Las Positas College 2012 Facilities Master Plan

MITIGATED NEGATIVE DECLARATION/ INITIAL STUDY

Chabot Las Positas Community College District

Draft – April 2017

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Chabot Las Positas
Community College District

NOTICE OF INTENT TO ADOPT A MITIGATED NEGATIVE DECLARATION FOR THE LAS POSITAS COLLEGE 2012 FACILITIES MASTER PLAN

PROJECT TITLE:	**Las Positas College 2012 Facilities Master Plan**
PROJECT LOCATION;	**3000 Campus Hill Drive, Livermore, CA 94551**
PROJECT SPONSOR:	**Chabot Las Positas Community College District (District)**
DATE OF PUBLIC NOTICE:	**April 19, 2017**
PUBLIC REVIEW PERIOD:	**April 20, 2017 through May 19, 2017**
DATE OF PUBLIC HEARING:	**June 20, 2017**
LOCATION OF PUBLIC HEARING:	**Chabot Las Positas Community College District 7600 Dublin Boulevard – 3rd Floor Dublin, CA 94545**

Project Description:
The proposed Project represents the buildout of the Las Positas College 2012 Facilities Master Plan (FMP). The FMP would be implemented in three phases over the next 13 years with construction starting in 2017 and ending in 2030. The FMP would construct six new buildings, with five of the new buildings constructed on the sites of existing buildings which would be demolished; campus entries, roads and parking lots would be improved; a new sports recreational area would be constructed; and improvements made to existing athletic facilities.

Environmental Review: An Initial Study (IS) has been prepared under the requirements of the California Environmental Quality Act (CEQA) for review and action by the District. The IS evaluates the potential environmental impacts of the proposed Project. Based on the results of the IS prepared according to CEQA Guidelines, it has been determined the Project will not have a significant effect on the environment and a Mitigated Negative Declaration (MND) has been prepared. The Project has been modified to incorporate mitigation measures identified in the IS that will reduce any potentially significant impacts to a less-than-significant level.

Public Review: The Draft MND/IS is available for public review at the District office at 7600 Dublin Boulevard – 3rd Floor, Dublin, CA 94545. The MND/IS is also available on the District website at: **http://www.clpccd.org/bond/**. Any interested party may comment on the proposed MND/IS. All comments received will be considered by the District prior to finalizing the MND/IS and making a decision on the Project. Written comments must be received no later than 4:00 pm on May 19, 2017 and sent to:

Doug Horner, Vice Chancellor, Facilities/Bond Programs and Operations
7600 Dublin Boulevard – 3rd Floor
Dublin, CA 94568
Email: dhorner@clpccd.org

MITIGATED NEGATIVE DECLARATION

PROJECT DESCRIPTION

The proposed Project is the *Las Positas College 2012 Facilities Master Plan* (2012 FMP) which comprises the following elements:

- **Library and Learning Center:** located at the sites of the existing Buildings B2100 and B2200 which will be demolished.
- **Horticulture/Viticulture Building:** new building.
- **Academic Buildings B600 and B800:** located at the sites of the existing Buildings B600 and B800 which will be demolished.
- **Academic Building B300:** located at the site of the existing Building B700, B900 and B1300 which will be demolished.
- **Academic Building B100:** located at the site of the existing Building B100, B200 and B300 which will be demolished.
- **Rebuilding of Vehicle Circulation, Parking Lots and Entries:** this will include campus entrance improvements to the Campus Hill Drive entry and the Collier Canyon entry, Campus Loop improvements, bus drop-off at B1600 and parking improvements at Lots A-A, B and C.
- **Athletic Field Improvements Phase I:** this will include installation of bleachers and locker rooms.
- **Athletic Field Improvements Phase II:** this will include installation of new athletic fields.

Buildout of the 2012 FMP would occur in three development phases: Phase 1: 2017 – 2022; Phase 2: 2021 – 2026; and Phase 3: 2025 – 2030. Construction hours would be 7:00 am to 4:00 pm Monday through Friday. If it is necessary to occasionally conduct construction activities on Saturdays, construction activities will start at 9:00 am.

PROJECT LOCATION

Las Positas College
3000 Campus Hill Drive
Livermore, CA 94551-9797

PROJECT SPONSOR

Chabot Las Positas Community College District
7600 Dublin Boulevard – 3rd Floor
Dublin, California 94568

FINDING

The Project will not have a significant effect on the environment based on the Initial Study prepared according to CEQA Guidelines. Mitigations have been incorporated into the Project to reduce the identified potentially significant impacts to a less-than-significant level.

POTENTIALLY SIGNIFICANT IMPACT

The attached Initial Study indicates that the Project could adversely affect the environment. Potentially significant impacts were identified and are presented below.

MITIGATION MