procurement practices, and promoting conservation principles.
- The Superintendent or designee shall regularly inspect district facilities and operations and make recommendations for maintenance and capital expenditures which may help the district reach its conservation and management goals.
- The Superintendent or designee shall make every effort to identify funding opportunities and cost-reducing incentive programs to help the district achieve its conservation and management goals.
- The Superintendent or designee shall periodically report to the Board on the district's progress in meeting its conservation and management goals.

4.13.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

Water

For the purposes of this EIR and based on Appendix G of CEQA Guidelines, implementation of the proposed project would have a significant effect on water facilities if it would:

a) Require or result in the construction of new water facilities or expansion of existing facilities, the construction of which could cause significant environmental effects; or

b) Have insufficient water supplies available to serve the project from existing entitlements and resources, or require new or expanded entitlements.

Wastewater

For the purposes of this EIR and based on Appendix G of CEQA Guidelines, implementation of the proposed project would have a significant effect on wastewater facilities if it would:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board;

b) Require or result in the construction of new wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects; or

c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments.

Solid Waste Disposal

For the purposes of this EIR and based on Appendix G of CEQA Guidelines, implementation of the proposed project would have a significant effect on solid waste disposal facilities if it would:

a) Be served by a landfill with insufficient permitted capacity to accommodate the project's solid waste disposal needs; or

b) Not comply with federal, state, or local statutes and regulations related to solid waste.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Need for New or Expanded Water Facilities

Development in accordance with the Master Facilities Long-Range Plan would not require or result in the construction of new water facilities or expansion of existing facilities that would have significant environmental effects.

As discussed in Chapter 3, Project Description, completion of the Long-Range Plan would result in an approximately 48,222-square-foot net increase in building area on the SRHS campus, as well as a 200-student increase in enrollment (from the current enrollment of approximately 1,125 students to approximately 1,325 students). As explained in Chapter 3, the number of faculty and staff at the high school would not change. In addition, approximately 84 additional events per year would be held at the stadium, which is proposed for renovation; however, the stadium's grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats) (see further discussion under "Impacts of Proposed Stadium Project" below).

Development in accordance with the Long-Range Plan would include connections to existing MMWD water facilities on the campus. Proposed new buildings, such as Building No. 1 (Science), Building No. 2 (Administration/Kitchen/Student Commons), Building No. 3 (CTE/Art), and Building No. 4 (Classrooms/Ceramics/Theater) would be constructed to replace existing buildings planned for demolition (Building F, Building I, Buildings O, M, and L, and Building R, respectively). Existing on-site piping and fire hydrants would be replaced in a phased manner as construction proceeds (*see* Figure 3-4 in Chapter 3, Project Description, of this EIR) (Hibser, 2016). MMWD would be informed about any new tie-ins to existing water mains prior to construction. It is anticipated that the Stadium Project would reconnect to the baseball irrigation system, connect to a new water system around the field perimeter, and extend a potable water line for use at the proposed restrooms (Building No. 10), concessions (Building No. 5), drinking fountains, and restrooms/changing rooms (Building No. 6) included in the project (Fee, 2016). (See further discussion under "Impacts of Proposed Stadium Project" below.)

Construction of new off-site water facilities or expansion of existing facilities is not expected to be necessary (Anderson, 2016). The environmental impacts of the water facilities required for the Long-Range Plan are therefore evaluated as part of the analysis of project construction impacts throughout this EIR. The water facilities would not have any specific significant environmental impacts requiring mitigation. The District (San Rafael City Schools) would pay appropriate development impact and utility connection fees toward ongoing improvements and maintenance of the water system (MMWD, 2016b). The environmental impact would be less than significant, and no mitigation is necessary.

Sufficiency of Water Supplies

Water supplies would be sufficient to serve Master Facilities Long-Range Plan development, and new or expanded water entitlements would not be necessary.

SRHS staff estimate that, based on the anticipated 200-student enrollment increase, development in accordance with the Master Facilities Long-Range Plan, including the Stadium Project, would generate a 20 percent increase in demand for water. Therefore, demand would increase by approximately 5,834 gallons per day, and would be up to 35,006 gallons per day (Pedroli, 2016). This estimate translates to up to approximately 0.11 acre-feet per day, or up to about 19.8 acre-feet per year assuming a 180-day school year.

Based on MMWD's water entitlement formula (see Table 4.13-1), the 200-student enrollment increase would increase water demand by 2.48 acre-feet per year (200 students x 0.0124 acre-feet per student per year). Therefore, with development in accordance with the Master Facilities Long-Range Plan, total estimated water consumption would be 16.43 acre-feet per year, based on the existing annual water consumption calculated for the SRHS campus using MMWD's current formula for the existing uses (13.95 acre-feet + 2.48 acre-feet = 16.43 acre-feet). Based on actual existing water consumption on the campus (4.21 acre-feet per year—see Table 4.13-2), total estimated water consumption with Master Facilities Long-Range Plan development would be 6.69 acre-feet per year (4.21 acre-feet + 2.48 acre-feet = 6.69 acre-feet).

The estimated water consumption of 16.43 acre-feet per year would represent the total water entitlement required for the SRHS campus with development under the Long-Range Plan. This water entitlement would be 41.29 acre-feet per year less than the existing historical entitlement of 57.72 acre-feet per year for the campus. It is therefore reasonable to conclude that water supplies would be sufficient to serve development in accordance with the Long-Range Plan, and no new or expanded water entitlements would be necessary (Anderson, 2016).[1]

Landscape irrigation on the campus would be subject to MMWD's landscape water conservation requirements, as well as State of California water conservation landscaping requirements. The

[1] Historical water entitlements were created by action of the MMWD Board of Directors and theoretically could be removed by action of the MMWD board. Under current MMWD Code Section 11.08.180, a water entitlement can be adjusted downward if, due to zoning changes, a historical use will not be experienced again. This is not the case for the Long-Range Plan, however.

campus would also continue to be subject to the San Rafael City Schools energy and water management policy (BP 3511). Compliance with these requirements would help reduce the Long-Range Plan's water use, in compliance with San Rafael General Plan and Climate Change Action Plan policies and programs for water conservation (see Section 4.13.3, Regulatory Framework, above).

The Long-Range Plan's impact on water supplies would therefore be less than significant, and no mitigation is necessary.

Need for New or Expanded Wastewater Facilities

Development in accordance with the Master Facilities Long-Range Plan would not require or result in the construction of new wastewater facilities or expansion of existing facilities that would have significant environmental effects.

As discussed in Chapter 3, Project Description, completion of the Long-Range Plan would result in an approximately 48,222-square-foot net increase in building area on the SRHS campus, as well as a 200-student increase in enrollment (from the current enrollment of approximately 1,125 students to approximately 1,325 students). As discussed in Chapter 3, the number of faculty and staff at the high school would not change. In addition, approximately 84 additional events per year would be held at the stadium, which is proposed for renovation; however, the stadium's grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats) (see further discussion under "Impacts of Proposed Stadium Project" below).

Development in accordance with the Long-Range Plan would include connections to existing San Rafael Sanitation District facilities serving the campus. Proposed new buildings, such as Building No. 1 (Science), Building No. 2 (Administration/Kitchen/Student Commons), Building No. 3 (CTE/Art), and Building No. 4 (Classrooms/Ceramics/Theater) would be constructed to replace existing buildings planned for demolition (Building F, Building I, Buildings O, M, and L, and Building R, respectively). Existing on-site sewer lines would be replaced as necessary (Hibser, 2016). The San Rafael Sanitation District would be informed about any new tie-ins to existing sewer lines. The Stadium Project would have a new sanitary sewer connection at the existing lift station at 3rd Street to serve the proposed restrooms (Building No. 10), concessions (Building 5), and restrooms/ changing rooms (Building No. 6) included in the project (Fee, 2016) (see further discussion under "Impacts of Proposed Stadium Project" below.)

Construction of new off-site wastewater facilities or expansion of existing facilities is not expected to be necessary. The environmental impacts of the wastewater facilities required for the Long-Range Plan are therefore evaluated as part of the analysis of project construction impacts throughout this EIR. The wastewater facilities would not have any specific significant environmental impacts requiring mitigation. The District (San Rafael City Schools) would be required to submit civil engineering plans to the San Rafael Sanitation District for approval; at that time, the capacity of each pipeline would be checked, and various options for connection would be evaluated. The lift station has adequate capacity to serve the additional flow (Toy, 2016). The District would also be required to pay appropriate development impact and utility connection fees toward ongoing improvement and maintenance of the wastewater system (San Rafael Sanitation District, 2016b). The environmental impact would be less than significant, and no mitigation is necessary.

Wastewater Treatment Requirements and Capacity

Development in accordance with the Master Facilities Long-Range Plan would not exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board or result in a determination by the wastewater treatment provider that serves the project site that it has inadequate capacity to serve the Long-Range Plan's projected demand in addition to the provider's existing commitments.

Since wastewater treatment capacity would be adequate to serve development in accordance with the Long-Range Plan (see discussion below), this development would not exceed wastewater treatment requirements of the San Francisco Bay Regional Water Quality Control Board. The Long-Range Plan's impact in relation to these significance criteria would therefore be less than significant.

The Long-Range Plan would include connections to existing on-site wastewater facilities, and wastewater would discharge into the existing sewer main in 3rd Street. Sewage from the development would be conveyed through the San Rafael Sanitation District sewer system to the CMSA Wastewater Treatment Plant.

SRHS staff estimate that, based on the anticipated 200-student enrollment increase, development in accordance with the Master Facilities Long-Range Plan, including the Stadium Project, would generate a 20 percent increase in wastewater generation. Therefore, wastewater solids would increase by approximately 240 pounds per day, to 1,440 pounds per day; and wastewater liquids would increase by approximately 2,207 gallons per day, to 13,240 gallons per day (Pedroli, 2016).

The CMSA Wastewater Treatment Plant would have adequate capacity to handle this increase (Dow, 2016b). The Long-Range Plan's impact would therefore be less than significant and no mitigation is necessary.

Impact on Landfill Capacity

The landfill serving the campus would have sufficient capacity to accommodate the solid waste disposal needs of Master Facilities Long-Range Plan development.

The Master Facilities Long-Range Plan would involve demolition of existing facilities and construction of new facilities on the SRHS campus, as described in Chapter 3, Project Description, of this EIR. Solid waste would be generated during both the construction and operational phases of the Long-Range Plan.

The construction phase would include building demolition, which would generate a substantial amount of debris. The goal would be to recycle the majority of demolition material, including metal (poles), wood (bleachers), glass (fixtures), paving, and concrete products, to minimize off-haul to the landfill (Pedroli, 2016).

Once in operation, Long-Range Plan development, including the Stadium Project, would be expected to increase paper/cardboard recycling by 12.8 cubic yards per month, to 76.6 cubic yards per month, and would increase landfilling by 7.8 cubic yards per month, to 46.8 cubic yards per month. These estimates are based on the 200-student enrollment increase anticipated under the

Long-Range Plan. The amount of material sent to the landfill may decrease with education and implementation of recycling programs on campus (Pedroli, 2016).

Redwood Landfill would have sufficient capacity to accommodate the Long-Range Plan's solid waste disposal needs. The landfill's maximum permitted capacity (19.1 million cubic yards) and permitted throughput (2,300 tons per day) far exceed the net increase in solid waste that would be generated by Long-Range Plan development (7.8 cubic yards per month). The impact on landfill capacity would therefore be less than significant.

Compliance with Applicable Solid Waste Regulations

Master Facilities Long-Range Plan development would comply with federal, state, and local statutes and regulations related to solid waste.

As discussed under "Impact on Landfill Capacity" above, the Long-Range Plan, including the Stadium Project, would involve building demolition and construction that would generate substantial quantities of waste. After the development is occupied, the 200-student enrollment increase would be expected to generate approximately 7.8 cubic yards of solid waste per month in addition to the approximately 39 cubic yards of waste currently generated at the SRHS campus, as discussed under "Impact on Landfill Capacity" above. Construction and occupancy of the development therefore would have the potential interfere with the City's achievement of waste diversion goals mandated by the California Integrated Waste Management Act. However, development would be subject to the CALGreen Code, which includes requirements for waste reduction and recycling; these include requirements that a minimum of 50 percent of nonhazardous construction and demolition waste be recycled and/or salvaged for reuse, that a construction waste management plan be prepared, and that readily accessible areas be provided to allow recycling by project occupants (DSA, 2016). The DSA would review projects proposed under the Long-Range Plan to verify compliance with State of California requirements, including the CALGreen Code. In addition, the campus would continue to be subject to the San Rafael City Schools energy and water management policy (BP 3511), which requires the Superintendent or designee to develop a resource management program that includes strategies for implementing effective and sustainable resource practices, reducing the amount of waste of consumable materials, and encouraging recycling. The impact would therefore be less than significant, and no mitigation measure is necessary.

Potentially Significant Impacts

The Long-Range Plan would not have any potentially significant impacts related to utilities.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Need for New or Expanded Water Facilities

The Stadium Project would not require or result in the construction of new water facilities or expansion of existing facilities that would have significant environmental effects.

As discussed under "Impacts of Proposed Master Facilities Long-Range Plan" above, it is anticipated that the Stadium Project would reconnect to the baseball irrigation system, connect to a new water system around the field perimeter, and extend a potable water line for use at the proposed restroom (Building No. 10), concessions (Building No. 5), drinking fountains, and restrooms/changing rooms (Building No. 6) included in the project (Fee, 2016). Construction of new off-site water facilities or expansion of existing facilities is not expected to be necessary (Anderson, 2016). The environmental impacts of the water facilities required for the Stadium Project are therefore evaluated as part of the analysis of project construction impacts throughout this EIR. The water facilities would not have any specific significant environmental impacts requiring mitigation. The District (San Rafael City Schools) would pay appropriate development impact and utility connection fees toward ongoing improvement and maintenance of the water system (MMWD, 2016b). The environmental impact would be less than significant, and no mitigation is necessary.

Sufficiency of Water Supplies

Water supplies would be sufficient to serve the Stadium Project, and new or expanded water entitlements would not be necessary.

This impact would be less than significant for the reasons explained under "Impacts of Proposed Master Facilities Long-Range Plan" above. The water demand estimates for the overall Long-Range Plan include the anticipated demand from the Stadium Project, which would include installation of a new concession stand (Building No. 5), restrooms/changing rooms (Building No. 6), and new restrooms (Building No. 10) with 10 new fixtures (4 male, 4 female, and 2 unisex). The project would replace the stadium's existing grass turf with synthetic turf, which would reduce the use of irrigation water in this area of the campus. As discussed above under "Impacts of Proposed Master Facilities Long-Range Plan" above, water supplies would be sufficient to serve the Stadium Project, and no new or expanded water entitlements would be necessary (Anderson, 2016). The project's impact on water supplies would therefore be less than significant, and no mitigation is necessary.

While not required as mitigation, use of low-flow fixtures is recommended by MMWD for the new restrooms included in the Stadium Project (Anderson, 2016).

Need for New or Expanded Wastewater Facilities

The Stadium Project would not require or result in the construction of new wastewater facilities or expansion of existing facilities that would have significant environmental effects.

As discussed under "Impacts of Proposed Master Facilities Long-Range Plan" above, it is anticipated that the Stadium Project would have a new sanitary sewer connection at the existing lift station at 3rd Street to serve the proposed restroom (Building No. 10), concessions (Building No. 5), and restrooms/changing rooms (Building No. 6) included in the project (Fee, 2016). The District (San Rafael City Schools) would be required to submit civil engineering plans to the San Rafael Sanitation District for approval; at that time, the designed connection at the lift station would be reviewed and coordinated (Toy, 2016). Construction of new off-site wastewater facilities or expansion of existing facilities is not expected to be necessary. The environmental impacts of the wastewater facilities required for the Stadium Project are therefore evaluated as part of the analysis of project construction impacts throughout this EIR. The wastewater facilities would not have any specific significant environmental impacts requiring mitigation. The District (San Rafael City Schools) would pay appropriate development impact and utility connection fees toward ongoing improvement and maintenance of the wastewater system (San Rafael Sanitation District, 2016b). The environmental impact would be less than significant, and no mitigation is necessary.

Wastewater Treatment Requirements and Capacity

The Stadium Project would not exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board or result in a determination by the wastewater treatment provider that serves the project site that it has inadequate capacity to serve the project's projected demand in addition to the provider's existing commitments.

This impact would be less than significant for the reasons explained under "Impacts of Proposed Master Facilities Long-Range Plan" above. The wastewater generation estimates for the overall Long-Range Plan include the anticipated generation from the Stadium Project, which would include installation of a new concession stand (Building No. 5), restrooms/changing rooms (Building No. 6), and new restrooms (Building No. 10) with 10 new fixtures. Wastewater treatment capacity would be adequate to serve the project, and the project would not exceed wastewater treatment requirements of the San Francisco Bay Regional Water Quality Control Board (Dow, 2016b). The project's impact in relation to these significance criteria would therefore be less than significant, and no mitigation is necessary.

Impact on Landfill Capacity

The landfill serving the campus would have sufficient capacity to accommodate the solid waste disposal needs of the Stadium Project.

This impact would be less than significant for the reasons explained under "Impacts of Proposed Master Facilities Long-Range Plan" above. The recycling and solid waste generation estimates for the overall Long-Range Plan include the anticipated generation from the Stadium Project. Redwood Landfill would have sufficient capacity to accommodate the Stadium Project's solid waste disposal needs, as the landfill's maximum permitted capacity (19.1 million cubic yards) and permitted throughput (2,300 tons per day) far exceed the net increase in solid waste that would be generated by Long-Range Plan development (7.8 cubic yards per month). The impact on landfill capacity would therefore be less than significant.

Compliance with Applicable Solid Waste Regulations

The Stadium Project would comply with federal, state, and local statutes and regulations related to solid waste.

This impact would be less than significant for the reasons explained under "Impacts of Proposed Master Facilities Long-Range Plan" above. The Stadium Project, which proposes renovation of the existing stadium, would involve demolition and construction that would generate substantial quantities of waste. While the stadium's grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats), approximately 84 additional events per year would be held at the stadium after the project is completed. Construction and occupancy of the Stadium Project therefore would have the potential to interfere with the City's achievement of waste diversion goals mandated by the California Integrated Waste Management Act. However, development would be subject to the CALGreen Code, which includes requirements for waste reduction and recycling; these include requirements that a minimum of 50 percent of nonhazardous construction and demolition waste be recycled and/or salvaged for reuse, that a construction waste management plan be prepared, and that readily accessible areas be provided to allow recycling by project occupants (DSA, 2016). The DSA would review the Stadium Project to verify compliance with State of California requirements, including the CALGreen Code. The impact would therefore be less than significant, and no mitigation measure is necessary.

Potentially Significant Impacts

The Stadium Project would not have any potentially significant impacts related to utilities.

CUMULATIVE IMPACTS

Water

For water service, the geographic scope for assessing cumulative impacts is the area within the MMWD service area.

The Master Facilities Long-Range Plan, including the Stadium Project and in conjunction with other past, present, and probable future projects, could result in a cumulative increase in water demand and the need for new or expanded water facilities. As discussed in the above project-specific analysis, however, water consumption by Long-Range Plan-related development, including the Stadium Project, would not result in a significant impact on water supply or create the need for new or expanded water facilities. MMWD expects water supply to be adequate for the Long-Range Plan because the total water entitlement required for the SRHS campus with Long-Range Plan development (16.43 acre-feet per year) would be 41.29 acre-feet per year less than the existing historical entitlement of 57.72 acre-feet per year for the campus (Anderson, 2016).

Currently, MMWD anticipates that water supplies are adequate to serve development in accordance with the Long-Range Plan, including the Stadium Project and combined with other anticipated projects. Individual projects proposed within the MMWD service area will need to calculate precise water demands and facilities needed to provide adequate long-term water supply (Anderson, 2016).

For these reasons, the effect of the Long-Range Plan on water service, in combination with other past, present, and probable future projects, would be less than significant. The Long-Range Plan would not result in or contribute to any significant cumulative water service impacts.

Wastewater

For wastewater service, the geographic scope for assessing cumulative impacts is the service area of the San Rafael Sanitation District and the CMSA Wastewater Treatment Plant. In San Rafael, approved or currently pending development includes approximately 530 housing units, 277,000 square feet of office space, 2,000 square feet of retail space, and a 44,000-square-foot Public Safety Center (see Table 6-1 and Figures 6-1 and 6-2 in Chapter 6, CEQA Considerations, of this EIR).

The Master Facilities Long-Range Plan, including the Stadium Project and in conjunction with other past, present, and probable future projects, could result in a cumulative increase in wastewater generation, resulting in increased demand on wastewater collection and treatment facilities. As discussed in the above project-specific analysis, however, service demand from the Long-Range Plan, including the Stadium Project, would not result in a significant impact on wastewater treatment plant capacity or create the need for new or expanded wastewater facilities (Dow, 2016b). While sewer lateral connections would not be identified until projects are in the design stage, the existing lift station is expected to have adequate capacity to serve the additional flow (Toy, 2016).

For these reasons, the effect of the Long-Range Plan on wastewater service, in combination with other past, present, and foreseeable projects, would be less than significant. The Long-Range Plan would not result in or contribute to any significant cumulative wastewater service impacts.

Solid Waste Disposal

For solid waste disposal service, the geographic scope for assessing cumulative impacts consists of the service area of Redwood Landfill through 2024. The location for disposal of San Rafael's waste beyond 2024 has yet to be determined.

Development under the Master Facilities Long-Range Plan, including the Stadium Project and in conjunction with past, present, and probable future projects, could result in a cumulative increase in solid waste and debris from both construction and operations. However, comprehensive implementation of state and local waste reduction and diversion requirements and programs has and would continue to reduce the potential for exceeding existing landfill capacity. Compliance with the CALGreen Code and the San Rafael City Schools energy and water management policy would ensure that Master Facilities Long-Range Plan development, including the Stadium Project, would not create conflicts with the City of San Rafael's state-mandated waste diversion goals.

For these reasons, the effect of the Master Facilities Long-Range Plan on solid waste disposal service, including the Stadium Project and in combination with other past, present, and probable future projects, would be less than significant. The proposed project would not result in or contribute to any significant cumulative solid waste disposal service impacts.

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4.14 ENERGY

4.14.1 INTRODUCTION

This section describes the existing setting and impacts on energy services that could result from implementation of the Master Facilities Long-Range Plan, including the Stadium Project.

4.14.2 ENVIRONMENTAL SETTING

Pacific Gas and Electric Company (PG&E) provides electricity and natural gas to San Rafael, including the San Rafael High School (SRHS) campus. PG&E is a fee-for-service provider. Electrical power conduits and natural gas lines are typically placed underground with street improvements and in new developments. PG&E is responsible for maintaining the physical infrastructure for gas and electrical distribution (Nichols-Berman, 2004).

Existing facilities on the SRHS campus include a network of natural gas and electrical lines. At the existing stadium, these include an existing underground high-voltage power line that extends from 3rd Street and serves a transformer and main switch board in the stadium behind the home bleachers. Night lighting at the stadium includes four sports light poles with nine 1,500-watt Metal Halide fixtures per pole for a total of 36 fixtures, plus 19 lights in canopies. Existing low-voltage wires connect the public announcer's booth at the home bleachers to an adjacent campus building (Fee, 2016).

Based on student population, it is estimated that approximately 4,629 million British thermal units (MBTU) of natural gas and 9,100 megawatt hours (MWh) of electricity are used on the SRHS campus each year (see further discussion in Section 4.14.4 below).

4.14.3 REGULATORY FRAMEWORK

FEDERAL REGULATIONS

No federal regulations related to energy would apply to the Master Facilities Long-Range Plan, including the Stadium Project.

STATE REGULATIONS

The Division of the State Architect (DSA) reviews school project designs to determine compliance with State of California requirements, including the California Energy Code and the California Green Building Standards Code (CALGreen Code) (DSA, 2016).

State of California energy conservation regulations (2013 Energy Efficiency Standards for Residential and Nonresidential Buildings, Title 24, Part 6, of the California Code of Regulations) specify the State's minimum energy efficiency standards for new construction of residential and nonresidential buildings. The standards regulate energy consumed for heating, cooling, ventilation, water heating, and lighting. Compliance with these standards is verified and enforced through the local building permit process. The California Energy Commission has estimated that the 2016 Building Energy Efficiency Standards, which take effect on January 1, 2017, will reduce energy consumption by about 46 percent for residential buildings and 33.5 percent for nonresidential buildings on average compared to the 2008 Building Energy Efficiency Standards (California Energy Commission, 2014 and 2015).

Part 11 of the 2013 Title 24 Building Standards Code is the California Green Building Standards Code, also known as the CALGreen Code. This is the first statewide green building standards code in the nation and applies to schools and community colleges. Only the mandatory measures will be required for projects submitted to the DSA for review. The voluntary measures are reach-standards, to encourage the design of more sustainable schools and community colleges. In future code cycles, the voluntary measures will be further discussed with stakeholders and some may become mandatory, as deemed appropriate.

The California Air Resources Board enforces California Code of Regulations Title 13, Section 2485 (Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling). Among other requirements, these regulations limit the idling time of diesel construction equipment to 5 minutes.

LOCAL REGULATIONS

San Rafael General Plan

The San Rafael General Plan contains the following relevant policies and programs regarding energy services and conservation (City of San Rafael, 2013):

Policy SU-5 **Reduce Use of Non-Renewable Resources.** Reduce dependency on non-renewable resources.

Program SU-5a **Green Building Regulations.** Require new construction and remodel projects to comply with adopted green building regulations.

Program SU-5b **Energy Efficiency Programs.** Develop and implement energy efficiency and conservation programs to achieve a 20% reduction in energy use by 2020, including PACE financing, stretch building codes, energy audits, upgrades upon resale, education and outreach.

Program SU-5d **Reflective Surfaces.** Encourage the use of high albedo (reflectivity) materials for future outdoor surfaces such as parking lots, roadways, roofs and sidewalks.

Policy SU-6 **New and Existing Trees.** Plant new and retain existing trees to maximize energy conservation and carbon sequestration benefits.

Policy CON-22 **Resource Efficiency in Site Development.** Encourage site planning and development practices that reduce energy demand, support transportation alternatives and incorporate resource- and energy-efficient infrastructure.

Program CON-22a **Site Design.** Evaluate as part of development review, proposed site design for energy-efficiency, such as shading of parking lots and summertime shading of south-facing windows.

San Rafael Climate Change Action Plan

The *City of San Rafael Climate Change Action Plan* contains the following programs related to energy services and conservation (City of San Rafael, 2009):

Program LF6 Continue to implement sidewalk and street improvements for the Safe Routes to School program. Encourage the school districts, Marin Transit and the Transportation Authority of Marin to increase funding for school busing programs, promote carpooling and limit vehicle idling.

Program LF7 Provide transit and carpool incentives to City employees, including alternate work schedules and telecommuting opportunities.

Program BU4 Apply green building requirements to residential, commercial and civic remodeling projects as well as new construction.

Program BU5 Develop a program to achieve energy savings in existing buildings, with a goal of decreasing energy use by 20% as of the year 2020.

San Rafael City Schools Energy and Water Management Policy

San Rafael City Schools has an energy and water management policy (BP 3511) that "recognizes the importance of minimizing the district's use of natural resources, providing a high-quality environment that promotes health and productivity, and effectively managing the district's fiscal resources." The policy provides as follows (San Rafael City Schools, 2016):

- The Superintendent or designee shall develop a resource management program which includes strategies for implementing effective and sustainable resource practices, exploring renewable and clean energy technologies, reducing energy and water consumption, minimizing utility costs, reducing the amount of waste of consumable materials, encouraging recycling and green procurement practices, and promoting conservation principles.
- The Superintendent or designee shall regularly inspect district facilities and operations and make recommendations for maintenance and capital expenditures which may help the district reach its conservation and management goals.
- The Superintendent or designee shall make every effort to identify funding opportunities and cost-reducing incentive programs to help the district achieve its conservation and management goals.

- The Superintendent or designee shall periodically report to the Board on the district's progress in meeting its conservation and management goals.

4.14.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

According to the CEQA Guidelines and a recent court decision, "An EIR must include a statement concerning mitigation measures proposed to minimize significant effects on the environment, included, but not limited to, measures to reduce the wasteful, inefficient, and unnecessary consumption of energy" (CEQA Guidelines, Section 21100(b)(3); *Ukiah Citizens for Safety First v. City of Ukiah,* (2016) 248 Cal.App.4th 256, 261-262). The CEQA Guidelines provide that "Energy conservation measures, as well as other appropriate mitigation measures, shall be discussed when relevant. Examples of energy conservation measures are provided in Appendix F" (CEQA Guidelines, Section 15126.4(a)(1)(C)). Appendix F of the CEQA Guidelines states: "Potentially significant energy implications of a project should be considered in an EIR to the extent relevant and applicable to the project. The following list of energy impact possibilities and potential conservation measures is designed to assist in the preparation of an EIR. In many instances, specific items may not apply or additional items may be needed."

For the purposes of this EIR and based on Appendix F of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on energy services if it would:

a) Result in a substantial increase in overall per capita energy consumption;

b) Result in wasteful, inefficient, or unnecessary consumption of energy;

c) Require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity, the construction of which could cause significant environmental effects; or

d) Conflict with applicable energy efficiency policies or standards.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

<u>Energy Consumption</u>

Development in accordance with the Master Facilities Long-Range Plan would not result in a substantial increase in overall per capita energy consumption or in the wasteful, inefficient, or unnecessary consumption of energy.

The Master Facilities Long-Range Plan would involve building demolition and construction on the SRHS campus. Energy would be consumed during both the construction and operational phases of plan implementation. The construction phase would require energy for the manufacture and transportation of building materials, preparation of the project site, and construction of buildings and infrastructure. Once in operation, the new buildings and other development would consume energy for multiple purposes, including but not limited to building heating and cooling, lighting, appliances, and electronics. In addition, vehicle trips associated with both construction and operation would consume gasoline.

The District is proposing that facilities on the campus be designed with efficient heating and cooling systems, beginning with the orientation of the buildings on the site and the placement of building windows to maximize natural winter heat gain and minimal summer heat gain. Structures would be constructed of building systems that provide thermal protection. Skylights and clerestory windows would assist in providing required lighting, thereby limiting the need for artificial light. New buildings would be designed with infrastructure for photovoltaic panels. In addition, photovoltaics are planned for other areas of the campus to provide additional power to the campus off the main power grid. Campus improvements would include more efficient mechanical and electrical systems in an effort to exceed California Building Code requirements (Hibser, 2016). As noted in Chapter 3, Project Description, of this EIR, to the extent practicable, area lighting and security lighting would be controlled by the use of timed switches and/or motion detector activation to reduce energy consumption. (For detailed discussion of energy-saving features included in the Stadium Project, see “Impacts of Proposed Stadium Project” below.)

The following discussion reviews potential energy use during construction and operation of development allowed by the Master Facilities Long-Range Plan. The discussion is based on an analysis conducted by BASELINE Environmental Consulting, the EIR air quality/greenhouse gas (GHG) consultant. Energy use calculations prepared by BASELINE are included in **Appendix E.**

Energy Use during Construction

The Master Facilities Long-Range Plan program improvements would be constructed over a 5-year period. Since construction activities would be temporary, they would not result in a long-term increase in energy consumption. The construction contractor would have a financial disincentive to waste fuel used by the construction equipment (i.e., excess fuel usage reduces profits). Therefore, it is generally assumed that fuel used during construction would be conserved to the maximum extent feasible. Furthermore, regulations enforced by the California Air Resources Board (Title 13, Section 2485 of California Code of Regulations) limit the idling time of diesel construction equipment to 5 minutes. It is anticipated that energy consumption during the construction period would be minimized to the maximum extent practical. This qualitative review therefore finds that the energy intensiveness of construction equipment and construction operations would not be inefficient.

Energy Use during Operation

The most current version of the California Emissions Estimator Model (CalEEMod) was used to evaluate energy consumed during operation of the SRHS campus under existing conditions and under build-out of the Master Facilities Long-Range Plan. Based on a combination of statewide and regional surveys, CalEEMod can be used to conservatively estimate average daily vehicle miles traveled for a range of vehicle trip types associated with operation of a high school (e.g., school bus trips, passenger car commute trips, vendor truck trips). CalEEMod can also be used to conservatively estimate annual electricity and natural gas consumption during operation of a high school based on the gross square footage. The following two scenarios were evaluated in CalEEMod for GHG emissions generated at a high school:

- "Existing Conditions" (without implementation of Master Facilities Long-Range Plan); and
- "Project Conditions" (with implementation of Master Facilities Long-Range Plan, including the Stadium Project).

The primary input data used to estimate energy use under each scenario are summarized in **Table 4.14-1.** A copy of the CalEEMod report, which summarizes the input parameters, assumptions, and findings, is included in Appendix E.

TABLE 4.14-1 SUMMARY OF CALEEMOD LAND USE INPUT PARAMETERS TO ESTIMATE ENERGY USE

	Existing Conditions	Master Facilities Long-Range Plan Conditions
Number of Students	1,125	1,325
Number of Faculty and Staff	100	100
Gross Square Feet of Building Area	279,670	327,892

Source: CalEEMod (Appendix E).

It was conservatively assumed that improvements proposed under the Master Facilities Long-Range Plan would be completed in 2018 (the earliest completion date for the Stadium Project), because vehicle fuel efficiency is expected to improve over time (as required by the Pavley[1] and Low-Emission Vehicle regulations[2]). In accordance with the traffic analysis by Parisi Transportation Consulting, the EIR transportation consultant, it was assumed that existing school operations generate 3,923 average daily vehicle trips during the weekdays and implementation of the Master Facilities Long-Range Plan would result in 4,620 average daily, campus-related vehicle trips during the weekdays.

There are various energy-saving strategies that are potentially applicable to developments under the Master Facilities Long-Range Plan. For example, the California Energy Commission has estimated that the 2016 Building Energy Efficiency Standards, which will take effect on January 1, 2017, will reduce energy consumption by about 33.5 percent for non-residential buildings on average compared to the 2008 Building Energy Efficiency Standards (California Energy Commission, 2014 and 2015). Furthermore, the existing stadium lighting would be replaced with more energy-efficient light-emitting diode (LED) stadium lights. Specifically, the existing 36 1,500-watt Metal Halide fixtures mounted on four poles, plus 19 light canopies, would be replaced with 80 597-watt LED fixtures, plus new LED pedestrian height poles and 18 86-watt LED fixtures on either field light poles or pedestrian light poles. However, since more detailed information about these

[1] California Air Resources Board. Assembly Bill 1493 (Pavley). 2002 (CARB, 2016a).

[2] California Air Resources Board. The LEV III Amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedure and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Requirements for Heavy-Duty Vehicles. August 7, 2012 (CARB, 2016b).

potential energy reductions and potential energy reductions in connection with other components of the Master Facilities Long-Range Plan is not currently available, it was conservatively assumed that no energy savings would result under build-out of the Master Facilities Long-Range Plan.

Energy Consumption from Buildings

Based on the CalEEMod results, electricity and natural gas consumption from buildings on the SRHS campus is summarized in **Table 4.14-2**. With the expected increase in student population and building square footage at total build-out of the Master Facilities Long-Range Plan, the campus would be expected to use approximately 1,489 MWh of electricity and 5,427 MBTU of natural gas per year. Compared to the existing demand, these estimates would represent about a 17.2 percent increase in both electricity use and natural gas use.

TABLE 4.14-2 EXISTING AND FUTURE ENERGY CONSUMPTION FROM BUILDINGS

Energy Type	Existing Conditions	Master Facilities Long-Range Plan Conditions	Net Increase	Percent Net Increase
Electricity (MWh/yr)	1,270	1,489	219	17.2
Natural Gas (MBTU/yr)	4,629	5,427	798	17.2

Notes: MWh/yr = megawatt hours per year; MBTU/yr = million British Thermal Units per year.
Source: CalEEMod (Appendix E).

Energy Consumption by Vehicles

CalEEMod and the California's Mobile Source EMission FACtor (EMFAC) 2014 model were used to estimate mobile energy consumption. Information on vehicle trips, trip lengths, and vehicle mix was obtained from CalEEMod, and information on fuel economy and type and amount of fuel used for each vehicle category was obtained from EMFAC. Total fuel consumption was calculated by summing the fuel consumption for each vehicle category. The estimated daily rates of gasoline, diesel, and electricity consumption by vehicles are summarized in **Table 4.14-3**. With the expected increase in student population at total build-out of the Master Facilities Long-Range Plan, the rate of increase in fuel consumption would be approximately 16 to 18 percent, depending on fuel type.

TABLE 4.14-3 EXISTING AND FUTURE ENERGY CONSUMPTION BY VEHICLES

Fuel Type	Existing Conditions	Master Facilities Long-Range Plan Conditions	Net Increase	Percent Net Increase
Gasoline (gallons/day)	1,491	1,756	265	17.8
Diesel (gallons/day)	179	208	29	16.2
Electricity (kWh/day)	94	111	17	18.1

Notes: kWh/day = kilowatt hours per day.
Source: CalEEMod (Appendix E).

Conclusion

Development allowed by the Master Facilities Long-Range Plan would not result in wasteful, inefficient, or unnecessary consumption of energy and would improve energy efficiency on the overall campus as related to lighting, heating, cooling, and other energy-using elements of campus operations. While energy consumption (by buildings and vehicles) would increase by approximately 16 to 18 percent, the net increase in overall per capita consumption would not be considered substantial given the proposed energy efficiency improvements on the SRHS campus. As noted in the above analysis, the energy consumption estimates for the Master Facilities Long-Range Plan conservatively assume that no energy-saving strategies would be incorporated into the development; therefore, actual energy consumption would likely be less than the estimates, since energy-saving strategies would be included. In addition, the campus would continue to be subject to the San Rafael City Schools energy and water management policy (BP 3511), which requires the Superintendent or designee to develop a resource management program that includes strategies for implementing effective and sustainable resource practices, exploring renewable and clean energy technologies, and reducing energy consumption. For these reasons, the impact would be less than significant and no mitigation is necessary.

While not required as mitigation, the District may wish to consider participating in the Savings By Design Program (www.savingsbydesign.com) administered by PG&E. This energy efficiency program offers incentives for non-residential building design and construction projects that exceed building code requirements.

Construction of New Energy Supplies or Infrastructure

Development in accordance with the Master Facilities Long-Range Plan would not require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity.

The campus is already served by PG&E electricity and natural gas facilities. It is generally expected that development would connect to existing PG&E utility lines serving the campus. As noted in Chapter 3, Project Description, of this EIR, natural gas lines would be upgraded as necessary to serve proposed buildings, which would likely require additional gas to support increased capacity. In addition, as part of the Stadium Project, existing on-site electrical lines serving the stadium would be replaced. (See further discussion under “Impacts of Proposed Stadium Project” below.) Provisions for photovoltaics would also be made (see discussion under “Conflict with Energy Efficiency Policies or Standards” below).

The necessary connections to existing PG&E service are not expected to require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity. Connections to PG&E utility lines are expected to be located on the campus or at the property line. Currently, the transformer and other PG&E facilities serving the campus have excess capacity (Brown, 2016). Details on extending service to on-campus development would be reviewed by PG&E’s Building & Renovation Services team when an “Application for Service” is submitted.

Conflict with Energy Efficiency Policies or Standards

Development in accordance with the Master Facilities Long-Range Plan would not conflict with applicable energy efficiency policies or standards.

As discussed under “Energy Consumption” above, the District is proposing that facilities on the campus be designed with efficient heating and cooling systems, and that campus improvements include more efficient mechanical and electrical systems in an effort to exceed California Building Code requirements. Furthermore, the structures would be constructed of building systems that provide appropriate levels of thermal protection. Skylights and clerestory windows would assist in providing required lighting. All new buildings would be designed with infrastructure for photovoltaic panels. In addition, photovoltaics are planned for other areas of the campus to provide additional power to the campus off the main power grid. The District would abide by all State of California mandates for energy conservation, and final designs would be approved by the Division of the State Architect (DSA). Development in accordance with the Master Facilities Long-Range Plan therefore would not conflict with applicable energy efficiency policies or standards.

Potentially Significant Impacts

The Master Facilities Long-Range Plan would not have any potentially significant impacts related to energy services.

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

Energy Consumption

The Stadium Project would not result in a substantial increase in overall per capita energy consumption or in the wasteful, inefficient, or unnecessary consumption of energy.

Energy would be consumed during both the construction and operational phases of the Stadium Project, but the energy consumption impact would be less than significant for the reasons described above for the Master Facilities Long-Range Plan. In addition, the Stadium Project is expected to result in a net decrease in electricity consumption, compared to the existing stadium, by replacing existing lighting with energy-efficient stadium lights. The four existing light poles would be replaced with six poles that include light-emitting diode (LED) sports lighting. Four of the poles would have 14 fixtures and the remaining two poles would have 12 fixtures, for a total of 80 597-watt LED fixtures. In addition, the Stadium Project would provide new LED pedestrian height pole lights (Fee, 2016).

The impact would be less than significant and no mitigation is necessary. As noted above for the Master Facilities Long-Range Plan, while not required as mitigation, the District may wish to consider participating in the Savings By Design Program (www.savingsbydesign.com) administered by PG&E. This energy efficiency program offers incentives for non-residential building design and construction projects that exceed building code requirements.

Construction of New Energy Supplies or Infrastructure

The Stadium Project would not require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity.

This impact would be less than significant for the reasons described above for the Master Facilities Long-Range Plan. The existing stadium is already served by PG&E electricity and natural gas facilities. The Stadium Project would connect to existing PG&E utility lines serving the campus. As noted in Chapter 3, Project Description, of this EIR, existing on-site electrical lines serving the stadium would be replaced. The Stadium Project would connect to existing low-voltage wires that currently serve the public announcer's booth, and would include a system of empty conduits and boxes in the stadium for future low-voltage needs (Fee, 2016).

The necessary connections to existing PG&E service are not expected to require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity. Connections to PG&E utility lines are expected to be located on the stadium site or at the property line. Currently, the transformer and other PG&E facilities serving the campus have excess capacity (Brown, 2016). Details on extending service to the Stadium Project would be reviewed by PG&E's Building & Renovation Services team when an "Application for Service" is submitted.

Conflict with Energy Efficiency Policies or Standards

The Stadium Project would not conflict with applicable energy efficiency policies or standards.

As discussed under "Energy Consumption" above, the Stadium Project would include replacement of existing lighting with energy-efficient lighting systems. The District would abide by all State of California mandates for energy conservation, and the final design would be approved by the Division of the State Architect (DSA). The Stadium Project therefore would not conflict with applicable energy efficiency policies or standards.

Potentially Significant Impacts

The Stadium Project would not have any potentially significant impacts related to energy services.

CUMULATIVE IMPACTS

For electrical and natural gas service, the geographic scope for assessing cumulative impacts is PG&E's northern and central California service area.

Despite annual statewide increases in energy consumption, the net increased energy demand from the Master Facilities Long-Range Plan, including the Stadium Project and combined with other past, present, and probable future projects, would not result in a significant cumulative impact, for the following reasons:

- Urbanized portions of San Rafael, including the SRHS campus, are already served by gas and electricity infrastructure, and the net increased energy demand from probable future projects, relative to the regional service area, would be minimal and would not require expanded or new energy facilities as a direct result of project development. PG&E expects that the relatively gradual residential and commercial growth projections for San Rafael would not cause a significant impact on the utility's ability to provide service; construction of major new distribution facilities would not be needed to meet the projected electrical demands, and the infill development anticipated would require less energy on an ongoing basis (City of San Rafael, 2013). As discussed in the project-specific analysis above, development in accordance with the Master Facilities Long-Range Plan would not result in any significant impacts on energy services. In addition, the Master Facilities Long-Range Plan would modernize facilities at an existing school located on an already-developed site close to other development and services; therefore, the Master Facilities Long-Range Plan would realize transportation-related energy savings compared to similar projects in a location at a distance from urban areas.

- The Master Facilities Long-Range Plan and other projects have been and would be required to comply with all standards of Title 24 of the California Code of Regulations.
- PG&E, which provides energy to the SRHS campus and vicinity, produces much of its energy from renewable sources and has plans in place to increase reliance on renewable energy sources. Because many agencies in California have adopted policies seeking increased use of renewable resources (and have established minimum standards for the provision of energy generated by renewable resources), it is expected that PG&E would continue to meet future demands for energy via a gradually increasing reliance on renewable resources, including small-scale sources such as photovoltaic panels and wind turbines, in addition to larger-scale facilities, such as wind farms. Therefore, although the Master Facilities Long-Range Plan and other anticipated projects would be expected to increase the demand for energy-producing facilities, this increase in demand would likely be met through the development of renewable resources that would have fewer environmental effects than the development of new conventional gas- or coal-fired power plants.

Thus, the Master Facilities Long-Range Plan, including the Stadium Project, would not result in or contribute to any significant cumulative energy service impacts.

4.14.5 REFERENCES

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4.15 RECREATION

4.15.1 INTRODUCTION

This section of the EIR describes park and recreation facilities on the San Rafael High School (SRHS) campus and in the vicinity and the potential impacts on these facilities that could result from development under the Master Facilities Long-Range Plan, including the Stadium Project that is part of the Long-Range Plan.

4.15.2 ENVIRONMENTAL SETTING

REGIONAL SETTING

The City of San Rafael provides local parks and recreational facilities within San Rafael, including 19 neighborhood parks and six community parks. The parks and recreational facilities closest to the SRHS campus include Peacock Gap Park about 3.8 miles northeast of the campus, along with the following parks and recreational facilities located on the south side of San Rafael Creek about 1 to 2 miles south of the campus via City streets: 0.1-acre Bayside Mini Park, 0.4-acre Beach Park, 0.1-acre Schoen Park, 17-acre Pickleweed Park, Albert J. Boro Community Center, San Rafael Community Center, and Albert Park (City of San Rafael, 2013; McCart, 2016).

The County of Marin provides eight parks in the San Rafael vicinity, including 55-acre McNear's Beach located approximately 4 miles northeast of the SRHS campus. In addition, 1,640-acre China Camp State Park is located 5.5 miles northeast of the campus (City of San Rafael, 2013).

San Rafael City Schools also operates other schools in the vicinity that provide recreational opportunities for the community. Other schools closest to the SRHS campus are 4-acre Coleman Elementary School, located about 1 mile northwest of the campus; and 7.3-acre San Pedro Elementary School, located about 1.6 miles east of the campus (City of San Rafael, 2013). Recreational facilities on these campuses include hardscape and softscape play areas, playground equipment, and sports fields.

PROJECT SITE SETTING

Recreational facilities on the SRHS campus include a stadium, three grass playing fields (soccer/softball, baseball, and football), an eight-lane track and field, six tennis courts, five exterior basketball courts, two interior basketball courts, a swimming pool, and a weight room (San Rafael City Schools, 2016).

San Rafael City Schools and the City of San Rafael do not currently have a joint use agreement for public access to the swimming pool or other recreational facilities at the high school. The San Rafael General Plan (see Section 4.15.3, Regulatory Framework, below) and City Council goals and objectives call for the creation of a joint use agreement, however. The City has occasionally rented pool time at the high school to accommodate interruptions in service at City-owned facilities (McCart, 2016). The District also makes its recreational facilities available to the community through the Civic Center Act in accordance with its Board Policies and Administrative Regulations.

The San Rafael General Plan also calls for the City to work with school districts to create and improve recreational opportunities and facilities. Potential park site locations identified in the General Plan include the SRHS campus, possibly at the south end of the football field along 3rd Street or by the tennis courts along Mission Avenue (see Section 4.15.3, Regulatory Framework, below). The City's Community Services Department staff continues to seek an appropriate site for a public park facility in the Montecito neighborhood in which the high school is located (McCart, 2016).

4.15.3 REGULATORY FRAMEWORK

FEDERAL AND STATE REGULATIONS

There are no federal or state regulations that are relevant to the Long-Range Plan's potential impacts on parks and recreational facilities.

LOCAL REGULATIONS

The San Rafael General Plan contains the following relevant policies and programs regarding parks and recreational facilities (City of San Rafael, 2013):

Policy NH-2 **Schools.** Work with the school districts to use active school sites as neighborhood gathering places and recreational amenities…

Policy NH-124 **Improved Recreation.** Create and improve neighborhood recreational opportunities and facilities.

Program NH-124 **Neighborhood Park.** Provide a neighborhood park with appropriate play structures and activities for young children. Potential park site locations include the School District's corporation yard and the San Rafael High School site, possibly at the south end of the football field along Third Street or by the tennis courts along Mission Avenue…

Policy G-15 **School Facilities as Gathering Places.** Collaborate with schools to provide greater access to school facilities for neighborhood and community activities.

Program G-15a **Joint Use of Educational Facilities.** Develop and adopt Memorandum of Understanding agreements with Dixie and San Rafael School Districts, Marin Academy, and Dominican University governing the development, maintenance, and community use of facilities for recreation, childcare and/or community events.

Policy PR-9 **New Parks.** Provide additional park sites as identified below. Park sites should be in the service area and designed to meet the needs of the targeted population, giving priority to underserved neighborhoods. If sites are unavailable, consider alternative park sites that are within the vicinity of the service area. Encourage the development of new parks as follows:…

b. Montecito/Happy Valley. Pursue opportunities to provide a neighborhood park. Encourage San Rafael High School or School District corporation yard to provide a neighborhood park with play facilities for toddlers and young children. Work with San Rafael City Schools to identify a potential park site.

Policy PR-11 **Public Pools.** Address the need for more public pools south of Puerto Suello Hill in San Rafael.

Program PR-11a **High School and University Pools.** Explore opportunities for public use of pools at the high schools and at Dominican University.

Policy PR-21 **City-School Cooperation.** Memorialize cooperation efforts between the City and school districts for the joint development, maintenance, and use of school facilities for educational programs, park development, and recreational use.

4.15.4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

SIGNIFICANCE CRITERIA

For the purposes of this EIR and based on Appendix G of the California Environmental Quality Act (CEQA) Guidelines, implementation of the proposed project would have a significant effect on parks and recreational facilities if it would:

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, or the need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services;

b) Increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or

c) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment.

IMPACTS OF PROPOSED MASTER FACILITIES LONG-RANGE PLAN

Less-than-Significant Impacts

Development in accordance with the Master Facilities Long-Range Plan would not increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated, or such that new or altered facilities would be needed.

The Master Facilities Long-Range Plan would entail modernization and new construction on the existing campus. As discussed in Chapter 3, Project Description, completion of the Long-Range Plan would result in an approximately 48,222-square-foot net increase in building area on the SRHS campus, as well as a 200-student increase in enrollment (from the current enrollment of approximately 1,125 students to approximately 1,325 students). As discussed in Chapter 3, the number of faculty and staff at the high school would not change. In addition, approximately 84 additional events per year would be held at the stadium, which is proposed for renovation; however, the stadium's grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats) (see further discussion under "Impacts of Proposed Stadium Project" below).

In addition to the changes to the existing stadium, construction allowed by the Long-Range Plan would include new buildings that would house ceramics and theater programs (Building No. 4), art programs (Building No. 3), science programs (Building No. 1), a student commons/conference space (Building No. 2), and wrestling and dance programs (Building No. 7) (see details in Chapter 3, Project Description). A portion of the existing gymnasium building (P1) would be demolished and replaced with proposed Building No. 7 (Wrestling/Dance/Classrooms/Offices). Proposed Building No. 8 would provide restrooms and changing facilities to the soccer/softball field on the northwest side of campus. Additionally, modernization is planned for Buildings A, D, and K.

The proposed on-site recreational facilities are expected to be adequate to serve the needs of the student population, which would increase by approximately 200 students as a result of the Long-Range Plan, as noted above. As also noted above, the number of faculty and staff on the campus would not change as a result of the Long-Range Plan. In addition, existing community activities on the campus would be expected to continue in the same manner after the project is completed (McCart, 2016).

While the Long-Range Plan does not provide for a neighborhood park on the campus as identified by the San Rafael General Plan, this aspect of the Long-Range Plan would not increase the use of existing parks, create the need for new parks, or represent a significant conflict with the General Plan. While there is a recognized need for a neighborhood park in the area (McCart, 2016), the campus is only one of several potential park locations identified by the General Plan.[1]

[1] As discussed in Section 1, Introduction, of this EIR, pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to a proposed classroom facilities project. Even though the District adopted Resolution No. 169.1, dated June 27, 2016, pursuant to Section 53094 exempting the Master Facilities Long-Range Plan and the SRHS campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City's Municipal Code, the City's General Plan, and related ordinances and

For these reasons, development in accordance with the Master Facilities Long-Range Plan would not be expected to result in the need for new or altered parks or cause deterioration of existing parks or recreational facilities. The impact would be less than significant, and no mitigation is necessary.

Potentially Significant Impacts

Impact REC-1: The Master Facilities Long-Range Plan would include recreational facilities that might have an adverse physical effect on the environment. (PS)

As noted under "Less-than-Significant Impacts" above, the Master Facilities Long-Range Plan would include on-site recreational facilities. The environmental impacts of constructing these features are evaluated throughout this Draft EIR. As discussed under "Less-than-Significant Impacts" above, the recreational needs of students would be met on-site; therefore, the Long-Range Plan would not create a need for construction or expansion of other recreational facilities.

> *Mitigation Measure REC-1: San Rafael City Schools shall comply with all mitigation measures identified in this EIR. Compliance with these measures would ensure that the impact of recreational facilities included in the Master Facilities Long-Range Plan would be reduced to a less-than-significant level. (LTS)*

IMPACTS OF PROPOSED STADIUM PROJECT

Less-than-Significant Impacts

The Stadium Project would not increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated, or such that new or altered facilities would be needed.

This impact would be less than significant for the reasons discussed above for the Master Facilities Long-Range Plan. The Stadium Project would consist of improvements to the existing stadium designed to serve the needs of the student population, including, among other improvements, a new grandstand, replacement of stadium lights with energy-efficient light-emitting diode (LED) stadium lights, new public address system, new scoreboard, synthetic turf field, new nine-lane 400-meter all-weather track with brokeback layout, new parking area with driveway access from 3rd Street, new concession stand and ticket booth, new restrooms/changing rooms, and a new welcome plaza. While approximately 84 additional events per year would be held at the stadium, grandstand capacity would decrease by 650 seats (from the existing capacity of 2,550 seats to 1,900 seats). It is possible that this 25 percent decrease in capacity could cause some events to relocate to other facilities with large grandstands, but it is unknown whether any events would relocate and if so, to which facilities. In any case, it is unlikely that any such events would cause

regulations that otherwise would be applicable, this EIR evaluates the project's consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District's goal that local policies and regulations be acknowledged and adhered to as much as feasible.

substantial physical deterioration of other facilities or create the need for new or altered facilities. For these reasons, the Stadium Project would not be expected to result in the need for new or altered parks or cause deterioration of existing parks or recreational facilities (McCart, 2016). The impact would be less than significant, and no mitigation is necessary.

Potentially Significant Impacts

Impact REC-2: The Stadium Project would consist of recreational facilities that might have an adverse physical effect on the environment. (PS)

The Stadium Project would make improvements to the existing stadium, as described in Chapter 3, Project Description, of this EIR. These improvements would include, among other improvements, new buildings (concessions, restrooms/changing rooms, bleachers, visitor team room), along with changes to the grandstand and turf, new energy-efficient lighting, a new public address system, new parking, new furnishings, a new ticket booth, and a new plaza.

The environmental impacts of constructing these features are evaluated throughout this Draft EIR. As discussed under “Less-than-Significant Impacts” above, the Stadium Project is not expected to create a need for construction or expansion of other recreational facilities.

> *Mitigation Measure REC-2: San Rafael City Schools shall comply with all mitigation measures for the Stadium Project that are identified in this EIR. Compliance with these measures would ensure that the impact of Stadium Project would be reduced to a less-than-significant level. (LTS)*

CUMULATIVE IMPACTS

For recreation, the scope for assessing cumulative impacts is the area within the San Rafael city limits and immediately surrounding area, since this area contains the recreational facilities that are most likely to be used by students and others on the SRHS campus.

The Master Facilities Long-Range Plan, including the Stadium Project and in conjunction with other past, present, and probable future projects, could result in a cumulative increase in demand for recreational facilities in the area. The cumulative increase in demand would result from the Long-Range Plan along with existing and future development in the area, particularly residential development. In San Rafael, approved or currently pending development includes approximately 530 housing units, along with 277,000 square feet of office space, 2,000 square feet of retail space, and a 44,000-square-foot Public Safety Center (see Table 6-1 and Figures 6-1 and 6-2 in Chapter 6, CEQA Considerations, of this EIR).

As discussed in the above analysis, however, demand from the Long-Range Plan, including the Stadium Project, would not result in a significant impact on recreational facilities or create the need for new or expanded facilities, because the recreational needs of students and others on the campus would be met on-site and existing community recreation programs offered on the site would continue (McCart, 2016).

In addition, anticipated residential projects in San Rafael and other cities would be subject to each city's respective standard requirements for parkland dedication or in-lieu payment of fees to fund parks and recreational facilities.

For these reasons, the Long-Range Plan, including the Stadium Project, would not result in or contribute to any significant cumulative recreation impacts.

4.15.5 REFERENCES

CEQA Guidelines, Appendix G.

City of San Rafael, 2013. *The City of San Rafael General Plan 2020.* Amended and reprinted January 18, pages 69, 113, 214, 232, 233, 238, 239, and 241.

McCart, Carlene, Community Services Director, City of San Rafael, 2016. E-mail communication re. "Response to EIR Questions," forwarded by Ashley Howe, Community Services Department, October 17.

San Rafael City Schools, 2016. "Appendix A, List of Needed Material for San Rafael High School EIR."

San Rafael City Schools, Resolution No. 169.1, June 27, 2016.

5. ALTERNATIVES

The California Environmental Quality Act (CEQA) Guidelines (Section 15126.6) require that an EIR describe and evaluate the comparative merits of a range of reasonable alternatives to the project, or to the location of the project, that could feasibly attain most of the basic objectives of the project. The CEQA Guidelines further require that the discussion focus on potentially feasible alternatives capable of avoiding or substantially lessening any of the significant effects of the project, including the “No Project” Alternative. Furthermore, if the environmentally superior alternative is the “No Project” Alternative, the EIR must also identify an environmentally superior alternative from among the other alternatives (14 CCR Section 15126.6(e)).

There is no ironclad rule governing the nature or scope of the alternatives to be discussed other than the “rule of reason” (14 CCR Section 15126.6(a)). The “rule of reason” requires that an EIR set forth only those alternatives necessary to permit a reasoned choice, and shall be limited to realistic alternatives that the lead agency determines could feasibly obtain most of the basic project objectives while avoiding or substantially lessening one or more of the significant effects (14 CCR Section 15126.6). The scope of alternatives comprising a reasonable range is in the lead agency’s discretion, and will vary from case to case depending on the nature of the project under review (*Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553, 566). Pursuant to the CEQA Guidelines, “An EIR need not consider an alternative whose effect cannot be reasonably ascertained and whose implementation is remote and speculative” (14 CCR Section 15126.6(f)(3)).

The requirement that an EIR evaluate alternatives to the proposed project or its location is broad. The description or evaluation of alternatives does not need to be exhaustive, nor is the same level of detail as the proposed project required (14 CCR Section 15126.6(a) and (c)). Alternatives need be environmentally superior to the proposed project in only some respects (*Sierra Club v. City of Orange* (2008) 163 Cal.App.4th 523, 547).

The project objectives are discussed in Chapter 3, Project Description, of this EIR. The discussion in this chapter will focus on feasible alternatives that could address potentially significant impacts. The EIR identifies potentially significant impacts that can be reduced to less-than-significant levels with implementation of mitigation measures (for aesthetics, geology, biological resources, hydrology and water quality, hazardous materials, cultural resources, transportation and traffic [in part], air quality, noise, public services, public utilities, and recreation). Transportation and traffic impacts related to increased vehicular movement on Mission Avenue with drop-off and pick-up activity, increased left-turning traffic on 3rd Street and vehicle delays at three intersections, and increased pedestrians/bicyclists using streets where conditions are not conducive to such use would remain significant and unavoidable.

Two alternatives to the project are evaluated in this chapter:

- Alternative 1: No Project
- Alternative 2: Relocated Madrone High Continuation School Alternative

These alternatives were identified as a reasonable range of alternatives for discussion in this EIR based on the following factors:

- The extent to which the alternative would accomplish most of the basic project objectives and purposes;
- The extent to which the alternative would reduce or eliminate one or more of the significant environmental effects of the project;
- The feasibility of the alternative, including whether the alternative could be accomplished in a successful manner within a reasonable period of time, taking into account site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries, and economic, environmental, legal, social, and technological factors (14 CCR Section 15364 & 15126.6(f); Pub. Resources Code, Section 21061.1);
- The extent to which the alternative would contribute to a “reasonable range” of alternatives necessary to permit a reasoned choice; and
- The requirement under the CEQA Guidelines to consider a No Project Alternative and to identify an “environmentally superior” alternative in addition to the No Project Alternative (14 CCR Section 15126.6(e)).

Alternatives that were considered but rejected as infeasible are discussed in Section 5.1 below.

The objectives for the project are the following:

1. Provide functional instructional and administrative space to meet program requirements;
2. Provide upgrades to the existing San Rafael High School (SRHS) campus to serve the population in this area;
3. Improve campus facilities to accommodate a total campus population of approximately 1,325 students at completion of the SRHS Master Facilities Long-Range Plan program improvements;
4. Modernize classrooms, laboratories, and libraries to meet contemporary standards of education to ensure all students are well prepared for success in the 21st century;
5. Implement modern computer technology for the campus;
6. Replace outmoded teaching equipment;
7. Create new space for administration staff that is closer to school entrance;
8. Upgrade buildings for fire safety, energy conservation, seismic safety, ADA compliance, and campus security;
9. Provide an upgraded sports stadium, track and field to improve SRHS’s physical education and athletic program for its students and other students in the District that utilize the stadium and field;
10. Address increasing enrollment while providing students and faculty with a learning environment that reflects the District’s strategic plan for the future;

11. Meet the intent of the Master Facilities Plan that was approved by the District's Board on July 27, 2015, and phase projects under the SRHS Master Facilities Long-Range Plan;
12. Improve disabled access;
13. Implement "green building" practices in all capital improvement projects;
14. Provide permanent classrooms for students currently located in temporary buildings; and
15. For the Stadium Project, provide an enhanced learning environment for both physical education and after-school sports activities.

5.1 ALTERNATIVE CONSIDERED BUT REJECTED

In addition to the on-site alternative included in Section 5.2, an off-site alternative was also considered for the project. However, an off-site alternative would not meet the needs of San Rafael City Schools because an off-site location for the campus does not exist and dividing the campus into two locations would not meet the educational or administrative needs of the students or the District. San Rafael City Schools currently has two high school campuses: the SRHS campus in central San Rafael, and Terra Linda High School in northern San Rafael. A third campus has not been found to be necessary, and the infrastructure for a successful high school is already in place at the SRHS campus location. In consideration of these factors, the off-site alternative for the project was considered but rejected.

5.2 SUMMARY OF ALTERNATIVES

ALTERNATIVE 1: NO PROJECT

Overview

Alternative 1, the No Project Alternative, would leave the SRHS campus unchanged. No improvements would be made to the campus, including improvements for drainage, access, and parking. With the campus left unchanged under this alternative, there would be fewer conditions related to traffic, noise, or other topics for the immediate neighbors of the campus. However, some increased traffic (and related noise) may occur due to the increased enrollment that may happen even if no new buildings were constructed. The No Project Alternative would also not result in increased energy savings, or improved lighting and noise measures proposed by the Stadium Project.

Impacts

Aesthetics

Under the No Project Alternative, no changes would occur to the building or grounds of the SRHS campus. No buildings would be replaced; no new landscaping would be added. Opportunities for new landscaping at the edges of the campus and within parking areas would not occur. Lighting at the stadium would continue as is, with no replacement with more efficient lighting fixtures.

Air Quality

The No Project Alternative would result in fewer potential air quality impacts than the proposed Master Facilities Long-Range Plan, because there would be no construction activities generating dust and exhaust. However, since Mitigation Measures AIR-1 through AIR-3 would reduce potential impacts during construction for the Master Facilities Long-Range Plan to a less-than-significant level, the Master Facilities Long-Range Plan would not result in any additional significant impacts compared to the No Project Alternative.

Biological Resources

With the No Project Alternative, no potential biological resources would be affected. No trees would be removed and the potential for impacts on nesting birds would not occur.

Cultural Resources

The No Project Alternative would not affect any potential archaeological or paleontological resources as no ground disturbance would occur. There would be no potential disturbance to human remains. Potential impacts as related to the historic qualities of Building A would not occur.

Geology and Soils

The No Project Alternative would result in fewer potential geology and soils impacts than the proposed Master Facilities Long-Range Plan. As no additional buildings would be constructed under this alternative, there would be no potential impacts from ground shaking, seismic-related ground failure, landslides, or unstable and/or expansive soils affecting those buildings. However, Mitigation Measures GEO-1 through GEO-6, ensuring that new development adheres to geotechnical requirements of the Field Act and related building codes, would reduce potential impacts of the Master Facilities Long-Range Plan to a less-than-significant level; thus, the Master Facilities Long-Range Plan would have no additional significant impacts compared to the No Project Alternative.

Greenhouse Gas Emissions

The No Project Alternative would generate fewer greenhouse gas impacts than the proposed Master Facilities Long-Range Plan. However, since the potential greenhouse gas impacts of the Master Facilities Long-Range Plan would be less than significant, the Master Facilities Long-Range Plan would not result in any additional significant impacts compared to the No Project Alternative.

Hazards and Hazardous Materials

The No Project Alternative would result in fewer potential hazards and hazardous materials impacts than the proposed Master Facilities Long-Range Plan. As no buildings would be demolished under this alternative, there would be no potential hazardous materials impacts related to releases of hazardous materials during building demolition. However, Mitigation Measures HAZARDS-1 and HAZARDS-2, ensuring that new development complies with the Department of Toxic Substances Control (DTSC) School Property Evaluation and Cleanup Program, would reduce potential hazards and hazardous materials impacts of the project to a less-than-significant level; thus, the Master Facilities Long-Range Plan would have no additional significant impacts compared to the No Project Alternative.

Hydrology and Water Quality

The No Project Alternative would result in fewer potential hydrology and water quality impacts than the proposed Master Facilities Long-Range Plan, although the proposed Master Facilities Long-Range Plan impacts would be less than significant. As no additional buildings would be constructed under the No Project Alternative, there would be no potential impacts related to violating water quality standards, altering drainage patterns resulting in erosion or siltation, or contributing runoff exceeding the capacity of stormwater drainage systems. However, existing regulatory requirements, including preparation and implementation of a Storm Water Pollution Prevention Plan during construction, project design incorporating stormwater treatment and flow control, and preparation and implementation of a Stormwater Control Plan during operation, would reduce potential impacts of the Master Facilities Long-Range Plan to a less-than-significant level; thus, the Master Facilities Long-Range Plan would have no additional significant impacts compared to the No Project Alternative.

Land Use and Planning

No impacts related to land use and planning would occur under the No Project Alternative, as there would be no change from existing conditions. However, the No Project Alternative would not allow the opportunity for the campus to meet San Rafael General Plan policies related to improving the compatibility with the surrounding residential neighborhood, improving campus design, increasing energy savings, and other policies, as applicable.

Noise

The No Project Alternative would prevent the exposure of on-campus and off-site receptors to potentially significant construction-generated increases in noise and vibration. Periodic noise from and stadium and operational noise from the campus would remain similar to existing conditions. While periodic noise would remain similar to existing conditions, the reduction in the stadium seating capacity and the installation of a new more acoustically sophisticated PA system proposed under the Master Facilities Long-Range Plan would not occur. Therefore, the No Project Alternative would not allow for the potentially beneficial impact of stadium noise reduction that could occur under the Master Facilities Long-Range Plan. With potential increases in student enrollment, even under the No Project Alternative, there could be minor increases in operation-related traffic noise in the surrounding area.

Public Services

Impacts of the No Project Alternative would be comparable to those of the Master Facilities Long-Range Plan because this alternative would not create a need for new or physically altered fire stations or police facilities.

Transportation and Traffic

The No Project Alternative would leave the traffic situation in the neighborhood and surrounding streets very similar to existing conditions; however, some increase in traffic could occur with the potential increase in enrollment that would be possible even without the project. Opportunities to improve pedestrian and bicycle conditions would not occur. Access and parking conditions would remain the same.

Utilities and Service Systems

Impacts of the No Project Alternative would be comparable to those of the Master Facilities Long-Range Plan because the alternative (1) would not require the construction of new water treatment facilities or expansion of existing facilities, (2) would not require new or expanded water entitlements, (3) would not require or result in the construction of new wastewater treatment facilities or expansion of existing facilities, (4) would not exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board, (5) would not exceed landfill capacity, and (6) would not conflict with federal, state, or local statutes and regulations related to solid waste. The impact related to debris from building demolition and construction would not occur.

Energy

Impacts of the No Project Alternative would be comparable to those of the Master Facilities Long-Range Plan because the alternative (1) would not result in a substantial increase in overall or per capita energy consumption or in the wasteful or unnecessary consumption of energy, (2) would not require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity, and (3) would not conflict with applicable energy efficiency policies or standards.

Recreation

Impacts of the No Project Alternative would be similar to those of the Master Facilities Long-Range Plan because this alternative would not increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated, or such that new or altered facilities would be needed. The recreational facilities proposed by the Master Facilities Long-Range Plan, including the Stadium Project, would not be built.

Relationship to Project Objectives

The No Project Alternative would not meet any of the objectives of the proposed project.

ALTERNATIVE 2: RELOCATED MADRONE HIGH CONTINUATION SCHOOL ALTERNATIVE

Overview

Alternative 2 would include relocation of the Madrone High Continuation School to the northwest corner of the SRHS campus as shown in **Figure 5-1**, with access that portion of the campus from Union Street. This new building would replace the building currently used by Head Start which would have to be relocated to a location not yet known. Currently, Head Start has about 50 students and 5 staff. The warehouse on this corner would be relocated to the south of Madrone High and rebuilt as shown in Figure 5-1. Both new buildings would be one story in height. New parking would be provided between the warehouse and Madrone High. This alternative would also remove the proposed demolition of the existing Science building (Building F) and construction of the proposed new Science building (Building No. 1) from the Master Facilities Long-Range Plan. Instead, the existing Science building (Building F) would remain as is. Otherwise, the campus development would be similar to that proposed by the Master Facilities Long-Range Plan.

The on-site student population would remain unchanged with a gain of about 200 students over the planning period. There would be no change in existing faculty or staffing levels.

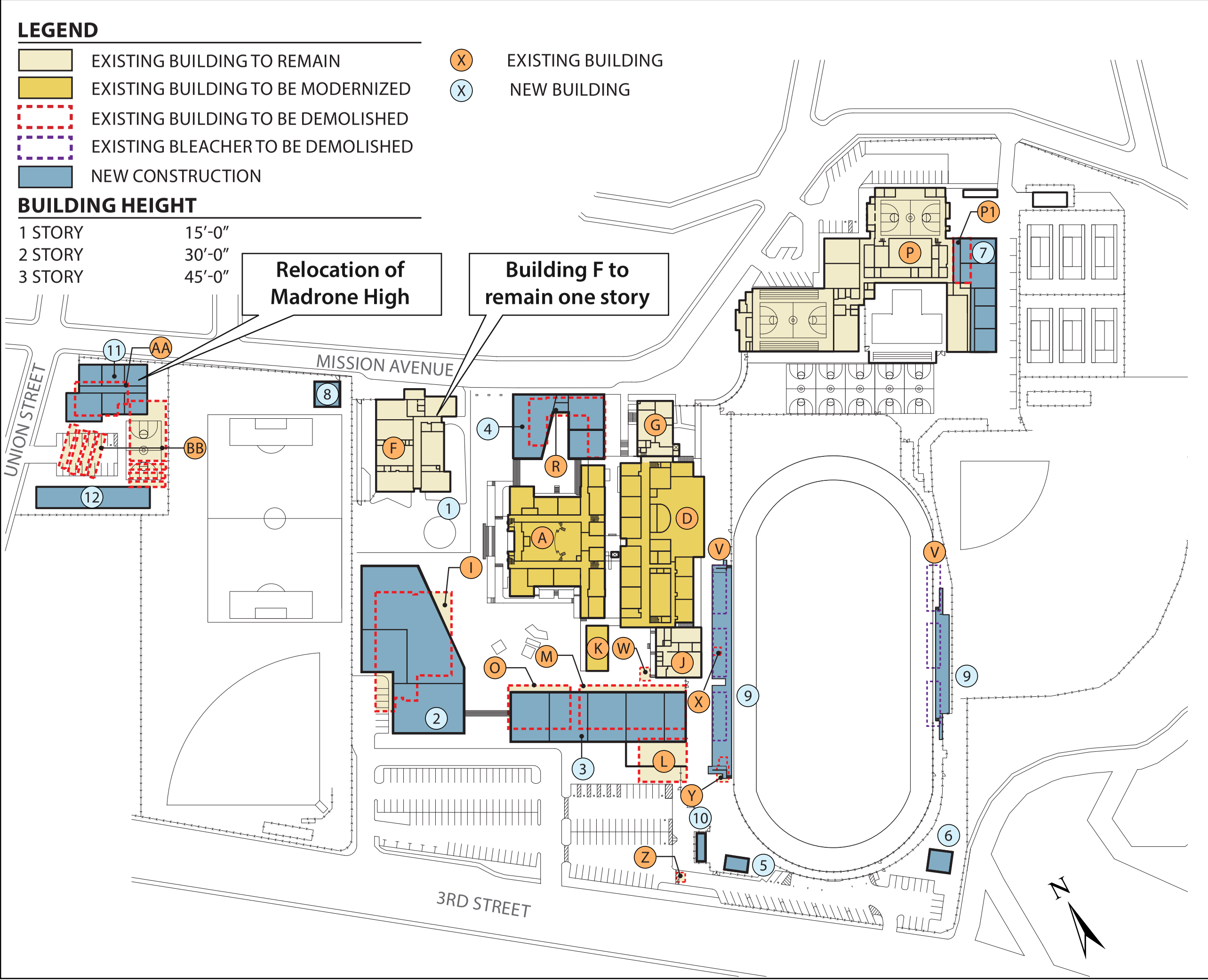
The environmental benefit of this alternative would be that a two-story building (Building No. 1) would not be constructed across from an existing residential area to replace the existing one-story building (Building F), and students for Madrone would now enter the campus from Union Street, thus reducing congestion on Mission Avenue and the 3rd Street entrance to the campus. Also, with the relocation of the Head Start program, there would be less overall traffic in this vicinity.

Impacts

Aesthetics

Visual impacts of this alternative would be similar to those of the Master Facilities Long-Range Plan, but the existing one-story Science Building (Building F) on Mission Avenue would remain as is and would not be demolished and replaced with the proposed new two-story Science building (Building No. 1). Thus, for the residences on the north side of Mission Avenue, this existing building would be lower than the Science Building proposed by the Master Facilities Long-Range Plan. Landscaping and parking associated with Alternative 2 are assumed to be similar to what is proposed by the Master Facilities Long-Range Plan.

With the new Madrone High building at the corner of Mission Avenue and Union Street, there would be a building closer to the street as compared to the existing building, but the new building would be one story and would not have significant impacts compared to the existing Head Start building. The proposed new warehouse building would be one story also and would be across from a proposed parking area on this portion of the campus, but would not result in significant impacts.



EXISTING BUILDING TO REMAIN			
BLDG #	NAME	# OF STORIES	S.F.
A	ADMIN / THEATER / CLASSROOM	3	60,125
D	CLASSROOM / LIBRARY	3	42,911
G	MEDIA	2	8,121
J	MUSIC	1	4,515
K	DAYCARE	1	1,958
P	GYMNASIUM	2	78,025
			195,655

EXISTING BUILDING TO BE DEMOLISHED			
BLDG #	NAME	# OF STORIES	S.F.
F	SCIENCE	1	13,648
I	MADRONE / CAFETERIA	1	14,844
L	PHOTOGRAPHY / CERAMICS	2	8,102
M	AUTO TECH / WOOD SHOP	2	17,934
O	ACADEMY	2	10,466
P1	GYMNASIUM (PARTIAL)	1	1,641
R	ART	2	9,379
V	BLEACHERS	-	6,951
W	DAYCARE SHED	1	249
X	PRESS BOX	1	144
Y	CONCESSION STAND	1	513
Z	TICKET BOOTH	1	144
AA	HEAD START	1	3,700
BB	WAREHOUSE	1	7,500
			95,215

NEW / REPLACEMENT BUILDING			
BLDG #	NAME	# OF STORIES	S.F.
1	SCIENCE	2	24,560
2	ADMIN / KITCHEN / STUDENT COMMONS	2	51,276
3	CTE / ART	1	17,220
4	CLASSROOMS / CERAMICS / THEATER	2	18,525
5	CONCESSIONS	1	640
6	RESTROOMS / CHANGING ROOMS	1	960
7	WRESTLING / DANCE / CLASSROOMS	1	6,195
8	RESTROOMS / CHANGING ROOMS	1	1,225
9	BLEACHERS	-	11,157
10	RESTROOMS	1	479
11	MADRONE HIGH SCHOOL	1	7,760
12	WAREHOUSE	1	4,800
			144,797
TOTAL MASTER PLAN S.F.			**435,667**

Figure 5-1

RELOCATION OF MADRONE HIGH

SOURCE: HY Architects, 2016

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

Air Quality

Alternative 2 would generate similar criteria air pollutant emissions from vehicles to those of the Master Facilities Long-Range Plan; however, the potential impact on regional air quality would remain less than significant (i.e., the same as the impact of the Master Facilities Long-Range Plan). Similar to the Master Facilities Long-Range Plan, construction activities for Alternative 2 would result in potentially significant impacts related to the generation of dust, criteria pollutants, and toxic air contaminants that could be reduced to a less-than-significant level with implementation of Mitigation Measures AIR-1 through AIR-3. Therefore, Alternative 2 would have essentially the same significant impacts as the Master Facilities Long-Range Plan.

Biological Resources

Impacts on biological resources would be similar to those of the Master Facilities Long-Range Plan, and there would be no new significant impacts under this alternative. The relocation site for Madrone High has been developed previously, and includes some trees at the periphery of the site that may be removed. There remains a potential for disturbance to nesting birds, and tree removal would be required under this alternative. Mitigation Measure BIO-1 would still apply. Controls to protect trees to be preserved and replacement landscaping that would include numerous tree plantings would serve to ensure that there are no major conflicts with the City's General Plan and Municipal Code.

Cultural Resources

Impacts on archaeological, paleontological, and historic resources would be comparable to those of the proposed Master Facilities Long-Range Plan because ground-disturbing activities (including the new Madrone site) have the potential to unearth these resources. Potential impacts in the vicinity of Building A would be similar to those proposed by the Master Facilities Long-Range Plan.

Geology and Soils

Alternative 2 would result in similar geology and soils impacts as the proposed Master Facilities Long-Range Plan after mitigation. The impacts identified for the Master Facilities Long-Range Plan would still apply to development under this alternative. However, Mitigation Measures GEO-1 through GEO-6, ensuring new development adheres to geotechnical requirements of the Field Act and related building codes, would also reduce potential impacts of Alternative 2 to a less-than-significant level; thus, this alternative would not have any additional significant impacts compared to the Master Facilities Long-Range Plan.

Greenhouse Gas Emissions

Alternative 2 would generate similar greenhouse pollutant emissions from vehicles to those of the Master Facilities Long-Range Plan, because operations would result in a similar student and staff population; however, with 50 fewer students at the Head Start site, and up to 5 fewer staff, the generation of greenhouse pollutant emissions would be slightly reduced. The potential impact on regional air quality would remain less than significant (i.e., the same as for the Master Facilities Long-Range Plan). Therefore, the Master Facilities Long-Range Plan would not result in any additional significant impacts compared to Alternative 2.

Hazards and Hazardous Materials

Alternative 2 would result in similar hazards and hazardous materials impacts as the proposed Master Facilities Long-Range Plan after mitigation. Although the new two-story Science Building (Building No. 1) would not be constructed to replace the existing one-story Science Building (Building F), resulting in a reduction of project size, the impacts identified for the Master Facilities Long-Range Plan would apply to development under this alternative. However, Mitigation Measures HAZARDS-1 and HAZARDS-2, ensuring construction complies with the DTSC School Property Evaluation and Cleanup Program, would also reduce potential hazards and hazardous materials impacts of Alternative 2 to a less-than-significant level; therefore, this alternative would not have any additional significant impacts compared to the Master Facilities Long-Range Plan. No significant hazards impacts would be associated with the relocation of Madrone High to the corner of Mission Avenue and Union Street.

Hydrology and Water Quality

Alternative 2 would result in similar hydrology and water quality impacts as the proposed Master Facilities Long-Range Plan. Although the new two-story Science Building (Building No. 1) would not be constructed to replace the existing one-story Science Building (Building F) and two new buildings would be constructed at the corner of Mission Avenue and Union Street, the impacts identified for the Master Facilities Long-Range Plan would apply to development under this alternative. However, no potentially significant impacts related to hydrology and water quality were identified for the proposed Master Facilities Long-Range Plan. Existing regulatory requirements, including preparation and implementation of a Storm Water Pollution Prevention Plan during construction, project design incorporating stormwater treatment and flow control, and preparation and implementation of a Stormwater Control Plan during operation, would also reduce potential significant impacts of this alternative to a less-than-significant level.

Land Use and Planning

The land use and planning impacts of Alternative 2 would be similar to those of the proposed Master Facilities Long-Range Plan, and there would be no significant impacts that would require mitigation. However, with respect to the SRHS campus project site, Alternative 2 may result in a project even more compliant with City of San Rafael Policy NH-2 regarding sensitivity of the scale of new development near residential areas. The new Madrone High building and the warehouse would be one story in height; and Building F would remain one story.

Noise

Alternative 2 would result in similar noise and vibration impacts as the proposed Master Facilities Long-Range Plan after mitigation. The type and number of heating, ventilation, and air conditioning (HVAC) systems installed under Alternative 2 at the SRHS campus would be similar to the Master Facilities Long-Range Plan; therefore, the operational noise generated would also be similar. It is assumed that operational noise impacts associated with 75 Madrone students would not be significantly different from the 50 Head Start students on the northwest corner of the SRHS campus. The implementation of Mitigation Measure NOISE-1 would reduce the potential impacts of HVAC system noise on receptors surrounding the SRHS campus to a less-than-significant level.

The Stadium Project under Alternative 2 would be the same as the Stadium Project under the Master Facilities Long-Range Plan; therefore, the periodic noise generated would also be the same. The implementation of Mitigation Measure NOISE-2 would reduce the potential for the public address (PA) system to be installed improperly under Alternative 2 to a less-than-significant level.

The potential construction noise impacts under Alterative 2 would be slightly reduced in the main campus area relative to the Master Facilities Long-Range Plan because the existing Science building (Building F) would not be demolished, and a new Science building (Building No. 1) would not be constructed. However, some construction noise would occur at the corner of Mission Avenue and Union Street with construction of the new Madrone High building and the new warehouse building. Construction and demolition activities on the SRHS campus under Alternative 2 would still occur in close proximity to both on-campus and off-site receptors. The implementation of Mitigation Measures NOISE-3a through 3d and NOISE-4 would reduce the potential impacts of construction-generated noise and vibration on surrounding receptors to a less-than-significant level. Traffic-related noise levels would be similar to the proposed project, though a minor amount of traffic noise would be shifted to Union Street by the relocation of Madrone High.

Through the implementation of the mitigation measures developed for the Master Facilities Long-Range Plan, all of the potential impacts of noise and vibration generated by construction and operation of the facilities proposed under Alternative 2 on the SRHS campus would be less than significant. Therefore, with mitigation, the potential noise and vibration impacts under Alternative 2 would be similar to the potential noise and vibration impacts under the proposed Master Facilities Long-Range Plan.

Public Services

Impacts of Alternative 2 would be comparable to those of the Master Facilities Long-Range Plan because this alternative would not create a need for new or physically altered fire stations or police facilities. Since the Madrone High Continuation School relocation site has already been developed, it would be unlikely to create any facilities needs in its new location.

Transportation and Traffic

The transportation and traffic impacts of Alternative 2 would be similar to but less than those of the proposed Master Facilities Long-Range Plan. With Alternative 2, overall traffic generated by campus activities would be similar to the proposed project except that there would be 50 fewer Head Start students being dropped off and picked up at the northwest corner of the SRHS campus. One benefit would be that this alternative moves the access to Madrone High to Union Street, thus alleviating some of the traffic for the Mission Avenue corridor near the campus, and for the 3rd Street entrance.

While the overall transportation and traffic impacts of Alternative 2 would be slightly reduced compared to those of the proposed Master Facilities Long-Range Plan, all mitigation measures recommended for the proposed Master Facilities Long-Range Plan would still apply to Alternative 2.

Utilities and Service Systems

Impacts of this alternative would be comparable to those of the Master Facilities Long-Range Plan. Since the Madrone High Continuation School relocation site has already been developed, it would be unlikely to create any new water, wastewater, or solid waste service needs in its new location.

Energy

Impacts of Alternative 2 would be comparable to those of the Master Facilities Long-Range Plan because the alternative (1) would not result in a substantial increase in overall or per capita energy consumption or in the wasteful or unnecessary consumption of energy, (2) would not require or result in the construction of new sources of energy supplies or additional energy infrastructure capacity, and (3) would not conflict with applicable energy efficiency policies or standards.

Recreation

Impacts of Alternative 2 would be similar to those of the Master Facilities Long-Range Plan because this alternative would not increase the use of existing neighborhood or regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated, or such that new or altered facilities would be needed.

Relationship to Project Objectives

Alternative 2 would meet all of the project objectives as listed at the beginning of this chapter except the following:

- Modernize classrooms, laboratories, and libraries to meet contemporary standards of education to ensure all students are well prepared for success in the 21st century;
- Address increasing enrollment while providing students and faculty with a learning environment that reflects the District's strategic plan for the future;
- Meet the intent of the Master Facilities Plan that was approved by the District's Board on July 27, 2015, and phase projects under the SRHS Master Facilities Long-Range Plan.

This alternative would provide capacity for up to 1,325 students but Building F would not be rebuilt and thus could possibly not allow the campus to create the full learning environment envisioned by the Master Facilities Long-Range Plan. Because the proposed new Science Building (Building No. 1) under the project would not be constructed as part of the alternative, and the existing Science Building (Building F) would remain, the alternative would not fully meet project objectives concerning modernization of classrooms and laboratories to meet contemporary standards of education, and upgrading of buildings for fire safety, energy conservation, seismic safety, ADA compliance, and campus security. And this alternative would not fully meet the intent of the original Master Facilities Plan because Building F would not be replaced with a new science building.

ENVIRONMENTALLY SUPERIOR ALTERNATIVE

The CEQA Guidelines require that the "environmentally superior alternative" be identified. For this project, the No Project Alternative with no changes to the campus would be the environmentally superior alternative because no changes would be made at the project site and no impacts on the surrounding neighborhood would occur under this alternative. However, the project objectives would not be met and no additional capacity would be provided at the SRHS campus. A comparison of the alternatives is provided in **Table 5-1** below.

TABLE 5-1 COMPARISON OF IMPACTS OF PROJECT ALTERNATIVES (AFTER MITIGATION)

Environmental Issue Area	**Proposed Project**	**ALTERNATIVE 1 No Project**	**ALTERNATIVE 2 Relocated Madrone Alternative**
Aesthetics	LTS	LTS-	LTS-
Air Quality	LTS	LTS-	LTS
Biological Resources	LTS	LTS-	LTS
Cultural Resources	LTS	LTS-	LTS
Geology and Soils	LTS	LTS-	LTS
Greenhouse Gas Emissions	LTS	LTS-	LTS
Hazards and Hazardous Materials	LTS	LTS-	LTS
Hydrology and Water Quality	LTS	LTS-	LTS
Land Use and Planning	LTS	LTS-	LTS-
Noise	LTS	LTS-	LTS
Public Services	LTS	LTS-	LTS
Transportation and Traffic	LTS/SU	LTS	LTS-/SU
Utilities and Service Systems	LTS	LTS-	LTS
Energy	LTS	LTS-	LTS
Recreation	LTS	LTS-	LTS

Notes: LTS = Less than Significant
SU = Significant and Unavoidable
+ = Greater adverse impact than proposed project
- = Lesser adverse impact than proposed project

If the environmentally superior alternative is the No Project Alternative, the CEQA Guidelines require that the EIR also identify an environmentally superior alternative from among the other alternatives. Alternative 2, the Reduced Scale Alternative, would therefore be considered the environmentally superior alternative because the smaller scale one-story existing Science building (Building F) would not be replaced with the two-story new Science building (Building No. 1) proposed under the project, and it would reduce some of the local traffic congestion by putting the entrance to the new relocated Madrone High on Union Street and removing 50 Head Start students from drop-off and pick-up activities at this northwest corner of the campus.

REFERENCES

California Public Resources Code, Section 21061.1.

CEQA Guidelines, Sections 15364 and 15126.6.

6. CEQA CONSIDERATIONS

As required by the California Environmental Quality Act (CEQA), this chapter identifies significant irreversible effects, significant unavoidable impacts, growth inducement, and cumulative impacts that may result from the project.

6.1 SIGNIFICANT IRREVERSIBLE EFFECTS

CEQA states that impacts associated with a proposed project may be considered to be significant and irreversible for the following reasons:

- Uses of non-renewable resources during the initial and continued phases of the project may be irreversible, since a large commitment of such resources makes the removal or non-use thereafter unlikely;
- Primary impacts and, particularly, secondary impacts (such as a highway improvement that provides access to a previously inaccessible area) generally commit future generations to similar uses; and
- Irreversible damage can result from environmental accidents associated with the project.

Pursuant to the CEQA Guidelines, irretrievable commitments of resources should also be evaluated to ensure that such current consumption is justified (CEQA Guidelines, Section 15126.2(c)).

The proposed structures at the San Rafael High School (SRHS) campus would be permanent buildings; therefore, their installation would constitute an irreversible use of these lands, as it is unlikely that the buildings would be removed. The proposed Master Facilities Long-Range Plan, including the Stadium Project, would irretrievably commit materials to the construction and maintenance of the new and renovated buildings. Non-renewable resources such as sand, gravel, and steel, and renewable resources such as lumber, would be consumed during project construction. In addition, the construction and operation of development allowed by the Master Facilities Long-Range Plan would result in the use of energy, including electricity and fossil fuels. While the consumption of such resources associated with construction would end upon completion of the Master Facilities Long-Range Plan, the consumption of such resources associated with operation would represent a long-term commitment of those resources. However, continued use of such resources is consistent with the anticipated growth.

The Master Facilities Long-Range Plan, including the Stadium Project, is not expected to result in any activities likely to result in accidents that could lead to irreversible environmental damage. While construction of proposed facilities could result in the use, transport, storage, and disposal of hazardous materials as described in Section 4.7, Hazards and Hazardous Materials, all activities would comply with applicable laws related to hazardous materials, which would significantly reduce the likelihood and severity of accidents that could result in irreversible environmental damage.

6.2 SIGNIFICANT UNAVOIDABLE IMPACTS

All potential impacts identified for the Master Facilities Long-Range Plan could be mitigated to a less-than-significant level except for the transportation/circulation impacts related to increased traffic flow on Mission Avenue due to drop-off and pick-up activities, increased left-turning traffic on 3rd Street and increased vehicle delays at some intersections, increased walkers/bicyclists where unsafe conditions exist, and cycling conditions that discourage the use of alternative transportation modes. These impacts would remain significant and unavoidable.

6.3 GROWTH INDUCEMENT

The CEQA Guidelines require that an EIR evaluate the growth-inducing impacts of a proposed action (CEQA Guidelines, Section 15126.2(d)). A growth-inducing impact is defined as:

> *[T]he ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth…It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.*

A project can have direct and/or indirect growth inducement potential. Direct growth inducement would result if a project actually induced or required that additional actions or projects be implemented. An example would be a new housing development that requires the construction of new utility lines and roads to serve the development. Indirect growth inducement would occur if the project would remove an obstacle to additional growth and development. An example would be a major expansion of a public service facility that increases service capability in the area.

The proposed Master Facilities Long-Range Plan would be developed on an existing high school campus, which is located in an urbanized portion of San Rafael. Services are readily available in this area. The project site is surrounded by existing residential development and commercial development. The Master Facilities Long-Range Plan would not require wastewater or water lines that would cross undeveloped lands and create the potential for new development. No major road improvements would be associated with the Master Facilities Long-Range Plan except that over the long term, some local road improvements may occur to improve vehicular, pedestrian, and bicycle circulation. While the Master Facilities Long-Range Plan would allow for an increased student enrollment, it is not expected to result in a significant new demand for housing or commercial services in San Rafael. For these reasons, the Master Facilities Long-Range Plan is not expected to result in growth inducement. Off-campus land uses in the vicinity would continue to be regulated by adopted zoning.

6.4 CUMULATIVE IMPACTS

Cumulative impacts have been addressed in Chapter 4 for each topic covered in this EIR. The projects that are proposed or approved in the vicinity of the Master Facilities Long-Range Plan are shown in **Table 6-1** and **Figures 6-1 and 6-2** below.

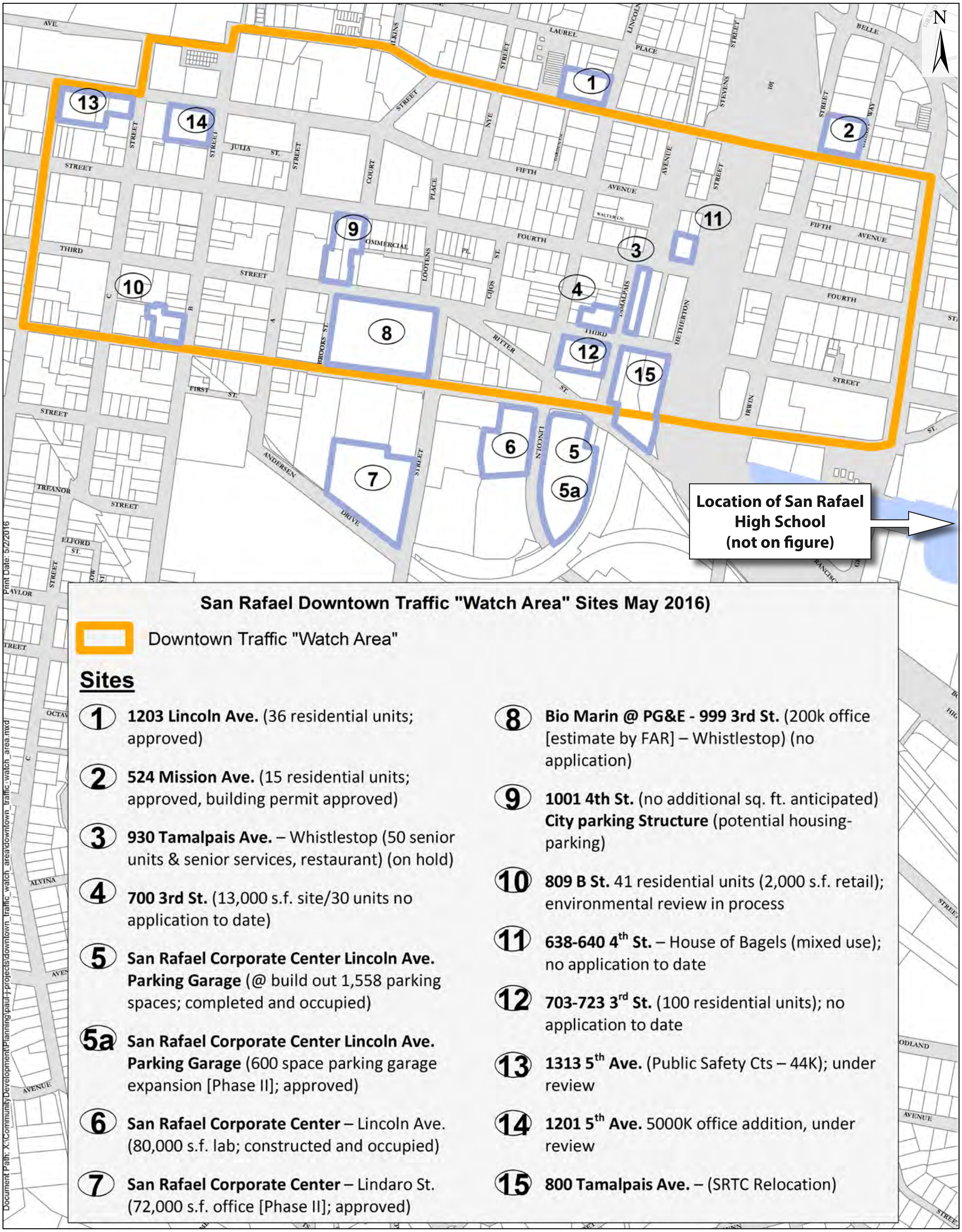
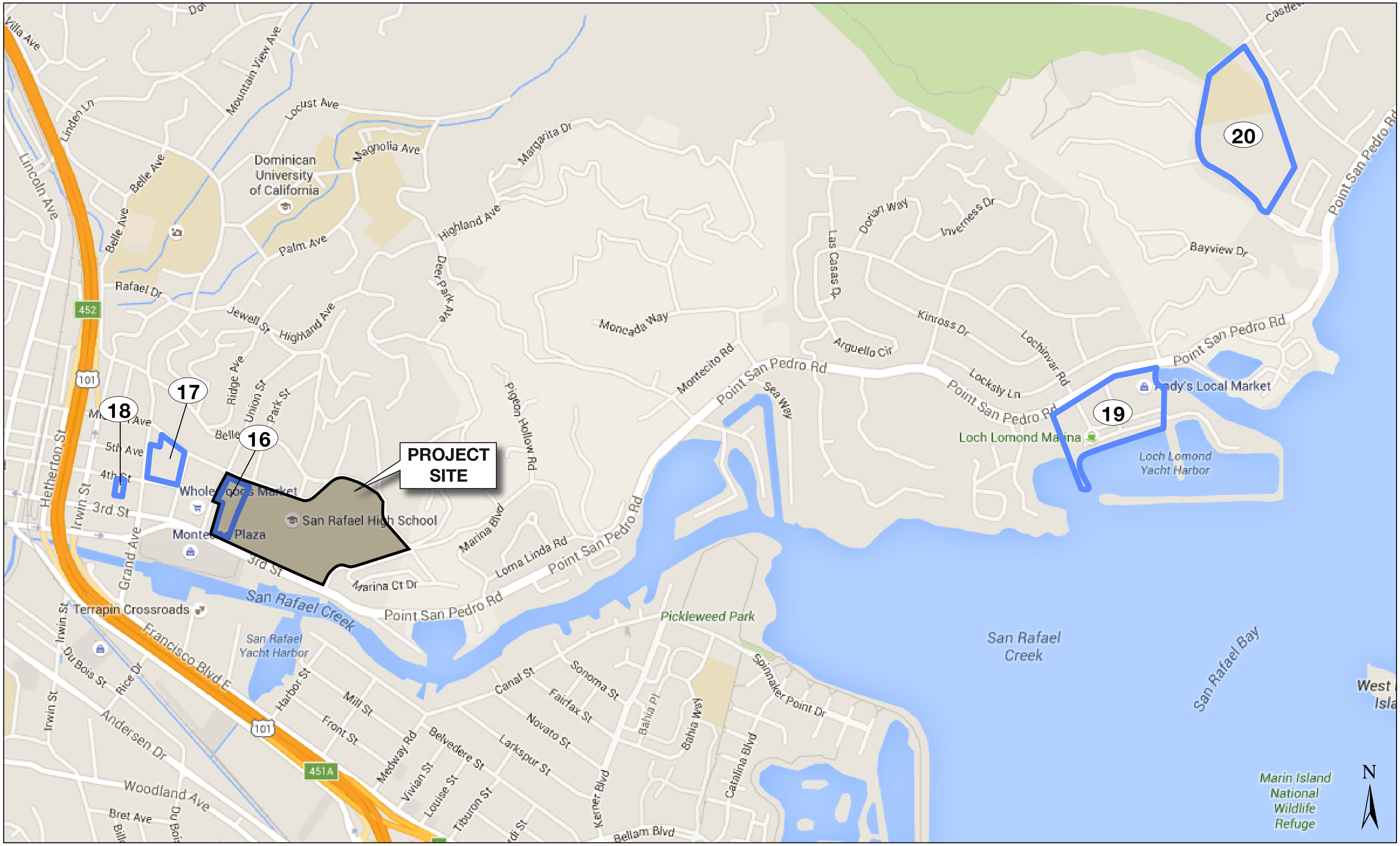


Figure 6-1

SOURCE: City of San Rafael, 2016

CUMULATIVE PROJECTS GENERALLY WEST OF U.S. HIGHWAY 101

AMY SKEWES~COX
ENVIRONMENTAL PLANNING



NOTE: Refer to Table 6-1 for details on numbered projects

Figure 6-2

SOURCE: Google Maps, 2016; City of San Rafael, 2016

CUMULATIVE PROJECTS GENERALLY EAST OF U.S. HIGHWAY 101

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

TABLE 6-1 CUMULATIVE PROJECTS

Number	Site	Proposed Use	Specifics of Use
1	1203 Lincoln	36 residential units (approved)	
2	524 Mission Avenue	15 residential units (approved)	
3	930 Tamalpais Avenue	Whistlestop – 50 senior units and senior services	On hold, may be relocated in neighborhood
4	700 3rd Street	30 residential units on 13,000-square-foot site (no application to date)	
5	San Rafael Corporate Center – Lincoln Avenue Parking Garage	1,558 parking spaces (completed and occupied)	Should be covered under "baseline" conditions
5a	San Rafael Corporate Center – Lincoln Avenue Parking Garage	600 parking spaces (Phase II) approved	
6	San Rafael Corporate Center on Lincoln Avenue	80,000-square-foot lab, constructed and occupied	Should be covered under "baseline conditions"
7	San Rafael Corporate Center – Lindaro Street	72,000-square-foot office – approved	
8	Bio Marin @ PGE Site – 999 3rd Street	200,000-square-foot office (may be future site for relocated Whistlestop) (no application for either)	
9	1001 4th Street – City Parking Structure	Potential housing and parking, no additional square footage (no application yet)	
10	809 B Street	41 residential units and 2,000-square-foot retail	Under environmental review
11	638-640 4th Street	House of Bagels – mixed use (no application yet)	
12	703-723 3rd Street	100 residential units (no application yet)	
13	1313 5th Avenue	Public Safety Center – 44,000 square feet (under review)	
14	1201 5th Avenue	5,000-square-foot office addition (under review)	
15	800 Tamalpais Avenue	San Rafael Transit Center Relocation (no application yet)	
16	San Rafael Corporation Yard (West Edge of Site)	2.6 acres, removal of 5,600 square feet of industrial uses and replacement with 40 units of senior housing (in General Plan but not approved)	

TABLE 6-1 CUMULATIVE PROJECTS

Number	Site	Proposed Use	Specifics of Use
17	Salvation Army Parking Lot (Northwest of Site)	1.1 acres, 35 residential units (no application yet)	
18	Dominican University	40 townhouses (not approved)	
19	Loch Lomond Marina	10 acres, 100 multi-family units, retention of existing retail/office (not approved)	
20	Glenwood School	7 acres, 42 multi-family units (not approved)	

Notes: See Figure 6-1 for location of projects.
Source: City of San Rafael Department of Community Development, October 2016.

Overall, all cumulative impacts would either be less than significant or could be mitigated through mitigation measures recommended in this EIR.

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APPENDIX A
NOTICE OF PREPARATION, RESPONSE TO NOTICE OF PREPARATION, AND SUMMARY OF SCOPING MEETING COMMENTS

NOTICE OF PREPARATION OF AN ENVIRONMENTAL IMPACT REPORT AND SCHEDULE SCOPING MEETING FOR THE SAN RAFAEL HIGH SCHOOL CAMPUS IMPLEMENTATION PLAN EIR
August 5, 2016

San Rafael City Schools (District) is preparing an Environmental Impact Report (EIR) for the proposed expansion and reconstruction at the San Rafael High School campus ("project") located at 185 Mission Avenue, San Rafael, California. The main campus entrance is on 3rd Street at the south end of the campus. The California Environmental Quality Act (CEQA) requires that the District conduct environmental review of the project, which has the potential to result in physical change in the environment. The District is the "Lead Agency" for the project and is the public agency with the principal responsibility for approving and carrying out the project. The District has determined that an EIR will be the required CEQA document for the project.

The District is issuing this Notice of Preparation (NOP) to invite comments on the scope and content of the EIR prior to its preparation. This NOP is being sent to local agencies, nearby residents, and other interested parties. When the Draft EIR is published, it will be sent to all parties who respond to this NOP or who otherwise indicate that they would like to receive a copy of the Draft EIR.

RESPONDING TO THIS NOP: Responses to this NOP and any related questions or comments regarding the scope or content of the Draft EIR, must be directed in writing to: **Dr. Dan Zaich, San Rafael City Schools, 310 Nova Albion Way, San Rafael, CA 94903 or by email to dzaich@srcs.org.**

Comments on the NOP must be received at the above mailing or e-mail address within 30 days of receipt of this notice, or **before Monday, September 6, 2016, at 5:00 p.m**. Please reference the project title shown below in all correspondence.

Responses to this NOP should focus, specific to this project, on the potentially significant environmental effects that the project may have on the physical environment, ways in which those effects might be minimized, and potential alternatives to the project that should be addressed in the EIR. This focus aligns with the purpose of the EIR to inform the public about these factors of the project.

EXISTING CONDITIONS: Existing buildings on the San Rafael High School campus are generally concentrated in the central and northeastern portion of the campus, with a large expanse of asphalt outdoor areas and turf playing fields located in the eastern and western portions of the campus. The existing high school currently accommodates about 1,125 students. Existing campus buildings are one to three stories in height and include a total of 279,670 square feet of building area. The project site is adjoined by residential uses to the north and east, 3rd Street and commercial business to the south, and commercial and residential uses to the west.

PROJECT DESCRIPTION: San Rafael City Schools (District) proposes building demolitions, renovations, and new construction for the campus that would result in the addition of 48,222 gross square feet (gsf) on the campus. About 84,015 gsf in 12 buildings (including bleachers and concession stands) would be removed and 132,237 gsf in 10 new buildings would be added to the site (see **Figure 1**). At completion, about 327,892 gross square feet of building area would be provided on the campus in buildings that would be one or two stories in height. Total on-campus enrollment would increase by 200 students. No new staff or faculty are projected.

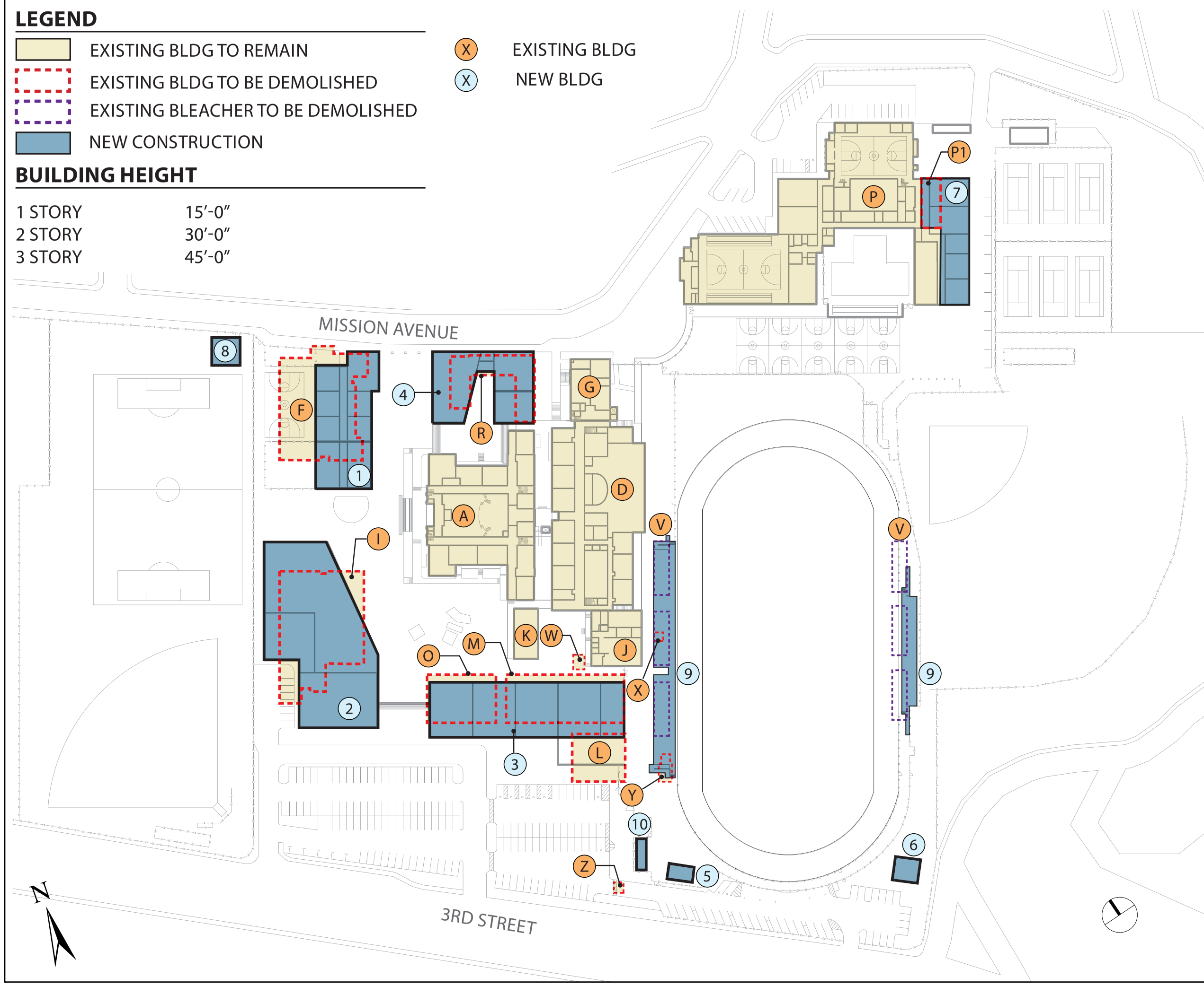
The EIR will be a Program EIR for many of the proposed improvements because specific details and designs have not yet been completed. However, the proposed improvements for the stadium area will be addressed at a project level of detail in the EIR. The proposed stadium project (also referred to as Miller Field) is located in a central portion of the campus, south of the existing gymnasium and east of the Library and Classrooms building where the existing stadium is located. New synthetic turf would replace the existing grass turf that now exists, thus extending the seasonal use of the field. No "crumb rubber" materials would be present in the synthetic turf. A number of other improvements would occur at the stadium portion of the campus such as energy-efficient lighting to replace existing lighting, a new public address system to direct sound to bleachers and the field; new parking for up to 39 cars at the south end of the field (just north of 3rd Street) with an exit driveway at this location, replacement of utilities, new furnishings, a new concessions stand and ticket booth, new restrooms, and a new plaza (see **Figure 2**).

Access for the high school would primarily be from 3rd Street with access to limited parking also from Mission Avenue. A new exit driveway would be provided at the new parking area south of Miller Field. A total of approximately 39 new on-site parking spaces would be provided and 2 existing spaces would be removed, for a total of 226 on-campus parking spaces at completion.

POTENTIAL ENVIRONMENTAL EFFECTS: The EIR will address the following potential environmental effects: Aesthetics, Air Quality, Biological Resources, Cultural Resources, Geology/Soils, Hazards, Noise, Public Services, Recreation, Greenhouse Gases, Hydrology and Water Quality, Land Use, Transportation/Traffic, Energy, and Utilities. The EIR will examine project and cumulative effects and a reasonable range of alternatives to the project that may be capable or reducing or avoiding potential environmental effects that may be identified for the project. The topics of Agricultural and Forestry Resources, Mineral Resources, and Population/Housing will not be addressed in the EIR as these do not apply to the project or project site.

SCOPING MEETING: A scoping meeting will be held in the San Rafael High School Library on Tuesday September 13th, 2016 at 6:00pm. San Rafael High School is located at 185 Mission Avenue, San Rafael, CA 94901. This meeting will include a brief overview of the EIR process and allow time for public comment.

Dan Zaich, Capital Facilities
San Rafael City Schools



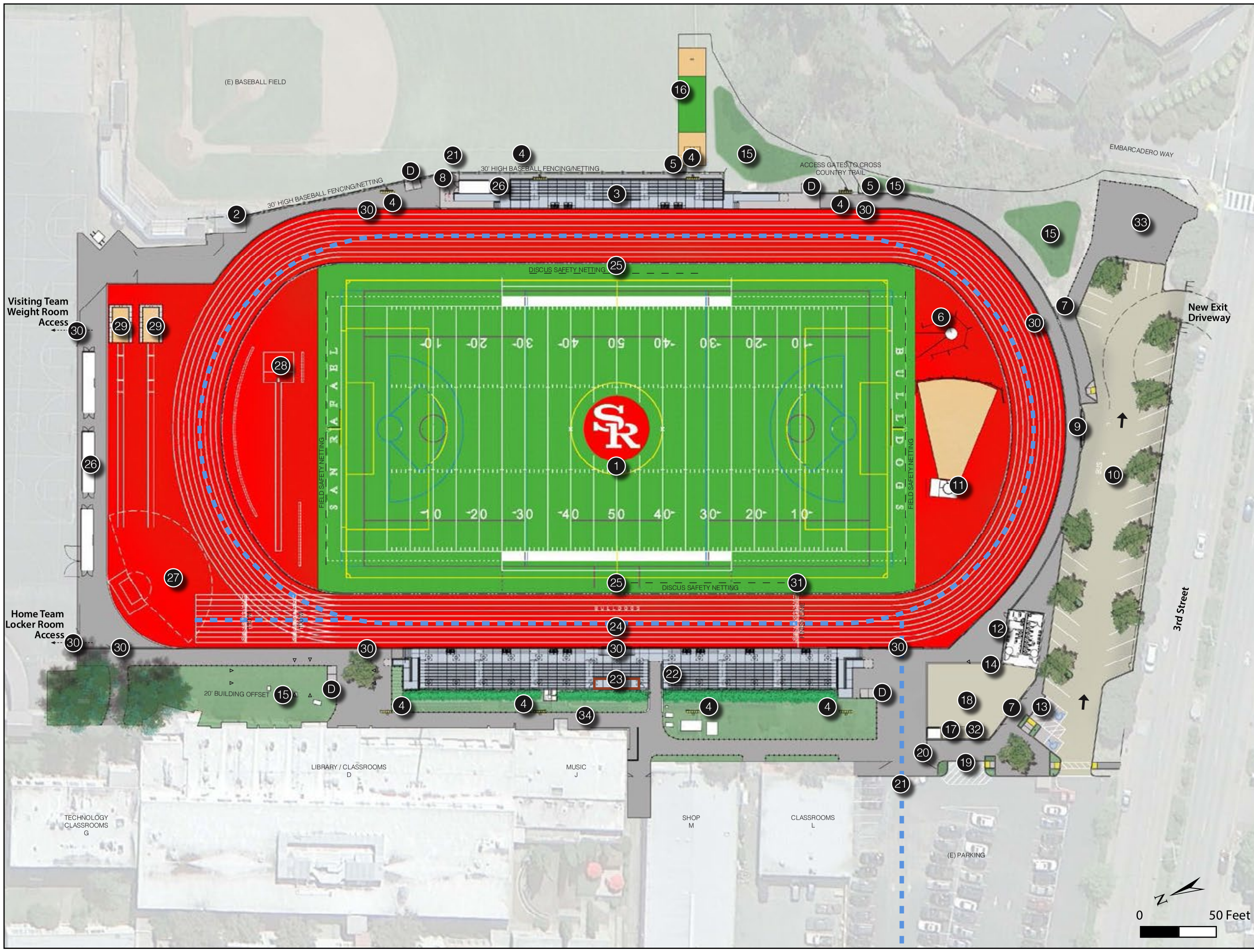
BLDG #	NAME	# OF STORIES	S.F.
EXISTING BUILDING TO REMAIN			
A	ADMIN / THEATER / CLASSROOM	3	60,125
D	CLASSROOM / LIBRARY	3	42,911
G	MEDIA	2	8,121
J	MUSIC	1	4,515
K	DAYCARE	1	1,958
P	GYMNASIUM	2	78,025
			195,655
EXISTING BUILDING TO BE DEMOLISHED			
F	SCIENCE	1	13,648
I	MADRONE / CAFETERIA	1	14,844
L	PHOTOGRAPHY / CERAMICS	2	8,102
M	AUTO TECH / WOOD SHOP	2	17,934
O	ACADEMY	2	10,466
P1	GYMNASIUM (PARTIAL)	1	1,641
R	ART	2	9,379
V	BLEACHERS	-	6,951
W	DAYCARE SHED	1	249
X	PRESS BOX	1	144
Y	CONCESSION STAND	1	513
Z	TICKET BOOTH	1	144
			84,015
NEW / REPLACEMENT BUILDING			
1	SCIENCE	2	24,560
2	ADMIN / KITCHEN / STUDENT COMMONS	2	51,276
3	CTE / ART	1	17,220
4	CLASSROOMS / CERAMICS / THEATER	2	18,525
5	CONCESSIONS	1	640
6	RESTROOMS / CHANGING ROOMS	1	960
7	WRESTLING / DANCE / CLASSROOMS	1	6,195
8	RESTROOMS / CHANGING ROOMS	1	1,225
9	BLEACHERS	-	11,157
10	RESTROOMS	1	479
			132,237
TOTAL MASTER PLAN S.F.			**327,892**

SOURCE: HY Architects, 2016

Figure 1

MASTER FACILITIES IMPLEMENTATION PLAN

AMY SKEWES~COX
ENVIRONMENTAL PLANNING



LEGEND

1. Multi-purpose field for football, soccer (110y x 65y) and boy's and girl's lacrosse
2. (E) Dugout to remain, fencing to modified to control foul balls
3. Visitor bleachers (approximately 512 seats)
4. New efficient stadium lighting posts (eight to minimize off-site glare)
5. Maintenance gate to access baseball field
6. Discus platform with net cage surrounded by rubber surface
7. Exist gate to open after sporting events
8. Flag pole
9. New scoreboard - located inside perimeter fence
10. New parking lot featuring approximately 39 additional parking spots with permeable paving surface
11. Shot put with QCV and shot put warm up space
12. Track record board
13. Accessible parking
14. Restrooms (eight female and six male fixtures)
15. Biofiltration planting
16. Relocated visiting team bullpen
17. Relocated ticket booth
18. Welcome Plaza with permeable pavers and donor pavers
19. Drop-off zone
20. Turnstile entry, accessible entry and exit gates
21. (E) Maintenance gate
22. Home-team bleachers (approximately 1,393 seats)
23. Announcer's booth with public address system (approximately 10' above field with roof deck 19' above field for cameras, etc)
24. 400-Meter rubberized track (nine lanes)
25. Electrical outlet and conduits to announcers booth for soccer and lacrosse scorekeepers
26. Sports equipment storage units (four units 3+1)
27. High jump on rubber surface
28. Pole vault
29. Two long jump and triple jump with QCV
30. Field fence access gates
31. Common finish line with electrical outlet and conduits to announcer's booth
32. Portable concession stand (NIC - Future Improvement)
33. Team room (NIC - Future Improvement. Base bid includes utility stub-outs)
34. Sky-bridge to band room (NIC - Future Improvement)

SOURCE: Carducci Associates, 2016

Figure 2

PROPOSED STADIUM SITE PLAN

AMY SKEWES~COX
ENVIRONMENTAL PLANNING

DEPARTMENT OF TRANSPORTATION
DISTRICT 4
P.O. BOX 23660
OAKLAND, CA 94623-0660
PHONE (510) 286-5528
FAX (510) 286-5559
TTY 711
www.dot.ca.gov

Serious Drought.
Help save water!

September 6, 2016

04-MRN-2016-00006
MRN/101/Var
SCH# 2016082017

Mr. Dan Zaich
San Rafael City Schools
310 Nova Albion Way
San Rafael, CA 94903

Dear Mr. Zaich:

San Rafael High School Implementation Plan – Notice of Preparation (NOP)

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above-referenced project. In tandem with the Metropolitan Transportation Commission's (MTC) Sustainable Communities Strategy (SCS), Caltrans new mission signals a modernization of our approach to evaluating and mitigating impacts to the State Transportation Network (STN). We aim to reduce Vehicle Miles Travelled (VMT) by tripling bicycle and doubling both pedestrian and transit travel by 2020. Our comments are based on the NOP.

Project Understanding
The proposed project includes building demolitions, renovations, and new construction for the campus of San Rafael High School that would result in the addition of 48,222 gross square feet (gsf). Approximately 84,015 gsf in 12 buildings (including bleachers and concession stands) would be removed and 132,237 gsf in 10 new buildings would be added to the site. At completion, about 327,892 gsf of building area would be provided on the campus in buildings that would be one or two stories in height. Total on-campus enrollment would increase by 200 students while no new staff or faculty are projected. Ingress and egress to the project will be provided via the US 101 north and south ramps at the Central San Rafael exit.

Lead Agency
As the lead agency, San Rafael City Schools is responsible for all project mitigation, including any needed improvements to State highways. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

Traffic Impact Analysis
During construction or starting "opening day", this project may generate traffic at volumes sufficient to impact the operations of nearby US 101, and it may be necessary to prepare a Traffic Impact Analysis (TIA). If it is found that a TIA is not required, please provide a verifiable explanation for this finding. The following criteria are among those that may be used to determine whether a TIA is warranted:

1. The project will generate over 100 peak hour trips assigned to the STN.

2. The project will generate between 50 and 100 peak hour trips assigned to the STN, approaching unstable traffic flow conditions.

3. The project will generate between one and 49 peak hour trips assigned to a State highway facility with unstable or forced traffic flow conditions.

Caltrans recommends using the Caltrans *Guide for the Preparation of Traffic Impact Studies* to determine which scenarios and methodologies to use in the analysis. It is available at the following website address: http://www.dot.ca.gov/hq/tpp/offices/ocp/igr_ceqa_files/tisguide.pdf.

Multimodal Planning
This project is located within a Priority Development Area (PDA) in the City of San Rafael. PDA's are identified by Bay Area communities as areas for investment, new homes, and job growth. To support the goals of PDA's, the project should be conditioned to ensure connections to existing bike lanes and multi-use trails to facilitate walking and biking to nearby jobs, neighborhood services, and transit nodes such as the San Rafael Sonoma-Marin Area Rail Transit (SMART) Station. Therefore, the proposed project should be conditioned to connect to the existing Class III bike lane as well as the proposed Class II bikeway along Third Street included in the 2011 City of San Rafael Bicycle/Pedestrian Master Plan. Providing these connections with streets configured for alternative transportation modes will reduce VMT by promoting usage of nearby Marin Transit Routes 233 and 257. Upgrading the bus stops with adequate bus shelters along Union Street may promote increased transit ridership as well.

We also encourage you to develop Transportation Demand Management (TDM) policies to promote smart mobility and reduce regional VMT and traffic impacts to the State highway system. Please consider the TDM options below:

- Project design to encourage walking, bicycling, and convenient transit access;
- Conveniently located carpool parking;
- Lower parking ratios;
- Transit fare incentives for employees and students such as subsidized transit passes on a continuing basis;
- Designated bicycle parking;
- Charging stations for electric vehicles;

- Participation/Formation in/of a Transportation Management Association (TMA) in partnership with other developments in the area;
- Aggressive trip reduction targets with Lead Agency monitoring and enforcement; and
- Reducing headway times of nearby Martin Transit Routes 233 and 257.

For additional TDM options, please refer to Chapter 8 of FHWA's *Integrating Demand Management into the Transportation Planning Process: A Desk Reference*, regarding TDM at the local planning level. The reference is available online at: http://www.ops.fhwa.dot.gov/publications/fhwahop12035/fhwahop12035.pdf. For information about parking ratios, please see MTC's report, Reforming Parking Policies to Support Smart Growth, or visit the MTC parking webpage: http://www.mtc.ca.gov/planning/smart_growth/parking.

Traffic Impact Fees
Given the project's contribution to area traffic and its proximity to US 101, the project should contribute fair share traffic impact fees. These contributions would be used to lessen future traffic congestion and improve transit in the project vicinity. Specific Plans should require traffic impact fees based on projected traffic and/or based on associated cost estimates for public transportation facilities necessitated by development. Scheduling and costs associated with planned improvements should be listed, in addition to identifying viable funding sources correlated to the pace of improvements for roadway improvements, if any. Please refer to the California Office of Planning and Research (OPR) *2003 General Plan Guidelines,* pages 105-106, 163, which can be accessed on-line at the following website: http://www.opr.ca.gov/index.php?a=planning/gpg.html.

This information should also be presented in the Mitigation Monitoring and Reporting Plan of the environmental document. Required roadway improvements should be completed prior to issuance of the Certificate of Occupancy. Since an encroachment permit is required for work in the State right-of-way (ROW), and Caltrans will not issue a permit until our concerns are adequately addressed, we strongly recommend that the County work with both the applicant and Caltrans to ensure that our concerns are resolved during the environmental process, and in any case prior to submittal of an encroachment permit application. Further comments will be provided during the encroachment permit process; see end of this letter for more information regarding encroachment permits.

Sea Level Rise
The effects of sea level rise may have impacts on transportation facilities located in the project area. Executive Order (EO) S-13-08 directs State agencies planning construction projects in areas vulnerable to sea level rise to begin planning for potential impacts by considering a range of sea level rise scenarios for the years 2050 and 2100. Higher water levels may increase erosion rates, change environmental characteristics that affect material durability, lead to increased groundwater levels and change sediment movement along shores and at estuaries and river

mouths, as well as affect soil pore pressure at dikes and levees on which transportation facilities are constructed. All these factors must be addressed through geotechnical and hydrological studies conducted in coordination with Caltrans.

Should you have any questions regarding this letter, please call Erik Bird of my staff at 510-286-5521 or Erik.Bird@dot.ca.gov.

Sincerely,

Pat C

PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

c: State Clearinghouse

COMMUNITY DEVELOPMENT DEPARTMENT
PHONE: 415-485-3085
FAX: 415-485-3184

September 1, 2016

Dr. Dan Zaich
San Rafael City Schools
310 Nova Albion Way
San Rafael, CA 94903

Subject: **Case No. P16-005, 185 Mission Avenue (APN 014-101-09); Notice of Preparation – San Rafael High School Campus Implementation Plan**

Dear Dr. Zaich:

The City of San Rafael (City) has received the Notice of Preparation (NOP) of an Environmental Impact Report (EIR) for the San Rafael High School Campus Implementation Plan (Campus Plan). Thank you for the opportunity to review and respond to the NOP. The City acknowledges that the adoption and implementation of the Campus Plan is not subject to City zoning clearances or building permits, as this oversight, review and approval is conducted by the State of California. Nonetheless, the planning for growth and improvement to all of the San Rafael City Schools facilities in integral to the City's long-range planning for the community. Further, implementation of the Campus Plan has the potential for both direct and indirect impacts on the City, City services as well as the residents and businesses in the general area of the high school. Therefore, it is critical that a thorough environmental document be prepared to address all pertinent issues. For these reasons, we respectfully request that the scope of the Campus Plan EIR fully study/assess the following topic areas:

1. Cultural Resources. Certain lands and geographic areas with the City contain significant archaeological resources, which include deposits and remains of the local Native Americans and other early inhabitants. According to the City of San Rafael Archaeological Sensitivity Map (2001), the high school property is located in an area of "Medium Sensitivity." It is requested that an assessment of potential pre-historic resources be prepared by a qualified archaeologist.

   The main high school building is listed in the City of San Rafael Historical/Architectural Survey (1977/1986). The survey rates this building as "Good." The California Office of Historic Preservation (SHPO) has recognized the City survey as a local resource for use in assessing impacts to potential historic resources. For this reason, it is requested that the main high school building be assessed to determine if it meets the criteria as a historic resource under CEQA Guidelines Section 15064.5. If it is determined that the main high school building meets the criteria as a historic resource, the Campus Plan should be assessed to determine potential historic impacts (direct or indirect).

2. Greenhouse Gas Emissions (GHG). The City of San Rafael has a qualified GHG Emissions Reduction Strategy. Included under this strategy is a quantified assessment of existing GHG

emissions, as well as project emissions based on forecasted growth for years 2020 and 2035. This plan was adopted by the City of San Rafael and accepted by the Bay Area Air Quality Management District. This plan allows the City to exempt projects that are within the land use and growth assumptions of the San Rafael General Plan 2020 from the preparation of a quantified GHG emissions assessment. The strategy and quantified assessment are based on projected growth in the San Rafael General Plan 2020, which does not include the current Campus Plan. The Campus Plan proposes the addition of 48,000+ square feet of campus building area as well as an increase in enrollment of up to 200 students. As the Campus Plan is not accounted for in the City's reduction strategy and quantified assessment, it is requested that a quantified GHG emissions assessment be prepared and included in the EIR.

3. Hydrology/Drainage. The high school campus is located within the FEMA Flood Insurance Rate Maps (FIRM) Special Flood Hazard Zones AE and X. Therefore, the campus is vulnerable to flooding and could be impacted by the long-term rise in sea level. It is requested that a detailed drainage analysis be prepared to assess storm water capacity and the potential for flooding. The City has a longstanding policy for new projects that increase impervious surface coverage. The policy requires that there be no net increase in the amount of storm water runoff that is generated from the project site. The Campus Plan presents areas where impervious surface coverage would be increased. Therefore, there will likely be the need to plan for and provide on-site storm water storage to ensure that there is no net increase in storm water runoff.

4. Water Quality. The project site is over one acre in size, so the Campus Plan is subject to its own NPDES General Construction Permit, which requires the preparation of a Storm Water Pollution Prevention Plan (SWPPP) and implementation of Best Management Practices. The City of San Rafael also regulates storm water discharge during construction activities and new development operation under San Rafael Municipal Code Chapter 9.30 (Urban Runoff Pollution Prevention). Water quality runoff is locally regulated through MCSTOPPP. It is requested that water quality be thoroughly analyzed in the EIR.

5. Public Services and Utilities. The project improvements will result in a net increase in 48,000+ square feet of campus building area, as well as an increase in school enrollment by 200 students. It is requested that a detailed assessment of potential impacts to public services be prepared and included in the EIR. There is the potential to increase demand for fire and police protection and paramedic service. Further, the project has the potential to increase demand for utilities such as water, wastewater and gas/electric.

   The City of San Rafael Fire Department provides fire prevention and paramedic services to San Rafael High School. The Campus Plan layout has been reviewed by the Fire Department staff. Fire Department staff recommends a number of standard conditions to ensure that the project complies with the California Code of Regulations, Title 24. Although not directly pertinent to the request for comments on the NOP, the attached memorandum from the San Rafael Fire Department provides a list of standard conditions that will be useful for the District to address during the various design phases of this project.

6. Transportation/Circulation. The proposed project will result in an increase in traffic to the local street network including an arterial (3^{rd} Street). Therefore, it is requested that a comprehensive traffic study be prepared. In addition to assessing sports events and activities, the traffic study will need to assess potential impacts associated with the planned increase in student enrollment and the 48,000+ square feet of additional campus building area. To date, City staff has had

several meetings with the Parisi Transportation Consulting (Parisi), the District's transportation consultants. In our meetings with Parisi, we discussed project scope, appropriate trip generation/distribution measures for this project, and traffic modeling responsibilities. At this point, the scope of the traffic study is still a work-in-progress, so we trust that the ultimate scope and details of the study will be a mutual effort between the District (Parisi) and the City.

The City realizes that the topic of parking (adequacy and potential impacts) is no longer one that is subject to environmental review under the CEQA Guidelines. However, parking for the Campus Plan is critical for many reasons, including the planning for increased enrollment. San Rafael High School is located in an area that has parking challenges. First, the bordering residential neighborhood to the north and east is older and has limited off-street and on-street parking. In the past, the Montecito Area Residents Association (MARA) was active in pursing the establishment a permit parking program. In addition, many of the commercial properties to the west and south are under-parked resulting in a greater reliance on use of on-street parking. For these reasons, it is recommended that a comprehensive parking supply and demand study be prepared, which includes measures to ensure that off-site parking is not negatively impacted. It is requested that this study be completed and available for public review simultaneous with the public review period for the EIR.

It is unclear from the NOP as to the type of EIR that will be prepared. Based on the scope of the project described in the NOP, it is assumed that the document will be prepared as a "Project EIR," meaning that it will assess the impacts at a detailed level. However, there are longer-range goals to the project, such as the increase in student enrollment, which may result in studying potential impacts at a broader program-level ("Program EIR"). We request clarification on this detail, as well as the timeline/forecast for full implementation of the Campus Plan.

Thank you again for the opportunity to review and comment on the NOP. Should you have any questions please do not hesitate to contact me at 415-485-5064 or paul.jensen@cityofsanrafael.org.

Sincerely,

Paul A. Jensen

Paul A. Jensen
CITY OF SAN RAFAEL
Community Development Director

Attachment: Memorandum from City of San Rafael Fire Department; August 18, 2016

cc: Mayor Gary Phillips and City Council Members
Jim Schutz, City Manager
Bill Guerin, Public Works Director & Josh Minshall, Associate Civil Engineer
Carlene McCart, Community Services Director
David Heida, Fire Prevention
Raffi Boloyan, Planning Manager
Lisa Goldfien, Assistant City Attorney
Montecito Area Residents Association; Attn: Vickie Hatos; P.O. Box 150266, San Rafael, CA 94915

CITY OF SAN RAFAEL

SAN RAFAEL, CALIFORNIA

INTER-DEPARTMENTAL MEMORANDUM

DATE: August 18, 2016
TO: Paul Jensen
FROM: David Heida
SUBJECT: Planning File #P16-005 - 185 MISSION AVE
SR High School Master Plan

This memorandum is intended to assist the applicant in determining the feasibility of this project and in the preparation of construction documents with regard to compliance with the California Code of Regulations Title 24 and local ordinance requirements. After review of the application and plans provided for this project, the **Fire Prevention Bureau** has the following comments:

Merits of the Project
Standard Comments:

1. The design and construction of all site alterations shall comply with the 2013 California Fire Code and City of San Rafael Ordinances and Amendments.

2. Provide Knox Key access for all gates located at entry points or across fire apparatus access roads on this property; show the location of all gates on the site plans. Note, the minimum clear unobstructed opening dimension of 20-feet shall be provided at all gates located across a fire road

3. Fire lanes must be designated; painted red with contrasting white lettering stating "No Parking Fire Lane" A sign shall be posted in accordance with the CFC Section 503.3.

4. Approved fire hydrants are required; the fire hydrant shall be located no more than 400 feet from any portion of the building. The fire hydrant shall be a wet barrel Clow model 960 and supply at least 1500 gpm at 20 psi.

5. Where a fire hydrant is located on a fire apparatus access road, the minimum width of the road shall be 26-feet. The 26-feet width is required to remain clear and obstructed for at least 20-feet of roadway on each side of the fire hydrant

6. All portions of each building must be located within 250-feet of an approved fire apparatus access road.

7. The minimum width of the fire apparatus access road is 20-feet.

8. The minimum inside turning radius for a fire apparatus access road is 28 feet.

9. If a building is over 30 feet in height, an aerial fire apparatus access roadway is required parallel to one entire side of the building. The Aerial apparatus access roadway shall be located within a minimum 15 feet and a maximum of 30 feet from the building.

10. The minimum unobstructed width for an aerial fire apparatus access road is 26-feet.

11. Overhead utility and power lines shall not be located within the aerial fire apparatus access roadway, or between the roadway and the building.

12. The fire lane must be asphalt or concrete and be improved to support an imposed load of 75,000 pounds.

13. As the fire apparatus access road serving this building is more than 150-feet in length, provide an approved turn-around. Contact the Fire Prevention Bureau for specific details.

14. Contact the Marin Municipal Water District (MMWD) to make arrangements for the water supply serving the fire protection system.

David Heida
Fire Inspector II

Gmail by Google

Amy Skewes-Cox <amysc@rtasc.com>

FW: Machado - NOP regarding EIR

1 message

Daniel Zaich <dzaich@srcs.org> Wed, Sep 14, 2016 at 8:27 AM
To: Amy Skewes-Cox <amysc@rtasc.com>
Cc: Mark Van Pelt <mark@vpcsonline.com>, "Mark W. Kelley" <mkelley@dwkesq.com>, Pete Norgaard <pete@vpcsonline.com>

Hi Amy – NOP response below

Dan Zaich, Ed.D. | Senior Director – Capital Facilities **| San Rafael City Schools**

Phone: 415.492.3285 |dzaich@srcs.org | www.SRCS.org

310 Nova Albion Way | San Rafael, CA 94903

From: paula machado [mailto:machadoarts@yahoo.com]
Sent: Wednesday, September 14, 2016 4:49 AM
To: Daniel Zaich
Subject: NOP regarding EIR

Greetings Mr Zaich!

Thank you for encouraging neighbors to share their concerns about SRHS NOP- EIR.

As a neighbor for 35 years who lives directly behind Miller field up the hill at the end of Mission Ave, I want to briefly share several item to consider and questions to be addressed:

1.

Will parking lot lights be installed in the new, small, extended parking area? Hope not! Not needed. More night glare directly into homes.

2.

Canal Day Care students often jaywalk across street with parents causing GREAT danger. Too many cars moving in and out to pick up, drop off at that busy corner. The entire Center is in need of a new fence, landscaping. Very run down . Change parking for drop off/ pick up? Move pre school? Unsafe. I have witnessed near misses. I know SRCS owns the property. It needs upgrades by owner and tenant.

3.

Off gassing and soil excavation from field? I am upwind, along with neighbors. We have concerns. Wind picks up in afternoons.

4.

Will new **PA system** focus sound onto field, not neighborhood? Please refer to the state of the art system that Marin Catholic allegedly has installed, along with focused lighting. SRHS PA is dreadfully archaic echoing sound throughout neighborhood.

5.

Can **stadium lights** be programmed to turn off by 10PM no later. Often in winter months left on til 11:30. Sometimes all weekend long by mistake!

6.

Can Maintenance Dept hire an arborist to "top" the eucalyptus trees on Mission to the height **right above the top of of utility poles.** Overgrown, spindly, dangerous. Specifically, across from 26, 22, 20, 18 Mission Ave. Trees that are topped will "thicken with leaves, safer, more efficient break from field for residents. **PLEASE DO NOT REMOVE.. just maintain, like they were maintained and topped annually 15 years ago!**

7.

Change drop off system by gym between Mission and Belle and in from of gym. Dangerous.

8.

Will **lighting poles be lower** (hopefully) and aiming light onto field and not at surrounding hillside dwellings?

9. Do what you can to **discourage parking on Mission Ave by parents or routing around that street** as track runners use the street to jog after school and the traffic is insane.

10.

At your convenience please send a report on NOP findings, concerns and post at SRCS website.

Thank you! This is a most exciting year for SRHS!

Congrats! Go Dawgs!

Sincerely,

PJ Machado

resident of area

.

MONTECITO AREA RESIDENTS' ASSOCIATION

P. O. Box 150266
San Rafael, CA 94901
www.montecitoresidents.com

Date: Sept 14, 2016
To: Dr. Dan Zaich, San Rafael City Schools
Re: San Rafael High School – Comments in Response to the NOP/Request for Comments and Questions for the San Rafael High School Campus Implementation Plan Draft EIR.

cc: San Rafael School Board, Superintendent of Schools, & Chris Thomas
Department of Public Works Director, City of San Rafael
Community Development Director, City of San Rafael
City of San Rafael Mayor & City Council
SRHS Principal
The Federation of San Rafael Neighborhoods
North San Rafael Coalition of Residents

Dear Dr. Zaich:

Montecito Area Residents' Association (MARA) is the neighborhood association for the neighborhood which includes San Rafael High School and the area of residences around it. Our neighborhood is one of the oldest residential neighborhoods in San Rafael; much of it was built in the late 19th and very early 20th centuries. SRHS is located at the bottom of a bowl formed by hills on three sides. The hills are covered with houses and apartment buildings. The street infrastructure reflects the age of the neighborhood. Most streets in the neighborhood above SRHS are narrow, winding, and steep. Most of our streets lack sidewalks, and blind corners abound. Our neighborhood is very diverse and densely populated.

MARA supports the effort to update and improve SRHS facilities for the students of San Rafael. We are pleased that there will be a complete Campus Plan EIR to study the possible negative impacts of both the Stadium Project and Future Master Plan and how they might be mitigated.

The topic areas of the Campus Plan EIR that most concern MARA include: Transportation/Circulation, Hydrology/Drainage, Noise and Light Pollution and Cultural or Aesthetic Resource (?) – the rock formation on Mission Avenue called Indian Rock.

1. Transportation/Circulation

<u>Traffic Study</u>: We advocate that the planned comprehensive traffic and parking study be done on the highest impact times and days. Weekdays at school start and end time, plus when afterschool activities conclude. Look at night traffic on weekdays when there are events like Back to School and football games with high attendance, like the Bell Game. In addition, the study should include weekend days, both Saturday and Sunday. Study days on the weekend should be chosen when the most activity or varied activities are happening, e.g. a day when all the gyms (basketball user group) are in use and other activities are on campus. (e.g. Summerfest Sept. 24, Dawg Pride cleanup -October 8th,) Homecoming weekend -Nov 4/5).

<u>Traffic and parking issue</u>: **EXISITNG CONDITIONS**: Around the Mission Avenue side of SRHS traffic and parking has always been a serious problem (which MARA has been complaining about for over 20 years), and conditions have deteriorated in recent years. We are particularly concerned about **ILLEGAL** traffic and parking, and would like to see the scope of the EIR address how this might get worse with more students and particularly more use of the stadium, and how this could be mitigated. Currently, parents of students and others attending or dropping off for school or games drive around and around the Mission Ave. side of the school, looking for parking, stop illegally (frequently in the middle of Mission Ave. by the gyms, forcing traffic behind them to drive on the wrong side of the road on a blind curve – one auto will continue doing this for 5-10 minutes, waiting for a student). Also drives drop off passengers in areas that are <u>not</u> designated drop-off zones and

where there is no cross walk. They also illegally park in red zones and in front of residential driveways. Large buses and large delivery trucks have also parked in illegal areas along Mission Ave. right by the school.

Recently, neighbors have witnessed dangerous road rage incidents in this area. There was one accident recently right along Mission Ave. where a car actually missed the curve, jumped the curb by the gyms, and crashed through what turned out to be decorative bollards between Mission and the school. Very unfortunately a student who was on the school property was hit and injured. Even though we understand that the driver in this instance was not a parent attempting to drop off anyone, or anyone attending a game, it illustrates how dangerous the Mission Ave. curve is.

One of our MARA Board members lives across the street from this location and has documented, using security cameras, many recent incidents and accidents. It is our hope that this film documentation will help us remedy this dangerous situation we have been discussing for 20 years with the School District and the City.

Of course, we are concerned that these problems will get worse with an increase in the size of the student body, the school and the more frequent use of the stadium (particularly by non SRHS schools and other entities, whose attendees might not be familiar with the area).

POSSIBLE MITIGATING MEASURES: MARA would like to suggest the following ways in which these problems, and the increase in them caused by the Plan, might be minimized:

i) **Change the address of SRHS** from its old address (185 Mission Ave.) to one on Third St. The Third St. side of the school has been the front entrance of the school for over a decade. Third St. is where the large parking lot is. However, people coming from other areas google the current address, and end up on the narrow residential streets of our neighborhood on the other side of the campus, looking for parking. We have been requesting this change of address for over 2 years, and are told it is “in the works”, but somehow it has not happened. Even before the address change is made the SRHS website could clearly indicate where the main parking lot is on Third St., with directions and and all user groups of the campus could be advised

ii) **Create signage on Mission Ave. to direct people to the main parking lot on Third St.** – there is none now.

iii) **Create a safe, lighted path for people to walk from the main parking lot to the gym area**. Many of the problems noted re Mission Ave. are caused by people insisting on dropping off or picking up students or others right in front of the gyms. If there was a safe, direct & easy way to get from the main parking lot to the gyms, this would be mitigated. There should be **signage** on Mission stating NO DROP OFF OR PICKUP – USE THIRD ST. PARKING LOT. There should be **signage** at the Third St. parking lot directing people to the path to the gyms.

iv) **City NO PARKING/STOPPING signage on Mission Ave**. After many years of MARA complaining about the dangerous stopping/waiting of cars along Mission in front of the gyms, the Department of Public Works (DPW) of the City of San Rafael finally agreed to put up several NO PARKING/STOPPING signs along that stretch of Mission, even though it is already a red zone. Unfortunately, the DPW (which has admitted this but declined to fix it) put the signs up in the wrong place – on Mission but on the other side of the school, near the soccer field.

v) **SRHS Management Plan for the use of the SRHS facilities** The School District has agreed to the creation of a Management Plan which would specify how many days per week, how late at night, etc. SRHS's sports and other facilities could be used. The committee working on this issue exists, and has neighborhood as well as SRHS and other stakeholders (such as parents of students) on it. We feel that it is critical that this Plan be finalized before the school's plans are finalized.

vi) Please share with MARA the draft list of streets the City of San Rafael wants studied. At the meeting on September 13th, you indicated that it was not complete and your team suggested Belle and Mission be added. Participants at the meeting added the following: Mission/Embarcadero, Embarcadero/Third. The list from the City was not at the meeting, so please share the complete draft list so we can be informed. In addition, we request that Alice St/Mission be added (many parents use that as a U-turn spot even though they are completely blind to what's coming around the curve!). Alice St. is part of their exit flow when they drop off/pick up on Mission.

2. Hydrology/Drainage

Seasonal Flooding: **EXISTING CONDITIONS:** SRHS is at the lowest point in our neighborhood, at the bottom of the aforementioned geologic bowl. During heavy winter rains there are many streams coming down the hills, most of which have been culverted, not always with complete success. There is a stream that is not completely in a culvert between #124 and #136 Mission Avenue. In years of heavy rain, the runoff from the hills on surface streets comes down Mission and has caused flooding. Some years ago, Gym #2 was flooded. At high tide in the winter, run off, rain, and the high water table causes saturation and sometimes flooding on the stadium field, the baseball field, and also the soccer fields on the West side of the school. We understand that the design of the new stadium includes measures to deal with this issue for the stadium field. However, we believe the scope of the EIR should include a comprehensive study of the water drainage over the entire campus, to study whether the implementation of the Plan will make flooding in the neighborhood worse by increasing the amount of hardscape, raising the height of the stadium field, or any other change not yet know.

3. Noise and Light Pollution

MARA Board members and neighbors have attended most of the Stadium Planning meetings. We are confident that the new stadium lights and sound system will provide greater control to the school. The specifications of the systems presented thus far appears to show that the current "pollution" of noise and light into the neighborhood will be greatly reduced. **However, we would advocate these systems be studied with SRHS' unique location as part of this EIR. A possible mitigation of any such pollution would be that the San Rafael Board of Trustees finalize and adopt the *SRHS Sport Facilities Management Plan* currently being drafted before the construction plans are finalized.** The Draft Facilities Management Plan limits the number of times per week the stadium or other sports facilities can be used at night, it limits the night time events duration, and it outlines that all events must comply with the existing City of San Rafael noise ordinance.

4. Cultural Resources

Indian Rock: MARA concurs with the immediate neighbors and alumni of SRHS that Indian Rock (located behind Gym #2) has been and continues to be a landmark with cultural significance. We do not know if the plans takes this into consideration or not. We advocate that the rock remains and that the landscape architects identify a creative way for the Indian Rock to be enjoyed by future students and neighbors.

Thank you for the opportunity to comment. Please do not hesitate to contact MARA if you have any questions or concerns we are happy to clarify and participate in future studies.

Respectfully,
Board of Directors of the Montecito Area Residents' Association

Sherna Deamer
Sid Waxman
Bryn Deamer
Jackie Schmidt
Constanza Perry
Kristie Garafola
Tom Hurray
Ann Bauer

Valerie Muller

108 Marina Court Drive, San Rafael, CA 94901

August 26, 2016

Dr. Dan Zaich
San Rafael City Schools
310 Nova Albion Way
San Rafael, CA 94903
dzaich@srcs.org

Dear Dr. Zaich;

I am writing in response to a Notice of Preparation of an Environmental Impact Report for the San Rafael High School Campus Implementation Plan EIR dated August 5, 2016 request for input. I am a 20+ year resident of the area. I have several areas I would like to address.

1. Currently the main student drop off entrance to SRHS is on Mission Avenue, with residences on one side of a two lane road with the high school on the other. Parents drop off and pick up students in a designated white zone and illegally in a designated red zone on a curve. Cars routinely double park on Mission Ave. in both those zones allowing students to disembark and load in the traffic lane, with cars then doing u-turns, pretty scary. Parking by students is significant on the more level sections of Mission Avenue. The school does not appear to monitor this area nor do they expect compliance with current traffic rules by the parents of the students.

The proposal is "Access for the high school would primarily be from Third Street with access to limited parking also from Mission Avenue." This is a positive acknowledgement of ongoing problems, although the solution will present its own problems. Indeed a traffic study should be required for Third Street/Pt. San Pedro Rd area, now supporting Montecito Shopping Center, San Rafael Fire Dept substation and training facility, a pre-school, a rock quarry running trucks, and primary access to Hwy 101 for thousands of residents along Pt. San Pedro Rd (Third Street).

2. Currently, students arriving via large school busses from out of the area to participate in sports events are being dropped off at the Gym on Mission Avenue, usually parking in the red zone. These buses have nowhere to turn around, or park on the residential streets. There is no designation in any of the parking areas on the school grounds for parking large buses dropping off students participating in sports events at the new main entrance on Third Street. On the map, traveling north east, up Mission Ave. to a five way intersection with stop signs, then making a right turn on Embarcadero Way (represented as a two lane road), appears to be easy access to 3rd Street. Embarcadero Way is a windy, steep, single lane road, with visible gas lines exposed on the uphill side, unsuitable for bus traffic. Somewhere on-site, areas should be designated for large bus parking.

Parking for buses could be accommodated on school grounds at the western area of the secondary baseball field and soccer field. Having a second soccer field and second baseball facility with a significant shortage of parking spaces seems out of step with trying to mitigate controversy that involves inadequate parking. This area accommodated parking for SRHS previously.

3. There seems to be an obvious error in calculating existing, new, and added parking spaces, then coming up with a total new number of on-campus parking spaces based on guesses. Determining existing on-site campus parking spaces has the same issue. The same is true with using words such as "up to" and "approximately" in calculating total numbers of parking spaces then rounding up those estimated numbers to be "total of on-campus parking

spaces at completion." No one wants a significant number of on-site parking spaces to be eliminated. School parking, on and offsite, and how it affects neighboring streets is a major issue, clarity should be the rule.

The existing conditions master plan dated July 27, 2015 refers to SRHS & Madrone with total parking being 182 stalls. This number omits 71+ existing, numbered and delineated spaces including handicapped spaces located between the existing gyms and tennis courts. The total existing onsite parking spaces as of July 27, 2015 is 253 parking spaces (182 + 71) not 182 as stated on the master plan.

The August 5, 2016 Notice of Preparation of an environmental Impact Report and Schedule Scoping Meeting for the San Rafael High School Campus Implementation Plan EIR references in one paragraph "new parking for up to 39 cars at the south end of the field (just north of 3rd Street)". That doesn't mean that 39 spaces will be added, it could be 2.

The following paragraph of that same letter states "A total of approximately 39 new on-site parking spaces would be provided and 2 existing spaces would be removed, for a total of 226 on-campus parking spaces at completion." Again, knowing how many spaces will be eliminated (2) and not knowing how many will be added, using approximately, questions the accuracy of these numbers.

Neither of these statements indicates how many parking spaces will actually be added. Coming up with a total number of 226 is unreliable, at best. Since we started off with 253 existing parking spaces, there is a definite reduction is parking, not an increase.

There is also additional parking used during swim meets, baseball practice and other times for approximately 50+ cars where the outdoor basketball courts are located adjacent to the pool.

The new construction of building number 7 (wrestling/dance/classroom) appears to eliminate these 71+ spaces and access to the other 50+ spaces. Even will all these existing parking spaces , there is an overflow of parked cars for swim, basketball, and volleyball meets, etc. up the hill on Mission Avenue. SRHS participants park on both sides of the street, where possible, with no paved sidewalks on either the residential or school property side, and on Marina Court Drive with restricted width.

Providing sidewalks along the west side of Mission Avenue up the hill contiguous with school property would provide a walking area off the street for the SRHS track team running up the street and for attendees of sport events parking along this street, attending swim, basketball, volleyball, etc. meets. This is the closest parking to where the attendees will be competing or attending events at the gym and pool areas.

Currently, SRHS doesn't seem to meet the minimum standard of parking for a student body of 1,125 students calculated on 50 percent of the school enrollment, (562 spaces), this is without taking into account the addition of a sports stadium with a seating capacity of 1,905 seats or factoring in bus parking.

Based on the controversy of not knowing how many actual parking spaces are currently on-site, there appears to be a signifant problem with adequate parking spaces. Acknowledging the lack of parking facilities would be a move in the right direction.

Yours truly,

Valerie Muller

Valerie Muller

August 30, 2016

Dr. Dan Zaich
San Rafael City Schools
310 Nova Albion Way
San Rafael, CA 94903

RE: Miller Field Project EIR

Dear Dr. Zaich,

In response to the NOP for the upcoming EIR on the Miller Field project, I'm submitting my comments for consideration regarding the scope and content for the Draft EIR. I am a neighbor of the high school, living in very close proximity to Miller Field and surrounding facilities (Jewell at Mission). I am also the parent of an elementary school student who will attend SR High and I welcome the planned improvements at the school.

I am concerned however about the environmental impact on parking and traffic that the proposed improvements to Miller Field and the high school will have in our neighborhood. With the current conditions at the high school, we experience significant traffic on Mission Avenue and Jewell Street any time there is an event at the high school. This includes cars circling looking for parking, cars turning around in our driveway and cars blocking our driveway. We've had a couple of close calls with our child sitting in our driveway or walking on the sidewalk when frantic drivers desperately turn around for a parking place. Additionally, traffic on Mission in front of the high school gym becomes very hazardous with cars driving very slowly, making unexpected u-turns or stopping in the red zone as they look for parking. Since the high school's official address is on Mission Street, navigation applications send drivers down Mission Street, rather than to the school parking lot on 3rd Street, which further compounds the traffic and parking issues.

The project plan calls for the elimination of the parking lot that currently exists between the tennis courts and the gym, which I believe provides upwards of 70 parking spaces, yet only adds "up to 39" new spaces on 3rd Street. I understand that the tennis court lot was only recently opened for event parking and may not originally been intended for that purpose; however, even with that lot open and available, parking and traffic is still extremely challenging.

I am concerned that 226 total parking spaces is not nearly enough, especially with the increased student population and plans to develop Miller Field to increase its desirability for additional use for non-high school related events. The parking and traffic situation is not tenable as it is and certainly can't be tolerated on a more frequent basis. Based on the following excerpt from the California State Department of Education, Guide to School Site Analysis and Development, 2000 Edition, 226 parking spaces is significantly lower than what has been suggested for school development in the past. *"Student parking at secondary schools. Secondary schools generally provide additional land for student parking. This provision allows students who drive cars to* *park on the school site rather than occupy street parking throughout a neighborhood. When student parking areas are located to permit use by the public attending athletic events or community events, more land than is needed for student parking must be provided as determined by the capacity of the gymnasium, stadium, or auditorium. In the past many school districts provided student lots with a minimum parking capacity calculated on 50 percent of the school enrollment. Thus a high school of 2,000 students would provide parking for 1,000 cars at 380 square feet per car - an area of 380,000 square feet or about 8.7 acres of land - in addition to the space needed for staff and visitor parking. The number of students driving cars differs for each school, but this amount of land is usually adequate for all school purposes."* While I realize this guideline may not be the governing document for SR High's modernization, it does provide insight into suggested parking capacity at high schools.

The EIR needs to focus specifically on the traffic impact in the surrounding neighborhood streets and address whether the proposed number of parking spaces is sufficient. I suggest additional parking be added or the tennis court parking be left in place. Additionally, the high school's official address needs to be changed to 3rd Street in order to relieve the hazardous conditions on Mission Street. Furthermore, the EIR should address the need to limit the number of events that can be held at Miller Field so as to minimize their impact on the neighborhood.

Thank you for consideration of my concerns. Please send a copy of the Draft EIR when it is published.

Best regards,

Tricia Green
19 Jewell Street
San Rafael, CA 94901
Pgreen_99@yahoo.com

Summary of Scoping Meeting Comments for San Rafael High School

Meeting Held September 13, 2016 at San Rafael Library at 6 PM

Attendees: Ann Bauer, Kristie Garatola, Tom Kvajan, Jeff Rhodes,

SRHS Team Attendees: Amy Skewes-Cox, Pete Norgaard, Dan Zaich, Sarah Schoening, Mark Kelley,

Glenn Dennis (SRHS Principal), Natu Tuatagaloa (Board member), and Dave Pedroli (Maintenance)

Project was described and process for EIR was described. Meeting was opened for public comment and the following comments were made:

Aesthetics: lighting and increased height of fixtures on field; settings allowed

Biology: wet marsh area in field during winter (but this area may not be impacted)

Cultural: need to contact San Rafael Heritage; Indian Rock on north side of campus to be assessed; this rock is surrounded by pepper trees which may not be appropriate for its historic character

Geology: Pete N. explained the geotechnical study and soil borings had been done for stadium and that future such studies would occur for Master Plan projects when they're in more final state

Hazards: Eucalyptus at east side of campus are a fire hazard; need fuel modification strategy

Hydrology: water table and salt levels; stream between houses to north of campus at 124 and 136 Mission comes into culverts and SRHS has been flooded in the past near the gym

Transportation: need to assess bike storage adequacy; need to assess traffic on weekends for tournaments, etc. when many are looking for parking in the neighborhood; need SRHS to change its formal address to 3rd Street (vs. Mission) so that visitors aren't looking for parking in Mission Street neighborhoods; users/teams need to be informed of new address; pedestrian safety is a concern, especially near the gym on Mission where a sitting area is close to cars coming/going for drop-off; student access and pedestrian safety throughout campus to be addressed as well as off the site; need to determine if sidewalks needed; need parking restrictions on south side of Mission for pedestrian safety; adequacy of parking signage, signage preventing U-Turns, etc.; need lighting of all paths from 3rd Street to Mission through the campus

Services: Fire Dept. is planning to move to 519 4th Street and this should be assessed; issue of Fire Dept. wanting trade of some land at west side of site (to discuss with VPCS team) in area of old street

Utilities: Adequacy of existing infrastructure

Solid Waste: Recycling opportunities on the site

APPENDIX B
AIR QUALITY BACKGROUND

San Rafael High School Stadium Project

Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Arena	5.00	Acre	5.00	217,800.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	427	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

San Rafael High School Stadium Project - Marin County, Annual

Project Characteristics - PG&E's default 2008 CO2 intensity factor updated to the 2013 emission factor (427) reported in PG&E’s (2015) Greenhouse Gas Emission Factors: Guidance for PG&E Customers.

Land Use - Information provided by project sponsor.

Construction Phase - Total work days provided by project sponsor. The actual calendar schedule for construction activities may vary.

Off-road Equipment - Information provided by project sponsor.

Off-road Equipment - Information provided by project sponsor.

Off-road Equipment - Information provided by project sponsor.

Off-road Equipment - Information provided by project sponsor.

Off-road Equipment - Information provided by project sponsor.

Off-road Equipment - Information provided by project sponsor.

Demolition - Approximately 13,500 square-feet of existing structures to be hauled off-site. This likely overestimates total haul trips, because most of the structures are bleachers and not buildings.

Grading - Approximately 4,000 cubic yards of soil import/export is anticipated.

Architectural Coating -

Energy Use - PG&E's default 2008 CO2 intensity factor updated to the 2013 emission factor reported in PG&E’s (2015) Greenhouse Gas Emission Factors: Guidance for PG&E Customers.

Water And Wastewater - Central Marin Sanitation Agency wastewater treatment plant uses 100% aerobic treatment and 100% cogeneration.

Construction Off-road Equipment Mitigation - Mitigation Measure for Tier 2 engines

Vehicle Trips - According to the traffic analysis by Parisi Transportation Consulting (2016), the project would generate 68 daily trips on weekdays (13.6 trips/acre/day).

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tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	40	0
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tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00

San Rafael High School Stadium Project - Marin County, Annual

tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
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tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	7.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
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tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
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tblConstructionPhase	NumDays	18.00	10.00
tblConstructionPhase	NumDays	230.00	90.00
tblConstructionPhase	NumDays	20.00	30.00

San Rafael High School Stadium Project - Marin County, Annual

tblConstructionPhase	NumDays	8.00	10.00
tblConstructionPhase	NumDays	18.00	20.00
tblConstructionPhase	NumDays	5.00	20.00
tblGrading	MaterialExported	0.00	4,000.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	2.00
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tblOffRoadEquipment	OffRoadEquipmentUnitAmount	1.00	0.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
tblOffRoadEquipment	OffRoadEquipmentUnitAmount	3.00	1.00
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tblOffRoadEquipment	UsageHours	7.00	8.00
tblOffRoadEquipment	UsageHours	8.00	4.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	427
tblVehicleTrips	WD_TR	33.33	13.60
tblWater	AerobicPercent	87.46	100.00
tblWater	AnaDigestCogenCombDigestGasPercent	0.00	100.00
tblWater	AnaDigestCombDigestGasPercent	100.00	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00

tblWater	SepticTankPercent	10.33	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.7731	1.9301	1.3794	2.7500e-003	0.1458	0.0990	0.2448	0.0512	0.0931	0.1443	0.0000	252.1973	252.1973	0.0424	0.0000	253.2582
2018	0.5691	8.6000e-003	0.0102	2.0000e-005	3.5000e-004	5.5000e-004	9.1000e-004	9.0000e-005	5.5000e-004	6.4000e-004	0.0000	1.5707	1.5707	2.1000e-004	0.0000	1.5759
Maximum	**0.7731**	**1.9301**	**1.3794**	**2.7500e-003**	**0.1458**	**0.0990**	**0.2448**	**0.0512**	**0.0931**	**0.1443**	**0.0000**	**252.1973**	**252.1973**	**0.0424**	**0.0000**	**253.2582**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017	0.6678	1.7753	1.3876	2.7500e-003	0.1458	0.0537	0.1994	0.0512	0.0535	0.1047	0.0000	252.1971	252.1971	0.0424	0.0000	253.2580
2018	0.5686	0.0121	0.0106	2.0000e-005	3.5000e-004	4.8000e-004	8.4000e-004	9.0000e-005	4.8000e-004	5.8000e-004	0.0000	1.5707	1.5707	2.1000e-004	0.0000	1.5759
Maximum	**0.6678**	**1.7753**	**1.3876**	**2.7500e-003**	**0.1458**	**0.0537**	**0.1994**	**0.0512**	**0.0535**	**0.1047**	**0.0000**	**252.1971**	**252.1971**	**0.0424**	**0.0000**	**253.2580**

San Rafael High School Stadium Project - Marin County, Annual

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**7.89**	**7.81**	**-0.62**	**0.00**	**0.00**	**45.62**	**18.49**	**0.00**	**42.34**	**27.35**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**5-1-2017**	**7-31-2017**	1.1140	0.9110
2	**8-1-2017**	**10-31-2017**	0.6399	0.6086
3	**11-1-2017**	**1-31-2018**	1.5097	1.4863
		Highest	1.5097	1.4863

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.9642	0.0000	5.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	9.0000e-005	9.0000e-005	0.0000	0.0000	1.0000e-004
Energy	0.0292	0.2651	0.2227	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	613.4097	613.4097	0.0276	9.8600e-003	617.0363
Mobile	0.0159	0.0503	0.1672	4.3000e-004	0.0350	6.0000e-004	0.0356	9.4100e-003	5.7000e-004	9.9800e-003	0.0000	38.9766	38.9766	1.6100e-003	0.0000	39.0168
Waste						0.0000	0.0000		0.0000	0.0000	0.0873	0.0000	0.0873	5.1600e-003	0.0000	0.2163
Water						0.0000	0.0000		0.0000	0.0000	2.3814	6.6882	9.0696	8.6500e-003	5.2700e-003	10.8571
Total	**1.0093**	**0.3154**	**0.3899**	**2.0200e-003**	**0.0350**	**0.0208**	**0.0558**	**9.4100e-003**	**0.0207**	**0.0301**	**2.4687**	**659.0746**	**661.5432**	**0.0430**	**0.0151**	**667.1266**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.9642	0.0000	5.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	9.0000e-005	9.0000e-005	0.0000	0.0000	1.0000e-004
Energy	0.0292	0.2651	0.2227	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	613.4097	613.4097	0.0276	9.8600e-003	617.0363
Mobile	0.0159	0.0503	0.1672	4.3000e-004	0.0350	6.0000e-004	0.0356	9.4100e-003	5.7000e-004	9.9800e-003	0.0000	38.9766	38.9766	1.6100e-003	0.0000	39.0168
Waste						0.0000	0.0000		0.0000	0.0000	0.0873	0.0000	0.0873	5.1600e-003	0.0000	0.2163
Water						0.0000	0.0000		0.0000	0.0000	2.3814	6.6882	9.0696	8.6500e-003	5.2700e-003	10.8571
Total	**1.0093**	**0.3154**	**0.3899**	**2.0200e-003**	**0.0350**	**0.0208**	**0.0558**	**9.4100e-003**	**0.0207**	**0.0301**	**2.4687**	**659.0746**	**661.5432**	**0.0430**	**0.0151**	**667.1266**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

San Rafael High School Stadium Project - Marin County, Annual

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	5/1/2017	6/9/2017	5	30	
2	Site Preparation	Site Preparation	6/10/2017	7/7/2017	5	20	
3	Grading	Grading	7/8/2017	7/21/2017	5	10	
4	Building Construction	Building Construction	7/22/2017	11/24/2017	5	90	
5	Paving	Paving	11/25/2017	12/22/2017	5	20	
6	Architectural Coating	Architectural Coating	12/23/2017	1/5/2018	5	10	

Acres of Grading (Site Preparation Phase): 30

Acres of Grading (Grading Phase): 20

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 326,700; Non-Residential Outdoor: 108,900; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

San Rafael High School Stadium Project - Marin County, Annual

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	2	6.00	81	0.73
Demolition	Excavators	1	8.00	158	0.38
Demolition	Rubber Tired Dozers	0	8.00	247	0.40
Demolition	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Site Preparation	Graders	1	8.00	187	0.41
Site Preparation	Rubber Tired Dozers	1	8.00	247	0.40
Site Preparation	Scrapers	1	8.00	367	0.48
Site Preparation	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	2	8.00	187	0.41
Grading	Rubber Tired Dozers	0	8.00	247	0.40
Grading	Scrapers	1	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Building Construction	Cranes	0	7.00	231	0.29
Building Construction	Forklifts	2	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Building Construction	Welders	1	4.00	46	0.45
Paving	Cement and Mortar Mixers	1	8.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	1	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37
Architectural Coating	Aerial Lifts	1	8.00	63	0.31
Architectural Coating	Air Compressors	1	8.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	5	13.00	0.00	61.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	5	13.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	5	13.00	0.00	500.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	5	91.00	36.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	2	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.6400e-003	0.0000	6.6400e-003	1.0100e-003	0.0000	1.0100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0279	0.2460	0.2062	3.1000e-004		0.0167	0.0167		0.0159	0.0159	0.0000	27.9425	27.9425	5.9200e-003	0.0000	28.0905
Total	**0.0279**	**0.2460**	**0.2062**	**3.1000e-004**	**6.6400e-003**	**0.0167**	**0.0233**	**1.0100e-003**	**0.0159**	**0.0169**	**0.0000**	**27.9425**	**27.9425**	**5.9200e-003**	**0.0000**	**28.0905**

3.2 Demolition - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.9000e-004	0.0109	3.5700e-003	2.0000e-005	5.1000e-004	7.0000e-005	5.8000e-004	1.4000e-004	6.0000e-005	2.0000e-004	0.0000	2.4015	2.4015	1.4000e-004	0.0000	2.4050
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.0000e-004	6.9000e-004	6.5800e-003	2.0000e-005	1.5400e-003	1.0000e-005	1.5500e-003	4.1000e-004	1.0000e-005	4.2000e-004	0.0000	1.4996	1.4996	5.0000e-005	0.0000	1.5008
Total	**1.2900e-003**	**0.0116**	**0.0102**	**4.0000e-005**	**2.0500e-003**	**8.0000e-005**	**2.1300e-003**	**5.5000e-004**	**7.0000e-005**	**6.2000e-004**	**0.0000**	**3.9010**	**3.9010**	**1.9000e-004**	**0.0000**	**3.9058**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					6.6400e-003	0.0000	6.6400e-003	1.0100e-003	0.0000	1.0100e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0128	0.2679	0.2159	3.1000e-004		0.0102	0.0102		0.0102	0.0102	0.0000	27.9425	27.9425	5.9200e-003	0.0000	28.0905
Total	**0.0128**	**0.2679**	**0.2159**	**3.1000e-004**	**6.6400e-003**	**0.0102**	**0.0168**	**1.0100e-003**	**0.0102**	**0.0112**	**0.0000**	**27.9425**	**27.9425**	**5.9200e-003**	**0.0000**	**28.0905**

3.2 Demolition - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.9000e-004	0.0109	3.5700e-003	2.0000e-005	5.1000e-004	7.0000e-005	5.8000e-004	1.4000e-004	6.0000e-005	2.0000e-004	0.0000	2.4015	2.4015	1.4000e-004	0.0000	2.4050
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	9.0000e-004	6.9000e-004	6.5800e-003	2.0000e-005	1.5400e-003	1.0000e-005	1.5500e-003	4.1000e-004	1.0000e-005	4.2000e-004	0.0000	1.4996	1.4996	5.0000e-005	0.0000	1.5008
Total	**1.2900e-003**	**0.0116**	**0.0102**	**4.0000e-005**	**2.0500e-003**	**8.0000e-005**	**2.1300e-003**	**5.5000e-004**	**7.0000e-005**	**6.2000e-004**	**0.0000**	**3.9010**	**3.9010**	**1.9000e-004**	**0.0000**	**3.9058**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0761	0.0000	0.0761	0.0348	0.0000	0.0348	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0372	0.4352	0.2174	3.7000e-004		0.0202	0.0202		0.0186	0.0186	0.0000	33.9325	33.9325	0.0104	0.0000	34.1924
Total	**0.0372**	**0.4352**	**0.2174**	**3.7000e-004**	**0.0761**	**0.0202**	**0.0963**	**0.0348**	**0.0186**	**0.0534**	**0.0000**	**33.9325**	**33.9325**	**0.0104**	**0.0000**	**34.1924**

3.3 Site Preparation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0000e-004	4.6000e-004	4.3900e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.9997	0.9997	3.0000e-005	0.0000	1.0005
Total	**6.0000e-004**	**4.6000e-004**	**4.3900e-003**	**1.0000e-005**	**1.0200e-003**	**1.0000e-005**	**1.0300e-003**	**2.7000e-004**	**1.0000e-005**	**2.8000e-004**	**0.0000**	**0.9997**	**0.9997**	**3.0000e-005**	**0.0000**	**1.0005**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0761	0.0000	0.0761	0.0348	0.0000	0.0348	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0104	0.3063	0.2081	3.7000e-004		7.8900e-003	7.8900e-003		7.8900e-003	7.8900e-003	0.0000	33.9325	33.9325	0.0104	0.0000	34.1924
Total	**0.0104**	**0.3063**	**0.2081**	**3.7000e-004**	**0.0761**	**7.8900e-003**	**0.0840**	**0.0348**	**7.8900e-003**	**0.0427**	**0.0000**	**33.9325**	**33.9325**	**0.0104**	**0.0000**	**34.1924**

3.3 Site Preparation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.0000e-004	4.6000e-004	4.3900e-003	1.0000e-005	1.0200e-003	1.0000e-005	1.0300e-003	2.7000e-004	1.0000e-005	2.8000e-004	0.0000	0.9997	0.9997	3.0000e-005	0.0000	1.0005
Total	**6.0000e-004**	**4.6000e-004**	**4.3900e-003**	**1.0000e-005**	**1.0200e-003**	**1.0000e-005**	**1.0300e-003**	**2.7000e-004**	**1.0000e-005**	**2.8000e-004**	**0.0000**	**0.9997**	**0.9997**	**3.0000e-005**	**0.0000**	**1.0005**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0108	0.0000	0.0108	1.1800e-003	0.0000	1.1800e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0153	0.1925	0.1001	1.8000e-004		7.8700e-003	7.8700e-003		7.2400e-003	7.2400e-003	0.0000	17.0430	17.0430	5.2200e-003	0.0000	17.1736
Total	**0.0153**	**0.1925**	**0.1001**	**1.8000e-004**	**0.0108**	**7.8700e-003**	**0.0187**	**1.1800e-003**	**7.2400e-003**	**8.4200e-003**	**0.0000**	**17.0430**	**17.0430**	**5.2200e-003**	**0.0000**	**17.1736**

3.4 Grading - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.1900e-003	0.0895	0.0293	2.0000e-004	4.2000e-003	5.4000e-004	4.7400e-003	1.1600e-003	5.1000e-004	1.6700e-003	0.0000	19.6841	19.6841	1.1600e-003	0.0000	19.7132
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-004	2.3000e-004	2.1900e-003	1.0000e-005	5.1000e-004	0.0000	5.2000e-004	1.4000e-004	0.0000	1.4000e-004	0.0000	0.4999	0.4999	2.0000e-005	0.0000	0.5003
Total	**3.4900e-003**	**0.0897**	**0.0315**	**2.1000e-004**	**4.7100e-003**	**5.4000e-004**	**5.2600e-003**	**1.3000e-003**	**5.1000e-004**	**1.8100e-003**	**0.0000**	**20.1840**	**20.1840**	**1.1800e-003**	**0.0000**	**20.2135**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0108	0.0000	0.0108	1.1800e-003	0.0000	1.1800e-003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.2200e-003	0.1521	0.1069	1.8000e-004		3.8400e-003	3.8400e-003		3.8400e-003	3.8400e-003	0.0000	17.0430	17.0430	5.2200e-003	0.0000	17.1736
Total	**5.2200e-003**	**0.1521**	**0.1069**	**1.8000e-004**	**0.0108**	**3.8400e-003**	**0.0147**	**1.1800e-003**	**3.8400e-003**	**5.0200e-003**	**0.0000**	**17.0430**	**17.0430**	**5.2200e-003**	**0.0000**	**17.1736**

3.4 Grading - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	3.1900e-003	0.0895	0.0293	2.0000e-004	4.2000e-003	5.4000e-004	4.7400e-003	1.1600e-003	5.1000e-004	1.6700e-003	0.0000	19.6841	19.6841	1.1600e-003	0.0000	19.7132
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-004	2.3000e-004	2.1900e-003	1.0000e-005	5.1000e-004	0.0000	5.2000e-004	1.4000e-004	0.0000	1.4000e-004	0.0000	0.4999	0.4999	2.0000e-005	0.0000	0.5003
Total	**3.4900e-003**	**0.0897**	**0.0315**	**2.1000e-004**	**4.7100e-003**	**5.4000e-004**	**5.2600e-003**	**1.3000e-003**	**5.1000e-004**	**1.8100e-003**	**0.0000**	**20.1840**	**20.1840**	**1.1800e-003**	**0.0000**	**20.2135**

3.5 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0702	0.5414	0.4330	6.3000e-004		0.0403	0.0403		0.0384	0.0384	0.0000	55.4196	55.4196	0.0109	0.0000	55.6912
Total	**0.0702**	**0.5414**	**0.4330**	**6.3000e-004**		**0.0403**	**0.0403**		**0.0384**	**0.0384**	**0.0000**	**55.4196**	**55.4196**	**0.0109**	**0.0000**	**55.6912**

3.5 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0117	0.2222	0.1009	4.4000e-004	0.0106	2.1300e-003	0.0127	3.0600e-003	2.0400e-003	5.1000e-003	0.0000	42.1941	42.1941	2.4600e-003	0.0000	42.2556
Worker	0.0190	0.0144	0.1382	3.5000e-004	0.0323	2.4000e-004	0.0325	8.5800e-003	2.2000e-004	8.8000e-003	0.0000	31.4910	31.4910	1.0000e-003	0.0000	31.5160
Total	**0.0306**	**0.2366**	**0.2390**	**7.9000e-004**	**0.0429**	**2.3700e-003**	**0.0452**	**0.0116**	**2.2600e-003**	**0.0139**	**0.0000**	**73.6851**	**73.6851**	**3.4600e-003**	**0.0000**	**73.7715**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0268	0.5419	0.4262	6.3000e-004		0.0227	0.0227		0.0227	0.0227	0.0000	55.4195	55.4195	0.0109	0.0000	55.6912
Total	**0.0268**	**0.5419**	**0.4262**	**6.3000e-004**		**0.0227**	**0.0227**		**0.0227**	**0.0227**	**0.0000**	**55.4195**	**55.4195**	**0.0109**	**0.0000**	**55.6912**

3.5 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0117	0.2222	0.1009	4.4000e-004	0.0106	2.1300e-003	0.0127	3.0600e-003	2.0400e-003	5.1000e-003	0.0000	42.1941	42.1941	2.4600e-003	0.0000	42.2556
Worker	0.0190	0.0144	0.1382	3.5000e-004	0.0323	2.4000e-004	0.0325	8.5800e-003	2.2000e-004	8.8000e-003	0.0000	31.4910	31.4910	1.0000e-003	0.0000	31.5160
Total	**0.0306**	**0.2366**	**0.2390**	**7.9000e-004**	**0.0429**	**2.3700e-003**	**0.0452**	**0.0116**	**2.2600e-003**	**0.0139**	**0.0000**	**73.6851**	**73.6851**	**3.4600e-003**	**0.0000**	**73.7715**

3.6 Paving - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0166	0.1667	0.1221	1.8000e-004		0.0103	0.0103		9.5200e-003	9.5200e-003	0.0000	16.3499	16.3499	4.9200e-003	0.0000	16.4728
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0166**	**0.1667**	**0.1221**	**1.8000e-004**		**0.0103**	**0.0103**		**9.5200e-003**	**9.5200e-003**	**0.0000**	**16.3499**	**16.3499**	**4.9200e-003**	**0.0000**	**16.4728**

3.6 Paving - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.9000e-004	5.3000e-004	5.0600e-003	1.0000e-005	1.1800e-003	1.0000e-005	1.1900e-003	3.1000e-004	1.0000e-005	3.2000e-004	0.0000	1.1535	1.1535	4.0000e-005	0.0000	1.1544
Total	**6.9000e-004**	**5.3000e-004**	**5.0600e-003**	**1.0000e-005**	**1.1800e-003**	**1.0000e-005**	**1.1900e-003**	**3.1000e-004**	**1.0000e-005**	**3.2000e-004**	**0.0000**	**1.1535**	**1.1535**	**4.0000e-005**	**0.0000**	**1.1544**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	7.3400e-003	0.1561	0.1297	1.8000e-004		5.5800e-003	5.5800e-003		5.5800e-003	5.5800e-003	0.0000	16.3499	16.3499	4.9200e-003	0.0000	16.4728
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**7.3400e-003**	**0.1561**	**0.1297**	**1.8000e-004**		**5.5800e-003**	**5.5800e-003**		**5.5800e-003**	**5.5800e-003**	**0.0000**	**16.3499**	**16.3499**	**4.9200e-003**	**0.0000**	**16.4728**

3.6 Paving - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.9000e-004	5.3000e-004	5.0600e-003	1.0000e-005	1.1800e-003	1.0000e-005	1.1900e-003	3.1000e-004	1.0000e-005	3.2000e-004	0.0000	1.1535	1.1535	4.0000e-005	0.0000	1.1544
Total	**6.9000e-004**	**5.3000e-004**	**5.0600e-003**	**1.0000e-005**	**1.1800e-003**	**1.0000e-005**	**1.1900e-003**	**3.1000e-004**	**1.0000e-005**	**3.2000e-004**	**0.0000**	**1.1535**	**1.1535**	**4.0000e-005**	**0.0000**	**1.1544**

3.7 Architectural Coating - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5679					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.2300e-003	9.3200e-003	8.9700e-003	1.0000e-005		6.5000e-004	6.5000e-004		6.4000e-004	6.4000e-004	0.0000	1.2404	1.2404	2.1000e-004	0.0000	1.2456
Total	**0.5691**	**9.3200e-003**	**8.9700e-003**	**1.0000e-005**		**6.5000e-004**	**6.5000e-004**		**6.4000e-004**	**6.4000e-004**	**0.0000**	**1.2404**	**1.2404**	**2.1000e-004**	**0.0000**	**1.2456**

3.7 Architectural Coating - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.1000e-004	1.6000e-004	1.5200e-003	0.0000	3.5000e-004	0.0000	3.6000e-004	9.0000e-005	0.0000	1.0000e-004	0.0000	0.3461	0.3461	1.0000e-005	0.0000	0.3463
Total	**2.1000e-004**	**1.6000e-004**	**1.5200e-003**	**0.0000**	**3.5000e-004**	**0.0000**	**3.6000e-004**	**9.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3461**	**0.3461**	**1.0000e-005**	**0.0000**	**0.3463**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5679					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.8000e-004	0.0119	9.2900e-003	1.0000e-005		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	1.2404	1.2404	2.1000e-004	0.0000	1.2456
Total	**0.5684**	**0.0119**	**9.2900e-003**	**1.0000e-005**		**4.8000e-004**	**4.8000e-004**		**4.8000e-004**	**4.8000e-004**	**0.0000**	**1.2404**	**1.2404**	**2.1000e-004**	**0.0000**	**1.2456**

3.7 Architectural Coating - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	2.1000e-004	1.6000e-004	1.5200e-003	0.0000	3.5000e-004	0.0000	3.6000e-004	9.0000e-005	0.0000	1.0000e-004	0.0000	0.3461	0.3461	1.0000e-005	0.0000	0.3463
Total	**2.1000e-004**	**1.6000e-004**	**1.5200e-003**	**0.0000**	**3.5000e-004**	**0.0000**	**3.6000e-004**	**9.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3461**	**0.3461**	**1.0000e-005**	**0.0000**	**0.3463**

3.7 Architectural Coating - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5679					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.1000e-003	8.4600e-003	8.9100e-003	1.0000e-005		5.5000e-004	5.5000e-004		5.5000e-004	5.5000e-004	0.0000	1.2342	1.2342	2.0000e-004	0.0000	1.2393
Total	**0.5690**	**8.4600e-003**	**8.9100e-003**	**1.0000e-005**		**5.5000e-004**	**5.5000e-004**		**5.5000e-004**	**5.5000e-004**	**0.0000**	**1.2342**	**1.2342**	**2.0000e-004**	**0.0000**	**1.2393**

3.7 Architectural Coating - 2018

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.9000e-004	1.4000e-004	1.3300e-003	0.0000	3.5000e-004	0.0000	3.6000e-004	9.0000e-005	0.0000	1.0000e-004	0.0000	0.3364	0.3364	1.0000e-005	0.0000	0.3367
Total	**1.9000e-004**	**1.4000e-004**	**1.3300e-003**	**0.0000**	**3.5000e-004**	**0.0000**	**3.6000e-004**	**9.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3364**	**0.3364**	**1.0000e-005**	**0.0000**	**0.3367**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.5679					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	5.8000e-004	0.0119	9.2900e-003	1.0000e-005		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	1.2342	1.2342	2.0000e-004	0.0000	1.2393
Total	**0.5684**	**0.0119**	**9.2900e-003**	**1.0000e-005**		**4.8000e-004**	**4.8000e-004**		**4.8000e-004**	**4.8000e-004**	**0.0000**	**1.2342**	**1.2342**	**2.0000e-004**	**0.0000**	**1.2393**

3.7 Architectural Coating - 2018

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.9000e-004	1.4000e-004	1.3300e-003	0.0000	3.5000e-004	0.0000	3.6000e-004	9.0000e-005	0.0000	1.0000e-004	0.0000	0.3364	0.3364	1.0000e-005	0.0000	0.3367
Total	**1.9000e-004**	**1.4000e-004**	**1.3300e-003**	**0.0000**	**3.5000e-004**	**0.0000**	**3.6000e-004**	**9.0000e-005**	**0.0000**	**1.0000e-004**	**0.0000**	**0.3364**	**0.3364**	**1.0000e-005**	**0.0000**	**0.3367**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0159	0.0503	0.1672	4.3000e-004	0.0350	6.0000e-004	0.0356	9.4100e-003	5.7000e-004	9.9800e-003	0.0000	38.9766	38.9766	1.6100e-003	0.0000	39.0168
Unmitigated	0.0159	0.0503	0.1672	4.3000e-004	0.0350	6.0000e-004	0.0356	9.4100e-003	5.7000e-004	9.9800e-003	0.0000	38.9766	38.9766	1.6100e-003	0.0000	39.0168

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Arena	68.00	0.00	0.00	94,323	94,323
Total	68.00	0.00	0.00	94,323	94,323

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Arena	9.50	7.30	7.30	0.00	81.00	19.00	66	28	6

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Arena	0.577091	0.045512	0.202682	0.115815	0.019822	0.005054	0.010113	0.010039	0.001995	0.004376	0.006002	0.000679	0.000822

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	324.8196	324.8196	0.0221	4.5600e-003	326.7312
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	324.8196	324.8196	0.0221	4.5600e-003	326.7312
NaturalGas Mitigated	0.0292	0.2651	0.2227	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	288.5901	288.5901	5.5300e-003	5.2900e-003	290.3050
NaturalGas Unmitigated	0.0292	0.2651	0.2227	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	288.5901	288.5901	5.5300e-003	5.2900e-003	290.3050

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Arena	5.40797e+006	0.0292	0.2651	0.2227	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	288.5901	288.5901	5.5300e-003	5.2900e-003	290.3050
Total		**0.0292**	**0.2651**	**0.2227**	**1.5900e-003**		**0.0202**	**0.0202**		**0.0202**	**0.0202**	**0.0000**	**288.5901**	**288.5901**	**5.5300e-003**	**5.2900e-003**	**290.3050**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Arena	5.40797e+006	0.0292	0.2651	0.2227	1.5900e-003		0.0202	0.0202		0.0202	0.0202	0.0000	288.5901	288.5901	5.5300e-003	5.2900e-003	290.3050
Total		**0.0292**	**0.2651**	**0.2227**	**1.5900e-003**		**0.0202**	**0.0202**		**0.0202**	**0.0202**	**0.0000**	**288.5901**	**288.5901**	**5.5300e-003**	**5.2900e-003**	**290.3050**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Arena	1.67706e+006	324.8196	0.0221	4.5600e-003	326.7312
Total		**324.8196**	**0.0221**	**4.5600e-003**	**326.7312**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Arena	1.67706e +006	324.8196	0.0221	4.5600e-003	326.7312
Total		**324.8196**	**0.0221**	**4.5600e-003**	**326.7312**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.9642	0.0000	5.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	9.0000e-005	9.0000e-005	0.0000	0.0000	1.0000e-004
Unmitigated	0.9642	0.0000	5.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	9.0000e-005	9.0000e-005	0.0000	0.0000	1.0000e-004

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1136					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8506					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	5.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	9.0000e-005	9.0000e-005	0.0000	0.0000	1.0000e-004
Total	**0.9642**	**0.0000**	**5.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**9.0000e-005**	**9.0000e-005**	**0.0000**	**0.0000**	**1.0000e-004**

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.1136					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.8506					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0000	0.0000	5.0000e-005	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	9.0000e-005	9.0000e-005	0.0000	0.0000	1.0000e-004
Total	**0.9642**	**0.0000**	**5.0000e-005**	**0.0000**		**0.0000**	**0.0000**		**0.0000**	**0.0000**	**0.0000**	**9.0000e-005**	**9.0000e-005**	**0.0000**	**0.0000**	**1.0000e-004**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	9.0696	8.6500e-003	5.2700e-003	10.8571
Unmitigated	9.0696	8.6500e-003	5.2700e-003	10.8571

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Arena	6.73078 / 0.429624	9.0696	8.6500e-003	5.2700e-003	10.8571
Total		**9.0696**	**8.6500e-003**	**5.2700e-003**	**10.8571**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Arena	6.73078 / 0.429624	9.0696	8.6500e-003	5.2700e-003	10.8571
Total		**9.0696**	**8.6500e-003**	**5.2700e-003**	**10.8571**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	0.0873	5.1600e-003	0.0000	0.2163
Unmitigated	0.0873	5.1600e-003	0.0000	0.2163

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Arena	0.43	0.0873	5.1600e-003	0.0000	0.2163
Total		**0.0873**	**5.1600e-003**	**0.0000**	**0.2163**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Arena	0.43	0.0873	5.1600e-003	0.0000	0.2163
Total		**0.0873**	**5.1600e-003**	**0.0000**	**0.2163**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Summary of ISCST3 Model Parameters, Assumptions, and Results for Construction of the Stadium Project

ISCST3 Model Parameters and Assumptions			
Source Type	**Units**	**Value**	**Notes**
Volume Source: Off-Road Equipment Exhaust (Unmitigated)			
Hours/Work Day	hours/day	8	Based on project description
DPM Emission Rate	gram/second	0.01690	Unmitigated exhaust PM10 from off-road equipment
Number of Sources	count	151	SMAQMD, 2015
Emission Rate/Source	gram/second	0.000112	
Release Height	meters	5.0	SMAQMD, 2015
Length of Side	meters	10.0	SMAQMD, 2015
Initial Lateral Dimension	meters	2.3	ISCST3 Calculator
Initial Vertical Dimension	meters	1.0	SMAQMD, 2015
Volume Source: Off-Road Equipment Exhaust (Mitigated with Tier 2 or higher engines)			
Hours/Work Day	hours/day	8	Based on project description
DPM Emission Rate	gram/second	0.00896	Unmitigated exhaust PM10 from off-road equipment
Number of Sources	count	151	SMAQMD, 2015
Emission Rate/Source	gram/second	0.000059	
Release Height	meters	5.0	SMAQMD, 2015
Length of Side	meters	10.0	SMAQMD, 2015
Initial Lateral Dimension	meters	2.3	ISCST3 Calculator
Initial Vertical Dimension	meters	1.0	SMAQMD, 2015

ISCST3 Model Results			
Emissions Source	**Pollutant**	**Annual Average Concentration**	**Notes**
Off-Road Equipment (Unmitigated)	DPM ($\mu g/m^{3)}$)	0.081	At maximum exposed individual student (MEIS) location
		0.159	At maximum exposed individual resident (MEIR) location
	PM2.5 ($\mu g/m^{3)}$)	0.076	At maximum exposed individual student (MEIS) location
		0.150	At maximum exposed individual resident (MEIR) location
Off-Road Equipment (Mitigated with Tier 2 or higher engines)	DPM ($\mu g/m^{3)}$)	0.043	At maximum exposed individual student (MEIS) location
		0.084	At maximum exposed individual resident (MEIR) location
	PM2.5 ($\mu g/m^{3)}$)	0.040	At maximum exposed individual student (MEIS) location
		0.079	At maximum exposed individual resident (MEIR) location

Notes:
DPM = diesel particulate matter
PM10 = particulate matter with aerodynamic resistance diameters equal to or less than 10 microns
PM2.5 = particulate matter with aerodynamic resistance diameters equal to or less than 2.5 microns
$\mu g/m^3$ = micrograms per cubic meter
Sacramento Metropolitan Air Quality Management District (SMAQMD), 2015. *Guide to Air Quality Assessment in Sacramento County* . June.
Bay Area Air Quality Management District (BAAQMD), 2012. *Recommended Methods for Screening and Modeling Local Risks and Hazards* .

Summary of Health Risk Assessment for Unmitigated DPM Emissions during Construction of the Stadium Project

Maximally Exposed Individual Student (Unmitigated) Health Risk Assessment Parameters and Results			
Inhalation Cancer Risk Assessment for DPM	**Units**	**Age Group 2-16 years**	**Notes**
DPM Concentration (C)	μg/m^3	0.0810	ISCST3 Annual Average
Worker Adjustment Factor (WAF)	unitless	4.2	Adjustment factor for 8-hour construction day (OEHHA, 2015)
Discount Factor (DF)	unitless	1.0	OEHHA, 2015 (conservative assumption)
Daily Breathing Rate (DBR)	L/kg-day	520	95th percentile for moderate intensity activity over an 8-hour period (OEHHA, 2015)
Inhalation absorption factor (A)	unitless	1.0	OEHHA, 2015
Exposure Frequency (EF)	unitless	1.0	OEHHA, 2015 (conservative assumption)
Dose Conversion Factor (CF_D)	mg-m^3/μg-L	0.000001	Conversion of μg to mg and L to m^3
Dose	mg/kg/day	0.00018	C*WAF*DF*DBR*A*EF*CF_D (OEHHA, 2015)
Cancer Potency Factor (CPF)	(mg/kg/day)$^{-1}$	1.1	OEHHA, 2015
Age Sensitivity Factor (ASF)	unitless	3	OEHHA, 2015
Annual Exposure Duration (ED)	years	0.69	180 work days converted to calendar year
Averaging Time (AT)	years	70	OEHHA, 2015
Cancer Risk Conversion Factor (CF)	m^3/L	1000000	Chances per million (OEHHA, 2015)
Cancer Risk	per million	5.8	D*CPF*ASF*ED/AT*CF (OEHHA, 2015)
Hazard Index for DPM	**Units**	**Value**	**Notes**
Chronic REL	μg/m^3	5.0	OEHHA, 2015
Chronic Hazard Index for DPM	unitless	0.02	At MEIS location

Maximally Exposed Individual Resident (Unmitigated) Health Risk Assessment Parameters and Results			
Inhalation Cancer Risk Assessment for DPM	**Units**	**Age Group 0-2 years**	**Notes**
DPM Concentration (C)	μg/m^3	0.1590	ISCST3 Annual Average
Daily Breathing Rate (DBR)	L/kg-day	1090	95th percentile (OEHHA, 2015)
Inhalation absorption factor (A)	unitless	1.0	OEHHA, 2015
Exposure Frequency (EF)	unitless	0.96	350 days/365 days in a year (OEHHA, 2015)
Dose Conversion Factor (CF_D)	mg-m^3/μg-L	0.000001	Conversion of μg to mg and L to m^3
Dose	mg/kg/day	0.00017	C*DBR*A*EF*CF_D (OEHHA, 2015)
Cancer Potency Factor (CPF)	(mg/kg/day)$^{-1}$	1.1	OEHHA, 2015
Age Sensitivity Factor (ASF)	unitless	10	OEHHA, 2015
Annual Exposure Duration (ED)	years	0.69	180 work days converted to calendar year
Averaging Time (AT)	years	70	70 years for residents (OEHHA, 2015)
Fraction of time at home (FAH)	unitless	0.85	OEHHA, 2015
Cancer Risk Conversion Factor (CF)	m^3/L	1000000	Chances per million (OEHHA, 2015)
Cancer Risk	per million	15.3	D*CPF*ASF*ED/AT*FAH*CF (OEHHA, 2015)
Hazard Index for DPM	**Units**	**Value**	**Notes**
Chronic REL	μg/m^3	5.0	OEHHA, 2015
Chronic Hazard Index for DPM	unitless	0.03	At MEIR location

Notes:

DPM = diesel particulate matter

REL = reference exposure level

μg/m^3 = micrograms per cubic meter

L/kg-day = liters per kilogram-day

m^3/L = cubic meters per liter

(mg/kg/day)$^{-1}$ = 1/milligrams per kilograms per day

MEIS = maximally exposed individual student

MEIR = maximally exposed individual resident

Office of Environmental Health Hazard Assessment (OEHHA), 2015. *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. February.*

Summary of Health Risk Assessment for Mitigated DPM Emissions during Construction of the Stadium Project

Maximally Exposed Individual Student (Mitigated with Tier 2 engines) Health Risk Assessment Parameters and Results			
Inhalation Cancer Risk Assessment for DPM	**Units**	**Age Group 2-16 years**	**Notes**
DPM Concentration (C)	μg/m^3	0.0430	ISCST3 Annual Average
Worker Adjustment Factor (WAF)	unitless	4.2	Adjustment factor for 8-hour construction day (OEHHA, 2015)
Discount Factor (DF)	unitless	1.0	OEHHA, 2015 (conservative assumption)
Daily Breathing Rate (DBR)	L/kg-day	520	95th percentile for moderate intensity activity over an 8-hour period (OEHHA, 2015)
Inhalation absorption factor (A)	unitless	1.0	OEHHA, 2015
Exposure Frequency (EF)	unitless	1.0	OEHHA, 2015 (conservative assumption)
Dose Conversion Factor (CF_D)	mg-m^3/μg-L	0.000001	Conversion of μg to mg and L to m^3
Dose	mg/kg/day	0.00009	C*WAF*DF*DBR*A*EF*CF_D (OEHHA, 2015)
Cancer Potency Factor (CPF)	(mg/kg/day)$^{-1}$	1.1	OEHHA, 2015
Age Sensitivity Factor (ASF)	unitless	3	OEHHA, 2015
Annual Exposure Duration (ED)	years	0.69	180 work days converted to calendar year
Averaging Time (AT)	years	70	OEHHA, 2015
Cancer Risk Conversion Factor (CF)	m^3/L	1000000	Chances per million (OEHHA, 2015)
Cancer Risk	per million	3.1	D*CPF*ASF*ED/AT*CF (OEHHA, 2015)
Hazard Index for DPM	**Units**	**Value**	**Notes**
Chronic REL	μg/m^3	5.0	OEHHA, 2015
Chronic Hazard Index for DPM	unitless	0.01	At MEIS location

Maximally Exposed Individual Resident (Mitigated with Tier 2 engines) Health Risk Assessment Parameters and Results			
Inhalation Cancer Risk Assessment for DPM	**Units**	**Age Group 0-2 years**	**Notes**
DPM Concentration (C)	μg/m^3	0.0840	ISCST3 Annual Average
Daily Breathing Rate (DBR)	L/kg-day	1090	95th percentile for residential (OEHHA, 2015)
Inhalation absorption factor (A)	unitless	1.0	OEHHA, 2015
Exposure Frequency (EF)	unitless	0.96	350 days/365 days in a year (OEHHA, 2015)
Dose Conversion Factor (CF_D)	mg-m^3/μg-L	0.000001	Conversion of μg to mg and L to m^3
Dose	mg/kg/day	0.00009	C*DBR*A*EF*CF_D (OEHHA, 2015)
Cancer Potency Factor (CPF)	(mg/kg/day)$^{-1}$	1.1	OEHHA, 2015
Age Sensitivity Factor (ASF)	unitless	10	OEHHA, 2015
Annual Exposure Duration (ED)	years	0.69	180 work days converted to calendar year
Averaging Time (AT)	years	70	70 years for residents (OEHHA, 2015)
Fraction of time at home (FAH)	unitless	0.85	OEHHA, 2015
Cancer Risk Conversion Factor (CF)	m^3/L	1000000	Chances per million (OEHHA, 2015)
Cancer Risk	per million	8.1	D*CPF*ASF*ED/AT*FAH*CF (OEHHA, 2015)
Hazard Index for DPM	**Units**	**Value**	**Notes**
Chronic REL	μg/m^3	5.0	OEHHA, 2015
Chronic Hazard Index for DPM	unitless	0.02	At MEIR location

Notes:

DPM = diesel particulate matter

REL = reference exposure level

μg/m^3 = micrograms per cubic meter

L/kg-day = liters per kilogram-day

m^3/L = cubic meters per liter

(mg/kg/day)$^{-1}$ = 1/milligrams per kilograms per day

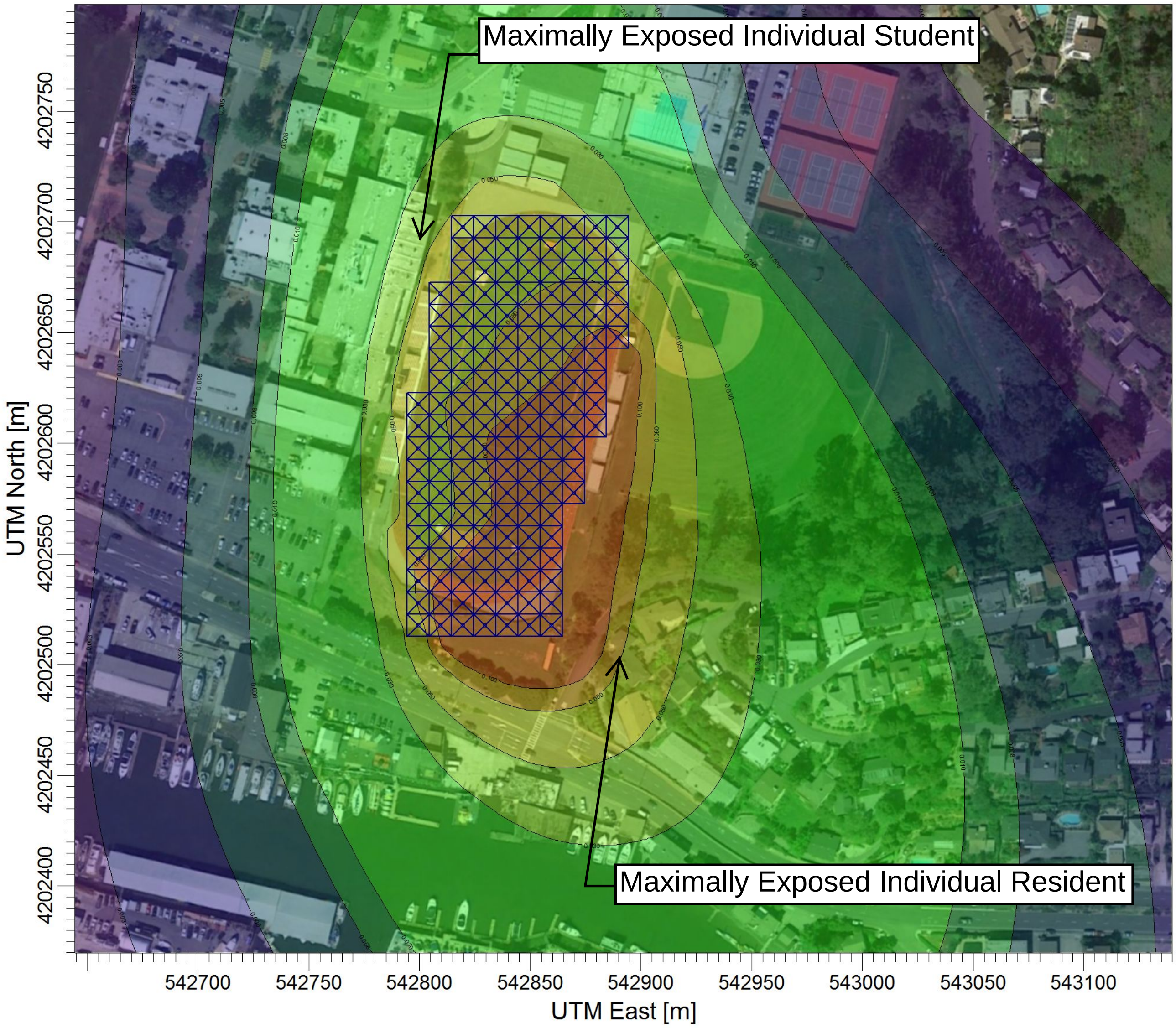
MEIS = maximally exposed individual student

MEIR = maximally exposed individual resident

Office of Environmental Health Hazard Assessment (OEHHA), 2015. *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. February.*

PROJECT TITLE:

C:\Users\BASELINE\Documents\Projects\16221-00 ASC San Rafael HS\SRHS



PLOT FILE OF ANNUAL VALUES FOR SOURCE GROUP: ALL

ug/m^3

Max: 0.162 [ug/m^3] at (542849.50, 4202517.50)

0.002 0.003 0.005 0.008 0.010 0.030 0.050 0.080 0.100 0.162

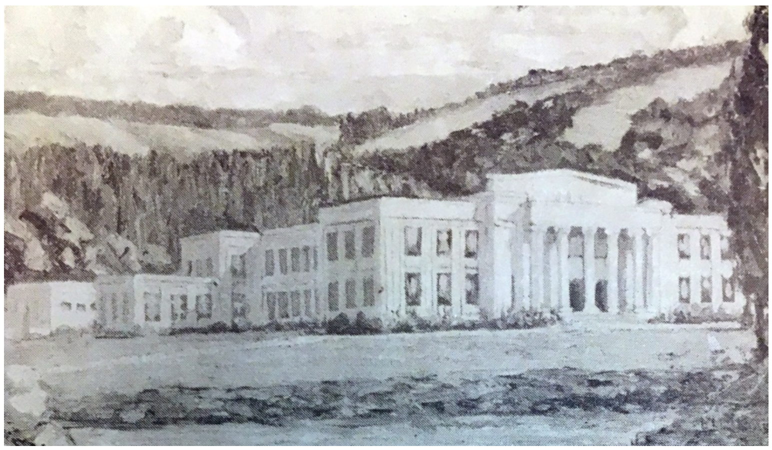
COMMENTS:	SOURCES: **151**	COMPANY NAME: **BASELINE Environmental Consulting**	
	RECEPTORS: **4915**		
	OUTPUT TYPE: **Concentration**	SCALE: 1:3,116 0 — 0.1 km	
	MAX: **0.162 ug/m^3**	DATE: **11/9/2016**	PROJECT NO.:

APPENDIX C
HISTORIC AND CULTURAL RESOURCES STUDIES

DRAFT
HISTORIC RESOURCE EVALUATION

San Rafael High School
185 Mission Avenue
San Rafael, CA 94901

October 30, 2016



Prepared for
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INTERACTIVE RESOURCES
Architects & Engineers

Contents

Introduction

At the request of the San Rafael City Schools District (District), Interactive Resources, Inc. (IR) has undertaken a Historic Resource Evaluation of the San Rafael High School (SRHS) campus located between Mission Avenue, 3rd Street, Union Street and Embarcadero Way, in San Rafael, California. As part of the environmental review process for the SRHS Master Facilities Implementation Plan, including the proposed Stadium Project, the District has requested that a historic resource evaluation be completed for the entire campus, as many of the existing buildings were constructed over fifty years ago. This report is intended to provide a historical evaluation of the campus and its buildings through a thorough analysis of the property, its history, and its historical associations in order to determine if the campus or any portion thereof qualifies as historical resources as defined by the California Environmental Quality Act (CEQA). The evaluation addresses the significance criteria of the National Register of Historic Places, the California Register Historical Resources and the City of San Rafael landmark designation.

Methodology

IR prepared this historic resource evaluation by reviewing existing materials provided by the client, undertaking targeted archival research, and conducting a site visit to inspect the property and buildings and take photographs. Archival research was carried out at the San Rafael City Schools Map Room, the Anne T. Kent California Room in the Marin County Free Library and through numerous on-line sources. The site visit was conducted on September 15, 2016.

Records Search

A records search was conducted at the Northwest Information Center of the California Historical Resource Information System (CHRIS) in Rohnert Park, California.

As part of the records search, the following local and state inventories for built environment cultural resources in and adjacent to the study area:

- *California Inventory of Historic Resources* (California Department of Parks and Recreation 1976);
- *Five Views: An Ethnic Historic Site Survey for California* (California Office of Historic Preservation 1988);
- *California Points of Historical Interest* (California Office of Historic Preservation 1992);
- *California Historical Landmarks* (California Office of Historic Preservation 1996);
- *An Architectural Guidebook to San Francisco and the Bay Area* (Cerny 2007); and
- *Directory of Properties in the Historic Property Data File* (California Office of Historic Preservation April 5, 2012). The directory includes the listings of the NRHP, National Historic Landmarks, the CRHR, California Historical Landmarks, and California Points of Historical Interest.

Literature and Map Review

IR reviewed the following publications, maps, and websites for historical information about the study area and its vicinity:

- *California Place Names* (Gudde 1998);
- *Historic Spots in California* (Hoover et al. 1990);
- *Historical Atlas of California* (Hayes 2007);
- *Tamalpais Quadrangle, California.*, 60-minute topographic quadrangle (U.S. Geological Survey 1941);
- *San Rafael, Calif.*, 7.5-minute topographic quadrangle (U.S. Geological Survey 1954, 1968, 1980, 1995);
- *Historical aerial photographs of San Rafael* (Nationwide Environmental Title Research, 1946, 1952, 1958, 1968, 1993, 2002, and 2012);
- Online Archive of California at http://www.oac.cdlib.org;
- Calisphere at http://www.calisphere.universityofcalifornia.edu; and
- California Digital Newspaper Collection at http://cdnc.ucr.edu.

Evaluation Summary

CEQA defines a "historical resource" as any resource that meets one or more of the following criteria:

- Listed in, or eligible for listing in, the California Register of Historical Resources;
- Listed in a local register of historical resources;
- Identified as significant in an historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code; or
- Determined to be an historical resource by a project's lead agency.

The following evaluation was based on the eligibility criteria for the National Register of Historic Places (NRHP) which requires that the resource be at least fifty years old (except under special circumstances), that it retain its historic integrity, and that it be significant under at least one of four criteria. These four criteria include: association with historic events, association with important persons, distinctive design or physical characteristics, and the potential to provide important information about history or prehistory. In determining National Register eligibility, the author weighed known historical associations, architectural merit, and the current level of integrity. The historic significance of the property was also evaluated using the established criteria of the California Register of Historical Resources (CRHR) in order to assess eligibility for listing in the state register. Finally, the City of San Rafael maintains a historic resource inventory and a set of criteria for the local designation of historic landmarks and districts. The City's specific criteria for listing were also used to evaluate the subject property.

The buildings on the SRHS campus are not currently listed in the NRHP or CRHR or as a City of San Rafael local landmark or historic district. The campus' address, 185 Mission Street, was identified in the *San Rafael Historical/Architectural Survey (Survey)* and was given a property classification ranking of "good" (Charles Hall Page & Associates, Inc., 1986). The *Survey* provides only the property address without any further description, and therefore it is not immediately clear if any of the campus buildings other than the original high school building (Building A, see Figure 6) were intended for inclusion. However, given that the survey was initially conducted in 1976, the only building on the campus that would have been over fifty years old at the time was Building A, the original San Rafael High School building; therefore, it is assumed that the document is only referring to the original building. Further, the listing in the Office of Historic Preservation's Historic Property Database (2012), which is based off of the *Survey,* clearly is referring to only Building A by identifying a 1924 construction date and assigning the property a State Inventory Code of "3S", which means the resource appears eligible the NRHP as an individual property through a survey evaluation (California Office of Historic Preservation, 2004). Identifying the resource as an individual property indicates that only one building is included and that the building is not being considered as part of a district.

The original high school building (Building A) at San Rafael High School is associated with the development of secondary public education in the City of San Rafael and Marin County in the early 20th century. The development of the campus at Mission Street began with the completion of "Old Main" (Building A) in 1925, following the significant increase in the student population that made the original school building on 4th Street obsolete and the local residents' decision to maintain a high school dedicated solely to San Rafael. Building A is also associated with the architect Frank T. Shea and is an exceptional example of the Neoclassical style.

Building A appears to maintain significance under NRHP/CRHR Criterion A/1 as being associated with the development of secondary public education in San Rafael and under Criterion C/3 as being an exceptional example of the Neoclassical style as designed by architect Frank T. Shea. Based on these findings and the inclusion of the building in the *San Rafael Historical/Architectural Survey*, it appears that Building A, the original San Rafael High School building at the 185 Mission Street campus, would be considered a potential historical resource under CEQA (CCR Title 14(3) §15064.5).

All of the other campus buildings were designed to be subordinate to the original Neoclassical building. The design of the northern section of the gymnasium, constructed in 1930, took some cues from the Neoclassical style with the minor decorative elements included on the east and west façades; however, by 1934 when the next building (Building M, see Figure 6) was constructed, the Neoclassical style was abandoned and a simple, utilitarian approach became the language for new development on the campus. Due to their lack of significance under any of the four CRHR criteria, none of the other campus buildings appear to qualify as historical resources under CEQA.

Historical Context

Summary History of San Rafael

In 1817, Mission San Rafael Arcangel, an adjunct of the Mission San Francisco de Dolores in San Francisco, was established in the region that would become the city of San Rafael. The mission was established as a hospital for ill Native American neophytes. Following the secularization of the Mexican missions, a land grant known as Rancho San Pablo that contained the former Mission San Rafael Arcangel was given to Timoteo (Timothy) Murphy. The town of San Rafael began to develop in the mid-1800s as an agricultural center for the region. After California achieved statehood in 1848, Marin County was established as one of the state's first 27 counties, and San Rafael was identified as one the county's four original townships and as the county seat. In 1866, the editor of the *Marin County Journal* published the following recollection of San Rafael circa 1851 (Miller, 1958):

> San Rafael boasted ten houses besides the Mission buildings; one store, one boarding house, and one whiskey mill. The buildings were all makeshifts except the residence of the late Timothy Murphy now owned and used by the county as a Court House; no fencing or other improvements were visible save a corral or two.

The first public school districts were established in Marin County in 1855. San Rafael was included in District 2 along with Sausalito, Corte Madera, Novato, Bolinas, and Punta de los Reyes. While schools opened in neighboring towns, a public school was not organized in San Rafael until 1861, at which time The San Rafael Institute was converted from a private school to a public school, serving only the primary grades.

Early on, San Rafael grew quite slowly due its lack of industry and isolation from San Francisco. The coming of the ferry and the railroad in the late 1800s changed the character of San Rafael, as commuting to San Francisco became a possibility. The area was no longer available to just a few wealthy residents and vacationers looking for good weather, but now to people of more moderate means who could work in San Francisco and permanently reside in Marin County. The population jumped from 841 people in 1870 to 2,276 in 1880 due to easier access across San Francisco Bay.

The development of San Rafael centered around Timothy Murphy's former adobe at 4th and C Streets, which would serve briefly as the county courthouse until a new courthouse was constructed in 1872. The town was laid out in a typical block pattern, and 4th Street became the primary commercial corridor. San Rafael was formally incorporated in 1874. The rail line via ferry continued to be the only way to travel between San Francisco and San Rafael until the construction of the Golden Gate Bridge in 1937 greatly improved access (Kyle, 2002; Miller, 1958; Spitz, 2006).

Summary History of San Rafael High School and the Subject Property

For the first few decades of public education in San Rafael, there was no high school available. Public education extended only through the 8th grade; after that point, parents sent their children to private boarding schools or to schools in San Francisco. San Rafael High School as an institution was established in 1888, following the approval of the school district and a special election of the residents. The first high school was established in a single room in the grammar school on 4th Street. Once a school bond was passed by voters in 1898, funding was available to construct a building for the newly established high school. The first San Rafael High School building, constructed on a site at 4th and E Streets, opened in 1899. The two-story building contained 15 classrooms, a gymnasium, and an assembly hall and served as the only high school in Marin County until 1908 (Miller, 1958).

By 1920, the increase in the school population, as well as the significant changes in the required curriculum led to a need for a new high school facility. After looking to construct a joint school with San Anselmo, the residents of San Rafael moved forward with plans to construct a new high school for San Rafael only. After much debate and evaluation, the “Eagle Rock” site on Mission Street was selected for the new high school campus that would accommodate 500 students. The 29-acre undeveloped site in eastern San Rafael was located just north of the canal in an area with little development except for single-family homes to the north. The property was purchased in 1923 and the ground-breaking ceremony was held in December of the same year. In June 1924, the firm Shea and Shea of San Francisco was awarded the contract for the architectural design of the new school. The cornerstone of the building, originally known as “Old Main,” was laid to much fanfare in December 1924. The building was dedicated on August 22, 1925, and the new building was officially open for the fall session. Constructed of reinforced concrete, “Old Main” contained 25 classrooms, a study hall, a gymnasium, and a little theater. The building was constructed for approximately $300,000 (Miller, 1958; Independent-Journal, 1963). The building still exists and is shown as Building A in Figure 3-4 in Chapter 3, Project Description, of this EIR.

Soon after the first building at the new San Rafael High School was completed, the school district hired architect N. W. Sexton, who had offices in both San Francisco and San Rafael, to begin designing additions and new buildings to expand the campus. The first project began in 1926 and consisted of a single-story addition that included two outdoor courtyards and a dining room and kitchen at the east side of the main building. (The addition was later demolished.) The next two projects designed by Sexton included the original gymnasium (the northern section of Building P shown in Figure 3-4 in Chapter 3) constructed in 1930 and the original shop building (Building M in Figure 3-4) constructed in 1934 (Sanborn, 1950). In 1938, Sexton took on the design of seven new buildings: a home economics building (Building G), a new cafeteria building (never constructed), two new shop buildings (Buildings O and L), a mechanical drawing building (Building K), a music building (Building J), and an arts building (Building R). The locations of these buildings can be seen in Figure 3-4 in Chapter 3 of this EIR. H. Engle served as the structural engineer for all of the San Rafael High School projects designed by Sexton.

In the late 1940s and early 1950s, the San Francisco architecture firm of Donald B. Kirby & Thomas B. Mulvin prepared several smaller projects, including alterations to the main building (Building A), the construction of the swimming pool, and the construction of the administration building on Union Street. (The latter building is not located on the project site and is outside the scope of this evaluation, because it is not part within the boundaries of the SRHS campus at 185 Mission Street.) Thomas Mulvin relocated to San Rafael and continued to design projects for the campus with the firm of Gromme, Mulvin & Priestly. In 1958, Gromme, Mulvin & Priestly designed an addition to the gymnasium (southern section of Building P), a science building (Building F), and a cafeteria and classroom building (Building I). The same firm, as only Carl Gromme and Ralph Priestly, also designed the new library building (Building D) in 1965 and alterations to the main building (Building A) in 1967. The construction of the new library building (Building D) required the demolition of the eastern 1926 addition on “Old Main” (Building A) (information attained from various drawings on file at the San Rafael City Schools, Map Room and Division of the State Architect Application Cards for San Rafael High School).

By the late 1960s, the campus essentially appeared much as it does today, with all the major buildings having been constructed. Numerous alterations and renovations to the existing buildings have occurred over the past four-and-one-half decades, but the overall campus layout has remained the same.

SRHS Campus Major Building Chronology

(See Figures 2 through 6 for graphics of SRHS Campus development)

1923 The 29-acre Eagle Rock site purchased for the construction of a new San Rafael High School

1925 “Old Main” (Building A) is completed and opens for the fall session. Architect Frank Shea of Shea and Shea.

1930 Original gymnasium (Building P) was constructed. Architect N. W. Sexton.

1934 The first shop building (Building M) was completed. Architect N. W. Sexton.

1939 Two new shop buildings, a home economics building (Building G), a mechanical drawing building (Building K), a music building (Building J) and an arts building (Building R) were all constructed. Architect N. W. Sexton. Engineer H. M. Engle.

1948 Alterations to the main building (Building A). Architects Donald B. Kirby & Thomas B. Mulvin.

1949 Swimming pool constructed. Architects Kirby & Mulvin.

1953 Administration building on Union Street constructed. Architects Kirby & Mulvin.

1958 Additions and alterations to the gymnasium (Building P). Architects Gromme, Mulvin & Priestly of San Rafael.

1958 Science building and the cafeteria and classroom buildings constructed (Buildings F and I). Architects Gromme, Mulvin & Priestly

1965 Eastern addition of the main classroom building (Building A) demolished, and replaced with a new library building (Building D). Architects Carl Gromme and Ralph Priestly.

1967 Alterations to the main classroom building (Building A). Architects Carl Gromme and Ralph Priestly.

1970 Alterations to gym and locker room (Building P). Architect Richard Marshall.

1979 Reconstruction of cafeteria building (Building I) due to fire damage. Work included replacing the roof and other structural members. Architect Richard Marshall.

1984 Alterations to the gymnasium (Building P). Architect Chester Bowles.

2001-06 Four-phased modernization of the campus including: site work, a new elevator tower, accessibility upgrades, window replacements, and numerous interior alterations. Architect TLDC.

Architectural Context

Early Architects of the SRHS Campus

Frank T. Shea

Frank Shea, of the San Francisco architectural firm Shea & Shea, designed the original SRHS campus building (Building A). Frank Shea was one of San Francisco's pioneering architects and was well known for his numerous designs of Catholic churches throughout the state. Born in Bloomington, Illinois, Shea attended the Ecole des Beaux Art in Paris and completed his education in California. Over the course of his career in San Francisco he was associated with both John O. Lofquist and his brother Will D. Shea. He worked as the city architect of San Francisco from 1906-1908, during which time he design the City Hall dome that had been destroyed in the fire of 1906. The majority of his works were completed in the Beaux Arts and Neoclassical architectural styles. Frank Shea died at his home in Marin County in September 1929 (*Architect and Engineer,* 1929).

N. W. Sexton

Sexton was a locally prominent architect that maintained an office in San Rafael. Before relocating to San Rafael he worked independently in San Francisco. He designed the majority of the buildings on the SRHS campus working throughout the1930s. He was a native England and designed a hospital in Napa for the Victory Hospital Association, fire stations in Sausalito and Vallejo among numerous other educational and civic buildings throughout the area. (Sausalito News, 1942; and *Architect and Engineer*, 1928 and 1942).

Architectural Styles

The campus includes a mixture of architectural styles in the existing buildings. The oldest building, dating back to 1925, was completed in the Neoclassical architectural style with specific features such as ionic columns, classical forms, strong symmetry, dominate entry porch, faux rustication and an overall monumentality. The original section of the gymnasium constructed in 1930, also minimally maintains some influences of the Neoclassical style. The second period of campus development was executed in the 1930s and includes buildings designed in the Moderne architectural style featuring elements such as simple forms, flat roofs with coping, speed bands in the coping, an emphasis on horizontality, minimal decorative features and smooth exterior wall finishes. The newer buildings, built in the late-1950s and mid-1960s, are more modern in style and include concrete finishes and details such as simple forms, flat roofs with no coping, minimal ornament and no decorative detailing at the doors and windows.

Neoclassical

The Neoclassical (circa 1895-1950) style of architecture evolved from a revival in interests in classical building models stemming from the World's Columbian Exposition, held in Chicago in 1893. It was mandated that all buildings in the exposition have a classical theme and many of the best-known architects of the period designed dramatic colonnaded buildings based on the use pure Roman and Greek forms and formally arranged around a central court. This display would become the model for public and commercial buildings through the country for decades to come and laid the groundwork for the City Beautiful movement, which strongly promoted classical civic architecture.

Several character-defining features of the Neoclassical style include:

- An overall monumentality to the building;
- Use of classical forms and ornament;
- Strong symmetry in plan and elevation;
- Front façade dominated by full-height porch;
- Entry porches with roof supported by classical columns;
- Columns typically featuring Ionic or Corinthian capitals;
- Façades having symmetrically balanced windows and central doorways; and
- Façades with faux-rustication.

The original San Rafael High School building at the Mission Street site is an exceptional example of the Neoclassical style. The building exhibits an overall monumentality and employs classical forms. Further, the design features a front façade dominated by a central full-height entry porch; porch columns with Ionic capitals; symmetrical facades with balanced doors and windows; and classical elements such as pilasters, entablatures, and a decorative frieze. The original section of the gymnasium also exhibits some influences of the Neoclassical style, although very minimally.

Moderne

The Moderne (1920-1940) style of architecture eschewed classical forms and found a language from the evolution of the streamlined industrial design of ships, airplanes and automobiles. Common characteristics of the style include:

- Simple forms;
- Flat roofs with narrow coping;
- Speed band at the coping;
- Emphasis on horizontality;
- Minimal decorative features, if any;
- Smooth wall surfaces; and
- Steel windows.

The Sexton buildings designed for the SRHS campus in the 1930s (Buildings M, G, K, J and R) are all minor examples of the Moderne style. The buildings all feature simple forms, flat roofs with a coping, smooth wall surfaces, minimal decoration, and a slight emphasis on horizontality. Primarily these buildings all serve as secondary, background buildings to the original and primary SRHS campus building, Building A.

Modern

The Modern style in the 1950s and 1960s developed from the ideal of the International Style which focused on the expression of a buildings function; the avoidance of unnecessary decorative features; the celebration of period technologies and materials; and an overall minimalism in appearance. Typical characteristics of buildings in the Modern style generally include:

- Simple forms;
- Overhanging eaves in some instances;
- Emphasis on horizontality;
- No decorative details at door or windows; and
- Minimal ornament.

Buildings D, F and I all can be classified within the Modern style. The buildings all lack traditional decorative elements; maintain simplistic forms and flat roofs; and illustrate an emphasis on horizontality. Similar to the Moderne structures on campus, these buildings are also subordinate to the original SRHS campus building.

Property Description

Overall Campus

The SRHS campus is located in central Marin County in the incorporated City of San Rafael. Sited east of Highway 101 and north of San Rafael Creek, the 29.8-acre campus is bordered by 3rd Street, Mission Avenue, Embarcadero Avenue and Union Street. The area surrounding the campus is generally residential to the north and east, and commercial and industrial to the south and west. The overall site is relatively flat with a slight downward slope to the north end. Athletic fields flank the central campus area that contains the academic and administrative buildings. The main surface parking lot is located on 3rd Street, south of the central campus area and between the athletic fields. The gymnasium and pool are sited at the northeast section of campus, and a second parking lot and tennis courts are located just east of the gymnasium.

The SRHS campus includes a total of 12 buildings and 9 modular classroom units. The campus buildings are all one-to-two stories in height and the majority of the buildings are located surrounding Building A, originally known as “Old Main.” A handful of smaller structures on the campus include a ticket booth, concession stand, press box, daycare shed and bleachers.

Individual Buildings

Building A, "Old Main" – Administration/Theater/Classroom

Building A is the oldest building at San Rafael High School. Standing at the center of the campus facing east, the two-story-plus-a-basement imposing building is generally H-shaped in plan and Neoclassical in style. The building is constructed of concrete and the exterior is clad in a painted cement plaster finish with select sections scored to emulate stone. Replacement aluminum doors and windows, both fixed and awning, and with wood surrounds, are typical throughout the building. The building exhibits numerous features that are typical of the Neoclassical style including: a front façade dominated by a full-height entry porch; porch columns with Ionic capitals; symmetrical facades with balanced doors and windows; pilasters, entablatures, and a decorative frieze. Building A has a flat roof surrounded by parapets and the raised central volume maintains parapets that resemble a gable roof line. Lightwells are located around the base of the building and exterior access to the basement is found through exterior stairwells on both the north and south sides. The rear, east side of the building, is located approximately twenty feet from the west wall of Building D; thereby, the two buildings create a narrow alley between them and share access to the elevator tower located in the alley.

Building D – Classrooms/Library

Building D is located east of and directly behind Building A and abuts Buildings G and J. The east façade of the Building D faces the athletic fields and features a protruding two-story volume with a ground floor loggia and prominent overhanging eave. Two stories in height, the reinforced concrete building steps up to the west and maintains a flat roof with a coping. The exterior is finished in painted concrete and is accented by protruding smooth finished concrete rectangular panels and pilasters laid out in a rhythmic pattern across the four façades with punched window openings extending between the panels and pilasters. Concrete masonry units columns support the covered walkways with corrugated metal roofs at the east and west sides. Replacement aluminum fixed and awning windows are found throughout the building and single aluminum-frame door with one-lite provide access at the east and west façades. An exterior stair at both the north and south end of the east façade connect to the second floor.

Building F – Science and Building I – Madrone/Cafeteria

Buildings F and I stand along the western edge of the campus adjacent to the western athletic fields. Together the north and south edges of the buildings form a plaza directly across from the main entrance of Building A. Both buildings are one story in height, feature flat roofs, metal coping, sliding aluminum windows and smooth finished and scored concrete exterior walls. The simple buildings are Modern in style, with simple forms and very minimal decorative features that include recessed wall planes and a geometrical scoring pattern. The recessed main entrances for each building face the plaza and are protected by a projecting awning. Building F is essentially C-shaped in plan and stands on a site the slopes down slightly to the north and Mission Avenue. Building I is L-shaped in plan, and maintains several unique features not included in Building F such as: exterior louvered sun shades on the west façade windows and a wood-frame storefront of fixed windows and doors adjacent to a row of exterior serving windows all beneath a covered porch supported by steel columns.

Building G - Media

Directly north of and connected to Building D, Building G stands near the curve in Mission Street. Rectangular in plan, the two story building is approximately 8,100 square feet and features a flat roof with a minimally overhanging eave. The ground floor exterior concrete walls are painted and maintain visible formwork, while the second floor is finished in a cement plaster coat. The building is Moderne in architectural style with minimal decorative features including: horizontal belt courses located at the window head and sills and a slightly projecting roof coping with speed bands. Newer exterior features include an exterior stair at the south façade and a corrugated metal covered awning over the second floor entry at the south façade and at the ground floor entry at the north façade. Combination fixed and awning aluminum sash replacement windows are found throughout the building, and both flush doors and aluminum storefronts with single lite doors punctuate the façades.

Building J - Music

Building J stands on the east side of campus directly west of the bleachers and athletic field and south of and connected to Building D. The building is square in plan, approximately 4,500 square feet in area, one story plus a basement in height and features a flat roof and a minimally overhanging eave. Constructed at the same time as Building G, Building J maintains the same simplified Modern architectural style and several unifying design features such as: horizontal belt courses located at the window head and sills and a slightly projecting roof coping with speed bands. Building J is constructed of concrete and cement plaster clads the upper half, while the painted lower half reveals the concrete formwork.

The building stands on a site that slopes down toward the south. The west façade features a covered walkway with a Mission tile, cap-and-pan roof and fronts a small courtyard. Due to the change in grade, the upper floor of Building J at the west façade is just above the courtyard level on the northern end. Combination fixed and awning aluminum sash replacement windows are found throughout the building, except at the ground floor where the window openings are sealed with painted plywood. Flush doors pierce the east and south facades, and an aluminum storefront with a pair of single lite doors punctuates the courtyard façade.

Building K – Daycare

Building K is located on the southern end of campus between Buildings A and M. The small building is rectangular in plan, and stands one story in height on a site that slopes down to the south. The building is constructed of concrete and the exterior walls feature an exposed base with a cement plaster finish above. The flat roof has a smooth metal coping and a horizontal course circles the building at the level of the window headers. A covered walkway extends from the west side, and the roof structure steps up in line with the raising grade. The building maintains steel sash combination fixed and awning windows and both flush and paneled doors.

Building L – Photography/Ceramics

Building L is essentially square in plan and two-stories in height. The building stands at the southeastern section of campus adjacent to the main parking lot. The simple concrete structure is finished in painted cement plaster at the exterior walls and features replacement fixed and awning windows throughout. The windows feature no decorative surrounds, but do have a narrow projecting sill. The north and west façades maintain a large percentage of openings within the walls and louvered metal sunshades extend out from these façades in the form of awnings.

Building M – Auto Tech/Wood Shop

Building M was the original shop building constructed on the campus. The concrete structure is one story in height and rectangular in plan. Painted cement plaster clads the exterior walls capped by smooth metal coping. The façades feature large bays infilled with multi-lite steel sash widows, combinations of steel sash windows and flush doors, plaster infill, and roll-up metal garage doors. The simplistic building maintains some aspects of the Moderne architectural style, but was executed with minimal ornament and with a focus on function over expression.

Building O - Academy

Similar to Building M, Building O, is rectangular in plan, one-story in height with a flat roof and narrow coping, finished in painted cement plaster and features large, multi-lite steel sash windows. Somewhat Moderne in style, the building lacks any ornament; however the façades are organized symmetrically in terms of the door and window openings. The building appears primarily industrial with a focus on function. Located adjacent to Building M, Building O backs up to the main parking lot.

Building P - Gymnasium

The gymnasium, Building P, covers the largest footprint of any building on the SRHS campus and stands at the northeast corner near Eagle Rock. The building's original section at the north end includes a two-story T-shaped, gable-roof segment with a combination stepped and peaked parapet at the gable-end walls and a one-story, C-shaped, flat-roof section that frames the swimming pool area. The three gable end walls each feature decorative rectangular recesses and a recessed solid oculus centered beneath each parapet apex. The poured concrete building's exterior walls are finished simply in paint and the form work in the concrete is visible. The front, western façade of the original gymnasium features a flat-roofed, single-story projecting entry volume with two, two-lite entry doors each with a side-light and a projecting metal awning overhead. Six engaged, fluted pilaster divide the entrance into bays and two decorative medallions hang above each entry door.

A two-story gable-roofed rectangular addition was constructed at the southwest corner of the original gymnasium. The gymnasium addition is a simple concrete structure with exposed concrete columns along the exterior façades. The new main entrance at the west side appears to have been more recent construction and includes a single-story projecting volume with a parapet reminiscent of the original building segment, paired two-lite, double-doors with transoms flanked by rectangular insets and a gabled, steel awning structure point loaded on concrete bases.

Building R - Art

The two-story, poured concrete frame Building R is C-shaped in plan and stands on a site that slopes significantly to the north from the north side of Building A to Mission Avenue. At the south façade only one floor is visible, while both floors are exposed on the Mission Avenue side. Similar to Building G, the upper floor is clad in a cement plaster finish and the ground floor walls reveal exposed concrete embedded formwork. Belt courses ring the building at the head and sill window levels and speed band run along the coping at the edge of the flat roof. Replacement aluminum windows and flush doors are found throughout the building. A covered walkway with Mission style cap-and-pan roofing extends out toward the raised plaza framed by the building at the south side.

Athletic Fields (Bleachers/Press Box/Concession Stand/Ticket Booth)

Located east of the central campus, the grass athletic field is bordered by a track and maintains metal bleachers at the east and west sides of the field, with the larger set of bleachers being at the east side nearest the buildings. The simple, small ticket booth, with plywood siding, two counter height openings and a flat roof, stands southeast of the field at 3rd Street parking lot. The concession stand, located just south of the eastern bleachers on an asphalt surface, is one story in height, constructed of concrete masonry units, features a flat roof with an overhang, has flush doors, and counter height openings. The press box is centrally located on top of the eastern bleachers and is clad in T-111 siding, features a flush door, and maintains a wood guardrail around the roof deck.

Evaluation Criteria

National

National Register Bulletin Number 15, *How to Apply the National Register Criteria for Evaluation*, describes the Criteria for Evaluation as being composed of two factors. First, the property must be "associated with an important historic context" (U.S. Department of the Interior, 1997a). The National Register of Historic Places identifies four possible context types, of which at least one must be applicable at the national, state, or local level. As listed under Section 8, "Statement of Significance," of the National Register of Historic Places Registration Form, these are:

> "A. Property is associated with events that have made a significant contribution to the broad patterns of our history.
>
> "B. Property is associated with the lives of persons significant in our past.
>
> "C. Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
>
> "D. Property has yielded, or is likely to yield, information important to prehistory or history" (U.S. Department of the Interior, 1997b).

Second, for a property to qualify under the National Register's Criteria for Evaluation, it must also retain "historic integrity of those features necessary to convey its significance" (U.S. Department of the Interior, 1997a). While a property's significance relates to its role within a specific historic context, its integrity refers to "a property's physical features and how they relate to its significance" (U.S. Department of the

Interior, 1997a). To determine if a property retains the physical characteristics corresponding to its historic context, the National Register has identified seven aspects of integrity. These are:

> "Location is the place where the historic property was constructed or the place where the historic event occurred...
>
> "Design is the combination of elements that create the form, plan, space, structure, and style of a property...
>
> "Setting is the physical environment of a historic property...
>
> "Materials is the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property...
>
> "Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory...
>
> "Feeling is a property's expression of the aesthetic or historic sense of a particular period of time...
>
> "Association is the direct link between an important historic event or person and a historic property" (U.S. Department of the Interior, 1997a).

Since integrity is based on a property's significance within a specific historic context, an evaluation of a property's integrity can only occur after historic significance has been established (U.S. Department of the Interior, 1997a).

State

California Office of Historic Preservation's Technical Assistance Series #6, *California Register and National Register: a Comparison*, outlines the differences between the federal and state processes. The context types to be used when establishing the significance of a property for listing on the California Register of Historical Resources are very similar, with emphasis on local and state significance. They are:

> "1. It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; or
>
> "2. It is associated with the lives of persons important to local, California, or national history; or
>
> "3. It embodies the distinctive characteristics of a type, period, region, or method of construction or represents the work of a master, or possesses high artistic values; or

"4. It has yielded, or is likely to yield, information important to prehistory or history of the local area, California, or the nation" (California Department of Parks and Recreation, 2006).

Integrity must also be determined for a property to be listed on the state register. The California Register of Historical Resources maintains a similar definition of integrity, while provided for a slightly lower threshold than the National Register.

In addition to separate evaluations for eligibility to the California Register, the state will automatically list resources if they are listed or determined eligible for the NRHP through a complete evaluation process.[1]

Local

Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource is eligible for listing on the National Register, meets the criteria for listing on the California Register (Pub. Res. Code §5024.1, Title 14 CCR, Section 4852), or is eligible for designation as a local landmark.

The City of San Rafael maintains a list of historic resources in the document *San Rafael Historical/Architectural Survey* (the *Survey),* which was first published in 1976 and updated in 1986. Structures included in the list are presumed significant resources unless evidence to the contrary in provided. The survey also provides ranking for the listed structures as "Exceptional," "Excellent" or "Good." Additionally, the City's Historic Preservation Ordinance (Chapter 2.18 of the Municipal Code) outlines procedures for the designation of landmarks and of structures of merit.

2.18.048 - Criteria for designation as landmark.

The criteria that shall be applied by the cultural affairs commission and by the city council in designating buildings, places, and areas as historic landmarks or historic districts shall include the following:

(a) Historical, Cultural Importance.
- (1) Has significant character, interest, or value as part of the development, heritage or cultural characteristics of the city, state or nation; or is associated with the life of a person significant in the past;
- (2) Is the site of a historic event with a significant effect upon society; or
- (3) Exemplifies the cultural, political, economic, social or historic heritage of the community.

(b) Architectural, Engineering Importance.
- (1) Portrays the environment in the era of history characterized by a distinctive architectural style;

[1] All State Historical Landmarks from number 770 onward are also automatically listed on the California Register. (*California Register of Historical Resources: The Listing Process*, California Office of Historic Preservation Technical Assistance Series, no. 5 [Sacramento, CA: California Department of Parks and Recreation, n.d.], 1.)

(2) Embodies those distinguishing characteristics of an architectural type or engineering specimen;
(3) Is the work of a designer whose individual work has significantly influenced the development of San Rafael or its environs;
(4) Contains elements of design, detail, materials or craftsmanship which represent a significant innovation; or
(5) The work of a designer and/or architect of merit.

(c) Geographic Importance.
(1) By being part of or related to a square, park or other distinctive area, should be developed or preserved according to a plan based on a historic, cultural or architectural motif; or
(2) Owing to its unique location or singular physical characteristic, represents an established and familiar visual feature of the neighborhood, community or city.

(d) Archaeological Importance. Has yielded information important in prehistory or history.

2.18.069 - Recognition of structures of merit.

(a) The commission may approve a list of structures of historic, architectural or aesthetic merit which have not been designated as landmarks and are not situated in designated historic districts. The said list may be added to from time to time. The purpose of this list shall be to recognize and encourage the protection, enhancement, perpetuation and the use of such structures. The commission shall maintain a record of historic structures in the city which have been officially designated by agencies of the state or federal government, and shall cause such structures to be added to the aforesaid list.

(b) Nothing in this chapter shall be construed to impose any regulations or controls upon such structures of merit included on the said list and neither designated as landmarks nor situated in historic districts.

(c) The commission may authorize such steps as it deems desirable to recognize the merit of, and to encourage the protection, enhancement, perpetuation and use of any such listed structure, or of any designated landmark or any structure in a designated historic district, including but not limited to the issuance of a certificate of recognition and the authorization of a plaque to be affixed to the exterior of the structure; and the commission shall cooperate with appropriate state and federal agencies in such efforts.

(d) The commission may make recommendations to the city council and to any other body or agency responsible, to encourage giving names pertaining to San Rafael history to streets, squares, walks, plazas and other public places.

Evaluation of Significance

Current Designations

None of the subject buildings are currently listed individually or as contributing structures to a district on the National Register or the California Register, or identified as local historic landmarks. The original SRHS building, Building A is listed in the *Survey* as 185 Mission Avenue and has been assigned the designation of "Good."

Age

The first consideration for determining a property's eligibility is age. Typically, a resource must be at least fifty years old to be included in either the National Register or the California Register. Research indicates that all of the SRHS campus buildings were constructed prior to 1966 and are therefore greater than fifty years old. Many of the building have had numerous alterations and undergone renovations since their initial construction.

Building Evaluations

Building A: Constructed 1925

It appears that the original high school building (Building A) at San Rafael High School is associated with the development of secondary public education in the City of San Rafael and Marin County in the early 20th century, as well as with architect Frank T. Shea and is an exceptional example of the Neoclassical style.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): The original building of the SRHS campus (Building A) was constructed following the community's decision to maintain a separate high school for the City of San Rafael and after a survey had determined that the current school facility on 4th Street was no longer sufficient to meet the needs of the growing high school student population. As a significant investment into the development of the public school system in San Rafael and Marin County in general, the population voted to construct a new, more suitable high school building on a site that would allow for future expansion. As the first and most substantial structure constructed at the SRHS campus, Building A has made a significant contribution to the broad patterns of local history, and to the cultural heritage of San Rafael. Therefore, it appears that the property would be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): While many people were instrumental in attaining the funding for and pursuing the planning of a new high school building San Rafael, research has not shown the property to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that the property would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Building A was designed by renowned San Francisco architect Frank T. Shea of the firm Shea and Shea in the Neoclassical architectural style.

Substantial in height and scale, Building A exhibits numerous features that are typical of the Neoclassical style including: a front façade dominated by a full-height entry porch; porch columns with Ionic capitals; symmetrical facades with balanced doors and windows; pilasters, entablatures, and a decorative frieze. The imposing building is the most prominent structure on campus and is emblematic of SRHS. The architect, Frank T. Shea, was classically trained at the Ecole des Beaux Arts in Paris and was most well-known for his Catholic Church designed in the Beaux Arts and Neoclassical styles. Therefore, Building A, the oldest building on the SRHS campus, appears to be eligible for individual listing for embodying the distinctive characteristics of a type and period, and for representing the work of a master under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that Building A has yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance

The period of significance refers to the span of time during which significant events and activities occurred. The period of significance for Building A, the original SRHS building would be from 1925, the date of construction to 1966, fifty years from today since the building has continued to operate as the central building for SRHS.

Evaluation of Integrity

After the historic significance has been established, the resource's historic integrity must also be assessed. For a property to qualify as historically significant under the National Register's Criteria for Evaluation, it must retain "historic integrity of those features necessary to convey its significance." The California Register of Historical Resources maintains a similar definition of integrity, while provided for a slightly lower threshold than the National Register. While a property's significance relates to its role within a specific historic context, its integrity refers to "a property's physical features and how they relate to its significance." Further, for a building to meet registration requirements under Criteria C/3 (Architecture) as an individual resource, the property would need to retain sufficient character-defining features in order to reflect design intent. To determine if a property retains the physical characteristics corresponding to its historic context, the National and California Registers have identified seven aspects of integrity, as described previously in this report.

Location
The building remains at its original site, and therefore retains the integrity of location.

Design
The building retains a significant amount of its original character defining features such as the entry porch, colonnade, pilasters, and numerous decorative features. The rear addition to the building was removed for the construction of Building D; however the primary façades, the front and sides, were unchanged. Several alterations have occurred over time including the replacement of the original windows with windows of similar design and operations, addition of access ramps at the exterior, and the

replacement of exterior doors. None of these alterations have impacted the overall understanding of the building's design; there Building A retains its integrity of design.

Setting
The building was originally constructed on a large undeveloped site located within a bourgeoning neighbor of single family houses. Numerous buildings have been constructed on the SRHS campus since the first building was completed. The integrity of setting has been slightly diminished due to the development of the site.

Materials
Although the building no longer retains its original doors and windows, they were replaced to match the original window patterns and the openings and decorative surrounds still remain. Additionally, the buildings concrete construction, cement plaster finish, and decorative features all remain. The building retains its integrity of materials.

Workmanship
The building retains much of its original construction and decorative features. Therefore, the building clearly retains its integrity of workmanship.

Feeling
The building maintains its integrity of feeling, as it clearly illustrates its aesthetic and historic nature as a high school building constructed in the Neoclassical style.

Association
Finally, the building maintains its integrity of association to San Rafael High School.

Findings
Overall, the Building A appears to retain all aspects of integrity, with only the integrity of setting having been slightly diminished. The building retains sufficient integrity to express its historical significance.

Building P: Constructed 1930, Addition 1958

It appears that the gymnasium (Building P) is not eligible for listing in any register due to a lack of significance under any of the established criteria.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): The gymnasium at the SRHS campus was originally constructed five years following the construction of the main building. The building was located in the northeastern corner of the campus and was the first building in a series of expansions that would lead to the development of a campus, rather than just a building in an open field. While the building maintains some significance in terms of the expansion of the campus, it does not appear that the gymnasium is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that the property would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown the gymnasium to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that the property would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): The original section of Building P was designed by N. W. Sexton, a somewhat locally prominent architect, to be a simple utilitarian building that was minimally aesthetically connected to Building A with a few Neoclassical surface details. Although the building maintains some decorative features, it does not embody the Neoclassical style beyond those few details. The addition constructed in 1958, was also very functional in design and lacked having any particular architectural style. The more recent entry design, maintains some elements that reflect back to the Neoclassical details. While, Sexton was locally well known architect, neither his body of work nor his legacy indicate that he was a master, nor do any scholarly works address the catalogue of N. W. Sexton. It does not appear that Building P embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the building would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that Building P has yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that the building is eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the building's integrity undertaken. A resource must first be shown to possess historical significance, before an evaluation of the building's ability to convey its significance and maintain integrity can be completed.

Buildings M, G, K, J and R: Constructed 1934-1939

It appears that none of the buildings constructed from 1934 to 1939 are eligible for listing in any register due to a lack of significance under any of the established criteria.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): Buildings M, G, K, J and R were all constructed from 1934 to 1939 to accommodate the needs of the growing high school population and curriculum. This group of buildings all houses specific programs ranging from mechanical drawing to the arts. While the buildings maintain some significance in terms of the expansion of the campus and its curriculum, it does not appear that the buildings are associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that Buildings M, G, K, J and R would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown Buildings M, G, K, J and R to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that these resources would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Buildings M, G, K, J and R were all designed by architect N. W. Sexton to be secondary to the primary SRHS campus building, Building A. These buildings are all minor examples of the Moderne style with simple forms, flat roofs with a coping, smooth wall surfaces, minimal decoration, and a slight emphasis on horizontality. Primarily these buildings all serve as background buildings on the SRHS campus. While, Sexton was locally well known architect, neither his body of work nor his legacy indicate that he was a master, nor do any scholarly works address the catalogue of N. W. Sexton. It does not appear that Buildings M, G, K, J and R embody the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the buildings would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that these buildings have yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that these buildings are eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the buildings' integrity undertaken. The resources must first be shown to possess historical significance, before an evaluation of the buildings' ability to convey their significance and maintain integrity can be completed.

Buildings F, I and D: Constructed 1958-1965

It appears that none of the buildings constructed from 1958-1965 are eligible for listing in any register due to a lack of significance under any of the established criteria.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): Building F, I and D were all constructed from 1958-1965 as part of a second wave of campus expansion. This group of buildings includes classrooms, a cafeteria and a library. While the buildings maintain some significance in terms of the expansion of the campus, it does not appear that the buildings are associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that Buildings F, I and D would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown Buildings F, I and D to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that these resources would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Buildings F, I and D were all designed by an iteration of the firm Gromme and Priestly and have similar design aesthetics. These buildings were also designed to be subordinate to the primary SRHS campus building, Building A. The Gromme and

Priestly buildings are all minor examples of the Modern style. The buildings all lack traditional decorative elements; maintain simplistic forms and flat roofs; and illustrate an emphasis on horizontality. Local architects Gromme and Priestly do not appear in scholarly journals and do not appear to have completed a body of work that would classify them as master architects. It does not appear that Buildings F, I and D embody the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the buildings would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that these buildings have yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that these buildings are eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the buildings' integrity undertaken. The resources must first be shown to possess historical significance, before an evaluation of the buildings' ability to convey their significance and maintain integrity can be completed.

Conclusion

Following a thorough evaluation of the SRHS campus and its buildings, it appears that only Building A is eligible for listing in the NRHP, CRHR and as a City of San Rafael landmark. Building A, the original building constructed on the SRHS campus maintains significance under NRHP/CRHR Criterion A/1 as being associated with the development of secondary public education in San Rafael and under Criterion C/3 as being an exceptional example of the Neoclassical style as designed by architect Frank T. Shea. Based on these findings and the inclusion of the building in the *San Rafael Historical/Architectural Survey*, it appears that Building A, the original San Rafael High School building at the 185 Mission Street campus, would be considered a potential historical resource under CEQA (CCR Title 14(3) §15064.5).

The other buildings on the SRHS campus were designed to be subordinate to the original Neoclassical building. Only the northern section of the gymnasium, constructed in 1930, took some cues from the Neoclassical style with minor decorative elements; however, by 1934 when the next building (Building M, see Figure 6) was constructed, the Neoclassical style was abandoned and a simple, utilitarian approach became the language for new development on the campus. Due to their lack of significance under any of the established criteria, none of the other campus buildings appear to qualify as historical resources under CEQA.

Consultant Qualifications

Pursuant to Code of Federal Regulations, 36 CFR Part 61, the author, Kimberly Butt, AIA, meets the Secretary of the Interior's qualification standards for professionals in historic architecture and architectural history.

Figures

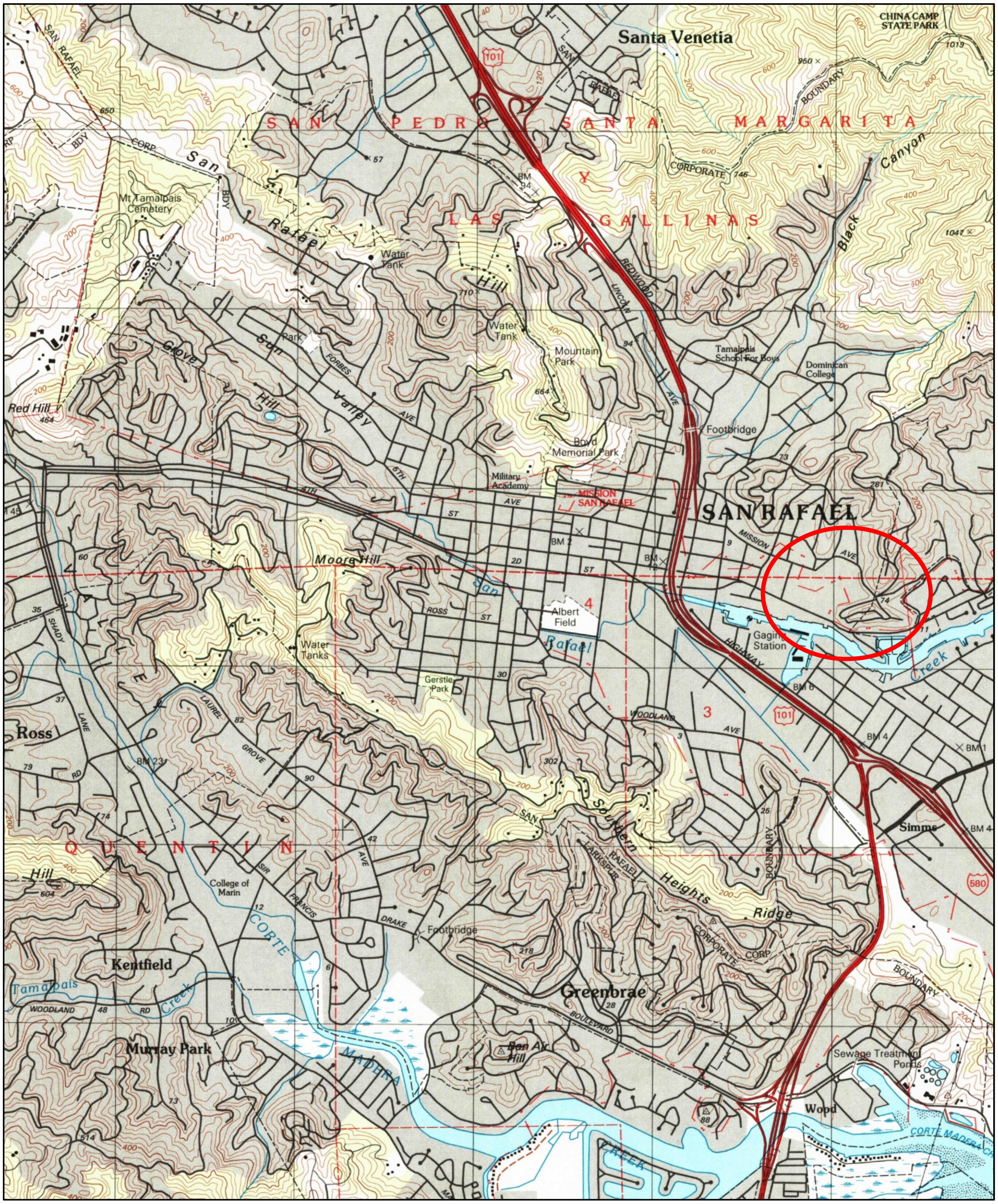

Figure 1: USGS Map showing the property location circled.

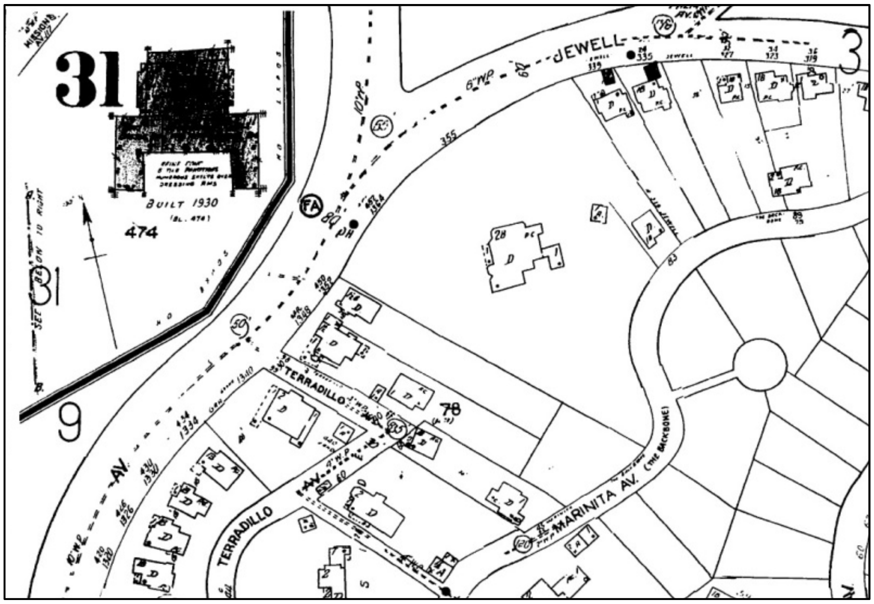

Figure 2: Sanborn Map of San Rafael, California dated 1950 showing the San Rafael High School gymnasium in the upper left-hand corner.

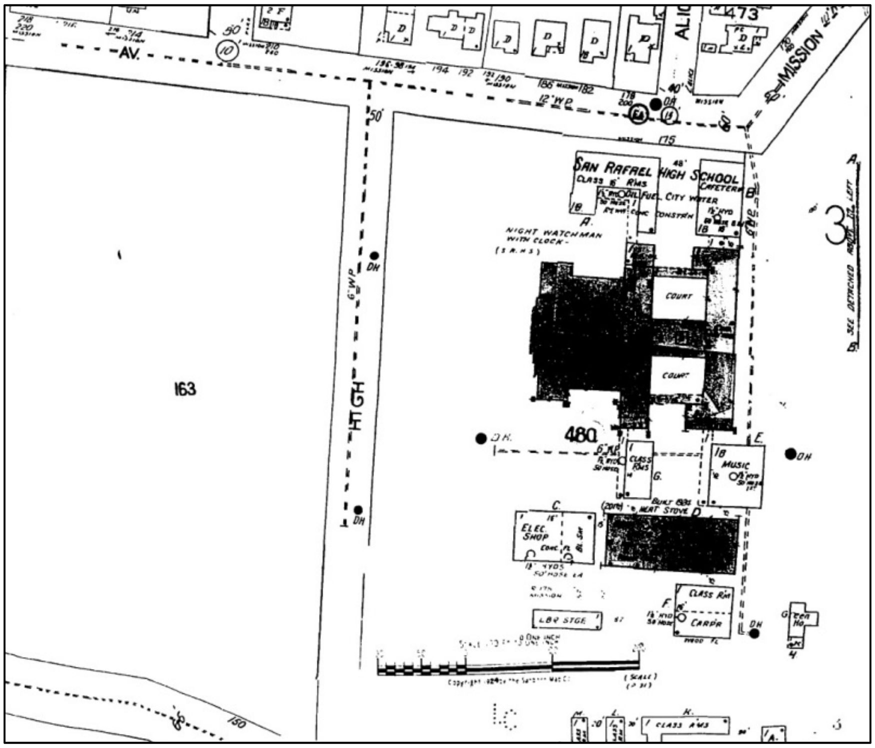

Figure 3: Sanborn Map of San Rafael, California dated 1950 showing the San Rafael High School campus.

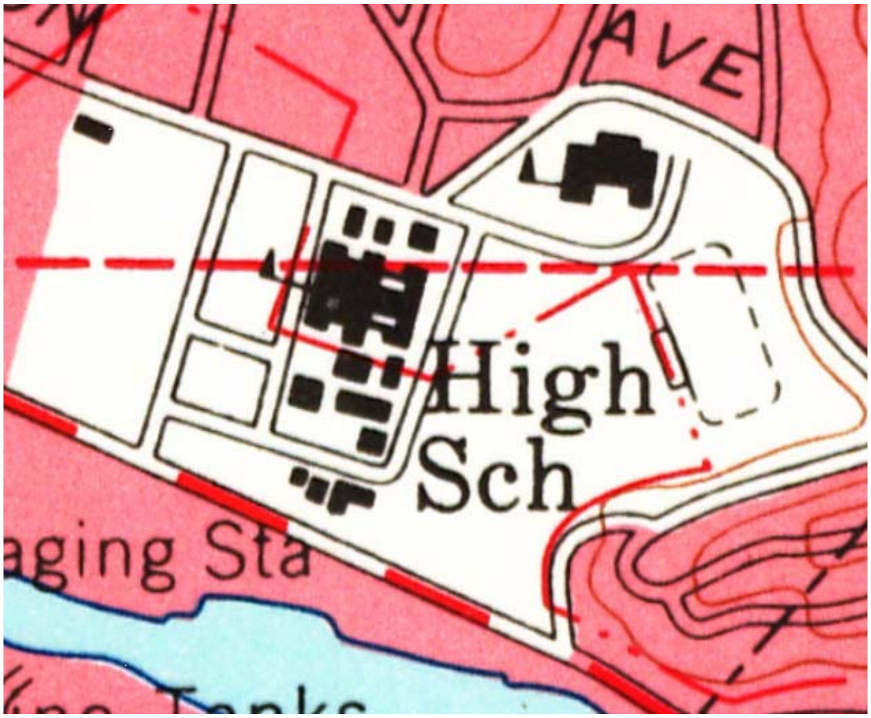

Figure 4: Segment of the USGS San Rafael 1954 map showing the SRHS Campus.

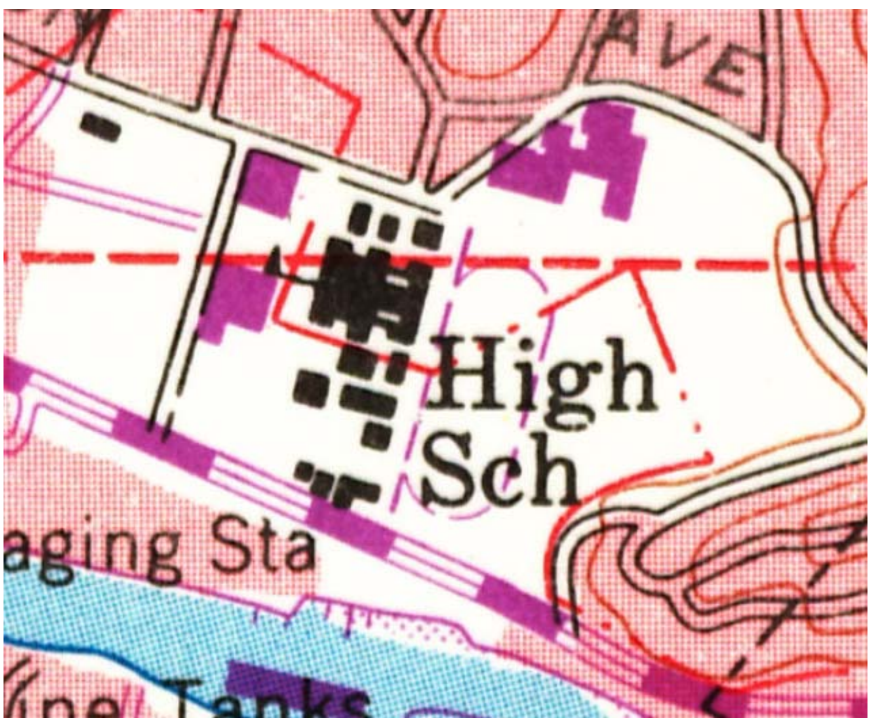

Figure 5: Segment of the USGS San Rafael 1968 map showing the SRHS Campus.

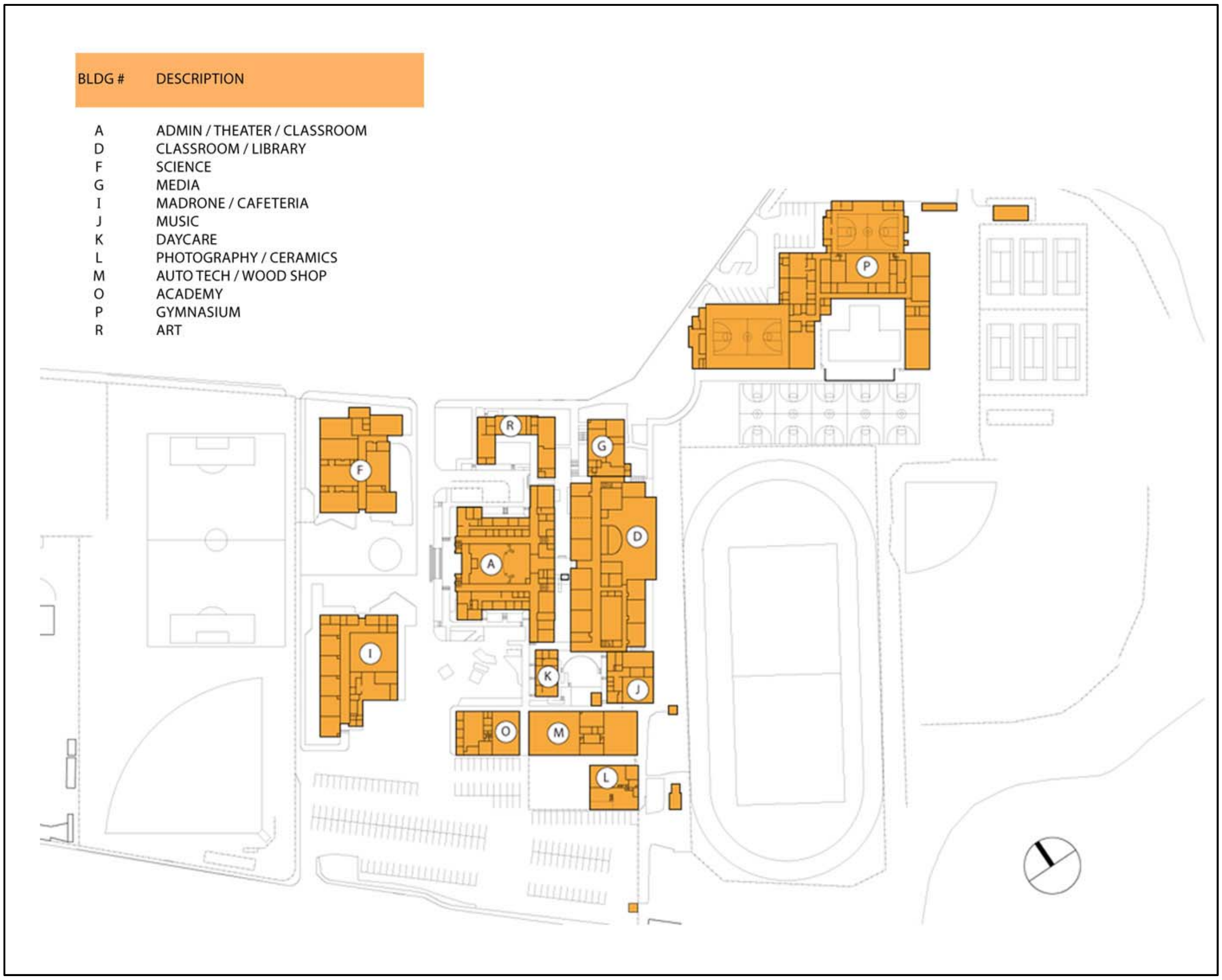

Figure 6: Current SRHS campus layout. Graphic derived from HY Architects San Rafael City School District Master Planning presentation September 22, 2014. Accessed online 2016 and edited by author.

Figure 7: View across the western athletic field towards Buildings F, A and I.

Figure 8: View toward the southwest corner of Building A from the 3rd Street parking lot entrance.

Figure 9: The front, west facade of Building A looking across the plaza.

Figure 10: The north facade of Building A.

Figure 11: View between Buildings A and D looking south. Note: Building A is on the right and Building D is on the left.

Figure 12: South facade of Building A.

Figure 13: View across the basketball courts looking toward the bleachers and the east facade of Building D.

Figure 14: Partial view of Building D's east façade looking northwest.

Figure 15: Partial view of Building D's east façade looking southwest.

*Figure 16: View of the covered walkway adjacent to Buildings D and G,
the east end of Building D's north façade, and a partial view of Building G's east façade.*

Figure 17: View of the western end of Building D's south facade.

Figure 18: View of Building F looking northeast.

Figure 19: View of the northeast corner of Building F from Mission Street.

Figure 20: View of Building I looking southeast.

Figure 21: View of the south facade of Building I.

Figure 22: View of the east facade of Building I looking north.

Figure 23: View of the intersection of Buildings D and J from the courtyard looking east.

Figure 24: View of the southeast corner of Building J.

Figure 25: View of the Gymnasium's west facade.

Figure 26: View across Mission Street looking at the north façades of Buildings R and G.

Figure 27: View looking northeast across the football field.

Figure 28: View of the track between the football field and the bleachers looking north.

Figure 29: View of the east facade of the concession stand.

Figure 30: View of the ticket booth looking east.

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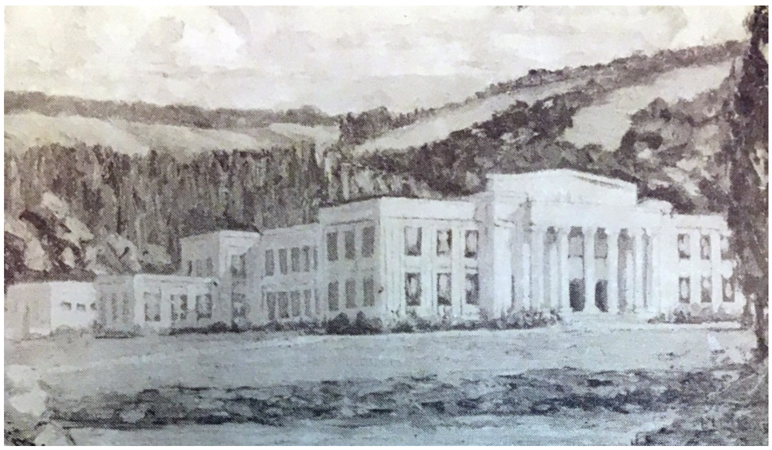
DRAFT
HISTORIC RESOURCE EVALUATION

San Rafael High School
185 Mission Avenue
San Rafael, CA 94901

December 2, 2016



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INTERACTIVE
RESOURCES
Architects & Engineers

Contents

Introduction

At the request of the San Rafael City Schools District (District), Interactive Resources, Inc. (IR) has undertaken a Historic Resource Evaluation of the San Rafael High School (SRHS) campus located between Mission Avenue, 3rd Street, Union Street and Embarcadero Way, in San Rafael, California. As part of the environmental review process for the SRHS Master Facilities Implementation Plan, including the proposed Stadium Project, the District has requested that a historic resource evaluation be completed for the entire campus, as many of the existing buildings were constructed over fifty years ago. This report is intended to provide a historical evaluation of the campus and its buildings through a thorough analysis of the property, its history, and its historical associations in order to determine if the campus or any portion thereof qualifies as historical resources as defined by the California Environmental Quality Act (CEQA). The evaluation addresses the significance criteria of the National Register of Historic Places, the California Register Historical Resources and the City of San Rafael landmark designation.

Methodology

IR prepared this historic resource evaluation by reviewing existing materials provided by the client, undertaking targeted archival research, and conducting a site visit to inspect the property and buildings and take photographs. Archival research was carried out at the San Rafael City Schools Map Room, the Anne T. Kent California Room in the Marin County Free Library and through numerous on-line sources. The site visit was conducted on September 15, 2016.

Records Search

A records search was conducted at the Northwest Information Center of the California Historical Resource Information System (CHRIS) in Rohnert Park, California.

As part of the records search, the following local and state inventories for built environment cultural resources in and adjacent to the study area:

- *California Inventory of Historic Resources* (California Department of Parks and Recreation 1976);
- *Five Views: An Ethnic Historic Site Survey for California* (California Office of Historic Preservation 1988);
- *California Points of Historical Interest* (California Office of Historic Preservation 1992);
- *California Historical Landmarks* (California Office of Historic Preservation 1996);
- *An Architectural Guidebook to San Francisco and the Bay Area* (Cerny 2007); and
- *Directory of Properties in the Historic Property Data File* (California Office of Historic Preservation April 5, 2012). The directory includes the listings of the NRHP, National Historic Landmarks, the CRHR, California Historical Landmarks, and California Points of Historical Interest.

Literature and Map Review

IR reviewed the following publications, maps, and websites for historical information about the study area and its vicinity:

- *California Place Names* (Gudde 1998);
- *Historic Spots in California* (Hoover et al. 1990);
- *Historical Atlas of California* (Hayes 2007);
- *Tamalpais Quadrangle, California.*, 60-minute topographic quadrangle (U.S. Geological Survey 1941);
- *San Rafael, Calif.*, 7.5-minute topographic quadrangle (U.S. Geological Survey 1954, 1968, 1980, 1995);
- *Historical aerial photographs of San Rafael* (Nationwide Environmental Title Research, 1946, 1952, 1958, 1968, 1993, 2002, and 2012);
- Online Archive of California at http://www.oac.cdlib.org;
- Calisphere at http://www.calisphere.universityofcalifornia.edu; and
- California Digital Newspaper Collection at http://cdnc.ucr.edu.

Evaluation Summary

CEQA defines a "historical resource" as any resource that meets one or more of the following criteria:

- Listed in, or eligible for listing in, the California Register of Historical Resources;
- Listed in a local register of historical resources;
- Identified as significant in an historical resource survey meeting the requirements of section 5024.1(g) of the Public Resources Code; or
- Determined to be an historical resource by a project's lead agency.

The following evaluation was based on the eligibility criteria for the National Register of Historic Places (NRHP) which requires that the resource be at least fifty years old (except under special circumstances), that it retain its historic integrity, and that it be significant under at least one of four criteria. These four criteria include: association with historic events, association with important persons, distinctive design or physical characteristics, and the potential to provide important information about history or prehistory. In determining National Register eligibility, the author weighed known historical associations, architectural merit, and the current level of integrity. The historic significance of the property was also evaluated using the established criteria of the California Register of Historical Resources (CRHR) in order to assess eligibility for listing in the state register. Finally, the City of San Rafael maintains a historic resource inventory and a set of criteria for the local designation of historic landmarks and districts. The City's specific criteria for listing were also used to evaluate the subject property.

The buildings on the SRHS campus are not currently listed in the NRHP or CRHR or as a City of San Rafael local landmark or historic district. The campus' address, 185 Mission Street, was identified in the *San Rafael Historical/Architectural Survey (Survey)* and was given a property classification ranking of "good" (Charles Hall Page & Associates, Inc., 1986). The *Survey* provides only the property address without any further description, and therefore it is not immediately clear if any of the campus buildings other than the original high school building (Building A, see Figure 6) were intended for inclusion. However, given that the survey was initially conducted in 1976, the only building on the campus that would have been over fifty years old at the time was Building A, the original San Rafael High School building; therefore, it is assumed that the document is only referring to the original building. Further, the listing in the Office of Historic Preservation's Historic Property Database (2012), which is based off of the *Survey,* clearly is referring to only Building A by identifying a 1924 construction date and assigning the property a State Inventory Code of "3S", which means the resource appears eligible the NRHP as an individual property through a survey evaluation (California Office of Historic Preservation, 2004). Identifying the resource as an individual property indicates that only one building is included and that the building is not being considered as part of a district.

The original high school building (Building A) at San Rafael High School is associated with the development of secondary public education in the City of San Rafael and Marin County in the early 20th century. The development of the campus at Mission Street began with the completion of "Old Main" (Building A) in 1925, following the significant increase in the student population that made the original school building on 4th Street obsolete and the local residents' decision to maintain a high school dedicated solely to San Rafael. Building A is also associated with the architect Frank T. Shea and is an exceptional example of the Neoclassical style.

Building A appears to maintain significance under NRHP/CRHR Criterion A/1 as being associated with the development of secondary public education in San Rafael and under Criterion C/3 as being an exceptional example of the Neoclassical style as designed by architect Frank T. Shea. Based on these findings and the inclusion of the building in the *San Rafael Historical/Architectural Survey*, it appears that Building A, the original San Rafael High School building at the 185 Mission Street campus, would be considered a potential historical resource under CEQA (CCR Title 14(3) §15064.5).

All of the other campus buildings were designed to be subordinate to the original Neoclassical building. The design of the northern section of the gymnasium, constructed in 1930, took some cues from the Neoclassical style with the minor decorative elements included on the east and west façades; however, by 1934 when the next building (Building M, see Figure 6) was constructed, the Neoclassical style was abandoned and a simple, utilitarian approach became the language for new development on the campus. Due to their lack of significance under any of the four CRHR criteria, none of the other campus buildings appear to qualify as historical resources under CEQA.

Historical Context

Summary History of San Rafael

In 1817, Mission San Rafael Arcangel, an adjunct of the Mission San Francisco de Dolores in San Francisco, was established in the region that would become the city of San Rafael. The mission was established as a hospital for ill Native American neophytes. Following the secularization of the Mexican missions, a land grant known as Rancho San Pablo that contained the former Mission San Rafael Arcangel was given to Timoteo (Timothy) Murphy. The town of San Rafael began to develop in the mid-1800s as an agricultural center for the region. After California achieved statehood in 1848, Marin County was established as one of the state's first 27 counties, and San Rafael was identified as one the county's four original townships and as the county seat. In 1866, the editor of the *Marin County Journal* published the following recollection of San Rafael circa 1851 (Miller, 1958):

> San Rafael boasted ten houses besides the Mission buildings; one store, one boarding house, and one whiskey mill. The buildings were all makeshifts except the residence of the late Timothy Murphy now owned and used by the county as a Court House; no fencing or other improvements were visible save a corral or two.

The first public school districts were established in Marin County in 1855. San Rafael was included in District 2 along with Sausalito, Corte Madera, Novato, Bolinas, and Punta de los Reyes. While schools opened in neighboring towns, a public school was not organized in San Rafael until 1861, at which time The San Rafael Institute was converted from a private school to a public school, serving only the primary grades.

Early on, San Rafael grew quite slowly due its lack of industry and isolation from San Francisco. The coming of the ferry and the railroad in the late 1800s changed the character of San Rafael, as commuting to San Francisco became a possibility. The area was no longer available to just a few wealthy residents and vacationers looking for good weather, but now to people of more moderate means who could work in San Francisco and permanently reside in Marin County. The population jumped from 841 people in 1870 to 2,276 in 1880 due to easier access across San Francisco Bay.

The development of San Rafael centered around Timothy Murphy's former adobe at 4th and C Streets, which would serve briefly as the county courthouse until a new courthouse was constructed in 1872. The town was laid out in a typical block pattern, and 4th Street became the primary commercial corridor. San Rafael was formally incorporated in 1874. The rail line via ferry continued to be the only way to travel between San Francisco and San Rafael until the construction of the Golden Gate Bridge in 1937 greatly improved access (Kyle, 2002; Miller, 1958; Spitz, 2006).

Summary History of San Rafael High School and the Subject Property

For the first few decades of public education in San Rafael, there was no high school available. Public education extended only through the 8th grade; after that point, parents sent their children to private boarding schools or to schools in San Francisco. San Rafael High School as an institution was established in 1888, following the approval of the school district and a special election of the residents. The first high school was established in a single room in the grammar school on 4th Street. Once a school bond was passed by voters in 1898, funding was available to construct a building for the newly established high school. The first San Rafael High School building, constructed on a site at 4th and E Streets, opened in 1899. The two-story building contained 15 classrooms, a gymnasium, and an assembly hall and served as the only high school in Marin County until 1908 (Miller, 1958).

By 1920, the increase in the school population, as well as the significant changes in the required curriculum led to a need for a new high school facility. After looking to construct a joint school with San Anselmo, the residents of San Rafael moved forward with plans to construct a new high school for San Rafael only. After much debate and evaluation, the "Eagle Rock" site on Mission Street was selected for the new high school campus that would accommodate 500 students. The 29-acre undeveloped site in eastern San Rafael was located just north of the canal in an area with little development except for single-family homes to the north. The property was purchased in 1923 and the ground-breaking ceremony was held in December of the same year. In June 1924, the firm Shea and Shea of San Francisco was awarded the contract for the architectural design of the new school. The cornerstone of the building, originally known as "Old Main," was laid to much fanfare in December 1924. The building was dedicated on August 22, 1925, and the new building was officially open for the fall session. Constructed of reinforced concrete, "Old Main" contained 25 classrooms, a study hall, a gymnasium, and a little theater. The building was constructed for approximately $300,000 (Miller, 1958; Independent-Journal, 1963). The building still exists and is shown as Building A in Figure 3-4 in Chapter 3, Project Description, of this EIR.

Soon after the first building at the new San Rafael High School was completed, the school district hired architect N. W. Sexton, who had offices in both San Francisco and San Rafael, to begin designing additions and new buildings to expand the campus. The first project began in 1926 and consisted of a single-story addition that included two outdoor courtyards and a dining room and kitchen at the east side of the main building. (The addition was later demolished.) The next two projects designed by Sexton included the original gymnasium (the northern section of Building P shown in Figure 3-4 in Chapter 3) constructed in 1930 and the original shop building (Building M in Figure 3-4) constructed in 1934 (Sanborn, 1950). In 1938, Sexton took on the design of seven new buildings: a home economics building (Building G), a new cafeteria building (never constructed), two new shop buildings (Buildings O and L), a mechanical drawing building (Building K), a music building (Building J), and an arts building (Building R). The locations of these buildings can be seen in Figure 3-4 in Chapter 3 of this EIR. H. Engle served as the structural engineer for all of the San Rafael High School projects designed by Sexton.

In the late 1940s and early 1950s, the San Francisco architecture firm of Donald B. Kirby & Thomas B. Mulvin prepared several smaller projects, including alterations to the main building (Building A), the construction of the swimming pool, and the construction of the administration building on Union Street. (The latter building is not located on the project site and is outside the scope of this evaluation, because it is not part within the boundaries of the SRHS campus at 185 Mission Street.) Thomas Mulvin relocated to San Rafael and continued to design projects for the campus with the firm of Gromme, Mulvin & Priestly. In 1958, Gromme, Mulvin & Priestly designed an addition to the gymnasium (southern section of Building P), a science building (Building F), and a cafeteria and classroom building (Building I). The same firm, as only Carl Gromme and Ralph Priestly, also designed the new library building (Building D) in 1965 and alterations to the main building (Building A) in 1967. The construction of the new library building (Building D) required the demolition of the eastern 1926 addition on “Old Main” (Building A) (information attained from various drawings on file at the San Rafael City Schools, Map Room and Division of the State Architect Application Cards for San Rafael High School).

By the late 1960s, the campus essentially appeared much as it does today, with all the major buildings having been constructed. Numerous alterations and renovations to the existing buildings have occurred over the past four-and-one-half decades, but the overall campus layout has remained the same.

The standard steel bleachers (Building V) and small structures associated with the athletic field appear to have been constructed during and after the later period of campus development. Aerial and archival yearbook photographs show the first bleachers (without a press box) in place at the west side of the field around 1958. The bleachers have been altered several times with: replacement sections, the addition of the press box (Building X) post-1968, the alteration or replacement of the western bleachers to include additional rows of seating and new benches in the 2000s, and the removal of northern and southern sections from the bleachers on the eastern side in 2010. No records have been found regarding the construction of Buildings Y and Z, the concession stand and ticket booth respectively; however aerial photographs illustrate that the buildings were constructed post-1968. A visual inspection of Buildings Y and Z, confirmed that the buildings were of more recent construction likely from the 1980s. Finally, the survey of aerial photographs also indicates that Building W, a prefabricated shed located in the courtyard adjacent to Building J, appears to have been installed around 2010 (Nationwide Environmental Title Research, 1946, 1952, 1958, 1968, 1993, 2002, and 2012).

SRHS Campus Major Building Chronology

(See Figures 2 through 6 for graphics of SRHS Campus development)

1923 The 29-acre Eagle Rock site purchased for the construction of a new San Rafael High School

1925 “Old Main” (Building A) is completed and opens for the fall session. Architect Frank Shea of Shea and Shea.

1930 Original gymnasium (Building P) was constructed. Architect N. W. Sexton.

1934 The first shop building (Building M) was completed. Architect N. W. Sexton.

1939 Two new shop buildings, a home economics building (Building G), a mechanical drawing building (Building K), a music building (Building J) and an arts building (Building R) were all constructed. Architect N. W. Sexton. Engineer H. M. Engle.

1948 Alterations to the main building (Building A). Architects Donald B. Kirby & Thomas B. Mulvin.

1949 Swimming pool constructed. Architects Kirby & Mulvin.

1953 Administration building on Union Street constructed. Architects Kirby & Mulvin.

1958 Additions and alterations to the gymnasium (Building P). Architects Gromme, Mulvin & Priestly of San Rafael.

1958 Science building and the cafeteria and classroom buildings constructed (Buildings F and I). Architects Gromme, Mulvin & Priestly

c. 1958 Steel bleachers installed at the athletic field.

1965 Eastern addition of the main classroom building (Building A) demolished, and replaced with a new library building (Building D). Architects Carl Gromme and Ralph Priestly.

1967 Alterations to the main classroom building (Building A). Architects Carl Gromme and Ralph Priestly.

1970 Alterations to gym and locker room (Building P). Architect Richard Marshall.

1979 Reconstruction of cafeteria building (Building I) due to fire damage. Work included replacing the roof and other structural members. Architect Richard Marshall.

1984 Alterations to the gymnasium (Building P). Architect Chester Bowles.

2001-06 Four-phased modernization of the campus including: site work, a new elevator tower, accessibility upgrades, window replacements, and numerous interior alterations. Architect TLDC.

2010 North and south sections of the eastern bleachers at the athletic fields were removed.

2012 New school entry constructed. Architect TLDC.

Architectural Context

Early Architects of the SRHS Campus

Frank T. Shea

Frank Shea, of the San Francisco architectural firm Shea & Shea, designed the original SRHS campus building (Building A). Frank Shea was one of San Francisco's pioneering architects and was well known for his numerous designs of Catholic churches throughout the state. Born in Bloomington, Illinois, Shea attended the Ecole des Beaux Art in Paris and completed his education in California. Over the course of his career in San Francisco he was associated with both John O. Lofquist and his brother Will D. Shea. He worked as the city architect of San Francisco from 1906-1908, during which time he design the City Hall dome that had been destroyed in the fire of 1906. The majority of his works were completed in the Beaux Arts and Neoclassical architectural styles. Frank Shea died at his home in Marin County in September 1929 (*Architect and Engineer,* 1929).

N. W. Sexton

Sexton was a locally prominent architect that maintained an office in San Rafael. Before relocating to San Rafael he worked independently in San Francisco. He designed the majority of the buildings on the SRHS campus working throughout the1930s. He was a native England and designed a hospital in Napa for the Victory Hospital Association, fire stations in Sausalito and Vallejo among numerous other educational and civic buildings throughout the area. (Sausalito News, 1942; and *Architect and Engineer*, 1928 and 1942).

Architectural Styles

The campus includes a mixture of architectural styles in the existing buildings. The oldest building, dating back to 1925, was completed in the Neoclassical architectural style with specific features such as ionic columns, classical forms, strong symmetry, dominate entry porch, faux rustication and an overall monumentality. The original section of the gymnasium constructed in 1930, also minimally maintains some influences of the Neoclassical style. The second period of campus development was executed in the 1930s and includes buildings designed in the Moderne architectural style featuring elements such as simple forms, flat roofs with coping, speed bands in the coping, an emphasis on horizontality, minimal decorative features and smooth exterior wall finishes. The newer buildings, built in the late-1950s and mid-1960s, are more modern in style and include concrete finishes and details such as simple forms, flat roofs with no coping, minimal ornament and no decorative detailing at the doors and windows.

Neoclassical

The Neoclassical (circa 1895-1950) style of architecture evolved from a revival in interests in classical building models stemming from the World's Columbian Exposition, held in Chicago in 1893. It was mandated that all buildings in the exposition have a classical theme and many of the best-known architects of the period designed dramatic colonnaded buildings based on the use pure Roman and Greek forms and formally arranged around a central court. This display would become the model for public and commercial buildings through the country for decades to come and laid the groundwork for the City Beautiful movement, which strongly promoted classical civic architecture.

Several character-defining features of the Neoclassical style include:

- An overall monumentality to the building;
- Use of classical forms and ornament;
- Strong symmetry in plan and elevation;
- Front façade dominated by full-height porch;
- Entry porches with roof supported by classical columns;
- Columns typically featuring Ionic or Corinthian capitals;
- Façades having symmetrically balanced windows and central doorways; and
- Façades with faux-rustication.

The original San Rafael High School building at the Mission Street site is an exceptional example of the Neoclassical style. The building exhibits an overall monumentality and employs classical forms. Further, the design features a front façade dominated by a central full-height entry porch; porch columns with Ionic capitals; symmetrical facades with balanced doors and windows; and classical elements such as pilasters, entablatures, and a decorative frieze. The original section of the gymnasium also exhibits some influences of the Neoclassical style, although very minimally.

Moderne

The Moderne (1920-1940) style of architecture eschewed classical forms and found a language from the evolution of the streamlined industrial design of ships, airplanes and automobiles. Common characteristics of the style include:

- Simple forms;
- Flat roofs with narrow coping;
- Speed band at the coping;
- Emphasis on horizontality;
- Minimal decorative features, if any;
- Smooth wall surfaces; and
- Steel windows.

The Sexton buildings designed for the SRHS campus in the 1930s (Buildings M, G, K, J and R) are all minor examples of the Moderne style. The buildings all feature simple forms, flat roofs with a coping, smooth wall surfaces, minimal decoration, and a slight emphasis on horizontality. Primarily these buildings all serve as secondary, background buildings to the original and primary SRHS campus building, Building A.

Modern

The Modern style in the 1950s and 1960s developed from the ideal of the International Style which focused on the expression of a buildings function; the avoidance of unnecessary decorative features; the celebration of period technologies and materials; and an overall minimalism in appearance. Typical characteristics of buildings in the Modern style generally include:

- Simple forms;
- Overhanging eaves in some instances;
- Emphasis on horizontality;
- No decorative details at door or windows; and
- Minimal ornament.

Buildings D, F and I all can be classified within the Modern style. The buildings all lack traditional decorative elements; maintain simplistic forms and flat roofs; and illustrate an emphasis on horizontality. Similar to the Moderne structures on campus, these buildings are also subordinate to the original SRHS campus building.

Property Description

Overall Campus

The SRHS campus is located in central Marin County in the incorporated City of San Rafael. Sited east of Highway 101 and north of San Rafael Creek, the 29.8-acre campus is bordered by 3rd Street, Mission Avenue, Embarcadero Avenue and Union Street. The area surrounding the campus is generally residential to the north and east, and commercial and industrial to the south and west. The overall site is relatively flat with a slight downward slope to the north end. Athletic fields flank the central campus area that contains the academic and administrative buildings. The main surface parking lot is located on 3rd Street, south of the central campus area and between the athletic fields. The gymnasium and pool are sited at the northeast section of campus, and a second parking lot and tennis courts are located just east of the gymnasium.

The SRHS campus includes a total of 12 buildings and 9 modular classroom units. The campus buildings are all one-to-two stories in height and the majority of the buildings are located surrounding Building A, originally known as "Old Main." A handful of smaller structures on the campus include a ticket booth, concession stand, press box, daycare shed and bleachers.

Individual Buildings

Building A, "Old Main" – Administration/Theater/Classroom

Building A is the oldest building at San Rafael High School. Standing at the center of the campus facing east, the two-story-plus-a-basement imposing building is generally H-shaped in plan and Neoclassical in style. The building is constructed of concrete and the exterior is clad in a painted cement plaster finish with select sections scored to emulate stone. Replacement aluminum doors and windows, both fixed and awning, and with wood surrounds, are typical throughout the building. The building exhibits numerous features that are typical of the Neoclassical style including: a front façade dominated by a full-height entry porch; porch columns with Ionic capitals; symmetrical facades with balanced doors and windows; pilasters, entablatures, and a decorative frieze. Building A has a flat roof surrounded by parapets and the raised central volume maintains parapets that resemble a gable roof line. Lightwells are located around the base of the building and exterior access to the basement is found through exterior stairwells on both the north and south sides. The rear, east side of the building, is located approximately twenty feet from the west wall of Building D; thereby, the two buildings create a narrow alley between them and share access to the elevator tower located in the alley.

Building D – Classrooms/Library

Building D is located east of and directly behind Building A and abuts Buildings G and J. The east façade of the Building D faces the athletic fields and features a protruding two-story volume with a ground floor loggia and prominent overhanging eave. Two stories in height, the reinforced concrete building steps up to the west and maintains a flat roof with a coping. The exterior is finished in painted concrete and is accented by protruding smooth finished concrete rectangular panels and pilasters laid out in a rhythmic pattern across the four façades with punched window openings extending between the panels and pilasters. Concrete masonry units columns support the covered walkways with corrugated metal roofs at the east and west sides. Replacement aluminum fixed and awning windows are found throughout the building and single aluminum-frame door with one-lite provide access at the east and west façades. An exterior stair at both the north and south end of the east façade connect to the second floor.

Building F – Science and Building I – Madrone/Cafeteria

Buildings F and I stand along the western edge of the campus adjacent to the western athletic fields. Together the north and south edges of the buildings form a plaza directly across from the main entrance of Building A. Both buildings are one story in height, feature flat roofs, metal coping, sliding aluminum windows and smooth finished and scored concrete exterior walls. The simple buildings are Modern in style, with simple forms and very minimal decorative features that include recessed wall planes and a geometrical scoring pattern. The recessed main entrances for each building face the plaza and are protected by a projecting awning. Building F is essentially C-shaped in plan and stands on a site the slopes down slightly to the north and Mission Avenue. Building I is L-shaped in plan, and maintains several unique features not included in Building F such as: exterior louvered sun shades on the west façade windows and a wood-frame storefront of fixed windows and doors adjacent to a row of exterior serving windows all beneath a covered porch supported by steel columns.

Building G - Media

Directly north of and connected to Building D, Building G stands near the curve in Mission Street. Rectangular in plan, the two story building is approximately 8,100 square feet and features a flat roof with a minimally overhanging eave. The ground floor exterior concrete walls are painted and maintain visible formwork, while the second floor is finished in a cement plaster coat. The building is Moderne in architectural style with minimal decorative features including: horizontal belt courses located at the window head and sills and a slightly projecting roof coping with speed bands. Newer exterior features include an exterior stair at the south façade and a corrugated metal covered awning over the second floor entry at the south façade and at the ground floor entry at the north façade. Combination fixed and awning aluminum sash replacement windows are found throughout the building, and both flush doors and aluminum storefronts with single lite doors punctuate the façades.

Building J - Music

Building J stands on the east side of campus directly west of the bleachers and athletic field and south of and connected to Building D. The building is square in plan, approximately 4,500 square feet in area, one story plus a basement in height and features a flat roof and a minimally overhanging eave. Constructed at the same time as Building G, Building J maintains the same simplified Modern architectural style and several unifying design features such as: horizontal belt courses located at the window head and sills and a slightly projecting roof coping with speed bands. Building J is constructed of concrete and cement plaster clads the upper half, while the painted lower half reveals the concrete formwork.

The building stands on a site that slopes down toward the south. The west façade features a covered walkway with a Mission tile, cap-and-pan roof and fronts a small courtyard. Due to the change in grade, the upper floor of Building J at the west façade is just above the courtyard level on the northern end.

Combination fixed and awning aluminum sash replacement windows are found throughout the building, except at the ground floor where the window openings are sealed with painted plywood. Flush doors pierce the east and south facades, and an aluminum storefront with a pair of single lite doors punctuates the courtyard façade.

Building K – Daycare

Building K is located on the southern end of campus between Buildings A and M. The small building is rectangular in plan, and stands one story in height on a site that slopes down to the south. The building is constructed of concrete and the exterior walls feature an exposed base with a cement plaster finish above. The flat roof has a smooth metal coping and a horizontal course circles the building at the level of the window headers. A covered walkway extends from the west side, and the roof structure steps up in line with the raising grade. The building maintains steel sash combination fixed and awning windows and both flush and paneled doors.

Building L – Photography/Ceramics

Building L is essentially square in plan and two-stories in height. The building stands at the southeastern section of campus adjacent to the main parking lot. The simple concrete structure is finished in painted cement plaster at the exterior walls and features replacement fixed and awning windows throughout. The windows feature no decorative surrounds, but do have a narrow projecting sill. The north and west façades maintain a large percentage of openings within the walls and louvered metal sunshades extend out from these façades in the form of awnings.

Building M – Auto Tech/Wood Shop

Building M was the original shop building constructed on the campus. The concrete structure is one story in height and rectangular in plan. Painted cement plaster clads the exterior walls capped by smooth metal coping. The façades feature large bays infilled with multi-lite steel sash widows, combinations of steel sash windows and flush doors, plaster infill, and roll-up metal garage doors. The simplistic building maintains some aspects of the Moderne architectural style, but was executed with minimal ornament and with a focus on function over expression.

Building O - Academy

Similar to Building M, Building O, is rectangular in plan, one-story in height with a flat roof and narrow coping, finished in painted cement plaster and features large, multi-lite steel sash windows. Somewhat Moderne in style, the building lacks any ornament; however the façades are organized symmetrically in terms of the door and window openings. The building appears primarily industrial with a focus on function. Located adjacent to Building M, Building O backs up to the main parking lot.

Building P - Gymnasium

The gymnasium, Building P, covers the largest footprint of any building on the SRHS campus and stands at the northeast corner near Eagle Rock. The building's original section at the north end includes a two-story T-shaped, gable-roof segment with a combination stepped and peaked parapet at the gable-end walls and a one-story, C-shaped, flat-roof section that frames the swimming pool area. The three gable end walls each feature decorative rectangular recesses and a recessed solid oculus centered beneath each parapet apex. The poured concrete building's exterior walls are finished simply in paint and the form work in the concrete is visible. The front, western façade of the original gymnasium features a flat-roofed, single-story projecting entry volume with two, two-lite entry doors each with a side-light and a projecting metal awning overhead. Six engaged, fluted pilaster divide the entrance into bays and two decorative medallions hang above each entry door.

A two-story gable-roofed rectangular addition was constructed at the southwest corner of the original gymnasium. The gymnasium addition is a simple concrete structure with exposed concrete columns along the exterior façades. The new main entrance at the west side appears to have been more recent construction and includes a single-story projecting volume with a parapet reminiscent of the original building segment, paired two-lite, double-doors with transoms flanked by rectangular insets and a gabled, steel awning structure point loaded on concrete bases.

Building R - Art

The two-story, poured concrete frame Building R is C-shaped in plan and stands on a site that slopes significantly to the north from the north side of Building A to Mission Avenue. At the south façade only one floor is visible, while both floors are exposed on the Mission Avenue side. Similar to Building G, the upper floor is clad in a cement plaster finish and the ground floor walls reveal exposed concrete embedded formwork. Belt courses ring the building at the head and sill window levels and speed band run along the coping at the edge of the flat roof. Replacement aluminum windows and flush doors are found throughout the building. A covered walkway with Mission style cap-and-pan roofing extends out toward the raised plaza framed by the building at the south side.

Athletic Fields (Bleachers/Press Box/Concession Stand/Ticket Booth)

Located east of the central campus, the grass athletic field is bordered by a track and maintains standard metal prefabricated bleachers at the east and west sides of the field, with the larger set of bleachers being at the east side nearest the buildings. The eastern bleachers include three separate units with twelve rows of seating and metal guardrails running along the sides and back of each section. The press box is centrally located on top of the eastern bleachers and is clad in T-111 siding, features a flush door, and maintains a wood guardrail around the roof deck. The western bleachers are also standard metal prefabricated bleachers with twelve rows of seating and guardrails at the sides and back edge. The very simple, small ticket booth, with plywood siding, two counter height openings and a flat roof, stands southeast of the field at 3rd Street parking lot. The concession stand, located just south of the eastern bleachers on an asphalt surface, is one story in height, constructed of concrete masonry units, features a flat roof with an overhang, has flush doors, and counter height openings.

Evaluation Criteria

National

National Register Bulletin Number 15, *How to Apply the National Register Criteria for Evaluation*, describes the Criteria for Evaluation as being composed of two factors. First, the property must be "associated with an important historic context" (U.S. Department of the Interior, 1997a). The National Register of Historic Places identifies four possible context types, of which at least one must be applicable at the national, state, or local level. As listed under Section 8, "Statement of Significance," of the National Register of Historic Places Registration Form, these are:

> "A. Property is associated with events that have made a significant contribution to the broad patterns of our history.
>
> "B. Property is associated with the lives of persons significant in our past.
>
> "C. Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
>
> "D. Property has yielded, or is likely to yield, information important to prehistory or history" (U.S. Department of the Interior, 1997b).

Second, for a property to qualify under the National Register's Criteria for Evaluation, it must also retain "historic integrity of those features necessary to convey its significance" (U.S. Department of the Interior, 1997a). While a property's significance relates to its role within a specific historic context, its integrity refers to "a property's physical features and how they relate to its significance" (U.S. Department of the Interior, 1997a). To determine if a property retains the physical characteristics corresponding to its historic context, the National Register has identified seven aspects of integrity. These are:

> "Location is the place where the historic property was constructed or the place where the historic event occurred...
>
> "Design is the combination of elements that create the form, plan, space, structure, and style of a property...
>
> "Setting is the physical environment of a historic property...
>
> "Materials is the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property...
>
> "Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory...
>
> "Feeling is a property's expression of the aesthetic or historic sense of a particular period of time...

> "Association is the direct link between an important historic event or person and a historic property" (U.S. Department of the Interior, 1997a).

Since integrity is based on a property's significance within a specific historic context, an evaluation of a property's integrity can only occur after historic significance has been established (U.S. Department of the Interior, 1997a).

State

California Office of Historic Preservation's Technical Assistance Series #6, *California Register and National Register: a Comparison*, outlines the differences between the federal and state processes. The context types to be used when establishing the significance of a property for listing on the California Register of Historical Resources are very similar, with emphasis on local and state significance. They are:

> "1. It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States; or
>
> "2. It is associated with the lives of persons important to local, California, or national history; or
>
> "3. It embodies the distinctive characteristics of a type, period, region, or method of construction or represents the work of a master, or possesses high artistic values; or
>
> "4. It has yielded, or is likely to yield, information important to prehistory or history of the local area, California, or the nation" (California Department of Parks and Recreation, 2006).

Integrity must also be determined for a property to be listed on the state register. The California Register of Historical Resources maintains a similar definition of integrity, while provided for a slightly lower threshold than the National Register.

In addition to separate evaluations for eligibility to the California Register, the state will automatically list resources if they are listed or determined eligible for the NRHP through a complete evaluation process.[1]

Local

[1] All State Historical Landmarks from number 770 onward are also automatically listed on the California Register. (*California Register of Historical Resources: The Listing Process*, California Office of Historic Preservation Technical Assistance Series, no. 5 [Sacramento, CA: California Department of Parks and Recreation, n.d.], 1.)

Generally, a resource shall be considered by the lead agency to be "historically significant" if the resource is eligible for listing on the National Register, meets the criteria for listing on the California Register (Pub. Res. Code §5024.1, Title 14 CCR, Section 4852), or is eligible for designation as a local landmark.

The City of San Rafael maintains a list of historic resources in the document *San Rafael Historical/Architectural Survey (*the *Survey),* which was first published in 1976 and updated in 1986. Structures included in the list are presumed significant resources unless evidence to the contrary in provided. The survey also provides ranking for the listed structures as "Exceptional," "Excellent" or "Good." Additionally, the City's Historic Preservation Ordinance (Chapter 2.18 of the Municipal Code) outlines procedures for the designation of landmarks and of structures of merit.

2.18.048 - Criteria for designation as landmark.

The criteria that shall be applied by the cultural affairs commission and by the city council in designating buildings, places, and areas as historic landmarks or historic districts shall include the following:

(a) Historical, Cultural Importance.
  (1) Has significant character, interest, or value as part of the development, heritage or cultural characteristics of the city, state or nation; or is associated with the life of a person significant in the past;
  (2) Is the site of a historic event with a significant effect upon society; or
  (3) Exemplifies the cultural, political, economic, social or historic heritage of the community.

(b) Architectural, Engineering Importance.
  (1) Portrays the environment in the era of history characterized by a distinctive architectural style;
  (2) Embodies those distinguishing characteristics of an architectural type or engineering specimen;
  (3) Is the work of a designer whose individual work has significantly influenced the development of San Rafael or its environs;
  (4) Contains elements of design, detail, materials or craftsmanship which represent a significant innovation; or
  (5) The work of a designer and/or architect of merit.

(c) Geographic Importance.
  (1) By being part of or related to a square, park or other distinctive area, should be developed or preserved according to a plan based on a historic, cultural or architectural motif; or
  (2) Owing to its unique location or singular physical characteristic, represents an established and familiar visual feature of the neighborhood, community or city.

(d) Archaeological Importance. Has yielded information important in prehistory or history.

2.18.069 - Recognition of structures of merit.

(a) The commission may approve a list of structures of historic, architectural or aesthetic merit which have not been designated as landmarks and are not situated in designated historic districts. The said list may be added to from time to time. The purpose of this list shall be to recognize and encourage the protection, enhancement, perpetuation and the use of such structures. The commission shall maintain a record of historic structures in the city which have been officially designated by agencies of the state or federal government, and shall cause such structures to be added to the aforesaid list.

(b) Nothing in this chapter shall be construed to impose any regulations or controls upon such structures of merit included on the said list and neither designated as landmarks nor situated in historic districts.

(c) The commission may authorize such steps as it deems desirable to recognize the merit of, and to encourage the protection, enhancement, perpetuation and use of any such listed structure, or of any designated landmark or any structure in a designated historic district, including but not limited to the issuance of a certificate of recognition and the authorization of a plaque to be affixed to the exterior of the structure; and the commission shall cooperate with appropriate state and federal agencies in such efforts.

(d) The commission may make recommendations to the city council and to any other body or agency responsible, to encourage giving names pertaining to San Rafael history to streets, squares, walks, plazas and other public places.

Evaluation of Significance

Current Designations

None of the subject buildings are currently listed individually or as contributing structures to a district on the National Register or the California Register, or identified as local historic landmarks. The original SRHS building, Building A is listed in the *Survey* as 185 Mission Avenue and has been assigned the designation of "Good."

Age

The first consideration for determining a property's eligibility is age. Typically, a resource must be at least fifty years old to be included in either the National Register or the California Register. Research indicates that all of the major SRHS campus buildings were constructed prior to 1966 and are therefore greater than fifty years old. Many of these building have had numerous alterations and undergone renovations since their initial construction. Minor buildings W, X, Y and Z all appear to be less than 50 years old and therefore would not be eligible for listing except under special circumstances. The bleachers, identified as Building V, appear to have been originally constructed circa 1958, however they have been altered and replac

Building Evaluations

Building A: Constructed 1925

It appears that the original high school building (Building A) at San Rafael High School is associated with the development of secondary public education in the City of San Rafael and Marin County in the early 20th century, as well as with architect Frank T. Shea and is an exceptional example of the Neoclassical style.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): The original building of the SRHS campus (Building A) was constructed following the community's decision to maintain a separate high school for the City of San Rafael and after a survey had determined that the current school facility on 4th Street was no longer sufficient to meet the needs of the growing high school student population. As a significant investment into the development of the public school system in San Rafael and Marin County in general, the population voted to construct a new, more suitable high school building on a site that would allow for future expansion. As the first and most substantial structure constructed at the SRHS campus, Building A has made a significant contribution to the broad patterns of local history, and to the cultural heritage of San Rafael. Therefore, it appears that the property would be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): While many people were instrumental in attaining the funding for and pursuing the planning of a new high school building San Rafael, research has not shown the property to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that the property would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Building A was designed by renowned San Francisco architect Frank T. Shea of the firm Shea and Shea in the Neoclassical architectural style. Substantial in height and scale, Building A exhibits numerous features that are typical of the Neoclassical style including: a front façade dominated by a full-height entry porch; porch columns with Ionic capitals; symmetrical facades with balanced doors and windows; pilasters, entablatures, and a decorative frieze. The imposing building is the most prominent structure on campus and is emblematic of SRHS. The architect, Frank T. Shea, was classically trained at the Ecole des Beaux Arts in Paris and was most well-known for his Catholic Church designed in the Beaux Arts and Neoclassical styles. Therefore, Building A, the oldest building on the SRHS campus, appears to be eligible for individual listing for embodying the distinctive characteristics of a type and period, and for representing the work of a master under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that Building A has yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance

The period of significance refers to the span of time during which significant events and activities occurred. The period of significance for Building A, the original SRHS building would be from 1925, the date of construction to 1966, fifty years from today since the building has continued to operate as the central building for SRHS.

Evaluation of Integrity

After the historic significance has been established, the resource's historic integrity must also be assessed. For a property to qualify as historically significant under the National Register's Criteria for Evaluation, it must retain "historic integrity of those features necessary to convey its significance." The California Register of Historical Resources maintains a similar definition of integrity, while provided for a slightly lower threshold than the National Register. While a property's significance relates to its role within a specific historic context, its integrity refers to "a property's physical features and how they relate to its significance." Further, for a building to meet registration requirements under Criteria C/3 (Architecture) as an individual resource, the property would need to retain sufficient character-defining features in order to reflect design intent. To determine if a property retains the physical characteristics corresponding to its historic context, the National and California Registers have identified seven aspects of integrity, as described previously in this report.

Location
The building remains at its original site, and therefore retains the integrity of location.

Design
The building retains a significant amount of its original character defining features such as the entry porch, colonnade, pilasters, and numerous decorative features. The rear addition to the building was removed for the construction of Building D; however the primary façades, the front and sides, were unchanged. Several alterations have occurred over time including the replacement of the original windows with windows of similar design and operations, addition of access ramps at the exterior, and the replacement of exterior doors. None of these alterations have impacted the overall understanding of the building's design; there Building A retains its integrity of design.

Setting
The building was originally constructed on a large undeveloped site located within a bourgeoning neighbor of single family houses. Numerous buildings have been constructed on the SRHS campus since the first building was completed. The integrity of setting has been slightly diminished due to the development of the site.

Materials
Although the building no longer retains its original doors and windows, they were replaced to match the original window patterns and the openings and decorative surrounds still remain. Additionally, the buildings concrete construction, cement plaster finish, and decorative features all remain. The building retains its integrity of materials.

Workmanship
The building retains much of its original construction and decorative features. Therefore, the building clearly retains its integrity of workmanship.

Feeling
The building maintains its integrity of feeling, as it clearly illustrates its aesthetic and historic nature as a high school building constructed in the Neoclassical style.

Association
Finally, the building maintains its integrity of association to San Rafael High School.

Findings
Overall, the Building A appears to retain all aspects of integrity, with only the integrity of setting having been slightly diminished. The building retains sufficient integrity to express its historical significance.

Building P: Constructed 1930, Addition 1958

It appears that the gymnasium (Building P) is not eligible for listing in any register due to a lack of significance under any of the established criteria.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): The gymnasium at the SRHS campus was originally constructed five years following the construction of the main building. The building was located in the northeastern corner of the campus and was the first building in a series of expansions that would lead to the development of a campus, rather than just a building in an open field. While the building maintains some significance in terms of the expansion of the campus, it does not appear that the gymnasium is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that the property would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown the gymnasium to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that the property would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): The original section of Building P was designed by N. W. Sexton, a somewhat locally prominent architect, to be a simple utilitarian building that was minimally aesthetically connected to Building A with a few Neoclassical surface details. Although the building maintains some decorative features, it does not embody the Neoclassical style beyond those few details. The addition constructed in 1958, was also very functional in design and lacked having any particular architectural style. The more recent entry design, maintains some elements that reflect back to the Neoclassical details. While, Sexton was locally well known architect, neither his body of work nor his legacy indicate that he was a master, nor do any scholarly works address the catalogue of N. W. Sexton. It does not appear that Building P embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the building would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that Building P has yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that the building is eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the building's integrity undertaken. A resource must first be shown to possess historical significance, before an evaluation of the building's ability to convey its significance and maintain integrity can be completed.

Buildings M, G, K, J and R: Constructed 1934-1939

It appears that none of the buildings constructed from 1934 to 1939 are eligible for listing in any register due to a lack of significance under any of the established criteria.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): Buildings M, G, K, J and R were all constructed from 1934 to 1939 to accommodate the needs of the growing high school population and curriculum. This group of buildings all houses specific programs ranging from mechanical drawing to the arts. While the buildings maintain some significance in terms of the expansion of the campus and its curriculum, it does not appear that the buildings are associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that Buildings M, G, K, J and R would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown Buildings M, G, K, J and R to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that these resources would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Buildings M, G, K, J and R were all designed by architect N. W. Sexton to be secondary to the primary SRHS campus building, Building A. These buildings are all minor examples of the Moderne style with simple forms, flat roofs with a coping, smooth wall surfaces, minimal decoration, and a slight emphasis on horizontality. Primarily these buildings all serve as background buildings on the SRHS campus. While, Sexton was locally well known architect, neither his body of work nor his legacy indicate that he was a master, nor do any scholarly works address the catalogue of N. W. Sexton. It does not appear that Buildings M, G, K, J and R embody the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the buildings would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that these buildings have yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that these buildings are eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the buildings' integrity undertaken. The resources must first be shown to possess historical significance, before an evaluation of the buildings' ability to convey their significance and maintain integrity can be completed.

Buildings F, I and D: Constructed 1958-1965

It appears that none of the buildings constructed from 1958-1965 are eligible for listing in any register due to a lack of significance under any of the established criteria.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): Building F, I and D were all constructed from 1958-1965 as part of a second wave of campus expansion. This group of buildings includes classrooms, a cafeteria and a library. While the buildings maintain some significance in terms of the expansion of the campus, it does not appear that the buildings are associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that Buildings F, I and D would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown Buildings F, I and D to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that these resources would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Buildings F, I and D were all designed by an iteration of the firm Gromme and Priestly and have similar design aesthetics. These buildings were also designed to be subordinate to the primary SRHS campus building, Building A. The Gromme and Priestly buildings are all minor examples of the Modern style. The buildings all lack traditional decorative elements; maintain simplistic forms and flat roofs; and illustrate an emphasis on horizontality. Local architects Gromme and Priestly do not appear in scholarly journals and do not appear to have completed a body of work that would classify them as master architects. It does not appear that Buildings F, I and D embody the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the buildings would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that these buildings have yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that these buildings are eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the buildings' integrity undertaken. The resources must first be shown to possess historical significance, before an evaluation of the buildings' ability to convey their significance and maintain integrity can be completed.

Buildings V, W, X, Y and Z: Constructed 1958-2010

It appears that none of the small structures or bleachers constructed from 1958-2010 are eligible for listing in any register due to a lack of significance under any of the established criteria and/or due to insufficient age.

Criterion A (NRHP) / 1 (CRHR)/ (a)(3) (City of San Rafael): The first prefabricated metal bleachers appear to have been installed at the athletic field circa 1958 as other campus expansions were being undertaken. The current bleachers do not appear to be the original installation or have been altered so as to incorporate a pressbox and additional rows of seating. While the bleachers were part of the expansion of the campus specifically related to athletic facilities, it does not appear that the bleachers or the pressbox are associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States. Therefore, it appears that Buildings V and X would not be potentially eligible for listing under Criterion A/1/(a)(3).

Criterion B (NRHP) / 2 (CRHR)/(a)(1)(City of San Rafael): Research has not shown Buildings V or X to be directly associated with the lives of persons significant in our past within a local, state or national context. Therefore, it appears that these resources would not be eligible for listing under Criterion B/2/(a)(1).

Criterion C (NRHP) / 3 (CRHR)/(b)(1,2,5)(City of San Rafael): Buildings V and X, the bleachers and the press box are both standardized prefabricated units that do not embody the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values. Therefore the structures would not be eligible under Criterion C/3/(b)(1,2,5).

Criterion D (NRHP) / 4 (CRHR)/ (d) City of San Rafael: It does not appear that these structures have yielded, or are likely to yield, information important to prehistory or history of the local area, California, or the nation, and therefore do not appear significant under Criterion D/4/(d).

Period of Significance and Evaluation of Integrity

Because it does not appear that these structures are eligible under any of the significance criteria for listing in any register, a period of significance was not established nor was an evaluation of the strcutres' integrity undertaken. The resources must first be shown to possess historical significance, before an evaluation of the buildings' ability to convey their significance and maintain integrity can be completed.

Conclusion

Following a thorough evaluation of the SRHS campus and its buildings, it appears that only Building A is eligible for listing in the NRHP, CRHR and as a City of San Rafael landmark. Building A, the original building constructed on the SRHS campus maintains significance under NRHP/CRHR Criterion A/1 as being associated with the development of secondary public education in San Rafael and under Criterion C/3 as being an exceptional example of the Neoclassical style as designed by architect Frank T. Shea. Based on these findings and the inclusion of the building in the *San Rafael Historical/Architectural Survey*, it appears that Building A, the original San Rafael High School building at the 185 Mission Street campus, would be considered a potential historical resource under CEQA (CCR Title 14(3) §15064.5).

The other buildings on the SRHS campus were designed to be subordinate to the original Neoclassical building. Only the northern section of the gymnasium, constructed in 1930, took some cues from the Neoclassical style with minor decorative elements; however, by 1934 when the next building (Building M, see Figure 6) was constructed, the Neoclassical style was abandoned and a simple, utilitarian approach became the language for new development on the campus. Due to their lack of significance under any of the established criteria, none of the other campus buildings appear to qualify as historical resources under CEQA.

Consultant Qualifications

Pursuant to Code of Federal Regulations, 36 CFR Part 61, the author, Kimberly Butt, AIA, meets the Secretary of the Interior's qualification standards for professionals in historic architecture and architectural history.

Figures

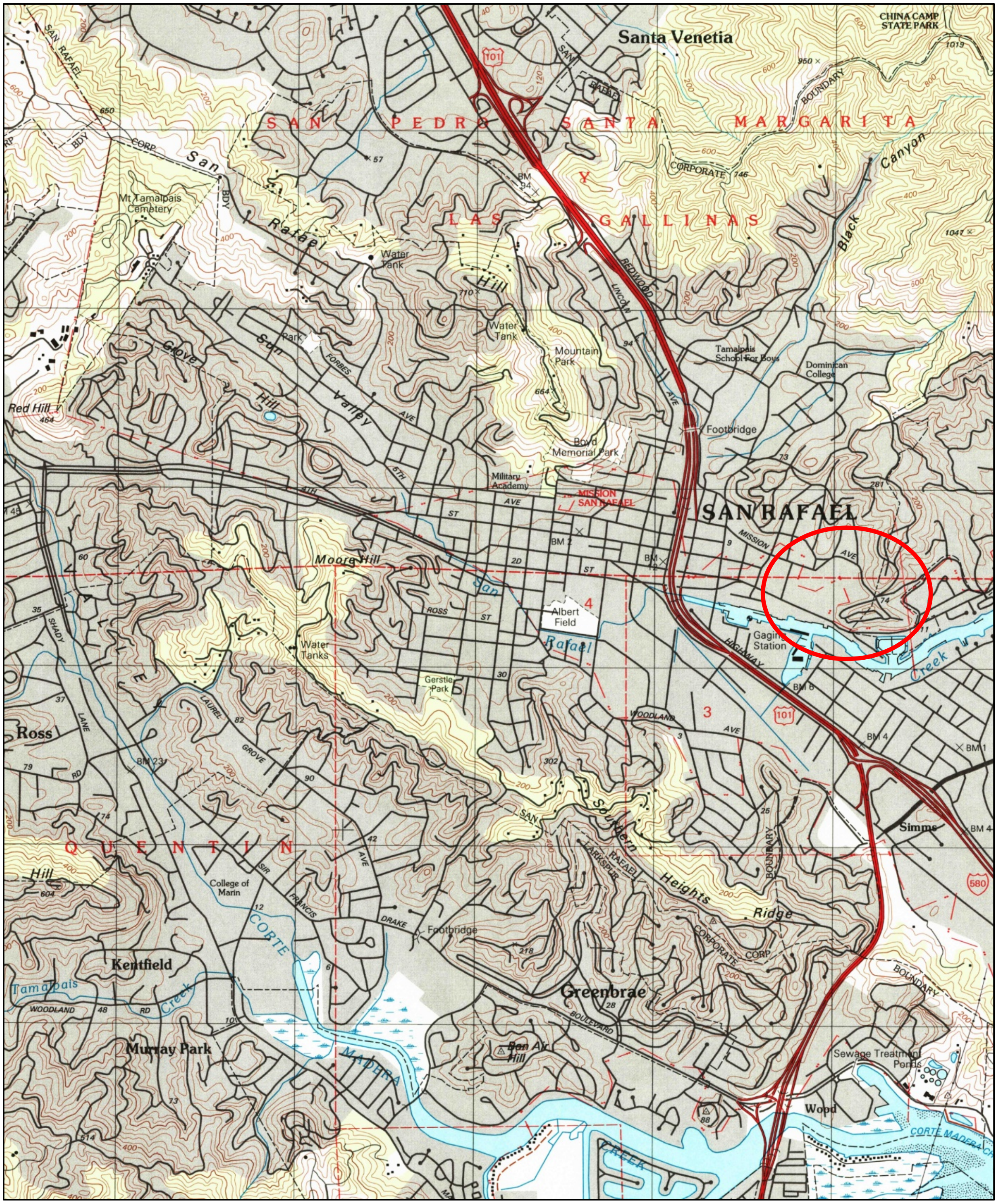

Figure 1: USGS Map showing the property location circled.

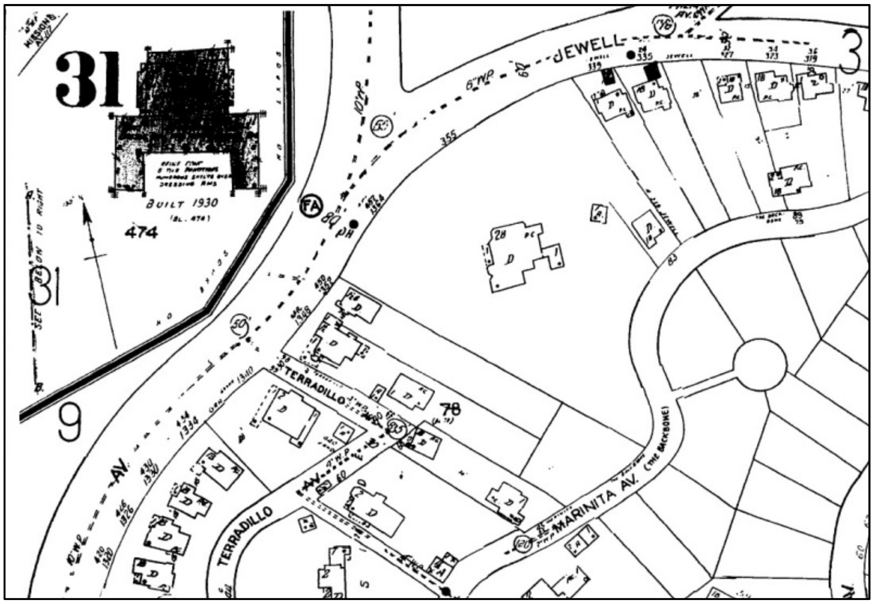

Figure 2: Sanborn Map of San Rafael, California dated 1950 showing the San Rafael High School gymnasium in the upper left-hand corner.

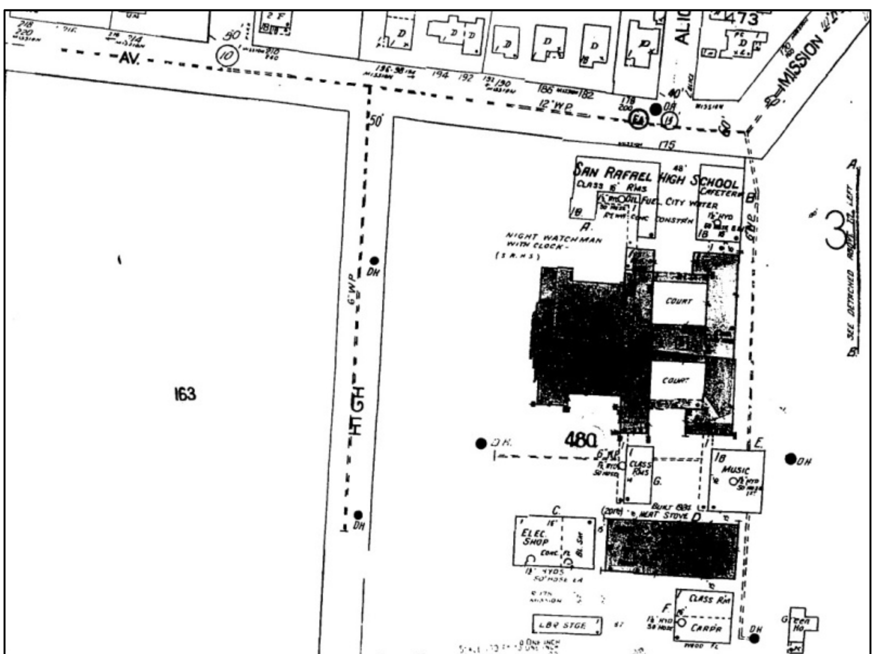

Figure 3: Sanborn Map of San Rafael, California dated 1950 showing the San Rafael High School campus.

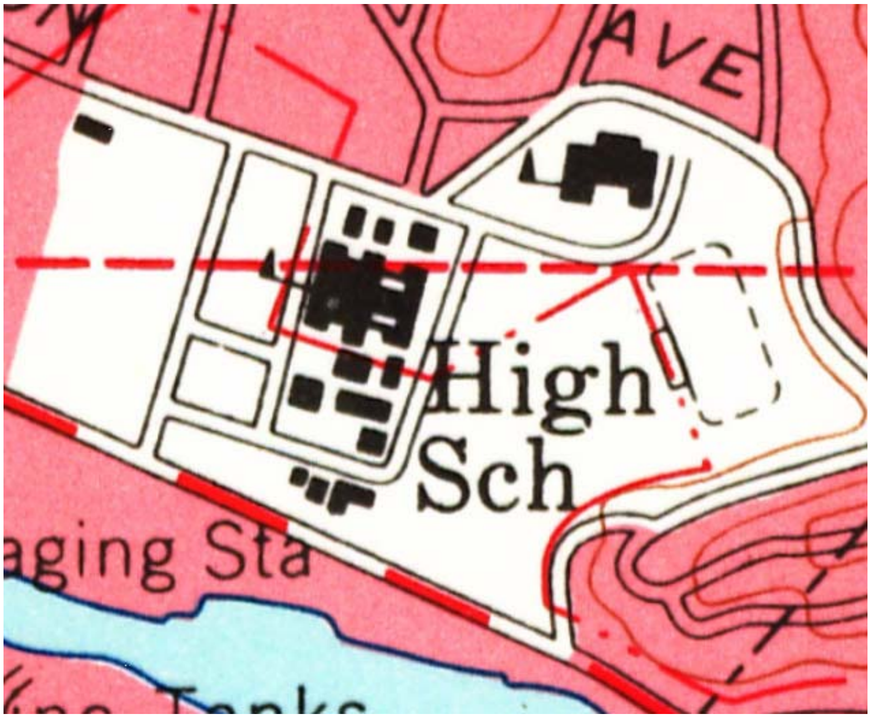

Figure 4: Segment of the USGS San Rafael 1954 map showing the SRHS Campus.

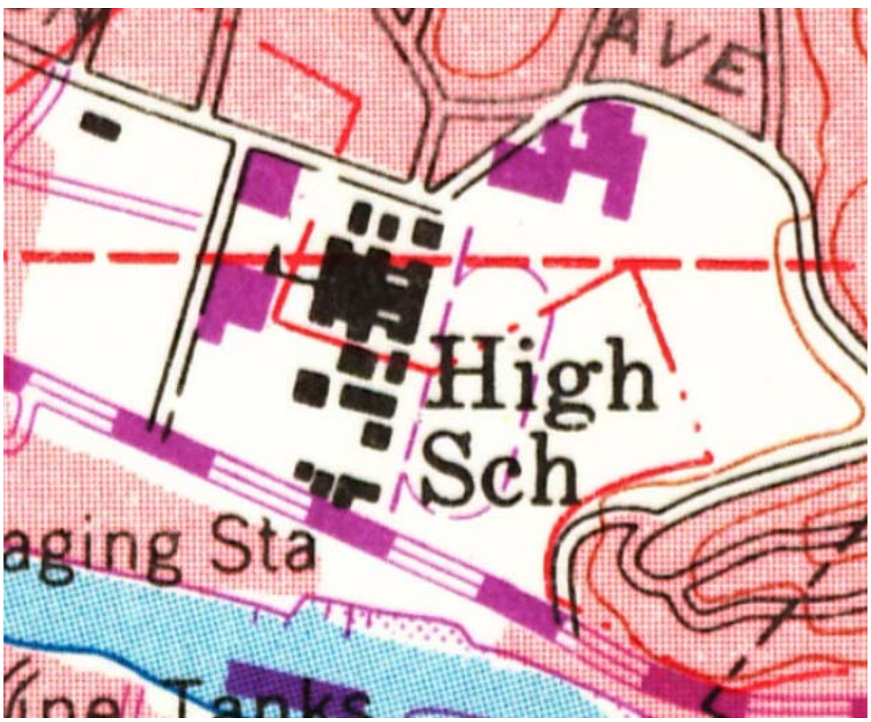

Figure 5: Segment of the USGS San Rafael 1968 map showing the SRHS Campus.

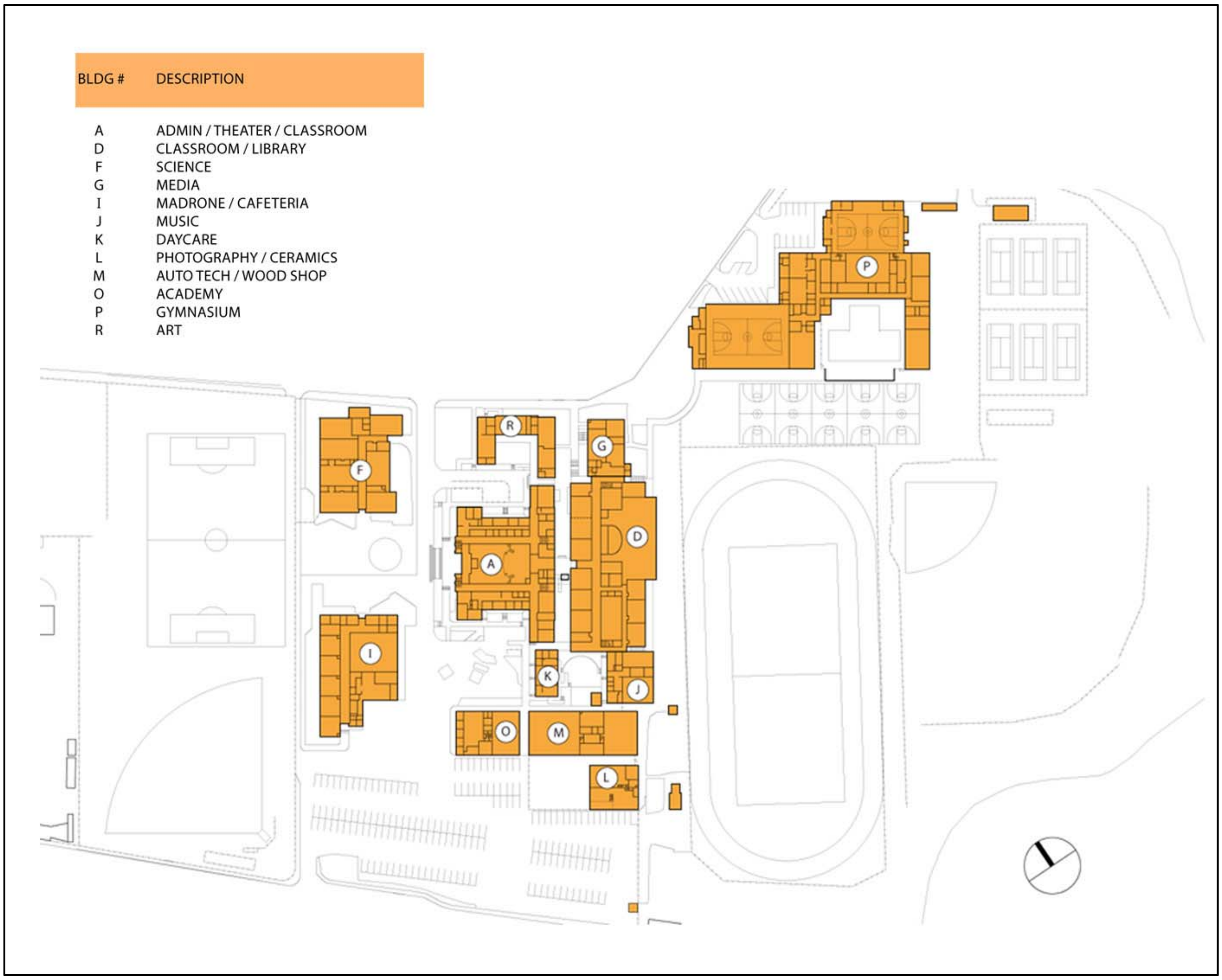

Figure 6: Current SRHS campus layout. Graphic derived from HY Architects San Rafael City School District Master Planning presentation September 22, 2014. Accessed online 2016 and edited by author.

Figure 7: View across the western athletic field towards Buildings F, A and I.

Figure 8: View toward the southwest corner of Building A from the 3rd Street parking lot entrance.

Figure 9: The front, west facade of Building A looking across the plaza.

Figure 10: The north facade of Building A.

Figure 11: View between Buildings A and D looking south. Note: Building A is on the right and Building D is on the left.

Figure 12: South facade of Building A.

Figure 13: View across the basketball courts looking toward the bleachers and the east facade of Building D.

Figure 14: Partial view of Building D's east façade looking northwest.

Figure 15: Partial view of Building D's east façade looking southwest.

*Figure 16: View of the covered walkway adjacent to Buildings D and G,
the east end of Building D's north façade, and a partial view of Building G’s east façade.*

Figure 17: View of the western end of Building D's south facade.

Figure 18: View of Building F looking northeast.

Figure 19: View of the northeast corner of Building F from Mission Street.

Figure 20: View of Building I looking southeast.

Figure 21: View of the south facade of Building I.

Figure 22: View of the east facade of Building I looking north.

Figure 23: View of the intersection of Buildings D and J from the courtyard looking east.

Figure 24: View of the southeast corner of Building J.

Figure 25: View of the Gymnasium's west facade.

Figure 26: View across Mission Street looking at the north façades of Buildings R and G.

Figure 27: View looking northeast across the football field.

Figure 28: View of the track between the football field and the bleachers looking north.

Figure 29: View of the east facade of the concession stand.

Figure 30: View of the ticket booth looking east.

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APPENDIX D
NOISE BACKGROUND DATA

Construation Phase	Equipment	Usage Factor	Quantity	Match Actual Measured Lmax R2 (Dba)	Dba Leq	Distance 1
Demolition	Concrete/Industrial Saws	20	2	90	83	50
	Excavators	40	1	81	77	50
	Tractors/Loaders/Backhoes	40	2	78	74	50
	10 Yard Dump	40	1	76	72	50
	20 Yard End Dumps	40	4	76	72	50
	Backup Alarm	5		80	67	50
		#N/A			#N/A	
Site Preparation	Graders	40	1	85	81	50
	Scrapers	40	1	84	80	50
	Rubber Tired Dozers	40	1	82	78	50
	Tractors/Loaders/Backhoes	40	2	78	74	50
	10 Yard Dump	40	2	76	72	50
	Backup Alarm	5		80	67	50
		#N/A			#N/A	
Grading	Graders	40	2	85	81	50
	Scrapers	40	1	84	80	50
	Excavators	40	1	81	77	50
	Tractors/Loaders/Backhoes	40	1	78	74	50
	10 Yard Dump	40	1	76	72	50
	Backup Alarm	5		80	67	50
		#N/A			#N/A	
Building Construction	Generator Sets	50	1	81	78	50
	Tractors/Loaders/Backhoes	40	1	78	74	50
	Forklifts	20	2	75	68	50
	Welders	40	1	74	70	50
	Backup Alarm	5		80	67	50
		#N/A			#N/A	
Architectural Coatings	Air Compressors	40	1	78	74	50
	JLG Lift	20	assume 1	75	68	50
		#N/A			#N/A	
		#N/A			#N/A	
Paving	Cement and Mortar Mixers	50	1	80	77	50
	Rollers	20	2	80	73	50
	Tractors/Loaders/Backhoes	40	1	78	74	50
	Pavers	50	1	77	74	50
	Paving Equipment	50	1	77	74	50
	Backup Alarm	5		80	67	50

Backup Alarm is added to the list

Spec. Lmax due to the lack of Actual Measured Lmax

Backup Aları

Two noisiest pieces+backup alarms (Dba)	Two noisie	Buffer distance for Off-site	Buffer distance for on-site/off-site		
93	86	66	219	Threshold	
				on-site/off	70
				off-site	90
89	84	45	177		
89	84	46	177		
85	80	30	122		
80	75	19	79		
85	79	31	115		

m

Equipment	d1(feet)	d2(feet)	RMS1	RMS2	PPV1	PPV2
Vibratory Roller	25		94	#NUM!	0.210	#DIV/0!
Large bulldozer	25		87	#NUM!	0.089	#DIV/0!
Loaded trucks	25		86	#NUM!	0.076	#DIV/0!
Small bulldozer	25		58	#NUM!	0.003	#DIV/0!

PPV2=PPV1*(D1/D2)^1.5
where
PPV1 is the reference vibration level at a specified distance
PPV2 is the calculated vibration level
D1 is the reference distance
D2 is the distance from the equipment to the receiver

Equipment	Reference PPV at 25 Feet (in/sec)	Requied Buffer Distance - Building Damage Threshold 0.5 PPV (feet)	Requied Buffer Distance - Building Damage Threshold 0.3 PPV (feet)	Requied Buffer Distance - Building Damage Threshold 0.2 PPV (feet)	Requied Buffer Distance - Building Damage Threshold 0.12 PPV (feet)	Reference RMS at 25 Feet (VdB)	Requied Buffer Distance - Institutional Threshold 83 VdB (feet)	Requied Buffer Distance - Sleep Threshold 80 VdB (feet)	Requied Buffer Distance - Interior operation Threshold 65 VdB (feet)
	25	0.5	0.3	0.2	0.12	25	83	80	65
Vibratory Roller	**0.210**	**14**	**20**	**26**	**36**	**94**	**58**	**73**	**232**
Large bulldozer	**0.089**	**8**	**11**	**15**	**20**	**87**	**34**	**43**	**135**
Loaded trucks	**0.076**	**7**	**10**	**13**	**18**	**86**	**31**	**40**	**125**
Small bulldozer	**0.003**	**1**	**1**	**2**	**2**	**58**	**4**	**5**	**15**
Pile Driver (impact) upper range	1.518	52	74	97	136	112	232	291	922
Pile Driver (impact) typical	0.644	30	42	55	77	104	125	158	499
Pile Driver (sonic) upper range	0.734	32	45	59	84	105	135	170	539
Pile Driver (sonic) typical	0.17	12	17	22	32	93	54	68	214
Vibratory Roller	0.21	14	20	26	36	94	58	73	232
Hoe Ram	0.089	8	11	15	20	87	34	43	135
Large bulldozer	0.089	8	11	15	20	87	34	43	135
Caisson drilling	0.089	8	11	15	20	87	34	43	135
Loaded trucks	0.076	7	10	13	18	86	31	40	125
Jackhammer	0.035	4	6	8	11	79	18	23	73
Small bulldozer	0.003	1	1	2	2	58	4	5	15

RMS2=RMS1-30*LOG10(D2/D1)
where
RMS1 is the reference vibration level at a specified distance
RMS2 is the calculated vibration level
D1 is the reference distance
D2 is the distance from the equipment to the receiver

typed in
calculated

Equipment	d1(feet)	d2(feet)	RMS1	RMS2	PPV1	PPV2
Vibratory Roller	25		94	#NUM!	0.210	#DIV/0!
Large bulldozer	25		87	#NUM!	0.089	#DIV/0!
Loaded trucks	25		86	#NUM!	0.076	#DIV/0!
Small bulldozer	25		58	#NUM!	0.003	#DIV/0!

PPV2=PPV1*(D1/D2)^1.5
where
PPV1 is the reference vibration level at a specified distance
PPV2 is the calculated vibration level
D1 is the reference distance
D2 is the distance from the equipment to the receiver

Equipment	Reference PPV at 25 Feet (in/sec)	Requied Buffer Distance - Building Damage Threshold 0.5 PPV (feet)	Requied Buffer Distance - Building Damage Threshold 0.3 PPV (feet)	Requied Buffer Distance - Building Damage Threshold 0.2 PPV (feet)	Requied Buffer Distance - Building Damage Threshold 0.12 PPV (feet)	Reference RMS at 25 Feet (VdB)	Requied Buffer Distance - Institutional Threshold 83 VdB (feet)	Requied Buffer Distance - Sleep Threshold 80 VdB (feet)	Requied Buffer Distance - Interior operation Threshold 65 VdB (feet)
	25	0.5	0.3	0.2	0.12	25	83	80	65
Vibratory Roller	**0.210**	**14**	**20**	**26**	**36**	**94**	**58**	**73**	**232**
Large bulldozer	**0.089**	**8**	**11**	**15**	**20**	**87**	**34**	**43**	**135**
Loaded trucks	**0.076**	**7**	**10**	**13**	**18**	**86**	**31**	**40**	**125**
Small bulldozer	**0.003**	**1**	**1**	**2**	**2**	**58**	**4**	**5**	**15**
Pile Driver (impact) upper range	1.518	52	74	97	136	112	232	291	922
Pile Driver (impact) typical	0.644	30	42	55	77	104	125	158	499
Pile Driver (sonic) upper range	0.734	32	45	59	84	105	135	170	539
Pile Driver (sonic) typical	0.17	12	17	22	32	93	54	68	214
Clam shovel drop (slurry wall)	0.202	14	19	25	35	94	58	73	232
Hydromill (slurry wall) in soil	0.008	2	2	3	4	66	7	9	27
Hydromill (slurry wall) in rock	0.017	3	4	5	7	75	14	17	54
Vibratory Roller	0.21	14	20	26	36	94	58	73	232
Hoe Ram	0.089	8	11	15	20	87	34	43	135
Large bulldozer	0.089	8	11	15	20	87	34	43	135
Caisson drilling	0.089	8	11	15	20	87	34	43	135
Loaded trucks	0.076	7	10	13	18	86	31	40	125
Jackhammer	0.035	4	6	8	11	79	18	23	73
Small bulldozer	0.003	1	1	2	2	58	4	5	15

RMS2=RMS1-30*LOG10(D2/D1)
where
RMS1 is the reference vibration level at a specified distance
RMS2 is the calculated vibration level
D1 is the reference distance
D2 is the distance from the equipment to the receiver

(green)	typed in
(yellow)	calculated

APPENDIX E
GREENHOUSE GAS EMISSIONS DATA

SRHS Existing Conditions Analysis for GHGs and Energy Use

Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
High School	1,125.00	Student	13.93	279,670.00	1225

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	427	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - PG&E's default 2008 CO2 intensity factor updated to the most recent (2013) emission factor verified by a 3rd party in PG&E’s (2015) Greenhouse Gas Emission Factors: Guidance for PG&E Customers.

Land Use - Based on project descriptions: Population= 1,125 Student+ 100 Faculty = 1225 population; Building Area = 279,670 gsf.

Construction Phase - Construction is not part of this analysis.

Grading -

Vehicle Trips - No school on weekends. According to the traffic analysis by Parisi Transportation Consulting (2016), the existing WkDy trip rate is 3,923/1125=3.49.

Road Dust -

Energy Use - PGEs default 2008 CO2 intensity factor updated to the most recent (2013) emission factor verified by a 3rd party in PGEs (2015) Greenhouse Gas Emission Factors: Guidance for PGE Customers.

Water And Wastewater - Central Marin Sanitation Agency wastewater treatment plant uses 100% aerobic treatment and 100% cogeneration.

Land Use Change -

Construction Off-road Equipment Mitigation -

Area Mitigation -

Operational Off-Road Equipment -

Stationary Sources - Emergency Generators and Fire Pumps -

Stationary Sources - Process Boilers -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	300.00	0.00
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	30.00	0.00
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	10.00	0.00
tblLandUse	BuildingSpaceSquareFeet	149,243.60	279,670.00
tblLandUse	LandUseSquareFeet	149,243.60	279,670.00
tblLandUse	LotAcreage	3.43	13.93
tblLandUse	Population	0.00	1,225.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	427
tblVehicleTrips	ST_TR	0.61	0.00
tblVehicleTrips	SU_TR	0.25	0.00
tblVehicleTrips	WD_TR	1.71	3.49
tblWater	AerobicPercent	87.46	100.00
tblWater	AnaDigestCogenCombDigestGasPercent	0.00	100.00
tblWater	AnaDigestCombDigestGasPercent	100.00	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	SepticTankPercent	10.33	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum											**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum											**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

SRHS Existing Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
		Highest		

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area											0.0000	0.0201	0.0201	6.0000e-005	0.0000	0.0215
Energy											0.0000	492.9173	492.9173	0.0214	7.9800e-003	495.8324
Mobile											0.0000	2,993.4870	2,993.4870	0.1176	0.0000	2,996.4257
Waste											41.6761	0.0000	41.6761	2.4630	0.0000	103.2507
Water											1.7533	13.3482	15.1015	6.9400e-003	4.0000e-003	16.4671
Total											**43.4294**	**3,499.7725**	**3,543.2019**	**2.6090**	**0.0120**	**3,611.9974**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area											0.0000	0.0201	0.0201	6.0000e-005	0.0000	0.0215
Energy											0.0000	492.9173	492.9173	0.0214	7.9800e-003	495.8324
Mobile											0.0000	2,993.4870	2,993.4870	0.1176	0.0000	2,996.4257
Waste											41.6761	0.0000	41.6761	2.4630	0.0000	103.2507
Water											1.7533	13.3482	15.1015	6.9400e-003	4.0000e-003	16.4671
Total											**43.4294**	**3,499.7725**	**3,543.2019**	**2.6090**	**0.0120**	**3,611.9974**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

SRHS Existing Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	4/1/2017	3/31/2017	5	0	
2	Site Preparation	Site Preparation	4/1/2017	3/31/2017	5	0	
3	Grading	Grading	4/1/2017	3/31/2017	5	0	
4	Building Construction	Building Construction	4/1/2017	3/31/2017	5	0	
5	Paving	Paving	4/1/2017	3/31/2017	5	0	
6	Architectural Coating	Architectural Coating	4/1/2017	3/31/2017	5	0	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 419,505; Non-Residential Outdoor: 139,835; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

SRHS Existing Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

SRHS Existing Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	117.00	46.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	23.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.2 Demolition - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.2 Demolition - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Paving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Paving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated											0.0000	2,993.487 0	2,993.487 0	0.1176	0.0000	2,996.425 7
Unmitigated											0.0000	2,993.487 0	2,993.487 0	0.1176	0.0000	2,996.425 7

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
High School	3,926.25	0.00	0.00	7,342,540	7,342,540
Total	3,926.25	0.00	0.00	7,342,540	7,342,540

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
High School	9.50	7.30	7.30	77.80	17.20	5.00	75	19	6

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
High School	0.577091	0.045512	0.202682	0.115815	0.019822	0.005054	0.010113	0.010039	0.001995	0.004376	0.006002	0.000679	0.000822

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated											0.0000	245.9209	245.9209	0.0167	3.4600e-003	247.3682
Electricity Unmitigated											0.0000	245.9209	245.9209	0.0167	3.4600e-003	247.3682
NaturalGas Mitigated											0.0000	246.9964	246.9964	4.7300e-003	4.5300e-003	248.4642
NaturalGas Unmitigated											0.0000	246.9964	246.9964	4.7300e-003	4.5300e-003	248.4642

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
High School	4.62854e+006											0.0000	246.9964	246.9964	4.7300e-003	4.5300e-003	248.4642
Total												**0.0000**	**246.9964**	**246.9964**	**4.7300e-003**	**4.5300e-003**	**248.4642**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
High School	4.62854e +006											0.0000	246.9964	246.9964	4.7300e-003	4.5300e-003	248.4642
Total												**0.0000**	**246.9964**	**246.9964**	**4.7300e-003**	**4.5300e-003**	**248.4642**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
High School	1.2697e +006	245.9209	0.0167	3.4600e-003	247.3682
Total		**245.9209**	**0.0167**	**3.4600e-003**	**247.3682**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
High School	1.2697e +006	245.9209	0.0167	3.4600e-003	247.3682
Total		**245.9209**	**0.0167**	**3.4600e-003**	**247.3682**

6.0 Area Detail

6.1 Mitigation Measures Area

No Hearths Installed

SRHS Existing Conditions Analysis for GHGs and Energy Use - Marin County, Annual

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated											0.0000	0.0201	0.0201	6.0000e-005	0.0000	0.0215
Unmitigated											0.0000	0.0201	0.0201	6.0000e-005	0.0000	0.0215

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping											0.0000	0.0201	0.0201	6.0000e-005	0.0000	0.0215
Total											**0.0000**	**0.0201**	**0.0201**	**6.0000e-005**	**0.0000**	**0.0215**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping											0.0000	0.0201	0.0201	6.0000e-005	0.0000	0.0215
Total											**0.0000**	**0.0201**	**0.0201**	**6.0000e-005**	**0.0000**	**0.0215**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	15.1015	6.9400e-003	4.0000e-003	16.4671
Unmitigated	15.1015	6.9400e-003	4.0000e-003	16.4671

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
High School	4.95558 / 12.7429	15.1015	6.9400e-003	4.0000e-003	16.4671
Total		**15.1015**	**6.9400e-003**	**4.0000e-003**	**16.4671**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
High School	4.95558 / 12.7429	15.1015	6.9400e-003	4.0000e-003	16.4671
Total		**15.1015**	**6.9400e-003**	**4.0000e-003**	**16.4671**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	41.6761	2.4630	0.0000	103.2507
Unmitigated	41.6761	2.4630	0.0000	103.2507

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
High School	205.31	41.6761	2.4630	0.0000	103.2507
Total		**41.6761**	**2.4630**	**0.0000**	**103.2507**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
High School	205.31	41.6761	2.4630	0.0000	103.2507
Total		**41.6761**	**2.4630**	**0.0000**	**103.2507**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

SRHS Future Conditions Analysis for GHGs and Energy Use

Marin County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
High School	1,325.00	Student	13.93	327,892.00	1425

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	69
Climate Zone	5			**Operational Year**	2018
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	427	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - PG&E's default 2008 CO2 intensity factor updated to the most recent (2013) emission factor verified by a 3rd party in PG&E’s (2015) Greenhouse Gas Emission Factors: Guidance for PG&E Customers.

Land Use - Based on project description: Population= 1,325 Student+ 100 Faculty = 1425 population; Building Area = 327,892 gsf.

Construction Phase - Construction is not part of this analysis

Grading -

Vehicle Trips - No school on weekend. According to the traffic analysis by Parisi Transportation Consulting (2016), future WkDy trip rate: 4,620/1325=3.49.

Road Dust -

Energy Use - PGEs default 2008 CO2 intensity factor updated to the most recent (2013) emission factor verified by a 3rd party in PGEs (2015) Greenhouse Gas Emission Factors: Guidance for PGE Customers.

Water And Wastewater - Central Marin Sanitation Agency wastewater treatment plant uses 100% aerobic treatment and 100% cogeneration.

Land Use Change -

Construction Off-road Equipment Mitigation -

Area Mitigation -

Energy Mitigation -

Operational Off-Road Equipment -

Stationary Sources - Emergency Generators and Fire Pumps -

Stationary Sources - Process Boilers -

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	300.00	0.00
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	30.00	0.00
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	10.00	0.00
tblLandUse	BuildingSpaceSquareFeet	175,775.80	327,892.00
tblLandUse	LandUseSquareFeet	175,775.80	327,892.00
tblLandUse	LotAcreage	4.04	13.93
tblLandUse	Population	0.00	1,425.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	427
tblVehicleTrips	ST_TR	0.61	0.00
tblVehicleTrips	SU_TR	0.25	0.00
tblVehicleTrips	WD_TR	1.71	3.49
tblWater	AerobicPercent	87.46	100.00
tblWater	AnaDigestCogenCombDigestGasPercent	0.00	100.00
tblWater	AnaDigestCombDigestGasPercent	100.00	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	SepticTankPercent	10.33	0.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum											**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2017											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum											**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

SRHS Future Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
		Highest		

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area											0.0000	0.0237	0.0237	6.0000e-005	0.0000	0.0253
Energy											0.0000	577.9084	577.9084	0.0251	9.3600e-003	581.3261
Mobile											0.0000	3,525.6625	3,525.6625	0.1385	0.0000	3,529.1236
Waste											49.0852	0.0000	49.0852	2.9009	0.0000	121.6066
Water											2.0650	15.7212	17.7862	8.1800e-003	4.7100e-003	19.3946
Total											**51.1502**	**4,119.3157**	**4,170.4659**	**3.0727**	**0.0141**	**4,251.4762**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area											0.0000	0.0237	0.0237	6.0000e-005	0.0000	0.0253
Energy											0.0000	577.9084	577.9084	0.0251	9.3600e-003	581.3261
Mobile											0.0000	3,525.6625	3,525.6625	0.1385	0.0000	3,529.1236
Waste											49.0852	0.0000	49.0852	2.9009	0.0000	121.6066
Water											2.0650	15.7212	17.7862	8.1800e-003	4.7100e-003	19.3946
Total											**51.1502**	**4,119.3157**	**4,170.4659**	**3.0727**	**0.0141**	**4,251.4762**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

SRHS Future Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	4/1/2017	3/31/2017	5	0	
2	Site Preparation	Site Preparation	4/1/2017	3/31/2017	5	0	
3	Grading	Grading	4/1/2017	3/31/2017	5	0	
4	Building Construction	Building Construction	4/1/2017	3/31/2017	5	0	
5	Paving	Paving	4/1/2017	3/31/2017	5	0	
6	Architectural Coating	Architectural Coating	4/1/2017	3/31/2017	5	0	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 0

Acres of Paving: 0

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 491,838; Non-Residential Outdoor: 163,946; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

SRHS Future Conditions Analysis for GHGs and Energy Use - Marin County, Annual

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	138.00	54.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	28.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.2 Demolition - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.2 Demolition - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Paving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Paving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

SRHS Future Conditions Analysis for GHGs and Energy Use - Marin County, Annual

3.6 Paving - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2017

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2017

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2017

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated											0.0000	3,525.662 5	3,525.662 5	0.1385	0.0000	3,529.123 6
Unmitigated											0.0000	3,525.662 5	3,525.662 5	0.1385	0.0000	3,529.123 6

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
High School	4,624.25	0.00	0.00	8,647,880	8,647,880
Total	4,624.25	0.00	0.00	8,647,880	8,647,880

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
High School	9.50	7.30	7.30	77.80	17.20	5.00	75	19	6

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
High School	0.577091	0.045512	0.202682	0.115815	0.019822	0.005054	0.010113	0.010039	0.001995	0.004376	0.006002	0.000679	0.000822

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated											0.0000	288.3237	288.3237	0.0196	4.0500e-003	290.0205
Electricity Unmitigated											0.0000	288.3237	288.3237	0.0196	4.0500e-003	290.0205
NaturalGas Mitigated											0.0000	289.5847	289.5847	5.5500e-003	5.3100e-003	291.3056
NaturalGas Unmitigated											0.0000	289.5847	289.5847	5.5500e-003	5.3100e-003	291.3056

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
High School	5.42661e+006											0.0000	289.5847	289.5847	5.5500e-003	5.3100e-003	291.3056
Total												**0.0000**	**289.5847**	**289.5847**	**5.5500e-003**	**5.3100e-003**	**291.3056**

5.2 Energy by Land Use - NaturalGas

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
High School	5.42661e+006											0.0000	289.5847	289.5847	5.5500e-003	5.3100e-003	291.3056
Total												**0.0000**	**289.5847**	**289.5847**	**5.5500e-003**	**5.3100e-003**	**291.3056**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
High School	1.48863e+006	288.3237	0.0196	4.0500e-003	290.0205
Total		**288.3237**	**0.0196**	**4.0500e-003**	**290.0205**

5.3 Energy by Land Use - Electricity

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
High School	1.48863e+006	288.3237	0.0196	4.0500e-003	290.0205
Total		**288.3237**	**0.0196**	**4.0500e-003**	**290.0205**

6.0 Area Detail

6.1 Mitigation Measures Area

No Hearths Installed

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated											0.0000	0.0237	0.0237	6.0000e-005	0.0000	0.0253
Unmitigated											0.0000	0.0237	0.0237	6.0000e-005	0.0000	0.0253

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping											0.0000	0.0237	0.0237	6.0000e-005	0.0000	0.0253
Total											**0.0000**	**0.0237**	**0.0237**	**6.0000e-005**	**0.0000**	**0.0253**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products											0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping											0.0000	0.0237	0.0237	6.0000e-005	0.0000	0.0253
Total											**0.0000**	**0.0237**	**0.0237**	**6.0000e-005**	**0.0000**	**0.0253**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	17.7862	8.1800e-003	4.7100e-003	19.3946
Unmitigated	17.7862	8.1800e-003	4.7100e-003	19.3946

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
High School	5.83657 / 15.0083	17.7862	8.1800e-003	4.7100e-003	19.3946
Total		**17.7862**	**8.1800e-003**	**4.7100e-003**	**19.3946**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
High School	5.83657 / 15.0083	17.7862	8.1800e-003	4.7100e-003	19.3946
Total		**17.7862**	**8.1800e-003**	**4.7100e-003**	**19.3946**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	49.0852	2.9009	0.0000	121.6066
Unmitigated	49.0852	2.9009	0.0000	121.6066

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
High School	241.81	49.0852	2.9009	0.0000	121.6066
Total		**49.0852**	**2.9009**	**0.0000**	**121.6066**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
High School	241.81	49.0852	2.9009	0.0000	121.6066
Total		**49.0852**	**2.9009**	**0.0000**	**121.6066**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

APPENDIX F
TRANSPORTATION BACKGROUND DATA

APPENDIX F-1

Intersection Turning Movement Counts

TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

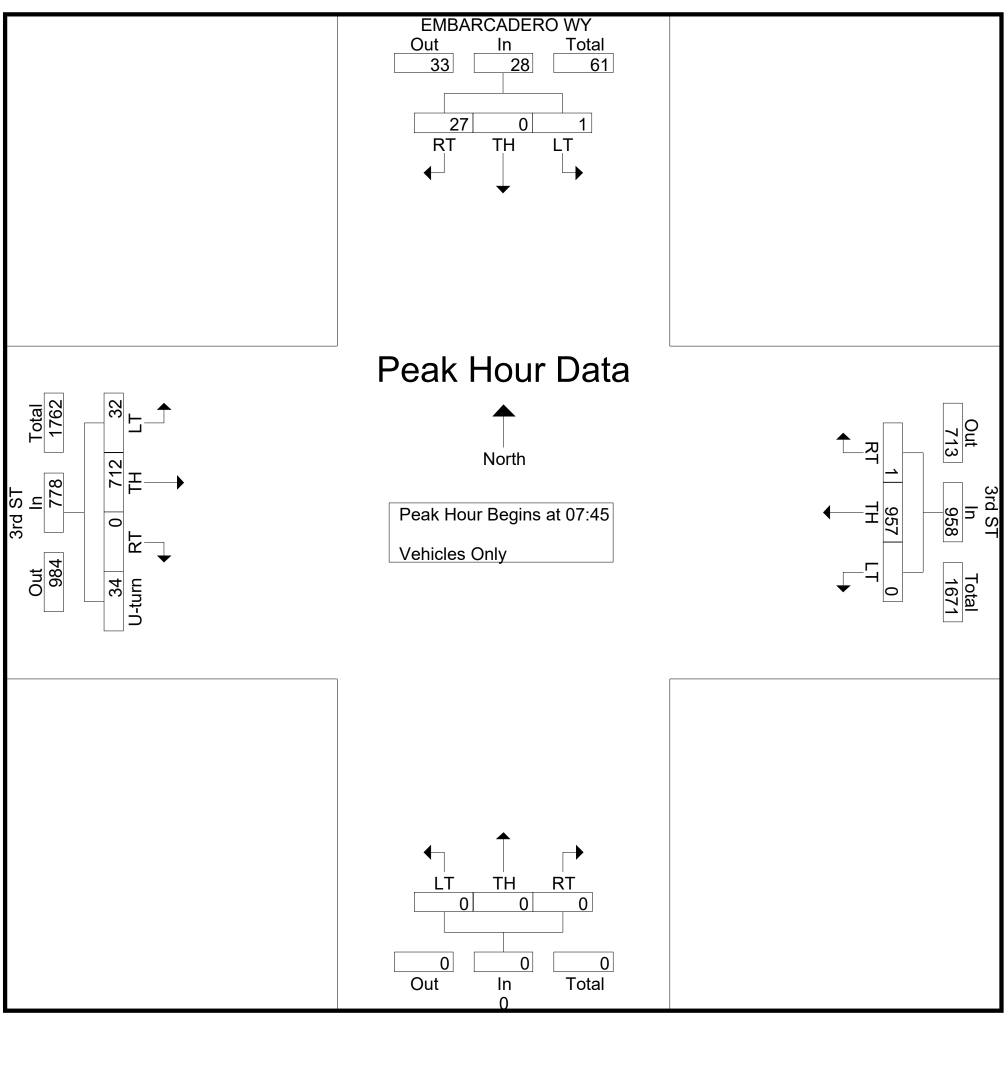
Latitude: 37.968774
Longitude: -122.512031

File Name : embarcadero-3rd-a
Site Code : 6
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
07:00	2	0	0	2	0	153	0	153	0	0	0	0	0	89	0	0	89	244
07:15	7	0	0	7	0	224	0	224	0	0	0	0	0	126	4	0	130	361
07:30	4	0	0	4	1	236	0	237	0	0	0	0	0	143	5	1	149	390
07:45	16	0	0	16	0	260	0	260	0	0	0	0	0	164	19	27	210	486
Total	29	0	0	29	1	873	0	874	0	0	0	0	0	522	28	28	578	1481
08:00	5	0	0	5	0	227	0	227	0	0	0	0	0	224	2	3	229	461
08:15	3	0	0	3	0	228	0	228	0	0	0	0	0	179	6	2	187	418
08:30	3	0	1	4	1	242	0	243	0	0	0	0	0	145	5	2	152	399
08:45	6	0	0	6	1	264	0	265	0	0	0	0	0	122	5	0	127	398
Total	17	0	1	18	2	961	0	963	0	0	0	0	0	670	18	7	695	1676
Grand Total	46	0	1	47	3	1834	0	1837	0	0	0	0	0	1192	46	35	1273	3157
Apprch %	97.9	0	2.1		0.2	99.8	0		0	0	0		0	93.6	3.6	2.7		
Total %	1.5	0	0	1.5	0.1	58.1	0	58.2	0	0	0	0	0	37.8	1.5	1.1	40.3	

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:45																		
07:45	**16**	0	0	**16**	0	**260**	0	**260**	0	0	0	0	0	164	**19**	**27**	210	**486**
08:00	5	0	0	5	0	227	0	227	0	0	0	0	0	**224**	2	3	**229**	461
08:15	3	0	0	3	0	228	0	228	0	0	0	0	0	179	6	2	187	418
08:30	3	0	**1**	4	**1**	242	0	243	0	0	0	0	0	145	5	2	152	399
Total Volume	27	0	1	28	1	957	0	958	0	0	0	0	0	712	32	34	778	1764
% App. Total	96.4	0	3.6		0.1	99.9	0		0	0	0		0	91.5	4.1	4.4		
PHF	.422	.000	.250	.438	.250	.920	.000	.921	.000	.000	.000	.000	.000	.795	.421	.315	.849	.907



TRAFFIC COUNTS PLUS

mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

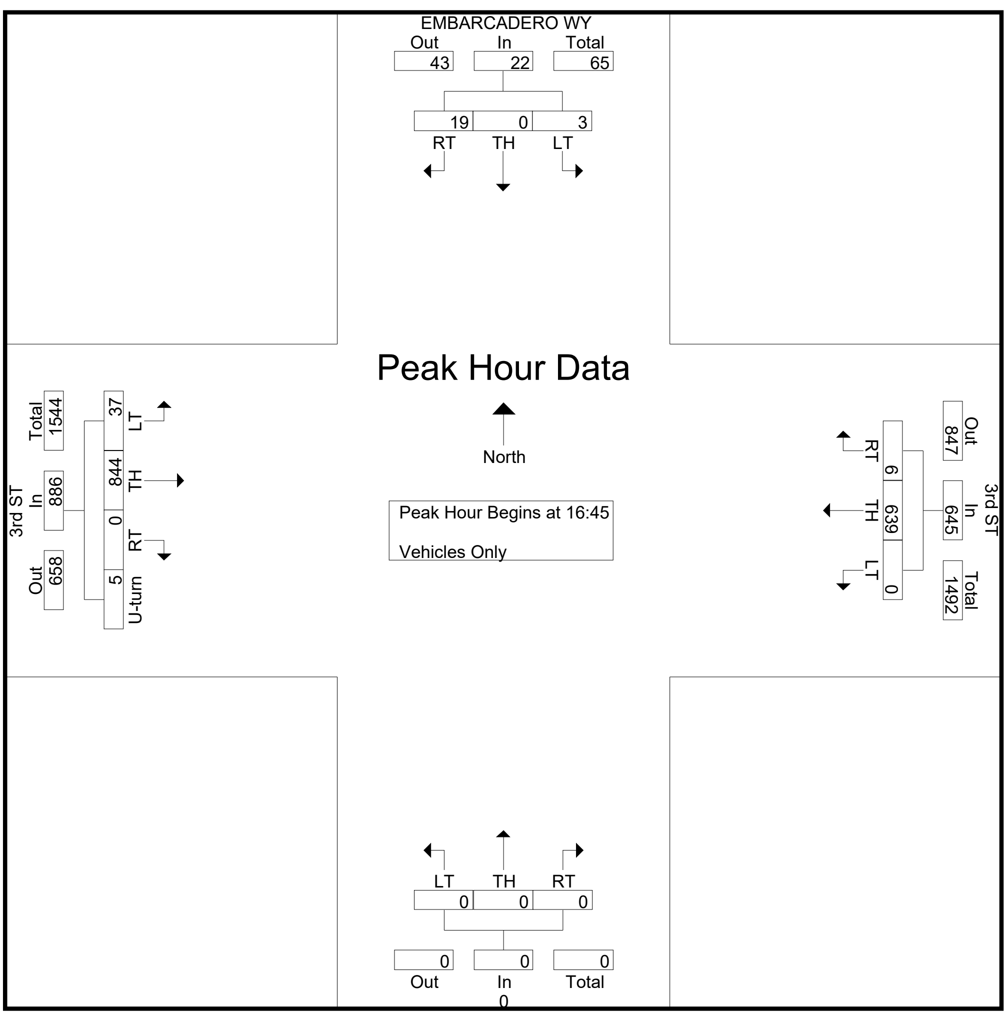
Latitude: 37.968774
Longitude: -122.512031

File Name : embarcadero-3rd-p
Site Code : 6
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
16:00	3	0	0	3	0	171	0	171	0	0	0	0	0	191	7	1	199	373
16:15	6	0	1	7	2	154	0	156	0	0	0	0	0	184	8	1	193	356
16:30	4	0	1	5	0	187	0	187	0	0	0	0	0	187	8	1	196	388
16:45	5	0	0	5	2	165	0	167	0	0	0	0	0	196	12	1	209	381
Total	18	0	2	20	4	677	0	681	0	0	0	0	0	758	35	4	797	1498
17:00	3	0	1	4	1	155	0	156	0	0	0	0	0	207	5	1	213	373
17:15	2	0	0	2	0	176	0	176	0	0	0	0	0	211	9	1	221	399
17:30	9	0	2	11	3	143	0	146	0	0	0	0	0	230	11	2	243	400
17:45	4	0	1	5	0	142	0	142	0	0	0	0	0	210	10	2	222	369
Total	18	0	4	22	4	616	0	620	0	0	0	0	0	858	35	6	899	1541
Grand Total	36	0	6	42	8	1293	0	1301	0	0	0	0	0	1616	70	10	1696	3039
Apprch %	85.7	0	14.3		0.6	99.4	0		0	0	0		0	95.3	4.1	0.6		
Total %	1.2	0	0.2	1.4	0.3	42.5	0	42.8	0	0	0	0	0	53.2	2.3	0.3	55.8	

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 16:45																		
16:45	5	0	0	5	2	165	0	167	0	0	0	0	0	196	**12**	1	209	381
17:00	3	0	1	4	1	155	0	156	0	0	0	0	0	207	5	1	213	373
17:15	2	0	0	2	0	**176**	0	**176**	0	0	0	0	0	211	9	1	221	399
17:30	**9**	0	**2**	**11**	**3**	143	0	146	0	0	0	0	0	**230**	11	**2**	**243**	**400**
Total Volume	19	0	3	22	6	639	0	645	0	0	0	0	0	844	37	5	886	1553
% App. Total	86.4	0	13.6		0.9	99.1	0		0	0	0		0	95.3	4.2	0.6		
PHF	.528	.000	.375	.500	.500	.908	.000	.916	.000	.000	.000	.000	.000	.917	.771	.625	.912	.971



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

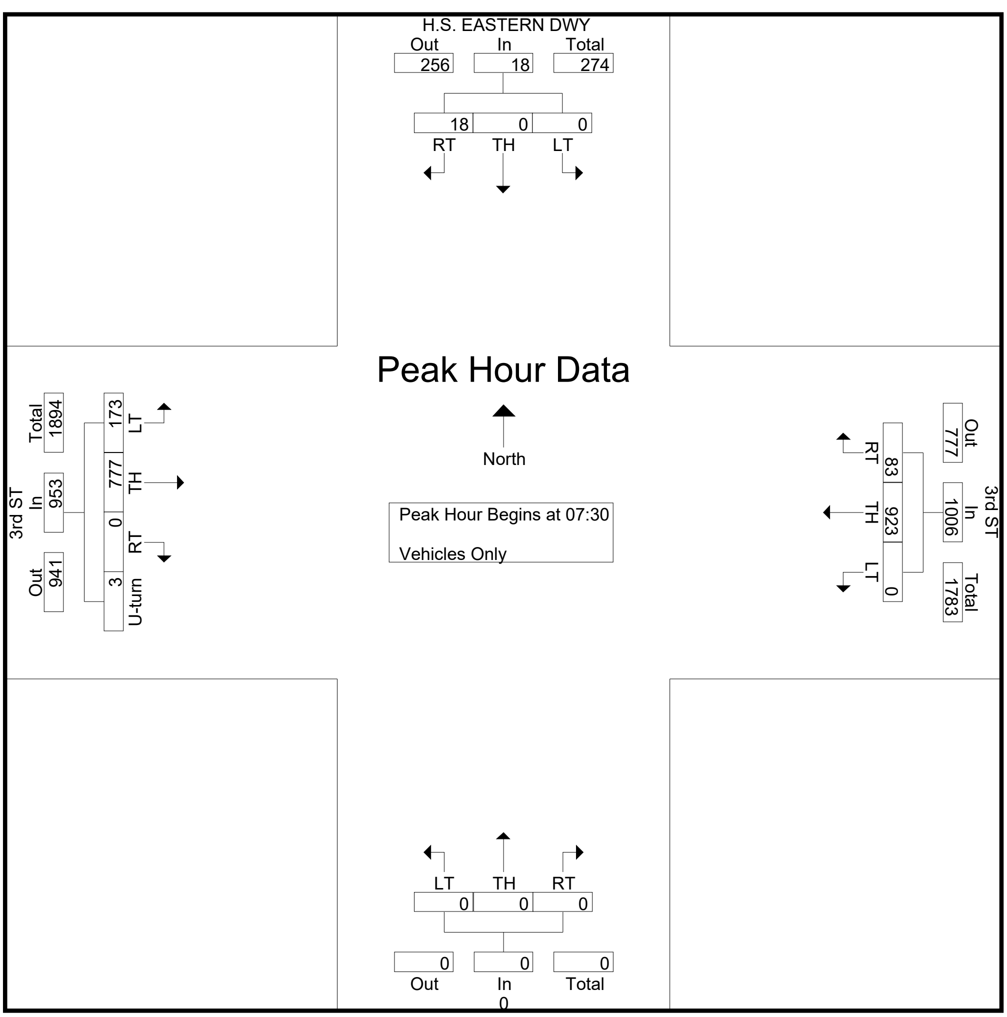
Latitude: 37.969422
Longitude: -122.513888

File Name : eastern school dwy-3rd-a
Site Code : 8
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	H.S. EASTERN DWY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
07:00	3	0	0	3	3	150	0	153	0	0	0	0	0	90	23	4	117	273
07:15	0	0	0	0	0	231	0	231	0	0	0	0	0	126	32	0	158	389
07:30	7	0	0	7	14	226	0	240	0	0	0	0	0	149	71	1	221	468
07:45	9	0	0	9	64	238	0	302	0	0	0	0	0	209	65	0	274	585
Total	19	0	0	19	81	845	0	926	0	0	0	0	0	574	191	5	770	1715
08:00	2	0	0	2	5	230	0	235	0	0	0	0	0	230	23	1	254	491
08:15	0	0	0	0	0	229	0	229	0	0	0	0	0	189	14	1	204	433
08:30	1	0	0	1	0	263	0	263	0	0	0	0	0	153	6	1	160	424
08:45	1	0	0	1	2	268	0	270	0	0	0	0	0	127	12	0	139	410
Total	4	0	0	4	7	990	0	997	0	0	0	0	0	699	55	3	757	1758
Grand Total	23	0	0	23	88	1835	0	1923	0	0	0	0	0	1273	246	8	1527	3473
Apprch %	100	0	0		4.6	95.4	0		0	0	0		0	83.4	16.1	0.5		
Total %	0.7	0	0	0.7	2.5	52.8	0	55.4	0	0	0	0	0	36.7	7.1	0.2	44	

	H.S. EASTERN DWY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:30																		
07:30	7	0	0	7	14	226	0	240	0	0	0	0	0	149	**71**	**1**	221	468
07:45	**9**	0	0	**9**	**64**	**238**	0	**302**	0	0	0	0	0	209	65	0	**274**	**585**
08:00	2	0	0	2	5	230	0	235	0	0	0	0	0	**230**	23	1	254	491
08:15	0	0	0	0	0	229	0	229	0	0	0	0	0	189	14	1	204	433
Total Volume	18	0	0	18	83	923	0	1006	0	0	0	0	0	777	173	3	953	1977
% App. Total	100	0	0		8.3	91.7	0		0	0	0		0	81.5	18.2	0.3		
PHF	.500	.000	.000	.500	.324	.970	.000	.833	.000	.000	.000	.000	.000	.845	.609	.750	.870	.845



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

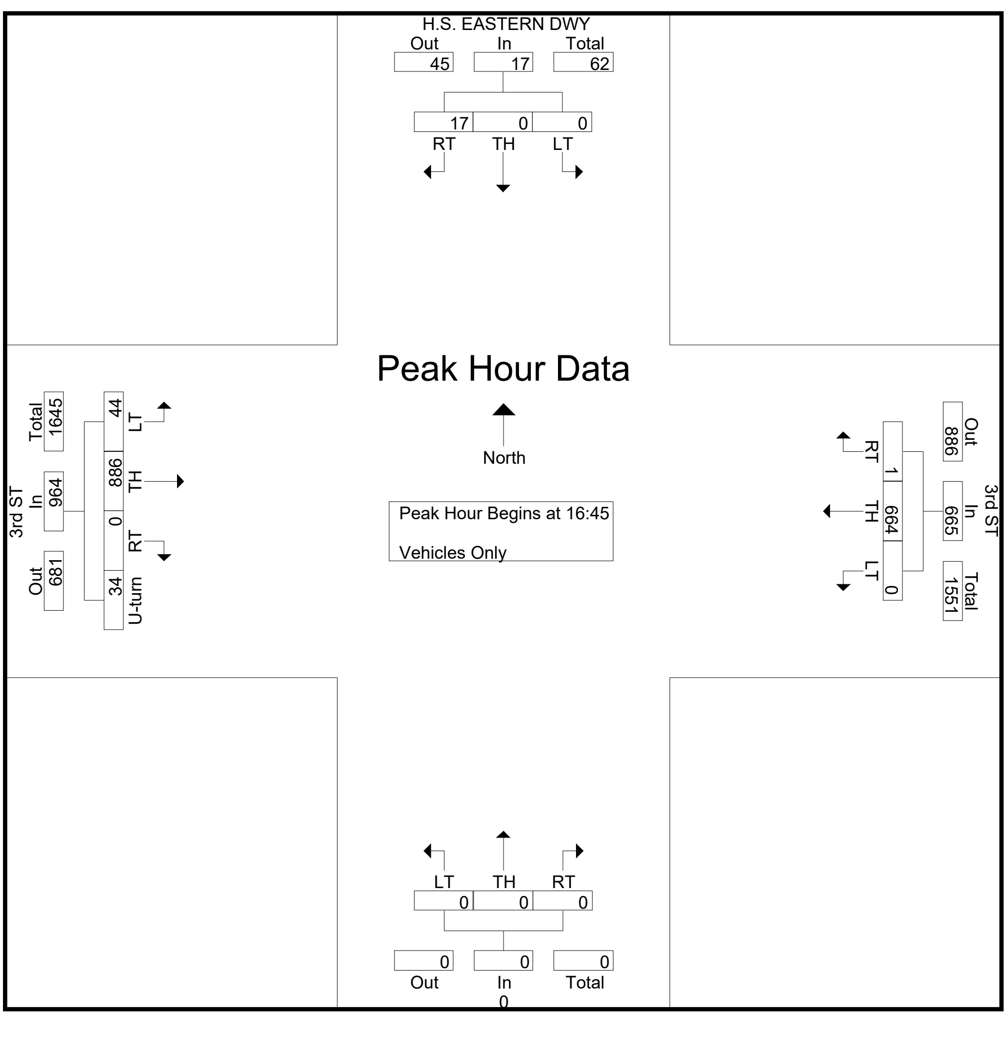
Latitude: 37.969422
Longitude: -122.513888

File Name : eastern school dwy-3rd-p
Site Code : 8
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	H.S. EASTERN DWY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
16:00	1	0	0	1	2	178	0	180	0	0	0	0	0	202	18	8	228	409
16:15	3	0	0	3	2	162	0	164	0	0	0	0	0	196	6	9	211	378
16:30	3	0	0	3	1	189	0	190	0	0	0	0	0	198	5	2	205	398
16:45	8	0	0	8	1	168	0	169	0	0	0	0	0	212	10	9	231	408
Total	15	0	0	15	6	697	0	703	0	0	0	0	0	808	39	28	875	1593
17:00	4	0	0	4	0	161	0	161	0	0	0	0	0	212	11	7	230	395
17:15	1	0	0	1	0	180	0	180	0	0	0	0	0	224	10	10	244	425
17:30	4	0	0	4	0	155	0	155	0	0	0	0	0	238	13	8	259	418
17:45	0	0	0	0	0	144	0	144	0	0	0	0	0	232	21	8	261	405
Total	9	0	0	9	0	640	0	640	0	0	0	0	0	906	55	33	994	1643
Grand Total	24	0	0	24	6	1337	0	1343	0	0	0	0	0	1714	94	61	1869	3236
Apprch %	100	0	0		0.4	99.6	0		0	0	0		0	91.7	5	3.3		
Total %	0.7	0	0	0.7	0.2	41.3	0	41.5	0	0	0	0	0	53	2.9	1.9	57.8	

	H.S. EASTERN DWY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 16:45																		
16:45	**8**	0	0	**8**	**1**	168	0	169	0	0	0	0	0	212	10	9	231	408
17:00	4	0	0	4	0	161	0	161	0	0	0	0	0	212	11	7	230	395
17:15	1	0	0	1	0	**180**	0	**180**	0	0	0	0	0	224	10	**10**	244	**425**
17:30	4	0	0	4	0	155	0	155	0	0	0	0	0	**238**	**13**	8	**259**	418
Total Volume	17	0	0	17	1	664	0	665	0	0	0	0	0	886	44	34	964	1646
% App. Total	100	0	0		0.2	99.8	0		0	0	0		0	91.9	4.6	3.5		
PHF	.531	.000	.000	.531	.250	.922	.000	.924	.000	.000	.000	.000	.000	.931	.846	.850	.931	.968



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

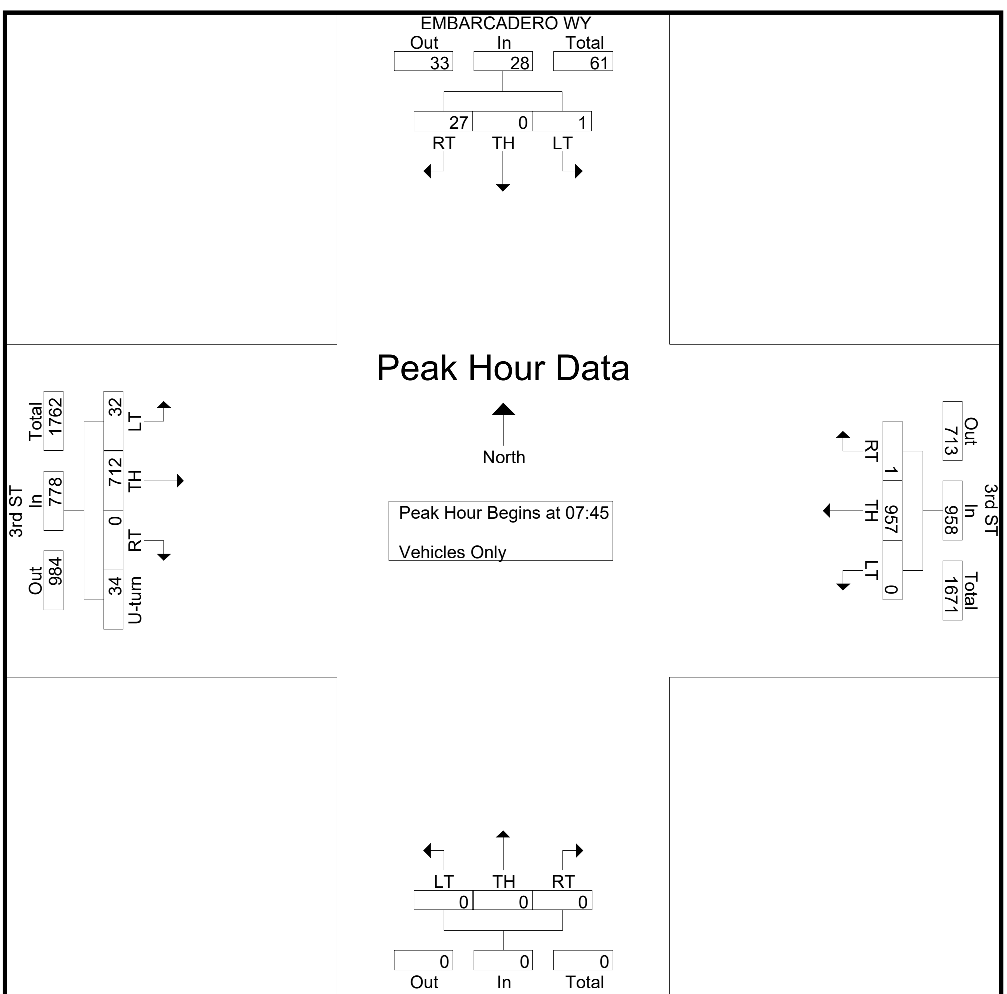
Latitude: 37.968774
Longitude: -122.512031

File Name : embarcadero-3rd-a
Site Code : 6
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
07:00	2	0	0	2	0	153	0	153	0	0	0	0	0	89	0	0	89	244
07:15	7	0	0	7	0	224	0	224	0	0	0	0	0	126	4	0	130	361
07:30	4	0	0	4	1	236	0	237	0	0	0	0	0	143	5	1	149	390
07:45	16	0	0	16	0	260	0	260	0	0	0	0	0	164	19	27	210	486
Total	29	0	0	29	1	873	0	874	0	0	0	0	0	522	28	28	578	1481
08:00	5	0	0	5	0	227	0	227	0	0	0	0	0	224	2	3	229	461
08:15	3	0	0	3	0	228	0	228	0	0	0	0	0	179	6	2	187	418
08:30	3	0	1	4	1	242	0	243	0	0	0	0	0	145	5	2	152	399
08:45	6	0	0	6	1	264	0	265	0	0	0	0	0	122	5	0	127	398
Total	17	0	1	18	2	961	0	963	0	0	0	0	0	670	18	7	695	1676
Grand Total	46	0	1	47	3	1834	0	1837	0	0	0	0	0	1192	46	35	1273	3157
Apprch %	97.9	0	2.1		0.2	99.8	0		0	0	0		0	93.6	3.6	2.7		
Total %	1.5	0	0	1.5	0.1	58.1	0	58.2	0	0	0	0	0	37.8	1.5	1.1	40.3	

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:45																		
07:45	**16**	0	0	**16**	0	**260**	0	**260**	0	0	0	0	0	164	**19**	**27**	210	**486**
08:00	5	0	0	5	0	227	0	227	0	0	0	0	0	**224**	2	3	**229**	461
08:15	3	0	0	3	0	228	0	228	0	0	0	0	0	179	6	2	187	418
08:30	3	0	**1**	4	**1**	242	0	243	0	0	0	0	0	145	5	2	152	399
Total Volume	27	0	1	28	1	957	0	958	0	0	0	0	0	712	32	34	778	1764
% App. Total	96.4	0	3.6		0.1	99.9	0		0	0	0		0	91.5	4.1	4.4		
PHF	.422	.000	.250	.438	.250	.920	.000	.921	.000	.000	.000	.000	.000	.795	.421	.315	.849	.907



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

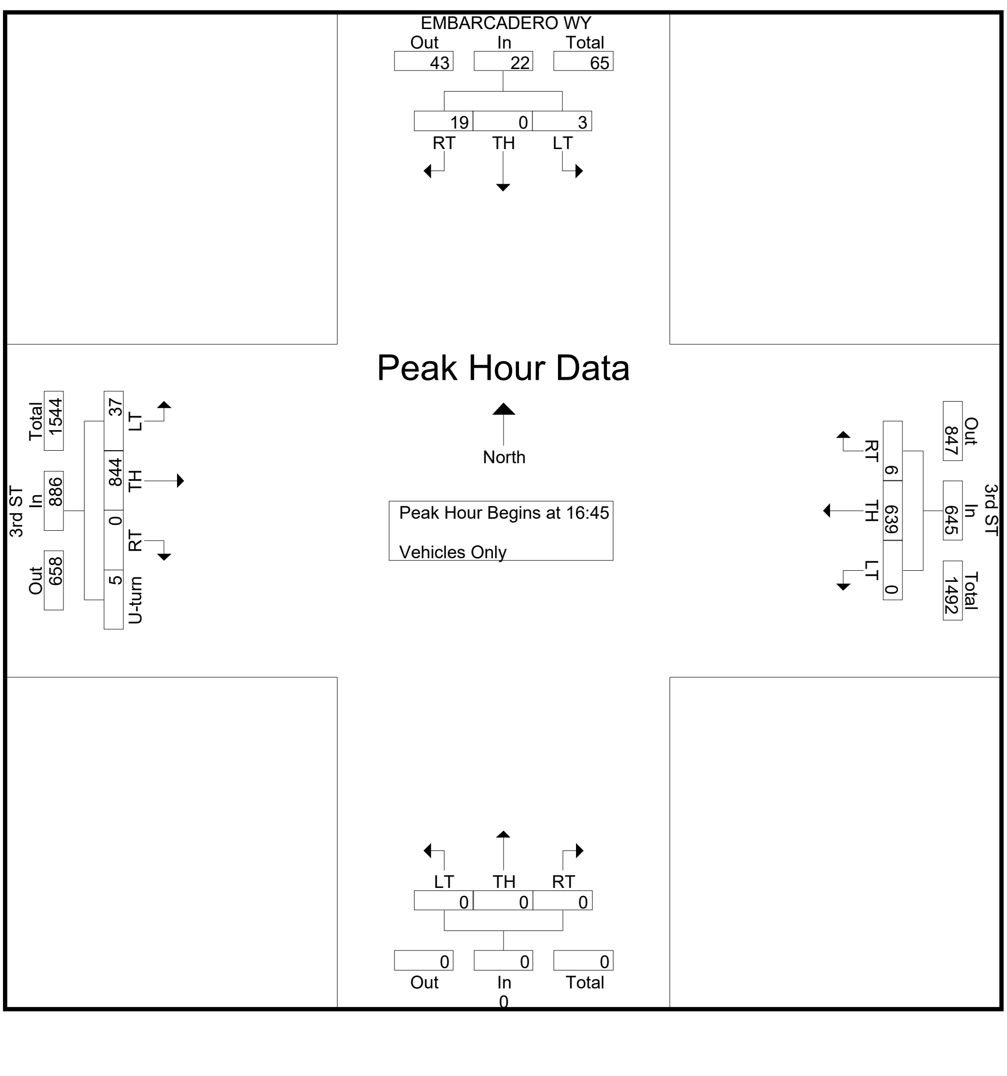
Latitude: 37.968774
Longitude: -122.512031

File Name : embarcadero-3rd-p
Site Code : 6
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
16:00	3	0	0	3	0	171	0	171	0	0	0	0	0	191	7	1	199	373
16:15	6	0	1	7	2	154	0	156	0	0	0	0	0	184	8	1	193	356
16:30	4	0	1	5	0	187	0	187	0	0	0	0	0	187	8	1	196	388
16:45	5	0	0	5	2	165	0	167	0	0	0	0	0	196	12	1	209	381
Total	18	0	2	20	4	677	0	681	0	0	0	0	0	758	35	4	797	1498
17:00	3	0	1	4	1	155	0	156	0	0	0	0	0	207	5	1	213	373
17:15	2	0	0	2	0	176	0	176	0	0	0	0	0	211	9	1	221	399
17:30	9	0	2	11	3	143	0	146	0	0	0	0	0	230	11	2	243	400
17:45	4	0	1	5	0	142	0	142	0	0	0	0	0	210	10	2	222	369
Total	18	0	4	22	4	616	0	620	0	0	0	0	0	858	35	6	899	1541
Grand Total	36	0	6	42	8	1293	0	1301	0	0	0	0	0	1616	70	10	1696	3039
Apprch %	85.7	0	14.3		0.6	99.4	0		0	0	0		0	95.3	4.1	0.6		
Total %	1.2	0	0.2	1.4	0.3	42.5	0	42.8	0	0	0	0	0	53.2	2.3	0.3	55.8	

	EMBARCADERO WY Southbound				3rd ST Westbound				0 Northbound				3rd ST Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 16:45																		
16:45	5	0	0	5	2	165	0	167	0	0	0	0	0	196	**12**	1	209	381
17:00	3	0	1	4	1	155	0	156	0	0	0	0	0	207	5	1	213	373
17:15	2	0	0	2	0	**176**	0	**176**	0	0	0	0	0	211	9	1	221	399
17:30	**9**	0	**2**	**11**	**3**	143	0	146	0	0	0	0	0	**230**	11	**2**	**243**	**400**
Total Volume	19	0	3	22	6	639	0	645	0	0	0	0	0	844	37	5	886	1553
% App. Total	86.4	0	13.6		0.9	99.1	0		0	0	0		0	95.3	4.2	0.6		
PHF	.528	.000	.375	.500	.500	.908	.000	.916	.000	.000	.000	.000	.000	.917	.771	.625	.912	.971



TRAFFIC COUNTS PLUS
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925.305.4358

CITY OF SAN RAFAEL

Latitude: 37.969978
Longitude: -122.508826

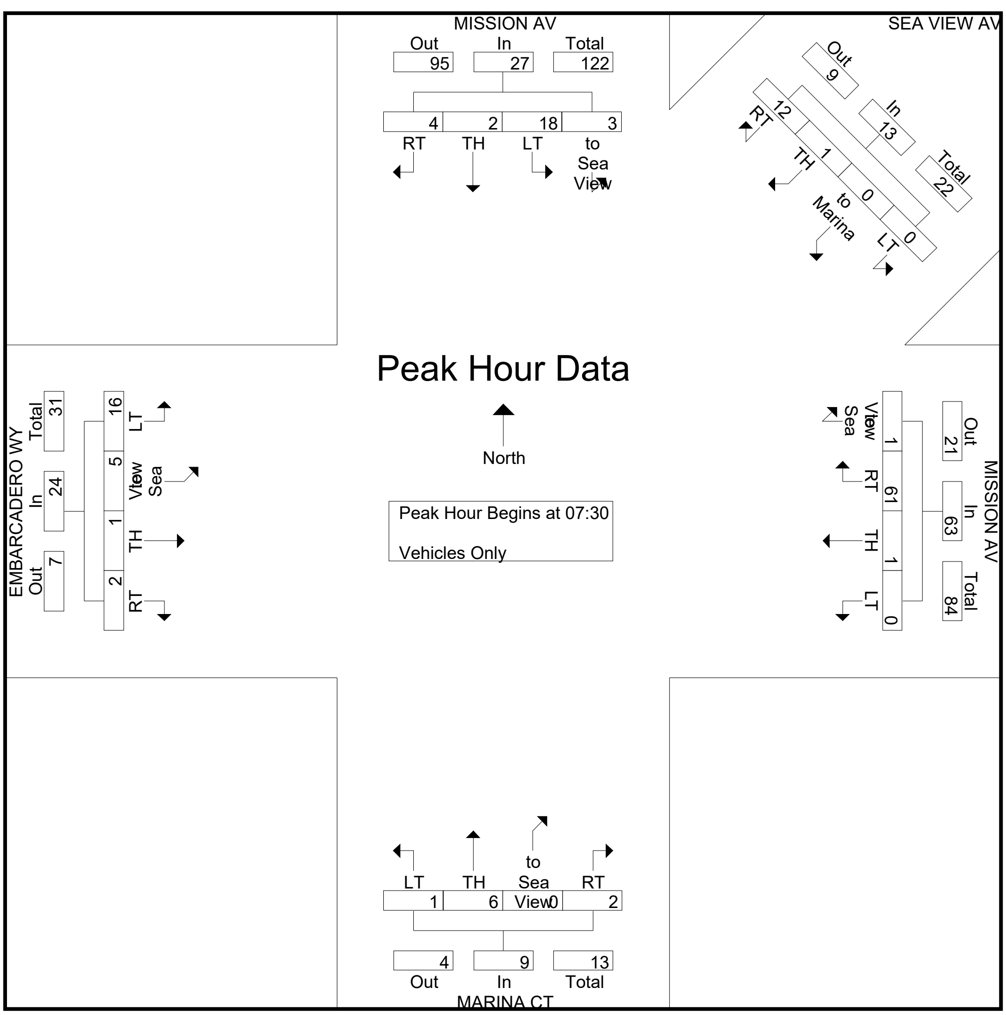
File Name : marina-mission-a
Site Code : 1
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	MISSION AV Southbound					MISSION AV Westbound					MARINA CT Northbound					EMBARCADERO WY Eastbound					SEA VIEW AV Southwestbound					
Start Time	RT	TH	LT	to Sea View	App. Total	to Sea View	RT	TH	LT	App. Total	RT	to Sea View	TH	LT	App. Total	RT	TH	to Sea View	LT	App. Total	RT	TH	to Marina	LT	App. Total	Int. Total
07:00	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	2	0	0	0	0	0	4
07:15	0	0	2	0	2	0	1	0	0	1	0	0	2	0	2	0	0	0	1	1	0	0	0	0	0	6
07:30	1	0	4	0	5	0	17	0	0	17	0	0	3	0	3	1	0	1	4	6	4	0	0	0	4	35
07:45	2	1	7	0	10	1	27	0	0	28	0	0	0	0	0	0	1	1	8	10	4	0	0	0	4	52
Total	3	1	14	0	18	1	46	0	0	47	0	0	5	0	5	1	1	3	14	19	8	0	0	0	8	97
08:00	1	1	3	0	5	0	12	1	0	13	1	0	1	1	3	1	0	1	2	4	2	0	0	0	2	27
08:15	0	0	4	3	7	0	5	0	0	5	1	0	2	0	3	0	0	2	2	4	2	1	0	0	3	22
08:30	0	0	4	1	5	0	10	0	0	10	0	0	5	0	5	0	0	3	3	6	2	0	0	0	2	28
08:45	0	2	5	0	7	1	8	0	0	9	1	0	2	0	3	0	0	2	1	3	1	0	0	0	1	23
Total	1	3	16	4	24	1	35	1	0	37	3	0	10	1	14	1	0	8	8	17	7	1	0	0	8	100
Grand Total	4	4	30	4	42	2	81	1	0	84	3	0	15	1	19	2	1	11	22	36	15	1	0	0	16	197
Apprch %	9.5	9.5	71.4	9.5		2.4	96.4	1.2	0		15.8	0	78.9	5.3		5.6	2.8	30.6	61.1		93.8	6.2	0	0		
Total %	2	2	15.2	2	21.3	1	41.1	0.5	0	42.6	1.5	0	7.6	0.5	9.6	1	0.5	5.6	11.2	18.3	7.6	0.5	0	0	8.1	

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 07:30

	MISSION AV Southbound					MISSION AV Westbound					MARINA CT Northbound					EMBARCADERO WY Eastbound					SEA VIEW AV Southwestbound					
Start Time	RT	TH	LT	to Sea View	App. Total	to Sea View	RT	TH	LT	App. Total	RT	to Sea View	TH	LT	App. Total	RT	TH	to Sea View	LT	App. Total	RT	TH	to Marina	LT	App. Total	Int. Total
07:30	1	0	4	0	5	0	17	0	0	17	0	0	**3**	0	**3**	**1**	0	1	4	6	**4**	0	0	0	**4**	35
07:45	**2**	**1**	**7**	0	**10**	**1**	**27**	0	0	**28**	0	0	0	0	0	0	**1**	1	**8**	**10**	4	0	0	0	4	**52**
08:00	1	1	3	0	5	0	12	**1**	0	13	**1**	0	1	**1**	3	1	0	1	2	4	2	0	0	0	2	27
08:15	0	0	4	**3**	7	0	5	0	0	5	1	0	2	0	3	0	0	**2**	2	4	2	**1**	0	0	3	22
Total Volume	4	2	18	3	27	1	61	1	0	63	2	0	6	1	9	2	1	5	16	24	12	1	0	0	13	136
% App. Total	14.8	7.4	66.7	11.1		1.6	96.8	1.6	0		22.2	0	66.7	11.1		8.3	4.2	20.8	66.7		92.3	7.7	0	0		
PHF	.500	.500	.643	.250	.675	.250	.565	.250	.000	.563	.500	.000	.500	.250	.750	.500	.250	.625	.500	.600	.750	.250	.000	.000	.813	.654



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

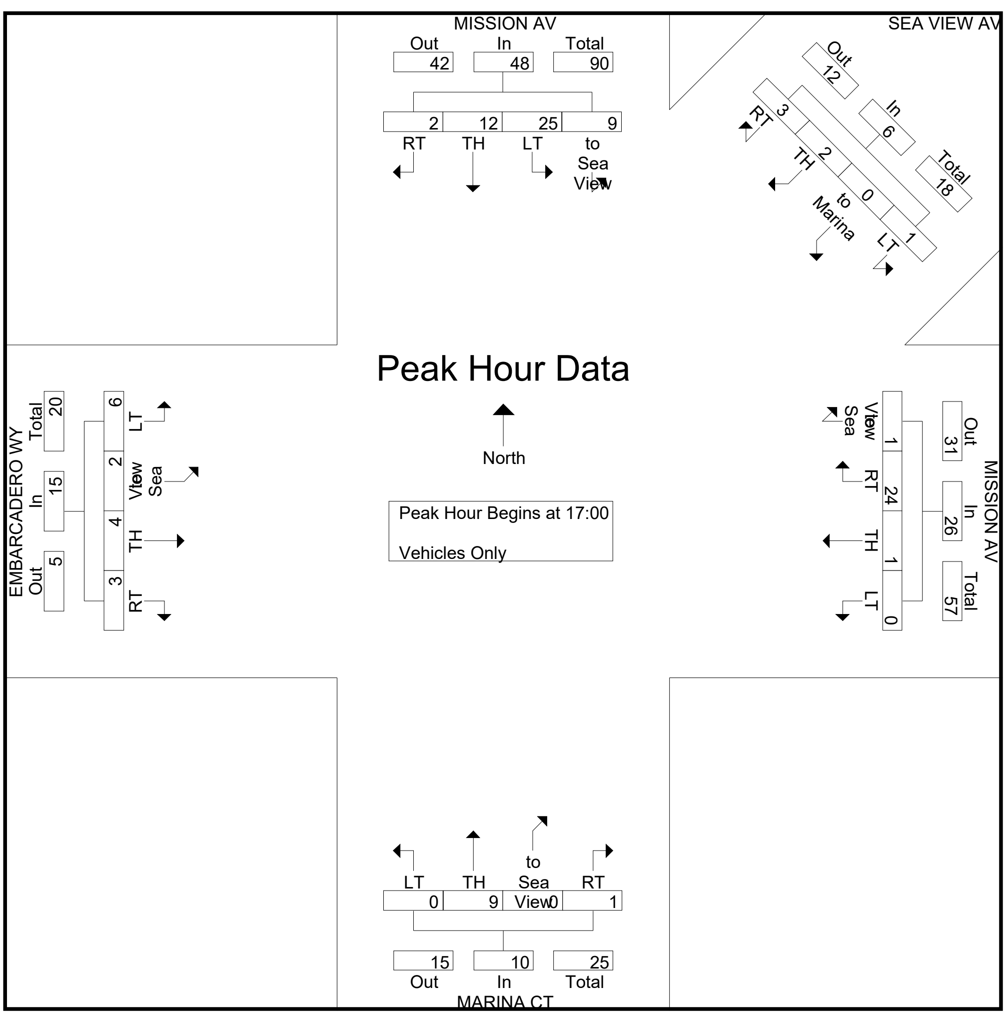
Latitude: 37.969978
Longitude: -122.508826

File Name : marina-mission-p
Site Code : 1
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	MISSION AV Southbound					MISSION AV Westbound					MARINA CT Northbound					EMBARCADERO WY Eastbound					SEA VIEW AV Southwestbound					
Start Time	RT	TH	LT	to Sea View	App. Total	to Sea View	RT	TH	LT	App. Total	RT	to Sea View	TH	LT	App. Total	RT	TH	to Sea View	LT	App. Total	RT	TH	to Marina	LT	App. Total	Int. Total
16:00	0	2	2	1	5	0	4	0	0	4	1	0	0	0	1	0	0	0	5	5	0	2	0	0	2	17
16:15	0	1	6	3	10	0	3	0	0	3	0	0	2	0	2	0	0	3	1	4	2	1	2	0	5	24
16:30	1	2	6	0	9	0	4	0	1	5	0	1	1	0	2	2	1	1	3	7	1	0	1	0	2	25
16:45	2	1	5	0	8	0	2	0	0	2	0	0	0	0	0	0	0	0	6	6	2	1	0	0	3	19
Total	3	6	19	4	32	0	13	0	1	14	1	1	3	0	5	2	1	4	15	22	5	4	3	0	12	85
17:00	0	1	6	3	10	0	7	0	0	7	0	0	1	0	1	0	0	0	2	2	0	1	0	0	1	21
17:15	0	2	13	0	15	0	6	0	0	6	0	0	4	0	4	1	3	0	1	5	0	0	0	1	1	31
17:30	1	5	2	1	9	1	6	0	0	7	0	0	3	0	3	0	1	1	1	3	1	0	0	0	1	23
17:45	1	4	4	5	14	0	5	1	0	6	1	0	1	0	2	2	0	1	2	5	2	1	0	0	3	30
Total	2	12	25	9	48	1	24	1	0	26	1	0	9	0	10	3	4	2	6	15	3	2	0	1	6	105
Grand Total	5	18	44	13	80	1	37	1	1	40	2	1	12	0	15	5	5	6	21	37	8	6	3	1	18	190
Apprch %	6.2	22.5	55	16.2		2.5	92.5	2.5	2.5		13.3	6.7	80	0		13.5	13.5	16.2	56.8		44.4	33.3	16.7	5.6		
Total %	2.6	9.5	23.2	6.8	42.1	0.5	19.5	0.5	0.5	21.1	1.1	0.5	6.3	0	7.9	2.6	2.6	3.2	11.1	19.5	4.2	3.2	1.6	0.5	9.5	

	MISSION AV Southbound					MISSION AV Westbound					MARINA CT Northbound					EMBARCADERO WY Eastbound					SEA VIEW AV Southwestbound					
Start Time	RT	TH	LT	to Sea View	App. Total	to Sea View	RT	TH	LT	App. Total	RT	to Sea View	TH	LT	App. Total	RT	TH	to Sea View	LT	App. Total	RT	TH	to Marina	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																										
Peak Hour for Entire Intersection Begins at 17:00																										
17:00	0	1	6	3	10	0	**7**	0	0	**7**	0	0	1	0	1	0	0	0	**2**	2	0	**1**	0	0	1	21
17:15	0	2	**13**	0	**15**	0	6	0	0	6	0	0	**4**	0	**4**	1	**3**	0	1	**5**	0	0	0	**1**	1	**31**
17:30	**1**	**5**	2	1	9	**1**	6	0	0	7	0	0	3	0	3	0	1	**1**	1	3	1	0	0	0	1	23
17:45	1	4	4	**5**	14	0	5	**1**	0	6	**1**	0	1	0	2	**2**	0	1	2	5	**2**	1	0	0	**3**	30
Total Volume	2	12	25	9	48	1	24	1	0	26	1	0	9	0	10	3	4	2	6	15	3	2	0	1	6	105
% App. Total	4.2	25	52.1	18.8		3.8	92.3	3.8	0		10	0	90	0		20	26.7	13.3	40		50	33.3	0	16.7		
PHF	.500	.600	.481	.450	.800	.250	.857	.250	.000	.929	.250	.000	.563	.000	.625	.375	.333	.500	.750	.750	.375	.500	.000	.250	.500	.847



TRAFFIC COUNTS PLUS
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925.305.4358

CITY OF SAN RAFAEL

Latitude: 37.971997
Longitude: -122.511725

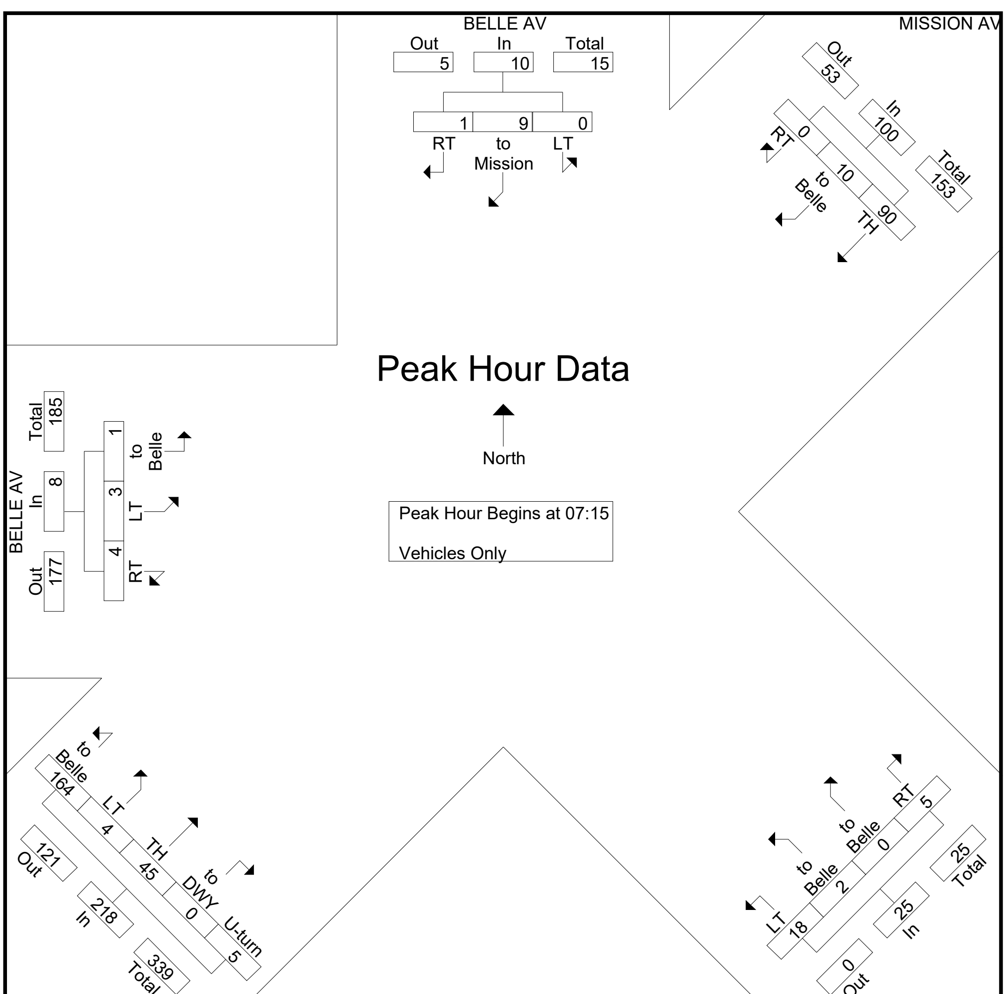
File Name : belle-mission-a
Site Code : 3
Start Date : 10/4/2016

Groups Printed- Vehicles Only

	BELLE AV Southbound				BELLE AV Eastbound				SCHOOL DWY Northwestbound					MISSION AV Southwestbound				MISSION AV Northeastbound						
Start Time	RT	to Mission	LT	App. Total	RT	LT	to Belle	App. Total	RT	to Belle	to Belle	LT	App. Total	RT	to Belle	TH	App. Total	to DWY	TH	LT	to Belle	U-turn	App. Total	Int. Total
07:00	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	6	6	1	3	0	2	1	7	14
07:15	0	3	0	3	0	0	1	1	0	0	0	2	2	0	0	8	8	0	17	0	6	3	26	40
07:30	0	3	0	3	1	1	0	2	0	0	0	1	1	0	0	32	32	0	8	1	29	2	40	78
07:45	0	3	0	3	2	2	0	4	4	0	2	10	16	0	9	30	39	0	9	2	95	0	106	168
Total	0	10	0	10	3	3	1	7	4	0	2	13	19	0	9	76	85	1	37	3	132	6	179	300
08:00	1	0	0	1	1	0	0	1	1	0	0	5	6	0	1	20	21	0	11	1	34	0	46	75
08:15	0	5	1	6	0	0	0	0	0	0	0	3	3	0	1	12	13	0	5	0	5	0	10	32
08:30	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	27	28	0	6	0	3	2	11	40
08:45	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	14	15	0	7	0	2	0	9	25
Total	1	5	2	8	1	1	0	2	1	0	0	8	9	0	4	73	77	0	29	1	44	2	76	172
Grand Total	1	15	2	18	4	4	1	9	5	0	2	21	28	0	13	149	162	1	66	4	176	8	255	472
Apprch %	5.6	83.3	11.1		44.4	44.4	11.1		17.9	0	7.1	75		0	8	92		0.4	25.9	1.6	69	3.1		
Total %	0.2	3.2	0.4	3.8	0.8	0.8	0.2	1.9	1.1	0	0.4	4.4	5.9	0	2.8	31.6	34.3	0.2	14	0.8	37.3	1.7	54	

Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 07:15

	BELLE AV Southbound				BELLE AV Eastbound				SCHOOL DWY Northwestbound					MISSION AV Southwestbound				MISSION AV Northeastbound						
Start Time	RT	to Mission	LT	App. Total	RT	LT	to Belle	App. Total	RT	to Belle	to Belle	LT	App. Total	RT	to Belle	TH	App. Total	to DWY	TH	LT	to Belle	U-turn	App. Total	Int. Total
07:15	0	**3**	0	**3**	0	0	**1**	1	0	0	0	2	2	0	0	8	8	0	**17**	0	6	**3**	26	40
07:30	0	3	0	3	1	1	0	2	0	0	0	1	1	0	0	**32**	32	0	8	1	29	2	40	78
07:45	0	3	0	3	**2**	**2**	0	**4**	**4**	0	**2**	**10**	**16**	0	**9**	30	**39**	0	9	**2**	**95**	0	**106**	**168**
08:00	**1**	0	0	1	1	0	0	1	1	0	0	5	6	0	1	20	21	0	11	1	34	0	46	75
Total Volume	1	9	0	10	4	3	1	8	5	0	2	18	25	0	10	90	100	0	45	4	164	5	218	361
% App. Total	10	90	0		50	37.5	12.5		20	0	8	72		0	10	90		0	20.6	1.8	75.2	2.3		
PHF	.250	.750	.000	.833	.500	.375	.250	.500	.313	.000	.250	.450	.391	.000	.278	.703	.641	.000	.662	.500	.432	.417	.514	.537



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

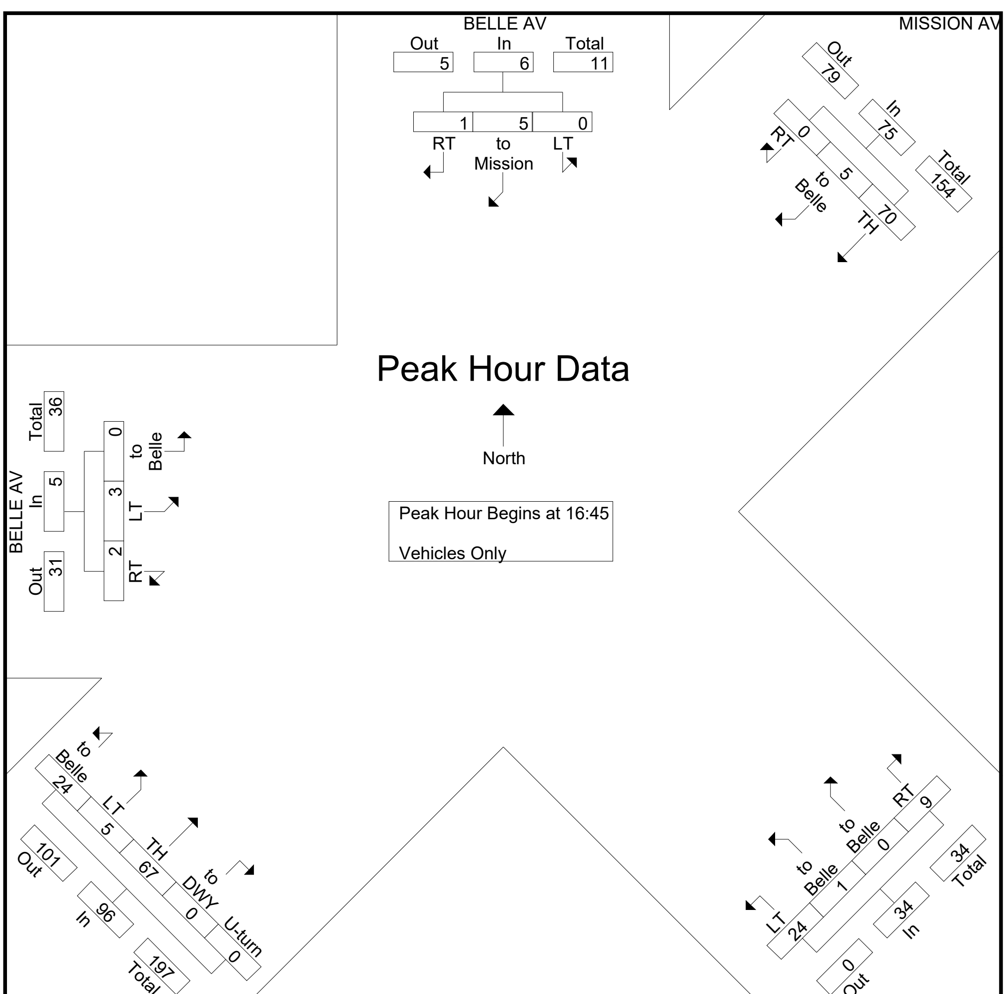
Latitude: 37.971997
Longitude: -122.511725

File Name : belle-mission-p
Site Code : 3
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	BELLE AV Southbound				BELLE AV Eastbound				SCHOOL DWY Northwestbound					MISSION AV Southwestbound				MISSION AV Northeastbound						
Start Time	RT	to Mission	LT	App. Total	RT	LT	to Belle	App. Total	RT	to Belle	to Belle	LT	App. Total	RT	to Belle	TH	App. Total	to DWY	TH	LT	to Belle	U-turn	App. Total	Int. Total
16:00	1	0	0	1	1	0	0	1	0	0	0	5	5	0	2	14	16	0	5	2	7	2	16	39
16:15	0	1	0	1	0	1	0	1	0	0	0	6	6	0	3	10	13	1	14	1	3	0	19	40
16:30	0	1	0	1	0	1	1	2	1	0	0	2	3	1	0	10	11	1	8	3	5	0	17	34
16:45	1	1	0	2	1	1	0	2	1	0	0	1	2	0	1	19	20	0	16	1	8	0	25	51
Total	2	3	0	5	2	3	1	6	2	0	0	14	16	1	6	53	60	2	43	7	23	2	77	164
17:00	0	0	0	0	0	1	0	1	0	0	1	7	8	0	0	10	10	0	18	1	5	0	24	43
17:15	0	2	0	2	0	1	0	1	8	0	0	10	18	0	2	26	28	0	14	1	4	0	19	68
17:30	0	2	0	2	1	0	0	1	0	0	0	6	6	0	2	15	17	0	19	2	7	0	28	54
17:45	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	12	12	0	30	3	3	0	36	50
Total	0	4	0	4	1	2	0	3	8	0	1	25	34	0	4	63	67	0	81	7	19	0	107	215
Grand Total	2	7	0	9	3	5	1	9	10	0	1	39	50	1	10	116	127	2	124	14	42	2	184	379
Apprch %	22.2	77.8	0		33.3	55.6	11.1		20	0	2	78		0.8	7.9	91.3		1.1	67.4	7.6	22.8	1.1		
Total %	0.5	1.8	0	2.4	0.8	1.3	0.3	2.4	2.6	0	0.3	10.3	13.2	0.3	2.6	30.6	33.5	0.5	32.7	3.7	11.1	0.5	48.5	

	BELLE AV Southbound				BELLE AV Eastbound				SCHOOL DWY Northwestbound					MISSION AV Southwestbound				MISSION AV Northeastbound						
Start Time	RT	to Mission	LT	App. Total	RT	LT	to Belle	App. Total	RT	to Belle	to Belle	LT	App. Total	RT	to Belle	TH	App. Total	to DWY	TH	LT	to Belle	U-turn	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																								
Peak Hour for Entire Intersection Begins at 16:45																								
16:45	**1**	1	0	**2**	**1**	**1**	0	**2**	1	0	0	1	2	0	1	19	20	0	16	1	**8**	0	25	51
17:00	0	0	0	0	0	1	0	1	0	0	**1**	7	8	0	0	10	10	0	18	1	5	0	24	43
17:15	0	**2**	0	2	0	1	0	1	**8**	0	0	**10**	**18**	0	**2**	**26**	**28**	0	14	1	4	0	19	**68**
17:30	0	2	0	2	1	0	0	1	0	0	0	6	6	0	2	15	17	0	**19**	**2**	7	0	**28**	54
Total Volume	1	5	0	6	2	3	0	5	9	0	1	24	34	0	5	70	75	0	67	5	24	0	96	216
% App. Total	16.7	83.3	0		40	60	0		26.5	0	2.9	70.6		0	6.7	93.3		0	69.8	5.2	25	0		
PHF	.250	.625	.000	.750	.500	.750	.000	.625	.281	.000	.250	.600	.472	.000	.625	.673	.670	.000	.882	.625	.750	.000	.857	.794



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

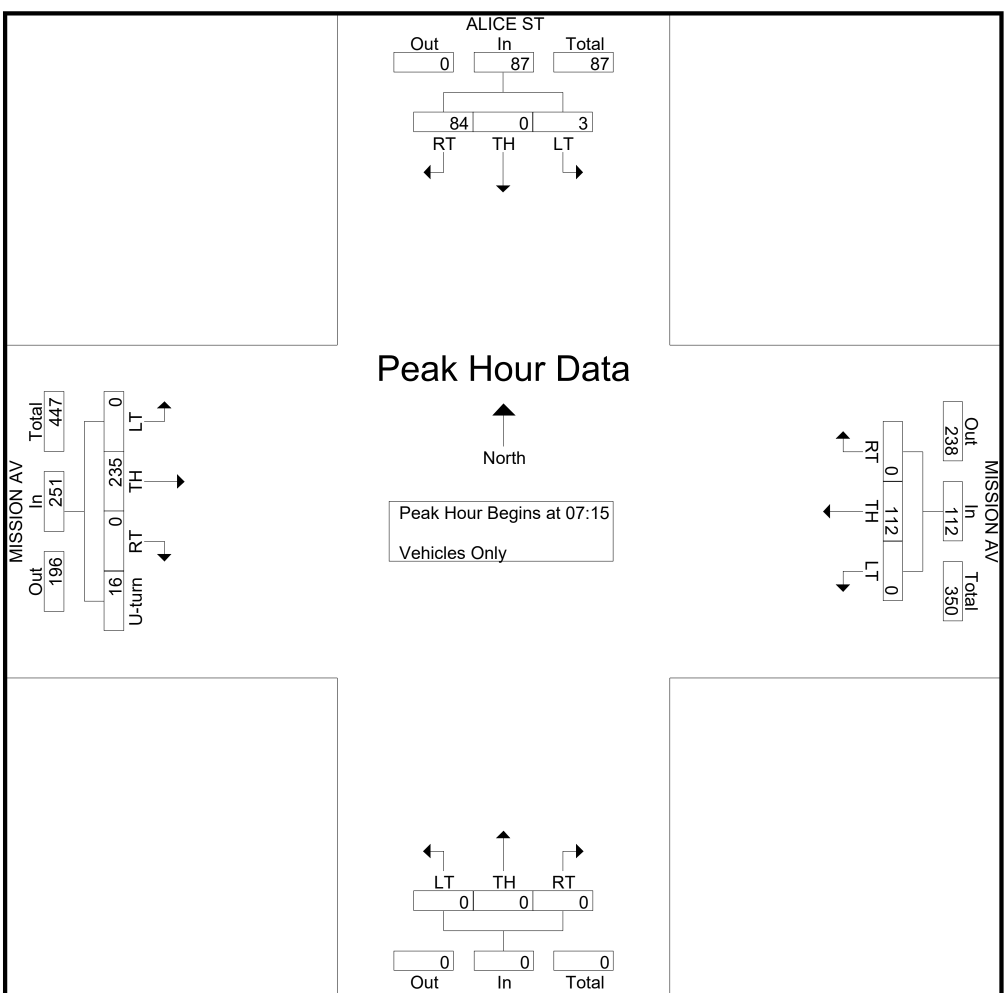
Latitude: 37.971452
Longitude: -122.512930

File Name : alice-mission-a
Site Code : 3
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	ALICE ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
07:00	6	0	0	6	0	7	0	7	0	0	0	0	0	10	0	1	11	24
07:15	8	0	0	8	0	15	0	15	0	0	0	0	0	34	0	3	37	60
07:30	18	0	0	18	0	39	0	39	0	0	0	0	0	44	0	5	49	106
07:45	47	0	2	49	0	36	0	36	0	0	0	0	0	114	0	6	120	205
Total	79	0	2	81	0	97	0	97	0	0	0	0	0	202	0	15	217	395
08:00	11	0	1	12	0	22	0	22	0	0	0	0	0	43	0	2	45	79
08:15	3	0	0	3	0	21	0	21	0	0	0	0	0	10	0	2	12	36
08:30	3	0	0	3	0	31	0	31	0	0	0	0	0	12	0	1	13	47
08:45	4	0	0	4	0	13	0	13	0	0	0	0	0	10	0	0	10	27
Total	21	0	1	22	0	87	0	87	0	0	0	0	0	75	0	5	80	189
Grand Total	100	0	3	103	0	184	0	184	0	0	0	0	0	277	0	20	297	584
Apprch %	97.1	0	2.9		0	100	0		0	0	0		0	93.3	0	6.7		
Total %	17.1	0	0.5	17.6	0	31.5	0	31.5	0	0	0	0	0	47.4	0	3.4	50.9	

	ALICE ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:15																		
07:15	8	0	0	8	0	15	0	15	0	0	0	0	0	34	0	3	37	60
07:30	18	0	0	18	0	**39**	0	**39**	0	0	0	0	0	44	0	5	49	106
07:45	**47**	0	**2**	**49**	0	36	0	36	0	0	0	0	0	**114**	0	**6**	**120**	**205**
08:00	11	0	1	12	0	22	0	22	0	0	0	0	0	43	0	2	45	79
Total Volume	84	0	3	87	0	112	0	112	0	0	0	0	0	235	0	16	251	450
% App. Total	96.6	0	3.4		0	100	0		0	0	0		0	93.6	0	6.4		
PHF	.447	.000	.375	.444	.000	.718	.000	.718	.000	.000	.000	.000	.000	.515	.000	.667	.523	.549



TRAFFIC COUNTS PLUS
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CITY OF SAN RAFAEL

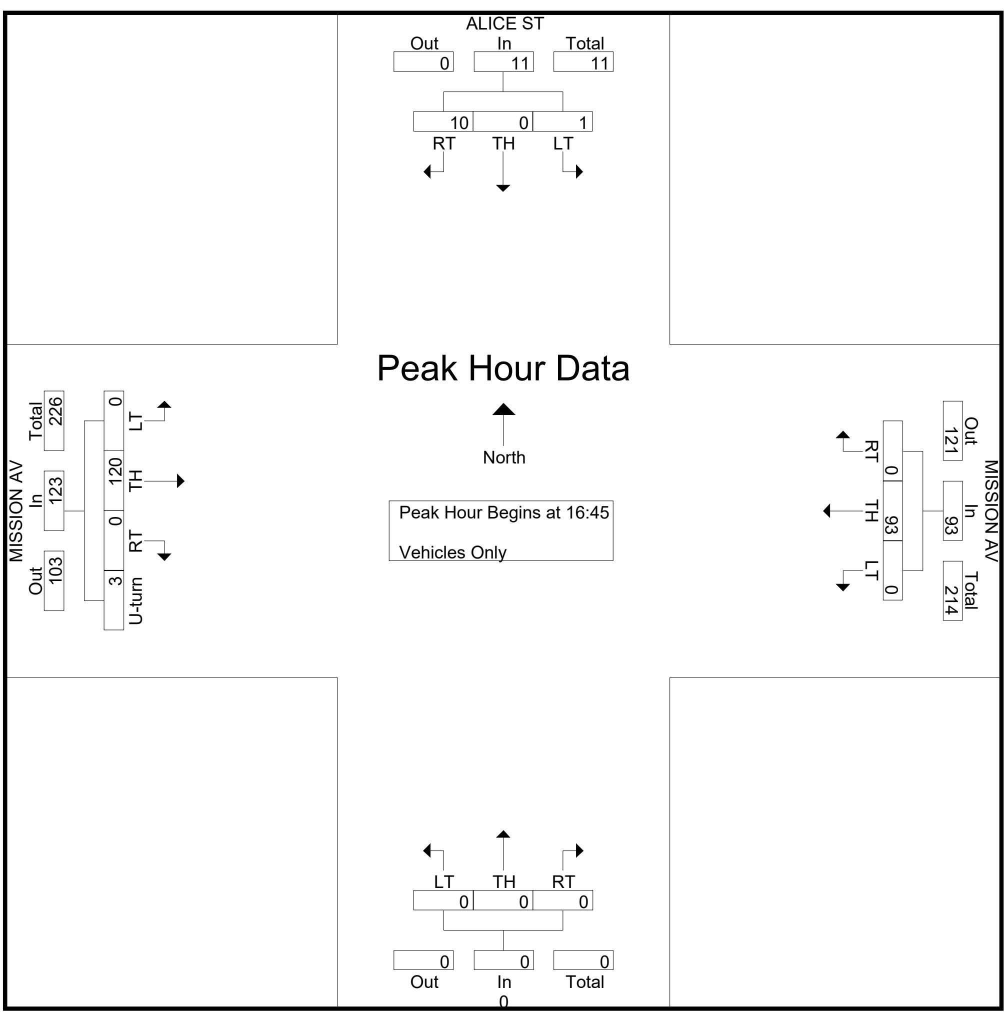
Latitude: 37.971452
Longitude: -122.512930

File Name : alice-mission-p
Site Code : 3
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	ALICE ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
16:00	6	0	0	6	0	19	0	19	0	0	0	0	0	19	0	1	20	45
16:15	7	0	0	7	0	19	0	19	0	0	0	0	0	24	0	1	25	51
16:30	0	0	0	0	0	10	0	10	0	0	0	0	0	19	0	0	19	29
16:45	5	0	0	5	0	22	0	22	0	0	0	0	0	29	0	1	30	57
Total	18	0	0	18	0	70	0	70	0	0	0	0	0	91	0	3	94	182
17:00	2	0	1	3	0	15	0	15	0	0	0	0	0	32	0	1	33	51
17:15	2	0	0	2	0	31	0	31	0	0	0	0	0	26	0	0	26	59
17:30	1	0	0	1	0	25	0	25	0	0	0	0	0	33	0	1	34	60
17:45	4	0	0	4	0	13	0	13	0	0	0	0	0	39	0	0	39	56
Total	9	0	1	10	0	84	0	84	0	0	0	0	0	130	0	2	132	226
Grand Total	27	0	1	28	0	154	0	154	0	0	0	0	0	221	0	5	226	408
Apprch %	96.4	0	3.6		0	100	0		0	0	0		0	97.8	0	2.2		
Total %	6.6	0	0.2	6.9	0	37.7	0	37.7	0	0	0	0	0	54.2	0	1.2	55.4	

	ALICE ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 16:45																		
16:45	**5**	0	0	**5**	0	22	0	22	0	0	0	0	0	29	0	**1**	30	57
17:00	2	0	**1**	3	0	15	0	15	0	0	0	0	0	32	0	1	33	51
17:15	2	0	0	2	0	**31**	0	**31**	0	0	0	0	0	26	0	0	26	59
17:30	1	0	0	1	0	25	0	25	0	0	0	0	0	**33**	0	1	**34**	**60**
Total Volume	10	0	1	11	0	93	0	93	0	0	0	0	0	120	0	3	123	227
% App. Total	90.9	0	9.1		0	100	0		0	0	0		0	97.6	0	2.4		
PHF	.500	.000	.250	.550	.000	.750	.000	.750	.000	.000	.000	.000	.000	.909	.000	.750	.904	.946



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

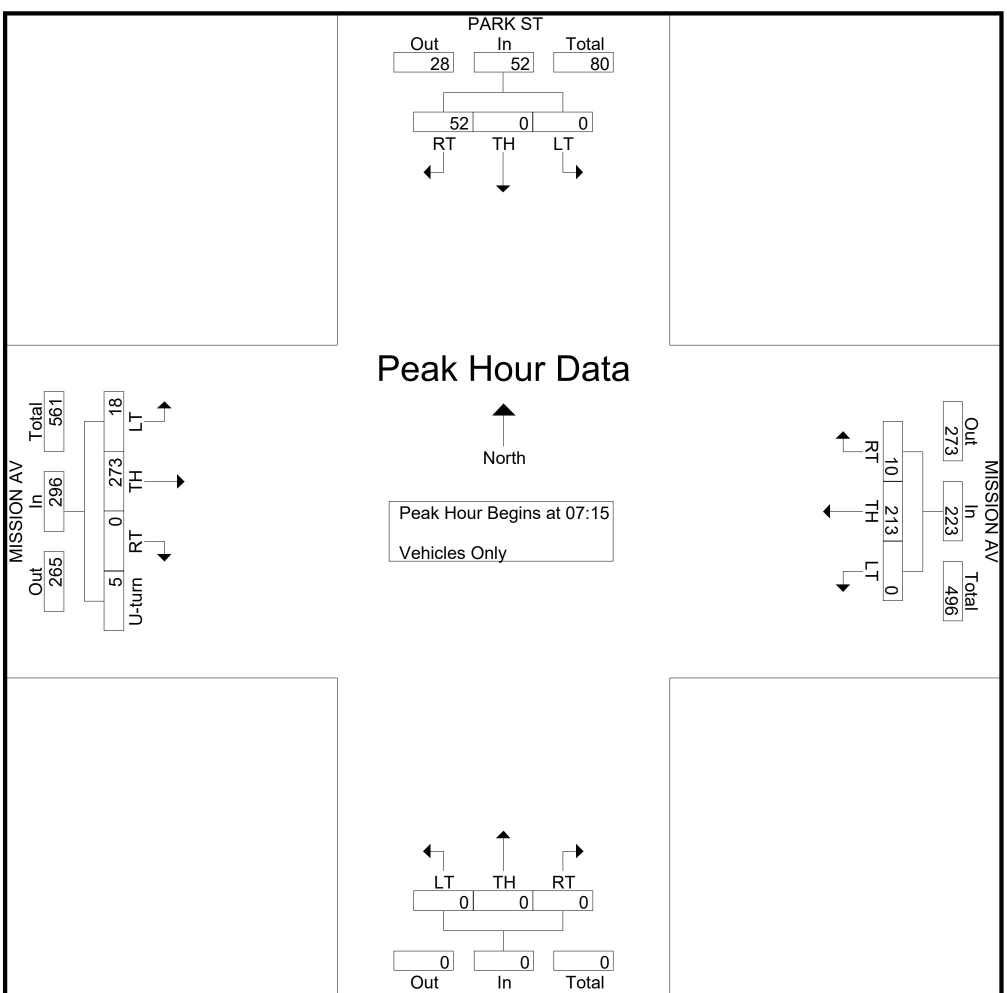
Latitude: 37.971946
Longitude: -122.514635

File Name : park-mission-a
Site Code : 4
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	PARK ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
07:00	10	0	0	10	0	17	0	17	0	0	0	0	0	16	3	1	20	47
07:15	10	0	0	10	2	28	0	30	0	0	0	0	0	45	2	1	48	88
07:30	17	0	0	17	1	63	0	64	0	0	0	0	0	61	7	1	69	150
07:45	17	0	0	17	5	71	0	76	0	0	0	0	0	124	3	0	127	220
Total	54	0	0	54	8	179	0	187	0	0	0	0	0	246	15	3	264	505
08:00	8	0	0	8	2	51	0	53	0	0	0	0	0	43	6	3	52	113
08:15	7	0	0	7	1	28	0	29	0	0	0	0	0	16	8	1	25	61
08:30	9	0	0	9	0	37	0	37	0	0	0	0	0	11	3	1	15	61
08:45	10	0	0	10	0	18	0	18	0	0	0	0	0	12	7	3	22	50
Total	34	0	0	34	3	134	0	137	0	0	0	0	0	82	24	8	114	285
Grand Total	88	0	0	88	11	313	0	324	0	0	0	0	0	328	39	11	378	790
Apprch %	100	0	0		3.4	96.6	0		0	0	0		0	86.8	10.3	2.9		
Total %	11.1	0	0	11.1	1.4	39.6	0	41	0	0	0	0	0	41.5	4.9	1.4	47.8	

	PARK ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 07:15																		
07:15	10	0	0	10	2	28	0	30	0	0	0	0	0	45	2	1	48	88
07:30	**17**	0	0	**17**	1	63	0	64	0	0	0	0	0	61	**7**	1	69	150
07:45	17	0	0	17	**5**	**71**	0	**76**	0	0	0	0	0	**124**	3	0	**127**	**220**
08:00	8	0	0	8	2	51	0	53	0	0	0	0	0	43	6	**3**	52	113
Total Volume	52	0	0	52	10	213	0	223	0	0	0	0	0	273	18	5	296	571
% App. Total	100	0	0		4.5	95.5	0		0	0	0		0	92.2	6.1	1.7		
PHF	.765	.000	.000	.765	.500	.750	.000	.734	.000	.000	.000	.000	.000	.550	.643	.417	.583	.649



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

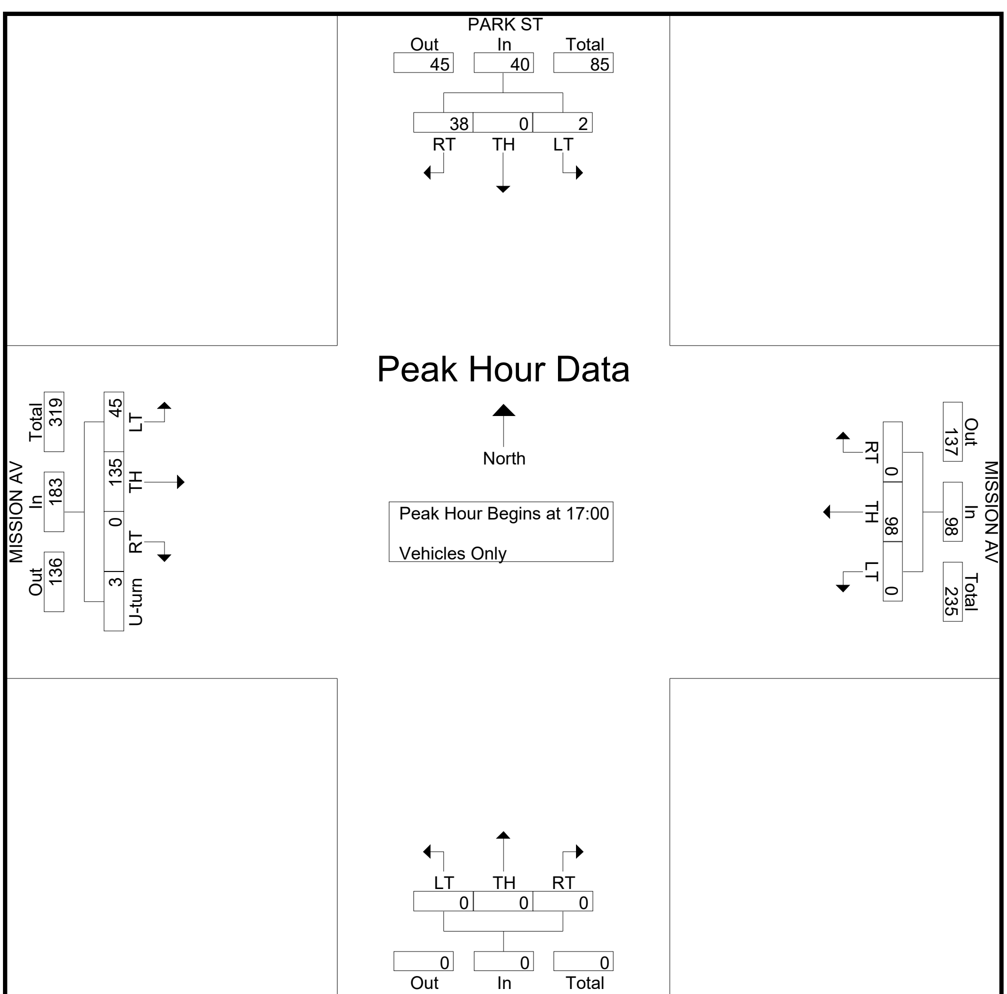
Latitude: 37.971946
Longitude: -122.514635

File Name : park-mission-p
Site Code : 4
Start Date : 10/4/2016
Page No : 1

Groups Printed- Vehicles Only

	PARK ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
16:00	9	0	0	9	1	29	0	30	0	0	0	0	0	22	13	2	37	76
16:15	5	0	0	5	0	28	0	28	0	0	0	0	0	30	12	6	48	81
16:30	7	0	0	7	0	14	0	14	0	0	0	0	0	23	16	7	46	67
16:45	6	0	0	6	0	31	0	31	0	0	0	0	0	31	13	2	46	83
Total	27	0	0	27	1	102	0	103	0	0	0	0	0	106	54	17	177	307
17:00	7	0	0	7	0	18	0	18	0	0	0	0	0	36	10	2	48	73
17:15	10	0	1	11	0	36	0	36	0	0	0	0	0	22	12	1	35	82
17:30	9	0	0	9	0	25	0	25	0	0	0	0	0	36	10	0	46	80
17:45	12	0	1	13	0	19	0	19	0	0	0	0	0	41	13	0	54	86
Total	38	0	2	40	0	98	0	98	0	0	0	0	0	135	45	3	183	321
Grand Total	65	0	2	67	1	200	0	201	0	0	0	0	0	241	99	20	360	628
Apprch %	97	0	3		0.5	99.5	0		0	0	0		0	66.9	27.5	5.6		
Total %	10.4	0	0.3	10.7	0.2	31.8	0	32	0	0	0	0	0	38.4	15.8	3.2	57.3	

	PARK ST Southbound				MISSION AV Westbound				0 Northbound				MISSION AV Eastbound					
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	U-turn	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																		
Peak Hour for Entire Intersection Begins at 17:00																		
17:00	7	0	0	7	0	18	0	18	0	0	0	0	0	36	10	**2**	48	73
17:15	10	0	**1**	11	0	**36**	0	**36**	0	0	0	0	0	22	12	1	35	82
17:30	9	0	0	9	0	25	0	25	0	0	0	0	0	36	10	0	46	80
17:45	**12**	0	1	**13**	0	19	0	19	0	0	0	0	0	**41**	**13**	0	**54**	**86**
Total Volume	38	0	2	40	0	98	0	98	0	0	0	0	0	135	45	3	183	321
% App. Total	95	0	5		0	100	0		0	0	0		0	73.8	24.6	1.6		
PHF	.792	.000	.500	.769	.000	.681	.000	.681	.000	.000	.000	.000	.000	.823	.865	.375	.847	.933



TRAFFIC COUNTS PLUS

mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

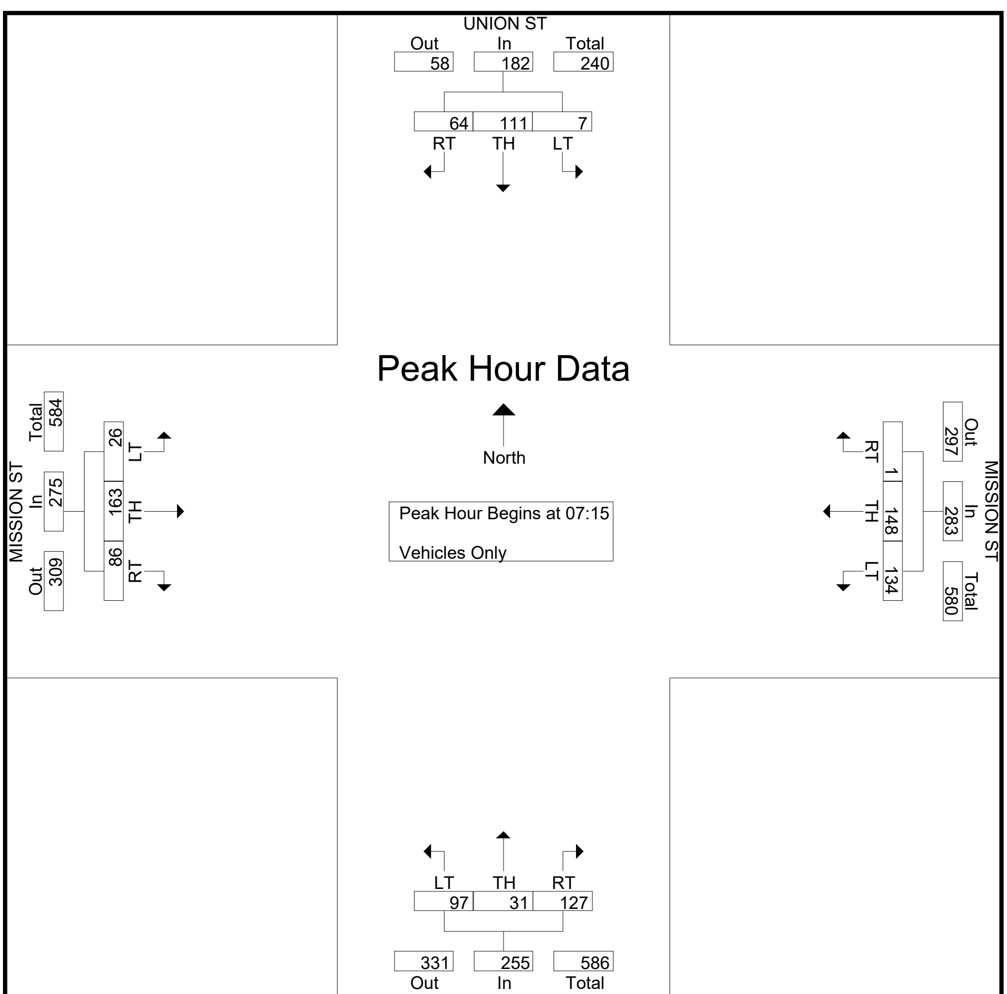
Latitude: 37.972205
Longitude: -122.515568

File Name : union-mission-a
Site Code : 3
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	UNION ST Southbound				MISSION ST Westbound				UNION ST Northbound				MISSION ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	8	13	0	21	1	8	18	27	11	0	6	17	17	7	5	29	94
07:15	9	26	0	35	0	19	28	47	18	7	23	48	25	19	3	47	177
07:30	9	25	0	34	0	45	35	80	29	9	36	74	20	52	7	79	267
07:45	30	32	6	68	1	46	39	86	61	7	16	84	17	68	8	93	331
Total	56	96	6	158	2	118	120	240	119	23	81	223	79	146	23	248	869
08:00	16	28	1	45	0	38	32	70	19	8	22	49	24	24	8	56	220
08:15	13	18	1	32	0	19	20	39	18	2	28	48	33	7	6	46	165
08:30	6	16	0	22	1	28	26	55	12	9	42	63	25	11	5	41	181
08:45	5	22	1	28	0	29	14	43	9	3	38	50	26	10	5	41	162
Total	40	84	3	127	1	114	92	207	58	22	130	210	108	52	24	184	728
Grand Total	96	180	9	285	3	232	212	447	177	45	211	433	187	198	47	432	1597
Apprch %	33.7	63.2	3.2		0.7	51.9	47.4		40.9	10.4	48.7		43.3	45.8	10.9		
Total %	6	11.3	0.6	17.8	0.2	14.5	13.3	28	11.1	2.8	13.2	27.1	11.7	12.4	2.9	27.1	

	UNION ST Southbound				MISSION ST Westbound				UNION ST Northbound				MISSION ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	9	26	0	35	0	19	28	47	18	7	23	48	**25**	19	3	47	177
07:30	9	25	0	34	0	45	35	80	29	**9**	**36**	74	20	52	7	79	267
07:45	**30**	**32**	**6**	**68**	**1**	**46**	**39**	**86**	**61**	7	16	**84**	17	**68**	**8**	**93**	**331**
08:00	16	28	1	45	0	38	32	70	19	8	22	49	24	24	8	56	220
Total Volume	64	111	7	182	1	148	134	283	127	31	97	255	86	163	26	275	995
% App. Total	35.2	61	3.8		0.4	52.3	47.3		49.8	12.2	38		31.3	59.3	9.5		
PHF	.533	.867	.292	.669	.250	.804	.859	.823	.520	.861	.674	.759	.860	.599	.813	.739	.752



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

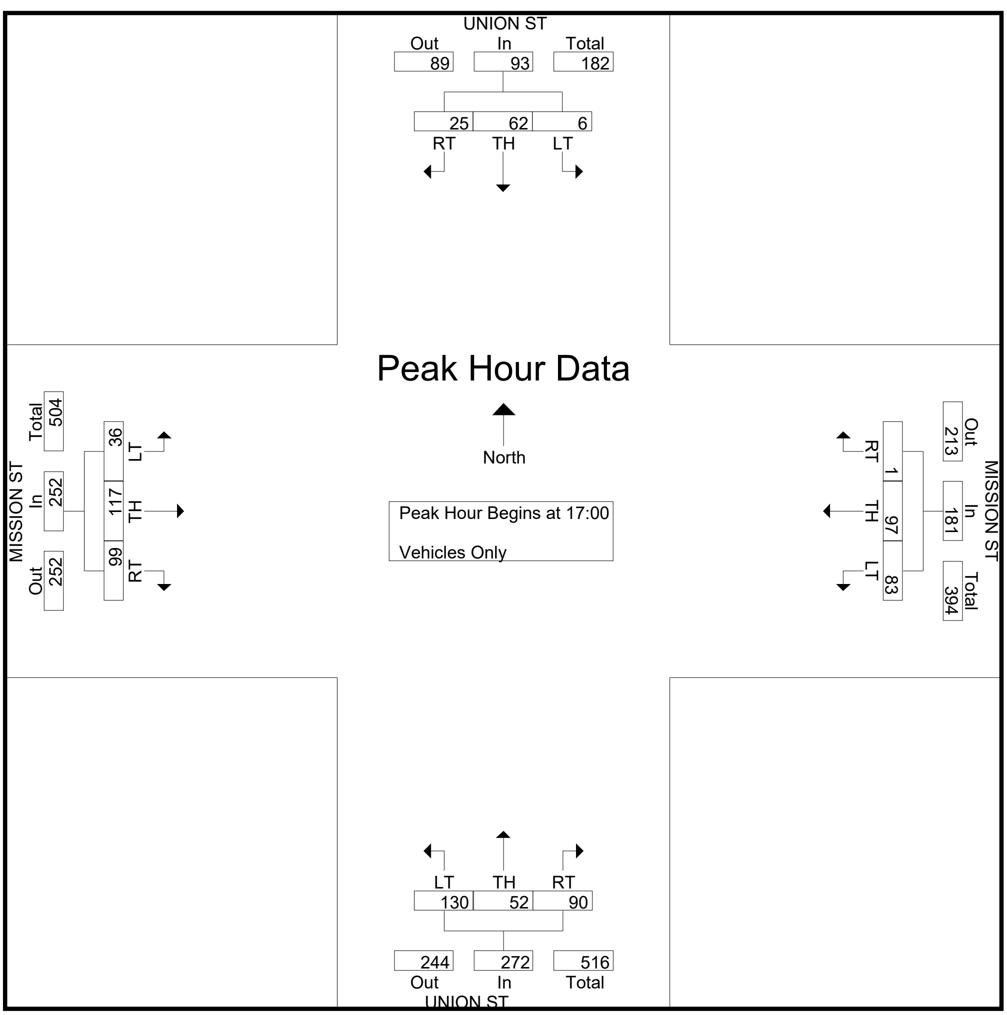
Latitude: 37.972205
Longitude: -122.515568

File Name : union-mission-p
Site Code : 3
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	UNION ST Southbound				MISSION ST Westbound				UNION ST Northbound				MISSION ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	7	21	1	29	0	18	25	43	23	10	44	77	22	21	10	53	202
16:15	5	14	0	19	0	13	17	30	27	13	26	66	15	25	17	57	172
16:30	3	15	0	18	0	20	21	41	22	18	42	82	29	20	10	59	200
16:45	5	14	0	19	0	19	16	35	24	9	41	74	15	37	13	65	193
Total	20	64	1	85	0	70	79	149	96	50	153	299	81	103	50	234	767
17:00	3	16	1	20	0	20	21	41	15	14	30	59	20	25	6	51	171
17:15	12	13	2	27	0	17	21	38	22	10	40	72	21	29	10	60	197
17:30	3	14	2	19	0	27	12	39	19	11	34	64	25	35	7	67	189
17:45	7	19	1	27	1	33	29	63	34	17	26	77	33	28	13	74	241
Total	25	62	6	93	1	97	83	181	90	52	130	272	99	117	36	252	798
Grand Total	45	126	7	178	1	167	162	330	186	102	283	571	180	220	86	486	1565
Apprch %	25.3	70.8	3.9		0.3	50.6	49.1		32.6	17.9	49.6		37	45.3	17.7		
Total %	2.9	8.1	0.4	11.4	0.1	10.7	10.4	21.1	11.9	6.5	18.1	36.5	11.5	14.1	5.5	31.1	

	UNION ST Southbound				MISSION ST Westbound				UNION ST Northbound				MISSION ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 17:00																	
17:00	3	16	1	20	0	20	21	41	15	14	30	59	20	25	6	51	171
17:15	**12**	13	**2**	**27**	0	17	21	38	22	10	**40**	72	21	29	10	60	197
17:30	3	14	2	19	0	27	12	39	19	11	34	64	25	**35**	7	67	189
17:45	7	**19**	1	27	**1**	**33**	**29**	**63**	**34**	**17**	26	**77**	**33**	28	**13**	**74**	**241**
Total Volume	25	62	6	93	1	97	83	181	90	52	130	272	99	117	36	252	798
% App. Total	26.9	66.7	6.5		0.6	53.6	45.9		33.1	19.1	47.8		39.3	46.4	14.3		
PHF	.521	.816	.750	.861	.250	.735	.716	.718	.662	.765	.813	.883	.750	.836	.692	.851	.828



TRAFFIC COUNTS PLUS

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925.305.4358

CITY OF SAN RAFAEL

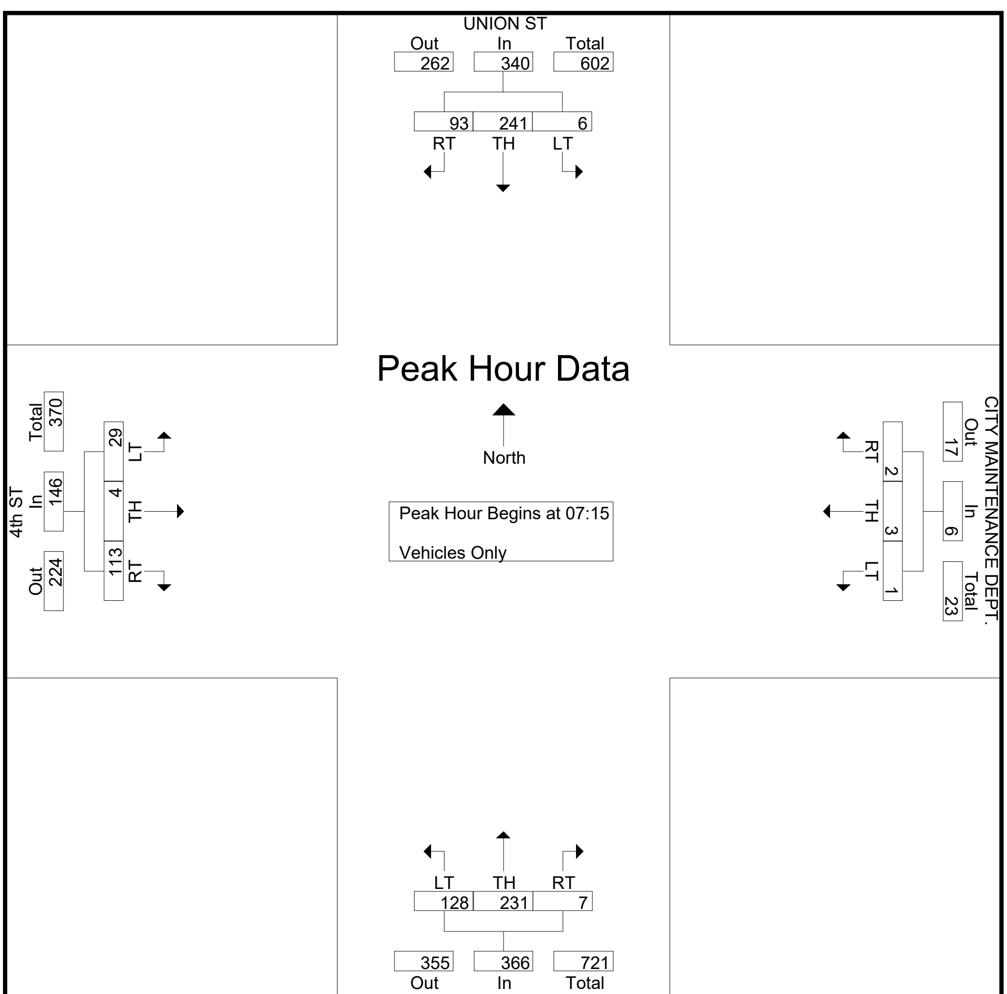
Latitude: 37.971461
Longitude: -122.516090

File Name : union-4th-a
Site Code : 4
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	UNION ST Southbound				CITY MAINTENANCE DEPT. Westbound				UNION ST Northbound				4th ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	7	44	0	51	0	1	0	1	3	14	14	31	15	0	1	16	99
07:15	21	49	5	75	0	0	0	0	2	42	26	70	19	3	9	31	176
07:30	28	62	0	90	0	0	0	0	2	70	30	102	22	0	10	32	224
07:45	28	64	0	92	2	1	0	3	2	76	45	123	35	0	4	39	257
Total	84	219	5	308	2	2	0	4	9	202	115	326	91	3	24	118	756
08:00	16	66	1	83	0	2	1	3	1	43	27	71	37	1	6	44	201
08:15	15	57	0	72	1	3	1	5	0	39	25	64	13	1	6	20	161
08:30	17	47	3	67	1	3	0	4	3	60	24	87	18	1	4	23	181
08:45	15	48	0	63	0	0	0	0	0	44	34	78	21	0	5	26	167
Total	63	218	4	285	2	8	2	12	4	186	110	300	89	3	21	113	710
Grand Total	147	437	9	593	4	10	2	16	13	388	225	626	180	6	45	231	1466
Apprch %	24.8	73.7	1.5		25	62.5	12.5		2.1	62	35.9		77.9	2.6	19.5		
Total %	10	29.8	0.6	40.5	0.3	0.7	0.1	1.1	0.9	26.5	15.3	42.7	12.3	0.4	3.1	15.8	

	UNION ST Southbound				CITY MAINTENANCE DEPT. Westbound				UNION ST Northbound				4th ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:15																	
07:15	21	49	**5**	75	0	0	0	0	**2**	42	26	70	19	**3**	9	31	176
07:30	**28**	62	0	90	0	0	0	0	2	70	30	102	22	0	**10**	32	224
07:45	28	64	0	**92**	**2**	1	0	**3**	2	**76**	**45**	**123**	35	0	4	39	**257**
08:00	16	**66**	1	83	0	**2**	**1**	3	1	43	27	71	**37**	1	6	**44**	201
Total Volume	93	241	6	340	2	3	1	6	7	231	128	366	113	4	29	146	858
% App. Total	27.4	70.9	1.8		33.3	50	16.7		1.9	63.1	35		77.4	2.7	19.9		
PHF	.830	.913	.300	.924	.250	.375	.250	.500	.875	.760	.711	.744	.764	.333	.725	.830	.835



TRAFFIC COUNTS PLUS

mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

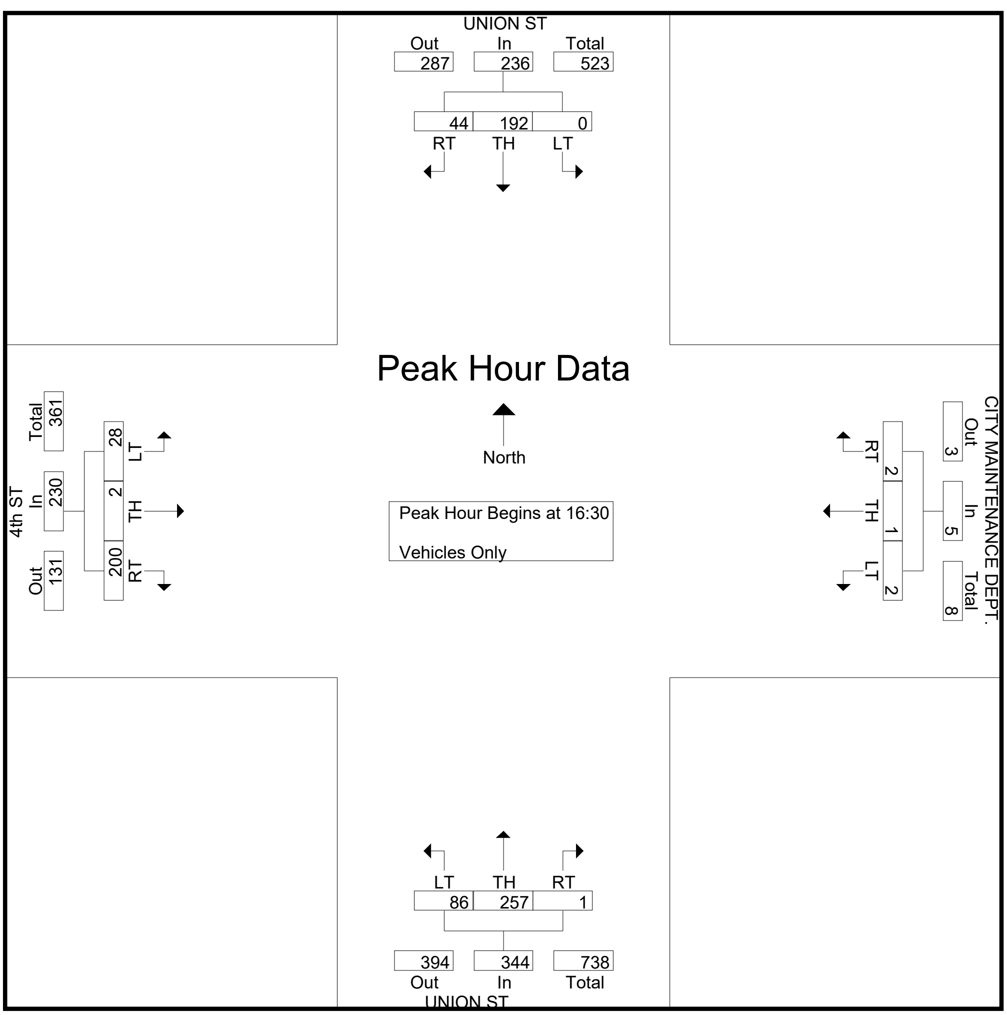
Latitude: 37.971461
Longitude: -122.516090

File Name : union-4th-p
Site Code : 4
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	UNION ST Southbound				CITY MAINTENANCE DEPT. Westbound				UNION ST Northbound				4th ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	13	57	0	70	2	5	2	9	0	69	23	92	44	0	5	49	220
16:15	8	40	0	48	0	1	0	1	0	57	25	82	42	0	7	49	180
16:30	9	54	0	63	0	0	1	1	0	73	24	97	39	0	6	45	206
16:45	8	45	0	53	0	0	0	0	0	64	18	82	57	1	8	66	201
Total	38	196	0	234	2	6	3	11	0	263	90	353	182	1	26	209	807
17:00	12	50	0	62	1	0	1	2	0	56	20	76	63	0	4	67	207
17:15	15	43	0	58	1	1	0	2	1	64	24	89	41	1	10	52	201
17:30	2	52	0	54	0	0	0	0	0	56	28	84	37	1	6	44	182
17:45	12	65	0	77	0	1	1	2	2	59	14	75	31	0	19	50	204
Total	41	210	0	251	2	2	2	6	3	235	86	324	172	2	39	213	794
Grand Total	79	406	0	485	4	8	5	17	3	498	176	677	354	3	65	422	1601
Apprch %	16.3	83.7	0		23.5	47.1	29.4		0.4	73.6	26		83.9	0.7	15.4		
Total %	4.9	25.4	0	30.3	0.2	0.5	0.3	1.1	0.2	31.1	11	42.3	22.1	0.2	4.1	26.4	

	UNION ST Southbound				CITY MAINTENANCE DEPT. Westbound				UNION ST Northbound				4th ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	9	**54**	0	**63**	0	0	**1**	1	0	**73**	**24**	**97**	39	0	6	45	206
16:45	8	45	0	53	0	0	0	0	0	64	18	82	57	**1**	8	66	201
17:00	12	50	0	62	**1**	0	1	**2**	0	56	20	76	**63**	0	4	**67**	**207**
17:15	**15**	43	0	58	1	**1**	0	2	**1**	64	24	89	41	1	**10**	52	201
Total Volume	44	192	0	236	2	1	2	5	1	257	86	344	200	2	28	230	815
% App. Total	18.6	81.4	0		40	20	40		0.3	74.7	25		87	0.9	12.2		
PHF	.733	.889	.000	.937	.500	.250	.500	.625	.250	.880	.896	.887	.794	.500	.700	.858	.984



TRAFFIC COUNTS PLUS
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CITY OF SAN RAFAEL

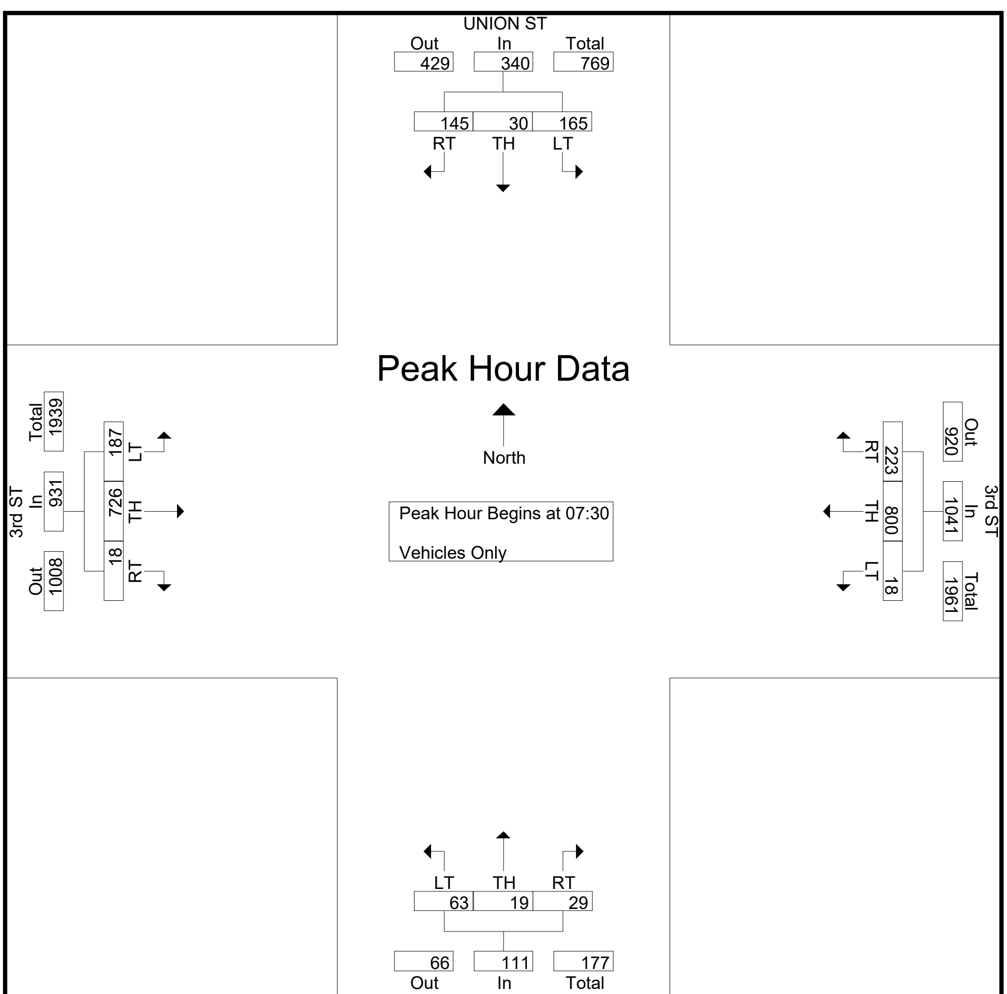
Latitude: 37.970402
Longitude: -122.516533

File Name : union-3rd-a
Site Code : 5
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	UNION ST Southbound				3rd ST Westbound				UNION ST Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	24	4	22	50	19	139	5	163	2	2	16	20	2	84	20	106	339
07:15	30	3	28	61	50	189	4	243	5	2	9	16	2	132	31	165	485
07:30	33	2	38	73	48	209	2	259	3	7	8	18	0	192	56	248	598
07:45	47	6	36	89	68	212	1	281	8	4	10	22	2	189	72	263	655
Total	134	15	124	273	185	749	12	946	18	15	43	76	6	597	179	782	2077
08:00	37	13	53	103	53	194	6	253	9	3	15	27	10	194	33	237	620
08:15	28	9	38	75	54	185	9	248	9	5	30	44	6	151	26	183	550
08:30	21	12	30	63	59	186	8	253	4	13	21	38	7	127	37	171	525
08:45	26	10	31	67	73	201	11	285	9	7	21	37	13	107	16	136	525
Total	112	44	152	308	239	766	34	1039	31	28	87	146	36	579	112	727	2220
Grand Total	246	59	276	581	424	1515	46	1985	49	43	130	222	42	1176	291	1509	4297
Apprch %	42.3	10.2	47.5		21.4	76.3	2.3		22.1	19.4	58.6		2.8	77.9	19.3		
Total %	5.7	1.4	6.4	13.5	9.9	35.3	1.1	46.2	1.1	1	3	5.2	1	27.4	6.8	35.1	

	UNION ST Southbound				3rd ST Westbound				UNION ST Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	33	2	38	73	48	209	2	259	3	**7**	8	18	0	192	56	248	598
07:45	**47**	6	36	89	**68**	**212**	1	**281**	8	4	10	22	2	189	**72**	**263**	**655**
08:00	37	**13**	**53**	**103**	53	194	6	253	**9**	3	15	27	**10**	**194**	33	237	620
08:15	28	9	38	75	54	185	**9**	248	9	5	**30**	**44**	6	151	26	183	550
Total Volume	145	30	165	340	223	800	18	1041	29	19	63	111	18	726	187	931	2423
% App. Total	42.6	8.8	48.5		21.4	76.8	1.7		26.1	17.1	56.8		1.9	78	20.1		
PHF	.771	.577	.778	.825	.820	.943	.500	.926	.806	.679	.525	.631	.450	.936	.649	.885	.925



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

Latitude: 37.970402
Longitude: -122.516533

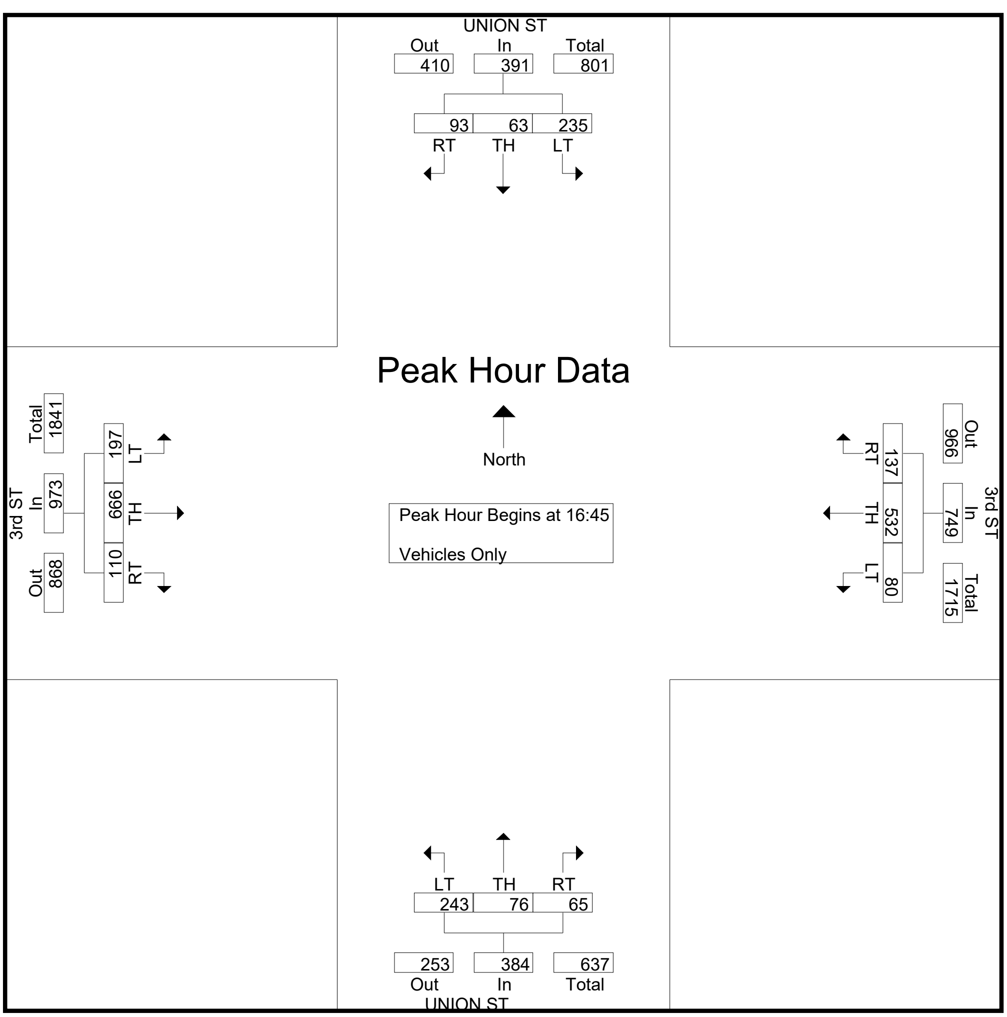
File Name : union-3rd-p
Site Code : 5
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	UNION ST Southbound				3rd ST Westbound				UNION ST Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	32	24	46	102	44	155	14	213	19	22	58	99	32	170	49	251	665
16:15	31	18	35	84	40	132	10	182	14	18	64	96	26	153	64	243	605
16:30	29	16	51	96	42	159	7	208	16	35	53	104	40	131	45	216	624
16:45	35	16	54	105	26	113	28	167	16	22	58	96	24	156	48	228	596
Total	127	74	186	387	152	559	59	770	65	97	233	395	122	610	206	938	2490
17:00	16	21	66	103	37	147	14	198	13	12	65	90	21	149	47	217	608
17:15	20	14	54	88	39	144	18	201	15	22	49	86	26	172	51	249	624
17:30	22	12	61	95	35	128	20	183	21	20	71	112	39	189	51	279	669
17:45	32	14	51	97	34	127	5	166	22	15	38	75	27	182	46	255	593
Total	90	61	232	383	145	546	57	748	71	69	223	363	113	692	195	1000	2494
Grand Total	217	135	418	770	297	1105	116	1518	136	166	456	758	235	1302	401	1938	4984
Apprch %	28.2	17.5	54.3		19.6	72.8	7.6		17.9	21.9	60.2		12.1	67.2	20.7		
Total %	4.4	2.7	8.4	15.4	6	22.2	2.3	30.5	2.7	3.3	9.1	15.2	4.7	26.1	8	38.9	

Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 16:45

	UNION ST Southbound				3rd ST Westbound				UNION ST Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:45	**35**	16	54	**105**	26	113	**28**	167	16	**22**	58	96	24	156	48	228	596
17:00	16	**21**	**66**	103	37	**147**	14	198	13	12	65	90	21	149	47	217	608
17:15	20	14	54	88	**39**	144	18	**201**	15	22	49	86	26	172	**51**	249	624
17:30	22	12	61	95	35	128	20	183	**21**	20	**71**	**112**	**39**	**189**	51	**279**	**669**
Total Volume	93	63	235	391	137	532	80	749	65	76	243	384	110	666	197	973	2497
% App. Total	23.8	16.1	60.1		18.3	71	10.7		16.9	19.8	63.3		11.3	68.4	20.2		
PHF	.664	.750	.890	.931	.878	.905	.714	.932	.774	.864	.856	.857	.705	.881	.966	.872	.933



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

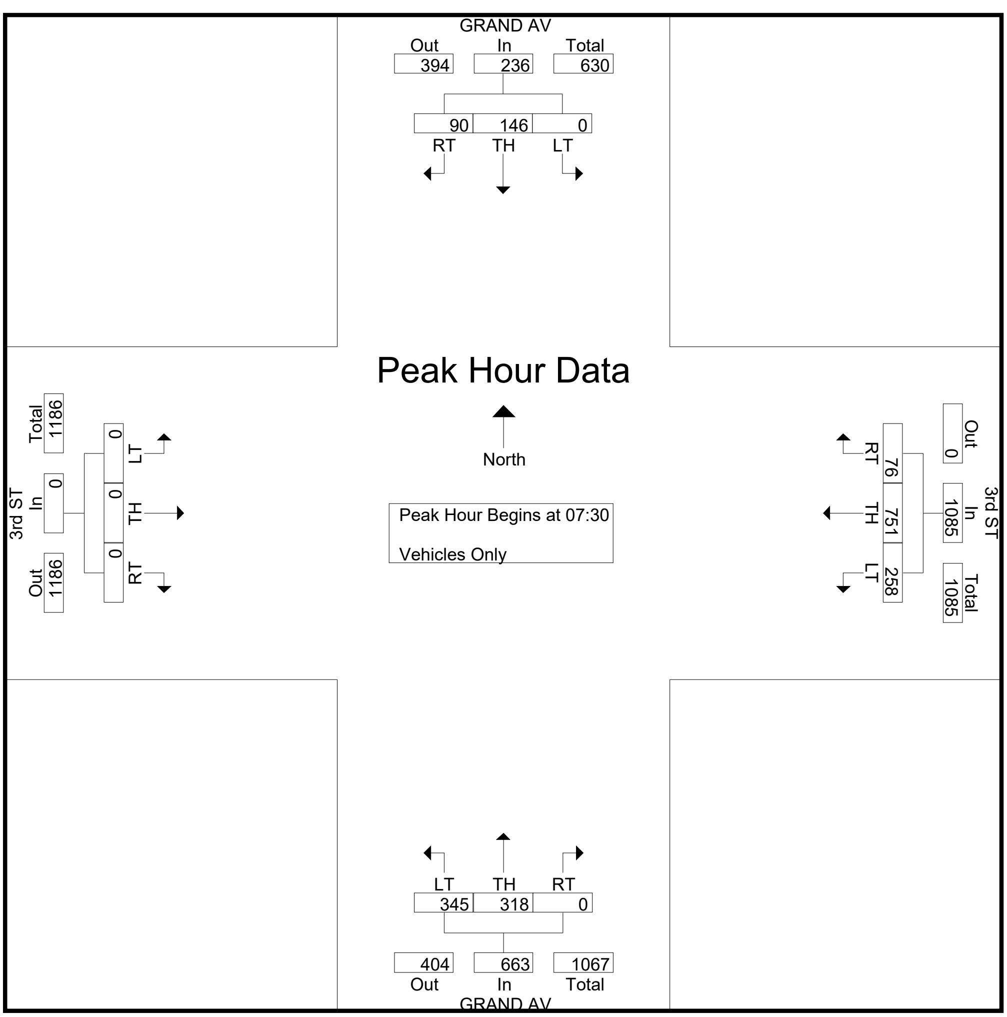
Latitude: 37.970960
Longitude: -122.518827

File Name : grand-3rd-a
Site Code : 1
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	GRAND AV Southbound				3rd ST Westbound				GRAND AV Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	19	30	0	49	8	160	25	193	0	47	66	113	0	0	0	0	355
07:15	27	20	0	47	13	193	31	237	0	55	103	158	0	0	0	0	442
07:30	20	35	0	55	10	192	61	263	0	80	122	202	0	0	0	0	520
07:45	24	38	0	62	22	195	80	297	0	91	100	191	0	0	0	0	550
Total	90	123	0	213	53	740	197	990	0	273	391	664	0	0	0	0	1867
08:00	26	40	0	66	15	173	57	245	0	61	67	128	0	0	0	0	439
08:15	20	33	0	53	29	191	60	280	0	86	56	142	0	0	0	0	475
08:30	29	43	0	72	19	186	54	259	0	74	61	135	0	0	0	0	466
08:45	35	41	0	76	21	221	47	289	0	58	65	123	0	0	0	0	488
Total	110	157	0	267	84	771	218	1073	0	279	249	528	0	0	0	0	1868
Grand Total	200	280	0	480	137	1511	415	2063	0	552	640	1192	0	0	0	0	3735
Apprch %	41.7	58.3	0		6.6	73.2	20.1		0	46.3	53.7		0	0	0		
Total %	5.4	7.5	0	12.9	3.7	40.5	11.1	55.2	0	14.8	17.1	31.9	0	0	0	0	

	GRAND AV Southbound				3rd ST Westbound				GRAND AV Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	20	35	0	55	10	192	61	263	0	80	**122**	**202**	0	0	0	0	520
07:45	24	38	0	62	22	**195**	**80**	**297**	0	**91**	100	191	0	0	0	0	**550**
08:00	**26**	**40**	0	**66**	15	173	57	245	0	61	67	128	0	0	0	0	439
08:15	20	33	0	53	**29**	191	60	280	0	86	56	142	0	0	0	0	475
Total Volume	90	146	0	236	76	751	258	1085	0	318	345	663	0	0	0	0	1984
% App. Total	38.1	61.9	0		7	69.2	23.8		0	48	52		0	0	0		
PHF	.865	.913	.000	.894	.655	.963	.806	.913	.000	.874	.707	.821	.000	.000	.000	.000	.902



TRAFFIC COUNTS PLUS

mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

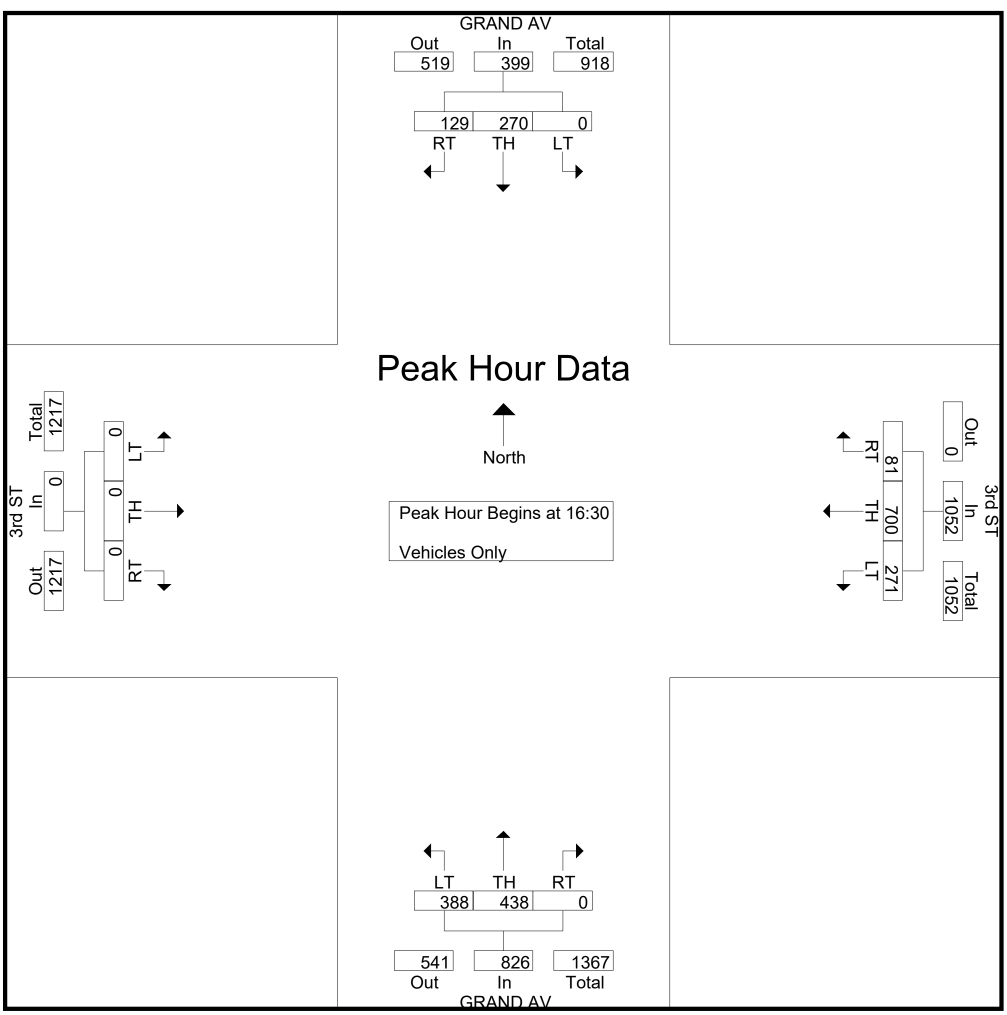
Latitude: 37.970960
Longitude: -122.518827

File Name : grand-3rd-p
Site Code : 1
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	GRAND AV Southbound				3rd ST Westbound				GRAND AV Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	45	62	0	107	23	189	79	291	0	80	74	154	0	0	0	0	552
16:15	38	73	0	111	24	186	57	267	0	85	82	167	0	0	0	0	545
16:30	33	73	0	106	31	182	73	286	0	80	93	173	0	0	0	0	565
16:45	26	83	0	109	15	179	73	267	0	110	80	190	0	0	0	0	566
Total	142	291	0	433	93	736	282	1111	0	355	329	684	0	0	0	0	2228
17:00	44	63	0	107	22	170	70	262	0	117	108	225	0	0	0	0	594
17:15	26	51	0	77	13	169	55	237	0	131	107	238	0	0	0	0	552
17:30	32	54	0	86	16	181	43	240	0	136	101	237	0	0	0	0	563
17:45	34	56	0	90	18	160	62	240	0	85	78	163	0	0	0	0	493
Total	136	224	0	360	69	680	230	979	0	469	394	863	0	0	0	0	2202
Grand Total	278	515	0	793	162	1416	512	2090	0	824	723	1547	0	0	0	0	4430
Apprch %	35.1	64.9	0		7.8	67.8	24.5		0	53.3	46.7		0	0	0		
Total %	6.3	11.6	0	17.9	3.7	32	11.6	47.2	0	18.6	16.3	34.9	0	0	0	0	

	GRAND AV Southbound				3rd ST Westbound				GRAND AV Northbound				3rd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:30																	
16:30	33	73	0	106	**31**	**182**	**73**	**286**	0	80	93	173	0	0	0	0	565
16:45	26	**83**	0	**109**	15	179	73	267	0	110	80	190	0	0	0	0	566
17:00	**44**	63	0	107	22	170	70	262	0	117	**108**	225	0	0	0	0	**594**
17:15	26	51	0	77	13	169	55	237	0	**131**	107	**238**	0	0	0	0	552
Total Volume	129	270	0	399	81	700	271	1052	0	438	388	826	0	0	0	0	2277
% App. Total	32.3	67.7	0		7.7	66.5	25.8		0	53	47		0	0	0		
PHF	.733	.813	.000	.915	.653	.962	.928	.920	.000	.836	.898	.868	.000	.000	.000	.000	.958



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

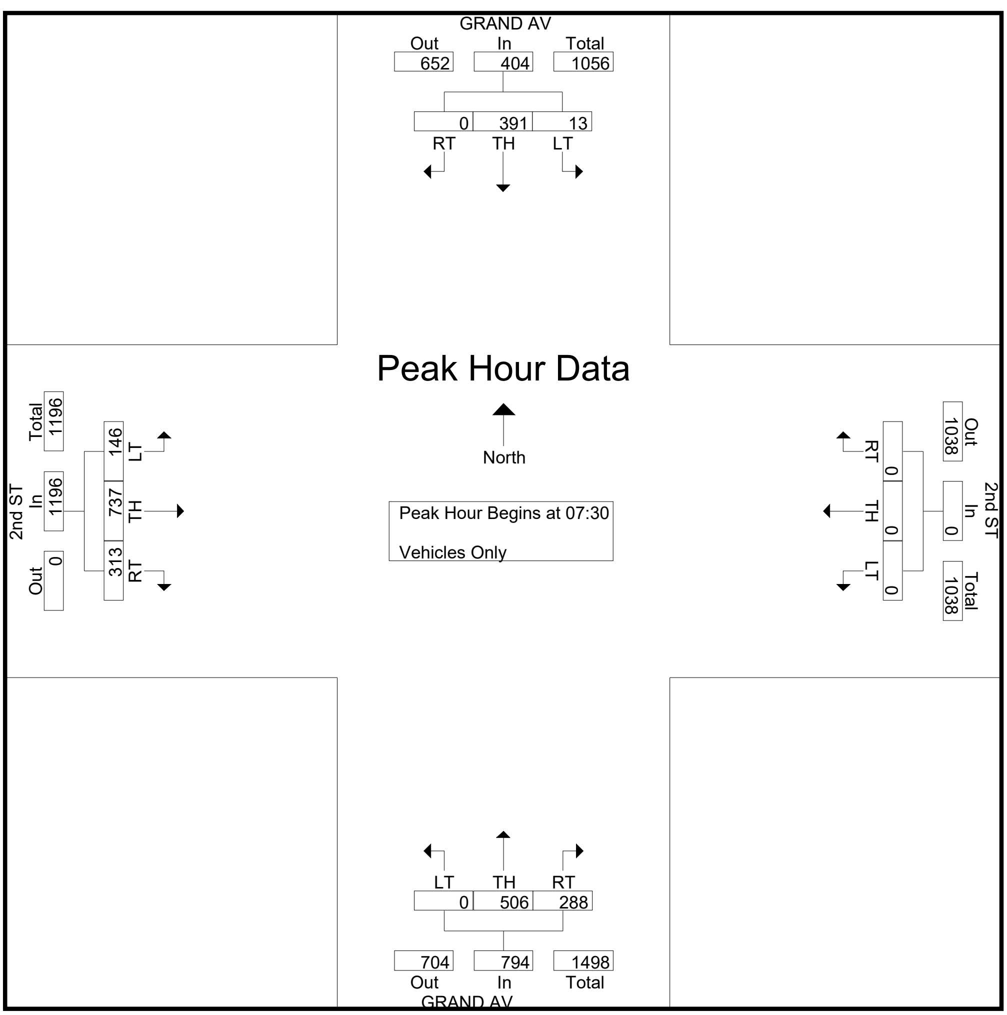
Latitude: 37.970249
Longitude: -122.519062

File Name : grand-2nd-a
Site Code : 2
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

	GRAND AV Southbound				2nd ST Westbound				GRAND AV Northbound				2nd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
07:00	0	47	3	50	0	0	0	0	29	99	0	128	66	91	20	177	355
07:15	0	56	0	56	0	0	0	0	41	126	0	167	81	157	32	270	493
07:30	0	88	2	90	0	0	0	0	71	167	0	238	65	191	29	285	613
07:45	0	113	2	115	0	0	0	0	89	150	0	239	84	211	42	337	691
Total	0	304	7	311	0	0	0	0	230	542	0	772	296	650	123	1069	2152
08:00	0	97	3	100	0	0	0	0	74	94	0	168	79	187	28	294	562
08:15	0	93	6	99	0	0	0	0	54	95	0	149	85	148	47	280	528
08:30	0	91	6	97	0	0	0	0	33	90	0	123	101	148	42	291	511
08:45	0	92	5	97	0	0	0	0	31	92	0	123	83	149	35	267	487
Total	0	373	20	393	0	0	0	0	192	371	0	563	348	632	152	1132	2088
Grand Total	0	677	27	704	0	0	0	0	422	913	0	1335	644	1282	275	2201	4240
Apprch %	0	96.2	3.8		0	0	0		31.6	68.4	0		29.3	58.2	12.5		
Total %	0	16	0.6	16.6	0	0	0	0	10	21.5	0	31.5	15.2	30.2	6.5	51.9	

	GRAND AV Southbound				2nd ST Westbound				GRAND AV Northbound				2nd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 07:00 to 08:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:30																	
07:30	0	88	2	90	0	0	0	0	71	**167**	0	238	65	191	29	285	613
07:45	0	**113**	2	**115**	0	0	0	0	**89**	150	0	**239**	84	**211**	42	**337**	**691**
08:00	0	97	3	100	0	0	0	0	74	94	0	168	79	187	28	294	562
08:15	0	93	**6**	99	0	0	0	0	54	95	0	149	**85**	148	**47**	280	528
Total Volume	0	391	13	404	0	0	0	0	288	506	0	794	313	737	146	1196	2394
% App. Total	0	96.8	3.2		0	0	0		36.3	63.7	0		26.2	61.6	12.2		
PHF	.000	.865	.542	.878	.000	.000	.000	.000	.809	.757	.000	.831	.921	.873	.777	.887	.866



TRAFFIC COUNTS PLUS
mietekm@comcast.net
925.305.4358

CITY OF SAN RAFAEL

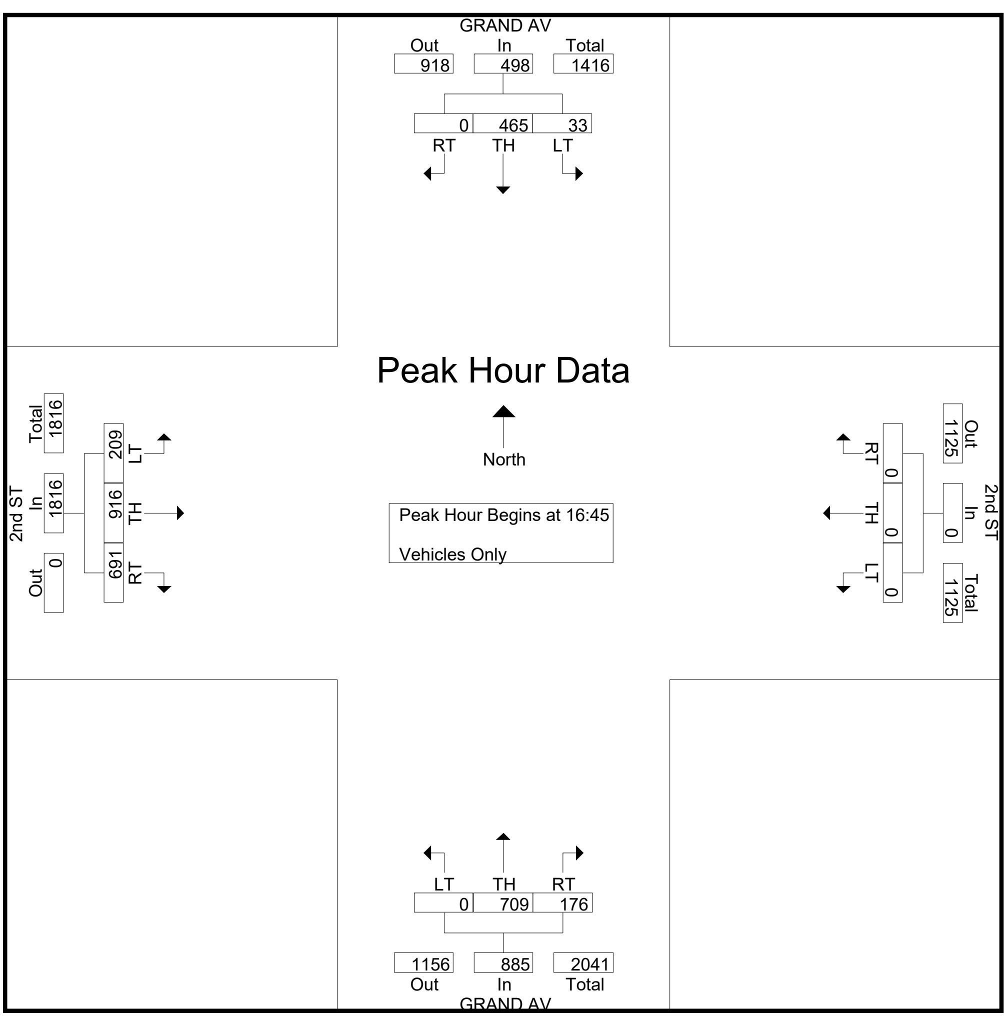
Latitude: 37.970249
Longitude: -122.519062

File Name : grand-2nd-p
Site Code : 2
Start Date : 5/25/2016
Page No : 1

Groups Printed- Vehicles Only

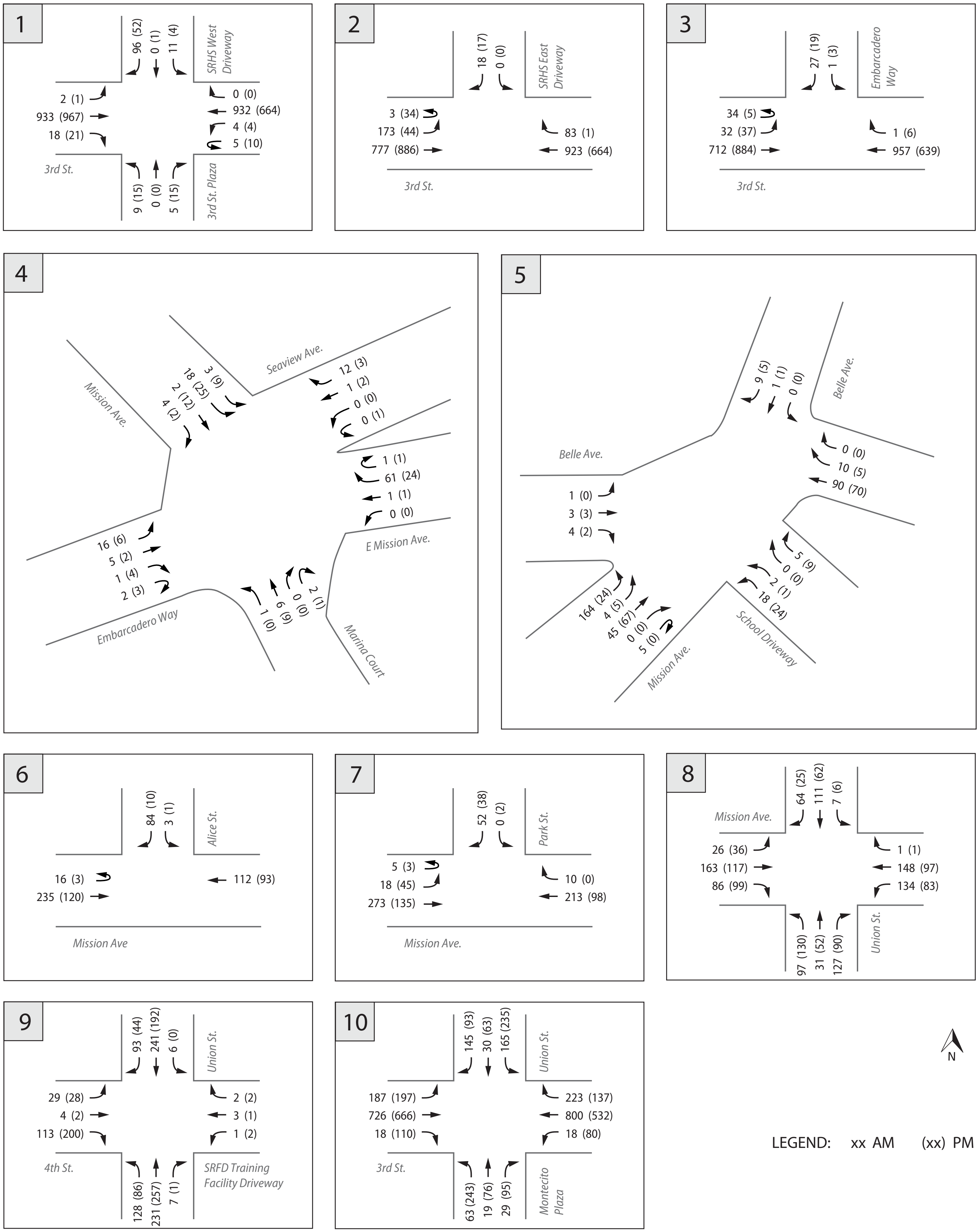
	GRAND AV Southbound				2nd ST Westbound				GRAND AV Northbound				2nd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
16:00	0	134	12	146	0	0	0	0	58	120	0	178	181	220	31	432	756
16:15	0	130	7	137	0	0	0	0	60	123	0	183	192	214	35	441	761
16:30	0	135	7	142	0	0	0	0	49	133	0	182	193	214	47	454	778
16:45	0	146	9	155	0	0	0	0	40	140	0	180	182	221	50	453	788
Total	0	545	35	580	0	0	0	0	207	516	0	723	748	869	163	1780	3083
17:00	0	131	4	135	0	0	0	0	41	185	0	226	156	204	54	414	775
17:15	0	103	10	113	0	0	0	0	52	194	0	246	201	228	49	478	837
17:30	0	85	10	95	0	0	0	0	43	190	0	233	152	263	56	471	799
17:45	0	109	7	116	0	0	0	0	48	117	0	165	155	238	53	446	727
Total	0	428	31	459	0	0	0	0	184	686	0	870	664	933	212	1809	3138
Grand Total	0	973	66	1039	0	0	0	0	391	1202	0	1593	1412	1802	375	3589	6221
Apprch %	0	93.6	6.4		0	0	0		24.5	75.5	0		39.3	50.2	10.4		
Total %	0	15.6	1.1	16.7	0	0	0	0	6.3	19.3	0	25.6	22.7	29	6	57.7	

	GRAND AV Southbound				2nd ST Westbound				GRAND AV Northbound				2nd ST Eastbound				
Start Time	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	RT	TH	LT	App. Total	Int. Total
Peak Hour Analysis From 16:00 to 17:45 - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 16:45																	
16:45	0	**146**	9	**155**	0	0	0	0	40	140	0	180	182	221	50	453	788
17:00	0	131	4	135	0	0	0	0	41	185	0	226	156	204	54	414	775
17:15	0	103	**10**	113	0	0	0	0	**52**	**194**	0	**246**	**201**	228	49	**478**	**837**
17:30	0	85	10	95	0	0	0	0	43	190	0	233	152	**263**	**56**	471	799
Total Volume	0	465	33	498	0	0	0	0	176	709	0	885	691	916	209	1816	3199
% App. Total	0	93.4	6.6		0	0	0		19.9	80.1	0		38.1	50.4	11.5		
PHF	.000	.796	.825	.803	.000	.000	.000	.000	.846	.914	.000	.899	.859	.871	.933	.950	.955



APPENDIX F-2

Vehicular Traffic Volumes

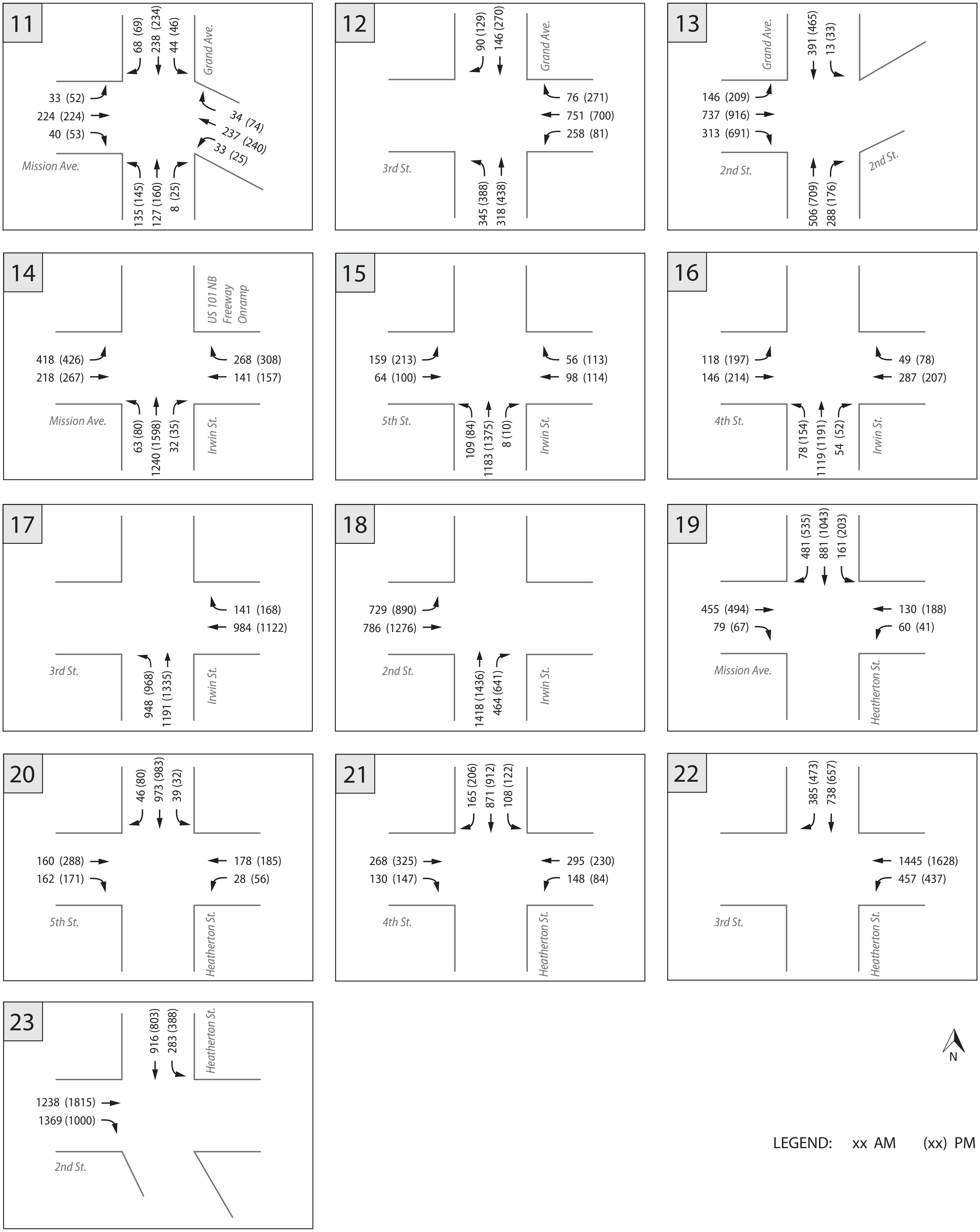


Existing Conditions

San Rafael High School EIR

Parisi
TRANSPORTATION CONSULTING

11/15/2016



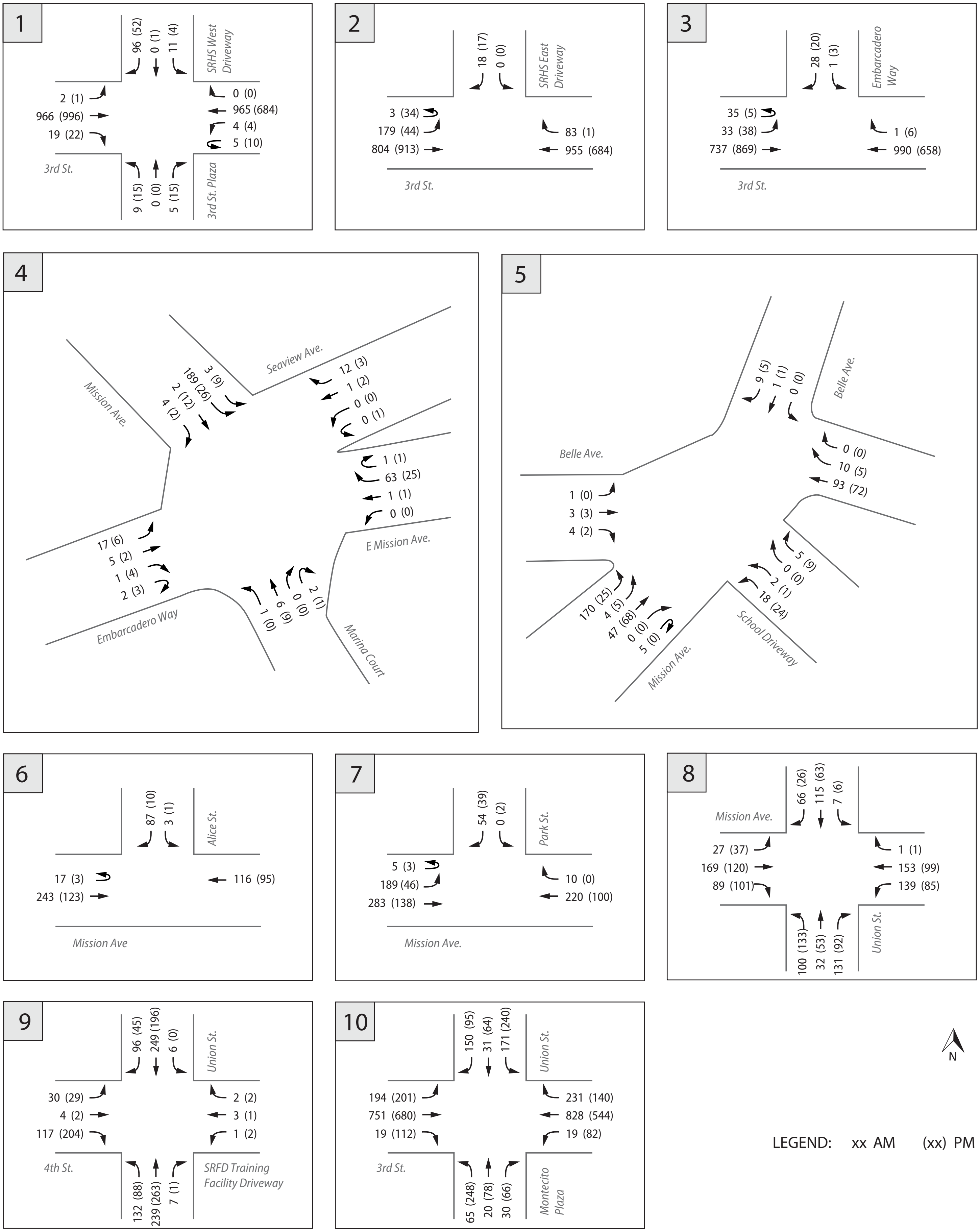
Existing Conditions

San Rafael High School EIR

Parisi

TRANSPORTATION CONSULTING

11/15/2016

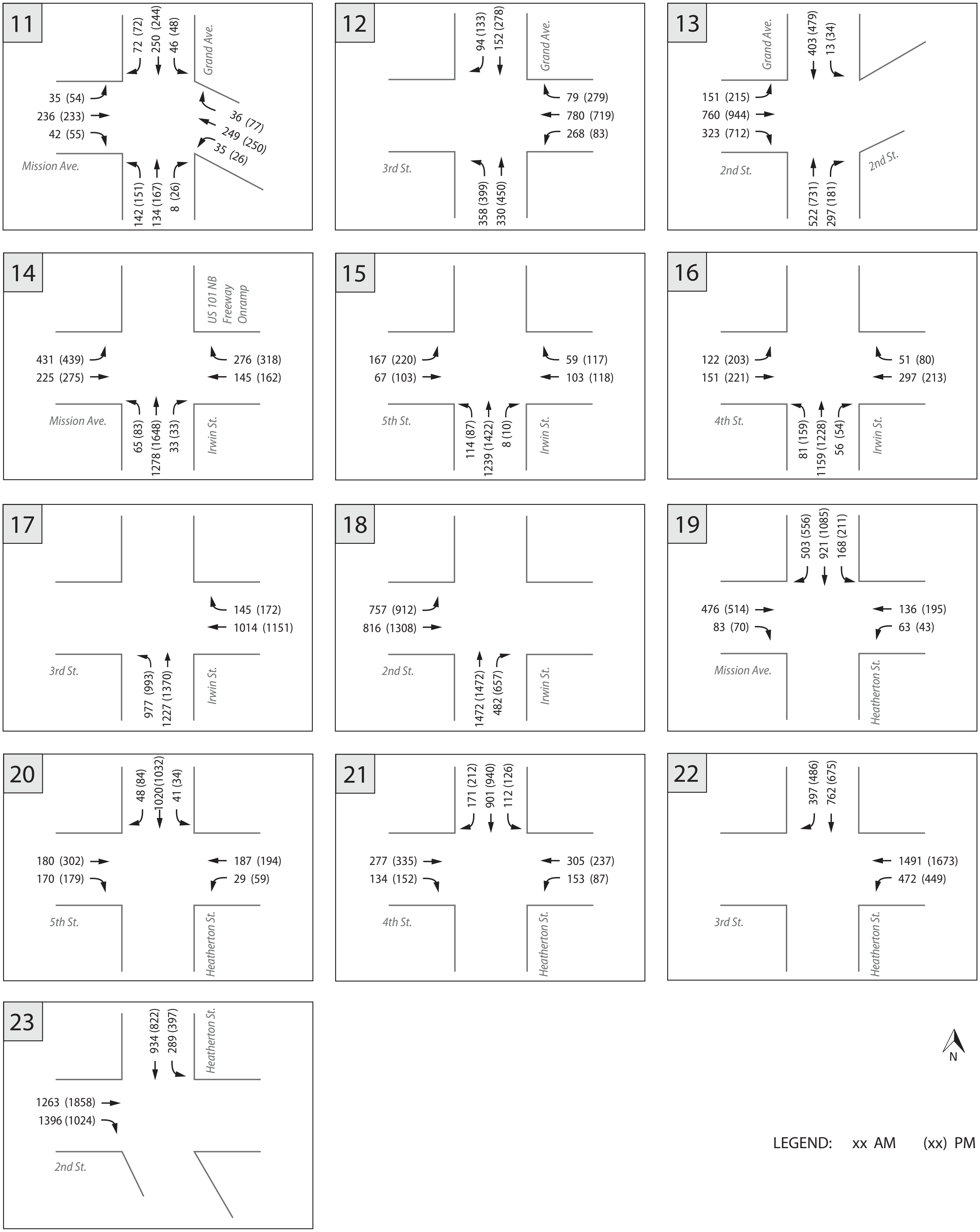


Near-term (2020) Conditions

San Rafael High School EIR

Parisi
TRANSPORTATION CONSULTING

11/15/2016

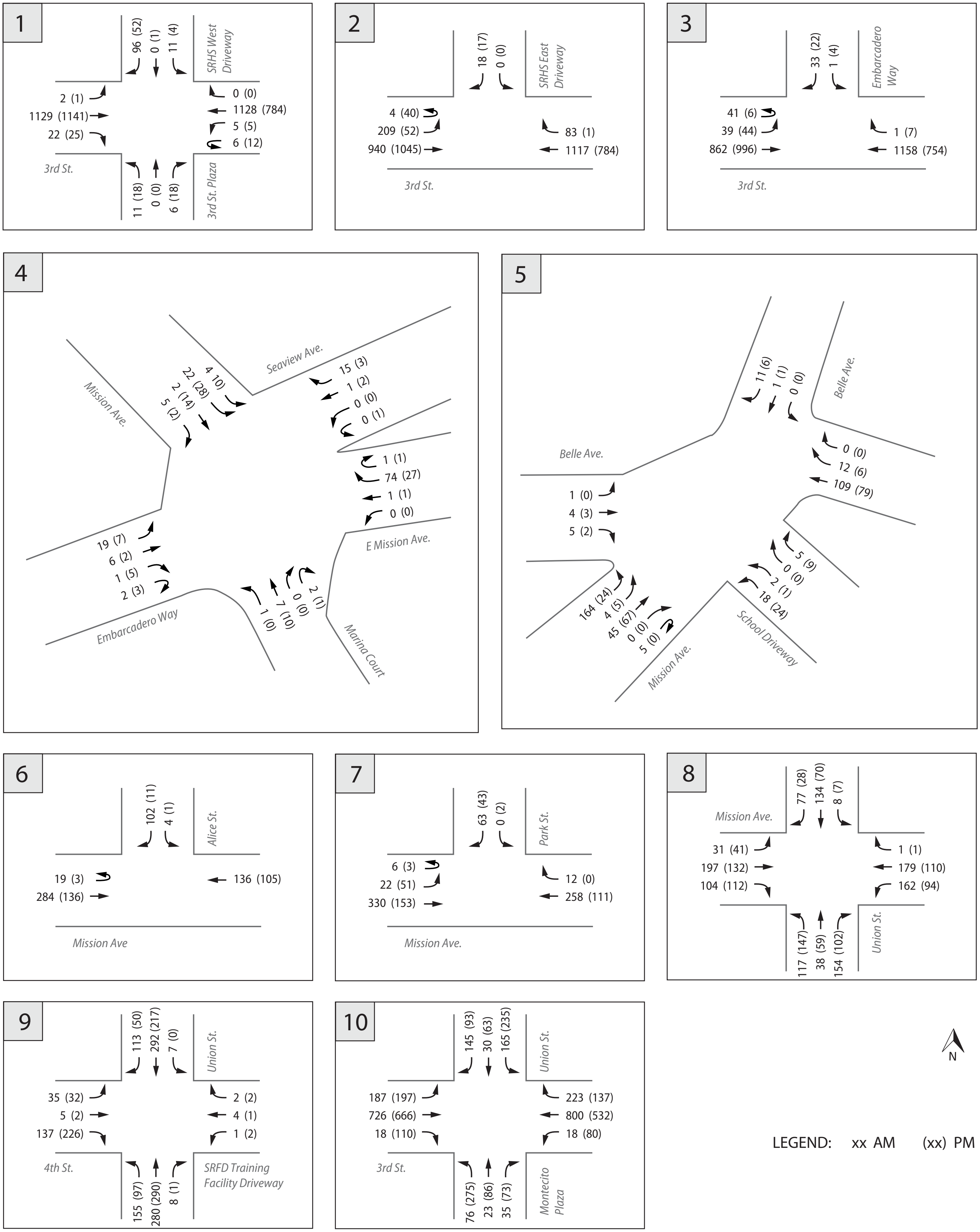


Near-term (2020) Conditions

San Rafael High School EIR

Parisi TRANSPORTATION CONSULTING

11/15/2016

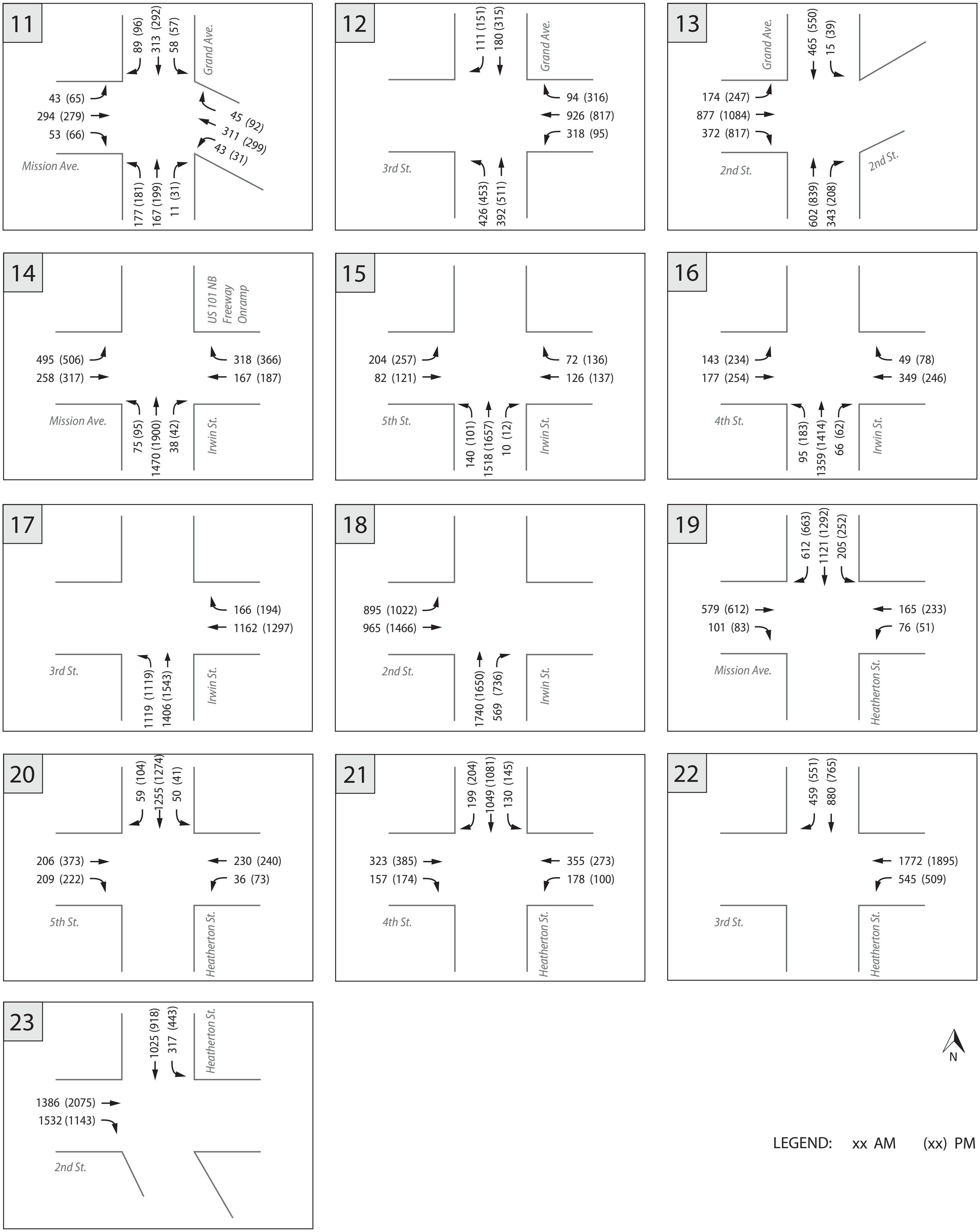


Cumulative (2040) Conditions

San Rafael High School EIR

Parisi TRANSPORTATION CONSULTING

11/15/2016



Cumulative (2040) Conditions

San Rafael High School EIR

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11/15/2016

APPENDIX F-3

San Rafael High School Campus Student Travel Survey

San Rafael High School
Student Arrival and Departure Tally Sheet

CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY

School Name: S A N R A F A E L H I G H

Teacher's First Name: ____________

Teacher's Last Name: ____________

Grade: (9, 10, 11, or 12) ____

Monday's Date (Week count was conducted) ___ ___ / ___ ___ / ___ ___ ___ ___
M M D D Y Y Y Y

Number of Students Enrolled in Class: ____

- Please conduct these counts during the first class of the day (first period or equivalent) only.
- Please conduct these counts **on two of the following three days: Tuesday, Wednesday, or Thursday. (Three days would provide better data if counted.)**
- **Please do not conduct these counts on Mondays or Fridays.**
- Before asking your students to raise their hands, please read through all possible answer choices so they will know their choices. Each student may only answer once.
- You can conduct the counts once per day, but during the count please ask students both the school arrival and departure questions.
- Ask your students as a group the question, **"How did you arrive at school today?"** Please review and explain to students the various response options for students travelling to school by private vehicle. i.e., survey responses should capture the number of students that drive to school separate from those dropped off. Survey should also capture the carpool rate for each category.
- Reread each answer choice and record the number of students that raised their hand for each. **Place just one character or number in each box.**
- Follow the same procedure for the question, **"How do you plan to leave for home after school?"**
- Please conduct this count regardless of weather conditions (*i.e.*, ask these questions on rainy days, too).

STEP 1
Fill in the weather conditions and number of students in each class.

STEP 2
AM – "How did you arrive at school today?" Record the number of hands for each answer.
PM – "How do you plan to leave for home after school?" Record the number of hands for each answer.

Key	Weather	Student Tally	Walk	Bike	Bus	Drive & Park	Ride & Park	Drop-Off (Alone)	Drop-Off (Carpool)	Other
	S = Sunny R = Rainy O= Overcast	Number in class when count made				Student Driver	Passenger of a Student Driver	Also includes "drive-off" i.e., any students that drive to or from school but guardian keeps the car.		
Sample AM	S N	2 9	7	3	5	2	3	5	3	1
Sample PM	R	2 8	9	3	5	2	3	3	2	1
Tues. AM										
Tues. PM										
Wed. AM										
Wed. PM										
Thurs. AM										
Thurs. PM										

Please list any disruptions to these counts or any unusual travel conditions to/from the school on the days of the tally.

San Rafael High School
Supplemental Questionnaire

CAPITAL LETTERS ONLY – BLUE OR BLACK INK ONLY

Instructions: Please provide this questionnaire to students during the travel survey period. Each student should take the survey only once.

1. Did you travel TO school by car?

A. ☐ Yes, I was dropped off at school by someone else
B. ☐ Yes, I drove myself to school
C. ☐ Yes, I was driven to school by a fellow student at SRHS
D. ☐ No, I came to school using other modes of transportation (e.g., walk, bicycle, bus, etc.)
E. ☐ Other (please explain) ____

2. Will you travel FROM school by car?

A. ☐ Yes, I will be picked up after school by someone else
B. ☐ Yes, I will drive myself after school
C. ☐ Yes, I will be driven from school by a fellow student at SRHS
D. ☐ No, I leave school using other modes of transportation (e.g., walk, bicycle, bus, etc.)
E. ☐ Other (please explain) ____

3. When will you leave campus today?

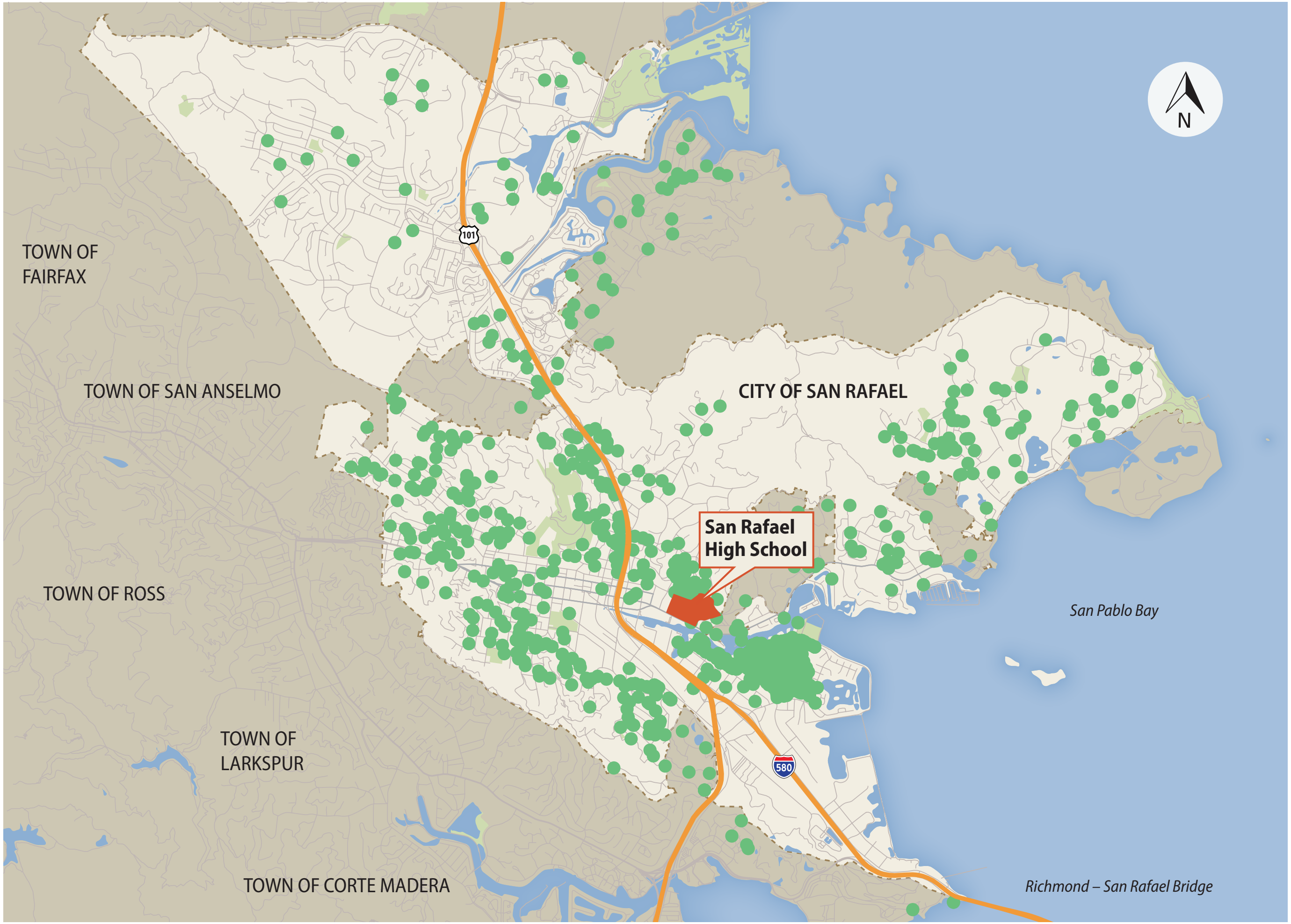
A. ☐ Before the last school bell rings (end of the last period)
B. ☐ Immediately after the last school bell rings (end of the last period)
C. ☐ When my after school activity ends (please provide approximate time) ___________________________
D. ☐ Other (please explain) ____

4. If you traveled by car, how many students (including yourself) were in the car?

A. ☐ 1
B. ☐ 2
C. ☐ 3
D. ☐ 4 or more

5. If you drove yourself to school, where did you park?

A. ☐ On campus, (3rd Street parking lot)
B. ☐ On campus, (Mission Avenue parking lot)
C. ☐ Off campus, on nearby street (please provide street name) ___________________________________
D. ☐ Off campus, in nearby parking lot (please provide address/business name) _____________________
E. ☐ Other (please explain) ____



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San Rafael High School
Student Origins

San Rafael High School Student Travel Survey

#	Date	Grade	Number of Students Enrolled	Travel Survey Data - AM									
				Weather - AM	Student Tally - AM	Walk - AM	Bike-AM	Bus - AM	Drive & Park - AM	Ride & Park - AM	Drop-Off (Alone)- AM	Drop-Off (Carpool)- AM	Other- AM
1	10/6/2016	Misc.	23	S	22	3	1	6	3	0	0	9	0
2	10/6/2016	Misc.	25	S	23	10	3	6	1	0	0	3	0
3	10/6/2016	Misc.	24	S	26	9	1	9	0	0	0	7	0
4	10/6/2016	Misc.	17		0								
5	10/5/2016	Misc.	20	S	18	3	1	6	1	4	1	2	0
6	10/5/2016	Misc.	19	S	18	0	0	12	1	0	0	5	0
7	10/4/2016	12			0								
8	10/5/2016	12		S	20	2	0	10	0	1	6	1	0
9	10/6/2016	12		S	18	1	0	5	0	1	8	3	0
10	10/4/2016	Misc.		S	20	2	3	9	1	0	4	1	0
11	10/5/2016	10		S	28	1	0	2	0	2	13	10	0
12	10/4/2016	11		O	29	3	1	2	7	2	7	6	1
13	10/4/2016	Misc.	23	O	19	8	0	5	1	0	5	0	0
14	10/5/2016	11	24	S	23	2	0	1	7	0	8	5	0
15	10/4/2016	10	32	O	28	3	0	5	0	2	15	3	0
16	10/4/2016	10	29	O	24	2	0	8	0	3	7	4	0
17	10/5/2016	10	24	S	19	2	2	5	0	0	9	1	0
18	10/4/2016	10	29	O	29	4	0	5	1	0	8	11	0
19	10/4/2016	10	29	O	27	2	1	2	0	2	13	7	0
20	10/4/2016	Misc.	23	O	22	3	1	6	3	0	0	9	0
21	10/4/2016	Misc.	25	S	23	10	3	6	1	0	0	3	0
22	10/4/2016	Misc.	24	S	24	9	1	7	0	0	0	7	0
23	10/4/2016	12	28	O	22	2	0	4	6	0	5	5	0
24	10/5/2016	12	28	S	28	0	0	2	11	4	11	0	0
25	10/5/2016	9	22	S	21	1	2	2	0	0	10	1	5
26	10/5/2016		16	S	18	7	0	5	3	0	3	0	0
27	10/5/2016		21	S	20	3	0	5	3	1	3	1	4
28	10/5/2016	9	20	O	19	2	1	16	0	0	0	0	0
29	10/4/2016	9	20	O	19	2	1	16	0	0	0	0	0
30	10/4/2016		25	O	21	0	1	5	0	0	11	4	0
31	10/5/2016	9	28	O	28	3	2	2	0	0	21	0	0
32	10/5/2016	11	30	S	28	1	0	3	3	1	19	0	1
33	10/5/2016	11			30	1	0	4	2	1	14	8	0
34	10/4/2016	12	31	O	28	3	1	0	9	1	11	2	1
35	10/4/2016	11	31	O	27	1	0	6	9	4	7	0	0
36	10/4/2016	11	21	O	19	3	0	3	7	0	5	1	0
37	10/4/2016	9	31	O	30	4	4	4	0	2	13	3	0
38	10/4/2016	9	27	O	24	0	4	2	0	3	10	5	0
39	10/6/2016	9	32	O	29	3	0	5	0	2	13	6	0
40	10/5/2016	9		O	25	1	1	2	0	1	13	7	0
41	10/6/2016	9		S	26	2	0	0	0	2	11	11	0
42	10/4/2016	12	21		21	2	0	8	2	2	7	0	0
43	10/5/2016	12	21		21	3	0	9	3	1	5	0	0
44	10/6/2016	12	21		21	2	0	9	2	2	6	0	0
45	10/4/2016	11	9		9	0	0	4	0	2	3	0	0
46	10/5/2016	11	9		9	0	0	2	1	1	5	0	0
47	10/6/2016	11	9		9	0	0	4	3	0	2	0	0
48	10/4/2016	12	20		19	3	1	5	1	2	7	0	0
49	10/5/2016	12	20		20	2	2	7	2	2	5	0	0
50	10/6/2016	12	20		20	3	3	6	2	2	4	0	0
51	10/4/2016	11	19		19	1	1	9	1	1	6	0	0
52	10/5/2016	11	19		19	2	1	8	2	2	4	0	0
53	10/6/2016	11	19		20	1	0	10	2	1	6	0	0
					1129	**137**	**43**	**284**	**101**	**57**	**344**	**151**	**12**

San Rafael High School Student Travel Survey

#	Date	Grade	Number of Students Enrolled	Travel Survey Data - PM									
				Weather - PM	Student Tally-PM	Walk - PM	Bike-PM	Bus - PM	Drive & Park - PM	Ride & Park - PM	Drop-Off (Alone)- PM	Drop-Off (Carpool)-PM	Other- PM
1	10/6/2016	Misc.	23	S	22	3	1	6	3	0	0	9	0
2	10/6/2016	Misc.	25	S	23	10	3	6	1	0	0	3	0
3	10/6/2016	Misc.	24	S	20	9	1	9	0	0	0	1	0
4	10/6/2016	Misc.	17	S	14	0	1	11	1	1	0	0	0
5	10/5/2016	Misc.	20		0								
6	10/5/2016	Misc.	19		0								
7	10/4/2016	12		O	22	2	0	3	5	3	9	0	0
8	10/5/2016	12		S	28	3	1	6	8	3	6	1	0
9	10/6/2016	12			0								
10	10/4/2016	Misc.			0								
11	10/5/2016	10		S	28	4	0	5	0	2	11	5	1
12	10/4/2016	11		S	28	3	1	9	7	1	3	3	1
13	10/4/2016	Misc.	23	O	19	7	0	5	1	2	2	0	2
14	10/5/2016	11	24	S	23	2	0	2	7	0	9	2	1
15	10/4/2016	10	32	O	28	7	0	5	0	2	9	4	1
16	10/4/2016	10	29	O	24	3	0	7	0	1	11	2	0
17	10/5/2016	10	24	S	18	6	2	4	0	2	3	1	0
18	10/4/2016	10	29	S	28	4	0	8	1	2	7	5	1
19	10/4/2016	10	29	O	26	3	1	6	0	4	11	1	0
20	10/4/2016	Misc.	23	S	22	3	1	6	3	0	0	9	0
21	10/4/2016	Misc.	25	S	23	10	3	6	1	0	0	3	0
22	10/4/2016	Misc.	24	S	24	9	1	7	0	0	0	7	0
23	10/4/2016	12	28	O	24	3	0	5	6	1	6	2	1
24	10/5/2016	12	28	S	29	2	0	2	11	4	10	0	0
25	10/5/2016	9	22	S	22	4	1	5	0	0	6	1	5
26	10/5/2016		16	S	15	6	0	3	3	2	1	0	0
27	10/5/2016		21	S	20	3	0	6	1	1	3	1	5
28	10/5/2016	9	20		0								
29	10/4/2016	9	20		0								
30	10/4/2016		25		0								
31	10/5/2016	9	28		0								
32	10/5/2016	11	30	S	28	8	0	7	3	3	6	0	1
33	10/5/2016	11			30	5	0	10	2	3	9	1	0
34	10/4/2016	12	31	O	28	6	1	4	9	1	4	2	1
35	10/4/2016	11	31	O	27	3	0	11	9	2	2	0	0
36	10/4/2016	11	21	O	18	3	0	2	7	4	2	0	0
37	10/4/2016	9	31	O	30	5	4	8	0	1	8	4	0
38	10/4/2016	9	27	S	21	1	4	2	0	2	5	7	0
39	10/6/2016	9	32	S	26	5	0	5	0	1	8	6	1
40	10/5/2016	9		S	24	5	1	5	0	1	10	2	0
41	10/6/2016	9			24	5	0	4	0	0	9	6	0
42	10/4/2016	12	21		0								
43	10/5/2016	12	21		0								
44	10/6/2016	12	21		0								
45	10/4/2016	11	9		0								
46	10/5/2016	11	9		0								
47	10/6/2016	11	9		0								
48	10/4/2016	12	20		0								
49	10/5/2016	12	20		0								
50	10/6/2016	12	20		0								
51	10/4/2016	11	19		0								
52	10/5/2016	11	19		0								
53	10/6/2016	11	19		0								
					786	**152**	**27**	**190**	**89**	**49**	**170**	**88**	**21**

Source : San Rafael School District, 2016; Parisi Transportation Consulting, 2016.

San Rafael High School Student Travel Survey

#	Date	Grade	Number of Students Enrolled	Student Travel Mode Share - AM							
				Walk - AM	Bike-AM	Bus - AM	Drive & Park - AM	Ride & Park - AM	Drop-Off (Alone)- AM	Drop-Off (Carpool)- AM	Other- AM
1	10/6/2016	Misc.	23	13.6%	4.5%	27.3%	13.6%	0.0%	0.0%	40.9%	0.0%
2	10/6/2016	Misc.	25	43.5%	13.0%	26.1%	4.3%	0.0%	0.0%	13.0%	0.0%
3	10/6/2016	Misc.	24	34.6%	3.8%	34.6%	0.0%	0.0%	0.0%	26.9%	0.0%
4	10/6/2016	Misc.	17	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5	10/5/2016	Misc.	20	16.7%	5.6%	33.3%	5.6%	22.2%	5.6%	11.1%	0.0%
6	10/5/2016	Misc.	19	0.0%	0.0%	66.7%	5.6%	0.0%	0.0%	27.8%	0.0%
7	10/4/2016	12		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	10/5/2016	12		10.0%	0.0%	50.0%	0.0%	5.0%	30.0%	5.0%	0.0%
9	10/6/2016	12		5.6%	0.0%	27.8%	0.0%	5.6%	44.4%	16.7%	0.0%
10	10/4/2016	Misc.		10.0%	15.0%	45.0%	5.0%	0.0%	20.0%	5.0%	0.0%
11	10/5/2016	10		3.6%	0.0%	7.1%	0.0%	7.1%	46.4%	35.7%	0.0%
12	10/4/2016	11		10.3%	3.4%	6.9%	24.1%	6.9%	24.1%	20.7%	3.4%
13	10/4/2016	Misc.	23	42.1%	0.0%	26.3%	5.3%	0.0%	26.3%	0.0%	0.0%
14	10/5/2016	11	24	8.7%	0.0%	4.3%	30.4%	0.0%	34.8%	21.7%	0.0%
15	10/4/2016	10	32	10.7%	0.0%	17.9%	0.0%	7.1%	53.6%	10.7%	0.0%
16	10/4/2016	10	29	8.3%	0.0%	33.3%	0.0%	12.5%	29.2%	16.7%	0.0%
17	10/5/2016	10	24	10.5%	10.5%	26.3%	0.0%	0.0%	47.4%	5.3%	0.0%
18	10/4/2016	10	29	13.8%	0.0%	17.2%	3.4%	0.0%	27.6%	37.9%	0.0%
19	10/4/2016	10	29	7.4%	3.7%	7.4%	0.0%	7.4%	48.1%	25.9%	0.0%
20	10/4/2016	Misc.	23	13.6%	4.5%	27.3%	13.6%	0.0%	0.0%	40.9%	0.0%
21	10/4/2016	Misc.	25	43.5%	13.0%	26.1%	4.3%	0.0%	0.0%	13.0%	0.0%
22	10/4/2016	Misc.	24	37.5%	4.2%	29.2%	0.0%	0.0%	0.0%	29.2%	0.0%
23	10/4/2016	12	28	9.1%	0.0%	18.2%	27.3%	0.0%	22.7%	22.7%	0.0%
24	10/5/2016	12	28	0.0%	0.0%	7.1%	39.3%	14.3%	39.3%	0.0%	0.0%
25	10/5/2016	9	22	4.8%	9.5%	9.5%	0.0%	0.0%	47.6%	4.8%	23.8%
26	10/5/2016		16	38.9%	0.0%	27.8%	16.7%	0.0%	16.7%	0.0%	0.0%
27	10/5/2016		21	15.0%	0.0%	25.0%	15.0%	5.0%	15.0%	5.0%	20.0%
28	10/5/2016	9	20	10.5%	5.3%	84.2%	0.0%	0.0%	0.0%	0.0%	0.0%
29	10/4/2016	9	20	10.5%	5.3%	84.2%	0.0%	0.0%	0.0%	0.0%	0.0%
30	10/4/2016		25	0.0%	4.8%	23.8%	0.0%	0.0%	52.4%	19.0%	0.0%
31	10/5/2016	9	28	10.7%	7.1%	7.1%	0.0%	0.0%	75.0%	0.0%	0.0%
32	10/5/2016	11	30	3.6%	0.0%	10.7%	10.7%	3.6%	67.9%	0.0%	3.6%
33	10/5/2016	11		3.3%	0.0%	13.3%	6.7%	3.3%	46.7%	26.7%	0.0%
34	10/4/2016	12	31	10.7%	3.6%	0.0%	32.1%	3.6%	39.3%	7.1%	3.6%
35	10/4/2016	11	31	3.7%	0.0%	22.2%	33.3%	14.8%	25.9%	0.0%	0.0%
36	10/4/2016	11	21	15.8%	0.0%	15.8%	36.8%	0.0%	26.3%	5.3%	0.0%
37	10/4/2016	9	31	13.3%	13.3%	13.3%	0.0%	6.7%	43.3%	10.0%	0.0%
38	10/4/2016	9	27	0.0%	16.7%	8.3%	0.0%	12.5%	41.7%	20.8%	0.0%
39	10/6/2016	9	32	10.3%	0.0%	17.2%	0.0%	6.9%	44.8%	20.7%	0.0%
40	10/5/2016	9		4.0%	4.0%	8.0%	0.0%	4.0%	52.0%	28.0%	0.0%
41	10/6/2016	9		7.7%	0.0%	0.0%	0.0%	7.7%	42.3%	42.3%	0.0%
42	10/4/2016	12	21	9.5%	0.0%	38.1%	9.5%	9.5%	33.3%	0.0%	0.0%
43	10/5/2016	12	21	14.3%	0.0%	42.9%	14.3%	4.8%	23.8%	0.0%	0.0%
44	10/6/2016	12	21	9.5%	0.0%	42.9%	9.5%	9.5%	28.6%	0.0%	0.0%
45	10/4/2016	11	9	0.0%	0.0%	44.4%	0.0%	22.2%	33.3%	0.0%	0.0%
46	10/5/2016	11	9	0.0%	0.0%	22.2%	11.1%	11.1%	55.6%	0.0%	0.0%
47	10/6/2016	11	9	0.0%	0.0%	44.4%	33.3%	0.0%	22.2%	0.0%	0.0%
48	10/4/2016	12	20	15.8%	5.3%	26.3%	5.3%	10.5%	36.8%	0.0%	0.0%
49	10/5/2016	12	20	10.0%	10.0%	35.0%	10.0%	10.0%	25.0%	0.0%	0.0%
50	10/6/2016	12	20	15.0%	15.0%	30.0%	10.0%	10.0%	20.0%	0.0%	0.0%
51	10/4/2016	11	19	5.3%	5.3%	47.4%	5.3%	5.3%	31.6%	0.0%	0.0%
52	10/5/2016	11	19	10.5%	5.3%	42.1%	10.5%	10.5%	21.1%	0.0%	0.0%
53	10/6/2016	11	19	5.0%	0.0%	50.0%	10.0%	5.0%	30.0%	0.0%	0.0%
				12%	**4%**	**25%**	**9%**	**6%**	**30%**	**13%**	**1%**

Source : San Rafael School District, 2016; Parisi Transportation Consulting, 2016.

San Rafael High School Student Travel Survey

#	Date	Grade	Number of Students Enrolled	Student Travel Mode Share - PM							
				Walk - PM	Bike-PM	Bus - PM	Drive & Park - PM	Ride & Park - PM	Drop-Off (Alone)- PM	Drop-Off (Carpool)-PM	Other- PM
1	10/6/2016	Misc.	23	13.6%	4.5%	27.3%	13.6%	0.0%	0.0%	40.9%	0.0%
2	10/6/2016	Misc.	25	43.5%	13.0%	26.1%	4.3%	0.0%	0.0%	13.0%	0.0%
3	10/6/2016	Misc.	24	45.0%	5.0%	45.0%	0.0%	0.0%	0.0%	5.0%	0.0%
4	10/6/2016	Misc.	17	0.0%	7.1%	78.6%	7.1%	7.1%	0.0%	0.0%	0.0%
5	10/5/2016	Misc.	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	10/5/2016	Misc.	19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7	10/4/2016	12		9.1%	0.0%	13.6%	22.7%	13.6%	40.9%	0.0%	0.0%
8	10/5/2016	12		10.7%	3.6%	21.4%	28.6%	10.7%	21.4%	3.6%	0.0%
9	10/6/2016	12		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	10/4/2016	Misc.		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11	10/5/2016	10		14.3%	0.0%	17.9%	0.0%	7.1%	39.3%	17.9%	3.6%
12	10/4/2016	11		10.7%	3.6%	32.1%	25.0%	3.6%	10.7%	10.7%	3.6%
13	10/4/2016	Misc.	23	36.8%	0.0%	26.3%	5.3%	10.5%	10.5%	0.0%	10.5%
14	10/5/2016	11	24	8.7%	0.0%	8.7%	30.4%	0.0%	39.1%	8.7%	4.3%
15	10/4/2016	10	32	25.0%	0.0%	17.9%	0.0%	7.1%	32.1%	14.3%	3.6%
16	10/4/2016	10	29	12.5%	0.0%	29.2%	0.0%	4.2%	45.8%	8.3%	0.0%
17	10/5/2016	10	24	33.3%	11.1%	22.2%	0.0%	11.1%	16.7%	5.6%	0.0%
18	10/4/2016	10	29	14.3%	0.0%	28.6%	3.6%	7.1%	25.0%	17.9%	3.6%
19	10/4/2016	10	29	11.5%	3.8%	23.1%	0.0%	15.4%	42.3%	3.8%	0.0%
20	10/4/2016	Misc.	23	13.6%	4.5%	27.3%	13.6%	0.0%	0.0%	40.9%	0.0%
21	10/4/2016	Misc.	25	43.5%	13.0%	26.1%	4.3%	0.0%	0.0%	13.0%	0.0%
22	10/4/2016	Misc.	24	37.5%	4.2%	29.2%	0.0%	0.0%	0.0%	29.2%	0.0%
23	10/4/2016	12	28	12.5%	0.0%	20.8%	25.0%	4.2%	25.0%	8.3%	4.2%
24	10/5/2016	12	28	6.9%	0.0%	6.9%	37.9%	13.8%	34.5%	0.0%	0.0%
25	10/5/2016	9	22	18.2%	4.5%	22.7%	0.0%	0.0%	27.3%	4.5%	22.7%
26	10/5/2016		16	40.0%	0.0%	20.0%	20.0%	13.3%	6.7%	0.0%	0.0%
27	10/5/2016		21	15.0%	0.0%	30.0%	5.0%	5.0%	15.0%	5.0%	25.0%
28	10/5/2016	9	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
29	10/4/2016	9	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
30	10/4/2016		25	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
31	10/5/2016	9	28	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
32	10/5/2016	11	30	28.6%	0.0%	25.0%	10.7%	10.7%	21.4%	0.0%	3.6%
33	10/5/2016	11		16.7%	0.0%	33.3%	6.7%	10.0%	30.0%	3.3%	0.0%
34	10/4/2016	12	31	21.4%	3.6%	14.3%	32.1%	3.6%	14.3%	7.1%	3.6%
35	10/4/2016	11	31	11.1%	0.0%	40.7%	33.3%	7.4%	7.4%	0.0%	0.0%
36	10/4/2016	11	21	16.7%	0.0%	11.1%	38.9%	22.2%	11.1%	0.0%	0.0%
37	10/4/2016	9	31	16.7%	13.3%	26.7%	0.0%	3.3%	26.7%	13.3%	0.0%
38	10/4/2016	9	27	4.8%	19.0%	9.5%	0.0%	9.5%	23.8%	33.3%	0.0%
39	10/6/2016	9	32	19.2%	0.0%	19.2%	0.0%	3.8%	30.8%	23.1%	3.8%
40	10/5/2016	9		20.8%	4.2%	20.8%	0.0%	4.2%	41.7%	8.3%	0.0%
41	10/6/2016	9		20.8%	0.0%	16.7%	0.0%	0.0%	37.5%	25.0%	0.0%
42	10/4/2016	12	21	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
43	10/5/2016	12	21	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
44	10/6/2016	12	21	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
45	10/4/2016	11	9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
46	10/5/2016	11	9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
47	10/6/2016	11	9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
48	10/4/2016	12	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
49	10/5/2016	12	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50	10/6/2016	12	20	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
51	10/4/2016	11	19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
52	10/5/2016	11	19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
53	10/6/2016	11	19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
				19%	**3%**	**24%**	**11%**	**7%**	**22%**	**11%**	**3%**

Source : San Rafael School District, 2016; Parisi Transportation Consulting, 2016.

San Rafael High School Student Travel Survey

#	Date	Grade	Number of Students Enrolled	Student Travel Mode Share - Average								
				Walk	Bike	Bus	Drive & Park	Ride & Park	Drop-Off (Alone)	Drop-Off (Carpool)	Other	Total
1	10/6/2016	Misc.	23	14%	5%	27%	14%	0%	0%	41%	0%	100%
2	10/6/2016	Misc.	25	43%	13%	26%	4%	0%	0%	13%	0%	100%
3	10/6/2016	Misc.	24	39%	4%	39%	0%	0%	0%	17%	0%	100%
4	10/6/2016	Misc.	17	0%	7%	79%	7%	7%	0%	0%	0%	100%
5	10/5/2016	Misc.	20	17%	6%	33%	6%	22%	6%	11%	0%	100%
6	10/5/2016	Misc.	19	0%	0%	67%	6%	0%	0%	28%	0%	100%
7	10/4/2016	12		9%	0%	14%	23%	14%	41%	0%	0%	100%
8	10/5/2016	12		10%	2%	33%	17%	8%	25%	4%	0%	100%
9	10/6/2016	12		6%	0%	28%	0%	6%	44%	17%	0%	100%
10	10/4/2016	Misc.		10%	15%	45%	5%	0%	20%	5%	0%	100%
11	10/5/2016	10		9%	0%	13%	0%	7%	43%	27%	2%	100%
12	10/4/2016	11		11%	4%	19%	25%	5%	18%	16%	4%	100%
13	10/4/2016	Misc.	23	39%	0%	26%	5%	5%	18%	0%	5%	100%
14	10/5/2016	11	24	9%	0%	7%	30%	0%	37%	15%	2%	100%
15	10/4/2016	10	32	18%	0%	18%	0%	7%	43%	13%	2%	100%
16	10/4/2016	10	29	10%	0%	31%	0%	8%	38%	13%	0%	100%
17	10/5/2016	10	24	22%	11%	24%	0%	5%	32%	5%	0%	100%
18	10/4/2016	10	29	14%	0%	23%	4%	4%	26%	28%	2%	100%
19	10/4/2016	10	29	9%	4%	15%	0%	11%	45%	15%	0%	100%
20	10/4/2016	Misc.	23	14%	5%	27%	14%	0%	0%	41%	0%	100%
21	10/4/2016	Misc.	25	43%	13%	26%	4%	0%	0%	13%	0%	100%
22	10/4/2016	Misc.	24	38%	4%	29%	0%	0%	0%	29%	0%	100%
23	10/4/2016	12	28	11%	0%	20%	26%	2%	24%	15%	2%	100%
24	10/5/2016	12	28	4%	0%	7%	39%	14%	37%	0%	0%	100%
25	10/5/2016	9	22	12%	7%	16%	0%	0%	37%	5%	23%	100%
26	10/5/2016		16	39%	0%	24%	18%	6%	12%	0%	0%	100%
27	10/5/2016		21	15%	0%	28%	10%	5%	15%	5%	23%	100%
28	10/5/2016	9	20	11%	5%	84%	0%	0%	0%	0%	0%	100%
29	10/4/2016	9	20	11%	5%	84%	0%	0%	0%	0%	0%	100%
30	10/4/2016		25	0%	5%	24%	0%	0%	52%	19%	0%	100%
31	10/5/2016	9	28	11%	7%	7%	0%	0%	75%	0%	0%	100%
32	10/5/2016	11	30	16%	0%	18%	11%	7%	45%	0%	4%	100%
33	10/5/2016	11		10%	0%	23%	7%	7%	38%	15%	0%	100%
34	10/4/2016	12	31	16%	4%	7%	32%	4%	27%	7%	4%	100%
35	10/4/2016	11	31	7%	0%	31%	33%	11%	17%	0%	0%	100%
36	10/4/2016	11	21	16%	0%	14%	38%	11%	19%	3%	0%	100%
37	10/4/2016	9	31	15%	13%	20%	0%	5%	35%	12%	0%	100%
38	10/4/2016	9	27	2%	18%	9%	0%	11%	33%	27%	0%	100%
39	10/6/2016	9	32	15%	0%	18%	0%	5%	38%	22%	2%	100%
40	10/5/2016	9		12%	4%	14%	0%	4%	47%	18%	0%	100%
41	10/6/2016	9		14%	0%	8%	0%	4%	40%	34%	0%	100%
42	10/4/2016	12	21	10%	0%	38%	10%	10%	33%	0%	0%	100%
43	10/5/2016	12	21	14%	0%	43%	14%	5%	24%	0%	0%	100%
44	10/6/2016	12	21	10%	0%	43%	10%	10%	29%	0%	0%	100%
45	10/4/2016	11	9	0%	0%	44%	0%	22%	33%	0%	0%	100%
46	10/5/2016	11	9	0%	0%	22%	11%	11%	56%	0%	0%	100%
47	10/6/2016	11	9	0%	0%	44%	33%	0%	22%	0%	0%	100%
48	10/4/2016	12	20	16%	5%	26%	5%	11%	37%	0%	0%	100%
49	10/5/2016	12	20	10%	10%	35%	10%	10%	25%	0%	0%	100%
50	10/6/2016	12	20	15%	15%	30%	10%	10%	20%	0%	0%	100%
51	10/4/2016	11	19	5%	5%	47%	5%	5%	32%	0%	0%	100%
52	10/5/2016	11	19	11%	5%	42%	11%	11%	21%	0%	0%	100%
53	10/6/2016	11	19	5%	0%	50%	10%	5%	30%	0%	0%	100%
				13.00%	**4.00%**	**30.00%**	**10.00%**	**6.00%**	**26.00%**	**10.00%**	**1.00%**	**100%**

Source : San Rafael School District, 2016; Parisi Transportation Consulting, 2016.

APPENDIX F-4

Student Trip Generation Estimates Increased Student Enrollment

Source		Vehicle-Trip Generation Rate		
		Morning	Afteroon	Evening
Project		0.88	0.60	0.33
ITE		0.43	0.29	0.13

Scenario	Total Students	Vehicle-Trip Generation		
		Morning	Afteroon	Evening
Existing	1,125	986	681	368
Project	200	175	121	65
Existing plus Project	1,325	1,162	802	433

Source		Inbound / Outbound Split					
		Morning Peak Hour		Afternoon Peak Hour		Evening Peak Hour	
		In	Out	In	Out	In	Out
ITE		0.68	0.32	0.33	0.67	0.47	0.53
Project- Driveway		0.27	0.13	0.13	0.27	0.18	0.22
Project-Neighborhood		0.32	0.28	0.28	0.32	0.29	0.31
Project Total		**0.60**	**0.40**	**0.42**	**0.58**	**0.47**	**0.53**

Scenario	Total Students	Inbound / Outbound Split - Total					
		Morning Peak Hour		Afternoon Peak Hour		Evening Peak Hour	
		In	Out	In	Out	In	Out
Existing Conditions	1,125	588	398	283	397	174	194
Project	200	105	71	50	71	31	35
Existing plus Project	1,325	693	469	334	468	204	229

Scenario / Location		Inbound / Outbound Split - By Location					
		Morning Peak Hour		Afternoon Peak Hour		Evening Peak Hour	
		In	Out	In	Out	In	Out
On-Site Trips							
Existing Conditions		269	126	91	181	68	80
Project		48	22	16	32	12	14
Existing plus Project		317	148	108	213	80	94
Off-Site Trips							
Existing Conditions		320	272	192	216	106	115
Project		57	48	34	38	19	20
Existing plus Project		376	321	226	255	125	135

APPENDIX F-5

Student Trip Generation Estimates
Stadium Project

SCHEDULE	SHARE OF SCHOOL DAYS PER ACADEMIC YEAR [1]	ACTIVITY	VEHICLE TRIP GENERATION - TIME OF DAY [2]																																			PEAK PERIOD TRIPS		
			1:30 PM	1:45 PM	2:00 PM	2:15 PM	2:30 PM	2:45 PM	3:00 PM	3:15 PM	3:30 PM	3:45 PM	4:00 PM	4:15 PM	4:30 PM	4:45 PM	5:00 PM	5:15 PM	5:30 PM	5:45 PM	6:00 PM	6:15 PM	6:30 PM	6:45 PM	7:00 PM	7:15 PM	7:30 PM	7:45 PM	8:00 PM	8:15 PM	8:30 PM	8:45 PM	9:00 PM	9:15 PM	9:30 PM	9:45 PM	10:00 PM	Existing	Proposed	Net Change
Traditional	<1%	Football Practices							32	32									24	24				198	198													24	24	0
		Lacrosse Practices							18	28									14	21				115	177													14	21	8
		Lacrosse Games																	80	110									30	47				290	439			80	110	30
		Track and Field Meets							133	133													48	48				469	469									0	0	0
Schedule A	6%	Football Practices	32	32									24	24				198	198																			222	222	0
		Lacrosse Practices	18	28									14	22				115	177																			128	199	71
		Lacrosse Games																	80	110									30	47				290	439			80	110	30
		Track and Field Meets							133	133													48	48				469	469									0	0	0
Schedule B	48%	Football Practices								32	32								24	24					198	198												24	24	0
		Lacrosse Practices								18	28								14	21					115	177												14	21	8
		Lacrosse Games																	80	110									30	47			290	439				80	110	30
		Track and Field Meets								133	133												48	48				469	469									0	0	0
Schedule A (a/t)	40%	Football Practices					32	32										24	24			198	198															24	24	0
		Lacrosse Practices					18	28										14	21			115	177															14	21	8
		Lacrosse Games																	80	110									30	47				290	439			80	110	30
		Track and Field Meets							133	133													48	48				469	469									0	0	0

Source: San Rafael City Schools, 2016; Parisi Transportation Consulting, 2016.

NOTES

[1] Share of school days based on the occurences of each schedule type during the 2016 – 2017 academic calendar.

[2] Vehicle Trip Generation estimates shown within the 30-minute window in which the may occur.

LEGEND

XX Existing **XX** Future

Last School Bell

Maximum Event Duration

Analysis Scenario

San Rafael High School EIR
Student Vehicle Trip Generation Estimates for Stadium Project

Parisi TRANSPORTATION CONSULTING

APPENDIX F-6

Intersection Level of Service Analysis

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	2	933	18	5	4	932	0	9	0	5	11	0
Future Volume (Veh/h)	2	933	18	5	4	932	0	9	0	5	11	0
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	1037	20	0	4	1036	0	10	0	6	12	0
Pedestrians		15				4						4
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		1				0						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		557										
pX, platoon unblocked				0.00	0.86			0.86	0.86	0.86	0.86	0.86
vC, conflicting volume	1040			0	1057			1699	2099	532	1580	2109
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1040			0	729			1480	1947	117	1341	1959
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			82	100	99	87	100
cM capacity (veh/h)	662			0	745			57	54	779	92	53

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	520	538	4	518	518	16	119
Volume Left	2	0	4	0	0	10	12
Volume Right	0	20	0	0	0	6	107
cSH	662	1700	745	1700	1700	87	338
Volume to Capacity	0.00	0.32	0.01	0.30	0.30	0.18	0.35
Queue Length 95th (ft)	0	0	0	0	0	16	39
Control Delay (s)	0.1	0.0	9.9	0.0	0.0	55.4	21.4
Lane LOS	A		A			F	C
Approach Delay (s)	0.0		0.0			55.4	21.4
Approach LOS						F	C

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	46.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: 3rd & SRHS Drive (W) 12/12/2016

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	96
Future Volume (Veh/h)	96
Sign Control	
Grade	
Peak Hour Factor	0.90
Hourly flow rate (vph)	107
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	537
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	537
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	78
cM capacity (veh/h)	481

Direction, Lane #

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	173	777	923	83	0	18
Future Volume (Veh/h)	3	173	777	923	83	0	18
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	206	925	1099	99	0	21
Pedestrians			10				
Lane Width (ft)			12.0				
Walking Speed (ft/s)			4.0				
Percent Blockage			1				
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			839				
pX, platoon unblocked	0.00					0.91	
vC, conflicting volume	0	1198				2023	609
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1198				1931	609
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	64				100	95
cM capacity (veh/h)	0	578				34	434

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	206	462	462	733	465	21
Volume Left	206	0	0	0	0	0
Volume Right	0	0	0	0	99	21
cSH	578	1700	1700	1700	1700	434
Volume to Capacity	0.36	0.27	0.27	0.43	0.27	0.05
Queue Length 95th (ft)	40	0	0	0	0	4
Control Delay (s)	14.6	0.0	0.0	0.0	0.0	13.7
Lane LOS	B					B
Approach Delay (s)	2.7			0.0		13.7
Approach LOS						B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	34	32	712	957	1	1	27
Future Volume (Veh/h)	34	32	712	957	1	1	27
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	35	782	1052	1	1	30
Pedestrians			9			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	1057				1518	540
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1057				1518	540
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	95				99	94
cM capacity (veh/h)	0	652				104	481

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	35	391	391	701	352	31
Volume Left	35	0	0	0	0	1
Volume Right	0	0	0	0	1	30
cSH	652	1700	1700	1700	1700	431
Volume to Capacity	0.05	0.23	0.23	0.41	0.21	0.07
Queue Length 95th (ft)	4	0	0	0	0	6
Control Delay (s)	10.8	0.0	0.0	0.0	0.0	14.0
Lane LOS	B					B
Approach Delay (s)	0.5			0.0		14.0
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	47.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina/Mission & Embarcadero/E Mission / Sea View
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	16	6	2	0	2	73	1	6	2	21	2	4
Future Volume (vph)	16	6	2	0	2	73	1	6	2	21	2	4
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	25	9	3	0	3	112	2	9	3	32	3	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	37	115	14	41
Volume Left (vph)	25	0	2	32
Volume Right (vph)	3	112	3	6
Hadj (s)	0.12	-0.55	-0.07	0.10
Departure Headway (s)	4.2	3.5	4.2	4.3
Degree Utilization, x	0.04	0.11	0.02	0.05
Capacity (veh/h)	828	1004	821	803
Control Delay (s)	7.4	7.0	7.2	7.5
Approach Delay (s)	7.4	7.0	7.2	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	21.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: HS Driveway Out/Belle W & Mission
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	164	49	0	0	99	11	18	2	5	4	4	0
Future Volume (Veh/h)	164	49	0	0	99	11	18	2	5	4	4	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Hourly flow rate (vph)	304	91	0	0	183	20	33	4	9	7	7	0
Pedestrians		1			8						16	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			1						1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	219			91			896	918	99	927	908	210
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	219			91			896	918	99	927	908	210
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	77			100			84	98	99	96	97	100
cM capacity (veh/h)	1332			1504			208	207	950	194	210	818

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	395	203	46	7
Volume Left	304	0	33	7
Volume Right	0	20	9	0
cSH	1332	1504	245	194
Volume to Capacity	0.23	0.00	0.19	0.04
Queue Length 95th (ft)	22	0	17	3
Control Delay (s)	7.0	0.0	23.1	24.2
Lane LOS	A		C	C
Approach Delay (s)	7.0	0.0	23.1	Err
Approach LOS			C	F

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
51: Mission & Belle Ave N

12/12/2016

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	53	100	0	0	10
Future Volume (Veh/h)	5	53	100	0	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	59	111	0	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	111				182	111
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	111				182	111
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1479				804	942

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	6	111	11
Volume Left	6	0	0
Volume Right	0	0	11
cSH	1479	1700	942
Volume to Capacity	0.00	0.07	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	7.4	0.0	8.9
Lane LOS	A		A
Approach Delay (s)	Err	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Mission & Alice

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	16	0	235	112	0	3	84
Future Volume (Veh/h)	16	0	235	112	0	3	84
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Hourly flow rate (vph)	0	0	427	204	0	5	153
Pedestrians			6			11	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			1	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	215				642	221
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	215				642	221
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				99	81
cM capacity (veh/h)	0	1343				434	807

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	427	204	158
Volume Left	0	0	5
Volume Right	0	0	153
cSH	1343	1700	786
Volume to Capacity	0.00	0.12	0.20
Queue Length 95th (ft)	0	0	19
Control Delay (s)	0.0	0.0	10.7
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.7
Approach LOS			B

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	34.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	18	273	213	10	0	52
Future Volume (Veh/h)	5	18	273	213	10	0	52
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	0	28	420	328	15	0	80
Pedestrians				14		32	
Lane Width (ft)				12.0		12.0	
Walking Speed (ft/s)				4.0		4.0	
Percent Blockage				1		3	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	375				858	368
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	375				858	368
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	98				100	88
cM capacity (veh/h)	0	1152				307	660

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	448	343	80
Volume Left	28	0	0
Volume Right	0	15	80
cSH	1152	1700	660
Volume to Capacity	0.02	0.20	0.12
Queue Length 95th (ft)	2	0	10
Control Delay (s)	0.8	0.0	11.2
Lane LOS	A		B
Approach Delay (s)	0.8	0.0	11.2
Approach LOS			B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	26	163	86	134	148	1	97	31	127	7	111	64
Future Volume (vph)	26	163	86	134	148	1	97	31	127	7	111	64
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	35	217	115	179	197	1	129	41	169	9	148	85

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	367	377	339	242
Volume Left (vph)	35	179	129	9
Volume Right (vph)	115	1	169	85
Hadj (s)	-0.13	0.13	-0.19	-0.17
Departure Headway (s)	7.1	7.3	7.2	7.6
Degree Utilization, x	0.72	0.76	0.68	0.51
Capacity (veh/h)	472	465	460	405
Control Delay (s)	26.3	30.0	24.0	18.1
Approach Delay (s)	26.3	30.0	24.0	18.1
Approach LOS	D	D	C	C

Intersection Summary			
Delay	25.3		
Level of Service	D		
Intersection Capacity Utilization	74.3%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	29	4	113	1	3	2	128	231	7	6	241	93
Future Volume (Veh/h)	29	4	113	1	3	2	128	231	7	6	241	93
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	35	5	136	1	4	2	154	278	8	7	290	112
Pedestrians		14			12			2			14	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			0			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								392				
pX, platoon unblocked												
vC, conflicting volume	982	980	362	1102	1032	308	416			298		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	982	980	362	1102	1032	308	416			298		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	82	98	80	99	98	100	86			99		
cM capacity (veh/h)	192	210	674	128	196	716	1130			1251		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	176	7	440	409
Volume Left	35	1	154	7
Volume Right	136	2	8	112
cSH	431	226	1130	1251
Volume to Capacity	0.41	0.03	0.14	0.01
Queue Length 95th (ft)	49	2	12	0
Control Delay (s)	19.0	21.5	4.0	0.2
Lane LOS	C	C	A	A
Approach Delay (s)	19.0	21.5	4.0	0.2
Approach LOS	C	C		

Intersection Summary			
Average Delay	5.1		
Intersection Capacity Utilization	64.2%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	187	726	18	18	800	223	63	19	29	165	30	145
Future Volume (vph)	187	726	18	18	800	223	63	19	29	165	30	145
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.85	1.00	0.97		1.00	0.92	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1427	3210	1144	1427	3136	975	2698	1367		1413	1195	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1427	3210	1144	1427	3136	975	2698	1367		1413	1195	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	201	781	19	19	860	240	68	20	31	177	32	156
RTOR Reduction (vph)	0	0	9	0	0	69	0	26	0	0	124	0
Lane Group Flow (vph)	201	781	10	19	860	171	68	25	0	177	64	0
Confl. Peds. (#/hr)			23			98	2		41	20		80
Confl. Bikes (#/hr)			5			7						5
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	19.9	57.1	57.1	2.6	39.8	39.8	16.1	16.1		20.6	20.6	
Effective Green, g (s)	21.4	59.1	59.1	4.1	41.8	41.8	17.6	17.6		22.1	22.1	
Actuated g/C Ratio	0.19	0.51	0.51	0.04	0.36	0.36	0.15	0.15		0.19	0.19	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	265	1651	588	50	1140	354	413	209		271	229	
v/s Ratio Prot	c0.14	0.24		0.01	c0.27		c0.03	0.02		c0.13	0.05	
v/s Ratio Perm			0.01			0.17						
v/c Ratio	0.76	0.47	0.02	0.38	0.75	0.48	0.16	0.12		0.65	0.28	
Uniform Delay, d1	44.3	17.9	13.7	54.2	32.0	28.2	42.3	42.0		42.9	39.6	
Progression Factor	1.00	1.00	1.00	1.01	1.01	1.02	1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.4	0.1	0.0	1.8	2.6	0.4	0.1	0.1		4.3	0.2	
Delay (s)	56.7	18.0	13.7	56.3	34.9	29.1	42.3	42.1		47.1	39.9	
Level of Service	E	B	B	E	C	C	D	D		D	D	
Approach Delay (s)		25.7			34.0			42.2			43.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	32.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	114.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	33	224	40	33	237	34	135	127	8	44	238	68
Future Volume (vph)	33	224	40	33	237	34	135	127	8	44	238	68
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	40	270	48	40	286	41	163	153	10	53	287	82

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	358	367	326	422
Volume Left (vph)	40	40	163	53
Volume Right (vph)	48	41	10	82
Hadj (s)	-0.02	-0.01	0.12	-0.06
Departure Headway (s)	8.9	8.9	9.2	8.8
Degree Utilization, x	0.88	0.90	0.83	1.03
Capacity (veh/h)	397	398	376	407
Control Delay (s)	50.7	53.8	43.9	82.0
Approach Delay (s)	50.7	53.8	43.9	82.0
Approach LOS	F	F	E	F

Intersection Summary			
Delay	59.0		
Level of Service	F		
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	258	751	76	345	318	0	0	146	90
Future Volume (vph)	0	0	0	258	751	76	345	318	0	0	146	90
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.95	0.95			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.90	1.00	1.00			1.00	0.86
Flpb, ped/bikes				0.98	1.00	1.00	0.99	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.98			1.00	1.00
Satd. Flow (prot)				1208	2543	1026	1240	1460			1365	958
Flt Permitted				0.95	1.00	1.00	0.57	0.76			1.00	1.00
Satd. Flow (perm)				1208	2543	1026	743	1125			1365	958
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	319	927	94	426	393	0	0	180	111
RTOR Reduction (vph)	0	0	0	0	0	54	0	0	0	0	0	61
Lane Group Flow (vph)	0	0	0	319	927	40	213	606	0	0	180	50
Confl. Peds. (#/hr)				14		121	17					118
Confl. Bikes (#/hr)						6						4
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					1		4	2			3	
Permitted Phases				1		1	2					3
Actuated Green, G (s)				30.8	30.8	30.8	36.0	36.0			20.8	20.8
Effective Green, g (s)				32.0	32.0	32.0	37.0	37.2			22.0	22.0
Actuated g/C Ratio				0.43	0.43	0.43	0.49	0.50			0.29	0.29
Clearance Time (s)				4.2	4.2	4.2	4.0	4.2			4.2	4.2
Lane Grp Cap (vph)				515	1085	437	446	612			400	281
v/s Ratio Prot					c0.36		0.08	c0.16			0.13	
v/s Ratio Perm				0.26		0.04	0.16	c0.33				0.05
v/c Ratio				0.62	0.85	0.09	0.48	0.99			0.45	0.18
Uniform Delay, d1				16.8	19.4	12.8	14.9	18.7			21.6	19.8
Progression Factor				1.00	1.00	1.00	0.78	0.88			0.93	1.13
Incremental Delay, d2				5.5	8.6	0.4	2.6	28.7			2.5	1.0
Delay (s)				22.3	28.0	13.2	14.3	45.1			22.5	23.2
Level of Service				C	C	B	B	D			C	C
Approach Delay (s)		0.0			25.6			37.1			22.8	
Approach LOS		A			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	29.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	108.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	146	737	313	0	0	0	0	506	288	13	391	0
Future Volume (vph)	146	737	313	0	0	0	0	506	288	13	391	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.89					0.98		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00		1.00	1.00	
Frt	1.00	1.00	0.85					0.95		1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)	1228	2455	1045					2351		1368	1161	
Flt Permitted	0.95	1.00	1.00					1.00		0.19	1.00	
Satd. Flow (perm)	1228	2455	1045					2351		276	1161	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	170	857	364	0	0	0	0	588	335	15	455	0
RTOR Reduction (vph)	0	0	148	0	0	0	0	34	0	0	0	0
Lane Group Flow (vph)	170	857	216	0	0	0	0	889	0	15	455	0
Confl. Peds. (#/hr)			88						70	20		
Confl. Bikes (#/hr)			3						5			
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	3%	3%	3%
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA		Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1							2		
Actuated Green, G (s)	34.5	34.5	34.5					31.5		31.5	31.5	
Effective Green, g (s)	36.0	36.0	36.0					33.0		33.0	33.0	
Actuated g/C Ratio	0.48	0.48	0.48					0.44		0.44	0.44	
Clearance Time (s)	4.5	4.5	4.5					4.5		4.5	4.5	
Lane Grp Cap (vph)	589	1178	501					1034		121	510	
v/s Ratio Prot	0.14	c0.35						0.38			c0.39	
v/s Ratio Perm			0.21							0.05		
v/c Ratio	0.29	0.73	0.43					0.86		0.12	0.89	
Uniform Delay, d1	11.8	15.6	12.8					18.9		12.4	19.4	
Progression Factor	0.78	0.89	0.50					1.00		0.91	0.95	
Incremental Delay, d2	0.7	2.3	1.6					9.3		1.8	17.9	
Delay (s)	9.9	16.3	7.9					28.2		13.0	36.3	
Level of Service	A	B	A					C		B	D	
Approach Delay (s)		13.3			0.0			28.2			35.5	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM 2000 Control Delay	22.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	108.7%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	418	218	0	0	141	268	63	1240	32	0	0	0
Future Volume (vph)	418	218	0	0	141	268	63	1240	32	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	2000	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.93			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1482			1482	1215		3100	1101			
Flt Permitted	0.58	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	832	1482			1482	1215		3100	1101			
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	486	253	0	0	164	312	73	1442	37	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	58	0	0	20	0	0	0
Lane Group Flow (vph)	486	253	0	0	164	254	0	1515	17	0	0	0
Confl. Peds. (#/hr)						14	9		27			
Confl. Bikes (#/hr)						1			1			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Parking (#/hr)								2	2			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	7	4			8	8	2	2				
Permitted Phases	4								2			
Actuated Green, G (s)	33.8	33.8			18.8	18.8		32.8	32.8			
Effective Green, g (s)	35.0	35.0			20.0	20.0		34.0	34.0			
Actuated g/C Ratio	0.47	0.47			0.27	0.27		0.45	0.45			
Clearance Time (s)	4.2	4.2			4.2	4.2		4.2	4.2			
Lane Grp Cap (vph)	472	691			395	324		1405	499			
v/s Ratio Prot	c0.16	0.17			0.11	0.21		c0.49				
v/s Ratio Perm	c0.32								0.02			
v/c Ratio	1.03	0.37			0.42	0.78		1.08	0.03			
Uniform Delay, d1	19.8	12.9			22.7	25.5		20.5	11.4			
Progression Factor	1.15	1.16			1.00	1.00		0.76	0.60			
Incremental Delay, d2	46.3	1.3			3.2	17.2		42.5	0.1			
Delay (s)	69.0	16.2			25.9	42.7		58.0	6.9			
Level of Service	E	B			C	D		E	A			
Approach Delay (s)		50.9			36.9			56.7			0.0	
Approach LOS		D			D			E			A	

Intersection Summary			
HCM 2000 Control Delay	51.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	159	64	0	0	98	56	109	1183	8	0	0	0
Future Volume (vph)	159	64	0	0	98	56	109	1183	8	0	0	0
Ideal Flow (vphpl)	1700	1700	1800	1800	1700	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	0.99	1.00			1.00			1.00				
Frt	1.00	1.00			0.95			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1260	1335			1258			2742				
Flt Permitted	0.59	1.00			1.00			1.00				
Satd. Flow (perm)	784	1335			1258			2742				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	177	71	0	0	109	62	121	1314	9	0	0	0
RTOR Reduction (vph)	0	0	0	0	27	0	0	0	0	0	0	0
Lane Group Flow (vph)	177	71	0	0	144	0	0	1444	0	0	0	0
Confl. Peds. (#/hr)	8					8	1		4			
Confl. Bikes (#/hr)						9			1			
Parking (#/hr)	2	2			2	2	2	2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		4			8		2	2				
Permitted Phases	4											
Actuated Green, G (s)	23.4	23.4			23.4			42.4				
Effective Green, g (s)	25.0	25.0			25.0			44.0				
Actuated g/C Ratio	0.33	0.33			0.33			0.59				
Clearance Time (s)	4.6	4.6			4.6			4.6				
Lane Grp Cap (vph)	261	445			419			1608				
v/s Ratio Prot		0.05			0.11			c0.53				
v/s Ratio Perm	c0.23											
v/c Ratio	0.68	0.16			0.34			0.90				
Uniform Delay, d1	21.5	17.6			18.8			13.5				
Progression Factor	0.79	0.67			1.17			0.21				
Incremental Delay, d2	10.8	0.6			2.2			3.1				
Delay (s)	27.8	12.3			24.2			5.9				
Level of Service	C	B			C			A				
Approach Delay (s)		23.4			24.2			5.9			0.0	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	118	146	0	0	287	49	78	1119	54	0	0	0
Future Volume (vph)	118	146	0	0	287	49	78	1119	54	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1365	1500			1302		1282	2494				
Flt Permitted	0.38	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	549	1500			1302		1282	2494				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	131	162	0	0	319	54	87	1243	60	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	5	0	0	0	0
Lane Group Flow (vph)	131	162	0	0	365	0	87	1298	0	0	0	0
Confl. Peds. (#/hr)	23					23			2			
Confl. Bikes (#/hr)						13			3			
Parking (#/hr)					2	2		2	2			
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		8			8			2				
Permitted Phases	8						2					
Actuated Green, G (s)	28.8	28.8			28.8		37.8	37.8				
Effective Green, g (s)	30.0	30.0			30.0		39.0	39.0				
Actuated g/C Ratio	0.40	0.40			0.40		0.52	0.52				
Clearance Time (s)	4.2	4.2			4.2		4.2	4.2				
Lane Grp Cap (vph)	219	600			520		666	1296				
v/s Ratio Prot		0.11			c0.28			c0.52				
v/s Ratio Perm	0.24						0.07					
v/c Ratio	0.60	0.27			0.70		0.13	1.00				
Uniform Delay, d1	17.7	15.1			18.8		9.3	18.0				
Progression Factor	0.65	0.61			1.03		0.70	0.53				
Incremental Delay, d2	9.9	0.9			6.8		0.0	7.9				
Delay (s)	21.4	10.2			26.1		6.5	17.5				
Level of Service	C	B			C		A	B				
Approach Delay (s)		15.2			26.1			16.8			0.0	
Approach LOS		B			C			B			A	

Intersection Summary			
HCM 2000 Control Delay	18.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	984	141	948	1191	0	0	0	0
Future Volume (vph)	0	0	0	0	984	141	948	1191	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1500	1500	1500	1500	1800	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.95	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3308	1009	990	3194				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3308	1009	990	3194				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	0	1158	166	1115	1401	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	24	10	10	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1158	142	581	1915	0	0	0	0
Confl. Peds. (#/hr)						42						
Confl. Bikes (#/hr)						6						
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					8		2	2				
Permitted Phases						8						
Actuated Green, G (s)					25.5	25.5	40.5	40.5				
Effective Green, g (s)					27.0	27.0	42.0	42.0				
Actuated g/C Ratio					0.36	0.36	0.56	0.56				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1190	363	554	1788				
v/s Ratio Prot					c0.35		0.59	c0.60				
v/s Ratio Perm						0.14						
v/c Ratio					0.97	0.39	1.05	1.07				
Uniform Delay, d1					23.6	17.9	16.5	16.5				
Progression Factor					0.73	0.60	0.84	0.82				
Incremental Delay, d2					14.8	1.9	42.8	39.2				
Delay (s)					32.1	12.6	56.7	52.6				
Level of Service					C	B	E	D				
Approach Delay (s)		0.0			29.7			53.6			0.0	
Approach LOS		A			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	45.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	103.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	729	786	0	0	0	0	0	1418	464	0	0	0
Future Volume (vph)	729	786	0	0	0	0	0	1418	464	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1600	1600	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.98			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1254	3775						3817	1083			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1254	3775						3817	1083			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	810	873	0	0	0	0	0	1576	516	0	0	0
RTOR Reduction (vph)	17	17	0	0	0	0	0	0	50	0	0	0
Lane Group Flow (vph)	412	1237	0	0	0	0	0	1576	466	0	0	0
Confl. Peds. (#/hr)									17			
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Perm	NA						NA	Perm			
Protected Phases		1						2				
Permitted Phases	1								2			
Actuated Green, G (s)	33.8	33.8						31.8	31.8			
Effective Green, g (s)	35.0	35.0						34.0	34.0			
Actuated g/C Ratio	0.47	0.47						0.45	0.45			
Clearance Time (s)	4.2	4.2						5.2	5.2			
Lane Grp Cap (vph)	585	1761						1730	490			
v/s Ratio Prot								0.41				
v/s Ratio Perm	c0.33	0.33							c0.43			
v/c Ratio	0.70	0.70						0.91	0.95			
Uniform Delay, d1	15.9	15.9						19.1	19.7			
Progression Factor	0.48	0.50						1.00	1.00			
Incremental Delay, d2	3.9	1.3						8.7	30.2			
Delay (s)	11.6	9.2						27.8	49.9			
Level of Service	B	A						C	D			
Approach Delay (s)		9.8			0.0			33.3			0.0	
Approach LOS		A			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	22.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	455	79	60	130	0	0	0	0	161	881	481
Future Volume (vph)	0	455	79	60	130	0	0	0	0	161	881	481
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.0
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.99	1.00
Satd. Flow (prot)		2735			1768						2965	1259
Flt Permitted		1.00			0.75						0.99	1.00
Satd. Flow (perm)		2735			1339						2965	1259
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	506	88	67	144	0	0	0	0	179	979	534
RTOR Reduction (vph)	0	19	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	575	0	0	211	0	0	0	0	0	1158	534
Confl. Peds. (#/hr)			24	16								11
Confl. Bikes (#/hr)			12									5
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		32.8			32.8						33.4	26.4
Effective Green, g (s)		34.0			34.0						35.0	28.0
Actuated g/C Ratio		0.45			0.45						0.47	0.37
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1239			607						1383	470
v/s Ratio Prot		c0.21									c0.39	
v/s Ratio Perm					0.16							c0.42
v/c Ratio		0.46			0.35						0.84	1.14
Uniform Delay, d1		14.2			13.3						17.5	23.5
Progression Factor		1.00			1.79						1.00	1.00
Incremental Delay, d2		1.3			1.2						6.2	84.5
Delay (s)		15.4			25.1						23.7	108.0
Level of Service		B			C						C	F
Approach Delay (s)		15.4			25.1			0.0			50.3	
Approach LOS		B			C			A			D	

Intersection Summary			
HCM 2000 Control Delay	39.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Hetherton & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	160	162	28	178	0	0	0	0	39	973	46
Future Volume (vph)	0	160	162	28	178	0	0	0	0	39	973	46
Ideal Flow (vphpl)	1800	1500	1800	1800	1500	1800	1800	1800	1800	1800	1600	1600
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.0
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.93			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1386			1490						3706	981
Flt Permitted		1.00			0.92						1.00	1.00
Satd. Flow (perm)		1386			1384						3706	981
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	193	195	34	214	0	0	0	0	47	1172	55
RTOR Reduction (vph)	0	16	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	372	0	0	248	0	0	0	0	0	1219	55
Confl. Peds. (#/hr)			3	3						80		32
Confl. Bikes (#/hr)			4									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		32.4			32.4						33.5	26.5
Effective Green, g (s)		34.0			34.0						35.0	28.0
Actuated g/C Ratio		0.45			0.45						0.47	0.37
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		628			627						1729	366
v/s Ratio Prot		c0.27									c0.33	
v/s Ratio Perm					0.18							0.06
v/c Ratio		0.59			0.40						0.71	0.15
Uniform Delay, d1		15.3			13.7						15.9	15.6
Progression Factor		1.00			1.18						0.36	0.42
Incremental Delay, d2		4.1			1.5						1.7	0.6
Delay (s)		19.4			17.6						7.4	7.1
Level of Service		B			B						A	A
Approach Delay (s)		19.4			17.6			0.0			7.4	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: Hetherton & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	268	130	148	295	0	0	0	0	108	871	165
Future Volume (vph)	0	268	130	148	295	0	0	0	0	108	871	165
Ideal Flow (vphpl)	1700	1700	1600	1600	1700	1700	1700	1700	1700	1700	1700	1600
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.0
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1550	1087	1464	1450						3920	1045
Flt Permitted		1.00	1.00	0.45	1.00						0.99	1.00
Satd. Flow (perm)		1550	1087	700	1450						3920	1045
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	335	162	185	369	0	0	0	0	135	1089	206
RTOR Reduction (vph)	0	0	42	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	335	121	185	369	0	0	0	0	0	1224	206
Confl. Peds. (#/hr)			15	15						5		
Confl. Bikes (#/hr)			7									2
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		32.8	32.8	32.8	32.8						33.8	26.8
Effective Green, g (s)		34.0	34.0	34.0	34.0						35.0	28.0
Actuated g/C Ratio		0.45	0.45	0.45	0.45						0.47	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		702	492	317	657						1829	390
v/s Ratio Prot		0.22			0.25							
v/s Ratio Perm			0.11	c0.26							0.31	0.20
v/c Ratio		0.48	0.25	0.58	0.56						0.67	0.53
Uniform Delay, d1		14.3	12.6	15.2	15.0						15.5	18.3
Progression Factor		1.00	1.00	0.89	0.89						0.36	0.46
Incremental Delay, d2		2.3	1.2	7.1	3.2						1.4	3.7
Delay (s)		16.6	13.8	20.7	16.5						7.0	12.1
Level of Service		B	B	C	B						A	B
Approach Delay (s)		15.7			17.9			0.0			7.8	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	457	1445	0	0	0	0	0	738	385
Future Volume (vph)	0	0	0	457	1445	0	0	0	0	0	738	385
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1800	1800	1800	1800	1800	1500	1500
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.90
Flpb, ped/bikes				0.96	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1018	3118						3426	956
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1018	3118						3426	956
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	564	1784	0	0	0	0	0	911	475
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	0	0	508	1840	0	0	0	0	0	911	466
Confl. Peds. (#/hr)				41								87
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type				Perm	NA						NA	Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)				39.0	39.0						27.0	27.0
Effective Green, g (s)				40.0	40.0						29.0	29.0
Actuated g/C Ratio				0.53	0.53						0.39	0.39
Clearance Time (s)				4.0	4.0						5.0	5.0
Lane Grp Cap (vph)				542	1662						1324	369
v/s Ratio Prot											0.27	
v/s Ratio Perm				0.50	0.59							c0.49
v/c Ratio				0.94	1.11						0.69	1.26
Uniform Delay, d1				16.3	17.5						19.2	23.0
Progression Factor				0.75	0.72						0.57	0.55
Incremental Delay, d2				9.6	50.9						2.3	134.3
Delay (s)				21.8	63.5						13.3	147.0
Level of Service				C	E						B	F
Approach Delay (s)		0.0			54.5			0.0			59.1	
Approach LOS		A			D			A			E	

Intersection Summary			
HCM 2000 Control Delay	56.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	120.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1238	1369	0	0	0	0	0	0	283	916	0
Future Volume (vph)	0	1238	1369	0	0	0	0	0	0	283	916	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		0.99	1.00							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.95	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4632	1047							1302	2835	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4632	1047							1302	2835	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1376	1521	0	0	0	0	0	0	314	1018	0
RTOR Reduction (vph)	0	14	14	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2123	746	0	0	0	0	0	0	314	1018	0
Confl. Peds. (#/hr)			7									
Confl. Bikes (#/hr)			4									
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type		NA	Prot							Split	NA	
Protected Phases		1	1							2	2	
Permitted Phases												
Actuated Green, G (s)		38.5	38.5							27.5	27.5	
Effective Green, g (s)		40.0	40.0							29.0	29.0	
Actuated g/C Ratio		0.53	0.53							0.39	0.39	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2470	558							503	1096	
v/s Ratio Prot		0.46	c0.71							0.24	c0.36	
v/s Ratio Perm												
v/c Ratio		1.15dr	1.34							0.62	0.93	
Uniform Delay, d1		15.1	17.5							18.6	22.0	
Progression Factor		1.00	1.00							0.68	0.68	
Incremental Delay, d2		4.2	163.1							3.4	9.7	
Delay (s)		19.3	180.6							16.1	24.6	
Level of Service		B	F							B	C	
Approach Delay (s)		61.6			0.0			0.0			22.6	
Approach LOS		E			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	49.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	158.2%	ICU Level of Service	H
Analysis Period (min)	15		
dr Defacto Right Lane. Recode with 1 though lane as a right lane.			
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	1	967	21	10	4	664	0	15	0	15	4	1
Future Volume (Veh/h)	1	967	21	10	4	664	0	15	0	15	4	1
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	997	22	0	4	685	0	15	0	15	4	1
Pedestrians						9						2
Lane Width (ft)						12.0						12.0
Walking Speed (ft/s)						4.0						4.0
Percent Blockage						1						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		538										
pX, platoon unblocked				0.00	0.83			0.83	0.83	0.83	0.83	0.83
vC, conflicting volume	687			0	1019			1415	1705	518	1220	1716
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	687			0	602			1081	1433	0	845	1446
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	100			88	100	98	98	99
cM capacity (veh/h)	901			0	802			129	109	889	205	107

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	500	520	4	342	342	30	59
Volume Left	1	0	4	0	0	15	4
Volume Right	0	22	0	0	0	15	54
cSH	901	1700	802	1700	1700	225	527
Volume to Capacity	0.00	0.31	0.00	0.20	0.20	0.13	0.11
Queue Length 95th (ft)	0	0	0	0	0	11	9
Control Delay (s)	0.0	0.0	9.5	0.0	0.0	23.5	12.7
Lane LOS	A		A			C	B
Approach Delay (s)	0.0		0.1			23.5	12.7
Approach LOS						C	B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	45.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	52
Future Volume (Veh/h)	52
Sign Control	
Grade	
Peak Hour Factor	0.97
Hourly flow rate (vph)	54
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	344
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	344
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	92
cM capacity (veh/h)	650

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS Drive (E)

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	34	44	886	664	1	0	17
Future Volume (Veh/h)	34	44	886	664	1	0	17
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	45	913	685	1	0	18
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			835				
pX, platoon unblocked	0.00					0.86	
vC, conflicting volume	0	686				1232	343
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	686				950	343
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	95				100	97
cM capacity (veh/h)	0	904				212	653

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	45	456	456	457	229	18
Volume Left	45	0	0	0	0	0
Volume Right	0	0	0	0	1	18
cSH	904	1700	1700	1700	1700	653
Volume to Capacity	0.05	0.27	0.27	0.27	0.13	0.03
Queue Length 95th (ft)	4	0	0	0	0	2
Control Delay (s)	9.2	0.0	0.0	0.0	0.0	10.7
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		10.7
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	37.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	37	844	639	6	3	19
Future Volume (Veh/h)	5	37	844	639	6	3	19
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	38	870	659	6	3	20
Pedestrians			3			2	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	667				1175	338
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	667				1175	338
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	96				98	97
cM capacity (veh/h)	0	917				177	656

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	38	435	435	439	226	23
Volume Left	38	0	0	0	0	3
Volume Right	0	0	0	0	6	20
cSH	917	1700	1700	1700	1700	484
Volume to Capacity	0.04	0.26	0.26	0.26	0.13	0.05
Queue Length 95th (ft)	3	0	0	0	0	4
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	12.8
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		12.8
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina/Mission & Embarcadero/E Mission / SeaView

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	6	6	3	0	3	27	0	9	1	34	12	2
Future Volume (vph)	6	6	3	0	3	27	0	9	1	34	12	2
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.47	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	7	7	4	0	4	57	0	11	1	40	14	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	18	61	12	56
Volume Left (vph)	7	0	0	40
Volume Right (vph)	4	57	1	2
Hadj (s)	-0.02	-0.53	-0.02	0.16
Departure Headway (s)	4.1	3.5	4.1	4.2
Degree Utilization, x	0.02	0.06	0.01	0.07
Capacity (veh/h)	859	992	849	833
Control Delay (s)	7.2	6.8	7.2	7.5
Approach Delay (s)	7.2	6.8	7.2	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.1		
Level of Service	A		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	72	0	0	75	6	24	1	9	3	0	2
Future Volume (Veh/h)	24	72	0	0	75	6	24	1	9	3	0	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	30	91	0	0	95	8	30	1	11	4	0	3
Pedestrians		1			3						12	
Lane Width (ft)		12.0			12.0						12.0	
Walking Speed (ft/s)		4.0			4.0						4.0	
Percent Blockage		0			0						1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	115			91			254	266	94	276	262	112
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	115			91			254	266	94	276	262	112
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			96	100	99	99	100	100
cM capacity (veh/h)	1459			1504			680	620	960	644	623	931

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	121	103	42	7
Volume Left	30	0	30	4
Volume Right	0	8	11	3
cSH	1459	1504	735	742
Volume to Capacity	0.02	0.00	0.06	0.01
Queue Length 95th (ft)	2	0	5	1
Control Delay (s)	2.0	0.0	10.2	9.9
Lane LOS	A		B	A
Approach Delay (s)	2.0	0.0	10.2	9.9
Approach LOS			B	A

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
51: Mission & Belle N

12/12/2016

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	79	75	0	0	6
Future Volume (Veh/h)	5	79	75	0	0	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	88	83	0	0	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	83				183	83
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	83				183	83
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1514				803	976

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	94	83	7
Volume Left	6	0	0
Volume Right	0	0	7
cSH	1514	1700	976
Volume to Capacity	0.00	0.05	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.5	0.0	8.7
Lane LOS	A		A
Approach Delay (s)	0.5	0.0	8.7
Approach LOS			A

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	18.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Mission & Alice

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	0	120	93	0	1	10
Future Volume (Veh/h)	3	0	120	93	0	1	10
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	126	98	0	1	11
Pedestrians			5			1	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	99				225	104
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	99				225	104
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	99
cM capacity (veh/h)	0	1493				763	946

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	126	98	12
Volume Left	0	0	1
Volume Right	0	0	11
cSH	1493	1700	927
Volume to Capacity	0.00	0.06	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	8.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	20.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	45	135	98	0	2	38
Future Volume (Veh/h)	3	45	135	98	0	2	38
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	48	145	105	0	2	41
Pedestrians			7			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	109				350	116
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	109				350	116
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	96
cM capacity (veh/h)	0	1476				624	928

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	193	105	43
Volume Left	48	0	2
Volume Right	0	0	41
cSH	1476	1700	907
Volume to Capacity	0.03	0.06	0.05
Queue Length 95th (ft)	3	0	4
Control Delay (s)	2.1	0.0	9.2
Lane LOS	A		A
Approach Delay (s)	2.1	0.0	9.2
Approach LOS			A

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	36	117	99	83	97	1	130	52	90	6	62	25
Future Volume (vph)	36	117	99	83	97	1	130	52	90	6	62	25
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	43	141	119	100	117	1	157	63	108	7	75	30

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	303	218	328	112
Volume Left (vph)	43	100	157	7
Volume Right (vph)	119	1	108	30
Hadj (s)	-0.17	0.12	-0.07	-0.11
Departure Headway (s)	5.4	5.8	5.5	5.9
Degree Utilization, x	0.46	0.35	0.50	0.18
Capacity (veh/h)	618	563	606	516
Control Delay (s)	12.8	12.0	14.0	10.2
Approach Delay (s)	12.8	12.0	14.0	10.2
Approach LOS	B	B	B	B

Intersection Summary			
Delay	12.7		
Level of Service	B		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Union & 4th/School 12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	28	2	200	2	1	2	86	257	1	0	192	44
Future Volume (Veh/h)	28	2	200	2	1	2	86	257	1	0	192	44
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	29	2	204	2	1	2	88	262	1	0	196	45
Pedestrians		15			8			12			15	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								392				
pX, platoon unblocked												
vC, conflicting volume	690	680	246	882	702	286	256			271		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	690	680	246	882	702	286	256			271		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	99	74	99	100	100	93			100		
cM capacity (veh/h)	326	341	776	180	331	739	1293			1284		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	235	5	351	241
Volume Left	29	2	88	0
Volume Right	204	2	1	45
cSH	657	297	1293	1284
Volume to Capacity	0.36	0.02	0.07	0.00
Queue Length 95th (ft)	41	1	5	0
Control Delay (s)	13.5	17.3	2.5	0.0
Lane LOS	B	C	A	
Approach Delay (s)	13.5	17.3	2.5	0.0
Approach LOS	B	C		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd 12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	197	666	110	80	532	137	243	76	65	235	63	93
Future Volume (vph)	197	666	110	80	532	137	243	76	65	235	63	93
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.92	1.00	0.98		1.00	0.97	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1441	3241	1155	1441	3167	1065	2698	1418		1441	1339	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1441	3241	1155	1441	3167	1065	2698	1418		1441	1339	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	212	716	118	86	572	147	261	82	70	253	68	100
RTOR Reduction (vph)	0	0	65	0	0	91	0	23	0	0	38	0
Lane Group Flow (vph)	212	716	53	86	572	56	261	129	0	253	130	0
Confl. Peds. (#/hr)	14		25	5		42	20		33	28		34
Confl. Bikes (#/hr)						11						5
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	22.9	37.1	37.1	9.7	23.9	23.9	24.0	24.0		25.5	25.5	
Effective Green, g (s)	24.4	39.1	39.1	11.2	25.9	25.9	25.5	25.5		27.0	27.0	
Actuated g/C Ratio	0.21	0.34	0.34	0.10	0.23	0.23	0.22	0.22		0.24	0.24	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	306	1103	393	140	714	240	599	314		338	314	
v/s Ratio Prot	c0.15	0.22		0.06	c0.18		c0.10	0.09		c0.18	0.10	
v/s Ratio Perm			0.05			0.05						
v/c Ratio	0.69	0.65	0.13	0.61	0.80	0.23	0.44	0.41		0.75	0.41	
Uniform Delay, d1	41.7	32.0	26.2	49.7	42.0	36.3	38.5	38.2		40.7	37.2	
Progression Factor	1.00	1.00	1.00	1.01	1.02	1.07	1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.1	1.0	0.1	5.5	6.1	0.2	0.2	0.3		7.7	0.3	
Delay (s)	48.9	33.0	26.2	55.7	49.1	39.2	38.6	38.6		48.5	37.5	
Level of Service	D	C	C	E	D	D	D	D		D	D	
Approach Delay (s)		35.5			48.0			38.6			44.1	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	114.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
11: Grand & Mission
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	52	224	53	25	240	74	145	160	25	46	234	69
Future Volume (vph)	52	224	53	25	240	74	145	160	25	46	234	69
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	58	249	59	28	267	82	161	178	28	51	260	77

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	366	377	367	388
Volume Left (vph)	58	28	161	51
Volume Right (vph)	59	82	28	77
Hadj (s)	-0.03	-0.08	0.08	-0.09
Departure Headway (s)	9.5	9.4	9.6	9.6
Degree Utilization, x	0.97	0.98	0.98	1.03
Capacity (veh/h)	366	377	367	388
Control Delay (s)	69.4	73.4	73.0	87.0
Approach Delay (s)	69.4	73.4	73.0	87.0
Approach LOS	F	F	F	F

Intersection Summary			
Delay	75.9		
Level of Service	F		
Intersection Capacity Utilization	74.9%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	81	700	271	388	438	0	0	270	129
Future Volume (vph)	0	0	0	81	700	271	388	438	0	0	270	129
Ideal Flow (vphpl)	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.95	0.95			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.95	1.00	1.00			1.00	0.94
Flpb, ped/bikes				0.97	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.99			1.00	1.00
Satd. Flow (prot)				1095	2350	997	1152	1360			1237	949
Flt Permitted				0.95	1.00	1.00	0.39	0.66			1.00	1.00
Satd. Flow (perm)				1095	2350	997	467	903			1237	949
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	0	101	875	339	485	548	0	0	338	161
RTOR Reduction (vph)	0	0	0	0	0	183	0	0	0	0	0	49
Lane Group Flow (vph)	0	0	0	101	875	156	315	718	0	0	338	112
Confl. Peds. (#/hr)				27		49	12					43
Confl. Bikes (#/hr)						5						4
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					1		4	2			3	
Permitted Phases				1		1	2					3
Actuated Green, G (s)				29.8	29.8	29.8	42.0	42.0			25.8	25.8
Effective Green, g (s)				31.0	31.0	31.0	43.0	43.2			27.0	27.0
Actuated g/C Ratio				0.39	0.39	0.39	0.54	0.54			0.34	0.34
Clearance Time (s)				4.2	4.2	4.2	4.0	4.2			4.2	4.2
Lane Grp Cap (vph)				424	910	386	362	563			417	320
v/s Ratio Prot					c0.37		0.14	c0.21			0.27	
v/s Ratio Perm				0.09		0.16	0.33	c0.48				0.12
v/c Ratio				0.24	0.96	0.41	0.87	1.28			0.81	0.35
Uniform Delay, d1				16.5	23.9	17.8	20.7	18.4			24.2	19.9
Progression Factor				1.00	1.00	1.00	0.58	0.55			0.85	0.84
Incremental Delay, d2				1.3	21.9	3.1	13.4	130.8			13.7	2.6
Delay (s)				17.9	45.8	20.9	25.3	140.9			34.3	19.3
Level of Service				B	D	C	C	F			C	B
Approach Delay (s)		0.0			37.2			105.7			29.4	
Approach LOS		A			D			F			C	

Intersection Summary			
HCM 2000 Control Delay	60.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	147.3%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	916	691	0	0	0	0	709	176	33	465	0
Future Volume (vph)	209	916	691	0	0	0	0	709	176	33	465	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.87					0.98		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00		1.00	1.00	
Frt	1.00	1.00	0.85					0.97		1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)	1252	2504	1039					2473		1381	1173	
Flt Permitted	0.95	1.00	1.00					1.00		0.13	1.00	
Satd. Flow (perm)	1252	2504	1039					2473		192	1173	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	249	1090	823	0	0	0	0	844	210	39	554	0
RTOR Reduction (vph)	0	0	99	0	0	0	0	17	0	0	0	0
Lane Group Flow (vph)	249	1090	724	0	0	0	0	1037	0	39	554	0
Confl. Peds. (#/hr)			113						105	30		
Confl. Bikes (#/hr)			5						1			
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA		Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1							2		
Actuated Green, G (s)	38.5	38.5	38.5					32.5		32.5	32.5	
Effective Green, g (s)	40.0	40.0	40.0					34.0		34.0	34.0	
Actuated g/C Ratio	0.50	0.50	0.50					0.42		0.42	0.42	
Clearance Time (s)	4.5	4.5	4.5					4.5		4.5	4.5	
Lane Grp Cap (vph)	626	1252	519					1051		81	498	
v/s Ratio Prot	0.20	0.44						0.42			c0.47	
v/s Ratio Perm			c0.70							0.20		
v/c Ratio	0.40	0.87	1.39					0.99		0.48	1.11	
Uniform Delay, d1	12.5	17.7	20.0					22.8		16.6	23.0	
Progression Factor	0.83	0.93	0.93					1.00		0.76	0.63	
Incremental Delay, d2	0.2	0.9	178.8					24.7		16.9	72.5	
Delay (s)	10.5	17.4	197.4					47.5		29.5	86.9	
Level of Service	B	B	F					D		C	F	
Approach Delay (s)		85.1			0.0			47.5			83.1	
Approach LOS		F			A			D			F	

Intersection Summary			
HCM 2000 Control Delay	74.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	147.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	426	267	0	0	157	308	80	1598	35	0	0	0
Future Volume (vph)	426	267	0	0	157	308	80	1598	35	0	0	0
Ideal Flow (vphpl)	1800	2000	1800	1800	2000	1800	1800	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.94			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1647			1647	1215		3345	1274			
Flt Permitted	0.54	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	765	1647			1647	1215		3345	1274			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	473	297	0	0	174	342	89	1776	39	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	57	0	0	20	0	0	0
Lane Group Flow (vph)	473	297	0	0	174	285	0	1865	20	0	0	0
Confl. Peds. (#/hr)							6		20			
Confl. Bikes (#/hr)						1			1			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	7	4			8	8	2	2				
Permitted Phases	4								2			
Actuated Green, G (s)	32.8	32.8			16.8	16.8		38.8	38.8			
Effective Green, g (s)	34.0	34.0			18.0	18.0		40.0	40.0			
Actuated g/C Ratio	0.42	0.42			0.22	0.22		0.50	0.50			
Clearance Time (s)	4.2	4.2			4.2	4.2		4.2	4.2			
Lane Grp Cap (vph)	421	699			370	273		1672	637			
v/s Ratio Prot	c0.18	0.18			0.11	0.23		c0.56				
v/s Ratio Perm	c0.29								0.02			
v/c Ratio	1.12	0.42			0.47	1.04		1.12	0.03			
Uniform Delay, d1	23.2	16.1			26.9	31.0		20.0	10.2			
Progression Factor	0.60	0.54			1.00	1.00		0.46	0.00			
Incremental Delay, d2	76.8	1.4			4.2	66.0		56.3	0.0			
Delay (s)	90.6	10.1			31.1	97.0		65.5	0.0			
Level of Service	F	B			C	F		E	A			
Approach Delay (s)		59.6			74.8			64.1			0.0	
Approach LOS		E			E			E			A	

Intersection Summary			
HCM 2000 Control Delay	64.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	109.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	213	100	0	0	114	113	84	1375	10	0	0	0
Future Volume (vph)	213	100	0	0	114	113	84	1375	10	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.91				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.93			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1167	1228			1139			3711				
Flt Permitted	0.52	1.00			1.00			1.00				
Satd. Flow (perm)	635	1228			1139			3711				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	242	114	0	0	130	128	95	1562	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	1	0	0	0	0
Lane Group Flow (vph)	242	114	0	0	249	0	0	1668	0	0	0	0
Confl. Peds. (#/hr)									7			
Confl. Bikes (#/hr)						2			4			
Parking (#/hr)	6	6			6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		4			8		2	2				
Permitted Phases	4											
Actuated Green, G (s)	32.4	32.4			32.4			38.4				
Effective Green, g (s)	34.0	34.0			34.0			40.0				
Actuated g/C Ratio	0.42	0.42			0.42			0.50				
Clearance Time (s)	4.6	4.6			4.6			4.6				
Lane Grp Cap (vph)	269	521			484			1855				
v/s Ratio Prot		0.09			0.22			c0.45				
v/s Ratio Perm	c0.38											
v/c Ratio	0.90	0.22			0.52			0.90				
Uniform Delay, d1	21.4	14.6			16.9			18.2				
Progression Factor	1.12	1.31			0.79			0.60				
Incremental Delay, d2	28.6	0.8			3.5			5.7				
Delay (s)	52.6	19.8			16.9			16.6				
Level of Service	D	B			B			B				
Approach Delay (s)		42.1			16.9			16.6			0.0	
Approach LOS		D			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis

16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	197	214	0	0	207	78	154	1191	52	0	0	0
Future Volume (vph)	197	214	0	0	207	78	154	1191	52	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1800	1600	1800	1800	1800
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.91				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1280	1412			1170		1205	4017				
Flt Permitted	0.41	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	557	1412			1170		1205	4017				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	219	238	0	0	230	87	171	1323	58	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	6	0	0	0	0
Lane Group Flow (vph)	219	238	0	0	300	0	171	1375	0	0	0	0
Confl. Peds. (#/hr)	28					28	2		2			
Confl. Bikes (#/hr)						8			3			
Parking (#/hr)					6	6						
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		8			8			2				
Permitted Phases	8						2					
Actuated Green, G (s)	27.8	27.8			27.8		43.8	43.8				
Effective Green, g (s)	29.0	29.0			29.0		45.0	45.0				
Actuated g/C Ratio	0.36	0.36			0.36		0.56	0.56				
Clearance Time (s)	4.2	4.2			4.2		4.2	4.2				
Lane Grp Cap (vph)	201	511			424		677	2259				
v/s Ratio Prot		0.17			0.26			c0.34				
v/s Ratio Perm	c0.39						0.14					
v/c Ratio	1.09	0.47			0.71		0.25	0.61				
Uniform Delay, d1	25.5	19.6			21.9		8.9	11.6				
Progression Factor	1.46	1.50			0.91		0.27	0.23				
Incremental Delay, d2	85.1	2.6			8.2		0.2	0.3				
Delay (s)	122.3	31.9			28.0		2.7	2.9				
Level of Service	F	C			C		A	A				
Approach Delay (s)		75.2			28.0			2.9			0.0	
Approach LOS		E			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1122	168	968	1335	0	0	0	0
Future Volume (vph)	0	0	0	0	1122	168	968	1335	0	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1500	1500	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.89	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3597	963	999	3452				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3597	963	999	3452				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	0	0	0	1305	195	1126	1552	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	13	9	9	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1305	182	723	1937	0	0	0	0
Confl. Peds. (#/hr)						96						
Confl. Bikes (#/hr)						17						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					8		2	2				
Permitted Phases						8						
Actuated Green, G (s)					29.5	29.5	41.5	41.5				
Effective Green, g (s)					31.0	31.0	43.0	43.0				
Actuated g/C Ratio					0.39	0.39	0.54	0.54				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1393	373	536	1855				
v/s Ratio Prot					c0.36		c0.72	0.56				
v/s Ratio Perm						0.19						
v/c Ratio					0.94	0.49	1.35	1.04				
Uniform Delay, d1					23.6	18.5	18.5	18.5				
Progression Factor					0.85	0.76	0.86	0.87				
Incremental Delay, d2					5.9	1.7	160.7	25.4				
Delay (s)					26.0	15.8	176.6	41.5				
Level of Service					C	B	F	D				
Approach Delay (s)		0.0			24.7			78.5			0.0	
Approach LOS		A			C			E			A	

Intersection Summary			
HCM 2000 Control Delay	59.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	111.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	890	1276	0	0	0	0	0	1436	641	0	0	0
Future Volume (vph)	890	1276	0	0	0	0	0	1436	641	0	0	0
Ideal Flow (vphpl)	1600	1600	1700	1700	1700	1700	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.97			
Flpb, ped/bikes	0.97	0.99						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1160	3586						3817	1075			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1160	3586						3817	1075			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	989	1418	0	0	0	0	0	1596	712	0	0	0
RTOR Reduction (vph)	15	15	0	0	0	0	0	0	12	0	0	0
Lane Group Flow (vph)	608	1769	0	0	0	0	0	1596	700	0	0	0
Confl. Peds. (#/hr)	43								28			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Perm	NA						NA	Perm			
Protected Phases		1						2				
Permitted Phases	1								2			
Actuated Green, G (s)	37.8	37.8						32.8	32.8			
Effective Green, g (s)	39.0	39.0						35.0	35.0			
Actuated g/C Ratio	0.49	0.49						0.44	0.44			
Clearance Time (s)	4.2	4.2						5.2	5.2			
Lane Grp Cap (vph)	565	1748						1669	470			
v/s Ratio Prot								0.42				
v/s Ratio Perm	c0.52	0.49							c0.65			
v/c Ratio	1.08	1.01						0.96	1.49			
Uniform Delay, d1	20.5	20.5						21.8	22.5			
Progression Factor	0.51	0.53						1.00	1.00			
Incremental Delay, d2	45.7	15.7						13.8	231.5			
Delay (s)	56.1	26.5						35.6	254.0			
Level of Service	E	C						D	F			
Approach Delay (s)		34.2			0.0			103.0			0.0	
Approach LOS		C			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	67.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	122.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	494	67	41	188	0	0	0	0	203	1043	535
Future Volume (vph)	0	494	67	41	188	0	0	0	0	203	1043	535
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.0
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2756			1782						2993	1265
Flt Permitted		1.00			0.84						0.99	1.00
Satd. Flow (perm)		2756			1509						2993	1265
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	549	74	46	209	0	0	0	0	226	1159	594
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	610	0	0	255	0	0	0	0	0	1385	594
Confl. Peds. (#/hr)			12	12						3		13
Confl. Bikes (#/hr)			6									1
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.8			30.8						40.4	33.4
Effective Green, g (s)		32.0			32.0						42.0	35.0
Actuated g/C Ratio		0.40			0.40						0.52	0.44
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1102			603						1571	553
v/s Ratio Prot		c0.22									c0.46	
v/s Ratio Perm					0.17							c0.47
v/c Ratio		0.55			0.42						0.88	1.07
Uniform Delay, d1		18.5			17.3						16.8	22.5
Progression Factor		1.00			0.30						1.00	1.00
Incremental Delay, d2		2.0			1.6						7.5	59.7
Delay (s)		20.5			6.7						24.3	82.2
Level of Service		C			A						C	F
Approach Delay (s)		20.5			6.7			0.0			41.7	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	33.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	83.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
20: Hetherton & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	288	171	56	185	0	0	0	0	32	983	80
Future Volume (vph)	0	288	171	56	185	0	0	0	0	32	983	80
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1699			1779						4170	1110
Flt Permitted		1.00			0.73						1.00	1.00
Satd. Flow (perm)		1699			1312						4170	1110
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	320	190	62	206	0	0	0	0	36	1092	89
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	490	0	0	268	0	0	0	0	0	1128	89
Confl. Peds. (#/hr)			2	2						73		27
Confl. Bikes (#/hr)			5									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		35.4			35.4						35.5	28.5
Effective Green, g (s)		37.0			37.0						37.0	29.5
Actuated g/C Ratio		0.46			0.46						0.46	0.37
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		785			606						1928	409
v/s Ratio Prot		c0.29									c0.27	
v/s Ratio Perm					0.20							0.08
v/c Ratio		0.62			0.44						0.59	0.22
Uniform Delay, d1		16.2			14.5						15.8	17.3
Progression Factor		1.00			0.95						0.37	0.47
Incremental Delay, d2		3.7			1.9						0.7	0.6
Delay (s)		20.0			15.7						6.5	8.8
Level of Service		B			B						A	A
Approach Delay (s)		20.0			15.7			0.0			6.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
21: Hetherton & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑	↱	↰	↑						↰↑↑	↱
Traffic Volume (vph)	0	325	147	84	230	0	0	0	0	122	912	206
Future Volume (vph)	0	325	147	84	230	0	0	0	0	122	912	206
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1218	1646	1535						4147	1172
Flt Permitted		1.00	1.00	0.42	1.00						0.99	1.00
Satd. Flow (perm)		1641	1218	734	1535						4147	1172
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	361	163	93	256	0	0	0	0	136	1013	229
RTOR Reduction (vph)	0	0	39	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	361	124	93	256	0	0	0	0	0	1149	229
Confl. Peds. (#/hr)			16	16						6		
Confl. Bikes (#/hr)			12									5
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		34.8	34.8	34.8	34.8						36.8	29.8
Effective Green, g (s)		36.0	36.0	36.0	36.0						38.0	30.8
Actuated g/C Ratio		0.45	0.45	0.45	0.45						0.48	0.39
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		738	548	330	690						1969	451
v/s Ratio Prot		c0.22			0.17							
v/s Ratio Perm			0.10	0.13							0.28	0.20
v/c Ratio		0.49	0.23	0.28	0.37						0.58	0.51
Uniform Delay, d1		15.5	13.5	13.9	14.5						15.3	18.8
Progression Factor		1.00	1.00	0.89	0.91						0.44	0.52
Incremental Delay, d2		2.3	1.0	1.8	1.3						1.1	3.4
Delay (s)		17.8	14.4	14.2	14.6						7.7	13.2
Level of Service		B	B	B	B						A	B
Approach Delay (s)		16.8			14.5			0.0			8.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↰↑↑						↑↑↑	↱
Traffic Volume (vph)	0	0	0	437	1628	0	0	0	0	0	657	473
Future Volume (vph)	0	0	0	437	1628	0	0	0	0	0	657	473
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1400	1800	1800	1800	1600	1600	1600
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.85
Flpb, ped/bikes				0.95	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1025	3184						3726	981
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1025	3184						3726	981
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	486	1809	0	0	0	0	0	730	526
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	10
Lane Group Flow (vph)	0	0	0	467	1828	0	0	0	0	0	730	516
Confl. Peds. (#/hr)				52								126
Confl. Bikes (#/hr)												2
Turn Type				Perm	NA						NA	Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)				45.0	45.0						26.0	26.0
Effective Green, g (s)				46.0	46.0						28.0	28.0
Actuated g/C Ratio				0.58	0.58						0.35	0.35
Clearance Time (s)				4.0	4.0						5.0	5.0
Lane Grp Cap (vph)				589	1830						1304	343
v/s Ratio Prot											0.20	
v/s Ratio Perm				0.46	0.57							c0.53
v/c Ratio				0.79	1.00						0.56	1.51
Uniform Delay, d1				13.3	17.0						21.0	26.0
Progression Factor				0.72	0.68						1.14	1.17
Incremental Delay, d2				1.0	6.1						1.5	240.1
Delay (s)				10.6	17.6						25.4	270.5
Level of Service				B	B						C	F
Approach Delay (s)		0.0			16.2			0.0			128.1	
Approach LOS		A			B			A			F	

Intersection Summary			
HCM 2000 Control Delay	55.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	128.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1815	1000	0	0	0	0	0	0	388	803	0
Future Volume (vph)	0	1815	1000	0	0	0	0	0	0	388	803	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		1.00	1.00							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.97	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4821	1057							1327	2891	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4821	1057							1327	2891	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2017	1111	0	0	0	0	0	0	431	892	0
RTOR Reduction (vph)	0	26	26	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2435	641	0	0	0	0	0	0	431	892	0
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)			8									
Turn Type		NA	Prot							Split	NA	
Protected Phases		1	1							2	2	
Permitted Phases												
Actuated Green, G (s)		40.5	40.5							30.5	30.5	
Effective Green, g (s)		42.0	42.0							32.0	32.0	
Actuated g/C Ratio		0.52	0.52							0.40	0.40	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2531	554							530	1156	
v/s Ratio Prot		0.51	c0.61							c0.32	0.31	
v/s Ratio Perm												
v/c Ratio		0.96	1.16							0.81	0.77	
Uniform Delay, d1		18.2	19.0							21.3	20.8	
Progression Factor		1.00	1.00							0.79	0.79	
Incremental Delay, d2		11.0	89.5							10.5	4.0	
Delay (s)		29.2	108.5							27.4	20.4	
Level of Service		C	F							C	C	
Approach Delay (s)		46.1			0.0			0.0			22.7	
Approach LOS		D			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	150.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	1	994	21	10	4	664	0	15	0	15	4	1
Future Volume (Veh/h)	1	994	21	10	4	664	0	15	0	15	4	1
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	1025	22	0	4	685	0	15	0	15	4	1
Pedestrians						9						2
Lane Width (ft)						12.0						12.0
Walking Speed (ft/s)						4.0						4.0
Percent Blockage						1						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		538										
pX, platoon unblocked				0.00	0.82			0.82	0.82	0.82	0.82	0.82
vC, conflicting volume	687			0	1047			1443	1733	532	1234	1744
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	687			0	613			1097	1451	0	841	1465
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			88	100	98	98	99
cM capacity (veh/h)	901			0	787			124	105	880	204	103

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	514	534	4	342	342	30	59
Volume Left	1	0	4	0	0	15	4
Volume Right	0	22	0	0	0	15	54
cSH	901	1700	787	1700	1700	218	525
Volume to Capacity	0.00	0.31	0.01	0.20	0.20	0.14	0.11
Queue Length 95th (ft)	0	0	0	0	0	12	9
Control Delay (s)	0.0	0.0	9.6	0.0	0.0	24.2	12.7
Lane LOS	A		A			C	B
Approach Delay (s)	0.0		0.1			24.2	12.7
Approach LOS						C	B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	46.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	52
Future Volume (Veh/h)	52
Sign Control	
Grade	
Peak Hour Factor	0.97
Hourly flow rate (vph)	54
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	344
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	344
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	92
cM capacity (veh/h)	650

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS Drive (E)

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	34	71	886	664	4	0	12
Future Volume (Veh/h)	34	71	886	664	4	0	12
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	73	913	685	4	0	12
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			835				
pX, platoon unblocked	0.00					0.86	
vC, conflicting volume	0	689				1290	344
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	689				1012	344
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	92				100	98
cM capacity (veh/h)	0	901				186	651

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	73	456	456	457	232	12
Volume Left	73	0	0	0	0	0
Volume Right	0	0	0	0	4	12
cSH	901	1700	1700	1700	1700	651
Volume to Capacity	0.08	0.27	0.27	0.27	0.14	0.02
Queue Length 95th (ft)	7	0	0	0	0	1
Control Delay (s)	9.3	0.0	0.0	0.0	0.0	10.6
Lane LOS	A					B
Approach Delay (s)	0.7			0.0		10.6
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

11/04/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	37	844	639	6	3	22
Future Volume (Veh/h)	5	37	844	639	6	3	22
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	38	870	659	6	3	23
Pedestrians			3			2	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	667				1175	338
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	667				1175	338
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	96				98	96
cM capacity (veh/h)	0	917				177	656

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	38	435	435	439	226	26
Volume Left	38	0	0	0	0	3
Volume Right	0	0	0	0	6	23
cSH	917	1700	1700	1700	1700	499
Volume to Capacity	0.04	0.26	0.26	0.26	0.13	0.05
Queue Length 95th (ft)	3	0	0	0	0	4
Control Delay (s)	9.1	0.0	0.0	0.0	0.0	12.6
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		12.6
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina/Mission & Embarcadero/E Mission / SeaView

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	6	6	3	0	6	27	0	9	1	34	12	2
Future Volume (vph)	6	6	3	0	6	27	0	9	1	34	12	2
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.47	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	7	7	4	0	7	57	0	11	1	40	14	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	18	64	12	56
Volume Left (vph)	7	0	0	40
Volume Right (vph)	4	57	1	2
Hadj (s)	-0.02	-0.50	-0.02	0.16
Departure Headway (s)	4.1	3.6	4.1	4.2
Degree Utilization, x	0.02	0.06	0.01	0.07
Capacity (veh/h)	859	985	847	832
Control Delay (s)	7.2	6.8	7.2	7.5
Approach Delay (s)	7.2	6.8	7.2	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.1		
Level of Service	A		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S

12/12/2016

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	24	72	0	1	0	75	6	24	1	9	3	2
Future Volume (Veh/h)	24	72	0	1	0	75	6	24	1	9	3	2
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.79	0.79	0.79	0.90	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	30	91	0	0	0	95	8	30	1	11	4	3
Pedestrians		1				3						12
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		0				0						1
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked				0.00								
vC, conflicting volume	115			0	91			252	266	94	276	262
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	115			0	91			252	266	94	276	262
tC, single (s)	4.1			0.0	4.1			7.1	6.5	6.2	7.1	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	98			0	100			96	100	99	99	100
cM capacity (veh/h)	1459			0	1504			682	620	960	644	623

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	121	103	42	7
Volume Left	30	0	30	4
Volume Right	0	8	11	0
cSH	1459	1504	736	635
Volume to Capacity	0.02	0.00	0.06	0.01
Queue Length 95th (ft)	2	0	5	1
Control Delay (s)	2.0	0.0	10.2	10.7
Lane LOS	A		B	B
Approach Delay (s)	2.0	0.0	10.2	10.7
Approach LOS			B	B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	0
Future Volume (Veh/h)	0
Sign Control	
Grade	
Peak Hour Factor	0.79
Hourly flow rate (vph)	0
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	112
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	112
tC, single (s)	6.2
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	100
cM capacity (veh/h)	931

Direction, Lane #

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	79	75	0	0	5
Future Volume (Veh/h)	5	79	75	0	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	88	83	0	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	83				183	83
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	83				183	83
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1514				803	976

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	94	83	6
Volume Left	6	0	0
Volume Right	0	0	6
cSH	1514	1700	976
Volume to Capacity	0.00	0.05	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.5	0.0	8.7
Lane LOS	A		A
Approach Delay (s)	0.5	0.0	8.7
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	18.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Mission & Alice

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	0	120	93	0	1	10
Future Volume (Veh/h)	3	0	120	93	0	1	10
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	126	98	0	1	11
Pedestrians			5			1	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	99				225	104
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	99				225	104
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	99
cM capacity (veh/h)	0	1493				763	946

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	126	98	12
Volume Left	0	0	1
Volume Right	0	0	11
cSH	1493	1700	927
Volume to Capacity	0.00	0.06	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	8.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	20.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Mission & Park

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	45	135	98	0	2	38
Future Volume (Veh/h)	3	45	135	98	0	2	38
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	48	145	105	0	2	41
Pedestrians			7			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	109				350	116
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	109				350	116
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	96
cM capacity (veh/h)	0	1476				624	928

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	193	105	43
Volume Left	48	0	2
Volume Right	0	0	41
cSH	1476	1700	907
Volume to Capacity	0.03	0.06	0.05
Queue Length 95th (ft)	3	0	4
Control Delay (s)	2.1	0.0	9.2
Lane LOS	A		A
Approach Delay (s)	2.1	0.0	9.2
Approach LOS			A

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	36	117	99	83	97	1	130	52	90	6	63	25
Future Volume (vph)	36	117	99	83	97	1	130	52	90	6	63	25
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	43	141	119	100	117	1	157	63	108	7	76	30

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	303	218	328	113
Volume Left (vph)	43	100	157	7
Volume Right (vph)	119	1	108	30
Hadj (s)	-0.17	0.12	-0.07	-0.11
Departure Headway (s)	5.4	5.8	5.5	5.9
Degree Utilization, x	0.46	0.35	0.50	0.19
Capacity (veh/h)	617	562	605	516
Control Delay (s)	12.9	12.0	14.0	10.2
Approach Delay (s)	12.9	12.0	14.0	10.2
Approach LOS	B	B	B	B

Intersection Summary			
Delay	12.7		
Level of Service	B		
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	28	2	202	2	1	2	86	257	1	0	198	44
Future Volume (Veh/h)	28	2	202	2	1	2	86	257	1	0	198	44
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	29	2	206	2	1	2	88	262	1	0	202	45
Pedestrians		15			8			12			15	
Lane Width (ft)		12.0			12.0			12.0			12.0	
Walking Speed (ft/s)		4.0			4.0			4.0			4.0	
Percent Blockage		1			1			1			1	
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)								392				
pX, platoon unblocked												
vC, conflicting volume	696	686	252	890	708	286	262			271		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	696	686	252	890	708	286	262			271		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	99	73	99	100	100	93			100		
cM capacity (veh/h)	323	338	770	176	328	739	1286			1284		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	237	5	351	247
Volume Left	29	2	88	0
Volume Right	206	2	1	45
cSH	652	293	1286	1284
Volume to Capacity	0.36	0.02	0.07	0.00
Queue Length 95th (ft)	41	1	6	0
Control Delay (s)	13.6	17.5	2.5	0.0
Lane LOS	B	C	A	
Approach Delay (s)	13.6	17.5	2.5	0.0
Approach LOS	B	C		

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	60.1%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	197	686	110	80	532	137	243	76	65	243	63	93
Future Volume (vph)	197	686	110	80	532	137	243	76	65	243	63	93
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.92	1.00	0.98		1.00	0.97	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1441	3241	1154	1441	3167	1065	2698	1417		1441	1339	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1441	3241	1154	1441	3167	1065	2698	1417		1441	1339	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	212	738	118	86	572	147	261	82	70	261	68	100
RTOR Reduction (vph)	0	0	64	0	0	91	0	23	0	0	38	0
Lane Group Flow (vph)	212	738	54	86	572	56	261	129	0	261	130	0
Confl. Peds. (#/hr)	14		25	5		42	20		33	28		34
Confl. Bikes (#/hr)						11						5
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	22.9	37.1	37.1	9.7	23.9	23.9	24.0	24.0		26.0	26.0	
Effective Green, g (s)	24.4	39.1	39.1	11.2	25.9	25.9	25.5	25.5		27.5	27.5	
Actuated g/C Ratio	0.21	0.34	0.34	0.10	0.22	0.22	0.22	0.22		0.24	0.24	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	304	1099	391	139	711	239	596	313		343	319	
v/s Ratio Prot	c0.15	0.23		0.06	c0.18		c0.10	0.09		c0.18	0.10	
v/s Ratio Perm			0.05			0.05						
v/c Ratio	0.70	0.67	0.14	0.62	0.80	0.24	0.44	0.41		0.76	0.41	
Uniform Delay, d1	42.0	32.6	26.4	50.0	42.3	36.6	38.7	38.5		40.8	37.0	
Progression Factor	1.00	1.00	1.00	1.01	1.02	1.07	1.00	1.00		1.00	1.00	
Incremental Delay, d2	7.3	1.3	0.1	5.7	6.2	0.2	0.2	0.3		8.7	0.3	
Delay (s)	49.4	33.9	26.5	56.1	49.5	39.5	38.9	38.8		49.5	37.3	
Level of Service	D	C	C	E	D	D	D	D		D	D	
Approach Delay (s)		36.1			48.4			38.9			44.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Unsignalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	52	229	53	25	240	74	145	160	25	46	235	69
Future Volume (vph)	52	229	53	25	240	74	145	160	25	46	235	69
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	58	254	59	28	267	82	161	178	28	51	261	77

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	371	377	367	389
Volume Left (vph)	58	28	161	51
Volume Right (vph)	59	82	28	77
Hadj (s)	-0.03	-0.08	0.08	-0.09
Departure Headway (s)	9.4	9.4	9.6	9.5
Degree Utilization, x	0.97	0.98	0.98	1.03
Capacity (veh/h)	371	377	367	389
Control Delay (s)	71.0	72.6	72.1	85.8
Approach Delay (s)	71.0	72.6	72.1	85.8
Approach LOS	F	F	F	F

Intersection Summary			
Delay	75.5		
Level of Service	F		
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	81	700	271	388	438	0	0	271	129
Future Volume (vph)	0	0	0	81	700	271	388	438	0	0	271	129
Ideal Flow (vphpl)	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.95	0.95			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.95	1.00	1.00			1.00	0.94
Flpb, ped/bikes				0.97	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.99			1.00	1.00
Satd. Flow (prot)				1095	2350	997	1152	1360			1237	949
Flt Permitted				0.95	1.00	1.00	0.38	0.66			1.00	1.00
Satd. Flow (perm)				1095	2350	997	466	901			1237	949
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	0	101	875	339	485	548	0	0	339	161
RTOR Reduction (vph)	0	0	0	0	0	183	0	0	0	0	0	49
Lane Group Flow (vph)	0	0	0	101	875	156	315	718	0	0	339	112
Confl. Peds. (#/hr)				27		49	12					43
Confl. Bikes (#/hr)						5						4
Turn Type				Perm	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases					1		4	2			3	
Permitted Phases				1		1	2					3
Actuated Green, G (s)				29.8	29.8	29.8	42.0	42.0			25.8	25.8
Effective Green, g (s)				31.0	31.0	31.0	43.0	43.2			27.0	27.0
Actuated g/C Ratio				0.39	0.39	0.39	0.54	0.54			0.34	0.34
Clearance Time (s)				4.2	4.2	4.2	4.0	4.2			4.2	4.2
Lane Grp Cap (vph)				424	910	386	361	562			417	320
v/s Ratio Prot					c0.37		0.14	c0.21			0.27	
v/s Ratio Perm				0.09		0.16	0.33	c0.48				0.12
v/c Ratio				0.24	0.96	0.41	0.87	1.28			0.81	0.35
Uniform Delay, d1				16.5	23.9	17.8	20.7	18.4			24.2	19.9
Progression Factor				1.00	1.00	1.00	0.57	0.55			0.85	0.84
Incremental Delay, d2				1.3	21.9	3.1	13.2	131.6			13.9	2.6
Delay (s)				17.9	45.8	20.9	25.0	141.6			34.5	19.4
Level of Service				B	D	C	C	F			C	B
Approach Delay (s)		0.0			37.2			106.1			29.6	
Approach LOS		A			D			F			C	

Intersection Summary			
HCM 2000 Control Delay	60.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	147.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	209	924	691	0	0	0	0	709	187	34	465	0
Future Volume (vph)	209	924	691	0	0	0	0	709	187	34	465	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.87					0.98		1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00		1.00	1.00	
Frt	1.00	1.00	0.85					0.97		1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00		0.95	1.00	
Satd. Flow (prot)	1252	2504	1039					2467		1381	1173	
Flt Permitted	0.95	1.00	1.00					1.00		0.13	1.00	
Satd. Flow (perm)	1252	2504	1039					2467		185	1173	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	249	1100	823	0	0	0	0	844	223	40	554	0
RTOR Reduction (vph)	0	0	99	0	0	0	0	17	0	0	0	0
Lane Group Flow (vph)	249	1100	724	0	0	0	0	1050	0	40	554	0
Confl. Peds. (#/hr)			113						105	30		
Confl. Bikes (#/hr)			5						1			
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA		Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1							2		
Actuated Green, G (s)	38.5	38.5	38.5					32.5		32.5	32.5	
Effective Green, g (s)	40.0	40.0	40.0					34.0		34.0	34.0	
Actuated g/C Ratio	0.50	0.50	0.50					0.42		0.42	0.42	
Clearance Time (s)	4.5	4.5	4.5					4.5		4.5	4.5	
Lane Grp Cap (vph)	626	1252	519					1048		78	498	
v/s Ratio Prot	0.20	0.44						0.43			c0.47	
v/s Ratio Perm			c0.70							0.22		
v/c Ratio	0.40	0.88	1.39					1.00		0.51	1.11	
Uniform Delay, d1	12.5	17.8	20.0					23.0		16.9	23.0	
Progression Factor	0.83	0.93	0.93					1.00		0.75	0.63	
Incremental Delay, d2	0.2	0.9	178.8					28.3		19.5	72.5	
Delay (s)	10.6	17.6	197.5					51.3		32.2	86.9	
Level of Service	B	B	F					D		C	F	
Approach Delay (s)		84.9			0.0			51.3			83.2	
Approach LOS		F			A			D			F	

Intersection Summary			
HCM 2000 Control Delay	75.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.26		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	147.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	426	272	0	0	157	308	80	1598	35	0	0	0
Future Volume (vph)	426	272	0	0	157	308	80	1598	35	0	0	0
Ideal Flow (vphpl)	1800	2000	1800	1800	2000	1800	1800	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0	3.0		3.0	3.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.94			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1647			1647	1215		3345	1274			
Flt Permitted	0.54	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	765	1647			1647	1215		3345	1274			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	473	302	0	0	174	342	89	1776	39	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	57	0	0	20	0	0	0
Lane Group Flow (vph)	473	302	0	0	174	285	0	1865	20	0	0	0
Confl. Peds. (#/hr)							6		20			
Confl. Bikes (#/hr)						1			1			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	7	4			8	8	2	2				
Permitted Phases	4								2			
Actuated Green, G (s)	32.8	32.8			16.8	16.8		38.8	38.8			
Effective Green, g (s)	34.0	34.0			18.0	18.0		40.0	40.0			
Actuated g/C Ratio	0.42	0.42			0.22	0.22		0.50	0.50			
Clearance Time (s)	4.2	4.2			4.2	4.2		4.2	4.2			
Lane Grp Cap (vph)	421	699			370	273		1672	637			
v/s Ratio Prot	c0.18	0.18			0.11	0.23		c0.56				
v/s Ratio Perm	c0.29								0.02			
v/c Ratio	1.12	0.43			0.47	1.04		1.12	0.03			
Uniform Delay, d1	23.2	16.2			26.9	31.0		20.0	10.2			
Progression Factor	0.60	0.54			1.00	1.00		0.46	0.00			
Incremental Delay, d2	76.7	1.5			4.2	66.0		56.3	0.0			
Delay (s)	90.7	10.2			31.1	97.0		65.5	0.0			
Level of Service	F	B			C	F		E	A			
Approach Delay (s)		59.3			74.8			64.1			0.0	
Approach LOS		E			E			E			A	

Intersection Summary			
HCM 2000 Control Delay	64.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	109.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	213	100	0	0	114	113	84	1375	10	0	0	0
Future Volume (vph)	213	100	0	0	114	113	84	1375	10	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.91				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.93			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1167	1228			1139			3711				
Flt Permitted	0.52	1.00			1.00			1.00				
Satd. Flow (perm)	635	1228			1139			3711				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	242	114	0	0	130	128	95	1562	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	1	0	0	0	0
Lane Group Flow (vph)	242	114	0	0	249	0	0	1668	0	0	0	0
Confl. Peds. (#/hr)									7			
Confl. Bikes (#/hr)						2			4			
Parking (#/hr)	6	6			6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		4			8		2	2				
Permitted Phases	4											
Actuated Green, G (s)	32.4	32.4			32.4			38.4				
Effective Green, g (s)	34.0	34.0			34.0			40.0				
Actuated g/C Ratio	0.42	0.42			0.42			0.50				
Clearance Time (s)	4.6	4.6			4.6			4.6				
Lane Grp Cap (vph)	269	521			484			1855				
v/s Ratio Prot		0.09			0.22			c0.45				
v/s Ratio Perm	c0.38											
v/c Ratio	0.90	0.22			0.52			0.90				
Uniform Delay, d1	21.4	14.6			16.9			18.2				
Progression Factor	1.12	1.31			0.79			0.60				
Incremental Delay, d2	28.6	0.8			3.5			5.7				
Delay (s)	52.6	19.8			16.9			16.6				
Level of Service	D	B			B			B				
Approach Delay (s)		42.1			16.9			16.6			0.0	
Approach LOS		D			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	197	216	0	0	207	78	154	1191	52	0	0	0
Future Volume (vph)	197	216	0	0	207	78	154	1191	52	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1800	1600	1800	1800	1800
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.91				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1280	1412			1170		1205	4017				
Flt Permitted	0.41	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	557	1412			1170		1205	4017				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	219	240	0	0	230	87	171	1323	58	0	0	0
RTOR Reduction (vph)	0	0	0	0	17	0	0	6	0	0	0	0
Lane Group Flow (vph)	219	240	0	0	300	0	171	1375	0	0	0	0
Confl. Peds. (#/hr)	28					28	2		2			
Confl. Bikes (#/hr)						8			3			
Parking (#/hr)					6	6						
Turn Type	Perm	NA			NA		Perm	NA				
Protected Phases		8			8			2				
Permitted Phases	8						2					
Actuated Green, G (s)	27.8	27.8			27.8		43.8	43.8				
Effective Green, g (s)	29.0	29.0			29.0		45.0	45.0				
Actuated g/C Ratio	0.36	0.36			0.36		0.56	0.56				
Clearance Time (s)	4.2	4.2			4.2		4.2	4.2				
Lane Grp Cap (vph)	201	511			424		677	2259				
v/s Ratio Prot		0.17			0.26			c0.34				
v/s Ratio Perm	c0.39						0.14					
v/c Ratio	1.09	0.47			0.71		0.25	0.61				
Uniform Delay, d1	25.5	19.6			21.9		8.9	11.6				
Progression Factor	1.46	1.50			0.91		0.27	0.23				
Incremental Delay, d2	85.1	2.7			8.2		0.2	0.3				
Delay (s)	122.2	32.0			28.0		2.7	2.9				
Level of Service	F	C			C		A	A				
Approach Delay (s)		75.0			28.0			2.9			0.0	
Approach LOS		E			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	20.6	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1122	168	968	1335	0	0	0	0
Future Volume (vph)	0	0	0	0	1122	168	968	1335	0	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1500	1500	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.89	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3597	963	999	3452				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3597	963	999	3452				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	0	0	0	1305	195	1126	1552	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	13	9	9	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1305	182	723	1937	0	0	0	0
Confl. Peds. (#/hr)						96						
Confl. Bikes (#/hr)						17						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					8		2	2				
Permitted Phases						8						
Actuated Green, G (s)					29.5	29.5	41.5	41.5				
Effective Green, g (s)					31.0	31.0	43.0	43.0				
Actuated g/C Ratio					0.39	0.39	0.54	0.54				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1393	373	536	1855				
v/s Ratio Prot					c0.36		c0.72	0.56				
v/s Ratio Perm						0.19						
v/c Ratio					0.94	0.49	1.35	1.04				
Uniform Delay, d1					23.6	18.5	18.5	18.5				
Progression Factor					0.85	0.76	0.86	0.87				
Incremental Delay, d2					5.9	1.7	160.7	25.4				
Delay (s)					26.0	15.8	176.6	41.5				
Level of Service					C	B	F	D				
Approach Delay (s)		0.0			24.7			78.4			0.0	
Approach LOS		A			C			E			A	

Intersection Summary			
HCM 2000 Control Delay	59.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	111.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	890	1279	0	0	0	0	0	1436	646	0	0	0
Future Volume (vph)	890	1279	0	0	0	0	0	1436	646	0	0	0
Ideal Flow (vphpl)	1600	1600	1700	1700	1700	1700	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.97			
Flpb, ped/bikes	0.97	0.99						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1160	3586						3817	1075			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1160	3586						3817	1075			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	989	1421	0	0	0	0	0	1596	718	0	0	0
RTOR Reduction (vph)	15	15	0	0	0	0	0	0	12	0	0	0
Lane Group Flow (vph)	608	1772	0	0	0	0	0	1596	706	0	0	0
Confl. Peds. (#/hr)	43								28			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Perm	NA						NA	Perm			
Protected Phases		1						2				
Permitted Phases	1								2			
Actuated Green, G (s)	37.8	37.8						32.8	32.8			
Effective Green, g (s)	39.0	39.0						35.0	35.0			
Actuated g/C Ratio	0.49	0.49						0.44	0.44			
Clearance Time (s)	4.2	4.2						5.2	5.2			
Lane Grp Cap (vph)	565	1748						1669	470			
v/s Ratio Prot								0.42				
v/s Ratio Perm	c0.52	0.49							c0.66			
v/c Ratio	1.08	1.01						0.96	1.50			
Uniform Delay, d1	20.5	20.5						21.8	22.5			
Progression Factor	0.51	0.53						1.00	1.00			
Incremental Delay, d2	45.7	16.2						13.8	237.1			
Delay (s)	56.1	27.0						35.6	259.6			
Level of Service	E	C						D	F			
Approach Delay (s)		34.5			0.0			105.1			0.0	
Approach LOS		C			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	69.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	122.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	494	67	41	188	0	0	0	0	208	1043	535
Future Volume (vph)	0	494	67	41	188	0	0	0	0	208	1043	535
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.0
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2756			1782						2993	1265
Flt Permitted		1.00			0.84						0.99	1.00
Satd. Flow (perm)		2756			1509						2993	1265
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	549	74	46	209	0	0	0	0	231	1159	594
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	610	0	0	255	0	0	0	0	0	1390	594
Confl. Peds. (#/hr)			12	12						3		13
Confl. Bikes (#/hr)			6									1
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.8			30.8						40.4	33.4
Effective Green, g (s)		32.0			32.0						42.0	35.0
Actuated g/C Ratio		0.40			0.40						0.52	0.44
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1102			603						1571	553
v/s Ratio Prot		c0.22									c0.46	
v/s Ratio Perm					0.17							c0.47
v/c Ratio		0.55			0.42						0.88	1.07
Uniform Delay, d1		18.5			17.3						16.9	22.5
Progression Factor		1.00			0.30						1.00	1.00
Incremental Delay, d2		2.0			1.6						7.7	59.7
Delay (s)		20.5			6.8						24.5	82.2
Level of Service		C			A						C	F
Approach Delay (s)		20.5			6.8			0.0			41.8	
Approach LOS		C			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	9.6
Intersection Capacity Utilization	83.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	288	171	56	185	0	0	0	0	32	983	80
Future Volume (vph)	0	288	171	56	185	0	0	0	0	32	983	80
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1699			1779						4170	1110
Flt Permitted		1.00			0.73						1.00	1.00
Satd. Flow (perm)		1699			1312						4170	1110
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	320	190	62	206	0	0	0	0	36	1092	89
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	490	0	0	268	0	0	0	0	0	1128	89
Confl. Peds. (#/hr)			2	2						73		27
Confl. Bikes (#/hr)			5									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		35.4			35.4						35.5	28.5
Effective Green, g (s)		37.0			37.0						37.0	29.5
Actuated g/C Ratio		0.46			0.46						0.46	0.37
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		785			606						1928	409
v/s Ratio Prot		c0.29									c0.27	
v/s Ratio Perm					0.20							0.08
v/c Ratio		0.62			0.44						0.59	0.22
Uniform Delay, d1		16.2			14.5						15.8	17.3
Progression Factor		1.00			0.95						0.37	0.47
Incremental Delay, d2		3.7			1.9						0.7	0.6
Delay (s)		20.0			15.7						6.5	8.8
Level of Service		B			B						A	A
Approach Delay (s)		20.0			15.7			0.0			6.7	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	327	147	84	230	0	0	0	0	122	912	206
Future Volume (vph)	0	327	147	84	230	0	0	0	0	122	912	206
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.0	3.0	3.0	3.0						3.0	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1218	1646	1535						4147	1172
Flt Permitted		1.00	1.00	0.42	1.00						0.99	1.00
Satd. Flow (perm)		1641	1218	731	1535						4147	1172
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	363	163	93	256	0	0	0	0	136	1013	229
RTOR Reduction (vph)	0	0	39	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	363	124	93	256	0	0	0	0	0	1149	229
Confl. Peds. (#/hr)			16	16						6		
Confl. Bikes (#/hr)			12									5
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		34.8	34.8	34.8	34.8						36.8	29.8
Effective Green, g (s)		36.0	36.0	36.0	36.0						38.0	30.8
Actuated g/C Ratio		0.45	0.45	0.45	0.45						0.48	0.39
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		738	548	328	690						1969	451
v/s Ratio Prot		c0.22			0.17							
v/s Ratio Perm			0.10	0.13							0.28	0.20
v/c Ratio		0.49	0.23	0.28	0.37						0.58	0.51
Uniform Delay, d1		15.5	13.5	13.9	14.5						15.3	18.8
Progression Factor		1.00	1.00	0.89	0.91						0.44	0.52
Incremental Delay, d2		2.3	1.0	1.9	1.3						1.1	3.4
Delay (s)		17.9	14.4	14.2	14.6						7.7	13.2
Level of Service		B	B	B	B						A	B
Approach Delay (s)		16.8			14.5			0.0			8.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	11.2
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	437	1628	0	0	0	0	0	657	473
Future Volume (vph)	0	0	0	437	1628	0	0	0	0	0	657	473
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1400	1800	1800	1800	1600	1600	1600
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.85
Flpb, ped/bikes				0.95	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1025	3184						3726	981
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1025	3184						3726	981
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	486	1809	0	0	0	0	0	730	526
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	10
Lane Group Flow (vph)	0	0	0	467	1828	0	0	0	0	0	730	516
Confl. Peds. (#/hr)				52								126
Confl. Bikes (#/hr)												2
Turn Type				Perm	NA						NA	Perm
Protected Phases					8						6	
Permitted Phases				8								6
Actuated Green, G (s)				45.0	45.0						26.0	26.0
Effective Green, g (s)				46.0	46.0						28.0	28.0
Actuated g/C Ratio				0.58	0.58						0.35	0.35
Clearance Time (s)				4.0	4.0						5.0	5.0
Lane Grp Cap (vph)				589	1830						1304	343
v/s Ratio Prot											0.20	
v/s Ratio Perm				0.46	0.57							c0.53
v/c Ratio				0.79	1.00						0.56	1.51
Uniform Delay, d1				13.3	17.0						21.0	26.0
Progression Factor				0.72	0.68						1.14	1.17
Incremental Delay, d2				1.0	6.1						1.5	240.1
Delay (s)				10.6	17.6						25.4	270.5
Level of Service				B	B						C	F
Approach Delay (s)		0.0			16.2			0.0			128.1	
Approach LOS		A			B			A			F	

Intersection Summary			
HCM 2000 Control Delay	55.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	128.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 2nd & Hetherton

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1818	1000	0	0	0	0	0	0	388	803	0
Future Volume (vph)	0	1818	1000	0	0	0	0	0	0	388	803	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		1.00	1.00							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.97	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4821	1057							1327	2891	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4821	1057							1327	2891	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2020	1111	0	0	0	0	0	0	431	892	0
RTOR Reduction (vph)	0	26	26	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2438	641	0	0	0	0	0	0	431	892	0
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)			8									
Turn Type		NA	Prot							Split	NA	
Protected Phases		1	1							2	2	
Permitted Phases												
Actuated Green, G (s)		40.5	40.5							30.5	30.5	
Effective Green, g (s)		42.0	42.0							32.0	32.0	
Actuated g/C Ratio		0.52	0.52							0.40	0.40	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2531	554							530	1156	
v/s Ratio Prot		0.51	c0.61							c0.32	0.31	
v/s Ratio Perm												
v/c Ratio		0.96	1.16							0.81	0.77	
Uniform Delay, d1		18.3	19.0							21.3	20.8	
Progression Factor		1.00	1.00							0.79	0.79	
Incremental Delay, d2		11.1	89.5							10.5	4.0	
Delay (s)		29.4	108.5							27.4	20.5	
Level of Service		C	F							C	C	
Approach Delay (s)		46.2			0.0			0.0			22.7	
Approach LOS		D			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	150.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	886	661	0	0	5
Future Volume (Veh/h)	0	886	661	0	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	984	734	0	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1265				
pX, platoon unblocked					0.89	
vC, conflicting volume	734				1226	367
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	734				1015	367
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	867				210	630

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	492	492	367	367	6
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	6
cSH	1700	1700	1700	1700	630
Volume to Capacity	0.29	0.29	0.22	0.22	0.01
Queue Length 95th (ft)	0	0	0	0	1
Control Delay (s)	0.0	0.0	0.0	0.0	10.8
Lane LOS					B
Approach Delay (s)	0.0		0.0		10.8
Approach LOS					B

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	29.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: 3rd & SRHS Dr. (W) 12/12/2016

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	2	966	18	5	4	965	0	9	0	5	11	0
Future Volume (Veh/h)	2	966	18	5	4	965	0	9	0	5	11	0
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	1073	20	0	4	1072	0	10	0	6	12	0
Pedestrians		15				4						4
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		1				0						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		550										
pX, platoon unblocked				0.00	0.85			0.85	0.85	0.85	0.85	0.85
vC, conflicting volume	1076			0	1093			1753	2171	550	1634	2181
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1076			0	760			1535	2026	122	1396	2038
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			80	100	99	86	100
cM capacity (veh/h)	642			0	722			51	48	768	84	47

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	538	556	4	536	536	16	119
Volume Left	2	0	4	0	0	10	12
Volume Right	0	20	0	0	0	6	107
cSH	642	1700	722	1700	1700	78	320
Volume to Capacity	0.00	0.33	0.01	0.32	0.32	0.20	0.37
Queue Length 95th (ft)	0	0	0	0	0	18	42
Control Delay (s)	0.1	0.0	10.0	0.0	0.0	62.3	22.8
Lane LOS	A		B			F	C
Approach Delay (s)	0.0		0.0			62.3	22.8
Approach LOS						F	C

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: 3rd & SRHS Dr. (W) 12/12/2016

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	96
Future Volume (Veh/h)	96
Sign Control	
Grade	
Peak Hour Factor	0.90
Hourly flow rate (vph)	107
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	555
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	555
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	77
cM capacity (veh/h)	468

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS Dr. (E)

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑↑	↑↱		Y	
Traffic Volume (veh/h)	3	179	804	955	86	0	18
Future Volume (Veh/h)	3	179	804	955	86	0	18
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	213	957	1137	102	0	21
Pedestrians			10				
Lane Width (ft)			12.0				
Walking Speed (ft/s)			4.0				
Percent Blockage			1				
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			899				
pX, platoon unblocked	0.00					0.92	
vC, conflicting volume	0	1239				2092	630
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1239				2016	630
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	62				100	95
cM capacity (veh/h)	0	558				29	421

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	213	478	478	758	481	21
Volume Left	213	0	0	0	0	0
Volume Right	0	0	0	0	102	21
cSH	558	1700	1700	1700	1700	421
Volume to Capacity	0.38	0.28	0.28	0.45	0.28	0.05
Queue Length 95th (ft)	44	0	0	0	0	4
Control Delay (s)	15.4	0.0	0.0	0.0	0.0	14.0
Lane LOS	C					B
Approach Delay (s)	2.8			0.0		14.0
Approach LOS						B

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↑↑	↑↱		Y	
Traffic Volume (veh/h)	35	33	737	990	1	1	28
Future Volume (Veh/h)	35	33	737	990	1	1	28
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	36	810	1088	1	1	31
Pedestrians			9			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	1093				1570	558
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1093				1570	558
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	94				99	93
cM capacity (veh/h)	0	632				95	468

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	36	405	405	725	364	32
Volume Left	36	0	0	0	0	1
Volume Right	0	0	0	0	1	31
cSH	632	1700	1700	1700	1700	417
Volume to Capacity	0.06	0.24	0.24	0.43	0.21	0.08
Queue Length 95th (ft)	5	0	0	0	0	6
Control Delay (s)	11.0	0.0	0.0	0.0	0.0	14.3
Lane LOS	B					B
Approach Delay (s)	0.5			0.0		14.3
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	48.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	17	6	2	0	2	75	1	6	2	22	2	4
Future Volume (vph)	17	6	2	0	2	75	1	6	2	22	2	4
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	26	9	3	0	3	115	2	9	3	34	3	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	38	118	14	43
Volume Left (vph)	26	0	2	34
Volume Right (vph)	3	115	3	6
Hadj (s)	0.12	-0.55	-0.07	0.11
Departure Headway (s)	4.3	3.5	4.2	4.3
Degree Utilization, x	0.04	0.12	0.02	0.05
Capacity (veh/h)	826	1002	819	800
Control Delay (s)	7.5	7.0	7.3	7.6
Approach Delay (s)	7.5	7.0	7.3	7.6
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (veh/h)	5	170	51	0	2	0	102	11	18	2	5	4
Future Volume (Veh/h)	5	170	51	0	2	0	102	11	18	2	5	4
Sign Control			Free				Free			Stop		
Grade			0%				0%			0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	189	57	0	0	0	113	12	20	2	6	4
Pedestrians							2					
Lane Width (ft)							12.0					
Walking Speed (ft/s)							4.0					
Percent Blockage							0					
Right turn flare (veh)												
Median type			None				None					
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked	0.00				0.00							
vC, conflicting volume	0	125			0	57			556	560	59	563
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	125			0	57			556	560	59	563
tC, single (s)	0.0	4.1			0.0	4.1			7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	0.0	2.2			0.0	2.2			3.5	4.0	3.3	3.5
p0 queue free %	0	87			0	100			95	99	99	99
cM capacity (veh/h)	0	1462			0	1547			395	381	1005	389

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	246	125	28	8
Volume Left	189	0	20	4
Volume Right	0	12	6	0
cSH	1462	1547	452	386
Volume to Capacity	0.13	0.00	0.06	0.02
Queue Length 95th (ft)	11	0	5	2
Control Delay (s)	6.3	0.0	13.5	14.5
Lane LOS	A		B	B
Approach Delay (s)	6.3	0.0	13.5	14.5
Approach LOS			B	B

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (veh/h)	4	0
Future Volume (Veh/h)	4	0
Sign Control	Stop	
Grade	0%	
Peak Hour Factor	0.90	0.90
Hourly flow rate (vph)	4	0
Pedestrians		
Lane Width (ft)		
Walking Speed (ft/s)		
Percent Blockage		
Right turn flare (veh)		
Median type		
Median storage veh)		
Upstream signal (ft)		
pX, platoon unblocked		
vC, conflicting volume	554	119
vC1, stage 1 conf vol		
vC2, stage 2 conf vol		
vCu, unblocked vol	554	119
tC, single (s)	6.5	6.2
tC, 2 stage (s)		
tF (s)	4.0	3.3
p0 queue free %	99	100
cM capacity (veh/h)	384	933

Direction, Lane #

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	55	103	0	0	10
Future Volume (Veh/h)	5	55	103	0	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	61	114	0	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	114				187	114
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	114				187	114
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1475				799	939

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	67	114	11
Volume Left	6	0	0
Volume Right	0	0	11
cSH	1475	1700	939
Volume to Capacity	0.00	0.07	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.7	0.0	8.9
Lane LOS	A		A
Approach Delay (s)	0.7	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	17.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	17	0	243	116	0	3	87
Future Volume (Veh/h)	17	0	243	116	0	3	87
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Hourly flow rate (vph)	0	0	442	211	0	5	158
Pedestrians			6			11	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			1	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	222				664	228
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	222				664	228
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				99	80
cM capacity (veh/h)	0	1335				422	800

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	442	211	163
Volume Left	0	0	5
Volume Right	0	0	158
cSH	1335	1700	778
Volume to Capacity	0.00	0.12	0.21
Queue Length 95th (ft)	0	0	20
Control Delay (s)	0.0	0.0	10.8
Lane LOS			B
Approach Delay (s)	0.0	0.0	10.8
Approach LOS			B

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	35.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	19	283	220	10	0	54
Future Volume (Veh/h)	5	19	283	220	10	0	54
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	0	29	435	338	15	0	83
Pedestrians				14		32	
Lane Width (ft)				12.0		12.0	
Walking Speed (ft/s)				4.0		4.0	
Percent Blockage				1		3	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	385				884	378
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	385				884	378
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	87
cM capacity (veh/h)	0	1142				296	651

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	464	353	83
Volume Left	29	0	0
Volume Right	0	15	83
cSH	1142	1700	651
Volume to Capacity	0.03	0.21	0.13
Queue Length 95th (ft)	2	0	11
Control Delay (s)	0.8	0.0	11.3
Lane LOS	A		B
Approach Delay (s)	0.8	0.0	11.3
Approach LOS			B

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	27	169	89	139	153	1	100	32	131	7	115	66
Future Volume (vph)	27	169	89	139	153	1	100	32	131	7	115	66
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	36	225	119	185	204	1	133	43	175	9	153	88

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	380	390	351	250
Volume Left (vph)	36	185	133	9
Volume Right (vph)	119	1	175	88
Hadj (s)	-0.13	0.13	-0.19	-0.17
Departure Headway (s)	7.5	7.6	7.6	8.0
Degree Utilization, x	0.79	0.83	0.74	0.55
Capacity (veh/h)	458	449	444	385
Control Delay (s)	32.7	37.9	29.1	20.5
Approach Delay (s)	32.7	37.9	29.1	20.5
Approach LOS	D	E	D	C

Intersection Summary			
Delay	31.0		
Level of Service	D		
Intersection Capacity Utilization	75.8%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	4	117	1	3	2	132	239	7	6	249	96
Future Volume (vph)	30	4	117	1	3	2	132	239	7	6	249	96
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.99			0.99		1.00	1.00			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.96		1.00	1.00			0.96	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1541			1666		1675	1758			1686	
Flt Permitted		0.94			0.97		0.54	1.00			1.00	
Satd. Flow (perm)		1463			1635		954	1758			1681	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	36	5	141	1	4	2	159	288	8	7	300	116
RTOR Reduction (vph)	0	117	0	0	2	0	0	1	0	0	15	0
Lane Group Flow (vph)	0	65	0	0	5	0	159	295	0	0	408	0
Confl. Peds. (#/hr)	14		2			12	2			12		14
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.5			7.5		34.5	34.5			34.5	
Effective Green, g (s)		8.5			8.5		35.5	35.5			35.5	
Actuated g/C Ratio		0.17			0.17		0.71	0.71			0.71	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		248			277		677	1248			1193	
v/s Ratio Prot								0.17				
v/s Ratio Perm		c0.04			0.00		0.17				c0.24	
v/c Ratio		0.26			0.02		0.23	0.24			0.34	
Uniform Delay, d1		18.0			17.3		2.5	2.5			2.8	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.6			0.0		0.8	0.4			0.8	
Delay (s)		18.6			17.3		3.3	3.0			3.6	
Level of Service		B			B		A	A			A	
Approach Delay (s)		18.6			17.3			3.1			3.6	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	58.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

10: Union & 3rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	194	751	19	19	828	231	65	20	30	171	31	150
Future Volume (vph)	194	751	19	19	828	231	65	20	30	171	31	150
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.85	1.00	0.97		1.00	0.92	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1427	3210	1143	1427	3136	977	2698	1372		1413	1195	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1427	3210	1143	1427	3136	977	2698	1372		1413	1195	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	209	808	20	20	890	248	70	22	32	184	33	161
RTOR Reduction (vph)	0	0	10	0	0	77	0	29	0	0	127	0
Lane Group Flow (vph)	209	808	10	20	890	171	70	25	0	184	67	0
Confl. Peds. (#/hr)			23			98	2		41	20		80
Confl. Bikes (#/hr)			5			7						5
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	19.2	52.5	52.5	3.5	36.8	36.8	9.8	9.8		20.5	20.5	
Effective Green, g (s)	20.7	54.5	54.5	5.0	38.8	38.8	11.3	11.3		22.0	22.0	
Actuated g/C Ratio	0.20	0.52	0.52	0.05	0.37	0.37	0.11	0.11		0.21	0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	281	1669	594	68	1161	361	290	147		296	250	
v/s Ratio Prot	c0.15	0.25		0.01	c0.28		c0.03	0.02		c0.13	0.06	
v/s Ratio Perm			0.01			0.17						
v/c Ratio	0.74	0.48	0.02	0.29	0.77	0.47	0.24	0.17		0.62	0.27	
Uniform Delay, d1	39.6	16.1	12.2	48.2	29.0	25.2	42.8	42.5		37.6	34.7	
Progression Factor	1.00	1.00	1.00	1.01	1.00	1.01	1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.8	0.1	0.0	0.9	2.8	0.4	0.2	0.2		2.9	0.2	
Delay (s)	50.4	16.2	12.2	49.4	31.9	25.8	43.0	42.7		40.5	34.9	
Level of Service	D	B	B	D	C	C	D	D		D	C	
Approach Delay (s)		23.0			30.9			42.9			37.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	29.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	104.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

11: Grand & Mission

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	236	42	35	249	36	142	134	8	46	250	72
Future Volume (vph)	35	236	42	35	249	36	142	134	8	46	250	72
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1500	1500	1500	1500	1500	1500
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		1.00	1.00		0.95	1.00	
Satd. Flow (prot)	1316	1575		1321	1545		1306	1468		1243	1425	
Flt Permitted	0.33	1.00		0.34	1.00		0.48	1.00		0.65	1.00	
Satd. Flow (perm)	456	1575		473	1545		624	1468		850	1425	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	42	284	51	42	300	43	171	161	10	55	301	87
RTOR Reduction (vph)	0	9	0	0	8	0	0	3	0	0	15	0
Lane Group Flow (vph)	42	326	0	42	335	0	171	168	0	55	373	0
Confl. Peds. (#/hr)	8		4	4		8	2					2
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.0	20.0		20.0	20.0		42.0	42.0		42.0	42.0	
Effective Green, g (s)	21.0	21.0		21.0	21.0		43.0	43.0		43.0	43.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.61	0.61		0.61	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	136	472		141	463		383	901		522	875	
v/s Ratio Prot		0.21			c0.22			0.11			0.26	
v/s Ratio Perm	0.09			0.09			c0.27			0.06		
v/c Ratio	0.31	0.69		0.30	0.72		0.45	0.19		0.11	0.43	
Uniform Delay, d1	18.9	21.6		18.8	21.9		7.2	5.9		5.6	7.1	
Progression Factor	0.51	0.53		1.00	1.00		1.03	1.08		1.00	1.00	
Incremental Delay, d2	5.7	7.9		5.3	9.5		0.8	0.1		0.4	1.5	
Delay (s)	15.3	19.4		24.2	31.4		8.2	6.4		6.0	8.6	
Level of Service	B	B		C	C		A	A		A	A	
Approach Delay (s)		18.9			30.6			7.3			8.3	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	67.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	268	780	79	358	330	0	0	152	94
Future Volume (vph)	0	0	0	268	780	79	358	330	0	0	152	94
Ideal Flow (vphpl)	1600	1600	1600	1500	1600	1500	1500	1600	1600	1600	1600	1500
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.85	1.00	1.00			1.00	0.86
Flpb, ped/bikes				1.00	1.00	1.00	0.99	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.98			1.00	1.00
Satd. Flow (prot)				1151	2543	903	1114	2797			1365	908
Flt Permitted				0.95	1.00	1.00	0.60	0.75			1.00	1.00
Satd. Flow (perm)				1151	2543	903	699	2136			1365	908
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	331	963	98	442	407	0	0	188	116
RTOR Reduction (vph)	0	0	0	0	0	62	0	0	0	0	0	48
Lane Group Flow (vph)	0	0	0	331	963	36	221	628	0	0	188	68
Confl. Peds. (#/hr)				14		121	17					118
Confl. Bikes (#/hr)						6						4
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				25.0	25.0	25.0	37.0	37.0			26.0	26.0
Effective Green, g (s)				26.0	26.0	26.0	38.0	38.0			27.0	27.0
Actuated g/C Ratio				0.37	0.37	0.37	0.54	0.54			0.39	0.39
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				427	944	335	426	1235			526	350
v/s Ratio Prot				0.29	c0.38		0.06	c0.06			0.14	
v/s Ratio Perm						0.04	c0.22	0.22				0.07
v/c Ratio				0.78	1.02	0.11	0.52	0.51			0.36	0.19
Uniform Delay, d1				19.4	22.0	14.4	11.7	10.1			15.3	14.3
Progression Factor				1.00	1.00	1.00	0.48	0.49			0.85	0.86
Incremental Delay, d2				12.9	34.5	0.7	3.7	1.2			1.7	1.1
Delay (s)				32.3	56.5	15.1	9.3	6.2			14.6	13.4
Level of Service				C	E	B	A	A			B	B
Approach Delay (s)		0.0			47.8			7.0			14.2	
Approach LOS		A			D			A			B	

Intersection Summary			
HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	151	760	323	0	0	0	0	522	297	13	403	0
Future Volume (vph)	151	760	323	0	0	0	0	522	297	13	403	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.87					1.00	0.92	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1228	2455	1020					2543	1079	1363	1161	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.29	1.00	
Satd. Flow (perm)	1228	2455	1020					2543	1079	418	1161	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	176	884	376	0	0	0	0	607	345	15	469	0
RTOR Reduction (vph)	0	0	69	0	0	0	0	0	65	0	0	0
Lane Group Flow (vph)	176	884	307	0	0	0	0	607	280	15	469	0
Confl. Peds. (#/hr)	3		88						70	20		
Confl. Bikes (#/hr)			3						5			
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	3%	3%	3%
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	39.5	39.5	39.5					21.5	21.5	21.5	21.5	
Effective Green, g (s)	41.0	41.0	41.0					23.0	23.0	23.0	23.0	
Actuated g/C Ratio	0.59	0.59	0.59					0.33	0.33	0.33	0.33	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	719	1437	597					835	354	137	381	
v/s Ratio Prot	0.14	c0.36						0.24			c0.40	
v/s Ratio Perm			0.30						0.26	0.04		
v/c Ratio	0.24	0.62	0.51					0.73	0.79	0.11	1.23	
Uniform Delay, d1	7.0	9.4	8.6					20.7	21.3	16.4	23.5	
Progression Factor	0.68	0.63	0.43					1.00	1.00	0.88	1.00	
Incremental Delay, d2	0.4	1.0	1.6					5.5	16.4	1.3	120.9	
Delay (s)	5.2	6.9	5.3					26.2	37.7	15.7	144.3	
Level of Service	A	A	A					C	D	B	F	
Approach Delay (s)		6.3			0.0			30.4			140.4	
Approach LOS		A			A			C			F	

Intersection Summary			
HCM 2000 Control Delay	36.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	107.3%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	431	225	0	0	145	276	65	1278	33	0	0	0
Future Volume (vph)	431	225	0	0	145	276	65	1278	33	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.92			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1482			1482	1215		2790	1081			
Flt Permitted	0.51	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	727	1482			1482	1215		2790	1081			
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	501	262	0	0	169	321	76	1486	38	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	61	0	0	20	0	0	0
Lane Group Flow (vph)	501	262	0	0	169	260	0	1562	18	0	0	0
Confl. Peds. (#/hr)						14	9		27			
Confl. Bikes (#/hr)						1			1			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Parking (#/hr)								2	2			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	31.0	31.0			14.0	14.0		31.0	31.0			
Effective Green, g (s)	32.0	33.0			15.0	15.0		33.0	33.0			
Actuated g/C Ratio	0.46	0.47			0.21	0.21		0.47	0.47			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	467	698			317	260		1315	509			
v/s Ratio Prot	c0.23	0.18			0.11	0.21		c0.56				
v/s Ratio Perm	c0.26								0.02			
v/c Ratio	1.07	0.38			0.53	1.00		1.19	0.04			
Uniform Delay, d1	19.5	11.9			24.4	27.5		18.5	9.9			
Progression Factor	0.69	0.52			0.98	1.03		0.89	1.51			
Incremental Delay, d2	58.9	1.3			5.1	49.8		88.2	0.1			
Delay (s)	72.3	7.5			29.0	78.0		104.6	15.1			
Level of Service	E	A			C	E		F	B			
Approach Delay (s)		50.1			61.1			102.5			0.0	
Approach LOS		D			E			F			A	

Intersection Summary			
HCM 2000 Control Delay	81.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.1%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	67	0	0	103	59	114	1239	8	0	0	0
Future Volume (vph)	167	67	0	0	103	59	114	1239	8	0	0	0
Ideal Flow (vphpl)	1700	1700	1800	1800	1700	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	0.99	1.00			1.00			1.00				
Frt	1.00	1.00			0.95			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1260	1335			1257			2742				
Flt Permitted	0.58	1.00			1.00			1.00				
Satd. Flow (perm)	764	1335			1257			2742				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	186	74	0	0	114	66	127	1377	9	0	0	0
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	0	0	0	0
Lane Group Flow (vph)	186	74	0	0	151	0	0	1513	0	0	0	0
Confl. Peds. (#/hr)	8					8	1		4			
Confl. Bikes (#/hr)						9			1			
Parking (#/hr)	2	2			2	2	2	2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	21.0	21.0			21.0			41.0				
Effective Green, g (s)	22.0	22.0			22.0			42.0				
Actuated g/C Ratio	0.31	0.31			0.31			0.60				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	240	419			395			1645				
v/s Ratio Prot		0.06			0.12			c0.55				
v/s Ratio Perm	c0.24											
v/c Ratio	0.78	0.18			0.38			0.92				
Uniform Delay, d1	21.8	17.4			18.7			12.5				
Progression Factor	0.71	0.80			0.79			0.59				
Incremental Delay, d2	17.1	0.7			2.8			4.8				
Delay (s)	32.5	14.7			17.5			12.2				
Level of Service	C	B			B			B				
Approach Delay (s)		27.4			17.5			12.2			0.0	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	151	0	0	297	51	81	1159	56	0	0	0
Future Volume (vph)	122	151	0	0	297	51	81	1159	56	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1363	1500			1300		1282	2493				
Flt Permitted	0.27	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	385	1500			1300		1282	2493				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	136	168	0	0	330	57	90	1288	62	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	5	0	0	0	0
Lane Group Flow (vph)	136	168	0	0	378	0	90	1345	0	0	0	0
Confl. Peds. (#/hr)	23					23			2			
Confl. Bikes (#/hr)						13			3			
Parking (#/hr)					2	2		2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	20.0	20.0			20.0		42.0	42.0				
Effective Green, g (s)	21.0	21.0			21.0		43.0	43.0				
Actuated g/C Ratio	0.30	0.30			0.30		0.61	0.61				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	115	450			390		787	1531				
v/s Ratio Prot		0.11			0.29		0.07	c0.54				
v/s Ratio Perm	c0.35											
v/c Ratio	1.18	0.37			0.97		0.11	0.88				
Uniform Delay, d1	24.5	19.3			24.2		5.6	11.3				
Progression Factor	0.69	0.76			1.20		0.30	0.38				
Incremental Delay, d2	133.9	2.0			35.4		0.0	0.8				
Delay (s)	150.8	16.6			64.4		1.7	5.1				
Level of Service	F	B			E		A	A				
Approach Delay (s)		76.6			64.4			4.9			0.0	
Approach LOS		E			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	25.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1014	145	977	1227	0	0	0	0
Future Volume (vph)	0	0	0	0	1014	145	977	1227	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1500	1500	1500	1500	1800	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.94	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3308	1004	990	3194				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3308	1004	990	3194				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	0	1193	171	1149	1444	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	24	10	10	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1193	147	599	1974	0	0	0	0
Confl. Peds. (#/hr)						42						
Confl. Bikes (#/hr)						6						
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					22.5	22.5	38.5	38.5				
Effective Green, g (s)					24.0	24.0	40.0	40.0				
Actuated g/C Ratio					0.34	0.34	0.57	0.57				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1134	344	565	1825				
v/s Ratio Prot					c0.36		0.61	c0.62				
v/s Ratio Perm						0.15						
v/c Ratio					1.05	0.43	1.06	1.08				
Uniform Delay, d1					23.0	17.7	15.0	15.0				
Progression Factor					0.96	0.85	1.39	1.38				
Incremental Delay, d2					35.1	2.1	45.2	42.8				
Delay (s)					57.2	17.2	66.1	63.5				
Level of Service					E	B	E	E				
Approach Delay (s)		0.0			52.2			64.1			0.0	
Approach LOS		A			D			E			A	

Intersection Summary			
HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	106.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	757	816	0	0	0	0	0	1472	482	0	0	0
Future Volume (vph)	757	816	0	0	0	0	0	1472	482	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1600	1600	1600	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.96			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1254	3775						3817	1069			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1254	3775						3817	1069			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	841	907	0	0	0	0	0	1636	536	0	0	0
RTOR Reduction (vph)	17	17	0	0	0	0	0	0	38	0	0	0
Lane Group Flow (vph)	429	1285	0	0	0	0	0	1636	498	0	0	0
Confl. Peds. (#/hr)									17			
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	30.0	30.0						31.0	31.0			
Effective Green, g (s)	31.0	31.0						33.0	33.0			
Actuated g/C Ratio	0.44	0.44						0.47	0.47			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	555	1671						1799	503			
v/s Ratio Prot	c0.34	0.34						0.43				
v/s Ratio Perm									c0.47			
v/c Ratio	0.77	0.77						0.91	0.99			
Uniform Delay, d1	16.5	16.5						17.1	18.4			
Progression Factor	1.39	1.38						1.00	1.00			
Incremental Delay, d2	6.1	2.1						8.3	38.0			
Delay (s)	29.0	24.8						25.5	56.3			
Level of Service	C	C						C	E			
Approach Delay (s)		25.9			0.0			33.1			0.0	
Approach LOS		C			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	29.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	94.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	476	83	63	136	0	0	0	0	168	921	503
Future Volume (vph)	0	476	83	63	136	0	0	0	0	168	921	503
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.99	1.00
Satd. Flow (prot)		2736			1768						2965	1262
Flt Permitted		1.00			0.73						0.99	1.00
Satd. Flow (perm)		2736			1319						2965	1262
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	529	92	70	151	0	0	0	0	187	1023	559
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	601	0	0	221	0	0	0	0	0	1210	559
Confl. Peds. (#/hr)			24	16								11
Confl. Bikes (#/hr)			12									5
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		28.8			28.8						32.4	25.4
Effective Green, g (s)		29.8			29.8						33.4	26.4
Actuated g/C Ratio		0.43			0.43						0.48	0.38
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1164			561						1414	475
v/s Ratio Prot		c0.22									c0.41	
v/s Ratio Perm					0.17							c0.44
v/c Ratio		0.52			0.39						0.86	1.18
Uniform Delay, d1		14.8			13.9						16.2	21.8
Progression Factor		1.00			0.16						1.00	1.00
Incremental Delay, d2		1.6			1.4						6.8	99.7
Delay (s)		16.4			3.5						23.0	121.5
Level of Service		B			A						C	F
Approach Delay (s)		16.4			3.5			0.0			54.1	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	40.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	76.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	168	170	29	187	0	0	0	0	41	1020	48
Future Volume (vph)	0	168	170	29	187	0	0	0	0	41	1020	48
Ideal Flow (vphpl)	1800	1500	1800	1800	1500	1800	1800	1800	1800	1800	1600	1600
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.1	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.93			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1386			1490						3706	985
Flt Permitted		1.00			0.92						1.00	1.00
Satd. Flow (perm)		1386			1382						3706	985
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	202	205	35	225	0	0	0	0	49	1229	58
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	395	0	0	260	0	0	0	0	0	1278	58
Confl. Peds. (#/hr)			3	3						80		32
Confl. Bikes (#/hr)			4									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.4	23.5
Effective Green, g (s)		32.0			32.0						31.9	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.6	4.5
Lane Grp Cap (vph)		633			631						1688	344
v/s Ratio Prot		c0.28									c0.34	
v/s Ratio Perm					0.19							0.06
v/c Ratio		0.62			0.41						0.76	0.17
Uniform Delay, d1		14.4			12.7						15.8	15.7
Progression Factor		1.00			0.79						0.37	0.44
Incremental Delay, d2		4.6			1.5						2.2	0.7
Delay (s)		19.0			11.6						8.1	7.6
Level of Service		B			B						A	A
Approach Delay (s)		19.0			11.6			0.0			8.1	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	277	134	153	305	0	0	0	0	112	901	171
Future Volume (vph)	0	277	134	153	305	0	0	0	0	112	901	171
Ideal Flow (vphpl)	1700	1700	1600	1600	1700	1700	1700	1700	1700	1700	1700	1600
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1550	1088	1465	1450						3920	1045
Flt Permitted		1.00	1.00	0.44	1.00						0.99	1.00
Satd. Flow (perm)		1550	1088	671	1450						3920	1045
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	346	168	191	381	0	0	0	0	140	1126	214
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	346	121	191	381	0	0	0	0	0	1266	214
Confl. Peds. (#/hr)			15	15						5		
Confl. Bikes (#/hr)			7									2
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		28.8	28.8	28.8	28.8						32.8	25.8
Effective Green, g (s)		29.8	29.8	29.8	29.8						33.8	26.8
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.48	0.38
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		659	463	285	617						1892	400
v/s Ratio Prot		0.22			0.26							
v/s Ratio Perm			0.11	c0.28							0.32	0.20
v/c Ratio		0.53	0.26	0.67	0.62						0.67	0.54
Uniform Delay, d1		14.9	13.0	16.2	15.7						13.8	16.8
Progression Factor		1.00	1.00	0.68	0.68						0.29	0.40
Incremental Delay, d2		3.0	1.4	9.9	3.8						1.3	3.4
Delay (s)		17.8	14.4	20.9	14.4						5.2	10.1
Level of Service		B	B	C	B						A	B
Approach Delay (s)		16.7			16.6			0.0			5.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	472	1491	0	0	0	0	0	762	397
Future Volume (vph)	0	0	0	472	1491	0	0	0	0	0	762	397
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1800	1800	1800	1800	1800	1500	1500
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.90
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1056	3126						3426	963
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1056	3126						3426	963
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	583	1841	0	0	0	0	0	941	490
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	583	1841	0	0	0	0	0	941	482
Confl. Peds. (#/hr)				41								87
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				29.0	29.0						33.0	33.0
Effective Green, g (s)				30.0	30.0						34.0	34.0
Actuated g/C Ratio				0.43	0.43						0.49	0.49
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				452	1339						1664	467
v/s Ratio Prot				0.55	c0.59						0.27	
v/s Ratio Perm												c0.50
v/c Ratio				1.29	1.37						0.57	1.03
Uniform Delay, d1				20.0	20.0						12.8	18.0
Progression Factor				1.12	1.13						1.16	1.21
Incremental Delay, d2				132.0	169.2						1.1	45.0
Delay (s)				154.5	191.7						15.9	66.8
Level of Service				F	F						B	E
Approach Delay (s)		0.0			182.7			0.0			33.3	
Approach LOS		A			F			A			C	

Intersection Summary			
HCM 2000 Control Delay	127.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	123.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1263	1396	0	0	0	0	0	0	289	934	0
Future Volume (vph)	0	1263	1396	0	0	0	0	0	0	289	934	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1700	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		0.99	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.95	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4632	1028							1302	2678	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4632	1028							1302	2678	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1403	1551	0	0	0	0	0	0	321	1038	0
RTOR Reduction (vph)	0	8	10	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2171	765	0	0	0	0	0	0	321	1038	0
Confl. Peds. (#/hr)			7									
Confl. Bikes (#/hr)			4									
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		38.5	38.5							22.5	22.5	
Effective Green, g (s)		40.0	40.0							24.0	24.0	
Actuated g/C Ratio		0.57	0.57							0.34	0.34	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2646	587							446	918	
v/s Ratio Prot		0.47								0.25	c0.39	
v/s Ratio Perm			c0.74									
v/c Ratio		1.10dr	1.30							0.72	1.13	
Uniform Delay, d1		12.1	15.0							20.1	23.0	
Progression Factor		1.00	1.00							0.61	0.66	
Incremental Delay, d2		3.0	148.7							5.1	66.5	
Delay (s)		15.1	163.7							17.2	81.7	
Level of Service		B	F							B	F	
Approach Delay (s)		54.1			0.0			0.0			66.5	
Approach LOS		D			A			A			E	

Intersection Summary			
HCM 2000 Control Delay	58.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	161.9%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	1	996	22	10	4	684	0	15	0	15	4	1
Future Volume (Veh/h)	1	996	22	10	4	684	0	15	0	15	4	1
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	1027	23	0	4	705	0	15	0	15	4	1
Pedestrians						9						2
Lane Width (ft)						12.0						12.0
Walking Speed (ft/s)						4.0						4.0
Percent Blockage						1						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		558										
pX, platoon unblocked				0.00	0.82			0.82	0.82	0.82	0.82	0.82
vC, conflicting volume	707			0	1050			1456	1756	534	1254	1767
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	707			0	635			1127	1491	9	883	1505
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			87	100	98	98	99
cM capacity (veh/h)	886			0	779			119	100	875	192	98

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	514	536	4	470	235	30	59
Volume Left	1	0	4	0	0	15	4
Volume Right	0	23	0	0	0	15	54
cSH	886	1700	779	1700	1700	209	512
Volume to Capacity	0.00	0.32	0.01	0.28	0.14	0.14	0.12
Queue Length 95th (ft)	0	0	0	0	0	12	10
Control Delay (s)	0.0	0.0	9.6	0.0	0.0	25.1	13.0
Lane LOS	A		A			D	B
Approach Delay (s)	0.0		0.1			25.1	13.0
Approach LOS						D	B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	46.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	52
Future Volume (Veh/h)	52
Sign Control	
Grade	
Peak Hour Factor	0.97
Hourly flow rate (vph)	54
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	354
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	354
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	92
cM capacity (veh/h)	641

Direction, Lane #

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	34	44	913	684	1	0	17
Future Volume (Veh/h)	34	44	913	684	1	0	17
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	45	941	705	1	0	18
Pedestrians						2	
Lane Width (ft)						12.0	
Walking Speed (ft/s)						4.0	
Percent Blockage						0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			873				
pX, platoon unblocked	0.00					0.87	
vC, conflicting volume	0	708				1268	355
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	708				1003	355
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	95				100	97
cM capacity (veh/h)	0	885				196	640

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	45	470	470	470	236	18
Volume Left	45	0	0	0	0	0
Volume Right	0	0	0	0	1	18
cSH	885	1700	1700	1700	1700	640
Volume to Capacity	0.05	0.28	0.28	0.28	0.14	0.03
Queue Length 95th (ft)	4	0	0	0	0	2
Control Delay (s)	9.3	0.0	0.0	0.0	0.0	10.8
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		10.8
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	38	869	658	6	3	20
Future Volume (Veh/h)	5	38	869	658	6	3	20
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	39	896	678	6	3	21
Pedestrians			3			2	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	686				1209	347
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	686				1209	347
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	96				98	97
cM capacity (veh/h)	0	902				167	646

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	39	448	448	452	232	24
Volume Left	39	0	0	0	0	3
Volume Right	0	0	0	0	6	21
cSH	902	1700	1700	1700	1700	476
Volume to Capacity	0.04	0.26	0.26	0.27	0.14	0.05
Queue Length 95th (ft)	3	0	0	0	0	4
Control Delay (s)	9.2	0.0	0.0	0.0	0.0	13.0
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		13.0
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina Ct/Mission & Embarcadero/E. Mission & Sea View

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	6	6	3	0	3	28	0	9	1	35	12	2
Future Volume (vph)	6	6	3	0	3	28	0	9	1	35	12	2
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	7	7	4	0	4	33	0	11	1	41	14	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	18	37	12	57
Volume Left (vph)	7	0	0	41
Volume Right (vph)	4	33	1	2
Hadj (s)	-0.02	-0.50	-0.02	0.16
Departure Headway (s)	4.1	3.6	4.0	4.2
Degree Utilization, x	0.02	0.04	0.01	0.07
Capacity (veh/h)	864	984	863	846
Control Delay (s)	7.1	6.7	7.1	7.5
Approach Delay (s)	7.1	6.7	7.1	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	22.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S

12/12/2016

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	25	73	0	3	0	77	6	24	1	9	3	2
Future Volume (Veh/h)	25	73	0	3	0	77	6	24	1	9	3	2
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	32	92	0	0	0	97	8	30	1	11	4	3
Pedestrians		1				3						12
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		0				0						1
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked				0.00								
vC, conflicting volume	117			0	92			260	273	95	284	269
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	117			0	92			260	273	95	284	269
tC, single (s)	4.1			0.0	4.1			7.1	6.5	6.2	7.1	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	98			0	100			96	100	99	99	100
cM capacity (veh/h)	1457			0	1503			674	614	959	636	617

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	124	105	42	7
Volume Left	32	0	30	4
Volume Right	0	8	11	0
cSH	1457	1503	729	628
Volume to Capacity	0.02	0.00	0.06	0.01
Queue Length 95th (ft)	2	0	5	1
Control Delay (s)	2.1	0.0	10.2	10.8
Lane LOS	A		B	B
Approach Delay (s)	2.1	0.0	10.2	10.8
Approach LOS			B	B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	23.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S

12/12/2016

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	0
Future Volume (Veh/h)	0
Sign Control	
Grade	
Peak Hour Factor	0.79
Hourly flow rate (vph)	0
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	114
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	114
tC, single (s)	6.2
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	100
cM capacity (veh/h)	928

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
51: Mission & Belle N

12/12/2016

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	5	80	77	0	0	5
Future Volume (Veh/h)	5	80	77	0	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	6	89	86	0	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	86				187	86
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	86				187	86
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1510				799	973

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	6	86	6
Volume Left	6	0	0
Volume Right	0	0	6
cSH	1510	1700	973
Volume to Capacity	0.00	0.05	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	7.4	0.0	8.7
Lane LOS	A		A
Approach Delay (s)	Err	0.0	8.7
Approach LOS			A

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Mission & Alice

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	0	123	95	0	1	10
Future Volume (Veh/h)	3	0	123	95	0	1	10
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	129	100	0	1	11
Pedestrians			5			1	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	101				230	106
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	101				230	106
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	99
cM capacity (veh/h)	0	1490				758	944

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	129	100	12
Volume Left	0	0	1
Volume Right	0	0	11
cSH	1490	1700	925
Volume to Capacity	0.00	0.06	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	8.9
Lane LOS			A
Approach Delay (s)	0.0	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	20.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Mission & Park

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	46	138	100	0	2	39
Future Volume (Veh/h)	3	46	138	100	0	2	39
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	49	148	108	0	2	42
Pedestrians			7			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	112				358	119
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	112				358	119
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	95
cM capacity (veh/h)	0	1473				617	924

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	197	108	44
Volume Left	49	0	2
Volume Right	0	0	42
cSH	1473	1700	904
Volume to Capacity	0.03	0.06	0.05
Queue Length 95th (ft)	3	0	4
Control Delay (s)	2.1	0.0	9.2
Lane LOS	A		A
Approach Delay (s)	2.1	0.0	9.2
Approach LOS			A

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	29.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	37	120	101	85	99	1	133	53	92	6	63	26
Future Volume (vph)	37	120	101	85	99	1	133	53	92	6	63	26
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	45	145	122	102	119	1	160	64	111	7	76	31

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	312	222	335	114
Volume Left (vph)	45	102	160	7
Volume Right (vph)	122	1	111	31
Hadj (s)	-0.17	0.12	-0.07	-0.12
Departure Headway (s)	5.5	5.9	5.6	6.0
Degree Utilization, x	0.47	0.36	0.52	0.19
Capacity (veh/h)	612	556	600	509
Control Delay (s)	13.3	12.2	14.4	10.4
Approach Delay (s)	13.3	12.2	14.4	10.4
Approach LOS	B	B	B	B

Intersection Summary				
Delay	13.1			
Level of Service	B			
Intersection Capacity Utilization	56.1%	ICU Level of Service		B
Analysis Period (min)	15			

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	2	204	2	1	2	88	263	1	0	196	45
Future Volume (vph)	29	2	204	2	1	2	88	263	1	0	196	45
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.98			0.99		1.00	1.00			1.00	
Flpb, ped/bikes		1.00			1.00		0.99	1.00			1.00	
Frt		0.88			0.95		1.00	1.00			0.97	
Flt Protected		0.99			0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1513			1614		1663	1764			1712	
Flt Permitted		0.97			0.93		0.61	1.00			1.00	
Satd. Flow (perm)		1469			1535		1061	1764			1712	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	30	2	208	2	1	2	90	268	1	0	200	46
RTOR Reduction (vph)	0	168	0	0	2	0	0	0	0	0	10	0
Lane Group Flow (vph)	0	72	0	0	3	0	90	269	0	0	236	0
Confl. Peds. (#/hr)	15		12	5		8	12		5	8		15
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.6			8.6		33.4	33.4			33.4	
Effective Green, g (s)		9.6			9.6		34.4	34.4			34.4	
Actuated g/C Ratio		0.19			0.19		0.69	0.69			0.69	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		282			294		729	1213			1177	
v/s Ratio Prot								c0.15			0.14	
v/s Ratio Perm		c0.05			0.00		0.08					
v/c Ratio		0.26			0.01		0.12	0.22			0.20	
Uniform Delay, d1		17.2			16.4		2.7	2.9			2.8	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.5			0.0		0.3	0.4			0.4	
Delay (s)		17.6			16.4		3.0	3.3			3.2	
Level of Service		B			B		A	A			A	
Approach Delay (s)		17.6			16.4			3.2			3.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.23		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	55.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	201	680	112	82	544	140	248	78	66	240	64	95
Future Volume (vph)	201	680	112	82	544	140	248	78	66	240	64	95
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.92	1.00	0.98		1.00	0.97	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1441	3241	1155	1441	3167	1069	2698	1419		1441	1339	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1441	3241	1155	1441	3167	1069	2698	1419		1441	1339	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	216	731	120	88	585	151	267	84	71	258	69	102
RTOR Reduction (vph)	0	0	68	0	0	91	0	25	0	0	40	0
Lane Group Flow (vph)	216	731	52	88	585	60	267	130	0	258	131	0
Confl. Peds. (#/hr)	14		25	5		42	20		33	28		34
Confl. Bikes (#/hr)						11						5
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	19.8	33.7	33.7	10.8	24.7	24.7	16.3	16.3		22.8	22.8	
Effective Green, g (s)	21.3	35.7	35.7	12.3	26.7	26.7	17.8	17.8		24.3	24.3	
Actuated g/C Ratio	0.21	0.35	0.35	0.12	0.26	0.26	0.17	0.17		0.24	0.24	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	300	1133	403	173	828	279	470	247		342	318	
v/s Ratio Prot	c0.15	0.23		0.06	c0.18		c0.10	0.09		c0.18	0.10	
v/s Ratio Perm			0.05			0.06						
v/c Ratio	0.72	0.65	0.13	0.51	0.71	0.22	0.57	0.53		0.75	0.41	
Uniform Delay, d1	37.6	27.9	22.6	42.1	34.2	29.5	38.6	38.3		36.1	32.9	
Progression Factor	1.00	1.00	1.00	1.00	1.02	1.07	1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.6	1.0	0.1	0.9	2.3	0.1	0.9	0.9		8.1	0.3	
Delay (s)	46.2	28.8	22.7	43.0	37.2	31.8	39.6	39.3		44.3	33.2	
Level of Service	D	C	C	D	D	C	D	D		D	C	
Approach Delay (s)		31.7			36.8			39.5			39.8	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	102.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	233	55	26	250	77	151	167	26	48	244	72
Future Volume (vph)	54	233	55	26	250	77	151	167	26	48	244	72
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		0.98	1.00		0.98	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	1897		1621	1884		1630	1927		1637	1887	
Flt Permitted	0.26	1.00		0.33	1.00		0.51	1.00		0.62	1.00	
Satd. Flow (perm)	453	1897		562	1884		880	1927		1065	1887	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	60	259	61	29	278	86	168	186	29	53	271	80
RTOR Reduction (vph)	0	15	0	0	19	0	0	6	0	0	11	0
Lane Group Flow (vph)	60	305	0	29	345	0	168	209	0	53	340	0
Confl. Peds. (#/hr)	11		21	21		11	14		8	8		14
Confl. Bikes (#/hr)			1			6			5			7
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	18.1	18.1		18.1	18.1		43.9	43.9		43.9	43.9	
Effective Green, g (s)	19.1	19.1		19.1	19.1		44.9	44.9		44.9	44.9	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.64	0.64		0.64	0.64	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	123	517		153	514		564	1236		683	1210	
v/s Ratio Prot		0.16			c0.18			0.11			0.18	
v/s Ratio Perm	0.13			0.05			c0.19			0.05		
v/c Ratio	0.49	0.59		0.19	0.67		0.30	0.17		0.08	0.28	
Uniform Delay, d1	21.3	22.1		19.5	22.7		5.6	5.0		4.7	5.5	
Progression Factor	0.71	0.73		1.00	1.00		0.44	0.46		1.00	1.00	
Incremental Delay, d2	2.9	1.7		0.6	3.4		1.2	0.3		0.2	0.6	
Delay (s)	18.0	17.9		20.1	26.1		3.7	2.6		5.0	6.1	
Level of Service	B	B		C	C		A	A		A	A	
Approach Delay (s)		17.9			25.7			3.1			5.9	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	58.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	83	719	279	399	450	0	0	278	133
Future Volume (vph)	0	0	0	83	719	279	399	450	0	0	278	133
Ideal Flow (vphpl)	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.93	1.00	1.00			1.00	0.94
Flpb, ped/bikes				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.99			1.00	1.00
Satd. Flow (prot)				1134	2350	977	1104	2606			1237	955
Flt Permitted				0.95	1.00	1.00	0.32	0.65			1.00	1.00
Satd. Flow (perm)				1134	2350	977	373	1716			1237	955
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	0	104	899	349	499	562	0	0	348	166
RTOR Reduction (vph)	0	0	0	0	0	142	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	104	899	207	324	738	0	0	348	109
Confl. Peds. (#/hr)				27		49	12					43
Confl. Bikes (#/hr)						5						4
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				29.0	29.0	29.0	33.0	33.0			18.0	18.0
Effective Green, g (s)				30.0	30.0	30.0	34.0	34.0			19.0	19.0
Actuated g/C Ratio				0.43	0.43	0.43	0.49	0.49			0.27	0.27
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				486	1007	418	306	986			335	259
v/s Ratio Prot				0.09	c0.38		c0.18	0.13			0.28	
v/s Ratio Perm						0.21	c0.33	0.24				0.11
v/c Ratio				0.21	0.89	0.50	1.06	0.75			1.04	0.42
Uniform Delay, d1				12.6	18.5	14.5	21.5	14.5			25.5	21.0
Progression Factor				1.00	1.00	1.00	0.66	0.55			1.04	1.12
Incremental Delay, d2				1.0	11.9	4.2	61.3	4.0			57.2	4.5
Delay (s)				13.6	30.4	18.7	75.5	12.0			83.6	28.0
Level of Service				B	C	B	E	B			F	C
Approach Delay (s)		0.0			26.1			31.4			65.7	
Approach LOS		A			C			C			E	

Intersection Summary			
HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	99.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	944	712	0	0	0	0	731	181	34	479	0
Future Volume (vph)	215	944	712	0	0	0	0	731	181	34	479	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.83					1.00	0.88	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1330	2660	1060					2755	1128	1463	1246	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.22	1.00	
Satd. Flow (perm)	1330	2660	1060					2755	1128	335	1246	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	256	1124	848	0	0	0	0	870	215	40	570	0
RTOR Reduction (vph)	0	0	107	0	0	0	0	0	13	0	0	0
Lane Group Flow (vph)	256	1124	741	0	0	0	0	870	202	40	570	0
Confl. Peds. (#/hr)			113						105	30		
Confl. Bikes (#/hr)			5						1			
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	31.5	31.5	31.5					29.5	29.5	29.5	29.5	
Effective Green, g (s)	33.0	33.0	33.0					31.0	31.0	31.0	31.0	
Actuated g/C Ratio	0.47	0.47	0.47					0.44	0.44	0.44	0.44	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	627	1254	499					1220	499	148	551	
v/s Ratio Prot	0.19	0.42						0.32			c0.46	
v/s Ratio Perm			c0.70						0.18	0.12		
v/c Ratio	0.41	0.90	1.49					0.71	0.41	0.27	1.03	
Uniform Delay, d1	12.1	16.9	18.5					15.9	13.2	12.3	19.5	
Progression Factor	1.30	1.20	1.27					1.00	1.00	0.45	0.44	
Incremental Delay, d2	0.2	1.1	219.4					3.6	2.4	3.5	43.0	
Delay (s)	15.9	21.5	242.9					19.4	15.7	9.0	51.7	
Level of Service	B	C	F					B	B	A	D	
Approach Delay (s)		105.1			0.0			18.7			48.9	
Approach LOS		F			A			B			D	

Intersection Summary			
HCM 2000 Control Delay	72.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	99.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	439	275	0	0	162	318	83	1648	36	0	0	0
Future Volume (vph)	439	275	0	0	162	318	83	1648	36	0	0	0
Ideal Flow (vphpl)	1800	2000	1800	1800	2000	1800	1800	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.94			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1647			1647	1215		3345	1276			
Flt Permitted	0.51	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	732	1647			1647	1215		3345	1276			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	488	306	0	0	180	353	92	1831	40	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	59	0	0	20	0	0	0
Lane Group Flow (vph)	488	306	0	0	180	294	0	1923	20	0	0	0
Confl. Peds. (#/hr)							6		20			
Confl. Bikes (#/hr)						1			1			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	29.0	29.0			16.0	16.0		33.0	33.0			
Effective Green, g (s)	30.0	31.0			17.0	17.0		35.0	35.0			
Actuated g/C Ratio	0.43	0.44			0.24	0.24		0.50	0.50			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	412	729			399	295		1672	638			
v/s Ratio Prot	c0.19	0.19			0.11	0.24		c0.57				
v/s Ratio Perm	c0.32								0.02			
v/c Ratio	1.18	0.42			0.45	1.00		1.15	0.03			
Uniform Delay, d1	20.6	13.3			22.5	26.5		17.5	8.9			
Progression Factor	0.93	1.04			1.31	1.45		0.31	0.00			
Incremental Delay, d2	99.6	1.3			3.4	49.8		68.3	0.0			
Delay (s)	118.9	15.2			33.0	88.1		73.7	0.0			
Level of Service	F	B			C	F		E	A			
Approach Delay (s)		78.9			69.5			72.2			0.0	
Approach LOS		E			E			E			A	

Intersection Summary			
HCM 2000 Control Delay	73.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	112.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	220	103	0	0	118	117	87	1422	10	0	0	0
Future Volume (vph)	220	103	0	0	118	117	87	1422	10	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.91				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.93			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1167	1228			1138			3711				
Flt Permitted	0.55	1.00			1.00			1.00				
Satd. Flow (perm)	671	1228			1138			3711				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	250	117	0	0	134	133	99	1616	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	250	117	0	0	265	0	0	1725	0	0	0	0
Confl. Peds. (#/hr)									7			
Confl. Bikes (#/hr)						2			4			
Parking (#/hr)	6	6			6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	35.0	35.0			35.0			27.0				
Effective Green, g (s)	36.0	36.0			36.0			28.0				
Actuated g/C Ratio	0.51	0.51			0.51			0.40				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	345	631			585			1484				
v/s Ratio Prot		0.10			0.23			c0.46				
v/s Ratio Perm	c0.37											
v/c Ratio	0.72	0.19			0.45			1.16				
Uniform Delay, d1	13.2	9.1			10.8			21.0				
Progression Factor	2.00	2.06			1.15			0.47				
Incremental Delay, d2	9.4	0.5			2.5			76.4				
Delay (s)	35.7	19.3			14.9			86.2				
Level of Service	D	B			B			F				
Approach Delay (s)		30.4			14.9			86.2			0.0	
Approach LOS		C			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	69.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	221	0	0	213	80	159	1228	54	0	0	0
Future Volume (vph)	203	221	0	0	213	80	159	1228	54	0	0	0
Ideal Flow (vphpl)	1800	1600	1600	1600	1600	1600	1600	1800	1600	1000	1800	1800
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.91				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.98	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1434	1412			1169		1207	4017				
Flt Permitted	0.51	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	773	1412			1169		1207	4017				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	226	246	0	0	237	89	177	1364	60	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	7	0	0	0	0
Lane Group Flow (vph)	226	246	0	0	324	0	177	1417	0	0	0	0
Confl. Peds. (#/hr)	28					28	2		2			
Confl. Bikes (#/hr)						8			3			
Parking (#/hr)					6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	39.0	39.0			39.0		23.0	23.0				
Effective Green, g (s)	40.0	40.0			40.0		24.0	24.0				
Actuated g/C Ratio	0.57	0.57			0.57		0.34	0.34				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	441	806			668		413	1377				
v/s Ratio Prot		0.17			0.28		0.15	c0.35				
v/s Ratio Perm	c0.29											
v/c Ratio	0.51	0.31			0.49		0.43	1.03				
Uniform Delay, d1	9.1	7.8			8.9		17.7	23.0				
Progression Factor	1.09	0.99			0.86		0.63	0.72				
Incremental Delay, d2	3.6	0.8			2.2		0.3	16.5				
Delay (s)	13.5	8.5			9.8		11.4	33.0				
Level of Service	B	A			A		B	C				
Approach Delay (s)		10.9			9.8			30.6			0.0	
Approach LOS		B			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1151	172	993	1370	0	0	0	0
Future Volume (vph)	0	0	0	0	1151	172	993	1370	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.88	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3597	1023	1066	3452				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3597	1023	1066	3452				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	0	0	0	1338	200	1155	1593	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	13	12	12	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1338	187	739	1985	0	0	0	0
Confl. Peds. (#/hr)						96						
Confl. Bikes (#/hr)						17						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					29.5	29.5	31.5	31.5				
Effective Green, g (s)					31.0	31.0	33.0	33.0				
Actuated g/C Ratio					0.44	0.44	0.47	0.47				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1592	453	502	1627				
v/s Ratio Prot					c0.37		c0.69	0.58				
v/s Ratio Perm						0.18						
v/c Ratio					0.84	0.41	1.47	1.22				
Uniform Delay, d1					17.3	13.3	18.5	18.5				
Progression Factor					1.04	1.12	0.76	0.77				
Incremental Delay, d2					2.7	1.3	215.6	100.8				
Delay (s)					20.6	16.2	229.6	115.0				
Level of Service					C	B	F	F				
Approach Delay (s)		0.0			20.0			146.3			0.0	
Approach LOS		A			C			F			A	

Intersection Summary			
HCM 2000 Control Delay	101.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	114.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	912	1308	0	0	0	0	0	1472	657	0	0	0
Future Volume (vph)	912	1308	0	0	0	0	0	1472	657	0	0	0
Ideal Flow (vphpl)	1600	1600	1700	1700	1700	1700	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.95			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1192	3606						3854	1064			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1192	3606						3854	1064			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1013	1453	0	0	0	0	0	1636	730	0	0	0
RTOR Reduction (vph)	18	18	0	0	0	0	0	0	8	0	0	0
Lane Group Flow (vph)	630	1800	0	0	0	0	0	1636	722	0	0	0
Confl. Peds. (#/hr)	43								28			
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	28.0	28.0						33.0	33.0			
Effective Green, g (s)	29.0	29.0						35.0	35.0			
Actuated g/C Ratio	0.41	0.41						0.50	0.50			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	493	1493						1927	532			
v/s Ratio Prot	c0.53	0.50						0.42				
v/s Ratio Perm									c0.68			
v/c Ratio	1.28	1.21						0.85	1.36			
Uniform Delay, d1	20.5	20.5						15.2	17.5			
Progression Factor	0.87	0.87						1.00	1.00			
Incremental Delay, d2	128.8	94.1						4.9	172.7			
Delay (s)	146.7	111.9						20.1	190.2			
Level of Service	F	F						C	F			
Approach Delay (s)		121.1			0.0			72.6			0.0	
Approach LOS		F			A			E			A	

Intersection Summary			
HCM 2000 Control Delay	97.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	125.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	514	70	43	195	0	0	0	0	211	1085	556
Future Volume (vph)	0	514	70	43	195	0	0	0	0	211	1085	556
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2756			1782						2993	1272
Flt Permitted		1.00			0.83						0.99	1.00
Satd. Flow (perm)		2756			1499						2993	1272
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	571	78	48	217	0	0	0	0	234	1206	618
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	634	0	0	265	0	0	0	0	0	1440	618
Confl. Peds. (#/hr)			12	12						3		13
Confl. Bikes (#/hr)			6									1
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		26.8			26.8						34.4	27.4
Effective Green, g (s)		27.8			27.8						35.4	28.4
Actuated g/C Ratio		0.40			0.40						0.51	0.41
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1094			595						1513	516
v/s Ratio Prot		c0.23									c0.48	
v/s Ratio Perm					0.18							c0.49
v/c Ratio		0.58			0.45						0.95	1.20
Uniform Delay, d1		16.5			15.5						16.5	20.8
Progression Factor		1.00			0.77						1.00	1.00
Incremental Delay, d2		2.2			1.7						14.2	106.6
Delay (s)		18.8			13.6						30.7	127.4
Level of Service		B			B						C	F
Approach Delay (s)		18.8			13.6			0.0			59.7	
Approach LOS		B			B			A			E	

Intersection Summary			
HCM 2000 Control Delay	46.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Hetherton & 5th
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	302	179	59	194	0	0	0	0	34	1032	84
Future Volume (vph)	0	302	179	59	194	0	0	0	0	34	1032	84
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.93
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1699			1779						4170	1118
Flt Permitted		1.00			0.70						1.00	1.00
Satd. Flow (perm)		1699			1261						4170	1118
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	336	199	66	216	0	0	0	0	38	1147	93
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	518	0	0	282	0	0	0	0	0	1185	93
Confl. Peds. (#/hr)			2	2						73		27
Confl. Bikes (#/hr)			5									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.5	23.5
Effective Green, g (s)		32.0			32.0						32.0	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		776			576						1906	391
v/s Ratio Prot		c0.30									c0.28	
v/s Ratio Perm					0.22							0.08
v/c Ratio		0.67			0.49						0.62	0.24
Uniform Delay, d1		14.8			13.3						14.4	16.1
Progression Factor		1.00			1.23						0.26	0.33
Incremental Delay, d2		4.5			2.3						0.6	0.6
Delay (s)		19.4			18.7						4.3	5.9
Level of Service		B			B						A	A
Approach Delay (s)		19.4			18.7			0.0			4.4	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: Hetherton & 4th
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	335	152	87	237	0	0	0	0	126	940	212
Future Volume (vph)	0	335	152	87	237	0	0	0	0	126	940	212
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.97
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1220	1648	1535						4152	1171
Flt Permitted		1.00	1.00	0.42	1.00						0.99	1.00
Satd. Flow (perm)		1641	1220	724	1535						4152	1171
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	372	169	97	263	0	0	0	0	140	1044	236
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	372	124	97	263	0	0	0	0	0	1184	236
Confl. Peds. (#/hr)			16	16						6		
Confl. Bikes (#/hr)			12									5
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases			4	8								5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						31.8	24.8
Effective Green, g (s)		30.8	30.8	30.8	30.8						32.8	25.8
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.47	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		722	536	318	675						1945	431
v/s Ratio Prot		c0.23			0.17						c0.29	
v/s Ratio Perm			0.10	0.13								0.20
v/c Ratio		0.52	0.23	0.31	0.39						0.61	0.55
Uniform Delay, d1		14.2	12.2	12.7	13.2						13.8	17.5
Progression Factor		1.00	1.00	1.07	1.09						0.38	0.49
Incremental Delay, d2		2.6	1.0	2.2	1.5						1.1	3.9
Delay (s)		16.8	13.2	15.8	16.0						6.3	12.5
Level of Service		B	B	B	B						A	B
Approach Delay (s)		15.7			15.9			0.0			7.3	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	449	1673	0	0	0	0	0	675	486
Future Volume (vph)	0	0	0	449	1673	0	0	0	0	0	675	486
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1400	1800	1800	1800	1600	1600	1600
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.86
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1077	3185						3726	1002
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1077	3185						3726	1002
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	499	1859	0	0	0	0	0	750	540
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	479	1879	0	0	0	0	0	750	532
Confl. Peds. (#/hr)				52								126
Confl. Bikes (#/hr)												2
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				27.0	27.0						35.0	35.0
Effective Green, g (s)				28.0	28.0						36.0	36.0
Actuated g/C Ratio				0.40	0.40						0.51	0.51
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				430	1274						1916	515
v/s Ratio Prot				0.44	c0.59						0.20	
v/s Ratio Perm												c0.53
v/c Ratio				1.11	1.47						0.39	1.03
Uniform Delay, d1				21.0	21.0						10.3	17.0
Progression Factor				0.87	0.89						0.42	0.43
Incremental Delay, d2				54.7	214.1						0.5	45.4
Delay (s)				73.1	232.8						4.8	52.8
Level of Service				E	F						A	D
Approach Delay (s)		0.0			200.3			0.0			24.9	
Approach LOS		A			F			A			C	

Intersection Summary			
HCM 2000 Control Delay	138.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	131.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1858	1024	0	0	0	0	0	0	397	822	0
Future Volume (vph)	0	1858	1024	0	0	0	0	0	0	397	822	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		1.00	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.97	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4797	1035							1327	2891	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4797	1035							1327	2891	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2064	1138	0	0	0	0	0	0	441	913	0
RTOR Reduction (vph)	0	21	21	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2589	571	0	0	0	0	0	0	441	913	0
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)			8									
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		35.5	35.5							25.5	25.5	
Effective Green, g (s)		37.0	37.0							27.0	27.0	
Actuated g/C Ratio		0.53	0.53							0.39	0.39	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2535	547							511	1115	
v/s Ratio Prot		0.54								c0.33	0.32	
v/s Ratio Perm			c0.55									
v/c Ratio		1.02	1.04							0.86	0.82	
Uniform Delay, d1		16.5	16.5							19.8	19.3	
Progression Factor		1.00	1.00							0.78	0.78	
Incremental Delay, d2		23.5	50.3							14.0	5.3	
Delay (s)		40.0	66.8							29.5	20.3	
Level of Service		D	E							C	C	
Approach Delay (s)		44.9			0.0			0.0			23.3	
Approach LOS		D			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	153.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	2	1010	19	5	4	965	0	9	0	5	11	0
Future Volume (Veh/h)	2	1010	19	5	4	965	0	9	0	5	11	0
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	1122	21	0	4	1072	0	10	0	6	12	0
Pedestrians		15				4						4
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		1				0						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		550										
pX, platoon unblocked				0.00	0.84			0.84	0.84	0.84	0.84	0.84
vC, conflicting volume	1076			0	1143			1824	2220	576	1659	2231
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1076			0	792			1603	2073	118	1406	2086
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			76	100	99	85	100
cM capacity (veh/h)	642			0	693			42	44	764	81	43

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	563	582	4	536	536	16	141
Volume Left	2	0	4	0	0	10	12
Volume Right	0	21	0	0	0	6	129
cSH	642	1700	693	1700	1700	65	333
Volume to Capacity	0.00	0.34	0.01	0.32	0.32	0.25	0.42
Queue Length 95th (ft)	0	0	0	0	0	21	51
Control Delay (s)	0.1	0.0	10.2	0.0	0.0	77.4	23.5
Lane LOS	A		B			F	C
Approach Delay (s)	0.0		0.0			77.4	23.5
Approach LOS						F	C

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	116
Future Volume (Veh/h)	116
Sign Control	
Grade	
Peak Hour Factor	0.90
Hourly flow rate (vph)	129
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	555
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	555
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	72
cM capacity (veh/h)	468

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS Dr. (E)

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	223	804	955	87	0	20
Future Volume (Veh/h)	3	223	804	955	87	0	20
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	265	957	1137	104	0	24
Pedestrians			10				
Lane Width (ft)			12.0				
Walking Speed (ft/s)			4.0				
Percent Blockage			1				
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			899				
pX, platoon unblocked	0.00					0.93	
vC, conflicting volume	0	1241				2198	630
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1241				2133	630
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	52				100	94
cM capacity (veh/h)	0	557				21	421

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	265	478	478	758	483	24
Volume Left	265	0	0	0	0	0
Volume Right	0	0	0	0	104	24
cSH	557	1700	1700	1700	1700	421
Volume to Capacity	0.48	0.28	0.28	0.45	0.28	0.06
Queue Length 95th (ft)	64	0	0	0	0	5
Control Delay (s)	17.2	0.0	0.0	0.0	0.0	14.1
Lane LOS	C					B
Approach Delay (s)	3.7			0.0		14.1
Approach LOS						B

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	35	35	737	990	1	1	33
Future Volume (Veh/h)	35	35	737	990	1	1	33
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	38	810	1088	1	1	36
Pedestrians			9			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	1093				1574	558
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1093				1574	558
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	94				99	92
cM capacity (veh/h)	0	632				94	468

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	38	405	405	725	364	37
Volume Left	38	0	0	0	0	1
Volume Right	0	0	0	0	1	36
cSH	632	1700	1700	1700	1700	423
Volume to Capacity	0.06	0.24	0.24	0.43	0.21	0.09
Queue Length 95th (ft)	5	0	0	0	0	7
Control Delay (s)	11.1	0.0	0.0	0.0	0.0	14.3
Lane LOS	B					B
Approach Delay (s)	0.5			0.0		14.3
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina/Mission & Embarcadero/E Mission / Sea View Ave

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	17	8	2	0	7	81	1	6	2	27	2	4
Future Volume (vph)	17	8	2	0	7	81	1	6	2	27	2	4
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	26	12	3	0	11	125	2	9	3	42	3	6

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	41	136	14	51
Volume Left (vph)	26	0	2	42
Volume Right (vph)	3	125	3	6
Hadj (s)	0.12	-0.52	-0.07	0.13
Departure Headway (s)	4.3	3.6	4.2	4.4
Degree Utilization, x	0.05	0.13	0.02	0.06
Capacity (veh/h)	818	985	803	775
Control Delay (s)	7.5	7.1	7.3	7.7
Approach Delay (s)	7.5	7.1	7.3	7.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.3		
Level of Service	A		
Intersection Capacity Utilization	24.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: HS Driveway/Belle S & Mission

12/12/2016

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (veh/h)	5	199	51	0	2	0	108	11	18	2	5	9
Future Volume (Veh/h)	5	199	51	0	2	0	108	11	18	2	5	9
Sign Control			Free				Free			Stop		
Grade			0%				0%			0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	221	57	0	0	0	120	12	20	2	6	10
Pedestrians							2					
Lane Width (ft)							12.0					
Walking Speed (ft/s)							4.0					
Percent Blockage							0					
Right turn flare (veh)												
Median type			None				None					
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked	0.00				0.00							
vC, conflicting volume	0	132			0	57			627	631	59	634
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	132			0	57			627	631	59	634
tC, single (s)	0.0	4.1			0.0	4.1			7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	0.0	2.2			0.0	2.2			3.5	4.0	3.3	3.5
p0 queue free %	0	85			0	100			94	99	99	97
cM capacity (veh/h)	0	1453			0	1547			347	338	1005	342

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	278	132	28	14
Volume Left	221	0	20	10
Volume Right	0	12	6	0
cSH	1453	1547	402	341
Volume to Capacity	0.15	0.00	0.07	0.04
Queue Length 95th (ft)	13	0	6	3
Control Delay (s)	6.6	0.0	14.6	16.0
Lane LOS	A		B	C
Approach Delay (s)	6.6	0.0	14.6	16.0
Approach LOS			B	C

Intersection Summary			
Average Delay	5.4		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: HS Driveway/Belle S & Mission

12/12/2016

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (veh/h)	4	0
Future Volume (Veh/h)	4	0
Sign Control	Stop	
Grade	0%	
Peak Hour Factor	0.90	0.90
Hourly flow rate (vph)	4	0
Pedestrians		
Lane Width (ft)		
Walking Speed (ft/s)		
Percent Blockage		
Right turn flare (veh)		
Median type		
Median storage veh)		
Upstream signal (ft)		
pX, platoon unblocked		
vC, conflicting volume	625	126
vC1, stage 1 conf vol		
vC2, stage 2 conf vol		
vCu, unblocked vol	625	126
tC, single (s)	6.5	6.2
tC, 2 stage (s)		
tF (s)	4.0	3.3
p0 queue free %	99	100
cM capacity (veh/h)	340	924

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
51: Mission & Belle N

12/12/2016

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	55	109	0	0	10
Future Volume (Veh/h)	10	55	109	0	0	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	61	121	0	0	11
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	121				204	121
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	121				204	121
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1467				779	930

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	72	121	11
Volume Left	11	0	0
Volume Right	0	0	11
cSH	1467	1700	930
Volume to Capacity	0.01	0.07	0.01
Queue Length 95th (ft)	1	0	1
Control Delay (s)	1.2	0.0	8.9
Lane LOS	A		A
Approach Delay (s)	1.2	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	20.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	17	9	255	116	5	3	111
Future Volume (Veh/h)	17	9	255	116	5	3	111
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Hourly flow rate (vph)	0	16	464	211	9	5	202
Pedestrians			6			11	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			1	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	231				722	232
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	231				722	232
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	99				99	75
cM capacity (veh/h)	0	1325				385	795

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	480	220	207
Volume Left	16	0	5
Volume Right	0	9	202
cSH	1325	1700	775
Volume to Capacity	0.01	0.13	0.27
Queue Length 95th (ft)	1	0	27
Control Delay (s)	0.4	0.0	11.3
Lane LOS	A		B
Approach Delay (s)	0.4	0.0	11.3
Approach LOS			B

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	19	320	244	12	0	68
Future Volume (Veh/h)	5	19	320	244	12	0	68
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	0	29	492	375	18	0	105
Pedestrians				14		32	
Lane Width (ft)				12.0		12.0	
Walking Speed (ft/s)				4.0		4.0	
Percent Blockage				1		3	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	425				980	416
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	425				980	416
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	83
cM capacity (veh/h)	0	1104				259	620

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	521	393	105
Volume Left	29	0	0
Volume Right	0	18	105
cSH	1104	1700	620
Volume to Capacity	0.03	0.23	0.17
Queue Length 95th (ft)	2	0	15
Control Delay (s)	0.8	0.0	12.0
Lane LOS	A		B
Approach Delay (s)	0.8	0.0	12.0
Approach LOS			B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	48.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	27	186	97	169	161	1	100	44	151	8	119	66
Future Volume (vph)	27	186	97	169	161	1	100	44	151	8	119	66
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	36	248	129	225	215	1	133	59	201	11	159	88

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	413	441	393	258
Volume Left (vph)	36	225	133	11
Volume Right (vph)	129	1	201	88
Hadj (s)	-0.14	0.13	-0.21	-0.16
Departure Headway (s)	8.3	8.7	8.4	9.1
Degree Utilization, x	0.96	1.06	0.91	0.65
Capacity (veh/h)	425	417	421	376
Control Delay (s)	62.1	91.8	53.7	27.5
Approach Delay (s)	62.1	91.8	53.7	27.5
Approach LOS	F	F	F	D

Intersection Summary			
Delay	62.7		
Level of Service	F		
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	30	4	121	1	3	2	134	271	7	6	272	115
Future Volume (vph)	30	4	121	1	3	2	134	271	7	6	272	115
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.99			0.99		1.00	1.00			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	
Frt		0.89			0.96		1.00	1.00			0.96	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1540			1666		1675	1758			1681	
Flt Permitted		0.94			0.98		0.51	1.00			1.00	
Satd. Flow (perm)		1464			1636		903	1758			1676	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	36	5	146	1	4	2	161	327	8	7	328	139
RTOR Reduction (vph)	0	121	0	0	2	0	0	1	0	0	17	0
Lane Group Flow (vph)	0	66	0	0	5	0	161	334	0	0	457	0
Confl. Peds. (#/hr)	14		2			12	2			12		14
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.5			7.5		34.5	34.5			34.5	
Effective Green, g (s)		8.5			8.5		35.5	35.5			35.5	
Actuated g/C Ratio		0.17			0.17		0.71	0.71			0.71	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		248			278		641	1248			1189	
v/s Ratio Prot								0.19				
v/s Ratio Perm		c0.04			0.00		0.18				c0.27	
v/c Ratio		0.27			0.02		0.25	0.27			0.38	
Uniform Delay, d1		18.0			17.3		2.6	2.6			2.9	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.6			0.0		0.9	0.5			0.9	
Delay (s)		18.6			17.3		3.5	3.1			3.8	
Level of Service		B			B		A	A			A	
Approach Delay (s)		18.6			17.3			3.2			3.8	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	225	783	19	19	846	233	65	20	30	184	31	164
Future Volume (vph)	225	783	19	19	846	233	65	20	30	184	31	164
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.85	1.00	0.97		1.00	0.92	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1427	3210	1142	1427	3136	975	2698	1371		1413	1190	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1427	3210	1142	1427	3136	975	2698	1371		1413	1190	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	242	842	20	20	910	251	70	22	32	198	33	176
RTOR Reduction (vph)	0	0	10	0	0	78	0	29	0	0	139	0
Lane Group Flow (vph)	242	842	10	20	910	173	70	25	0	198	70	0
Confl. Peds. (#/hr)			23			98	2		41	20		80
Confl. Bikes (#/hr)			5			7						5
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	20.3	53.3	53.3	3.6	36.6	36.6	9.9	9.9		20.9	20.9	
Effective Green, g (s)	21.8	55.3	55.3	5.1	38.6	38.6	11.4	11.4		22.4	22.4	
Actuated g/C Ratio	0.21	0.52	0.52	0.05	0.36	0.36	0.11	0.11		0.21	0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	292	1671	594	68	1139	354	289	147		298	250	
v/s Ratio Prot	c0.17	0.26		0.01	c0.29		c0.03	0.02		c0.14	0.06	
v/s Ratio Perm			0.01			0.18						
v/c Ratio	0.83	0.50	0.02	0.29	0.80	0.49	0.24	0.17		0.66	0.28	
Uniform Delay, d1	40.4	16.5	12.3	48.8	30.3	26.2	43.4	43.1		38.5	35.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	18.1	0.1	0.0	0.9	3.7	0.4	0.2	0.2		4.3	0.2	
Delay (s)	58.5	16.6	12.3	49.7	34.1	26.5	43.6	43.3		42.7	35.4	
Level of Service	E	B	B	D	C	C	D	D		D	D	
Approach Delay (s)		25.7			32.7			43.5			38.9	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	106.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	260	42	35	257	36	142	135	8	47	252	72
Future Volume (vph)	35	260	42	35	257	36	142	135	8	47	252	72
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1500	1500	1500	1500	1500	1500
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		1.00	1.00		0.95	1.00	
Satd. Flow (prot)	1316	1576		1321	1546		1306	1469		1243	1426	
Flt Permitted	0.32	1.00		0.30	1.00		0.48	1.00		0.65	1.00	
Satd. Flow (perm)	437	1576		417	1546		621	1469		848	1426	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	42	313	51	42	310	43	171	163	10	57	304	87
RTOR Reduction (vph)	0	8	0	0	7	0	0	3	0	0	15	0
Lane Group Flow (vph)	42	356	0	42	346	0	171	170	0	57	376	0
Confl. Peds. (#/hr)	8		4	4		8	2					2
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.0	20.0		20.0	20.0		42.0	42.0		42.0	42.0	
Effective Green, g (s)	21.0	21.0		21.0	21.0		43.0	43.0		43.0	43.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.61	0.61		0.61	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	131	472		125	463		381	902		520	875	
v/s Ratio Prot		c0.23			0.22			0.12			0.26	
v/s Ratio Perm	0.10			0.10			c0.28			0.07		
v/c Ratio	0.32	0.75		0.34	0.75		0.45	0.19		0.11	0.43	
Uniform Delay, d1	19.0	22.2		19.1	22.1		7.2	5.9		5.6	7.1	
Progression Factor	0.49	0.53		1.00	1.00		1.03	1.07		1.00	1.00	
Incremental Delay, d2	6.2	10.3		7.1	10.5		0.8	0.1		0.4	1.5	
Delay (s)	15.5	22.0		26.2	32.6		8.2	6.4		6.0	8.6	
Level of Service	B	C		C	C		A	A		A	A	
Approach Delay (s)		21.3			31.9			7.3			8.3	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	17.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	281	799	80	358	330	0	0	200	94
Future Volume (vph)	0	0	0	281	799	80	358	330	0	0	200	94
Ideal Flow (vphpl)	1600	1600	1600	1500	1600	1500	1500	1600	1600	1600	1600	1500
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.85	1.00	1.00			1.00	0.86
Flpb, ped/bikes				1.00	1.00	1.00	0.99	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.98			1.00	1.00
Satd. Flow (prot)				1151	2543	903	1116	2799			1365	908
Flt Permitted				0.95	1.00	1.00	0.53	0.71			1.00	1.00
Satd. Flow (perm)				1151	2543	903	620	2022			1365	908
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	347	986	99	442	407	0	0	247	116
RTOR Reduction (vph)	0	0	0	0	0	62	0	0	0	0	0	48
Lane Group Flow (vph)	0	0	0	347	986	37	221	628	0	0	247	68
Confl. Peds. (#/hr)				14		121	17					118
Confl. Bikes (#/hr)						6						4
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				25.0	25.0	25.0	37.0	37.0			26.0	26.0
Effective Green, g (s)				26.0	26.0	26.0	38.0	38.0			27.0	27.0
Actuated g/C Ratio				0.37	0.37	0.37	0.54	0.54			0.39	0.39
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				427	944	335	393	1186			526	350
v/s Ratio Prot				0.30	c0.39		c0.06	0.06			0.18	
v/s Ratio Perm						0.04	c0.24	0.23				0.07
v/c Ratio				0.81	1.04	0.11	0.56	0.53			0.47	0.19
Uniform Delay, d1				19.8	22.0	14.4	13.3	10.3			16.1	14.3
Progression Factor				1.00	1.00	1.00	0.48	0.49			0.82	0.87
Incremental Delay, d2				15.5	41.6	0.7	4.8	1.4			2.6	1.1
Delay (s)				35.3	63.6	15.1	11.1	6.4			15.9	13.5
Level of Service				D	E	B	B	A			B	B
Approach Delay (s)		0.0			53.4			7.6			15.1	
Approach LOS		A			D			A			B	

Intersection Summary			
HCM 2000 Control Delay	33.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	151	784	323	0	0	0	0	522	335	15	429	0
Future Volume (vph)	151	784	323	0	0	0	0	522	335	15	429	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.87					1.00	0.92	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1228	2455	1020					2543	1079	1363	1161	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.29	1.00	
Satd. Flow (perm)	1228	2455	1020					2543	1079	418	1161	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	176	912	376	0	0	0	0	607	390	17	499	0
RTOR Reduction (vph)	0	0	61	0	0	0	0	0	61	0	0	0
Lane Group Flow (vph)	176	912	315	0	0	0	0	607	329	17	499	0
Confl. Peds. (#/hr)	3		88						70	20		
Confl. Bikes (#/hr)			3						5			
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	3%	3%	3%
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	39.5	39.5	39.5					21.5	21.5	21.5	21.5	
Effective Green, g (s)	41.0	41.0	41.0					23.0	23.0	23.0	23.0	
Actuated g/C Ratio	0.59	0.59	0.59					0.33	0.33	0.33	0.33	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	719	1437	597					835	354	137	381	
v/s Ratio Prot	0.14	c0.37						0.24			c0.43	
v/s Ratio Perm			0.31						0.30	0.04		
v/c Ratio	0.24	0.63	0.53					0.73	0.93	0.12	1.31	
Uniform Delay, d1	7.0	9.6	8.7					20.7	22.7	16.4	23.5	
Progression Factor	0.69	0.63	0.47					1.00	1.00	0.82	0.92	
Incremental Delay, d2	0.4	1.0	1.6					5.5	32.8	1.4	152.8	
Delay (s)	5.2	7.1	5.7					26.2	55.5	14.9	174.4	
Level of Service	A	A	A					C	E	B	F	
Approach Delay (s)		6.5			0.0			37.7			169.2	
Approach LOS		A			A			D			F	

Intersection Summary			
HCM 2000 Control Delay	45.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	111.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	431	249	0	0	145	284	65	1282	33	0	0	0
Future Volume (vph)	431	249	0	0	145	284	65	1282	33	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.92			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1482			1482	1215		2790	1081			
Flt Permitted	0.51	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	727	1482			1482	1215		2790	1081			
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	501	290	0	0	169	330	76	1491	38	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	61	0	0	20	0	0	0
Lane Group Flow (vph)	501	290	0	0	169	269	0	1567	18	0	0	0
Confl. Peds. (#/hr)						14	9		27			
Confl. Bikes (#/hr)						1			1			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Parking (#/hr)								2	2			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	31.0	31.0			14.0	14.0		31.0	31.0			
Effective Green, g (s)	32.0	33.0			15.0	15.0		33.0	33.0			
Actuated g/C Ratio	0.46	0.47			0.21	0.21		0.47	0.47			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	467	698			317	260		1315	509			
v/s Ratio Prot	c0.23	0.20			0.11	0.22		c0.56				
v/s Ratio Perm	c0.26								0.02			
v/c Ratio	1.07	0.42			0.53	1.03		1.19	0.04			
Uniform Delay, d1	19.5	12.2			24.4	27.5		18.5	9.9			
Progression Factor	0.71	0.54			0.98	1.03		0.89	1.50			
Incremental Delay, d2	58.6	1.5			5.0	58.6		89.8	0.1			
Delay (s)	72.4	8.1			28.9	86.9		106.3	14.9			
Level of Service	E	A			C	F		F	B			
Approach Delay (s)		48.8			67.3			104.1			0.0	
Approach LOS		D			E			F			A	

Intersection Summary			
HCM 2000 Control Delay	82.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.8%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	167	67	0	0	103	59	114	1243	8	0	0	0
Future Volume (vph)	167	67	0	0	103	59	114	1243	8	0	0	0
Ideal Flow (vphpl)	1700	1700	1800	1800	1700	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	0.99	1.00			1.00			1.00				
Frt	1.00	1.00			0.95			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1260	1335			1257			2742				
Flt Permitted	0.58	1.00			1.00			1.00				
Satd. Flow (perm)	764	1335			1257			2742				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	186	74	0	0	114	66	127	1381	9	0	0	0
RTOR Reduction (vph)	0	0	0	0	29	0	0	0	0	0	0	0
Lane Group Flow (vph)	186	74	0	0	151	0	0	1517	0	0	0	0
Confl. Peds. (#/hr)	8					8	1		4			
Confl. Bikes (#/hr)						9			1			
Parking (#/hr)	2	2			2	2	2	2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	21.0	21.0			21.0			41.0				
Effective Green, g (s)	22.0	22.0			22.0			42.0				
Actuated g/C Ratio	0.31	0.31			0.31			0.60				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	240	419			395			1645				
v/s Ratio Prot		0.06			0.12			c0.55				
v/s Ratio Perm	c0.24											
v/c Ratio	0.78	0.18			0.38			0.92				
Uniform Delay, d1	21.8	17.4			18.7			12.5				
Progression Factor	0.71	0.80			0.79			0.60				
Incremental Delay, d2	17.1	0.7			2.8			4.8				
Delay (s)	32.5	14.7			17.6			12.2				
Level of Service	C	B			B			B				
Approach Delay (s)		27.4			17.6			12.2			0.0	
Approach LOS		C			B			B			A	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	122	155	0	0	304	51	81	1163	56	0	0	0
Future Volume (vph)	122	155	0	0	304	51	81	1163	56	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1363	1500			1301		1282	2494				
Flt Permitted	0.26	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	370	1500			1301		1282	2494				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	136	172	0	0	338	57	90	1292	62	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	5	0	0	0	0
Lane Group Flow (vph)	136	172	0	0	387	0	90	1349	0	0	0	0
Confl. Peds. (#/hr)	23					23			2			
Confl. Bikes (#/hr)						13			3			
Parking (#/hr)					2	2		2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	20.0	20.0			20.0		42.0	42.0				
Effective Green, g (s)	21.0	21.0			21.0		43.0	43.0				
Actuated g/C Ratio	0.30	0.30			0.30		0.61	0.61				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	111	450			390		787	1532				
v/s Ratio Prot		0.11			0.30		0.07	c0.54				
v/s Ratio Perm	c0.37											
v/c Ratio	1.23	0.38			0.99		0.11	0.88				
Uniform Delay, d1	24.5	19.4			24.4		5.6	11.3				
Progression Factor	0.69	0.76			1.20		0.31	0.39				
Incremental Delay, d2	150.5	2.0			40.4		0.0	0.8				
Delay (s)	167.5	16.8			69.6		1.7	5.2				
Level of Service	F	B			E		A	A				
Approach Delay (s)		83.3			69.6			5.0			0.0	
Approach LOS		F			E			A			A	

Intersection Summary			
HCM 2000 Control Delay	28.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1029	149	977	1227	0	0	0	0
Future Volume (vph)	0	0	0	0	1029	149	977	1227	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1500	1500	1500	1500	1800	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.94	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3308	1004	990	3194				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3308	1004	990	3194				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	0	1211	175	1149	1444	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	24	10	10	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1211	151	599	1974	0	0	0	0
Confl. Peds. (#/hr)						42						
Confl. Bikes (#/hr)						6						
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					22.5	22.5	38.5	38.5				
Effective Green, g (s)					24.0	24.0	40.0	40.0				
Actuated g/C Ratio					0.34	0.34	0.57	0.57				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1134	344	565	1825				
v/s Ratio Prot					c0.37		0.61	c0.62				
v/s Ratio Perm						0.15						
v/c Ratio					1.07	0.44	1.06	1.08				
Uniform Delay, d1					23.0	17.8	15.0	15.0				
Progression Factor					0.95	0.85	1.39	1.38				
Incremental Delay, d2					40.2	2.1	45.2	42.8				
Delay (s)					62.1	17.2	66.0	63.5				
Level of Service					E	B	E	E				
Approach Delay (s)		0.0			56.4			64.1			0.0	
Approach LOS		A			E			E			A	

Intersection Summary			
HCM 2000 Control Delay	61.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	107.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	757	832	0	0	0	0	0	1472	491	0	0	0
Future Volume (vph)	757	832	0	0	0	0	0	1472	491	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1600	1600	1600	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.96			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1254	3776						3817	1069			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1254	3776						3817	1069			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	841	924	0	0	0	0	0	1636	546	0	0	0
RTOR Reduction (vph)	17	17	0	0	0	0	0	0	35	0	0	0
Lane Group Flow (vph)	429	1302	0	0	0	0	0	1636	511	0	0	0
Confl. Peds. (#/hr)									17			
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	30.0	30.0						31.0	31.0			
Effective Green, g (s)	31.0	31.0						33.0	33.0			
Actuated g/C Ratio	0.44	0.44						0.47	0.47			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	555	1672						1799	503			
v/s Ratio Prot	0.34	c0.34						0.43				
v/s Ratio Perm									c0.48			
v/c Ratio	0.77	0.78						0.91	1.02			
Uniform Delay, d1	16.5	16.6						17.1	18.5			
Progression Factor	1.39	1.38						1.00	1.00			
Incremental Delay, d2	6.0	2.1						8.3	44.0			
Delay (s)	29.0	25.0						25.5	62.5			
Level of Service	C	C						C	E			
Approach Delay (s)		26.0			0.0			34.7			0.0	
Approach LOS		C			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	483	83	63	136	0	0	0	0	185	921	503
Future Volume (vph)	0	483	83	63	136	0	0	0	0	185	921	503
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.99	1.00
Satd. Flow (prot)		2737			1768						2964	1262
Flt Permitted		1.00			0.73						0.99	1.00
Satd. Flow (perm)		2737			1315						2964	1262
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	537	92	70	151	0	0	0	0	206	1023	559
RTOR Reduction (vph)	0	20	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	609	0	0	221	0	0	0	0	0	1229	559
Confl. Peds. (#/hr)			24	16								11
Confl. Bikes (#/hr)			12									5
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		28.8			28.8						32.4	25.4
Effective Green, g (s)		29.8			29.8						33.4	26.4
Actuated g/C Ratio		0.43			0.43						0.48	0.38
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1165			559						1414	475
v/s Ratio Prot		c0.22									c0.41	
v/s Ratio Perm					0.17							c0.44
v/c Ratio		0.52			0.40						0.87	1.18
Uniform Delay, d1		14.9			13.9						16.3	21.8
Progression Factor		1.00			0.16						1.00	1.00
Incremental Delay, d2		1.7			1.4						7.5	99.7
Delay (s)		16.5			3.5						23.8	121.5
Level of Service		B			A						C	F
Approach Delay (s)		16.5			3.5			0.0			54.4	
Approach LOS		B			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	41.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	77.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Hetherton & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	168	170	29	187	0	0	0	0	41	1020	48
Future Volume (vph)	0	168	170	29	187	0	0	0	0	41	1020	48
Ideal Flow (vphpl)	1800	1500	1800	1800	1500	1800	1800	1800	1800	1800	1600	1600
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.1	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.93			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1386			1490						3706	985
Flt Permitted		1.00			0.92						1.00	1.00
Satd. Flow (perm)		1386			1382						3706	985
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	202	205	35	225	0	0	0	0	49	1229	58
RTOR Reduction (vph)	0	12	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	395	0	0	260	0	0	0	0	0	1278	58
Confl. Peds. (#/hr)			3	3						80		32
Confl. Bikes (#/hr)			4									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.4	23.5
Effective Green, g (s)		32.0			32.0						31.9	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.6	4.5
Lane Grp Cap (vph)		633			631						1688	344
v/s Ratio Prot		c0.28									c0.34	
v/s Ratio Perm					0.19							0.06
v/c Ratio		0.62			0.41						0.76	0.17
Uniform Delay, d1		14.4			12.7						15.8	15.7
Progression Factor		1.00			0.78						0.37	0.44
Incremental Delay, d2		4.6			1.5						2.2	0.7
Delay (s)		19.0			11.5						8.0	7.6
Level of Service		B			B						A	A
Approach Delay (s)		19.0			11.5			0.0			8.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: Hetherton & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	281	134	153	312	0	0	0	0	112	901	171
Future Volume (vph)	0	281	134	153	312	0	0	0	0	112	901	171
Ideal Flow (vphpl)	1700	1700	1600	1600	1700	1700	1700	1700	1700	1700	1700	1600
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1550	1088	1465	1450						3920	1045
Flt Permitted		1.00	1.00	0.43	1.00						0.99	1.00
Satd. Flow (perm)		1550	1088	663	1450						3920	1045
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	351	168	191	390	0	0	0	0	140	1126	214
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	351	121	191	390	0	0	0	0	0	1266	214
Confl. Peds. (#/hr)			15	15						5		
Confl. Bikes (#/hr)			7									2
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		28.8	28.8	28.8	28.8						32.8	25.8
Effective Green, g (s)		29.8	29.8	29.8	29.8						33.8	26.8
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.48	0.38
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		659	463	282	617						1892	400
v/s Ratio Prot		0.23			0.27							
v/s Ratio Perm			0.11	c0.29							0.32	0.20
v/c Ratio		0.53	0.26	0.68	0.63						0.67	0.54
Uniform Delay, d1		14.9	13.0	16.2	15.8						13.8	16.8
Progression Factor		1.00	1.00	0.67	0.67						0.29	0.40
Incremental Delay, d2		3.1	1.4	10.1	4.0						1.3	3.4
Delay (s)		18.0	14.4	21.1	14.6						5.2	10.0
Level of Service		B	B	C	B						A	B
Approach Delay (s)		16.8			16.7			0.0			5.9	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	84.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	476	1502	0	0	0	0	0	762	397
Future Volume (vph)	0	0	0	476	1502	0	0	0	0	0	762	397
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1800	1800	1800	1800	1800	1500	1500
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.90
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1056	3126						3426	963
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1056	3126						3426	963
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	588	1854	0	0	0	0	0	941	490
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	588	1854	0	0	0	0	0	941	482
Confl. Peds. (#/hr)				41								87
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				29.0	29.0						33.0	33.0
Effective Green, g (s)				30.0	30.0						34.0	34.0
Actuated g/C Ratio				0.43	0.43						0.49	0.49
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				452	1339						1664	467
v/s Ratio Prot				0.56	c0.59						0.27	
v/s Ratio Perm												c0.50
v/c Ratio				1.30	1.38						0.57	1.03
Uniform Delay, d1				20.0	20.0						12.8	18.0
Progression Factor				1.13	1.13						1.16	1.21
Incremental Delay, d2				136.9	173.5						1.1	45.0
Delay (s)				159.5	196.1						15.9	66.7
Level of Service				F	F						B	E
Approach Delay (s)		0.0			187.3			0.0			33.3	
Approach LOS		A			F			A			C	

Intersection Summary			
HCM 2000 Control Delay	130.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	124.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1279	1396	0	0	0	0	0	0	289	938	0
Future Volume (vph)	0	1279	1396	0	0	0	0	0	0	289	938	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1700	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		0.99	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.95	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4635	1028							1302	2678	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4635	1028							1302	2678	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1421	1551	0	0	0	0	0	0	321	1042	0
RTOR Reduction (vph)	0	7	10	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2190	765	0	0	0	0	0	0	321	1042	0
Confl. Peds. (#/hr)			7									
Confl. Bikes (#/hr)			4									
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		38.5	38.5							22.5	22.5	
Effective Green, g (s)		40.0	40.0							24.0	24.0	
Actuated g/C Ratio		0.57	0.57							0.34	0.34	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2648	587							446	918	
v/s Ratio Prot		0.47								0.25	c0.39	
v/s Ratio Perm			c0.74									
v/c Ratio		1.10dr	1.30							0.72	1.14	
Uniform Delay, d1		12.2	15.0							20.1	23.0	
Progression Factor		1.00	1.00							0.61	0.66	
Incremental Delay, d2		3.1	148.7							5.0	68.2	
Delay (s)		15.3	163.7							17.2	83.4	
Level of Service		B	F							B	F	
Approach Delay (s)		54.0			0.0			0.0			67.8	
Approach LOS		D			A			A			E	

Intersection Summary			
HCM 2000 Control Delay	58.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	162.2%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↱
Traffic Volume (veh/h)	0	2	5	0	0	0
Future Volume (Veh/h)	0	2	5	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	2	6	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1304				
pX, platoon unblocked						
vC, conflicting volume	6				7	3
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	6				7	3
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1613				1013	1080

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	1	1	3	3	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	1	1034	22	10	4	685	0	15	0	15	4	1
Future Volume (Veh/h)	1	1034	22	10	4	685	0	15	0	15	4	1
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	1066	23	0	4	706	0	15	0	15	4	1
Pedestrians						9						2
Lane Width (ft)						12.0						12.0
Walking Speed (ft/s)						4.0						4.0
Percent Blockage						1						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		558				717						
pX, platoon unblocked				0.00	0.81			0.81	0.81	0.81	0.81	0.81
vC, conflicting volume	708			0	1089			1507	1796	554	1275	1807
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	708			0	655			1168	1522	0	883	1536
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			86	100	98	98	99
cM capacity (veh/h)	885			0	756			107	95	877	190	93

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	534	556	4	471	235	30	71
Volume Left	1	0	4	0	0	15	4
Volume Right	0	23	0	0	0	15	66
cSH	885	1700	756	1700	1700	191	526
Volume to Capacity	0.00	0.33	0.01	0.28	0.14	0.16	0.13
Queue Length 95th (ft)	0	0	0	0	0	14	12
Control Delay (s)	0.0	0.0	9.8	0.0	0.0	27.3	12.9
Lane LOS	A		A			D	B
Approach Delay (s)	0.0		0.1			27.3	12.9
Approach LOS						D	B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	48.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	64
Future Volume (Veh/h)	64
Sign Control	
Grade	
Peak Hour Factor	0.97
Hourly flow rate (vph)	66
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	355
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	355
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	90
cM capacity (veh/h)	640

Direction, Lane #

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	34	82	913	685	5	1	11
Future Volume (Veh/h)	34	82	913	685	5	1	11
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	85	941	706	5	1	11
Pedestrians						2	
Lane Width (ft)						12.0	
Walking Speed (ft/s)						4.0	
Percent Blockage						0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			873	402			
pX, platoon unblocked	0.00					0.87	
vC, conflicting volume	0	713				1351	358
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	713				1096	358
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	90				99	98
cM capacity (veh/h)	0	881				162	638

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	85	470	470	471	240	12
Volume Left	85	0	0	0	0	1
Volume Right	0	0	0	0	5	11
cSH	881	1700	1700	1700	1700	513
Volume to Capacity	0.10	0.28	0.28	0.28	0.14	0.02
Queue Length 95th (ft)	8	0	0	0	0	2
Control Delay (s)	9.5	0.0	0.0	0.0	0.0	12.2
Lane LOS	A					B
Approach Delay (s)	0.8			0.0		12.2
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	5	39	869	658	6	3	24
Future Volume (Veh/h)	5	39	869	658	6	3	24
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	40	896	678	6	3	25
Pedestrians			3			2	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			166				
pX, platoon unblocked	0.00						
vC, conflicting volume	0	686				1211	347
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	686				1211	347
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	96				98	96
cM capacity (veh/h)	0	902				167	646

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	40	448	448	452	232	28
Volume Left	40	0	0	0	0	3
Volume Right	0	0	0	0	6	25
cSH	902	1700	1700	1700	1700	494
Volume to Capacity	0.04	0.26	0.26	0.27	0.14	0.06
Queue Length 95th (ft)	3	0	0	0	0	4
Control Delay (s)	9.2	0.0	0.0	0.0	0.0	12.7
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		12.7
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina Ct/Mission & Embarcadero/E. Mission & Sea View

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	6	7	3	0	7	30	0	9	1	37	12	2
Future Volume (vph)	6	7	3	0	7	30	0	9	1	37	12	2
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	7	8	4	0	8	35	0	11	1	44	14	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	19	43	12	60
Volume Left (vph)	7	0	0	44
Volume Right (vph)	4	35	1	2
Hadj (s)	-0.02	-0.45	-0.02	0.16
Departure Headway (s)	4.1	3.6	4.1	4.2
Degree Utilization, x	0.02	0.04	0.01	0.07
Capacity (veh/h)	860	969	858	841
Control Delay (s)	7.2	6.8	7.1	7.5
Approach Delay (s)	7.2	6.8	7.1	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	22.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S

12/12/2016

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	25	73	0	3	0	88	6	24	1	9	5	2
Future Volume (Veh/h)	25	73	0	3	0	88	6	24	1	9	5	2
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	32	92	0	0	0	111	8	30	1	11	6	3
Pedestrians		1				3						12
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		0				0						1
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked				0.00								
vC, conflicting volume	131			0	92			274	287	95	298	283
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	131			0	92			274	287	95	298	283
tC, single (s)	4.1			0.0	4.1			7.1	6.5	6.2	7.1	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	98			0	100			95	100	99	99	100
cM capacity (veh/h)	1440			0	1503			659	603	959	623	606

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	124	119	42	9
Volume Left	32	0	30	6
Volume Right	0	8	11	0
cSH	1440	1503	716	617
Volume to Capacity	0.02	0.00	0.06	0.01
Queue Length 95th (ft)	2	0	5	1
Control Delay (s)	2.1	0.0	10.3	10.9
Lane LOS	A		B	B
Approach Delay (s)	2.1	0.0	10.3	10.9
Approach LOS			B	B

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	23.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	0
Future Volume (Veh/h)	0
Sign Control	
Grade	
Peak Hour Factor	0.79
Hourly flow rate (vph)	0
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	128
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	128
tC, single (s)	6.2
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	100
cM capacity (veh/h)	912

Direction, Lane #

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	80	79	0	0	5
Future Volume (Veh/h)	7	80	79	0	0	5
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	8	89	88	0	0	6
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	88				193	88
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	88				193	88
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1508				792	970

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	8	88	6
Volume Left	8	0	0
Volume Right	0	0	6
cSH	1508	1700	970
Volume to Capacity	0.01	0.05	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	7.4	0.0	8.7
Lane LOS	A		A
Approach Delay (s)	Err	0.0	8.7
Approach LOS			A

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	4	128	95	2	1	20
Future Volume (Veh/h)	3	4	128	95	2	1	20
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	4	135	100	2	1	21
Pedestrians			5			1	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	103				245	107
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	103				245	107
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	98
cM capacity (veh/h)	0	1488				741	942

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	139	102	22
Volume Left	4	0	1
Volume Right	0	2	21
cSH	1488	1700	931
Volume to Capacity	0.00	0.06	0.02
Queue Length 95th (ft)	0	0	2
Control Delay (s)	0.2	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	0.2	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	24.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	46	151	110	1	2	44
Future Volume (Veh/h)	3	46	151	110	1	2	44
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	49	162	118	1	2	47
Pedestrians			7			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	123				382	130
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	123				382	130
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	95
cM capacity (veh/h)	0	1459				597	912

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	211	119	49
Volume Left	49	0	2
Volume Right	0	1	47
cSH	1459	1700	893
Volume to Capacity	0.03	0.07	0.05
Queue Length 95th (ft)	3	0	4
Control Delay (s)	2.0	0.0	9.3
Lane LOS	A		A
Approach Delay (s)	2.0	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	30.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	37	125	103	97	102	1	133	58	99	6	67	26
Future Volume (vph)	37	125	103	97	102	1	133	58	99	6	67	26
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	45	151	124	117	123	1	160	70	119	7	81	31

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	320	241	349	119
Volume Left (vph)	45	117	160	7
Volume Right (vph)	124	1	119	31
Hadj (s)	-0.17	0.13	-0.08	-0.11
Departure Headway (s)	5.6	6.0	5.7	6.2
Degree Utilization, x	0.50	0.40	0.55	0.20
Capacity (veh/h)	594	534	589	491
Control Delay (s)	14.0	13.0	15.5	10.7
Approach Delay (s)	14.0	13.0	15.5	10.7
Approach LOS	B	B	C	B

Intersection Summary			
Delay	13.9		
Level of Service	B		
Intersection Capacity Utilization	60.7%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	29	2	207	2	1	2	89	275	1	0	210	53
Future Volume (vph)	29	2	207	2	1	2	89	275	1	0	210	53
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.98			0.99		1.00	1.00			0.99	
Flpb, ped/bikes		1.00			1.00		0.99	1.00			1.00	
Frt		0.88			0.95		1.00	1.00			0.97	
Flt Protected		0.99			0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1513			1614		1663	1764			1708	
Flt Permitted		0.97			0.93		0.59	1.00			1.00	
Satd. Flow (perm)		1470			1532		1040	1764			1708	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	30	2	211	2	1	2	91	281	1	0	214	54
RTOR Reduction (vph)	0	170	0	0	2	0	0	0	0	0	11	0
Lane Group Flow (vph)	0	73	0	0	3	0	91	282	0	0	257	0
Confl. Peds. (#/hr)	15		12	5		8	12		5	8		15
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.6			8.6		33.4	33.4			33.4	
Effective Green, g (s)		9.6			9.6		34.4	34.4			34.4	
Actuated g/C Ratio		0.19			0.19		0.69	0.69			0.69	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		282			294		715	1213			1175	
v/s Ratio Prot								c0.16			0.15	
v/s Ratio Perm		c0.05			0.00		0.09					
v/c Ratio		0.26			0.01		0.13	0.23			0.22	
Uniform Delay, d1		17.2			16.4		2.7	2.9			2.9	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.5			0.0		0.4	0.4			0.4	
Delay (s)		17.7			16.4		3.0	3.3			3.3	
Level of Service		B			B		A	A			A	
Approach Delay (s)		17.7			16.4			3.3			3.3	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	212	708	112	82	556	142	248	78	66	252	64	101
Future Volume (vph)	212	708	112	82	556	142	248	78	66	252	64	101
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.92	1.00	0.98		1.00	0.97	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1441	3241	1153	1441	3167	1067	2698	1418		1441	1334	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1441	3241	1153	1441	3167	1067	2698	1418		1441	1334	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	228	761	120	88	598	153	267	84	71	271	69	109
RTOR Reduction (vph)	0	0	65	0	0	91	0	25	0	0	42	0
Lane Group Flow (vph)	228	761	55	88	598	62	267	130	0	271	136	0
Confl. Peds. (#/hr)	14		25	5		42	20		33	28		34
Confl. Bikes (#/hr)						11						5
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	20.4	34.7	34.7	10.8	25.1	25.1	16.3	16.3		23.8	23.8	
Effective Green, g (s)	21.9	36.7	36.7	12.3	27.1	27.1	17.8	17.8		25.3	25.3	
Actuated g/C Ratio	0.21	0.35	0.35	0.12	0.26	0.26	0.17	0.17		0.24	0.24	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	303	1142	406	170	824	277	461	242		350	324	
v/s Ratio Prot	c0.16	c0.23		0.06	0.19		c0.10	0.09		c0.19	0.10	
v/s Ratio Perm			0.05			0.06						
v/c Ratio	0.75	0.67	0.14	0.52	0.73	0.22	0.58	0.54		0.77	0.42	
Uniform Delay, d1	38.6	28.5	22.9	43.1	35.1	30.2	39.7	39.4		36.7	33.2	
Progression Factor	1.00	1.00	1.00	1.00	1.02	1.07	1.00	1.00		1.00	1.00	
Incremental Delay, d2	10.7	1.1	0.1	1.1	2.7	0.1	1.1	1.2		9.4	0.3	
Delay (s)	49.3	29.7	23.0	44.1	38.6	32.6	40.8	40.5		46.1	33.5	
Level of Service	D	C	C	D	D	C	D	D		D	C	
Approach Delay (s)		33.0			38.1			40.7			41.1	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	37.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	104.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	54	245	55	26	253	77	151	168	26	48	246	72
Future Volume (vph)	54	245	55	26	253	77	151	168	26	48	246	72
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		0.98	1.00		0.98	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	1900		1623	1885		1630	1928		1637	1887	
Flt Permitted	0.26	1.00		0.31	1.00		0.51	1.00		0.62	1.00	
Satd. Flow (perm)	449	1900		531	1885		877	1928		1063	1887	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	60	272	61	29	281	86	168	187	29	53	273	80
RTOR Reduction (vph)	0	14	0	0	19	0	0	6	0	0	12	0
Lane Group Flow (vph)	60	319	0	29	348	0	168	210	0	53	341	0
Confl. Peds. (#/hr)	11		21	21		11	14		8	8		14
Confl. Bikes (#/hr)			1			6			5			7
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	18.2	18.2		18.2	18.2		43.8	43.8		43.8	43.8	
Effective Green, g (s)	19.2	19.2		19.2	19.2		44.8	44.8		44.8	44.8	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.64	0.64		0.64	0.64	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	123	521		145	517		561	1233		680	1207	
v/s Ratio Prot		0.17			c0.18			0.11			0.18	
v/s Ratio Perm	0.13			0.05			c0.19			0.05		
v/c Ratio	0.49	0.61		0.20	0.67		0.30	0.17		0.08	0.28	
Uniform Delay, d1	21.3	22.2		19.5	22.6		5.6	5.1		4.8	5.5	
Progression Factor	0.70	0.72		1.00	1.00		0.44	0.46		1.00	1.00	
Incremental Delay, d2	2.9	2.0		0.7	3.5		1.3	0.3		0.2	0.6	
Delay (s)	17.7	18.1		20.2	26.1		3.7	2.6		5.0	6.1	
Level of Service	B	B		C	C		A	A		A	A	
Approach Delay (s)		18.0			25.6			3.1			6.0	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	91	728	280	399	450	0	0	286	133
Future Volume (vph)	0	0	0	91	728	280	399	450	0	0	286	133
Ideal Flow (vphpl)	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.93	1.00	1.00			1.00	0.94
Flpb, ped/bikes				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.99			1.00	1.00
Satd. Flow (prot)				1134	2350	977	1104	2606			1237	955
Flt Permitted				0.95	1.00	1.00	0.31	0.64			1.00	1.00
Satd. Flow (perm)				1134	2350	977	357	1694			1237	955
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	0	114	910	350	499	562	0	0	358	166
RTOR Reduction (vph)	0	0	0	0	0	142	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	114	910	208	324	738	0	0	358	109
Confl. Peds. (#/hr)				27		49	12					43
Confl. Bikes (#/hr)						5						4
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				29.0	29.0	29.0	33.0	33.0			18.0	18.0
Effective Green, g (s)				30.0	30.0	30.0	34.0	34.0			19.0	19.0
Actuated g/C Ratio				0.43	0.43	0.43	0.49	0.49			0.27	0.27
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				486	1007	418	301	979			335	259
v/s Ratio Prot				0.10	c0.39		c0.18	0.13			0.29	
v/s Ratio Perm						0.21	c0.34	0.24				0.11
v/c Ratio				0.23	0.90	0.50	1.08	0.75			1.07	0.42
Uniform Delay, d1				12.7	18.7	14.5	21.7	14.6			25.5	21.0
Progression Factor				1.00	1.00	1.00	0.67	0.56			1.04	1.12
Incremental Delay, d2				1.1	12.9	4.2	67.2	4.1			66.2	4.5
Delay (s)				13.8	31.6	18.7	81.7	12.3			92.7	28.1
Level of Service				B	C	B	F	B			F	C
Approach Delay (s)		0.0			26.8			33.4			72.2	
Approach LOS		A			C			C			E	

Intersection Summary			
HCM 2000 Control Delay	37.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	99.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	215	959	712	0	0	0	0	731	203	36	492	0
Future Volume (vph)	215	959	712	0	0	0	0	731	203	36	492	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.83					1.00	0.88	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1330	2660	1060					2755	1128	1463	1246	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.22	1.00	
Satd. Flow (perm)	1330	2660	1060					2755	1128	335	1246	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	256	1142	848	0	0	0	0	870	242	43	586	0
RTOR Reduction (vph)	0	0	101	0	0	0	0	0	13	0	0	0
Lane Group Flow (vph)	256	1142	747	0	0	0	0	870	229	43	586	0
Confl. Peds. (#/hr)			113						105	30		
Confl. Bikes (#/hr)			5						1			
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	31.5	31.5	31.5					29.5	29.5	29.5	29.5	
Effective Green, g (s)	33.0	33.0	33.0					31.0	31.0	31.0	31.0	
Actuated g/C Ratio	0.47	0.47	0.47					0.44	0.44	0.44	0.44	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	627	1254	499					1220	499	148	551	
v/s Ratio Prot	0.19	0.43						0.32			c0.47	
v/s Ratio Perm			c0.70						0.20	0.13		
v/c Ratio	0.41	0.91	1.50					0.71	0.46	0.29	1.06	
Uniform Delay, d1	12.1	17.1	18.5					15.9	13.6	12.5	19.5	
Progression Factor	1.30	1.20	1.26					1.00	1.00	0.45	0.44	
Incremental Delay, d2	0.2	1.3	224.2					3.6	3.0	3.7	51.5	
Delay (s)	15.9	21.8	247.5					19.4	16.7	9.3	60.1	
Level of Service	B	C	F					B	B	A	E	
Approach Delay (s)		106.4			0.0			18.8			56.6	
Approach LOS		F			A			B			E	

Intersection Summary			
HCM 2000 Control Delay	74.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.28		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	99.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	439	287	0	0	162	321	83	1650	36	0	0	0
Future Volume (vph)	439	287	0	0	162	321	83	1650	36	0	0	0
Ideal Flow (vphpl)	1800	2000	1800	1800	2000	1800	1800	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.94			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1647			1647	1215		3345	1276			
Flt Permitted	0.51	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	732	1647			1647	1215		3345	1276			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	488	319	0	0	180	357	92	1833	40	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	59	0	0	20	0	0	0
Lane Group Flow (vph)	488	319	0	0	180	298	0	1925	20	0	0	0
Confl. Peds. (#/hr)							6		20			
Confl. Bikes (#/hr)						1			1			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	29.0	29.0			16.0	16.0		33.0	33.0			
Effective Green, g (s)	30.0	31.0			17.0	17.0		35.0	35.0			
Actuated g/C Ratio	0.43	0.44			0.24	0.24		0.50	0.50			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	412	729			399	295		1672	638			
v/s Ratio Prot	c0.19	0.19			0.11	0.25		c0.58				
v/s Ratio Perm	c0.32								0.02			
v/c Ratio	1.18	0.44			0.45	1.01		1.15	0.03			
Uniform Delay, d1	20.6	13.5			22.5	26.5		17.5	8.9			
Progression Factor	0.93	1.03			1.31	1.45		0.31	0.00			
Incremental Delay, d2	99.5	1.3			3.4	53.2		68.8	0.0			
Delay (s)	118.6	15.3			33.0	91.5		74.2	0.0			
Level of Service	F	B			C	F		E	A			
Approach Delay (s)		77.7			71.9			72.7			0.0	
Approach LOS		E			E			E			A	

Intersection Summary			
HCM 2000 Control Delay	73.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	112.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	220	103	0	0	118	117	87	1424	10	0	0	0
Future Volume (vph)	220	103	0	0	118	117	87	1424	10	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.91				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.93			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1167	1228			1138			3711				
Flt Permitted	0.55	1.00			1.00			1.00				
Satd. Flow (perm)	671	1228			1138			3711				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	250	117	0	0	134	133	99	1618	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	1	0	0	0	0
Lane Group Flow (vph)	250	117	0	0	265	0	0	1727	0	0	0	0
Confl. Peds. (#/hr)									7			
Confl. Bikes (#/hr)						2			4			
Parking (#/hr)	6	6			6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	35.0	35.0			35.0			27.0				
Effective Green, g (s)	36.0	36.0			36.0			28.0				
Actuated g/C Ratio	0.51	0.51			0.51			0.40				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	345	631			585			1484				
v/s Ratio Prot		0.10			0.23			c0.47				
v/s Ratio Perm	c0.37											
v/c Ratio	0.72	0.19			0.45			1.16				
Uniform Delay, d1	13.2	9.1			10.8			21.0				
Progression Factor	2.00	2.06			1.15			0.46				
Incremental Delay, d2	9.4	0.5			2.5			76.9				
Delay (s)	35.7	19.3			14.9			86.7				
Level of Service	D	B			B			F				
Approach Delay (s)		30.4			14.9			86.7			0.0	
Approach LOS		C			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	69.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	82.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	224	0	0	216	80	159	1230	54	0	0	0
Future Volume (vph)	203	224	0	0	216	80	159	1230	54	0	0	0
Ideal Flow (vphpl)	1800	1600	1600	1600	1600	1600	1600	1800	1600	1000	1800	1800
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.91				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.98	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1434	1412			1169		1207	4017				
Flt Permitted	0.51	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	769	1412			1169		1207	4017				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	226	249	0	0	240	89	177	1367	60	0	0	0
RTOR Reduction (vph)	0	0	0	0	2	0	0	7	0	0	0	0
Lane Group Flow (vph)	226	249	0	0	327	0	177	1420	0	0	0	0
Confl. Peds. (#/hr)	28					28	2		2			
Confl. Bikes (#/hr)						8			3			
Parking (#/hr)					6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	39.0	39.0			39.0		23.0	23.0				
Effective Green, g (s)	40.0	40.0			40.0		24.0	24.0				
Actuated g/C Ratio	0.57	0.57			0.57		0.34	0.34				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	439	806			668		413	1377				
v/s Ratio Prot		0.18			0.28		0.15	c0.35				
v/s Ratio Perm	c0.29											
v/c Ratio	0.51	0.31			0.49		0.43	1.03				
Uniform Delay, d1	9.1	7.8			8.9		17.7	23.0				
Progression Factor	1.09	0.99			0.86		0.63	0.72				
Incremental Delay, d2	3.6	0.8			2.2		0.3	17.3				
Delay (s)	13.6	8.5			9.9		11.4	33.8				
Level of Service	B	A			A		B	C				
Approach Delay (s)		10.9			9.9			31.3			0.0	
Approach LOS		B			A			C			A	

Intersection Summary			
HCM 2000 Control Delay	24.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1158	174	993	1370	0	0	0	0
Future Volume (vph)	0	0	0	0	1158	174	993	1370	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.88	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3597	1023	1066	3452				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3597	1023	1066	3452				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	0	0	0	1347	202	1155	1593	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	13	12	12	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1347	189	739	1985	0	0	0	0
Confl. Peds. (#/hr)						96						
Confl. Bikes (#/hr)						17						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					29.5	29.5	31.5	31.5				
Effective Green, g (s)					31.0	31.0	33.0	33.0				
Actuated g/C Ratio					0.44	0.44	0.47	0.47				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1592	453	502	1627				
v/s Ratio Prot					c0.37		c0.69	0.58				
v/s Ratio Perm						0.18						
v/c Ratio					0.85	0.42	1.47	1.22				
Uniform Delay, d1					17.4	13.3	18.5	18.5				
Progression Factor					1.04	1.12	0.76	0.77				
Incremental Delay, d2					2.7	1.3	215.6	100.8				
Delay (s)					20.7	16.2	229.6	114.9				
Level of Service					C	B	F	F				
Approach Delay (s)		0.0			20.1			146.3			0.0	
Approach LOS		A			C			F			A	

Intersection Summary			
HCM 2000 Control Delay	100.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	114.8%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	912	1316	0	0	0	0	0	1472	664	0	0	0
Future Volume (vph)	912	1316	0	0	0	0	0	1472	664	0	0	0
Ideal Flow (vphpl)	1600	1600	1700	1700	1700	1700	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.95			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1192	3606						3854	1064			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1192	3606						3854	1064			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1013	1462	0	0	0	0	0	1636	738	0	0	0
RTOR Reduction (vph)	18	18	0	0	0	0	0	0	8	0	0	0
Lane Group Flow (vph)	630	1809	0	0	0	0	0	1636	730	0	0	0
Confl. Peds. (#/hr)	43								28			
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	28.0	28.0						33.0	33.0			
Effective Green, g (s)	29.0	29.0						35.0	35.0			
Actuated g/C Ratio	0.41	0.41						0.50	0.50			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	493	1493						1927	532			
v/s Ratio Prot	c0.53	0.50						0.42				
v/s Ratio Perm									c0.69			
v/c Ratio	1.28	1.21						0.85	1.37			
Uniform Delay, d1	20.5	20.5						15.2	17.5			
Progression Factor	0.87	0.87						1.00	1.00			
Incremental Delay, d2	128.7	96.8						4.9	179.1			
Delay (s)	146.6	114.6						20.1	196.6			
Level of Service	F	F						C	F			
Approach Delay (s)		123.0			0.0			75.0			0.0	
Approach LOS		F			A			E			A	

Intersection Summary			
HCM 2000 Control Delay	99.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	126.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	516	70	43	195	0	0	0	0	221	1085	556
Future Volume (vph)	0	516	70	43	195	0	0	0	0	221	1085	556
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2756			1782						2992	1272
Flt Permitted		1.00			0.83						0.99	1.00
Satd. Flow (perm)		2756			1498						2992	1272
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	573	78	48	217	0	0	0	0	246	1206	618
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	636	0	0	265	0	0	0	0	0	1452	618
Confl. Peds. (#/hr)			12	12						3		13
Confl. Bikes (#/hr)			6									1
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		26.8			26.8						34.4	27.4
Effective Green, g (s)		27.8			27.8						35.4	28.4
Actuated g/C Ratio		0.40			0.40						0.51	0.41
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1094			594						1513	516
v/s Ratio Prot		c0.23									c0.49	
v/s Ratio Perm					0.18							c0.49
v/c Ratio		0.58			0.45						0.96	1.20
Uniform Delay, d1		16.5			15.5						16.6	20.8
Progression Factor		1.00			0.77						1.00	1.00
Incremental Delay, d2		2.3			1.7						15.3	106.6
Delay (s)		18.8			13.6						32.0	127.4
Level of Service		B			B						C	F
Approach Delay (s)		18.8			13.6			0.0			60.4	
Approach LOS		B			B			A			E	

Intersection Summary			
HCM 2000 Control Delay	47.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	302	179	59	194	0	0	0	0	34	1032	84
Future Volume (vph)	0	302	179	59	194	0	0	0	0	34	1032	84
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.93
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1699			1779						4170	1118
Flt Permitted		1.00			0.70						1.00	1.00
Satd. Flow (perm)		1699			1261						4170	1118
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	336	199	66	216	0	0	0	0	38	1147	93
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	518	0	0	282	0	0	0	0	0	1185	93
Confl. Peds. (#/hr)			2	2						73		27
Confl. Bikes (#/hr)			5									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.5	23.5
Effective Green, g (s)		32.0			32.0						32.0	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		776			576						1906	391
v/s Ratio Prot		c0.30									c0.28	
v/s Ratio Perm					0.22							0.08
v/c Ratio		0.67			0.49						0.62	0.24
Uniform Delay, d1		14.8			13.3						14.4	16.1
Progression Factor		1.00			1.23						0.26	0.33
Incremental Delay, d2		4.5			2.3						0.6	0.5
Delay (s)		19.4			18.7						4.3	5.8
Level of Service		B			B						A	A
Approach Delay (s)		19.4			18.7			0.0			4.4	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	338	152	87	240	0	0	0	0	126	940	212
Future Volume (vph)	0	338	152	87	240	0	0	0	0	126	940	212
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.97
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1220	1648	1535						4152	1171
Flt Permitted		1.00	1.00	0.41	1.00						0.99	1.00
Satd. Flow (perm)		1641	1220	717	1535						4152	1171
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	376	169	97	267	0	0	0	0	140	1044	236
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	376	124	97	267	0	0	0	0	0	1184	236
Confl. Peds. (#/hr)			16	16						6		
Confl. Bikes (#/hr)			12									5
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases			4	8								5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						31.8	24.8
Effective Green, g (s)		30.8	30.8	30.8	30.8						32.8	25.8
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.47	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		722	536	315	675						1945	431
v/s Ratio Prot		c0.23			0.17						c0.29	
v/s Ratio Perm			0.10	0.14								0.20
v/c Ratio		0.52	0.23	0.31	0.40						0.61	0.55
Uniform Delay, d1		14.2	12.2	12.7	13.3						13.8	17.5
Progression Factor		1.00	1.00	1.07	1.09						0.38	0.49
Incremental Delay, d2		2.7	1.0	2.3	1.6						1.1	3.9
Delay (s)		16.9	13.2	15.9	16.1						6.3	12.5
Level of Service		B	B	B	B						A	B
Approach Delay (s)		15.8			16.0			0.0			7.3	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	451	1678	0	0	0	0	0	675	486
Future Volume (vph)	0	0	0	451	1678	0	0	0	0	0	675	486
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1400	1800	1800	1800	1600	1600	1600
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.86
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1077	3185						3726	1002
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1077	3185						3726	1002
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	501	1864	0	0	0	0	0	750	540
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	481	1884	0	0	0	0	0	750	532
Confl. Peds. (#/hr)				52								126
Confl. Bikes (#/hr)												2
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				27.0	27.0						35.0	35.0
Effective Green, g (s)				28.0	28.0						36.0	36.0
Actuated g/C Ratio				0.40	0.40						0.51	0.51
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				430	1274						1916	515
v/s Ratio Prot				0.45	c0.59						0.20	
v/s Ratio Perm												c0.53
v/c Ratio				1.12	1.48						0.39	1.03
Uniform Delay, d1				21.0	21.0						10.3	17.0
Progression Factor				0.87	0.89						0.42	0.43
Incremental Delay, d2				56.7	215.9						0.5	45.4
Delay (s)				75.1	234.5						4.8	52.7
Level of Service				E	F						A	D
Approach Delay (s)		0.0			202.1			0.0			24.9	
Approach LOS		A			F			A			C	

Intersection Summary			
HCM 2000 Control Delay	139.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	132.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1866	1024	0	0	0	0	0	0	397	824	0
Future Volume (vph)	0	1866	1024	0	0	0	0	0	0	397	824	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		1.00	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.97	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4798	1035							1327	2891	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4798	1035							1327	2891	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2073	1138	0	0	0	0	0	0	441	916	0
RTOR Reduction (vph)	0	21	21	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2598	571	0	0	0	0	0	0	441	916	0
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)			8									
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		35.5	35.5							25.5	25.5	
Effective Green, g (s)		37.0	37.0							27.0	27.0	
Actuated g/C Ratio		0.53	0.53							0.39	0.39	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2536	547							511	1115	
v/s Ratio Prot		0.54								c0.33	0.32	
v/s Ratio Perm			c0.55									
v/c Ratio		1.02	1.04							0.86	0.82	
Uniform Delay, d1		16.5	16.5							19.8	19.3	
Progression Factor		1.00	1.00							0.79	0.78	
Incremental Delay, d2		24.4	50.3							14.0	5.4	
Delay (s)		40.9	66.8							29.5	20.4	
Level of Service		D	E							C	C	
Approach Delay (s)		45.7			0.0			0.0			23.4	
Approach LOS		D			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	39.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	153.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	0	1	4	0	0	6
Future Volume (vph)	0	1	4	0	0	6
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.0	4.0			4.0
Lane Util. Factor		0.95	0.95			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		3353	3353			1526
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		3353	3353			1526
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1	4	0	0	7
RTOR Reduction (vph)	0	0	0	0	0	4
Lane Group Flow (vph)	0	1	4	0	0	3
Turn Type		NA	NA			Perm
Protected Phases		4	8			
Permitted Phases						6
Actuated Green, G (s)		16.0	16.0			16.0
Effective Green, g (s)		16.0	16.0			16.0
Actuated g/C Ratio		0.40	0.40			0.40
Clearance Time (s)		4.0	4.0			4.0
Lane Grp Cap (vph)		1341	1341			610
v/s Ratio Prot		0.00	c0.00			
v/s Ratio Perm						c0.00
v/c Ratio		0.00	0.00			0.00
Uniform Delay, d1		7.2	7.2			7.2
Progression Factor		1.00	1.00			1.00
Incremental Delay, d2		0.0	0.0			0.0
Delay (s)		7.2	7.2			7.2
Level of Service		A	A			A
Approach Delay (s)		7.2	7.2		7.2	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	2	1129	18	6	5	1128	0	11	0	6	11	0
Future Volume (Veh/h)	2	1129	18	6	5	1128	0	11	0	6	11	0
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	1254	20	0	6	1253	0	12	0	7	12	0
Pedestrians		15				4						4
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		1				0						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		550										
pX, platoon unblocked				0.00	0.79			0.79	0.79	0.79	0.79	0.79
vC, conflicting volume	1257			0	1274			2028	2537	641	1911	2547
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1257			0	814			1770	2414	13	1621	2426
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			60	100	99	77	100
cM capacity (veh/h)	547			0	639			30	25	837	53	25

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	629	647	6	626	626	19	119
Volume Left	2	0	6	0	0	12	12
Volume Right	0	20	0	0	0	7	107
cSH	547	1700	639	1700	1700	47	243
Volume to Capacity	0.00	0.38	0.01	0.37	0.37	0.41	0.49
Queue Length 95th (ft)	0	0	1	0	0	36	62
Control Delay (s)	0.1	0.0	10.7	0.0	0.0	127.9	33.4
Lane LOS	A		B			F	D
Approach Delay (s)	0.1		0.1			127.9	33.4
Approach LOS						F	D

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	51.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	96
Future Volume (Veh/h)	96
Sign Control	
Grade	
Peak Hour Factor	0.90
Hourly flow rate (vph)	107
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	646
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	646
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	74
cM capacity (veh/h)	408

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS Dr. (E)

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	4	209	940	1117	100	0	18
Future Volume (Veh/h)	4	209	940	1117	100	0	18
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	249	1119	1330	119	0	21
Pedestrians			10				
Lane Width (ft)			12.0				
Walking Speed (ft/s)			4.0				
Percent Blockage			1				
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			899				
pX, platoon unblocked	0.00					0.85	
vC, conflicting volume	0	1449				2447	734
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1449				2353	734
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	46				100	94
cM capacity (veh/h)	0	463				12	359

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	249	560	560	887	562	21
Volume Left	249	0	0	0	0	0
Volume Right	0	0	0	0	119	21
cSH	463	1700	1700	1700	1700	359
Volume to Capacity	0.54	0.33	0.33	0.52	0.33	0.06
Queue Length 95th (ft)	78	0	0	0	0	5
Control Delay (s)	21.4	0.0	0.0	0.0	0.0	15.6
Lane LOS	C					C
Approach Delay (s)	3.9			0.0		15.6
Approach LOS						C

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	41	39	862	1158	1	1	33
Future Volume (Veh/h)	41	39	862	1158	1	1	33
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	43	947	1273	1	1	36
Pedestrians			9			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	1278				1837	650
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1278				1837	650
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	92				98	91
cM capacity (veh/h)	0	537				62	407

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	43	474	474	849	425	37
Volume Left	43	0	0	0	0	1
Volume Right	0	0	0	0	1	36
cSH	537	1700	1700	1700	1700	354
Volume to Capacity	0.08	0.28	0.28	0.50	0.25	0.10
Queue Length 95th (ft)	6	0	0	0	0	9
Control Delay (s)	12.3	0.0	0.0	0.0	0.0	16.4
Lane LOS	B					C
Approach Delay (s)	0.5			0.0		16.4
Approach LOS						C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	54.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina/Mission & Embarcadero/E Mission / Sea View Ave 12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	19	7	2	0	2	89	1	7	2	26	2	5
Future Volume (vph)	19	7	2	0	2	89	1	7	2	26	2	5
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	29	11	3	0	3	137	2	11	3	40	3	8

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	43	140	16	51
Volume Left (vph)	29	0	2	40
Volume Right (vph)	3	137	3	8
Hadj (s)	0.13	-0.55	-0.05	0.10
Departure Headway (s)	4.3	3.5	4.3	4.4
Degree Utilization, x	0.05	0.14	0.02	0.06
Capacity (veh/h)	814	992	798	777
Control Delay (s)	7.5	7.1	7.3	7.7
Approach Delay (s)	7.5	7.1	7.3	7.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.3		
Level of Service	A		
Intersection Capacity Utilization	24.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: HS Driveway/Belle S & Mission 12/12/2016

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (veh/h)	6	198	59	0	4	0	120	13	18	2	5	5
Future Volume (Veh/h)	6	198	59	0	4	0	120	13	18	2	5	5
Sign Control			Free				Free			Stop		
Grade			0%				0%			0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	220	66	0	0	0	133	14	20	2	6	6
Pedestrians							2					
Lane Width (ft)							12.0					
Walking Speed (ft/s)							4.0					
Percent Blockage							0					
Right turn flare (veh)												
Median type			None				None					
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked	0.00				0.00							
vC, conflicting volume	0	147			0	66			649	653	68	655
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	147			0	66			649	653	68	655
tC, single (s)	0.0	4.1			0.0	4.1			7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	0.0	2.2			0.0	2.2			3.5	4.0	3.3	3.5
p0 queue free %	0	85			0	100			94	99	99	98
cM capacity (veh/h)	0	1435			0	1536			333	327	994	331

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	286	147	28	12
Volume Left	220	0	20	6
Volume Right	0	14	6	0
cSH	1435	1536	388	331
Volume to Capacity	0.15	0.00	0.07	0.04
Queue Length 95th (ft)	14	0	6	3
Control Delay (s)	6.4	0.0	15.0	16.3
Lane LOS	A		B	C
Approach Delay (s)	6.4	0.0	15.0	16.3
Approach LOS			B	C

Intersection Summary			
Average Delay	5.2		
Intersection Capacity Utilization	36.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: HS Driveway/Belle S & Mission
12/12/2016

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (veh/h)	5	0
Future Volume (Veh/h)	5	0
Sign Control	Stop	
Grade	0%	
Peak Hour Factor	0.90	0.90
Hourly flow rate (vph)	6	0
Pedestrians		
Lane Width (ft)		
Walking Speed (ft/s)		
Percent Blockage		
Right turn flare (veh)		
Median type		
Median storage veh)		
Upstream signal (ft)		
pX, platoon unblocked		
vC, conflicting volume	646	140
vC1, stage 1 conf vol		
vC2, stage 2 conf vol		
vCu, unblocked vol	646	140
tC, single (s)	6.5	6.2
tC, 2 stage (s)		
tF (s)	4.0	3.3
p0 queue free %	98	100
cM capacity (veh/h)	330	908

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
51: Mission & Belle N
12/12/2016

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	63	121	0	0	12
Future Volume (Veh/h)	6	63	121	0	0	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	70	134	0	0	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	134				218	134
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	134				218	134
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1451				766	915

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	77	134	13
Volume Left	7	0	0
Volume Right	0	0	13
cSH	1451	1700	915
Volume to Capacity	0.00	0.08	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.7	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	0.7	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	18.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Mission & Alice
12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	19	0	284	136	0	4	102
Future Volume (Veh/h)	19	0	284	136	0	4	102
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Hourly flow rate (vph)	0	0	516	247	0	7	185
Pedestrians			6			11	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			1	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	258				774	264
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	258				774	264
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				98	76
cM capacity (veh/h)	0	1295				363	764

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	516	247	192
Volume Left	0	0	7
Volume Right	0	0	185
cSH	1295	1700	734
Volume to Capacity	0.00	0.15	0.26
Queue Length 95th (ft)	0	0	26
Control Delay (s)	0.0	0.0	11.6
Lane LOS			B
Approach Delay (s)	0.0	0.0	11.6
Approach LOS			B

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	44.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Mission & Park
12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	6	22	330	258	12	0	63
Future Volume (Veh/h)	6	22	330	258	12	0	63
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	0	34	508	397	18	0	97
Pedestrians				14		32	
Lane Width (ft)				12.0		12.0	
Walking Speed (ft/s)				4.0		4.0	
Percent Blockage				1		3	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	447				1028	438
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	447				1028	438
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	84
cM capacity (veh/h)	0	1084				242	602

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	542	415	97
Volume Left	34	0	0
Volume Right	0	18	97
cSH	1084	1700	602
Volume to Capacity	0.03	0.24	0.16
Queue Length 95th (ft)	2	0	14
Control Delay (s)	0.9	0.0	12.1
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	12.1
Approach LOS			B

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	49.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	31	197	104	162	179	1	117	38	154	8	134	77
Future Volume (vph)	31	197	104	162	179	1	117	38	154	8	134	77
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	41	263	139	216	239	1	156	51	205	11	179	103

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	443	456	412	293
Volume Left (vph)	41	216	156	11
Volume Right (vph)	139	1	205	103
Hadj (s)	-0.14	0.13	-0.19	-0.17
Departure Headway (s)	8.8	9.1	8.8	9.4
Degree Utilization, x	1.09	1.15	1.00	0.76
Capacity (veh/h)	398	398	412	378
Control Delay (s)	99.5	122.5	75.5	37.1
Approach Delay (s)	99.5	122.5	75.5	37.1
Approach LOS	F	F	F	E

Intersection Summary			
Delay	88.5		
Level of Service	F		
Intersection Capacity Utilization	85.4%	ICU Level of Service	E
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	5	137	1	4	2	155	280	8	7	292	113
Future Volume (vph)	35	5	137	1	4	2	155	280	8	7	292	113
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.99			0.99		1.00	1.00			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	
Frt		0.90			0.97		1.00	1.00			0.96	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1541			1678		1675	1757			1686	
Flt Permitted		0.94			0.98		0.50	1.00			1.00	
Satd. Flow (perm)		1461			1650		881	1757			1680	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	42	6	165	1	5	2	187	337	10	8	352	136
RTOR Reduction (vph)	0	136	0	0	2	0	0	1	0	0	15	0
Lane Group Flow (vph)	0	77	0	0	6	0	187	346	0	0	481	0
Confl. Peds. (#/hr)	14		2			12	2			12		14
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		7.7			7.7		34.3	34.3			34.3	
Effective Green, g (s)		8.7			8.7		35.3	35.3			35.3	
Actuated g/C Ratio		0.17			0.17		0.71	0.71			0.71	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		254			287		621	1240			1186	
v/s Ratio Prot								0.20				
v/s Ratio Perm		c0.05			0.00		0.21				c0.29	
v/c Ratio		0.30			0.02		0.30	0.28			0.41	
Uniform Delay, d1		18.0			17.1		2.7	2.7			3.0	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.7			0.0		1.2	0.6			1.0	
Delay (s)		18.7			17.2		4.0	3.3			4.1	
Level of Service		B			B		A	A			A	
Approach Delay (s)		18.7			17.2			3.5			4.1	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.38		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	226	878	22	22	968	270	76	23	35	200	36	175
Future Volume (vph)	226	878	22	22	968	270	76	23	35	200	36	175
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.85	1.00	0.97		1.00	0.92	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1427	3210	1140	1427	3136	971	2698	1367		1413	1193	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1427	3210	1140	1427	3136	971	2698	1367		1413	1193	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	243	944	24	24	1041	290	82	25	38	215	39	188
RTOR Reduction (vph)	0	0	13	0	0	81	0	33	0	0	135	0
Lane Group Flow (vph)	243	944	11	24	1041	209	82	30	0	215	92	0
Confl. Peds. (#/hr)			23			98	2		41	20		80
Confl. Bikes (#/hr)			5			7						5
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	20.1	49.4	49.4	5.8	35.1	35.1	13.1	13.1		21.6	21.6	
Effective Green, g (s)	21.6	51.4	51.4	7.3	37.1	37.1	14.6	14.6		23.1	23.1	
Actuated g/C Ratio	0.20	0.47	0.47	0.07	0.34	0.34	0.13	0.13		0.21	0.21	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	284	1522	540	96	1073	332	363	184		301	254	
v/s Ratio Prot	c0.17	0.29		0.02	c0.33		c0.03	0.02		c0.15	0.08	
v/s Ratio Perm			0.01			0.22						
v/c Ratio	0.86	0.62	0.02	0.25	0.97	0.63	0.23	0.16		0.71	0.36	
Uniform Delay, d1	41.9	21.2	15.1	48.0	35.1	29.9	41.9	41.5		39.6	36.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.01	1.00	1.00		1.00	1.00	
Incremental Delay, d2	22.1	0.6	0.0	0.5	20.5	2.7	0.1	0.2		6.5	0.3	
Delay (s)	64.0	21.8	15.1	48.5	55.7	32.8	42.0	41.7		46.1	36.7	
Level of Service	E	C	B	D	E	C	D	D		D	D	
Approach Delay (s)		30.1			50.7			41.8			41.3	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	108.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	294	53	43	311	45	177	167	11	58	313	89
Future Volume (vph)	43	294	53	43	311	45	177	167	11	58	313	89
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1500	1500	1500	1500	1500	1500
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		1.00	1.00		0.95	1.00	
Satd. Flow (prot)	1318	1575		1322	1545		1307	1468		1243	1426	
Flt Permitted	0.21	1.00		0.23	1.00		0.41	1.00		0.61	1.00	
Satd. Flow (perm)	294	1575		315	1545		534	1468		805	1426	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	52	354	64	52	375	54	213	201	13	70	377	107
RTOR Reduction (vph)	0	9	0	0	8	0	0	3	0	0	15	0
Lane Group Flow (vph)	52	409	0	52	421	0	213	211	0	70	469	0
Confl. Peds. (#/hr)	8		4	4		8	2					2
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.0	20.0		20.0	20.0		42.0	42.0		42.0	42.0	
Effective Green, g (s)	21.0	21.0		21.0	21.0		43.0	43.0		43.0	43.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.61	0.61		0.61	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	88	472		94	463		328	901		494	875	
v/s Ratio Prot		0.26			c0.27			0.14			0.33	
v/s Ratio Perm	0.18			0.17			c0.40			0.09		
v/c Ratio	0.59	0.87		0.55	0.91		0.65	0.23		0.14	0.54	
Uniform Delay, d1	20.8	23.2		20.6	23.6		8.7	6.1		5.7	7.8	
Progression Factor	0.58	0.57		1.00	1.00		1.50	1.60		1.00	1.00	
Incremental Delay, d2	25.3	18.4		21.4	24.5		4.3	0.1		0.6	2.4	
Delay (s)	37.4	31.7		42.0	48.1		17.3	9.9		6.3	10.1	
Level of Service	D	C		D	D		B	A		A	B	
Approach Delay (s)		32.4			47.4			13.6			9.6	
Approach LOS		C			D			B			A	

Intersection Summary			
HCM 2000 Control Delay	25.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	318	926	94	426	392	0	0	180	111
Future Volume (vph)	0	0	0	318	926	94	426	392	0	0	180	111
Ideal Flow (vphpl)	1600	1600	1600	1500	1600	1500	1500	1600	1600	1600	1600	1500
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.85	1.00	1.00			1.00	0.86
Flpb, ped/bikes				1.00	1.00	1.00	0.99	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.98			1.00	1.00
Satd. Flow (prot)				1151	2543	903	1115	2798			1365	908
Flt Permitted				0.95	1.00	1.00	0.55	0.72			1.00	1.00
Satd. Flow (perm)				1151	2543	903	647	2062			1365	908
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	393	1143	116	526	484	0	0	222	137
RTOR Reduction (vph)	0	0	0	0	0	73	0	0	0	0	0	49
Lane Group Flow (vph)	0	0	0	393	1143	43	263	747	0	0	222	88
Confl. Peds. (#/hr)				14		121	17					118
Confl. Bikes (#/hr)						6						4
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				25.0	25.0	25.0	37.0	37.0			25.0	25.0
Effective Green, g (s)				26.0	26.0	26.0	38.0	38.0			26.0	26.0
Actuated g/C Ratio				0.37	0.37	0.37	0.54	0.54			0.37	0.37
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				427	944	335	411	1214			507	337
v/s Ratio Prot				0.34	c0.45		c0.08	0.08			0.16	
v/s Ratio Perm						0.05	c0.26	0.25				0.10
v/c Ratio				0.92	1.21	0.13	0.64	0.62			0.44	0.26
Uniform Delay, d1				21.0	22.0	14.5	13.9	11.0			16.5	15.3
Progression Factor				1.00	1.00	1.00	1.00	1.00			0.85	0.87
Incremental Delay, d2				27.5	104.8	0.8	7.4	2.3			2.4	1.6
Delay (s)				48.6	126.8	15.3	21.3	13.3			16.4	14.9
Level of Service				D	F	B	C	B			B	B
Approach Delay (s)		0.0			100.3			15.4			15.9	
Approach LOS		A			F			B			B	

Intersection Summary			
HCM 2000 Control Delay	61.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	120.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	174	877	372	0	0	0	0	602	343	15	465	0
Future Volume (vph)	174	877	372	0	0	0	0	602	343	15	465	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.87					1.00	0.92	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1228	2455	1019					2543	1078	1364	1161	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.23	1.00	
Satd. Flow (perm)	1228	2455	1019					2543	1078	323	1161	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	202	1020	433	0	0	0	0	700	399	17	541	0
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	50	0	0	0
Lane Group Flow (vph)	202	1020	386	0	0	0	0	700	349	17	541	0
Confl. Peds. (#/hr)	3		88						70	20		
Confl. Bikes (#/hr)			3						5			
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	3%	3%	3%
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	40.5	40.5	40.5					21.0	21.0	21.0	21.0	
Effective Green, g (s)	42.0	42.0	42.0					22.5	22.5	22.5	22.5	
Actuated g/C Ratio	0.60	0.60	0.60					0.32	0.32	0.32	0.32	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	731	1462	607					811	344	103	370	
v/s Ratio Prot	0.16	c0.42						0.28			c0.47	
v/s Ratio Perm			0.38						0.32	0.05		
v/c Ratio	0.28	0.70	0.64					0.86	1.01	0.17	1.46	
Uniform Delay, d1	6.9	9.9	9.3					22.6	24.0	17.2	24.0	
Progression Factor	1.00	1.00	1.00					1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.9	2.8	5.0					11.8	52.0	3.4	222.4	
Delay (s)	7.8	12.6	14.3					34.3	76.0	20.7	246.4	
Level of Service	A	B	B					C	E	C	F	
Approach Delay (s)		12.5			0.0			49.4			239.5	
Approach LOS		B			A			D			F	

Intersection Summary			
HCM 2000 Control Delay	63.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	70.5	Sum of lost time (s)	6.0
Intersection Capacity Utilization	120.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	495	258	0	0	167	318	75	1470	38	0	0	0
Future Volume (vph)	495	258	0	0	167	318	75	1470	38	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.92			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1482			1482	1215		2790	1081			
Flt Permitted	0.46	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	660	1482			1482	1215		2790	1081			
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	576	300	0	0	194	370	87	1709	44	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	61	0	0	23	0	0	0
Lane Group Flow (vph)	576	300	0	0	194	309	0	1796	21	0	0	0
Confl. Peds. (#/hr)						14	9		27			
Confl. Bikes (#/hr)						1			1			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Parking (#/hr)								2	2			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	31.0	31.0			14.0	14.0		31.0	31.0			
Effective Green, g (s)	32.0	33.0			15.0	15.0		33.0	33.0			
Actuated g/C Ratio	0.46	0.47			0.21	0.21		0.47	0.47			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	451	698			317	260		1315	509			
v/s Ratio Prot	c0.27	0.20			0.13	0.25		c0.64				
v/s Ratio Perm	c0.31								0.02			
v/c Ratio	1.28	0.43			0.61	1.19		1.37	0.04			
Uniform Delay, d1	20.1	12.3			24.9	27.5		18.5	10.0			
Progression Factor	0.63	0.46			0.98	1.00		0.92	1.36			
Incremental Delay, d2	135.8	1.3			5.3	105.6		165.1	0.0			
Delay (s)	148.4	6.9			29.7	133.0		182.0	13.5			
Level of Service	F	A			C	F		F	B			
Approach Delay (s)		99.9			97.5			178.0			0.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	143.3	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	116.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	82	0	0	126	72	140	1518	10	0	0	0
Future Volume (vph)	204	82	0	0	126	72	140	1518	10	0	0	0
Ideal Flow (vphpl)	1700	1700	1800	1800	1700	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	0.99	1.00			1.00			1.00				
Frt	1.00	1.00			0.95			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1261	1335			1257			2742				
Flt Permitted	0.50	1.00			1.00			1.00				
Satd. Flow (perm)	661	1335			1257			2742				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	227	91	0	0	140	80	156	1687	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	20	0	0	1	0	0	0	0
Lane Group Flow (vph)	227	91	0	0	200	0	0	1853	0	0	0	0
Confl. Peds. (#/hr)	8					8	1		4			
Confl. Bikes (#/hr)						9			1			
Parking (#/hr)	2	2			2	2	2	2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	19.0	19.0			19.0			43.0				
Effective Green, g (s)	20.0	20.0			20.0			44.0				
Actuated g/C Ratio	0.29	0.29			0.29			0.63				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	188	381			359			1723				
v/s Ratio Prot		0.07			0.16			c0.68				
v/s Ratio Perm	c0.34											
v/c Ratio	1.21	0.24			0.56			1.08				
Uniform Delay, d1	25.0	19.2			21.2			13.0				
Progression Factor	0.78	0.89			0.97			0.62				
Incremental Delay, d2	119.2	0.9			6.1			35.3				
Delay (s)	138.6	18.0			26.7			43.4				
Level of Service	F	B			C			D				
Approach Delay (s)		104.1			26.7			43.4			0.0	
Approach LOS		F			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	49.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	177	0	0	349	60	95	1359	66	0	0	0
Future Volume (vph)	143	177	0	0	349	60	95	1359	66	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1366	1500			1300		1282	2493				
Flt Permitted	0.19	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	274	1500			1300		1282	2493				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	197	0	0	388	67	106	1510	73	0	0	0
RTOR Reduction (vph)	0	0	0	0	9	0	0	5	0	0	0	0
Lane Group Flow (vph)	159	197	0	0	446	0	106	1578	0	0	0	0
Confl. Peds. (#/hr)	23					23			2			
Confl. Bikes (#/hr)						13			3			
Parking (#/hr)					2	2		2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	20.0	20.0			20.0		42.0	42.0				
Effective Green, g (s)	21.0	21.0			21.0		43.0	43.0				
Actuated g/C Ratio	0.30	0.30			0.30		0.61	0.61				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	82	450			390		787	1531				
v/s Ratio Prot		0.13			0.34		0.08	c0.63				
v/s Ratio Perm	c0.58											
v/c Ratio	1.94	0.44			1.14		0.13	1.03				
Uniform Delay, d1	24.5	19.7			24.5		5.7	13.5				
Progression Factor	0.73	0.81			1.10		0.31	0.43				
Incremental Delay, d2	453.9	2.3			88.5		0.0	16.7				
Delay (s)	471.8	18.3			115.5		1.8	22.6				
Level of Service	F	B			F		A	C				
Approach Delay (s)		220.9			115.5			21.3			0.0	
Approach LOS		F			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	66.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1162	166	1119	1406	0	0	0	0
Future Volume (vph)	0	0	0	0	1162	166	1119	1406	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1500	1500	1500	1500	1800	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.94	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3308	1004	990	3194				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3308	1004	990	3194				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	0	1367	195	1316	1654	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	15	10	10	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1367	180	687	2263	0	0	0	0
Confl. Peds. (#/hr)						42						
Confl. Bikes (#/hr)						6						
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					22.5	22.5	38.5	38.5				
Effective Green, g (s)					24.0	24.0	40.0	40.0				
Actuated g/C Ratio					0.34	0.34	0.57	0.57				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1134	344	565	1825				
v/s Ratio Prot					c0.41		0.69	c0.71				
v/s Ratio Perm						0.18						
v/c Ratio					1.21	0.52	1.22	1.24				
Uniform Delay, d1					23.0	18.4	15.0	15.0				
Progression Factor					0.82	0.79	1.33	1.32				
Incremental Delay, d2					94.9	1.6	98.9	108.5				
Delay (s)					113.9	16.1	118.8	128.2				
Level of Service					F	B	F	F				
Approach Delay (s)		0.0			101.7			126.0			0.0	
Approach LOS		A			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	117.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	122.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	895	965	0	0	0	0	0	1740	569	0	0	0
Future Volume (vph)	895	965	0	0	0	0	0	1740	569	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1600	1600	1600	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.96			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1254	3775						3817	1069			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1254	3775						3817	1069			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	994	1072	0	0	0	0	0	1933	632	0	0	0
RTOR Reduction (vph)	17	17	0	0	0	0	0	0	22	0	0	0
Lane Group Flow (vph)	510	1522	0	0	0	0	0	1933	610	0	0	0
Confl. Peds. (#/hr)									17			
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	30.0	30.0						31.0	31.0			
Effective Green, g (s)	31.0	31.0						33.0	33.0			
Actuated g/C Ratio	0.44	0.44						0.47	0.47			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	555	1671						1799	503			
v/s Ratio Prot	c0.41	0.40						0.51				
v/s Ratio Perm									c0.57			
v/c Ratio	0.92	0.91						1.07	1.21			
Uniform Delay, d1	18.3	18.2						18.5	18.5			
Progression Factor	1.34	1.32						1.00	1.00			
Incremental Delay, d2	14.7	5.5						44.4	112.8			
Delay (s)	39.2	29.5						62.9	131.3			
Level of Service	D	C						E	F			
Approach Delay (s)		32.0			0.0			79.8			0.0	
Approach LOS		C			A			E			A	

Intersection Summary			
HCM 2000 Control Delay	58.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	110.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	579	101	76	165	0	0	0	0	205	1121	612
Future Volume (vph)	0	579	101	76	165	0	0	0	0	205	1121	612
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.99	1.00
Satd. Flow (prot)		2736			1769						2965	1262
Flt Permitted		1.00			0.65						0.99	1.00
Satd. Flow (perm)		2736			1162						2965	1262
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	643	112	84	183	0	0	0	0	228	1246	680
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	740	0	0	267	0	0	0	0	0	1474	680
Confl. Peds. (#/hr)			24	16								11
Confl. Bikes (#/hr)			12									5
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		29.8			29.8						31.4	24.4
Effective Green, g (s)		30.8			30.8						32.4	25.4
Actuated g/C Ratio		0.44			0.44						0.46	0.36
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1203			511						1372	457
v/s Ratio Prot		c0.27									c0.50	
v/s Ratio Perm					0.23							c0.54
v/c Ratio		0.62			0.52						1.07	1.49
Uniform Delay, d1		15.1			14.3						18.8	22.3
Progression Factor		1.00			0.29						1.00	1.00
Incremental Delay, d2		2.4			1.9						47.0	231.0
Delay (s)		17.4			6.0						65.8	253.3
Level of Service		B			A						E	F
Approach Delay (s)		17.4			6.0			0.0			125.0	
Approach LOS		B			A			A			F	

Intersection Summary			
HCM 2000 Control Delay	89.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Hetherton & 5th
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	206	209	36	230	0	0	0	0	50	1255	59
Future Volume (vph)	0	206	209	36	230	0	0	0	0	50	1255	59
Ideal Flow (vphpl)	1800	1500	1800	1800	1500	1800	1800	1800	1800	1800	1600	1600
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.1	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.93			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1386			1490						3706	985
Flt Permitted		1.00			0.89						1.00	1.00
Satd. Flow (perm)		1386			1334						3706	985
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	248	252	43	277	0	0	0	0	60	1512	71
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	495	0	0	320	0	0	0	0	0	1572	71
Confl. Peds. (#/hr)			3	3						80		32
Confl. Bikes (#/hr)			4									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.4	23.5
Effective Green, g (s)		32.0			32.0						31.9	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.6	4.5
Lane Grp Cap (vph)		633			609						1688	344
v/s Ratio Prot		c0.36									c0.42	
v/s Ratio Perm					0.24							0.07
v/c Ratio		0.78			0.53						0.93	0.21
Uniform Delay, d1		16.1			13.6						18.0	15.9
Progression Factor		1.00			0.76						0.38	0.44
Incremental Delay, d2		9.3			2.0						5.8	0.6
Delay (s)		25.4			12.3						12.7	7.7
Level of Service		C			B						B	A
Approach Delay (s)		25.4			12.3			0.0			12.5	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: Hetherton & 4th
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	323	157	178	355	0	0	0	0	130	1049	199
Future Volume (vph)	0	323	157	178	355	0	0	0	0	130	1049	199
Ideal Flow (vphpl)	1700	1700	1600	1600	1700	1700	1700	1700	1700	1700	1700	1600
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1550	1088	1466	1450						3920	1045
Flt Permitted		1.00	1.00	0.38	1.00						0.99	1.00
Satd. Flow (perm)		1550	1088	580	1450						3920	1045
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	404	196	222	444	0	0	0	0	162	1311	249
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	404	149	223	444	0	0	0	0	0	1474	249
Confl. Peds. (#/hr)			15	15						5		
Confl. Bikes (#/hr)			7									2
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		28.8	28.8	28.8	28.8						32.8	25.8
Effective Green, g (s)		29.8	29.8	29.8	29.8						33.8	26.8
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.48	0.38
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		659	463	246	617						1892	400
v/s Ratio Prot		0.26			0.31							
v/s Ratio Perm			0.14	c0.38							0.38	0.24
v/c Ratio		0.61	0.32	0.91	0.72						0.78	0.62
Uniform Delay, d1		15.6	13.4	18.8	16.6						15.0	17.5
Progression Factor		1.00	1.00	0.68	0.69						0.26	0.37
Incremental Delay, d2		4.2	1.8	29.8	5.2						1.4	3.0
Delay (s)		19.8	15.2	42.6	16.7						5.3	9.4
Level of Service		B	B	D	B						A	A
Approach Delay (s)		18.3			25.4			0.0			5.9	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	545	1722	0	0	0	0	0	880	459
Future Volume (vph)	0	0	0	545	1722	0	0	0	0	0	880	459
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1800	1800	1800	1800	1800	1500	1500
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.90
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1056	3126						3426	963
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1056	3126						3426	963
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	673	2126	0	0	0	0	0	1086	567
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	673	2126	0	0	0	0	0	1086	559
Confl. Peds. (#/hr)				41								87
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				29.0	29.0						33.0	33.0
Effective Green, g (s)				30.0	30.0						34.0	34.0
Actuated g/C Ratio				0.43	0.43						0.49	0.49
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				452	1339						1664	467
v/s Ratio Prot				0.64	c0.68						0.32	
v/s Ratio Perm												c0.58
v/c Ratio				1.49	1.59						0.65	1.20
Uniform Delay, d1				20.0	20.0						13.6	18.0
Progression Factor				1.12	1.12						1.09	1.13
Incremental Delay, d2				221.1	264.8						1.3	101.5
Delay (s)				243.5	287.2						16.0	121.9
Level of Service				F	F						B	F
Approach Delay (s)		0.0			276.7			0.0			52.3	
Approach LOS		A			F			A			D	

Intersection Summary			
HCM 2000 Control Delay	193.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	139.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1386	1532	0	0	0	0	0	0	317	1025	0
Future Volume (vph)	0	1386	1532	0	0	0	0	0	0	317	1025	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1700	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		0.99	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.95	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4633	1028							1302	2678	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4633	1028							1302	2678	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1540	1702	0	0	0	0	0	0	352	1139	0
RTOR Reduction (vph)	0	5	10	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2386	841	0	0	0	0	0	0	352	1139	0
Confl. Peds. (#/hr)			7									
Confl. Bikes (#/hr)			4									
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		38.5	38.5							22.5	22.5	
Effective Green, g (s)		40.0	40.0							24.0	24.0	
Actuated g/C Ratio		0.57	0.57							0.34	0.34	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2647	587							446	918	
v/s Ratio Prot		0.52								0.27	c0.43	
v/s Ratio Perm			c0.82									
v/c Ratio		1.21dr	1.43							0.79	1.24	
Uniform Delay, d1		13.3	15.0							20.7	23.0	
Progression Factor		1.00	1.00							0.62	0.66	
Incremental Delay, d2		5.5	204.5							4.1	111.1	
Delay (s)		18.8	219.5							17.0	126.2	
Level of Service		B	F							B	F	
Approach Delay (s)		71.5			0.0			0.0			100.4	
Approach LOS		E			A			A			F	

Intersection Summary			
HCM 2000 Control Delay	80.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	180.6%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	1	1141	21	12	5	784	0	18	0	18	4	1
Future Volume (Veh/h)	1	1141	21	12	5	784	0	18	0	18	4	1
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	1176	22	0	5	808	0	19	0	19	4	1
Pedestrians						9						2
Lane Width (ft)						12.0						12.0
Walking Speed (ft/s)						4.0						4.0
Percent Blockage						1						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		558										
pX, platoon unblocked				0.00	0.79			0.79	0.79	0.79	0.79	0.79
vC, conflicting volume	810			0	1198			1658	2009	608	1438	2020
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	810			0	731			1310	1752	0	1033	1766
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			77	100	98	97	98
cM capacity (veh/h)	810			0	690			83	66	855	142	65

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	589	610	5	539	269	38	59
Volume Left	1	0	5	0	0	19	4
Volume Right	0	22	0	0	0	19	54
cSH	810	1700	690	1700	1700	151	439
Volume to Capacity	0.00	0.36	0.01	0.32	0.16	0.25	0.13
Queue Length 95th (ft)	0	0	1	0	0	24	12
Control Delay (s)	0.0	0.0	10.3	0.0	0.0	36.8	14.5
Lane LOS	A		B			E	B
Approach Delay (s)	0.0		0.1			36.8	14.5
Approach LOS						E	B

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	51.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	52
Future Volume (Veh/h)	52
Sign Control	
Grade	
Peak Hour Factor	0.97
Hourly flow rate (vph)	54
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	406
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	406
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	91
cM capacity (veh/h)	593

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS (E)

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	40	52	1045	784	1	0	17
Future Volume (Veh/h)	40	52	1045	784	1	0	17
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	54	1077	808	1	0	18
Pedestrians						2	
Lane Width (ft)						12.0	
Walking Speed (ft/s)						4.0	
Percent Blockage						0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			873				
pX, platoon unblocked	0.00					0.83	
vC, conflicting volume	0	811				1457	406
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	811				1145	406
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	93				100	97
cM capacity (veh/h)	0	810				150	593

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	54	538	538	539	270	18
Volume Left	54	0	0	0	0	0
Volume Right	0	0	0	0	1	18
cSH	810	1700	1700	1700	1700	593
Volume to Capacity	0.07	0.32	0.32	0.32	0.16	0.03
Queue Length 95th (ft)	5	0	0	0	0	2
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	11.3
Lane LOS	A					B
Approach Delay (s)	0.5			0.0		11.3
Approach LOS						B

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	6	44	996	754	7	4	22
Future Volume (Veh/h)	6	44	996	754	7	4	22
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	45	1027	777	7	4	23
Pedestrians			3			2	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	786				1386	397
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	786				1386	397
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	95				97	96
cM capacity (veh/h)	0	827				127	600

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	45	514	514	518	266	27
Volume Left	45	0	0	0	0	4
Volume Right	0	0	0	0	7	23
cSH	827	1700	1700	1700	1700	386
Volume to Capacity	0.05	0.30	0.30	0.30	0.16	0.07
Queue Length 95th (ft)	4	0	0	0	0	6
Control Delay (s)	9.6	0.0	0.0	0.0	0.0	15.0
Lane LOS	A					C
Approach Delay (s)	0.4			0.0		15.0
Approach LOS						C

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina Ct/Mission & Embarcadero/E. Mission & Sea View
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	7	7	3	0	3	30	0	10	1	38	14	2
Future Volume (vph)	7	7	3	0	3	30	0	10	1	38	14	2
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	8	8	4	0	4	35	0	12	1	45	16	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	20	39	13	63
Volume Left (vph)	8	0	0	45
Volume Right (vph)	4	35	1	2
Hadj (s)	-0.01	-0.50	-0.01	0.16
Departure Headway (s)	4.1	3.6	4.1	4.2
Degree Utilization, x	0.02	0.04	0.01	0.07
Capacity (veh/h)	856	978	858	843
Control Delay (s)	7.2	6.7	7.1	7.5
Approach Delay (s)	7.2	6.7	7.1	7.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S
12/12/2016

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		✣				✣			✣			✣
Traffic Volume (veh/h)	27	82	0	5	0	85	7	24	1	9	3	2
Future Volume (Veh/h)	27	82	0	5	0	85	7	24	1	9	3	2
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	34	104	0	0	0	108	9	30	1	11	4	3
Pedestrians		1				3						12
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		0				0						1
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked				0.00								
vC, conflicting volume	129			0	104			287	301	107	311	296
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	129			0	104			287	301	107	311	296
tC, single (s)	4.1			0.0	4.1			7.1	6.5	6.2	7.1	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	98			0	100			95	100	99	99	99
cM capacity (veh/h)	1442			0	1488			645	591	945	609	595

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	138	117	42	7
Volume Left	34	0	30	4
Volume Right	0	9	11	0
cSH	1442	1488	702	603
Volume to Capacity	0.02	0.00	0.06	0.01
Queue Length 95th (ft)	2	0	5	1
Control Delay (s)	2.0	0.0	10.5	11.0
Lane LOS	A		B	B
Approach Delay (s)	2.0	0.0	10.5	11.0
Approach LOS			B	B

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	23.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	0
Future Volume (Veh/h)	0
Sign Control	
Grade	
Peak Hour Factor	0.79
Hourly flow rate (vph)	0
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	126
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	126
tC, single (s)	6.2
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	100
cM capacity (veh/h)	915

Direction, Lane #

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	88	85	0	0	6
Future Volume (Veh/h)	6	88	85	0	0	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	7	98	94	0	0	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	94				206	94
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	94				206	94
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	99
cM capacity (veh/h)	1500				779	963

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	7	94	7
Volume Left	7	0	0
Volume Right	0	0	7
cSH	1500	1700	963
Volume to Capacity	0.00	0.06	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	7.4	0.0	8.8
Lane LOS	A		A
Approach Delay (s)	Err	0.0	8.8
Approach LOS			A

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	0	136	105	0	1	11
Future Volume (Veh/h)	3	0	136	105	0	1	11
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	0	143	111	0	1	12
Pedestrians			5			1	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	112				255	117
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	112				255	117
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	99
cM capacity (veh/h)	0	1476				733	930

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	143	111	13
Volume Left	0	0	1
Volume Right	0	0	12
cSH	1476	1700	912
Volume to Capacity	0.00	0.07	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	0.0	0.0	9.0
Lane LOS			A
Approach Delay (s)	0.0	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	21.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	51	153	111	0	2	43
Future Volume (Veh/h)	3	51	153	111	0	2	43
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	55	165	119	0	2	46
Pedestrians			7			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	123				398	130
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	123				398	130
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	96				100	95
cM capacity (veh/h)	0	1459				583	911

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	220	119	48
Volume Left	55	0	2
Volume Right	0	0	46
cSH	1459	1700	890
Volume to Capacity	0.04	0.07	0.05
Queue Length 95th (ft)	3	0	4
Control Delay (s)	2.1	0.0	9.3
Lane LOS	A		A
Approach Delay (s)	2.1	0.0	9.3
Approach LOS			A

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	30.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥			✥			✥	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	41	132	112	94	110	1	147	59	102	7	70	28
Future Volume (vph)	41	132	112	94	110	1	147	59	102	7	70	28
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	49	159	135	113	133	1	177	71	123	8	84	34

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	343	247	371	126
Volume Left (vph)	49	113	177	8
Volume Right (vph)	135	1	123	34
Hadj (s)	-0.17	0.12	-0.07	-0.12
Departure Headway (s)	5.8	6.3	5.9	6.4
Degree Utilization, x	0.55	0.43	0.61	0.22
Capacity (veh/h)	578	514	572	468
Control Delay (s)	15.8	13.9	17.6	11.3
Approach Delay (s)	15.8	13.9	17.6	11.3
Approach LOS	C	B	C	B

Intersection Summary			
Delay	15.5		
Level of Service	C		
Intersection Capacity Utilization	60.6%	ICU Level of Service	B
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✥			✥		↰	↱			✥	
Traffic Volume (vph)	32	2	226	2	1	2	97	290	1	0	217	50
Future Volume (vph)	32	2	226	2	1	2	97	290	1	0	217	50
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.98			0.99		1.00	1.00			1.00	
Flpb, ped/bikes		1.00			1.00		0.99	1.00			1.00	
Frt		0.88			0.95		1.00	1.00			0.97	
Flt Protected		0.99			0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1513			1614		1664	1764			1712	
Flt Permitted		0.96			0.92		0.59	1.00			1.00	
Satd. Flow (perm)		1469			1509		1037	1764			1712	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	33	2	231	2	1	2	99	296	1	0	221	51
RTOR Reduction (vph)	0	186	0	0	2	0	0	0	0	0	10	0
Lane Group Flow (vph)	0	80	0	0	3	0	99	297	0	0	262	0
Confl. Peds. (#/hr)	15		12	5		8	12		5	8		15
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.7			8.7		33.3	33.3			33.3	
Effective Green, g (s)		9.7			9.7		34.3	34.3			34.3	
Actuated g/C Ratio		0.19			0.19		0.69	0.69			0.69	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		284			292		711	1210			1174	
v/s Ratio Prot								c0.17			0.15	
v/s Ratio Perm		c0.05			0.00		0.10					
v/c Ratio		0.28			0.01		0.14	0.25			0.22	
Uniform Delay, d1		17.2			16.3		2.7	3.0			2.9	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.5			0.0		0.4	0.5			0.4	
Delay (s)		17.7			16.3		3.1	3.4			3.4	
Level of Service		B			B		A	A			A	
Approach Delay (s)		17.7			16.3			3.4			3.4	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.25		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	223	753	124	90	601	155	275	86	73	266	71	105
Future Volume (vph)	223	753	124	90	601	155	275	86	73	266	71	105
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.92	1.00	1.00	0.92	1.00	0.98		1.00	0.97	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1441	3241	1151	1441	3167	1065	2698	1417		1441	1337	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1441	3241	1151	1441	3167	1065	2698	1417		1441	1337	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	240	810	133	97	646	167	296	92	78	286	76	113
RTOR Reduction (vph)	0	0	67	0	0	91	0	26	0	0	40	0
Lane Group Flow (vph)	240	810	66	97	646	76	296	144	0	286	149	0
Confl. Peds. (#/hr)	14		25	5		42	20		33	28		34
Confl. Bikes (#/hr)						11						5
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	20.4	36.0	36.0	10.8	26.4	26.4	17.5	17.5		25.3	25.3	
Effective Green, g (s)	21.9	38.0	38.0	12.3	28.4	28.4	19.0	19.0		26.8	26.8	
Actuated g/C Ratio	0.20	0.35	0.35	0.11	0.26	0.26	0.18	0.18		0.25	0.25	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	291	1139	404	163	832	279	474	249		357	331	
v/s Ratio Prot	c0.17	0.25		0.07	c0.20		c0.11	0.10		c0.20	0.11	
v/s Ratio Perm			0.06			0.07						
v/c Ratio	0.82	0.71	0.16	0.60	0.78	0.27	0.62	0.58		0.80	0.45	
Uniform Delay, d1	41.3	30.3	24.1	45.5	36.9	31.7	41.2	40.9		38.1	34.4	
Progression Factor	1.00	1.00	1.00	1.00	1.02	1.08	1.00	1.00		1.00	1.00	
Incremental Delay, d2	17.8	1.8	0.1	3.8	4.2	0.2	1.8	2.2		11.5	0.4	
Delay (s)	59.0	32.1	24.2	49.5	42.0	34.2	43.1	43.1		49.7	34.8	
Level of Service	E	C	C	D	D	C	D	D		D	C	
Approach Delay (s)		36.7			41.4			43.1			43.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	40.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	108.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	279	66	31	299	92	181	199	31	57	292	86
Future Volume (vph)	65	279	66	31	299	92	181	199	31	57	292	86
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		0.98	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.96		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1644	1897		1627	1885		1634	1928		1638	1886	
Flt Permitted	0.21	1.00		0.28	1.00		0.45	1.00		0.58	1.00	
Satd. Flow (perm)	370	1897		482	1885		778	1928		1000	1886	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	72	310	73	34	332	102	201	221	34	63	324	96
RTOR Reduction (vph)	0	14	0	0	18	0	0	7	0	0	13	0
Lane Group Flow (vph)	72	369	0	34	416	0	201	248	0	63	407	0
Confl. Peds. (#/hr)	11		21	21		11	14		8	8		14
Confl. Bikes (#/hr)			1			6			5			7
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.4	20.4		20.4	20.4		41.6	41.6		41.6	41.6	
Effective Green, g (s)	21.4	21.4		21.4	21.4		42.6	42.6		42.6	42.6	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.61	0.61		0.61	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	113	579		147	576		473	1173		608	1147	
v/s Ratio Prot		0.19			c0.22			0.13			0.22	
v/s Ratio Perm	0.19			0.07			c0.26			0.06		
v/c Ratio	0.64	0.64		0.23	0.72		0.42	0.21		0.10	0.36	
Uniform Delay, d1	21.0	21.0		18.2	21.7		7.2	6.2		5.7	6.8	
Progression Factor	0.64	0.68		1.00	1.00		0.44	0.48		1.00	1.00	
Incremental Delay, d2	10.6	2.2		0.8	4.5		2.6	0.4		0.3	0.9	
Delay (s)	23.9	16.4		19.0	26.1		5.7	3.3		6.1	7.7	
Level of Service	C	B		B	C		A	A		A	A	
Approach Delay (s)		17.6			25.6			4.4			7.5	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	95	817	316	453	511	0	0	315	151
Future Volume (vph)	0	0	0	95	817	316	453	511	0	0	315	151
Ideal Flow (vphpl)	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.93	1.00	1.00			1.00	0.94
Flpb, ped/bikes				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.99			1.00	1.00
Satd. Flow (prot)				1134	2350	977	1105	2606			1237	955
Flt Permitted				0.95	1.00	1.00	0.26	0.59			1.00	1.00
Satd. Flow (perm)				1134	2350	977	300	1566			1237	955
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	0	119	1021	395	566	639	0	0	394	189
RTOR Reduction (vph)	0	0	0	0	0	119	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	119	1021	276	368	837	0	0	394	132
Confl. Peds. (#/hr)				27		49	12					43
Confl. Bikes (#/hr)						5						4
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				29.0	29.0	29.0	33.0	33.0			18.0	18.0
Effective Green, g (s)				30.0	30.0	30.0	34.0	34.0			19.0	19.0
Actuated g/C Ratio				0.43	0.43	0.43	0.49	0.49			0.27	0.27
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				486	1007	418	283	938			335	259
v/s Ratio Prot				0.10	c0.43		c0.22	0.15			0.32	
v/s Ratio Perm						0.28	c0.41	0.28				0.14
v/c Ratio				0.24	1.01	0.66	1.30	0.89			1.18	0.51
Uniform Delay, d1				12.8	20.0	15.9	22.6	16.3			25.5	21.6
Progression Factor				1.00	1.00	1.00	0.65	0.55			1.04	1.13
Incremental Delay, d2				1.2	31.9	7.9	151.3	8.8			104.0	6.4
Delay (s)				14.0	51.9	23.9	165.9	17.9			130.4	30.7
Level of Service				B	D	C	F	B			F	C
Approach Delay (s)		0.0			41.7			63.1			98.1	
Approach LOS		A			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	59.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	111.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	247	1084	817	0	0	0	0	839	208	39	550	0
Future Volume (vph)	247	1084	817	0	0	0	0	839	208	39	550	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.83					1.00	0.88	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1330	2660	1060					2755	1128	1465	1246	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.17	1.00	
Satd. Flow (perm)	1330	2660	1060					2755	1128	256	1246	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	294	1290	973	0	0	0	0	999	248	46	655	0
RTOR Reduction (vph)	0	0	82	0	0	0	0	0	13	0	0	0
Lane Group Flow (vph)	294	1290	891	0	0	0	0	999	235	46	655	0
Confl. Peds. (#/hr)			113						105	30		
Confl. Bikes (#/hr)			5						1			
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	31.5	31.5	31.5					29.5	29.5	29.5	29.5	
Effective Green, g (s)	33.0	33.0	33.0					31.0	31.0	31.0	31.0	
Actuated g/C Ratio	0.47	0.47	0.47					0.44	0.44	0.44	0.44	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	627	1254	499					1220	499	113	551	
v/s Ratio Prot	0.22	0.48						0.36			c0.53	
v/s Ratio Perm			c0.84						0.21	0.18		
v/c Ratio	0.47	1.03	1.78					0.82	0.47	0.41	1.19	
Uniform Delay, d1	12.6	18.5	18.5					17.0	13.7	13.3	19.5	
Progression Factor	1.28	1.18	1.23					1.00	1.00	0.42	0.45	
Incremental Delay, d2	0.2	16.5	353.8					6.2	3.2	7.5	97.5	
Delay (s)	16.3	38.4	376.6					23.2	16.9	13.0	106.2	
Level of Service	B	D	F					C	B	B	F	
Approach Delay (s)		164.6			0.0			22.0			100.1	
Approach LOS		F			A			C			F	

Intersection Summary			
HCM 2000 Control Delay	115.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	111.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	506	317	0	0	187	366	95	1900	42	0	0	0
Future Volume (vph)	506	317	0	0	187	366	95	1900	42	0	0	0
Ideal Flow (vphpl)	1800	2000	1800	1800	2000	1800	1800	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.94			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1647			1647	1215		3345	1276			
Flt Permitted	0.46	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	665	1647			1647	1215		3345	1276			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	562	352	0	0	208	407	106	2111	47	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	59	0	0	24	0	0	0
Lane Group Flow (vph)	562	352	0	0	208	348	0	2217	24	0	0	0
Confl. Peds. (#/hr)							6		20			
Confl. Bikes (#/hr)						1			1			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	29.0	29.0			16.0	16.0		33.0	33.0			
Effective Green, g (s)	30.0	31.0			17.0	17.0		35.0	35.0			
Actuated g/C Ratio	0.43	0.44			0.24	0.24		0.50	0.50			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	393	729			399	295		1672	638			
v/s Ratio Prot	c0.22	0.21			0.13	0.29		c0.66				
v/s Ratio Perm	c0.39								0.02			
v/c Ratio	1.43	0.48			0.52	1.18		1.33	0.04			
Uniform Delay, d1	21.1	13.8			23.0	26.5		17.5	8.9			
Progression Factor	1.02	1.16			1.28	1.41		0.29	0.00			
Incremental Delay, d2	201.4	1.2			4.2	107.3		147.1	0.0			
Delay (s)	222.9	17.2			33.5	144.6		152.2	0.0			
Level of Service	F	B			C	F		F	A			
Approach Delay (s)		143.7			107.1			149.1			0.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	141.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	127.8%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	121	0	0	137	136	101	1657	12	0	0	0
Future Volume (vph)	257	121	0	0	137	136	101	1657	12	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.91				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.93			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1167	1228			1138			3710				
Flt Permitted	0.51	1.00			1.00			1.00				
Satd. Flow (perm)	622	1228			1138			3710				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	292	138	0	0	156	155	115	1883	14	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	292	138	0	0	311	0	0	2011	0	0	0	0
Confl. Peds. (#/hr)									7			
Confl. Bikes (#/hr)						2			4			
Parking (#/hr)	6	6			6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	35.0	35.0			35.0			27.0				
Effective Green, g (s)	36.0	36.0			36.0			28.0				
Actuated g/C Ratio	0.51	0.51			0.51			0.40				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	319	631			585			1484				
v/s Ratio Prot		0.11			0.27			c0.54				
v/s Ratio Perm	c0.47											
v/c Ratio	0.92	0.22			0.53			1.35				
Uniform Delay, d1	15.6	9.3			11.4			21.0				
Progression Factor	1.91	1.97			1.16			0.45				
Incremental Delay, d2	20.6	0.4			3.4			160.2				
Delay (s)	50.4	18.7			16.6			169.7				
Level of Service	D	B			B			F				
Approach Delay (s)		40.2			16.6			169.7			0.0	
Approach LOS		D			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	132.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	234	254	0	0	246	93	183	1414	62	0	0	0
Future Volume (vph)	234	254	0	0	246	93	183	1414	62	0	0	0
Ideal Flow (vphpl)	1800	1600	1600	1600	1600	1600	1600	1800	1600	1000	1800	1800
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.91				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.98	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1436	1412			1169		1207	4017				
Flt Permitted	0.47	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	714	1412			1169		1207	4017				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	260	282	0	0	273	103	203	1571	69	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	7	0	0	0	0
Lane Group Flow (vph)	260	282	0	0	375	0	203	1633	0	0	0	0
Confl. Peds. (#/hr)	28					28	2		2			
Confl. Bikes (#/hr)						8			3			
Parking (#/hr)					6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	39.0	39.0			39.0		23.0	23.0				
Effective Green, g (s)	40.0	40.0			40.0		24.0	24.0				
Actuated g/C Ratio	0.57	0.57			0.57		0.34	0.34				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	408	806			668		413	1377				
v/s Ratio Prot		0.20			0.32		0.17	c0.41				
v/s Ratio Perm	c0.36											
v/c Ratio	0.64	0.35			0.56		0.49	1.19				
Uniform Delay, d1	10.1	8.0			9.5		18.2	23.0				
Progression Factor	1.11	0.99			0.85		0.65	0.72				
Incremental Delay, d2	5.9	0.9			2.9		0.4	84.5				
Delay (s)	17.1	8.9			11.0		12.2	101.1				
Level of Service	B	A			B		B	F				
Approach Delay (s)		12.8			11.0			91.3			0.0	
Approach LOS		B			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	65.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1297	194	1119	1543	0	0	0	0
Future Volume (vph)	0	0	0	0	1297	194	1119	1543	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.88	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3597	1023	1066	3452				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3597	1023	1066	3452				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	0	0	0	1508	226	1301	1794	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	13	12	12	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1508	213	834	2237	0	0	0	0
Confl. Peds. (#/hr)						96						
Confl. Bikes (#/hr)						17						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					29.5	29.5	31.5	31.5				
Effective Green, g (s)					31.0	31.0	33.0	33.0				
Actuated g/C Ratio					0.44	0.44	0.47	0.47				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1592	453	502	1627				
v/s Ratio Prot					c0.42		c0.78	0.65				
v/s Ratio Perm						0.21						
v/c Ratio					0.95	0.47	1.66	1.37				
Uniform Delay, d1					18.7	13.7	18.5	18.5				
Progression Factor					1.04	1.10	0.82	0.82				
Incremental Delay, d2					1.7	0.3	298.3	169.0				
Delay (s)					21.1	15.5	313.4	184.3				
Level of Service					C	B	F	F				
Approach Delay (s)		0.0			20.4			219.6			0.0	
Approach LOS		A			C			F			A	

Intersection Summary			
HCM 2000 Control Delay	148.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	129.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	1022	1466	0	0	0	0	0	1650	736	0	0	0
Future Volume (vph)	1022	1466	0	0	0	0	0	1650	736	0	0	0
Ideal Flow (vphpl)	1600	1600	1700	1700	1700	1700	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.95			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1192	3606						3854	1064			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1192	3606						3854	1064			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1136	1629	0	0	0	0	0	1833	818	0	0	0
RTOR Reduction (vph)	18	18	0	0	0	0	0	0	8	0	0	0
Lane Group Flow (vph)	709	2020	0	0	0	0	0	1833	810	0	0	0
Confl. Peds. (#/hr)	43								28			
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	28.0	28.0						33.0	33.0			
Effective Green, g (s)	29.0	29.0						35.0	35.0			
Actuated g/C Ratio	0.41	0.41						0.50	0.50			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	493	1493						1927	532			
v/s Ratio Prot	c0.59	0.56						0.48				
v/s Ratio Perm									c0.76			
v/c Ratio	1.44	1.35						0.95	1.52			
Uniform Delay, d1	20.5	20.5						16.7	17.5			
Progression Factor	0.90	0.91						1.00	1.00			
Incremental Delay, d2	198.1	159.2						11.8	244.6			
Delay (s)	216.6	177.8						28.5	262.1			
Level of Service	F	F						C	F			
Approach Delay (s)		188.0			0.0			100.6			0.0	
Approach LOS		F			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	145.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.48		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	141.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	612	83	51	233	0	0	0	0	252	1292	663
Future Volume (vph)	0	612	83	51	233	0	0	0	0	252	1292	663
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2757			1783						2993	1272
Flt Permitted		1.00			0.76						0.99	1.00
Satd. Flow (perm)		2757			1361						2993	1272
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	680	92	57	259	0	0	0	0	280	1436	737
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	759	0	0	316	0	0	0	0	0	1716	737
Confl. Peds. (#/hr)			12	12						3		13
Confl. Bikes (#/hr)			6									1
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		26.8			26.8						34.4	27.4
Effective Green, g (s)		27.8			27.8						35.4	28.4
Actuated g/C Ratio		0.40			0.40						0.51	0.41
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1094			540						1513	516
v/s Ratio Prot		c0.28									c0.57	
v/s Ratio Perm					0.23							c0.58
v/c Ratio		0.69			0.59						1.13	1.43
Uniform Delay, d1		17.6			16.6						17.3	20.8
Progression Factor		1.00			0.80						1.00	1.00
Incremental Delay, d2		3.6			2.7						69.2	203.7
Delay (s)		21.2			16.0						86.5	224.5
Level of Service		C			B						F	F
Approach Delay (s)		21.2			16.0			0.0			127.9	
Approach LOS		C			B			A			F	

Intersection Summary			
HCM 2000 Control Delay	94.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	101.2%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	373	222	73	240	0	0	0	0	41	1274	104
Future Volume (vph)	0	373	222	73	240	0	0	0	0	41	1274	104
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.93
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1699			1779						4170	1118
Flt Permitted		1.00			0.50						1.00	1.00
Satd. Flow (perm)		1699			898						4170	1118
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	414	247	81	267	0	0	0	0	46	1416	116
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	654	0	0	348	0	0	0	0	0	1462	116
Confl. Peds. (#/hr)			2	2						73		27
Confl. Bikes (#/hr)			5									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.5	23.5
Effective Green, g (s)		32.0			32.0						32.0	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		776			410						1906	391
v/s Ratio Prot		0.38									c0.35	
v/s Ratio Perm					c0.39							0.10
v/c Ratio		0.84			0.85						0.77	0.30
Uniform Delay, d1		16.8			16.9						15.9	16.5
Progression Factor		1.00			1.17						0.26	0.32
Incremental Delay, d2		10.8			14.6						0.3	0.2
Delay (s)		27.6			34.3						4.4	5.4
Level of Service		C			C						A	A
Approach Delay (s)		27.6			34.3			0.0			4.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	385	174	100	273	0	0	0	0	145	1081	244
Future Volume (vph)	0	385	174	100	273	0	0	0	0	145	1081	244
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.97
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1220	1649	1535						4152	1171
Flt Permitted		1.00	1.00	0.36	1.00						0.99	1.00
Satd. Flow (perm)		1641	1220	630	1535						4152	1171
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	428	193	111	303	0	0	0	0	161	1201	271
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	428	148	111	303	0	0	0	0	0	1362	271
Confl. Peds. (#/hr)			16	16						6		
Confl. Bikes (#/hr)			12									5
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases			4	8								5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						31.8	24.8
Effective Green, g (s)		30.8	30.8	30.8	30.8						32.8	25.8
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.47	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		722	536	277	675						1945	431
v/s Ratio Prot		c0.26			0.20						c0.33	
v/s Ratio Perm			0.12	0.18								0.23
v/c Ratio		0.59	0.28	0.40	0.45						0.70	0.63
Uniform Delay, d1		14.8	12.5	13.3	13.7						14.7	18.2
Progression Factor		1.00	1.00	1.04	1.06						0.33	0.45
Incremental Delay, d2		3.6	1.3	3.7	1.8						1.3	4.1
Delay (s)		18.4	13.8	17.5	16.3						6.2	12.4
Level of Service		B	B	B	B						A	B
Approach Delay (s)		17.0			16.6			0.0			7.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	84.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	509	1895	0	0	0	0	0	765	551
Future Volume (vph)	0	0	0	509	1895	0	0	0	0	0	765	551
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1400	1800	1800	1800	1600	1600	1600
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.86
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1077	3185						3726	1002
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1077	3185						3726	1002
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	566	2106	0	0	0	0	0	850	612
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	543	2129	0	0	0	0	0	850	604
Confl. Peds. (#/hr)				52								126
Confl. Bikes (#/hr)												2
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				27.0	27.0						35.0	35.0
Effective Green, g (s)				28.0	28.0						36.0	36.0
Actuated g/C Ratio				0.40	0.40						0.51	0.51
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				430	1274						1916	515
v/s Ratio Prot				0.50	c0.67						0.23	
v/s Ratio Perm												c0.60
v/c Ratio				1.26	1.67						0.44	1.17
Uniform Delay, d1				21.0	21.0						10.7	17.0
Progression Factor				0.88	0.88						0.42	0.42
Incremental Delay, d2				120.0	302.3						0.6	93.3
Delay (s)				138.5	320.9						5.1	100.4
Level of Service				F	F						A	F
Approach Delay (s)		0.0			283.8			0.0			45.0	
Approach LOS		A			F			A			D	

Intersection Summary			
HCM 2000 Control Delay	199.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.39		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	146.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2075	1143	0	0	0	0	0	0	443	918	0
Future Volume (vph)	0	2075	1143	0	0	0	0	0	0	443	918	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		1.00	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.97	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4797	1035							1327	2891	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4797	1035							1327	2891	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2306	1270	0	0	0	0	0	0	492	1020	0
RTOR Reduction (vph)	0	15	15	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2901	645	0	0	0	0	0	0	492	1020	0
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)			8									
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		35.5	35.5							25.5	25.5	
Effective Green, g (s)		37.0	37.0							27.0	27.0	
Actuated g/C Ratio		0.53	0.53							0.39	0.39	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2535	547							511	1115	
v/s Ratio Prot		0.60								c0.37	0.35	
v/s Ratio Perm			c0.62									
v/c Ratio		1.14	1.18							0.96	0.91	
Uniform Delay, d1		16.5	16.5							21.0	20.4	
Progression Factor		1.00	1.00							0.82	0.82	
Incremental Delay, d2		70.2	98.6							24.7	9.3	
Delay (s)		86.7	115.1							42.0	26.1	
Level of Service		F	F							D	C	
Approach Delay (s)		92.0			0.0			0.0			31.3	
Approach LOS		F			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	73.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	170.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	2	1173	22	6	5	1128	0	11	0	6	11	0
Future Volume (Veh/h)	2	1173	22	6	5	1128	0	11	0	6	11	0
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	1303	24	0	6	1253	0	12	0	7	12	0
Pedestrians		15				4						4
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		1				0						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		550										
pX, platoon unblocked				0.00	0.78			0.78	0.78	0.78	0.78	0.78
vC, conflicting volume	1257			0	1327			2102	2588	668	1936	2600
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1257			0	846			1843	2470	0	1629	2485
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			50	100	99	76	100
cM capacity (veh/h)	547			0	611			24	23	839	51	22

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	654	676	6	626	626	19	141
Volume Left	2	0	6	0	0	12	12
Volume Right	0	24	0	0	0	7	129
cSH	547	1700	611	1700	1700	37	255
Volume to Capacity	0.00	0.40	0.01	0.37	0.37	0.51	0.55
Queue Length 95th (ft)	0	0	1	0	0	44	76
Control Delay (s)	0.1	0.0	10.9	0.0	0.0	175.1	35.2
Lane LOS	A		B			F	E
Approach Delay (s)	0.1		0.1			175.1	35.2
Approach LOS						F	E

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	54.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	116
Future Volume (Veh/h)	116
Sign Control	
Grade	
Peak Hour Factor	0.90
Hourly flow rate (vph)	129
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	646
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	646
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	68
cM capacity (veh/h)	408

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
2: 3rd & SRHS Dr. (E)

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	4	253	940	1117	87	0	20
Future Volume (Veh/h)	4	253	940	1117	87	0	20
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Hourly flow rate (vph)	0	301	1119	1330	104	0	24
Pedestrians			10				
Lane Width (ft)			12.0				
Walking Speed (ft/s)			4.0				
Percent Blockage			1				
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			899				
pX, platoon unblocked	0.00					0.85	
vC, conflicting volume	0	1434				2544	727
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1434				2466	727
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	36				100	93
cM capacity (veh/h)	0	470				8	363

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	301	560	560	887	547	24
Volume Left	301	0	0	0	0	0
Volume Right	0	0	0	0	104	24
cSH	470	1700	1700	1700	1700	363
Volume to Capacity	0.64	0.33	0.33	0.52	0.32	0.07
Queue Length 95th (ft)	111	0	0	0	0	5
Control Delay (s)	25.4	0.0	0.0	0.0	0.0	15.6
Lane LOS	D					C
Approach Delay (s)	5.4			0.0		15.6
Approach LOS						C

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: 3rd & Embarcadero

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	41	41	862	1158	1	1	38
Future Volume (Veh/h)	41	41	862	1158	1	1	38
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	0	45	947	1273	1	1	42
Pedestrians			9			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	1278				1841	650
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	1278				1841	650
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	92				98	90
cM capacity (veh/h)	0	537				61	407

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	45	474	474	849	425	43
Volume Left	45	0	0	0	0	1
Volume Right	0	0	0	0	1	42
cSH	537	1700	1700	1700	1700	360
Volume to Capacity	0.08	0.28	0.28	0.50	0.25	0.12
Queue Length 95th (ft)	7	0	0	0	0	10
Control Delay (s)	12.3	0.0	0.0	0.0	0.0	16.4
Lane LOS	B					C
Approach Delay (s)	0.6			0.0		16.4
Approach LOS						C

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

4: Marina/Mission & Embarcadero/E Mission / Sea View Ave

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	19	9	2	0	7	95	1	7	2	31	2	5
Future Volume (vph)	19	9	2	0	7	95	1	7	2	31	2	5
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	29	14	3	0	11	146	2	11	3	48	3	8

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	46	157	16	59
Volume Left (vph)	29	0	2	48
Volume Right (vph)	3	146	3	8
Hadj (s)	0.12	-0.52	-0.05	0.12
Departure Headway (s)	4.3	3.6	4.3	4.4
Degree Utilization, x	0.06	0.16	0.02	0.07
Capacity (veh/h)	807	976	785	763
Control Delay (s)	7.6	7.3	7.4	7.8
Approach Delay (s)	7.6	7.3	7.4	7.8
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.4		
Level of Service	A		
Intersection Capacity Utilization	24.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis

5: HS Driveway/Belle S & Mission

12/12/2016

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL
Lane Configurations												
Traffic Volume (veh/h)	6	227	59	0	4	0	126	13	18	2	5	10
Future Volume (Veh/h)	6	227	59	0	4	0	126	13	18	2	5	10
Sign Control			Free				Free			Stop		
Grade			0%				0%			0%		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	252	66	0	0	0	140	14	20	2	6	11
Pedestrians							2					
Lane Width (ft)							12.0					
Walking Speed (ft/s)							4.0					
Percent Blockage							0					
Right turn flare (veh)												
Median type			None				None					
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked	0.00				0.00							
vC, conflicting volume	0	154			0	66			720	724	68	726
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0	154			0	66			720	724	68	726
tC, single (s)	0.0	4.1			0.0	4.1			7.1	6.5	6.2	7.1
tC, 2 stage (s)												
tF (s)	0.0	2.2			0.0	2.2			3.5	4.0	3.3	3.5
p0 queue free %	0	82			0	100			93	99	99	96
cM capacity (veh/h)	0	1426			0	1536			292	290	994	290

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	318	154	28	17
Volume Left	252	0	20	11
Volume Right	0	14	6	0
cSH	1426	1536	344	291
Volume to Capacity	0.18	0.00	0.08	0.06
Queue Length 95th (ft)	16	0	7	5
Control Delay (s)	6.7	0.0	16.4	18.1
Lane LOS	A		C	C
Approach Delay (s)	6.7	0.0	16.4	18.1
Approach LOS			C	C

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: HS Driveway/Belle S & Mission
12/12/2016

Movement	SBT	SBR
Lane Configurations		
Traffic Volume (veh/h)	5	0
Future Volume (Veh/h)	5	0
Sign Control	Stop	
Grade	0%	
Peak Hour Factor	0.90	0.90
Hourly flow rate (vph)	6	0
Pedestrians		
Lane Width (ft)		
Walking Speed (ft/s)		
Percent Blockage		
Right turn flare (veh)		
Median type		
Median storage veh)		
Upstream signal (ft)		
pX, platoon unblocked		
vC, conflicting volume	717	147
vC1, stage 1 conf vol		
vC2, stage 2 conf vol		
vCu, unblocked vol	717	147
tC, single (s)	6.5	6.2
tC, 2 stage (s)		
tF (s)	4.0	3.3
p0 queue free %	98	100
cM capacity (veh/h)	293	900

Direction, Lane #

HCM Unsignalized Intersection Capacity Analysis
51: Mission & Belle N
12/12/2016

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	11	63	127	0	0	12
Future Volume (Veh/h)	11	63	127	0	0	12
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	12	70	141	0	0	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	141				235	141
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141				235	141
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1442				747	907

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	82	141	13
Volume Left	12	0	0
Volume Right	0	0	13
cSH	1442	1700	907
Volume to Capacity	0.01	0.08	0.01
Queue Length 95th (ft)	1	0	1
Control Delay (s)	1.2	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	1.2	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	23.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
6: Mission & Alice

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	19	9	296	136	5	4	126
Future Volume (Veh/h)	19	9	296	136	5	4	126
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Hourly flow rate (vph)	0	16	538	247	9	7	229
Pedestrians			6			11	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			1	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	267				832	268
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	267				832	268
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	99				98	70
cM capacity (veh/h)	0	1285				332	759

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	554	256	236
Volume Left	16	0	7
Volume Right	0	9	229
cSH	1285	1700	731
Volume to Capacity	0.01	0.15	0.32
Queue Length 95th (ft)	1	0	35
Control Delay (s)	0.4	0.0	12.3
Lane LOS	A		B
Approach Delay (s)	0.4	0.0	12.3
Approach LOS			B

Intersection Summary			
Average Delay	3.0		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
7: Mission & Park

12/12/2016

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	6	22	367	282	14	0	77
Future Volume (Veh/h)	6	22	367	282	14	0	77
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Hourly flow rate (vph)	0	34	565	434	22	0	118
Pedestrians				14		32	
Lane Width (ft)				12.0		12.0	
Walking Speed (ft/s)				4.0		4.0	
Percent Blockage				1		3	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	488				1124	477
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	488				1124	477
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	97				100	79
cM capacity (veh/h)	0	1046				211	572

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	599	456	118
Volume Left	34	0	0
Volume Right	0	22	118
cSH	1046	1700	572
Volume to Capacity	0.03	0.27	0.21
Queue Length 95th (ft)	3	0	19
Control Delay (s)	0.9	0.0	12.9
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	12.9
Approach LOS			B

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	53.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	31	214	112	192	187	1	117	50	174	9	138	77
Future Volume (vph)	31	214	112	192	187	1	117	50	174	9	138	77
Peak Hour Factor	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Hourly flow rate (vph)	41	285	149	256	249	1	156	67	232	12	184	103

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	475	506	455	299
Volume Left (vph)	41	256	156	12
Volume Right (vph)	149	1	232	103
Hadj (s)	-0.14	0.13	-0.20	-0.16
Departure Headway (s)	8.9	9.1	8.8	9.4
Degree Utilization, x	1.17	1.28	1.11	0.78
Capacity (veh/h)	406	401	421	378
Control Delay (s)	128.3	172.7	108.0	38.8
Approach Delay (s)	128.3	172.7	108.0	38.8
Approach LOS	F	F	F	E

Intersection Summary			
Delay	120.5		
Level of Service	F		
Intersection Capacity Utilization	91.3%	ICU Level of Service	F
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	5	141	1	4	2	157	312	8	7	315	132
Future Volume (vph)	35	5	141	1	4	2	157	312	8	7	315	132
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.99			0.99		1.00	1.00			0.99	
Flpb, ped/bikes		1.00			1.00		1.00	1.00			1.00	
Frt		0.89			0.97		1.00	1.00			0.96	
Flt Protected		0.99			0.99		0.95	1.00			1.00	
Satd. Flow (prot)		1541			1678		1675	1758			1682	
Flt Permitted		0.94			0.97		0.47	1.00			1.00	
Satd. Flow (perm)		1467			1646		824	1758			1675	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	42	6	170	1	5	2	189	376	10	8	380	159
RTOR Reduction (vph)	0	137	0	0	2	0	0	1	0	0	18	0
Lane Group Flow (vph)	0	81	0	0	6	0	189	385	0	0	529	0
Confl. Peds. (#/hr)	14		2			12	2			12		14
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.8			8.8		33.2	33.2			33.2	
Effective Green, g (s)		9.8			9.8		34.2	34.2			34.2	
Actuated g/C Ratio		0.20			0.20		0.68	0.68			0.68	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		287			322		563	1202			1145	
v/s Ratio Prot								0.22				
v/s Ratio Perm		c0.06			0.00		0.23				c0.32	
v/c Ratio		0.28			0.02		0.34	0.32			0.46	
Uniform Delay, d1		17.1			16.2		3.2	3.2			3.6	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.5			0.0		1.6	0.7			1.3	
Delay (s)		17.7			16.2		4.8	3.9			5.0	
Level of Service		B			B		A	A			A	
Approach Delay (s)		17.7			16.2			4.2			5.0	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	6.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	71.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	910	22	22	986	272	76	23	35	213	36	189
Future Volume (vph)	257	910	22	22	986	272	76	23	35	213	36	189
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.93	1.00	1.00	0.85	1.00	0.97		1.00	0.91	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.91		1.00	0.87	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1427	3210	1140	1427	3136	970	2698	1367		1413	1189	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1427	3210	1140	1427	3136	970	2698	1367		1413	1189	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	276	978	24	24	1060	292	82	25	38	229	39	203
RTOR Reduction (vph)	0	0	13	0	0	81	0	33	0	0	146	0
Lane Group Flow (vph)	276	978	11	24	1060	211	82	30	0	229	96	0
Confl. Peds. (#/hr)			23			98	2		41	20		80
Confl. Bikes (#/hr)			5			7						5
Heavy Vehicles (%)	3%	3%	3%	3%	3%	3%	2%	2%	2%	4%	4%	4%
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	20.1	49.4	49.4	5.8	35.1	35.1	13.1	13.1		22.1	22.1	
Effective Green, g (s)	21.6	51.4	51.4	7.3	37.1	37.1	14.6	14.6		23.6	23.6	
Actuated g/C Ratio	0.20	0.47	0.47	0.07	0.34	0.34	0.13	0.13		0.22	0.22	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	283	1515	538	95	1068	330	361	183		306	257	
v/s Ratio Prot	c0.19	0.30		0.02	c0.34		c0.03	0.02		c0.16	0.08	
v/s Ratio Perm			0.01			0.22						
v/c Ratio	0.98	0.65	0.02	0.25	0.99	0.64	0.23	0.16		0.75	0.37	
Uniform Delay, d1	43.4	21.8	15.3	48.2	35.8	30.3	42.1	41.7		39.9	36.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	46.4	0.7	0.0	0.5	25.6	3.0	0.1	0.2		8.5	0.3	
Delay (s)	89.8	22.5	15.3	48.7	61.3	33.2	42.2	41.9		48.3	36.7	
Level of Service	F	C	B	D	E	C	D	D		D	D	
Approach Delay (s)		36.9			55.1			42.1			42.4	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM 2000 Control Delay	45.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	108.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	43	318	53	43	319	45	177	168	11	59	315	89
Future Volume (vph)	43	318	53	43	319	45	177	168	11	59	315	89
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1500	1500	1500	1500	1500	1500
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.98		1.00	0.99		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		1.00	1.00		0.95	1.00	
Satd. Flow (prot)	1319	1576		1323	1545		1307	1468		1243	1426	
Flt Permitted	0.20	1.00		0.19	1.00		0.41	1.00		0.61	1.00	
Satd. Flow (perm)	277	1576		265	1545		531	1468		804	1426	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	52	383	64	52	384	54	213	202	13	71	380	107
RTOR Reduction (vph)	0	8	0	0	7	0	0	3	0	0	15	0
Lane Group Flow (vph)	52	439	0	52	431	0	213	212	0	71	472	0
Confl. Peds. (#/hr)	8		4	4		8	2					2
Confl. Bikes (#/hr)						2			2			2
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.0	20.0		20.0	20.0		42.0	42.0		42.0	42.0	
Effective Green, g (s)	21.0	21.0		21.0	21.0		43.0	43.0		43.0	43.0	
Actuated g/C Ratio	0.30	0.30		0.30	0.30		0.61	0.61		0.61	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	83	472		79	463		326	901		493	875	
v/s Ratio Prot		0.28			c0.28			0.14			0.33	
v/s Ratio Perm	0.19			0.20			c0.40			0.09		
v/c Ratio	0.63	0.93		0.66	0.93		0.65	0.23		0.14	0.54	
Uniform Delay, d1	21.1	23.8		21.4	23.8		8.7	6.1		5.7	7.8	
Progression Factor	0.57	0.57		1.00	1.00		1.09	1.08		1.00	1.00	
Incremental Delay, d2	29.8	26.4		35.6	27.7		4.5	0.1		0.6	2.4	
Delay (s)	41.9	39.9		57.0	51.5		14.0	6.7		6.3	10.2	
Level of Service	D	D		E	D		B	A		A	B	
Approach Delay (s)		40.1			52.1			10.4			9.7	
Approach LOS		D			D			B			A	

Intersection Summary			
HCM 2000 Control Delay	28.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd 12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰	↑↑	↱	↰	↰↑			↑	↱
Traffic Volume (vph)	0	0	0	331	945	95	426	392	0	0	228	111
Future Volume (vph)	0	0	0	331	945	95	426	392	0	0	228	111
Ideal Flow (vphpl)	1600	1600	1600	1500	1600	1500	1500	1600	1600	1600	1600	1500
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.85	1.00	1.00			1.00	0.86
Flpb, ped/bikes				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.98			1.00	1.00
Satd. Flow (prot)				1151	2543	903	1117	2800			1365	908
Flt Permitted				0.95	1.00	1.00	0.48	0.68			1.00	1.00
Satd. Flow (perm)				1151	2543	903	568	1947			1365	908
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	409	1167	117	526	484	0	0	281	137
RTOR Reduction (vph)	0	0	0	0	0	74	0	0	0	0	0	49
Lane Group Flow (vph)	0	0	0	409	1167	43	263	747	0	0	281	88
Confl. Peds. (#/hr)				14		121	17					118
Confl. Bikes (#/hr)						6						4
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				25.0	25.0	25.0	37.0	37.0			25.0	25.0
Effective Green, g (s)				26.0	26.0	26.0	38.0	38.0			26.0	26.0
Actuated g/C Ratio				0.37	0.37	0.37	0.54	0.54			0.37	0.37
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				427	944	335	378	1166			507	337
v/s Ratio Prot				0.36	c0.46		c0.09	0.08			0.21	
v/s Ratio Perm						0.05	c0.29	0.27				0.10
v/c Ratio				0.96	1.24	0.13	0.70	0.64			0.55	0.26
Uniform Delay, d1				21.5	22.0	14.5	15.9	11.2			17.4	15.3
Progression Factor				1.00	1.00	1.00	0.49	0.49			0.83	0.87
Incremental Delay, d2				34.2	115.5	0.8	7.9	2.1			3.8	1.6
Delay (s)				55.6	137.5	15.3	15.7	7.6			18.2	15.0
Level of Service				E	F	B	B	A			B	B
Approach Delay (s)		0.0			109.3			9.7			17.1	
Approach LOS		A			F			A			B	

Intersection Summary			
HCM 2000 Control Delay	64.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	124.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd 12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱					↑↑	↱	↰	↑	
Traffic Volume (vph)	174	901	372	0	0	0	0	602	381	17	491	0
Future Volume (vph)	174	901	372	0	0	0	0	602	381	17	491	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.87					1.00	0.92	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1228	2455	1020					2543	1079	1364	1161	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.23	1.00	
Satd. Flow (perm)	1228	2455	1020					2543	1079	335	1161	
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	202	1048	433	0	0	0	0	700	443	20	571	0
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	44	0	0	0
Lane Group Flow (vph)	202	1048	388	0	0	0	0	700	399	20	571	0
Confl. Peds. (#/hr)	3		88						70	20		
Confl. Bikes (#/hr)			3						5			
Heavy Vehicles (%)	4%	4%	4%	2%	2%	2%	4%	4%	4%	3%	3%	3%
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	39.5	39.5	39.5					21.5	21.5	21.5	21.5	
Effective Green, g (s)	41.0	41.0	41.0					23.0	23.0	23.0	23.0	
Actuated g/C Ratio	0.59	0.59	0.59					0.33	0.33	0.33	0.33	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	719	1437	597					835	354	110	381	
v/s Ratio Prot	0.16	c0.43						0.28			c0.49	
v/s Ratio Perm			0.38						0.37	0.06		
v/c Ratio	0.28	0.73	0.65					0.84	1.13	0.18	1.50	
Uniform Delay, d1	7.2	10.5	9.7					21.8	23.5	16.8	23.5	
Progression Factor	0.70	0.62	0.54					1.00	1.00	0.81	0.91	
Incremental Delay, d2	0.1	0.3	0.5					9.8	86.6	2.1	232.4	
Delay (s)	5.2	6.8	5.7					31.6	110.1	15.7	253.7	
Level of Service	A	A	A					C	F	B	F	
Approach Delay (s)		6.3			0.0			62.0			245.7	
Approach LOS		A			A			E			F	

Intersection Summary			
HCM 2000 Control Delay	66.4	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	124.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
14: Irwin/101 NBOn Mission & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	495	282	0	0	167	326	75	1474	38	0	0	0
Future Volume (vph)	495	282	0	0	167	326	75	1474	38	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.92			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1482			1482	1215		2790	1081			
Flt Permitted	0.46	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	660	1482			1482	1215		2790	1081			
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	576	328	0	0	194	379	87	1714	44	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	61	0	0	23	0	0	0
Lane Group Flow (vph)	576	328	0	0	194	318	0	1801	21	0	0	0
Confl. Peds. (#/hr)						14	9		27			
Confl. Bikes (#/hr)						1			1			
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	4%	4%	4%	2%	2%	2%
Parking (#/hr)								2	2			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	31.0	31.0			14.0	14.0		31.0	31.0			
Effective Green, g (s)	32.0	33.0			15.0	15.0		33.0	33.0			
Actuated g/C Ratio	0.46	0.47			0.21	0.21		0.47	0.47			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	451	698			317	260		1315	509			
v/s Ratio Prot	c0.27	0.22			0.13	0.26		c0.65				
v/s Ratio Perm	c0.31								0.02			
v/c Ratio	1.28	0.47			0.61	1.22		1.37	0.04			
Uniform Delay, d1	20.1	12.6			24.9	27.5		18.5	10.0			
Progression Factor	0.64	0.47			0.99	1.00		0.92	1.36			
Incremental Delay, d2	135.5	1.4			5.1	118.8		166.8	0.0			
Delay (s)	148.4	7.4			29.6	146.3		183.8	13.5			
Level of Service	F	A			C	F		F	B			
Approach Delay (s)		97.2			106.8			179.7			0.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	144.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.35		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	117.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
15: Irwin & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	204	82	0	0	126	72	140	1522	10	0	0	0
Future Volume (vph)	204	82	0	0	126	72	140	1522	10	0	0	0
Ideal Flow (vphpl)	1700	1700	1800	1800	1700	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.95				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	0.99	1.00			1.00			1.00				
Frt	1.00	1.00			0.95			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1261	1335			1257			2742				
Flt Permitted	0.50	1.00			1.00			1.00				
Satd. Flow (perm)	661	1335			1257			2742				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	227	91	0	0	140	80	156	1691	11	0	0	0
RTOR Reduction (vph)	0	0	0	0	20	0	0	1	0	0	0	0
Lane Group Flow (vph)	227	91	0	0	200	0	0	1857	0	0	0	0
Confl. Peds. (#/hr)	8					8	1		4			
Confl. Bikes (#/hr)						9			1			
Parking (#/hr)	2	2			2	2	2	2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	19.0	19.0			19.0			43.0				
Effective Green, g (s)	20.0	20.0			20.0			44.0				
Actuated g/C Ratio	0.29	0.29			0.29			0.63				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	188	381			359			1723				
v/s Ratio Prot		0.07			0.16			c0.68				
v/s Ratio Perm	c0.34											
v/c Ratio	1.21	0.24			0.56			1.08				
Uniform Delay, d1	25.0	19.2			21.2			13.0				
Progression Factor	0.78	0.89			0.83			0.62				
Incremental Delay, d2	119.2	0.9			6.1			36.3				
Delay (s)	138.6	18.0			23.6			44.4				
Level of Service	F	B			C			D				
Approach Delay (s)		104.1			23.6			44.4			0.0	
Approach LOS		F			C			D			A	

Intersection Summary			
HCM 2000 Control Delay	50.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.12		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	95.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	143	181	0	0	356	60	95	1363	66	0	0	0
Future Volume (vph)	143	181	0	0	356	60	95	1363	66	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.95				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.99	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.98		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1366	1500			1300		1282	2493				
Flt Permitted	0.19	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	274	1500			1300		1282	2493				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	159	201	0	0	396	67	106	1514	73	0	0	0
RTOR Reduction (vph)	0	0	0	0	8	0	0	5	0	0	0	0
Lane Group Flow (vph)	159	201	0	0	455	0	106	1582	0	0	0	0
Confl. Peds. (#/hr)	23					23			2			
Confl. Bikes (#/hr)						13			3			
Parking (#/hr)					2	2		2	2			
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	20.0	20.0			20.0		42.0	42.0				
Effective Green, g (s)	21.0	21.0			21.0		43.0	43.0				
Actuated g/C Ratio	0.30	0.30			0.30		0.61	0.61				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	82	450			390		787	1531				
v/s Ratio Prot		0.13			0.35		0.08	c0.63				
v/s Ratio Perm	c0.58											
v/c Ratio	1.94	0.45			1.17		0.13	1.03				
Uniform Delay, d1	24.5	19.8			24.5		5.7	13.5				
Progression Factor	0.74	0.82			1.16		0.32	0.44				
Incremental Delay, d2	453.7	2.4			97.0		0.0	17.8				
Delay (s)	471.8	18.6			125.5		1.8	23.7				
Level of Service	F	B			F		A	C				
Approach Delay (s)		218.8			125.5			22.4			0.0	
Approach LOS		F			F			C			A	

Intersection Summary			
HCM 2000 Control Delay	69.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	97.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1177	170	1119	1406	0	0	0	0
Future Volume (vph)	0	0	0	0	1177	170	1119	1406	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1500	1500	1500	1500	1800	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.94	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3308	1004	990	3194				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3308	1004	990	3194				
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	0	0	0	0	1385	200	1316	1654	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	15	10	10	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1385	185	687	2263	0	0	0	0
Confl. Peds. (#/hr)						42						
Confl. Bikes (#/hr)						6						
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	4%	4%	4%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					22.5	22.5	38.5	38.5				
Effective Green, g (s)					24.0	24.0	40.0	40.0				
Actuated g/C Ratio					0.34	0.34	0.57	0.57				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1134	344	565	1825				
v/s Ratio Prot					c0.42		0.69	c0.71				
v/s Ratio Perm						0.18						
v/c Ratio					1.22	0.54	1.22	1.24				
Uniform Delay, d1					23.0	18.5	15.0	15.0				
Progression Factor					0.92	0.85	1.33	1.32				
Incremental Delay, d2					100.4	0.5	98.9	108.5				
Delay (s)					121.6	16.3	118.8	128.2				
Level of Service					F	B	F	F				
Approach Delay (s)		0.0			108.3			126.0			0.0	
Approach LOS		A			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	119.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	123.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	895	981	0	0	0	0	0	1740	578	0	0	0
Future Volume (vph)	895	981	0	0	0	0	0	1740	578	0	0	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1600	1600	1600	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.96			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1254	3776						3817	1069			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1254	3776						3817	1069			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	994	1090	0	0	0	0	0	1933	642	0	0	0
RTOR Reduction (vph)	17	17	0	0	0	0	0	0	21	0	0	0
Lane Group Flow (vph)	510	1540	0	0	0	0	0	1933	621	0	0	0
Confl. Peds. (#/hr)									17			
Confl. Bikes (#/hr)									1			
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	30.0	30.0						31.0	31.0			
Effective Green, g (s)	31.0	31.0						33.0	33.0			
Actuated g/C Ratio	0.44	0.44						0.47	0.47			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	555	1672						1799	503			
v/s Ratio Prot	0.41	c0.41						0.51				
v/s Ratio Perm									c0.58			
v/c Ratio	0.92	0.92						1.07	1.23			
Uniform Delay, d1	18.3	18.3						18.5	18.5			
Progression Factor	1.34	1.32						1.00	1.00			
Incremental Delay, d2	14.5	6.0						44.4	121.8			
Delay (s)	39.1	30.3						62.9	140.3			
Level of Service	D	C						E	F			
Approach Delay (s)		32.5			0.0			82.2			0.0	
Approach LOS		C			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	60.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	112.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	586	101	76	165	0	0	0	0	222	1121	612
Future Volume (vph)	0	586	101	76	165	0	0	0	0	222	1121	612
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.98						0.99	1.00
Satd. Flow (prot)		2737			1769						2964	1262
Flt Permitted		1.00			0.64						0.99	1.00
Satd. Flow (perm)		2737			1153						2964	1262
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	651	112	84	183	0	0	0	0	247	1246	680
RTOR Reduction (vph)	0	15	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	748	0	0	267	0	0	0	0	0	1493	680
Confl. Peds. (#/hr)			24	16								11
Confl. Bikes (#/hr)			12									5
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	2%	2%	3%	3%	3%
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		29.8			29.8						31.4	24.4
Effective Green, g (s)		30.8			30.8						32.4	25.4
Actuated g/C Ratio		0.44			0.44						0.46	0.36
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1204			507						1371	457
v/s Ratio Prot		c0.27									c0.50	
v/s Ratio Perm					0.23							c0.54
v/c Ratio		0.62			0.53						1.09	1.49
Uniform Delay, d1		15.1			14.3						18.8	22.3
Progression Factor		1.00			0.29						1.00	1.00
Incremental Delay, d2		2.4			2.0						52.3	231.0
Delay (s)		17.5			6.2						71.1	253.3
Level of Service		B			A						E	F
Approach Delay (s)		17.5			6.2			0.0			128.1	
Approach LOS		B			A			A			F	

Intersection Summary			
HCM 2000 Control Delay	91.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
20: Hetherton & 5th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	206	209	36	230	0	0	0	0	50	1255	59
Future Volume (vph)	0	206	209	36	230	0	0	0	0	50	1255	59
Ideal Flow (vphpl)	1800	1500	1800	1800	1500	1800	1800	1800	1800	1800	1600	1600
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.1	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.92
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.93			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1386			1490						3706	985
Flt Permitted		1.00			0.89						1.00	1.00
Satd. Flow (perm)		1386			1334						3706	985
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	0	248	252	43	277	0	0	0	0	60	1512	71
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	495	0	0	320	0	0	0	0	0	1572	71
Confl. Peds. (#/hr)			3	3						80		32
Confl. Bikes (#/hr)			4									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.4	23.5
Effective Green, g (s)		32.0			32.0						31.9	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.6	4.5
Lane Grp Cap (vph)		633			609						1688	344
v/s Ratio Prot		c0.36									c0.42	
v/s Ratio Perm					0.24							0.07
v/c Ratio		0.78			0.53						0.93	0.21
Uniform Delay, d1		16.1			13.6						18.0	15.9
Progression Factor		1.00			0.76						0.38	0.44
Incremental Delay, d2		9.3			2.0						5.6	0.6
Delay (s)		25.4			12.3						12.5	7.6
Level of Service		C			B						B	A
Approach Delay (s)		25.4			12.3			0.0			12.3	
Approach LOS		C			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	14.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	96.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
21: Hetherton & 4th

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	327	157	178	362	0	0	0	0	130	1049	199
Future Volume (vph)	0	327	157	178	362	0	0	0	0	130	1049	199
Ideal Flow (vphpl)	1700	1700	1600	1600	1700	1700	1700	1700	1700	1700	1700	1600
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.98
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1550	1088	1466	1450						3920	1045
Flt Permitted		1.00	1.00	0.37	1.00						0.99	1.00
Satd. Flow (perm)		1550	1088	573	1450						3920	1045
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	409	196	222	452	0	0	0	0	162	1311	249
RTOR Reduction (vph)	0	0	47	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	409	149	223	453	0	0	0	0	0	1474	249
Confl. Peds. (#/hr)			15	15						5		
Confl. Bikes (#/hr)			7									2
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Perm	NA	custom
Protected Phases		4			8						2	
Permitted Phases			4	8						2		5
Actuated Green, G (s)		28.8	28.8	28.8	28.8						32.8	25.8
Effective Green, g (s)		29.8	29.8	29.8	29.8						33.8	26.8
Actuated g/C Ratio		0.43	0.43	0.43	0.43						0.48	0.38
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		659	463	243	617						1892	400
v/s Ratio Prot		0.26			0.31							
v/s Ratio Perm			0.14	c0.39							0.38	0.24
v/c Ratio		0.62	0.32	0.92	0.73						0.78	0.62
Uniform Delay, d1		15.7	13.4	18.9	16.8						15.0	17.5
Progression Factor		1.00	1.00	0.68	0.69						0.26	0.37
Incremental Delay, d2		4.4	1.8	31.2	5.4						1.4	3.0
Delay (s)		20.0	15.2	44.1	17.0						5.3	9.4
Level of Service		C	B	D	B						A	A
Approach Delay (s)		18.5			25.9			0.0			5.9	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	97.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	549	1733	0	0	0	0	0	880	459
Future Volume (vph)	0	0	0	549	1733	0	0	0	0	0	880	459
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1800	1800	1800	1800	1800	1500	1500
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.90
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1056	3126						3426	963
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1056	3126						3426	963
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	0	0	0	678	2140	0	0	0	0	0	1086	567
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	678	2140	0	0	0	0	0	1086	559
Confl. Peds. (#/hr)				41								87
Heavy Vehicles (%)	2%	2%	2%	4%	4%	4%	2%	2%	2%	4%	4%	4%
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				29.0	29.0						33.0	33.0
Effective Green, g (s)				30.0	30.0						34.0	34.0
Actuated g/C Ratio				0.43	0.43						0.49	0.49
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				452	1339						1664	467
v/s Ratio Prot				0.64	c0.68						0.32	
v/s Ratio Perm												c0.58
v/c Ratio				1.50	1.60						0.65	1.20
Uniform Delay, d1				20.0	20.0						13.6	18.0
Progression Factor				1.12	1.12						1.09	1.13
Incremental Delay, d2				226.1	269.5						1.3	101.5
Delay (s)				248.5	291.9						16.0	121.8
Level of Service				F	F						B	F
Approach Delay (s)		0.0			281.5			0.0			52.3	
Approach LOS		A			F			A			D	

Intersection Summary			
HCM 2000 Control Delay	196.8	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.38		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	140.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	1402	1532	0	0	0	0	0	0	317	1029	0
Future Volume (vph)	0	1402	1532	0	0	0	0	0	0	317	1029	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1700	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		0.99	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.95	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4635	1028							1302	2678	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4635	1028							1302	2678	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1558	1702	0	0	0	0	0	0	352	1143	0
RTOR Reduction (vph)	0	5	10	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2404	841	0	0	0	0	0	0	352	1143	0
Confl. Peds. (#/hr)			7									
Confl. Bikes (#/hr)			4									
Heavy Vehicles (%)	3%	3%	3%	2%	2%	2%	2%	2%	2%	4%	4%	4%
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		38.5	38.5							22.5	22.5	
Effective Green, g (s)		40.0	40.0							24.0	24.0	
Actuated g/C Ratio		0.57	0.57							0.34	0.34	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2648	587							446	918	
v/s Ratio Prot		0.52								0.27	c0.43	
v/s Ratio Perm			c0.82									
v/c Ratio		1.21dr	1.43							0.79	1.25	
Uniform Delay, d1		13.4	15.0							20.7	23.0	
Progression Factor		1.00	1.00							0.63	0.66	
Incremental Delay, d2		5.9	204.5							3.9	112.9	
Delay (s)		19.2	219.5							16.9	128.1	
Level of Service		B	F							B	F	
Approach Delay (s)		71.5			0.0			0.0			101.9	
Approach LOS		E			A			A			F	

Intersection Summary			
HCM 2000 Control Delay	81.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	181.0%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	2	5	0	0	0
Future Volume (Veh/h)	0	2	5	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	0	2	6	0	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		1277				
pX, platoon unblocked						
vC, conflicting volume	6				7	3
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	6				7	3
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1613				1013	1080

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	1	1	3	3	0
Volume Left	0	0	0	0	0
Volume Right	0	0	0	0	0
cSH	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.00	0.00	0.00	0.00
Queue Length 95th (ft)	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0
Lane LOS					A
Approach Delay (s)	0.0		0.0		0.0
Approach LOS					A

Intersection Summary			
Average Delay	0.0		
Intersection Capacity Utilization	6.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (veh/h)	1	1179	25	12	5	785	0	18	0	18	4	1
Future Volume (Veh/h)	1	1179	25	12	5	785	0	18	0	18	4	1
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	1	1215	26	0	5	809	0	19	0	19	4	1
Pedestrians						9						2
Lane Width (ft)						12.0						12.0
Walking Speed (ft/s)						4.0						4.0
Percent Blockage						1						0
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)		558				717						
pX, platoon unblocked				0.00	0.78			0.78	0.78	0.78	0.78	0.78
vC, conflicting volume	811			0	1241			1711	2051	630	1458	2064
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	811			0	751			1352	1787	0	1029	1803
tC, single (s)	4.1			0.0	4.1			7.5	6.5	6.9	7.5	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	100			0	99			74	100	98	97	98
cM capacity (veh/h)	810			0	668			74	62	842	141	61

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	608	634	5	539	270	38	71
Volume Left	1	0	5	0	0	19	4
Volume Right	0	26	0	0	0	19	66
cSH	810	1700	668	1700	1700	136	455
Volume to Capacity	0.00	0.37	0.01	0.32	0.16	0.28	0.16
Queue Length 95th (ft)	0	0	1	0	0	27	14
Control Delay (s)	0.0	0.0	10.4	0.0	0.0	41.5	14.4
Lane LOS	A		B			E	B
Approach Delay (s)	0.0		0.1			41.5	14.4
Approach LOS						E	B

Intersection Summary			
Average Delay	1.2		
Intersection Capacity Utilization	53.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	64
Future Volume (Veh/h)	64
Sign Control	
Grade	
Peak Hour Factor	0.97
Hourly flow rate (vph)	66
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	406
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	406
tC, single (s)	6.9
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	89
cM capacity (veh/h)	593

Direction, Lane #

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	40	90	1045	785	5	1	12
Future Volume (Veh/h)	40	90	1045	785	5	1	12
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	93	1077	809	5	1	12
Pedestrians						2	
Lane Width (ft)						12.0	
Walking Speed (ft/s)						4.0	
Percent Blockage						0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			873	402			
pX, platoon unblocked	0.00					0.83	
vC, conflicting volume	0	816				1538	409
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	816				1233	409
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	88				99	98
cM capacity (veh/h)	0	806				124	591

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	93	538	538	539	275	13
Volume Left	93	0	0	0	0	1
Volume Right	0	0	0	0	5	12
cSH	806	1700	1700	1700	1700	458
Volume to Capacity	0.12	0.32	0.32	0.32	0.16	0.03
Queue Length 95th (ft)	10	0	0	0	0	2
Control Delay (s)	10.0	0.0	0.0	0.0	0.0	13.1
Lane LOS	B					B
Approach Delay (s)	0.8			0.0		13.1
Approach LOS						B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	44.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	6	45	996	754	7	4	26
Future Volume (Veh/h)	6	45	996	754	7	4	26
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	46	1027	777	7	4	27
Pedestrians			3			2	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)			166				
pX, platoon unblocked	0.00						
vC, conflicting volume	0	786				1388	397
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	786				1388	397
tC, single (s)	0.0	4.1				6.8	6.9
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	94				97	95
cM capacity (veh/h)	0	827				126	600

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1
Volume Total	46	514	514	518	266	31
Volume Left	46	0	0	0	0	4
Volume Right	0	0	0	0	7	27
cSH	827	1700	1700	1700	1700	404
Volume to Capacity	0.06	0.30	0.30	0.30	0.16	0.08
Queue Length 95th (ft)	4	0	0	0	0	6
Control Delay (s)	9.6	0.0	0.0	0.0	0.0	14.6
Lane LOS	A					B
Approach Delay (s)	0.4			0.0		14.6
Approach LOS						B

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
4: Marina Ct/Mission & Embarcadero/E. Mission & Sea View

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		✣			✣			✣			✣	
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	7	8	3	0	7	32	0	10	1	40	14	2
Future Volume (vph)	7	8	3	0	7	32	0	10	1	40	14	2
Peak Hour Factor	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Hourly flow rate (vph)	8	9	4	0	8	38	0	12	1	47	16	2

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	21	46	13	65
Volume Left (vph)	8	0	0	47
Volume Right (vph)	4	38	1	2
Hadj (s)	0.00	-0.46	-0.01	0.16
Departure Headway (s)	4.1	3.6	4.1	4.2
Degree Utilization, x	0.02	0.05	0.01	0.08
Capacity (veh/h)	852	965	852	838
Control Delay (s)	7.2	6.8	7.1	7.6
Approach Delay (s)	7.2	6.8	7.1	7.6
Approach LOS	A	A	A	A

Intersection Summary			
Delay	7.2		
Level of Service	A		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Mission & Belle S

12/12/2016

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations		✣				✣			✣			✣
Traffic Volume (veh/h)	27	82	0	5	0	96	7	24	1	9	5	2
Future Volume (Veh/h)	27	82	0	5	0	96	7	24	1	9	5	2
Sign Control		Free				Free			Stop			Stop
Grade		0%				0%			0%			0%
Peak Hour Factor	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Hourly flow rate (vph)	34	104	0	0	0	122	9	30	1	11	6	3
Pedestrians		1				3						12
Lane Width (ft)		12.0				12.0						12.0
Walking Speed (ft/s)		4.0				4.0						4.0
Percent Blockage		0				0						1
Right turn flare (veh)												
Median type		None				None						
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked				0.00								
vC, conflicting volume	143			0	104			301	315	107	325	310
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	143			0	104			301	315	107	325	310
tC, single (s)	4.1			0.0	4.1			7.1	6.5	6.2	7.1	6.5
tC, 2 stage (s)												
tF (s)	2.2			0.0	2.2			3.5	4.0	3.3	3.5	4.0
p0 queue free %	98			0	100			95	100	99	99	99
cM capacity (veh/h)	1425			0	1488			632	580	945	596	584

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	138	131	42	9
Volume Left	34	0	30	6
Volume Right	0	9	11	0
cSH	1425	1488	690	592
Volume to Capacity	0.02	0.00	0.06	0.02
Queue Length 95th (ft)	2	0	5	1
Control Delay (s)	2.0	0.0	10.6	11.2
Lane LOS	A		B	B
Approach Delay (s)	2.0	0.0	10.6	11.2
Approach LOS			B	B

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	23.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SBR
Lane Configurations	
Traffic Volume (veh/h)	0
Future Volume (Veh/h)	0
Sign Control	
Grade	
Peak Hour Factor	0.79
Hourly flow rate (vph)	0
Pedestrians	
Lane Width (ft)	
Walking Speed (ft/s)	
Percent Blockage	
Right turn flare (veh)	
Median type	
Median storage veh)	
Upstream signal (ft)	
pX, platoon unblocked	
vC, conflicting volume	140
vC1, stage 1 conf vol	
vC2, stage 2 conf vol	
vCu, unblocked vol	140
tC, single (s)	6.2
tC, 2 stage (s)	
tF (s)	3.3
p0 queue free %	100
cM capacity (veh/h)	899

Direction, Lane #

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	88	87	0	0	6
Future Volume (Veh/h)	8	88	87	0	0	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	9	98	97	0	0	7
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	97				213	97
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	97				213	97
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	99
cM capacity (veh/h)	1496				771	959

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	9	97	7
Volume Left	9	0	0
Volume Right	0	0	7
cSH	1496	1700	959
Volume to Capacity	0.01	0.06	0.01
Queue Length 95th (ft)	0	0	1
Control Delay (s)	7.4	0.0	8.8
Lane LOS	A		A
Approach Delay (s)	Err	0.0	8.8
Approach LOS			A

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	4	141	105	2	1	21
Future Volume (Veh/h)	3	4	141	105	2	1	21
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	0	4	148	111	2	1	22
Pedestrians			5			1	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			0			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	114				269	118
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	114				269	118
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	100				100	98
cM capacity (veh/h)	0	1474				718	929

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	152	113	23
Volume Left	4	0	1
Volume Right	0	2	22
cSH	1474	1700	917
Volume to Capacity	0.00	0.07	0.03
Queue Length 95th (ft)	0	0	2
Control Delay (s)	0.2	0.0	9.0
Lane LOS	A		A
Approach Delay (s)	0.2	0.0	9.0
Approach LOS			A

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	25.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBU	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations							
Traffic Volume (veh/h)	3	51	166	121	1	2	48
Future Volume (Veh/h)	3	51	166	121	1	2	48
Sign Control			Free	Free		Stop	
Grade			0%	0%		0%	
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Hourly flow rate (vph)	0	55	178	130	1	2	52
Pedestrians			7			4	
Lane Width (ft)			12.0			12.0	
Walking Speed (ft/s)			4.0			4.0	
Percent Blockage			1			0	
Right turn flare (veh)							
Median type			None	None			
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked	0.00						
vC, conflicting volume	0	135				422	142
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	0	135				422	142
tC, single (s)	0.0	4.1				6.4	6.2
tC, 2 stage (s)							
tF (s)	0.0	2.2				3.5	3.3
p0 queue free %	0	96				100	94
cM capacity (veh/h)	0	1445				564	898

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	233	131	54
Volume Left	55	0	2
Volume Right	0	1	52
cSH	1445	1700	879
Volume to Capacity	0.04	0.08	0.06
Queue Length 95th (ft)	3	0	5
Control Delay (s)	2.0	0.0	9.4
Lane LOS	A		A
Approach Delay (s)	2.0	0.0	9.4
Approach LOS			A

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	35.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
8: Union & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	41	137	114	106	113	1	147	64	109	7	74	28
Future Volume (vph)	41	137	114	106	113	1	147	64	109	7	74	28
Peak Hour Factor	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Hourly flow rate (vph)	49	165	137	128	136	1	177	77	131	8	89	34

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	351	265	385	131
Volume Left (vph)	49	128	177	8
Volume Right (vph)	137	1	131	34
Hadj (s)	-0.17	0.13	-0.08	-0.11
Departure Headway (s)	6.0	6.4	6.0	6.6
Degree Utilization, x	0.58	0.47	0.65	0.24
Capacity (veh/h)	562	504	560	449
Control Delay (s)	17.0	15.1	19.4	11.7
Approach Delay (s)	17.0	15.1	19.4	11.7
Approach LOS	C	C	C	B

Intersection Summary			
Delay	16.8		
Level of Service	C		
Intersection Capacity Utilization	65.2%	ICU Level of Service	C
Analysis Period (min)	15		

HCM Signalized Intersection Capacity Analysis
9: Union & 4th/School

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	32	2	229	2	1	2	98	302	1	0	231	58
Future Volume (vph)	32	2	229	2	1	2	98	302	1	0	231	58
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Total Lost time (s)		3.0			3.0		3.0	3.0			3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frpb, ped/bikes		0.98			0.99		1.00	1.00			0.99	
Flpb, ped/bikes		1.00			1.00		0.99	1.00			1.00	
Frt		0.88			0.95		1.00	1.00			0.97	
Flt Protected		0.99			0.98		0.95	1.00			1.00	
Satd. Flow (prot)		1513			1614		1664	1764			1708	
Flt Permitted		0.97			0.91		0.58	1.00			1.00	
Satd. Flow (perm)		1469			1504		1013	1764			1708	
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	33	2	234	2	1	2	100	308	1	0	236	59
RTOR Reduction (vph)	0	189	0	0	2	0	0	0	0	0	10	0
Lane Group Flow (vph)	0	80	0	0	3	0	100	309	0	0	285	0
Confl. Peds. (#/hr)	15		12	5		8	12		5	8		15
Turn Type	Perm	NA		Perm	NA		Perm	NA			NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		8.7			8.7		33.3	33.3			33.3	
Effective Green, g (s)		9.7			9.7		34.3	34.3			34.3	
Actuated g/C Ratio		0.19			0.19		0.69	0.69			0.69	
Clearance Time (s)		4.0			4.0		4.0	4.0			4.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0			3.0	
Lane Grp Cap (vph)		284			291		694	1210			1171	
v/s Ratio Prot								c0.18			0.17	
v/s Ratio Perm		c0.05			0.00		0.10					
v/c Ratio		0.28			0.01		0.14	0.26			0.24	
Uniform Delay, d1		17.2			16.3		2.7	3.0			3.0	
Progression Factor		1.00			1.00		1.00	1.00			1.00	
Incremental Delay, d2		0.5			0.0		0.4	0.5			0.5	
Delay (s)		17.7			16.3		3.2	3.5			3.5	
Level of Service		B			B		A	A			A	
Approach Delay (s)		17.7			16.3			3.4			3.5	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	7.4	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	50.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
10: Union & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	234	781	124	90	613	157	275	86	73	278	71	111
Future Volume (vph)	234	781	124	90	613	157	275	86	73	278	71	111
Ideal Flow (vphpl)	1600	1800	1600	1600	1700	1600	1600	1700	1700	1600	1600	1600
Lane Width	11	11	10	11	12	8	10	10	12	11	11	12
Total Lost time (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.92	1.00	1.00	0.92	1.00	0.98		1.00	0.97	
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.93		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1441	3241	1150	1441	3167	1064	2698	1417		1441	1333	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1441	3241	1150	1441	3167	1064	2698	1417		1441	1333	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	252	840	133	97	659	169	296	92	78	299	76	119
RTOR Reduction (vph)	0	0	65	0	0	91	0	26	0	0	42	0
Lane Group Flow (vph)	252	840	68	97	659	78	296	144	0	299	153	0
Confl. Peds. (#/hr)	14		25	5		42	20		33	28		34
Confl. Bikes (#/hr)						11						5
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Split	NA		Split	NA	
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases			6			2						
Actuated Green, G (s)	20.3	36.5	36.5	10.8	27.0	27.0	17.6	17.6		26.5	26.5	
Effective Green, g (s)	21.8	38.5	38.5	12.3	29.0	29.0	19.1	19.1		28.0	28.0	
Actuated g/C Ratio	0.20	0.35	0.35	0.11	0.26	0.26	0.17	0.17		0.25	0.25	
Clearance Time (s)	4.5	5.0	5.0	4.5	5.0	5.0	4.5	4.5		4.5	4.5	
Vehicle Extension (s)	4.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0		2.0	2.0	
Lane Grp Cap (vph)	285	1135	402	161	835	280	468	246		367	339	
v/s Ratio Prot	c0.17	c0.26		0.07	0.21		c0.11	0.10		c0.21	0.11	
v/s Ratio Perm			0.06			0.07						
v/c Ratio	0.88	0.74	0.17	0.60	0.79	0.28	0.63	0.59		0.81	0.45	
Uniform Delay, d1	42.8	31.3	24.7	46.5	37.6	32.2	42.1	41.8		38.5	34.5	
Progression Factor	1.00	1.00	1.00	1.00	1.02	1.07	1.00	1.00		1.00	1.00	
Incremental Delay, d2	26.6	2.3	0.1	4.3	4.6	0.2	2.1	2.3		12.4	0.4	
Delay (s)	69.4	33.6	24.7	50.9	43.1	34.7	44.2	44.1		50.9	34.8	
Level of Service	E	C	C	D	D	C	D	D		D	C	
Approach Delay (s)		40.0			42.4			44.1			44.5	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	42.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	109.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
11: Grand & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	65	291	66	31	302	92	181	200	31	57	294	86
Future Volume (vph)	65	291	66	31	302	92	181	200	31	57	294	86
Ideal Flow (vphpl)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Lane Width	12	16	12	12	16	12	12	16	12	12	16	12
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	0.99		1.00	0.99		1.00	0.99		1.00	0.99	
Flpb, ped/bikes	0.99	1.00		0.98	1.00		0.99	1.00		0.99	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.98		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1645	1900		1629	1886		1634	1928		1639	1887	
Flt Permitted	0.21	1.00		0.27	1.00		0.45	1.00		0.58	1.00	
Satd. Flow (perm)	364	1900		456	1886		773	1928		998	1887	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	72	323	73	34	336	102	201	222	34	63	327	96
RTOR Reduction (vph)	0	13	0	0	17	0	0	7	0	0	13	0
Lane Group Flow (vph)	72	383	0	34	421	0	201	249	0	63	410	0
Confl. Peds. (#/hr)	11		21	21		11	14		8	8		14
Confl. Bikes (#/hr)			1			6			5			7
Parking (#/hr)	2	2	2	2	2	2	2	2	2	2	2	2
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8			4		
Actuated Green, G (s)	20.5	20.5		20.5	20.5		41.5	41.5		41.5	41.5	
Effective Green, g (s)	21.5	21.5		21.5	21.5		42.5	42.5		42.5	42.5	
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.61	0.61		0.61	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	111	583		140	579		469	1170		605	1145	
v/s Ratio Prot		0.20			c0.22			0.13			0.22	
v/s Ratio Perm	0.20			0.07			c0.26			0.06		
v/c Ratio	0.65	0.66		0.24	0.73		0.43	0.21		0.10	0.36	
Uniform Delay, d1	21.0	21.0		18.2	21.6		7.3	6.2		5.8	6.9	
Progression Factor	0.63	0.67		1.00	1.00		0.44	0.48		1.00	1.00	
Incremental Delay, d2	11.6	2.5		0.9	4.5		2.6	0.4		0.3	0.9	
Delay (s)	24.7	16.7		19.1	26.2		5.8	3.4		6.1	7.8	
Level of Service	C	B		B	C		A	A		A	A	
Approach Delay (s)		17.9			25.6			4.5			7.6	
Approach LOS		B			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	13.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
12: Grand & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	103	826	317	453	511	0	0	323	151
Future Volume (vph)	0	0	0	103	826	317	453	511	0	0	323	151
Ideal Flow (vphpl)	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450	1450
Lane Width	12	12	12	10	11	11	12	16	12	12	11	10
Total Lost time (s)				3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Util. Factor				1.00	0.95	1.00	0.91	0.91			1.00	1.00
Frpb, ped/bikes				1.00	1.00	0.93	1.00	1.00			1.00	0.94
Flpb, ped/bikes				1.00	1.00	1.00	1.00	1.00			1.00	1.00
Frt				1.00	1.00	0.85	1.00	1.00			1.00	0.85
Flt Protected				0.95	1.00	1.00	0.95	0.99			1.00	1.00
Satd. Flow (prot)				1134	2350	977	1105	2606			1237	955
Flt Permitted				0.95	1.00	1.00	0.24	0.59			1.00	1.00
Satd. Flow (perm)				1134	2350	977	284	1544			1237	955
Peak-hour factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
Adj. Flow (vph)	0	0	0	129	1032	396	566	639	0	0	404	189
RTOR Reduction (vph)	0	0	0	0	0	120	0	0	0	0	0	57
Lane Group Flow (vph)	0	0	0	129	1033	276	368	837	0	0	404	132
Confl. Peds. (#/hr)				27		49	12					43
Confl. Bikes (#/hr)						5						4
Turn Type				Split	NA	Perm	pm+pt	NA			NA	Perm
Protected Phases				1	1		4	8			3	
Permitted Phases						1	8					3
Actuated Green, G (s)				29.0	29.0	29.0	33.0	33.0			18.0	18.0
Effective Green, g (s)				30.0	30.0	30.0	34.0	34.0			19.0	19.0
Actuated g/C Ratio				0.43	0.43	0.43	0.49	0.49			0.27	0.27
Clearance Time (s)				4.0	4.0	4.0	4.0	4.0			4.0	4.0
Lane Grp Cap (vph)				486	1007	418	278	932			335	259
v/s Ratio Prot				0.11	c0.44		c0.23	0.15			0.33	
v/s Ratio Perm						0.28	c0.42	0.28				0.14
v/c Ratio				0.27	1.03	0.66	1.32	0.90			1.21	0.51
Uniform Delay, d1				12.9	20.0	15.9	22.9	16.4			25.5	21.6
Progression Factor				1.00	1.00	1.00	0.65	0.56			1.04	1.13
Incremental Delay, d2				1.3	35.1	8.0	161.3	9.3			115.5	6.4
Delay (s)				14.2	55.1	23.9	176.3	18.4			142.0	30.7
Level of Service				B	E	C	F	B			F	C
Approach Delay (s)		0.0			43.8			66.6			106.5	
Approach LOS		A			D			E			F	

Intersection Summary			
HCM 2000 Control Delay	63.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.0
Intersection Capacity Utilization	112.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
13: Grand & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	247	1099	817	0	0	0	0	839	230	41	563	0
Future Volume (vph)	247	1099	817	0	0	0	0	839	230	41	563	0
Ideal Flow (vphpl)	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700
Lane Width	10	10	12	12	12	12	12	11	12	13	10	12
Total Lost time (s)	3.0	3.0	3.0					3.0	3.0	3.0	3.0	
Lane Util. Factor	1.00	0.95	1.00					0.95	1.00	1.00	1.00	
Frpb, ped/bikes	1.00	1.00	0.83					1.00	0.88	1.00	1.00	
Flpb, ped/bikes	1.00	1.00	1.00					1.00	1.00	0.99	1.00	
Frt	1.00	1.00	0.85					1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00	1.00					1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1330	2660	1060					2755	1128	1465	1246	
Flt Permitted	0.95	1.00	1.00					1.00	1.00	0.17	1.00	
Satd. Flow (perm)	1330	2660	1060					2755	1128	256	1246	
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	294	1308	973	0	0	0	0	999	274	49	670	0
RTOR Reduction (vph)	0	0	79	0	0	0	0	0	13	0	0	0
Lane Group Flow (vph)	294	1308	894	0	0	0	0	999	261	49	670	0
Confl. Peds. (#/hr)			113						105	30		
Confl. Bikes (#/hr)			5						1			
Parking (#/hr)											2	
Turn Type	Split	NA	Perm					NA	Perm	Perm	NA	
Protected Phases	1	1						2			2	
Permitted Phases			1						2	2		
Actuated Green, G (s)	31.5	31.5	31.5					29.5	29.5	29.5	29.5	
Effective Green, g (s)	33.0	33.0	33.0					31.0	31.0	31.0	31.0	
Actuated g/C Ratio	0.47	0.47	0.47					0.44	0.44	0.44	0.44	
Clearance Time (s)	4.5	4.5	4.5					4.5	4.5	4.5	4.5	
Lane Grp Cap (vph)	627	1254	499					1220	499	113	551	
v/s Ratio Prot	0.22	0.49						0.36			c0.54	
v/s Ratio Perm			c0.84						0.23	0.19		
v/c Ratio	0.47	1.04	1.79					0.82	0.52	0.43	1.22	
Uniform Delay, d1	12.6	18.5	18.5					17.0	14.1	13.4	19.5	
Progression Factor	1.28	1.18	1.23					1.00	1.00	0.44	0.44	
Incremental Delay, d2	0.2	22.1	357.2					6.2	3.9	8.0	108.3	
Delay (s)	16.3	43.9	379.9					23.2	18.0	13.9	116.9	
Level of Service	B	D	F					C	B	B	F	
Approach Delay (s)		167.7			0.0			22.1			109.9	
Approach LOS		F			A			C			F	

Intersection Summary			
HCM 2000 Control Delay	118.0	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.51		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	112.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	506	329	0	0	187	369	95	1902	42	0	0	0
Future Volume (vph)	506	329	0	0	187	369	95	1902	42	0	0	0
Ideal Flow (vphpl)	1800	2000	1800	1800	2000	1800	1800	2000	1800	1800	1800	1800
Lane Width	9	10	12	12	10	9	12	12	12	12	12	12
Total Lost time (s)	3.0	2.0			2.0	2.0		2.0	2.0			
Lane Util. Factor	1.00	1.00			1.00	1.00		0.95	1.00			
Frpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	0.94			
Flpb, ped/bikes	1.00	1.00			1.00	1.00		1.00	1.00			
Frt	1.00	1.00			1.00	0.85		1.00	0.85			
Flt Protected	0.95	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (prot)	1358	1647			1647	1215		3345	1276			
Flt Permitted	0.46	1.00			1.00	1.00		1.00	1.00			
Satd. Flow (perm)	665	1647			1647	1215		3345	1276			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	562	366	0	0	208	410	106	2113	47	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	59	0	0	24	0	0	0
Lane Group Flow (vph)	562	366	0	0	208	351	0	2219	24	0	0	0
Confl. Peds. (#/hr)							6		20			
Confl. Bikes (#/hr)						1			1			
Turn Type	pm+pt	NA			NA	Prot	Split	NA	Perm			
Protected Phases	4	8			3	3	1	1				
Permitted Phases	8								1			
Actuated Green, G (s)	29.0	29.0			16.0	16.0		33.0	33.0			
Effective Green, g (s)	30.0	31.0			17.0	17.0		35.0	35.0			
Actuated g/C Ratio	0.43	0.44			0.24	0.24		0.50	0.50			
Clearance Time (s)	4.0	4.0			3.0	3.0		4.0	4.0			
Lane Grp Cap (vph)	393	729			399	295		1672	638			
v/s Ratio Prot	c0.22	0.22			0.13	0.29		c0.66				
v/s Ratio Perm	c0.39								0.02			
v/c Ratio	1.43	0.50			0.52	1.19		1.33	0.04			
Uniform Delay, d1	21.1	14.0			23.0	26.5		17.5	8.9			
Progression Factor	1.02	1.15			1.28	1.41		0.29	0.00			
Incremental Delay, d2	201.2	1.3			4.2	111.1		147.6	0.0			
Delay (s)	222.8	17.3			33.6	148.5		152.7	0.0			
Level of Service	F	B			C	F		F	A			
Approach Delay (s)		141.7			109.8			149.6			0.0	
Approach LOS		F			F			F			A	

Intersection Summary			
HCM 2000 Control Delay	141.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.40		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	128.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	257	121	0	0	137	136	101	1659	12	0	0	0
Future Volume (vph)	257	121	0	0	137	136	101	1659	12	0	0	0
Ideal Flow (vphpl)	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lane Width	12	12	12	12	12	12	12	11	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0			3.0				
Lane Util. Factor	1.00	1.00			1.00			0.91				
Frpb, ped/bikes	1.00	1.00			0.99			1.00				
Flpb, ped/bikes	1.00	1.00			1.00			1.00				
Frt	1.00	1.00			0.93			1.00				
Flt Protected	0.95	1.00			1.00			1.00				
Satd. Flow (prot)	1167	1228			1138			3710				
Flt Permitted	0.51	1.00			1.00			1.00				
Satd. Flow (perm)	622	1228			1138			3710				
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	292	138	0	0	156	155	115	1885	14	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	292	138	0	0	311	0	0	2013	0	0	0	0
Confl. Peds. (#/hr)									7			
Confl. Bikes (#/hr)						2			4			
Parking (#/hr)	6	6			6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	35.0	35.0			35.0			27.0				
Effective Green, g (s)	36.0	36.0			36.0			28.0				
Actuated g/C Ratio	0.51	0.51			0.51			0.40				
Clearance Time (s)	4.0	4.0			4.0			4.0				
Lane Grp Cap (vph)	319	631			585			1484				
v/s Ratio Prot		0.11			0.27			c0.54				
v/s Ratio Perm	c0.47											
v/c Ratio	0.92	0.22			0.53			1.36				
Uniform Delay, d1	15.6	9.3			11.4			21.0				
Progression Factor	1.91	1.97			1.16			0.45				
Incremental Delay, d2	20.6	0.4			3.4			160.8				
Delay (s)	50.4	18.7			16.5			170.3				
Level of Service	D	B			B			F				
Approach Delay (s)		40.2			16.5			170.3			0.0	
Approach LOS		D			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	132.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	94.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
16: Irwin & 4th
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	234	257	0	0	249	93	183	1416	62	0	0	0
Future Volume (vph)	234	257	0	0	249	93	183	1416	62	0	0	0
Ideal Flow (vphpl)	1800	1600	1600	1600	1600	1600	1600	1800	1600	1000	1800	1800
Lane Width	11	12	12	12	12	12	9	10	12	12	12	12
Total Lost time (s)	3.0	3.0			3.0		3.0	3.0				
Lane Util. Factor	1.00	1.00			1.00		1.00	0.91				
Frpb, ped/bikes	1.00	1.00			0.99		1.00	1.00				
Flpb, ped/bikes	0.98	1.00			1.00		1.00	1.00				
Frt	1.00	1.00			0.96		1.00	0.99				
Flt Protected	0.95	1.00			1.00		0.95	1.00				
Satd. Flow (prot)	1436	1412			1169		1207	4017				
Flt Permitted	0.47	1.00			1.00		0.95	1.00				
Satd. Flow (perm)	709	1412			1169		1207	4017				
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	260	286	0	0	277	103	203	1573	69	0	0	0
RTOR Reduction (vph)	0	0	0	0	1	0	0	7	0	0	0	0
Lane Group Flow (vph)	260	286	0	0	379	0	203	1635	0	0	0	0
Confl. Peds. (#/hr)	28					28	2		2			
Confl. Bikes (#/hr)						8			3			
Parking (#/hr)					6	6						
Turn Type	Perm	NA			NA		Split	NA				
Protected Phases		2			2		1	1				
Permitted Phases	2											
Actuated Green, G (s)	39.0	39.0			39.0		23.0	23.0				
Effective Green, g (s)	40.0	40.0			40.0		24.0	24.0				
Actuated g/C Ratio	0.57	0.57			0.57		0.34	0.34				
Clearance Time (s)	4.0	4.0			4.0		4.0	4.0				
Lane Grp Cap (vph)	405	806			668		413	1377				
v/s Ratio Prot		0.20			0.32		0.17	c0.41				
v/s Ratio Perm	c0.37											
v/c Ratio	0.64	0.35			0.57		0.49	1.19				
Uniform Delay, d1	10.2	8.1			9.5		18.2	23.0				
Progression Factor	1.11	0.99			0.86		0.65	0.72				
Incremental Delay, d2	6.0	1.0			3.0		0.4	85.2				
Delay (s)	17.3	9.0			11.1		12.2	101.8				
Level of Service	B	A			B		B	F				
Approach Delay (s)		12.9			11.1			92.0			0.0	
Approach LOS		B			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	65.3	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
17: Irwin & 3rd
12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	1304	196	1119	1543	0	0	0	0
Future Volume (vph)	0	0	0	0	1304	196	1119	1543	0	0	0	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1600	1600	1600	1600	1600	1800	1800	1800
Lane Width	12	12	12	12	10	11	10	11	12	12	12	12
Total Lost time (s)					3.0	3.0	3.0	3.0				
Lane Util. Factor					0.91	1.00	0.86	0.86				
Frpb, ped/bikes					1.00	0.88	1.00	1.00				
Flpb, ped/bikes					1.00	1.00	1.00	1.00				
Frt					1.00	0.85	1.00	1.00				
Flt Protected					1.00	1.00	0.95	0.99				
Satd. Flow (prot)					3597	1023	1066	3452				
Flt Permitted					1.00	1.00	0.95	0.99				
Satd. Flow (perm)					3597	1023	1066	3452				
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	0	0	0	0	1516	228	1301	1794	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	13	12	12	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1516	215	834	2237	0	0	0	0
Confl. Peds. (#/hr)						96						
Confl. Bikes (#/hr)						17						
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Turn Type					NA	Perm	Split	NA				
Protected Phases					2		1	1				
Permitted Phases						2						
Actuated Green, G (s)					29.5	29.5	31.5	31.5				
Effective Green, g (s)					31.0	31.0	33.0	33.0				
Actuated g/C Ratio					0.44	0.44	0.47	0.47				
Clearance Time (s)					4.5	4.5	4.5	4.5				
Lane Grp Cap (vph)					1592	453	502	1627				
v/s Ratio Prot					c0.42		c0.78	0.65				
v/s Ratio Perm						0.21						
v/c Ratio					0.95	0.48	1.66	1.37				
Uniform Delay, d1					18.8	13.8	18.5	18.5				
Progression Factor					1.04	1.10	0.82	0.82				
Incremental Delay, d2					1.9	0.3	298.3	169.0				
Delay (s)					21.4	15.5	313.4	184.3				
Level of Service					C	B	F	F				
Approach Delay (s)		0.0			20.6			219.6			0.0	
Approach LOS		A			C			F			A	

Intersection Summary			
HCM 2000 Control Delay	147.9	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	129.7%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
18: 101 NBOff Irwin/Irwin & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↰↑↑						↑↑↑	↱			
Traffic Volume (vph)	1022	1474	0	0	0	0	0	1650	743	0	0	0
Future Volume (vph)	1022	1474	0	0	0	0	0	1650	743	0	0	0
Ideal Flow (vphpl)	1600	1600	1700	1700	1700	1700	1700	1600	1600	1700	1700	1700
Lane Width	13	12	12	12	12	12	12	12	10	12	12	12
Total Lost time (s)	3.0	3.0						3.0	3.0			
Lane Util. Factor	0.86	0.86						0.91	1.00			
Frpb, ped/bikes	1.00	1.00						1.00	0.95			
Flpb, ped/bikes	1.00	1.00						1.00	1.00			
Frt	1.00	1.00						1.00	0.85			
Flt Protected	0.95	0.99						1.00	1.00			
Satd. Flow (prot)	1192	3606						3854	1064			
Flt Permitted	0.95	0.99						1.00	1.00			
Satd. Flow (perm)	1192	3606						3854	1064			
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1136	1638	0	0	0	0	0	1833	826	0	0	0
RTOR Reduction (vph)	18	18	0	0	0	0	0	0	8	0	0	0
Lane Group Flow (vph)	709	2029	0	0	0	0	0	1833	818	0	0	0
Confl. Peds. (#/hr)	43								28			
Turn Type	Split	NA						NA	Perm			
Protected Phases	1	1						2				
Permitted Phases									2			
Actuated Green, G (s)	28.0	28.0						33.0	33.0			
Effective Green, g (s)	29.0	29.0						35.0	35.0			
Actuated g/C Ratio	0.41	0.41						0.50	0.50			
Clearance Time (s)	4.0	4.0						5.0	5.0			
Lane Grp Cap (vph)	493	1493						1927	532			
v/s Ratio Prot	c0.59	0.56						0.48				
v/s Ratio Perm									c0.77			
v/c Ratio	1.44	1.36						0.95	1.54			
Uniform Delay, d1	20.5	20.5						16.7	17.5			
Progression Factor	0.90	0.91						1.00	1.00			
Incremental Delay, d2	198.1	161.9						11.8	251.2			
Delay (s)	216.6	180.5						28.5	268.7			
Level of Service	F	F						C	F			
Approach Delay (s)		190.0			0.0			103.1			0.0	
Approach LOS		F			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	147.5	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	141.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
19: Hetherton/101 SB Off Hetherton & Mission

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↱			↰						↰↑	↱
Traffic Volume (vph)	0	614	83	51	233	0	0	0	0	262	1292	663
Future Volume (vph)	0	614	83	51	233	0	0	0	0	262	1292	663
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	10	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.2			3.2						3.6	3.6
Lane Util. Factor		0.95			1.00						0.95	1.00
Frpb, ped/bikes		1.00			1.00						1.00	0.94
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.98			1.00						1.00	0.85
Flt Protected		1.00			0.99						0.99	1.00
Satd. Flow (prot)		2757			1783						2992	1272
Flt Permitted		1.00			0.76						0.99	1.00
Satd. Flow (perm)		2757			1358						2992	1272
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	682	92	57	259	0	0	0	0	291	1436	737
RTOR Reduction (vph)	0	13	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	761	0	0	316	0	0	0	0	0	1727	737
Confl. Peds. (#/hr)			12	12						3		13
Confl. Bikes (#/hr)			6									1
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		26.8			26.8						34.4	27.4
Effective Green, g (s)		27.8			27.8						35.4	28.4
Actuated g/C Ratio		0.40			0.40						0.51	0.41
Clearance Time (s)		4.2			4.2						4.6	4.6
Lane Grp Cap (vph)		1094			539						1513	516
v/s Ratio Prot		c0.28									c0.58	
v/s Ratio Perm					0.23							c0.58
v/c Ratio		0.70			0.59						1.14	1.43
Uniform Delay, d1		17.6			16.6						17.3	20.8
Progression Factor		1.00			0.80						1.00	1.00
Incremental Delay, d2		3.7			2.8						72.1	203.7
Delay (s)		21.2			16.1						89.4	224.5
Level of Service		C			B						F	F
Approach Delay (s)		21.2			16.1			0.0			129.8	
Approach LOS		C			B			A			F	

Intersection Summary			
HCM 2000 Control Delay	96.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	9.8
Intersection Capacity Utilization	101.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	373	222	73	240	0	0	0	0	41	1274	104
Future Volume (vph)	0	373	222	73	240	0	0	0	0	41	1274	104
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	16	12	12	16	12	12	12	12	12	12	12
Total Lost time (s)		3.0			3.0						3.0	3.5
Lane Util. Factor		1.00			1.00						0.91	1.00
Frpb, ped/bikes		0.99			1.00						1.00	0.93
Flpb, ped/bikes		1.00			1.00						1.00	1.00
Frt		0.95			1.00						1.00	0.85
Flt Protected		1.00			0.99						1.00	1.00
Satd. Flow (prot)		1699			1779						4170	1118
Flt Permitted		1.00			0.50						1.00	1.00
Satd. Flow (perm)		1699			898						4170	1118
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	414	247	81	267	0	0	0	0	46	1416	116
RTOR Reduction (vph)	0	7	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	654	0	0	348	0	0	0	0	0	1462	116
Confl. Peds. (#/hr)			2	2						73		27
Confl. Bikes (#/hr)			5									3
Parking (#/hr)											2	2
Turn Type		NA		Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases				8								5
Actuated Green, G (s)		30.4			30.4						30.5	23.5
Effective Green, g (s)		32.0			32.0						32.0	24.5
Actuated g/C Ratio		0.46			0.46						0.46	0.35
Clearance Time (s)		4.6			4.6						4.5	4.5
Lane Grp Cap (vph)		776			410						1906	391
v/s Ratio Prot		0.38									c0.35	
v/s Ratio Perm					c0.39							0.10
v/c Ratio		0.84			0.85						0.77	0.30
Uniform Delay, d1		16.8			16.9						15.9	16.5
Progression Factor		1.00			1.17						0.26	0.32
Incremental Delay, d2		10.8			14.6						0.3	0.2
Delay (s)		27.6			34.3						4.4	5.4
Level of Service		C			C						A	A
Approach Delay (s)		27.6			34.3			0.0			4.5	
Approach LOS		C			C			A			A	

Intersection Summary			
HCM 2000 Control Delay	14.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	10.5
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	388	174	100	276	0	0	0	0	145	1081	244
Future Volume (vph)	0	388	174	100	276	0	0	0	0	145	1081	244
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	13	10	15	11	12	12	12	12	12	12	12
Total Lost time (s)		3.2	3.2	3.2	3.2						3.2	3.2
Lane Util. Factor		1.00	1.00	1.00	1.00						0.91	1.00
Frpb, ped/bikes		1.00	0.97	1.00	1.00						1.00	0.97
Flpb, ped/bikes		1.00	1.00	0.99	1.00						1.00	1.00
Frt		1.00	0.85	1.00	1.00						1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00						0.99	1.00
Satd. Flow (prot)		1641	1220	1649	1535						4152	1171
Flt Permitted		1.00	1.00	0.36	1.00						0.99	1.00
Satd. Flow (perm)		1641	1220	625	1535						4152	1171
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	431	193	111	307	0	0	0	0	161	1201	271
RTOR Reduction (vph)	0	0	45	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	431	148	111	307	0	0	0	0	0	1362	271
Confl. Peds. (#/hr)			16	16						6		
Confl. Bikes (#/hr)			12									5
Parking (#/hr)											2	2
Turn Type		NA	Perm	Perm	NA					Split	NA	custom
Protected Phases		4			8					2	2	
Permitted Phases			4	8								5
Actuated Green, G (s)		29.8	29.8	29.8	29.8						31.8	24.8
Effective Green, g (s)		30.8	30.8	30.8	30.8						32.8	25.8
Actuated g/C Ratio		0.44	0.44	0.44	0.44						0.47	0.37
Clearance Time (s)		4.2	4.2	4.2	4.2						4.2	4.2
Lane Grp Cap (vph)		722	536	275	675						1945	431
v/s Ratio Prot		c0.26			0.20						c0.33	
v/s Ratio Perm			0.12	0.18								0.23
v/c Ratio		0.60	0.28	0.40	0.45						0.70	0.63
Uniform Delay, d1		14.9	12.5	13.3	13.7						14.7	18.2
Progression Factor		1.00	1.00	1.04	1.06						0.33	0.45
Incremental Delay, d2		3.6	1.3	3.7	1.9						1.3	4.1
Delay (s)		18.5	13.8	17.7	16.5						6.2	12.4
Level of Service		B	B	B	B						A	B
Approach Delay (s)		17.0			16.8			0.0			7.2	
Approach LOS		B			B			A			A	

Intersection Summary			
HCM 2000 Control Delay	11.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	11.4
Intersection Capacity Utilization	84.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
22: Hetherton & 3rd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	511	1900	0	0	0	0	0	765	551
Future Volume (vph)	0	0	0	511	1900	0	0	0	0	0	765	551
Ideal Flow (vphpl)	1800	1800	1800	1400	1400	1400	1800	1800	1800	1600	1600	1600
Lane Width	12	12	12	14	12	12	12	12	12	12	11	11
Total Lost time (s)				3.0	3.0						3.0	3.0
Lane Util. Factor				0.86	0.86						0.91	1.00
Frpb, ped/bikes				1.00	1.00						1.00	0.86
Flpb, ped/bikes				1.00	1.00						1.00	1.00
Frt				1.00	1.00						1.00	0.85
Flt Protected				0.95	1.00						1.00	1.00
Satd. Flow (prot)				1077	3185						3726	1002
Flt Permitted				0.95	1.00						1.00	1.00
Satd. Flow (perm)				1077	3185						3726	1002
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	0	0	568	2111	0	0	0	0	0	850	612
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	0	0	545	2134	0	0	0	0	0	850	604
Confl. Peds. (#/hr)				52								126
Confl. Bikes (#/hr)												2
Turn Type				Split	NA						NA	Perm
Protected Phases				2	2						1	
Permitted Phases												1
Actuated Green, G (s)				27.0	27.0						35.0	35.0
Effective Green, g (s)				28.0	28.0						36.0	36.0
Actuated g/C Ratio				0.40	0.40						0.51	0.51
Clearance Time (s)				4.0	4.0						4.0	4.0
Lane Grp Cap (vph)				430	1274						1916	515
v/s Ratio Prot				0.51	c0.67						0.23	
v/s Ratio Perm												c0.60
v/c Ratio				1.27	1.68						0.44	1.17
Uniform Delay, d1				21.0	21.0						10.7	17.0
Progression Factor				0.88	0.88						0.42	0.42
Incremental Delay, d2				122.1	304.1						0.6	93.3
Delay (s)				140.5	322.6						5.1	100.4
Level of Service				F	F						A	F
Approach Delay (s)		0.0			285.6			0.0			45.0	
Approach LOS		A			F			A			D	

Intersection Summary			
HCM 2000 Control Delay	200.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.39		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	146.9%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
23: 101 SBOn 2nd/Hetherton & 2nd

12/12/2016

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	2083	1143	0	0	0	0	0	0	443	920	0
Future Volume (vph)	0	2083	1143	0	0	0	0	0	0	443	920	0
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Lane Width	12	11	11	12	12	12	12	12	12	11	12	12
Total Lost time (s)		3.0	3.0							3.0	3.0	
Lane Util. Factor		0.81	0.81							0.91	0.91	
Frpb, ped/bikes		1.00	0.98							1.00	1.00	
Flpb, ped/bikes		1.00	1.00							1.00	1.00	
Frt		0.97	0.85							1.00	1.00	
Flt Protected		1.00	1.00							0.95	1.00	
Satd. Flow (prot)		4798	1035							1327	2891	
Flt Permitted		1.00	1.00							0.95	1.00	
Satd. Flow (perm)		4798	1035							1327	2891	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	2314	1270	0	0	0	0	0	0	492	1022	0
RTOR Reduction (vph)	0	14	14	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	2910	646	0	0	0	0	0	0	492	1022	0
Confl. Peds. (#/hr)			8									
Confl. Bikes (#/hr)			8									
Turn Type		NA	Perm							Split	NA	
Protected Phases		1								2	2	
Permitted Phases			1									
Actuated Green, G (s)		35.5	35.5							25.5	25.5	
Effective Green, g (s)		37.0	37.0							27.0	27.0	
Actuated g/C Ratio		0.53	0.53							0.39	0.39	
Clearance Time (s)		4.5	4.5							4.5	4.5	
Lane Grp Cap (vph)		2536	547							511	1115	
v/s Ratio Prot		0.61								c0.37	0.35	
v/s Ratio Perm			c0.62									
v/c Ratio		1.15	1.18							0.96	0.92	
Uniform Delay, d1		16.5	16.5							21.0	20.4	
Progression Factor		1.00	1.00							0.82	0.82	
Incremental Delay, d2		71.5	99.0							24.6	9.4	
Delay (s)		88.0	115.5							41.9	26.3	
Level of Service		F	F							D	C	
Approach Delay (s)		93.0			0.0			0.0			31.4	
Approach LOS		F			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	74.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	6.0
Intersection Capacity Utilization	171.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

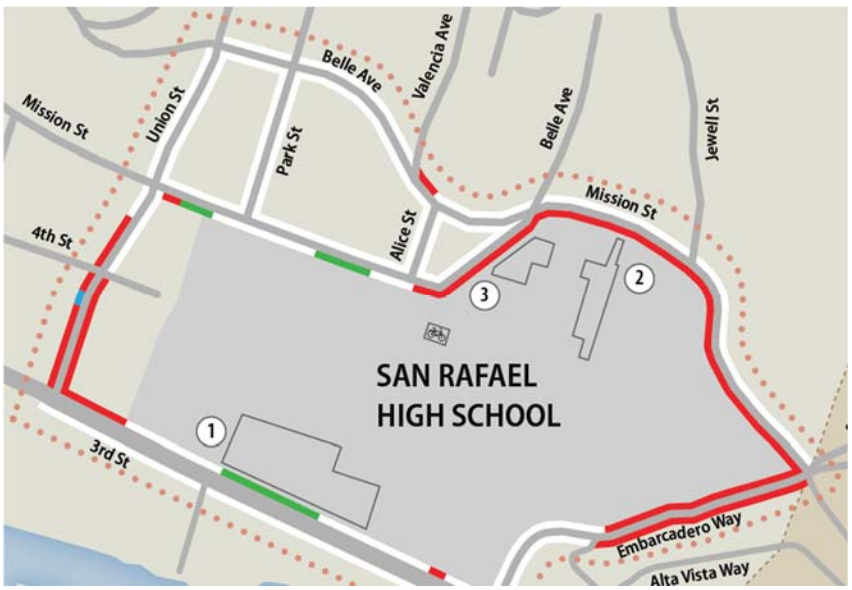
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑			↱
Traffic Volume (vph)	0	1	4	0	0	6
Future Volume (vph)	0	1	4	0	0	6
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Total Lost time (s)		4.0	4.0			4.0
Lane Util. Factor		0.95	0.95			1.00
Frt		1.00	1.00			0.86
Flt Protected		1.00	1.00			1.00
Satd. Flow (prot)		3353	3353			1526
Flt Permitted		1.00	1.00			1.00
Satd. Flow (perm)		3353	3353			1526
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	0	1	4	0	0	7
RTOR Reduction (vph)	0	0	0	0	0	4
Lane Group Flow (vph)	0	1	4	0	0	3
Turn Type		NA	NA			Perm
Protected Phases		4	8			
Permitted Phases						6
Actuated Green, G (s)		16.0	16.0			16.0
Effective Green, g (s)		16.0	16.0			16.0
Actuated g/C Ratio		0.40	0.40			0.40
Clearance Time (s)		4.0	4.0			4.0
Lane Grp Cap (vph)		1341	1341			610
v/s Ratio Prot		0.00	c0.00			
v/s Ratio Perm						c0.00
v/c Ratio		0.00	0.00			0.00
Uniform Delay, d1		7.2	7.2			7.2
Progression Factor		1.00	1.00			1.00
Incremental Delay, d2		0.0	0.0			0.0
Delay (s)		7.2	7.2			7.2
Level of Service		A	A			A
Approach Delay (s)		7.2	7.2		7.2	
Approach LOS		A	A		A	

Intersection Summary			
HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.00		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX F-7

Parking Study

San Rafael High School EIR
Parking Study



December 2016

Prepared for:

San Rafael City Schools

Prepared by:

Parisi
TRANSPORTATION CONSULTING

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1.Introduction

A. STUDY PURPOSE

This report summarizes the results of a parking utilization study conducted as a supplement to the *San Rafael High School Environmental Impact Report* (EIR). The study was conducted by Parisi Transportation Consulting (Parisi) on behalf of San Rafael City Schools (District) in support of improvements proposed under the San Rafael High School Master Facilities Long-Range Plan (hereafter referred to as the "Project"). The purpose of the study is to evaluate existing parking conditions at San Rafael High School and along streets neighboring the campus, through the assessment of current regulations, supply, and demand. The study also evaluates future parking conditions at the Project site and assesses potential impacts related to an increase in parking demand resulting from the Project. The results of this study are intended to inform the District and the City of San Rafael (City) of existing and anticipated on and off-site parking utilization, and help develop potential improvement measures that would encourage more efficient use of future parking resources.

A parking study area that encompasses the streets surrounding San Rafael High School was identified. The parking study area is bounded by:

- Belle Avenue to the north;
- 3rd Street to the south;
- Embarcadero Way to the east; and,
- Union Street to the west.

The parking study area also includes three off-street vehicular parking and one bicycle parking area provided on campus. The vehicular parking lots consist of a main student lot and two staff parking lots on the north side of the campus. The student lot is accessible via two driveways (one two-way driveway and one one-way outbound driveway) located along 3rd Street, whereas the two staff parking lots are accessible via three driveways located along Mission Avenue, i.e., one two-way driveway east of Belle Avenue, a one-way inbound and one-way outbound driveway at the Mission Avenue / Belle Avenue intersections.

2. Existing Conditions

A. PARKING REGULATIONS

Current parking regulations are conveyed to motorists using signage, curb paint, and parking stall striping. Parking regulations are enforced by the San Rafael Police Department through warnings and the issuance of parking citations. The majority of on-street parking regulations are generally in effect from 9:00 AM to 6:00 PM, Monday through Saturday. There is occasional variation in enforcement times; for example, parking enforcement for passenger loading zones begin at 7:00 AM. All public parking spaces within City limits are subject to parking regulations documented in Chapter 6 of the *City of San Rafael Municipal Code.*

As part of this study an inventory was conducted to document the existing parking supply and regulations of both on-street and off-street spaces within the study area. Field surveyors walked along the study corridor and noted the parking supply and corresponding parking regulations.

The following on-street parking regulations were identified within the study area:

- <u>Unregulated Parking</u>: Parking spaces that lack accompanying signage and /or curb markings limiting parking duration or usage.
- <u>Time-limited Parking</u>: Parking spaces with signage limiting parking duration to two-hour time periods.
- <u>Metered Parking</u>: Parking spaces that require payment for use. Payment is accepted through adjacent coin-operated parking meters.
- <u>Disabled Parking (Blue)</u>: Parking spaces restricted to use by vehicles bearing a disabled person parking placard issued by the California Department of Motor Vehicles (DMV).
- <u>Passenger Loading (White)</u>: Parking restricted to short-term (generally five minutes or less) loading and unloading activities for non-commercial vehicles.
- <u>No Parking (Red)</u>: Parking prohibited for non-emergency vehicles.

North of San Rafael High School, the parking study area is generally residential in nature, and most of the parking supply is unrestricted. There are no metered parking spaces as is common in more commercial areas of San Rafael. Along 3rd Street and Union Street, on-street parking is more commercial / non-residential in nature. On-street parking consists of marked parking spaces, a subset of which are time-limited (two-hours) between 9:00 AM and 6:00 PM, while the rest are unregulated. During field observations, it was noted that paint markings along certain curb and street segments appeared to be chipped and fading.

The parking study area and existing parking regulations are depicted in Figure 1.

Parisi TRANSPORTATION CONSULTING

LEGEND

- No Parking
- Unregulated
- 2 Hour Parking
- Passenger Loading
- # Parking Lot ID
- Bicycle Parking
- Parking Study Area

San Rafael High School EIR – Parking Study

Existing Parking Regulations

B. DATA COLLECTION

An extensive data collection effort was conducted over multiple weekdays in October 2016. As previously mentioned, a preliminary parking survey was conducted to estimate parking supply and regulations within the parking study area. Parking occupancy and duration surveys were conducted over the course of two weekdays.

The data collected on the first day (October 5, 2016) reflects parking conditions on a typical weekday when San Rafael High School is in session. The survey was conducted in two-hour intervals from 7:00 AM to 7:00 PM. A second survey was conducted during an at-home football game to capture parking conditions during an "event day" at the high school which would represent a peak parking demand at the school site. The event day survey was conducted in two-hour intervals beginning at 3:00 PM and ending at 9:00 PM.

The parking occupancy survey consisted of counting the number of occupied spaces at both on-street and off-street parking facilities within the parking study area.

A parking duration survey was conducted of all on-street parking spaces. The parking duration survey consisted of noting the first four digits of vehicle license plates for all parked vehicles during the survey periods. The license plate numbers were tallied at the end of each count period to determine the duration of occupancy for parking spaces within the parking study area.

C. AVERAGE PARKING OCCUPANCY

The following sections summarize the parking supply and occupancy of on- and off-street parking spaces within the study area. More detailed parking occupancy data is provided in the appendix of this report.

Parking Occupancy – Average Weekday

During the survey period the number of occupied parking spaces was compared to the estimated parking supply within the parking study area. This comparison was done to determine the average parking occupancy rates as well as the peak period of parking demand for parking facilities within the study area. The results of this analysis are summarized in Table 2-1 and Table 2-2.

The segment of Mission Avenue between Union Street and Belle Avenue was found to have the highest average occupancy rates, ranging between 81 and 83 percent during the morning period. The parking occupancy along Mission Avenue drops to below 60 percent in the evening when school is no longer in session.

Throughout the day, the parking occupancy rate along 3rd Street between Union Street and Embarcadero Way is generally low. It ranges between 50 and 60 percent between 9:00 AM and 3:00 PM, and drops to below 40 percent in the early morning (7:00 AM) and in the evening, after 5:00 PM.

Table 2-1: Average Weekday Parking Occupancy – On-Street Parking (Number of Spaces)

Street	Segment	Supply[1]	Average Parking Occupancy (Start of Two-Hour Period) 7:00 am	9:00 am	11:00 am	1:00 pm	3:00 pm	5:00 pm	7:00 pm
Mission Avenue	Union to Belle	±53	45	43	44	41	42	32	30
	Belle to Embarcadero	±46	20	19	14	15	13	13	15
Belle Avenue	Union to Mission	±68	49	49	42	46	44	51	55
3rd Street	Union to Embarcadero	±64	23	33	38	37	33	23	20
Side Streets[2]	--	±101	61	58	55	57	61	55	58
Total	**--**	**±332**	**198**	**202**	**193**	**196**	**193**	**174**	**178**

Source: Parisi Transportation Consulting, 2016.

Notes:
(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.
(2) Parking survey results for the "Side Streets" includes data collected along Alice Street, Park Street, Jewel Street, Union Street, and Embarcadero Way.

Table 2-2: Average Weekday Parking Occupancy – On-Street Parking (Share of Spaces)

Street	Segment	Supply[1]	Average Parking Occupancy (Start of Two-Hour Period) 7:00 am	9:00 am	11:00 am	1:00 pm	3:00 pm	5:00 pm	7:00 pm
Mission Avenue	Union to Belle	±53	83%	81%	83%	77%	79%	60%	57%
	Belle to Embarcadero	±46	43%	41%	30%	33%	28%	28%	33%
Belle Avenue	Union to Mission	±68	72%	72%	62%	68%	65%	75%	81%
3rd Street	Union to Embarcadero	±64	36%	52%	59%	58%	52%	36%	31%
Side Streets[2]	--	±101	60%	57%	54%	56%	60%	54%	57%
Total	**--**	**±332**	**60%**	**61%**	**58%**	**59%**	**58%**	**52%**	**53%**

Source: Parisi Transportation Consulting, 2016.

Notes:
(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.
(2) Parking survey results for the "Side Streets" includes data collected along Alice Street, Park Street, Jewel Street, Union Street, and Embarcadero Way

Although parking is provided along the north side of 3rd Street bordering the school property, it is generally underutilized during school hours. The parking is only accessible by vehicles travelling eastbound on 3rd Street. Eastbound-to-westbound U-turns are prohibited along this segment of 3rd Street due to high traffic volumes and a roadway curvature that limits visibility of opposing traffic. As documented in the EIR, only a small percentage of students originate from destinations east of the school accessible via 3rd Street (less than one percent of students originate from east of Embarcadero Way along Point San Pedro Road). This means that only a small percentage of visitors to the school site would be able to easily access parking along 3rd Street.

The parking occupancy rates at the off-street parking facilities (including the bicycle parking area) were similarly analyzed, and the results are summarized in Table 2-3 and Table 2-4. The off-street lots are striped to identify available parking spaces within each lot. However, field observations indicated that the de facto parking supply varies greatly depending on how vehicles are parked within the lots. The parking supply numbers presented are based on the de facto parking supply rather than the striped parking supply.

The on-campus parking facilities are well utilized throughout the day. During school hours (9:00 AM to 3:00 PM), the 24-space bicycle parking area was at capacity (100 percent occupied). Similarly, the student vehicle parking lot was also operating at or above capacity. The peak parking period for parking demand occurred in the late-morning / early-afternoon (11:00 AM to 1:00 PM), at which time the student lot and bicycle parking area were both at 100 percent capacity.

In general, the staff parking lots operate at an occupancy rate that varies between 60 and 75 percent. In the evening, Lot 3 was observed to have a higher parking occupancy than during school hours. During field visits, this parking lot was observed to be used as a pick-up location, i.e., parents parked their vehicles in the lot and waited for their children to leave the campus.

The variation in average parking occupancy throughout the day is graphically depicted in Figure 3 and Figure 2, and is also presented in a series of parking study area maps provided at the end of this report. As shown in the graphs, the student lot and 3rd Street parking occupancy rates peaks during the school hours (8:00 AM to 3:00 PM), with the highest peaks occurring in the middle of the day. Meanwhile, along the other street segments, the parking occupancy rates slowly decrease between 7:00 AM and 9:00 AM, coinciding with the time area residents leave for work. The rates fluctuate during school hours, and begin to steadily increase between 5:00 PM to 7:00 PM when coinciding with the time when area residents return.

Table 2-3: Average Weekday Parking Occupancy – Off-Street Parking (Number of Spaces)

Location	Usage	Supply[1]		Average Parking Occupancy (Start of Two-Hour Period)						
		Std.	ADA	7:00 am	9:00 am	11:00 am	1:00 pm	3:00 pm	5:00 pm	7:00 pm
Bicycle Parking	Student	±24	N/A	5	24	24	24	24	4	1
Vehicular Parking										
Lot 1 (3rd Street)	Student Parking	±162	9	27	166	169	158	109	38	17
Lot 2 (Mission Avenue)	Staff Parking	±42	2	12	30	32	29	28	24	3
Lot 3 (Mission Avenue)	Staff Parking	±17	1	6	13	11	12	14	15	13

Source: Parisi Transportation Consulting, 2016.

Notes:
"Std." = Standard Parking Spaces, "ADA" = Spaces compliant with the Americans with Disabilities Act. "N/A" = Not Applicable
(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.

Table 2-4: Average Weekday Parking Occupancy – Off-Street Parking (Share of Spaces)

Location	Usage	Supply[1]		Average Parking Occupancy[2] (Start of Two-Hour Period)						
		Std.	ADA	7:00 am	9:00 am	11:00 am	1:00 pm	3:00 pm	5:00 pm	7:00 pm
Bicycle Parking	Student	±24		21%	100%	100%	100%	100%	17%	4%
Vehicular Parking										
Lot 1 (3rd Street)	Student Parking	±162	9	17%	102%	104%	98%	67%	23%	10%
Lot 2 (Mission Avenue)	Staff Parking	±42	2	29%	71%	76%	69%	67%	57%	7%
Lot 3 (Mission Avenue)	Staff Parking	±17	1	35%	76%	65%	71%	82%	88%	76%

Source: Parisi Transportation Consulting, 2016.

Notes:
"Std." = Standard Parking Spaces, "ADA" = Spaces compliant with the Americans with Disabilities Act. "N/A" = Not Applicable
(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.
(2) Parking occupancy rates are based on the supply of standard parking spaces.

Figure 3: Average Weekday Parking Occupancy (Number of Spaces)

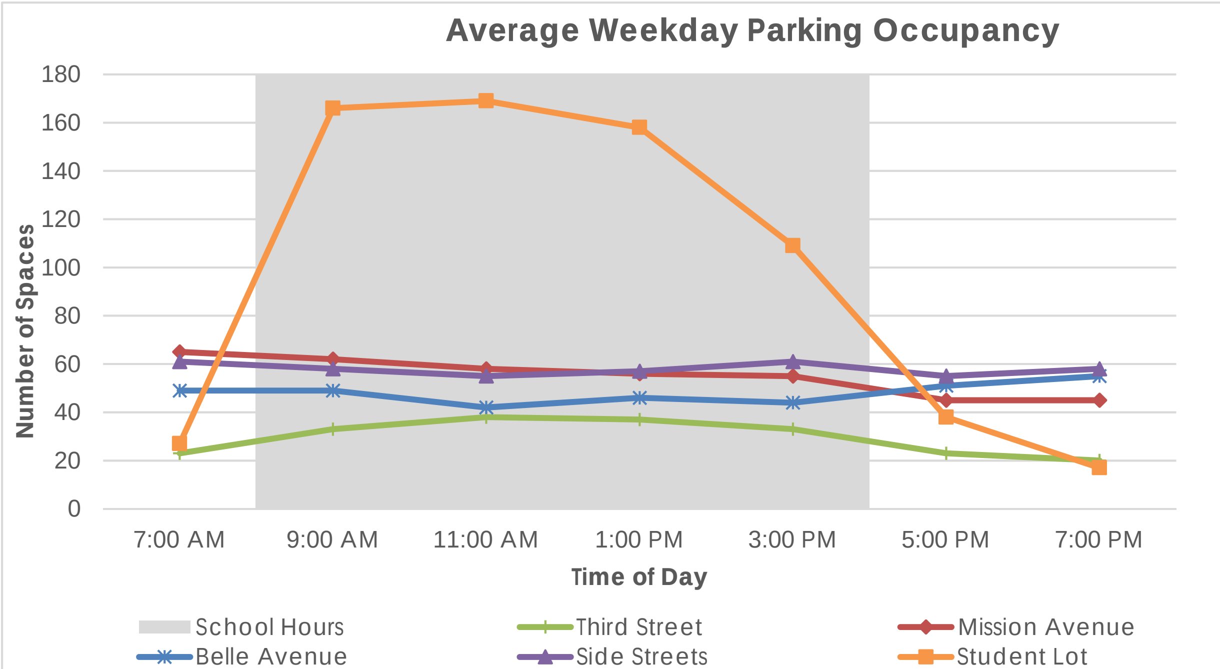
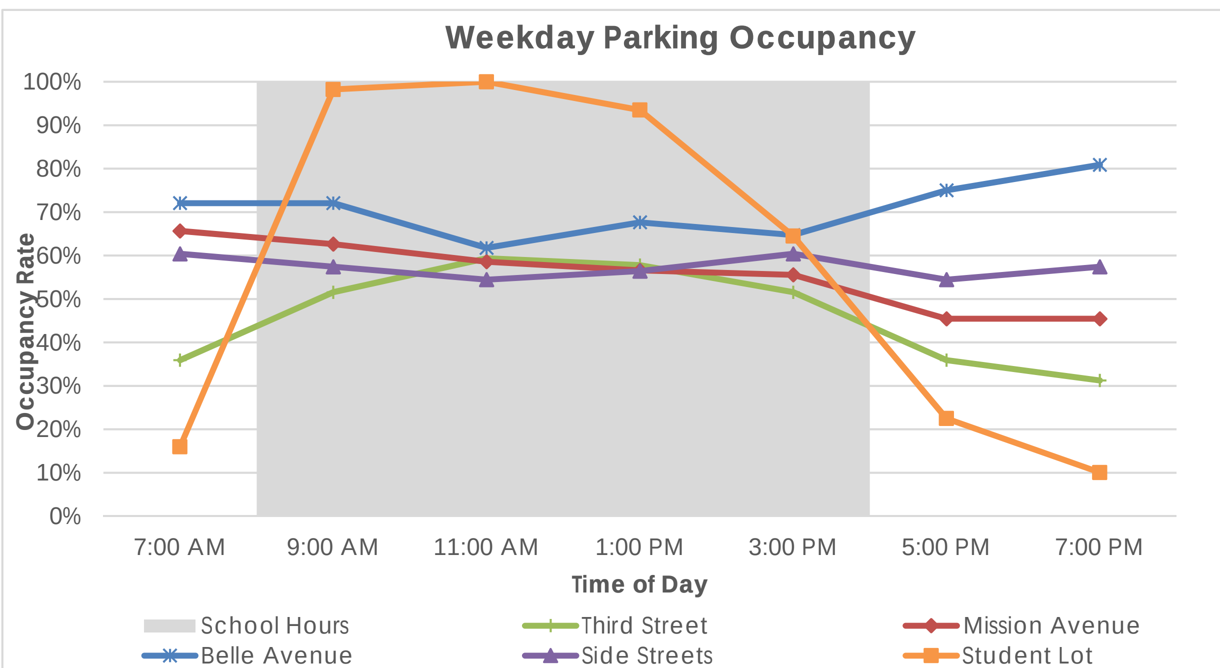


Figure 2: Average Weekday Parking Occupancy (Rate)



Parking Occupancy – Stadium Event

Per information provided by the San Rafael High School Athletic Department, the high school stadium hosts up to 22 football games a year (including games for the Freshman, Junior Varsity, and Varsity teams), with a potential attendance of about 1,600 athletes and spectators. These attendance projections for football games would potentially result in the highest parking demand at on-street and off-street parking facilities within the parking study area.

A similar parking occupancy survey was conducted during an event held on the evening of October 21, 2016. On this day, San Rafael High School hosted three football games against Terra Linda High School, i.e., one for each high school level of football (i.e., Freshman, Junior Varsity, and Varsity). As Terra Linda High school is located within the City of San Rafael, the game was anticipated to draw a relatively large number of spectators. The three games were held throughout the evening beginning at 4:30 PM for the Freshman football team, 6:00 PM for the Junior Varsity Team, and 7:00 PM for the Varsity team.

The parking survey was conducted between 3:00 PM and 9:00 PM to potentially capture the trends in parking demand for the stadium activities.

Table 2-5 and Table 2-6 summarize the average parking occupancy for on-street parking during a stadium event.

Table 2-5: Average Stadium Event Parking Occupancy – On-Street Parking (Number of Spaces)

			Average Parking Occupancy (Start of Two-Hour Period)			
Street	**Segment**	**Supply[1]**	**3:00 pm**	**5:00 pm**	**7:00 pm**	**9:00 pm**
Mission Avenue	Union to Belle	±53	50	36	43	43
	Belle to Embarcadero	±46	20	17	20	20
Belle Avenue	Union to Mission	±68	39	49	56	64
3rd Street	Union to Embarcadero	±64	23	38	56	29
Side Streets[2]	--	±101	52	59	65	71
Total	**--**	**±332**	**184**	**199**	**240**	**227**

Source: Parisi Transportation Consulting, 2016.

Notes:
(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.
(2) Parking survey results for the “Side Streets” includes data collected along Alice Street, Park Street, Jewel Street, Union Street, and Embarcadero Way

Table 2-6: Average Stadium Event Parking Occupancy – On-Street Parking (Share of Spaces)

Street	Segment	Supply[1]	Average Parking Occupancy (Start of Two-Hour Period)			
			3:00 pm	5:00 pm	7:00 pm	9:00 pm
Mission Avenue	Union to Belle	±53	94%	68%	81%	81%
	Belle to Embarcadero	±46	43%	37%	43%	43%
Belle Avenue	Union to Mission	±68	57%	72%	82%	94%
3rd Street	Union to Embarcadero	±64	36%	59%	88%	45%
Side Streets[2]	--	±101	51%	58%	64%	70%
Total	**--**	**±332**	**55%**	**60%**	**72%**	**68%**

Source: Parisi Transportation Consulting, 2016.

Notes:

(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.

(2) Parking survey results for the "Side Streets" includes data collected along Alice Street, Park Street, Jewel Street, Union Street, and Embarcadero Way

During the peak period of the event (5:00 PM to 9:00 PM), parking occupancy rates are highest along Mission Avenue between Union Street and Belle Avenue. The occupancy increases from 68 percent at 5:00 PM to 81 percent at 9:00 PM. Parking occupancy rates are also high along Belle Avenue during this time. However, it should be noted that during the evening hours on-street parking demand is mostly driven by residential parking needs. It is less likely that event attendees would park at streets further away from the campus while streets closer to the campus have parking availability.

Table 2-7 and Table 2-8 summarize the average parking occupancy for off-street parking during a stadium event.

Table 2-7: Average Weekday Parking Occupancy – Off-Street Parking (Number of Spaces)

Location	Usage	Supply[1]		Average Parking Occupancy (Start of Two-Hour Period)			
		Std.	ADA	3:00 pm	5:00 pm	7:00 pm	9:00 pm
Bicycle Parking	Student	±24	N/A	27	2	0	0
Vehicular Parking							
Lot 1 (3rd Street)	Student Parking	±162	9	82	159	217	87
Lot 2 (Mission Avenue)	Staff Parking	±42	2	29	29	33	26
Lot 3 (Mission Avenue)	Staff Parking	±17	1	14	12	18	15

Source: Parisi Transportation Consulting, 2016.

Notes:

"Std." = Standard Parking Spaces, "ADA" = Spaces compliant with the Americans with Disabilities Act. "N/A" = Not Applicable

(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.

Table 2-8: Average Weekday Parking Occupancy – Off-Street Parking (Share of Spaces)

Location	Usage	Supply[1]		Average Parking Occupancy (Start of Two-Hour Period)			
		Std.	ADA	3:00 pm	5:00 pm	7:00 pm	9:00 pm
Bicycle Parking	Student	±24	N/A	113%	8%	0%	0%
Vehicular Parking							
Lot 1 (3rd Street)	Student Parking	±162	9	51%	98%	134%	54%
Lot 2 (Mission Avenue)	Staff Parking	±42	2	69%	69%	79%	62%
Lot 3 (Mission Avenue)	Staff Parking	±17	1	82%	71%	106%	88%

Source: Parisi Transportation Consulting, 2016.

Notes:

"Std." = Standard Parking Spaces, "ADA" = Spaces compliant with the Americans with Disabilities Act. "N/A" = Not Applicable

(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.

(2) Parking occupancy rates are based on the supply of standard parking spaces.

At the peak period for off-street parking demand (7:00 PM to 9:00 PM), parking occupancy rates at the campus lot are over 100 percent, in other words during these times visitors park at any available space (marked or not) within the parking lot. No attendants were observed directing traffic flow or monitoring parking access or traffic lane flows. Visitor parking was haphazard with cars parked wherever space was available.

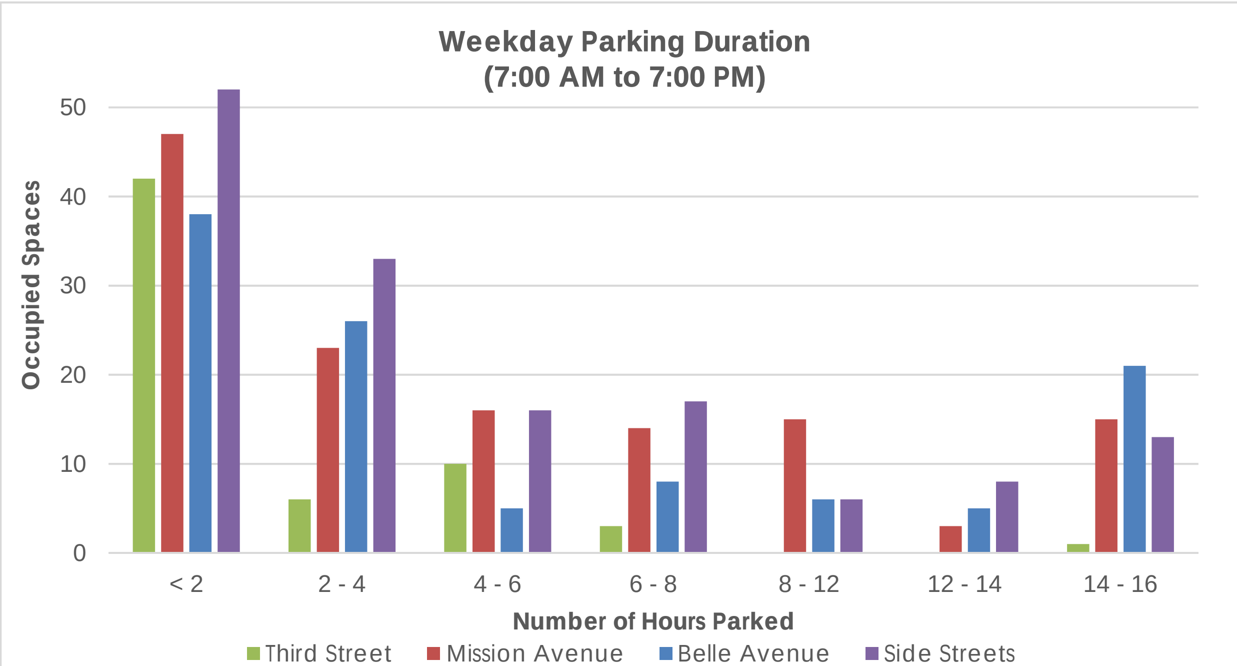
Average Weekday Parking Occupancy – Duration

Considering the results of the average parking occupancy rates for on-street parking, an additional analysis was conducted to better understand parking utilization along streets close to the campus. This supplemental analysis was conducted to determine the duration of parking for vehicles parked within the parking study area. It involved a review of the tabulated license plate survey discussed in the Data Collection section of this report. The purpose of the review was to assess how long these spaces were occupied by the same vehicle during the analysis period.

Figure 4 graphically shows the number of vehicles that were parked for durations varying from less than two hours to 16 hours. It should be noted that the figure summarizes parking duration during the survey period only (7:00 AM to 7:00 PM); it is likely that vehicles parked at the beginning or end, (e.g., vehicles parked before 7:00 AM and/or after 7:00 PM) of the survey period may have been parked for longer than the number of hours recorded during the survey.

The survey was conducted on a day in which the school schedule began at 8:00 AM and ended at 3:30 PM (i.e., Schedule B). Students would likely arrive just before their first period, and leave after their last class of the day. Students of driving-age are likely juniors and seniors at the school and may have a varied schedule (for example students with off-campus work study or fewer classes a day). It can be assumed that school-related parking demand would have a duration of between five to eight hours during the day. Considering the two-hour survey periods, school-related parking would be captured by the parking duration of between four and eight hours.

Figure 4: Average Weekday Parking Duration – On-Street Parking



As shown in the figure, along all streets these equate to around 90 vehicles along all the street segments included in the parking study area.An analysis (detailed in the EIR) was conducted of the inbound and outbound vehicular traffic volumes at the school's driveways on 3rd Street and along Mission Avenue. The results of this analysis provided insight regarding the number of on-site and off-site parking trips generated by the school under existing conditions.

During the morning peak hour, about 395 vehicle trips (269 inbound and 126 outbound) are made to and for the school site via the 3rd Street parking lot. About 143 of these consist of vehicles driven by students who park in the lot. As noted in the above parking occupancy analysis, during the midday peak period, occupancy at the lot is typically at capacity. Indicating that the remaining vehicles that park at the student vehicle parking lot arrive just outside of the peak hour.

About 591 vehicle trips (319 inbound and 272 outbound) access the school site via neighborhood streets, including Mission Avenue. About 47 vehicles park either at the two school parking lots at the north side of the campus, or along neighborhood streets. As noted by the parking duration analysis, throughout the day parking along neighborhood streets potentially attributable to school uses increases to up to about 90 vehicles.

3. Project Parking Impacts

This study serves as an addendum to the Transportation and Traffic chapter of the *San Rafael High School EIR*. Under the California Environmental Quality Act (CEQA) Guidelines (by which the level of significance of the Project's transportation-related impacts were assessed), the adequacy of Project parking is not in and of itself a CEQA issue. However, the District acknowledges that under existing conditions, high parking demand generated by campus visitors strains the limited parking supply within the Project compass.

Furthermore, as detailed in the EIR, the San Rafael High School Master Facilities Long-Range Plan would result in an increase in vehicular traffic from both a projected increase in student enrollment, and proposed improvements at the school stadium. This increase in vehicular traffic would also generate an increase in vehicular parking demand. As part of this study the Project's future parking supply and demand were assessed for any Project-related impacts associated with parking.

The Project proposes to increase on-site parking by 19 standard spaces and one ADA-compliant space for a future total of 240 standard parking spaces and 13 ADA-compliant spaces. About 171 of these spaces will be accessible from 3rd Street and would be available for parking by students.

The Project-proposed parking supply was compared against the City of San Rafael's parking requirements, as documented in Section 14.18.040 of the City's *Code of Ordinances*. For public school's serving grades 9 -12, the City requires "one space for each student based on maximum school capacity, or as specified by use permit". After the implementation of the San Rafael High School Master Facilities Long-Range Plan, the school is expected to have an enrollment of approximately 1,325 enrolled students. Therefore, the San Rafael High School would be required to provide 331spaces. The Project's proposed vehicular parking supply of 231 spaces would not satisfy the City's minimum parking requirements[1].

In addition to vehicular parking requirements, the Project site would also be subject to the City's bicycle parking requirements detailed in Section 14.18.090 of the City's *Code of Ordinances.* "The number of long-term parking spaces required for non-residential buildings with over ten tenant-occupants: Five percent (5%) of the requirement for automobile parking spaces, with a minimum

[1] As discussed in Section 1, Introduction, of this EIR, pursuant to California Government Code Section 53094, the governing board of a school district may render city or county zoning ordinances and general plan requirements inapplicable to a proposed classroom facilities project. Even though the District plans to adopt a resolution pursuant to Section 53094 exempting the Master Facilities Implementation Plan and the SRHS campus from any zoning ordinances or regulations of the City of San Rafael, including, without limitation, the City's Municipal Code, the City's General Plan, and related ordinances and regulations that otherwise would be applicable, the project EIR evaluates the project's consistency with local regulations and policies for the purposes of CEQA compliance, and also because it is the District's goal that local policies and regulations be acknowledged and adhered to as much as feasible.

of one (1) space". Based on the school's vehicular parking space requirement (331 spaces), the school would be required to provide at least 16 bicycle parking spaces. The school's existing supply of 24 parking spaces exceeds this requirement.

As detailed in the EIR, the projected increase in student enrollment will result in about 35 additional parking trips arriving at school during the morning peak hour. Based on existing vehicular travel and parking patterns, it is estimated that 26 of these trips would hope to be accommodated on-site and nine of the vehicle trips would seek parking along neighborhood streets. It should be noted that these estimates are based on a conservative assumption that the travel mode shares for future student enrollment would remain consistent with existing conditions (i.e., approximately 55 to 58 percent of students travel to and/or from school by private vehicle).

Table 3-1 compares the parking supply and demand under both existing and proposed conditions.

Table 3-1: Parking Supply, Occupancy and Demand – Existing and Future Conditions

<table>
<tr><th rowspan="4">Location</th><th colspan="10">Number of Parking Spaces</th></tr>
<tr><th colspan="3">Existing Conditions</th><th colspan="3">Project (Net-New)</th><th colspan="4">Future Conditions</th></tr>
<tr><th colspan="2">Supply[1]</th><th rowspan="2">Demand[2]</th><th colspan="2">Supply</th><th rowspan="2">Demand</th><th colspan="2">Supply</th><th rowspan="2">Demand</th><th rowspan="2">Availability</th></tr>
<tr><th>Std.</th><th>ADA</th><th>Std.</th><th>ADA</th><th>Std.</th><th>ADA</th></tr>
<tr><td colspan="11">On-Site (On Campus Lots)</td></tr>
<tr><td>Lot 1
(3rd Street)</td><td>±162</td><td>9</td><td>169</td><td>0</td><td>0</td><td>26</td><td>162</td><td>9</td><td>195</td><td>(33)</td></tr>
<tr><td>Lot 2
(Mission Avenue)</td><td>±42</td><td>2</td><td>32</td><td>-32</td><td>-2</td><td>0</td><td>10</td><td>0</td><td rowspan="2">47</td><td rowspan="2">(8)</td></tr>
<tr><td>Lot 3
(Mission Avenue)</td><td>±17</td><td>1</td><td>15</td><td>12</td><td>1</td><td>0</td><td>29</td><td>2</td></tr>
<tr><td>New Lot
(South of Stadium)</td><td>N/A</td><td>N/A</td><td>N/A</td><td>39</td><td>2</td><td>0</td><td>39</td><td>2</td><td>--</td><td>39</td></tr>
<tr><td>Total</td><td>221</td><td>12</td><td>216</td><td>19</td><td>1</td><td>26</td><td>240</td><td>13</td><td>242</td><td>2</td></tr>
<tr><td colspan="11">Off-Site (Neighborhood Streets)</td></tr>
<tr><td>Total</td><td colspan="2">±332</td><td>202</td><td>0</td><td></td><td>9</td><td>±332</td><td></td><td>211</td><td>±121</td></tr>
</table>

Source: San Rafael City Schools, 2016; HY Architects, 2016; Parisi Transportation Consulting, 2016.

<u>Note</u>:

(1) Parking supply at unmarked locations were estimated assuming average vehicular length. Actual parking supply may vary based on the size of parked vehicles.

(2) Represents peak average parking occupancy under existing conditions.

As shown, under future conditions the additional parking demand at the Project site would result in a shortfall of about two parking spaces at the student lot. The demand for these spaces could be accommodated by the available parking spaces along neighborhood streets.

It is likely overflow parking would place additional demand on neighborhood streets closest to the campus. Particularly Mission Avenue which currently has a peak average parking occupancy of about 83 percent (9 available spaces) could see an increase in parking occupancy during school hours. Furthermore, lack of parking on the campus would increase traffic flow along residential streets as students and campus visitors drive around looking for available parking spaces. During peak hours, this would potentially increase congestion and vehicular delay at key intersections surrounding the campus.

4. Summary of Results

The results of the parking study provide insight into the existing supply, supply, regulation, and utilization of parking at facilities surrounding San Rafael High School:

- On-campus parking facilities are well utilized throughout the day. The student vehicle parking lot operates at or near-capacity during school hours.
- Rates of off-street parking occupancy increases with proximity to San Rafael High School. Mission Avenue between Union Street and Belle Avenue experiences the highest rates of parking occupancy.
- Several unregulated parking spaces along 3rd Street could be used to supplement parking shortfalls at the student vehicle parking lot. However, these spaces are only accessible for vehicles travelling eastbound along 3rd Street, but only a small number of the student body travels to school in that direction.
- Faded curb markings and parking stall striping potentially result in ambiguity in the supply of parking within the study area, with parking availability varying greatly at the on-campus parking lots.
- High demand for parking during event days leads to the parking lots operating over capacity. Lack of parking and/or traffic controls leads to vehicles parking haphazardly throughout the parking lot potentially hindering vehicular circulation.
- It can be inferred from the parking duration survey that on-street parking within proximity of the school is used to supplement on-campus parking shortfalls. The streets may potentially absorb the parking demands of about 90 vehicles during school hours.
- The Project's proposed vehicular parking supply of 231 spaces would not satisfy the City's minimum parking requirements.
- Under future conditions the Project site would have a shortfall of 11 parking spaces. This would lead to parking demand overflowing to neighborhood streets. The occupancy rates at neighborhood streets such as Mission Avenue could be pushed to capacity. Additionally, lack of parking on the campus would increase traffic flow along residential streets from vehicles searching for available parking spaces. Potentially resulting in increased traffic congestion and vehicular delay along surrounding streets.

5. Recommendations

The following transportation impact mitigation measures and parking improvement measures have been recommended based on the result of this study. The purpose of these recommendations is to encourage more efficient use of existing and future parking facilities within the parking study area. The mitigation measure below is consistent with the mitigation measure provided in the Transportation and Traffic chapter of the EIR.

Mitigation Measure TRANS-1: San Rafael City Schools shall develop a Transportation Demand Management (TDM) program for San Rafael High School that focuses on reducing vehicle trips with just one student per vehicle and improving traffic flow by implementing a series of measures including, but not limited to, the following:

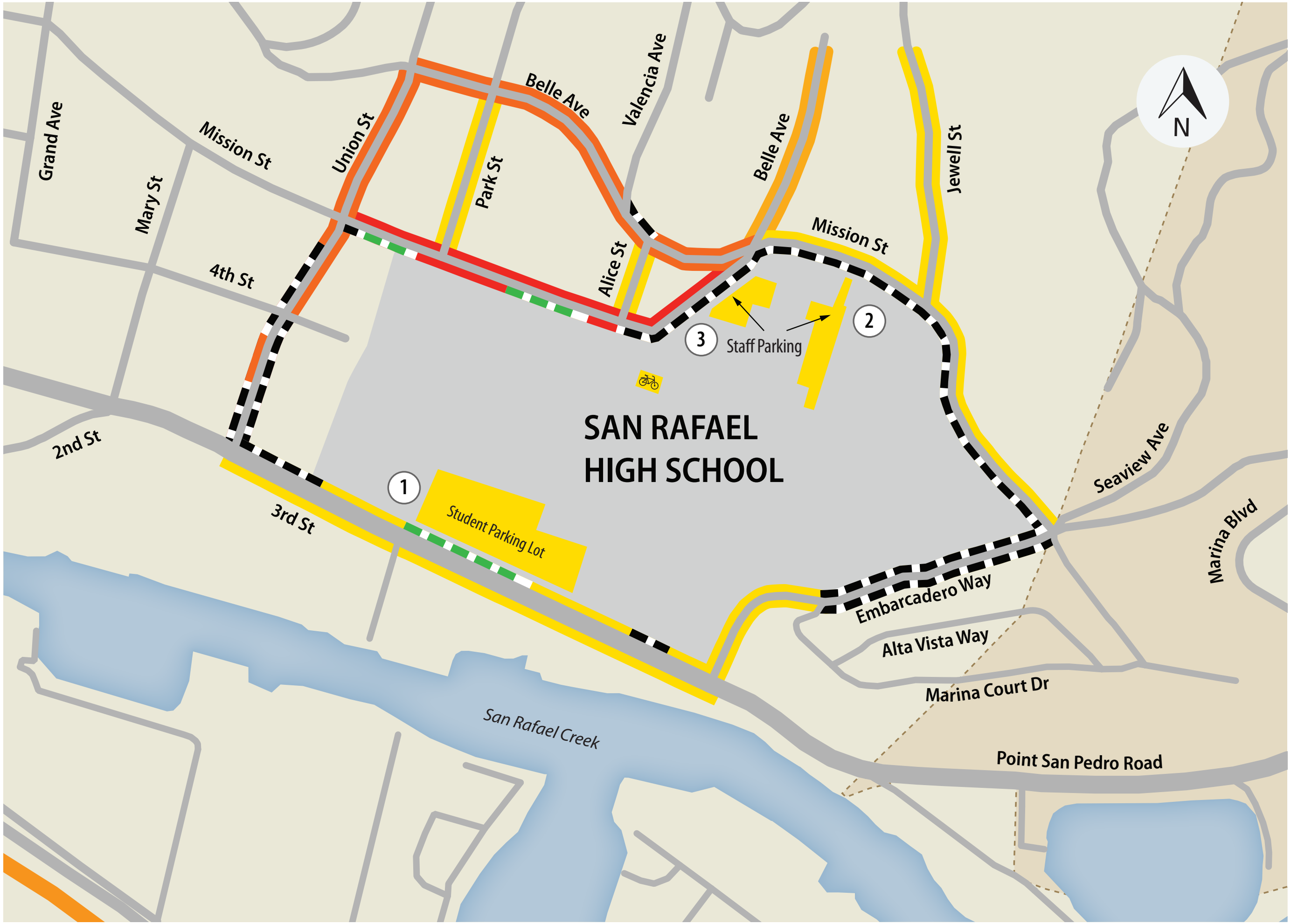
- *Updating and enforcing elements of the school's transportation measures in the School Handbook, such as requiring on-site parking permits; instructing parents and students on expected travel routes to use, drop-off/pick-up locations, and appropriate driver behaviors; and providing bus stop and bus route information.*
- *Considering promotion of carpool trips, and designating specific on-site parking spaces for carpool use only.*
- *Enrolling in Marin County's Safe Routes to School program to take advantage of County resources focused on reducing single student occupant vehicle trips and to promote walking, bicycling, use of public transit, and carpooling.*
- *Conducting periodic monitoring of traffic, including single student occupant vehicles and carpools, pedestrian and bicycle trips, and school trips made by public transit to gauge success and promote appropriate measures to reduce vehicle trips.*

The improvement measures presented below are provided as recommendations, and can be used for discussion purposes by the San Rafael City Schools and the City of San Rafael.

Recommendation PARKING-1: San Rafael City Schools will modify the Master Facilities Long-Range to include additional bicycle parking on-campus to encourage more students to bicycle to and from school.

Recommendation PARKING-2: The City of San Rafael shall Implement a neighborhood parking permit program for the residential neighborhood north of San Rafael High School. The residential permit program will limit parking along neighborhood streets to timed periods (e.g., 2-hour, 4-hour etc.) except for vehicles with neighborhood parking permits procured from the City of San Rafael.

<u>Recommendation PARKING</u>-3: As feasible, *San Rafael City Schools shall monitor the occupancy rates at the student lot, and shall consider modifying on-campus parking restrictions to allow a subset of students to park at the on-campus lots accessible via Mission Avenue.*



Parisi TRANSPORTATION CONSULTING

LEGEND

- 0–60%
- 61–70%
- 71–80%
- 81–90%
- 91–100%
- No Parking
- Passenger Loading
- Parking Lot ID
- Bicycle Parking

San Rafael High School EIR – Parking Study

Average Parking Occupancy: 7 am

Parisi TRANSPORTATION CONSULTING

San Rafael High School EIR – Parking Study

Average Parking Occupancy: 9 – 11 am

LEGEND

- 0–60%
- 61–70%
- 71–80%
- 81–90%
- 91–100%
- No Parking
- Passenger Loading
- # Parking Lot ID
- Bicycle Parking

San Rafael High School EIR – Parking Study

Average Parking Occupancy: 11am – 1 pm

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LEGEND

- 0–60%
- 61–70%
- 71–80%
- 81–90%
- 91–100%
- No Parking
- Passenger Loading
- # Parking Lot ID
- Bicycle Parking

San Rafael High School EIR – Parking Study

Average Parking Occupancy: 1 – 3 pm

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LEGEND

- 0–60%
- 61–70%
- 71–80%
- 81–90%
- 91–100%
- No Parking
- Passenger Loading
- # Parking Lot ID
- Bicycle Parking

San Rafael High School EIR – Parking Study

Average Parking Occupancy: 3 –5 pm

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LEGEND

- 0–60%
- 61–70%
- 71–80%
- 81–90%
- 91–100%
- No Parking
- Passenger Loading
- # Parking Lot ID
- Bicycle Parking

San Rafael High School EIR – Parking Study

Average Parking Occupancy: 5 –7 pm

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San Rafael High School EIR – Parking Study

Average Parking Occupancy: 7– 9 pm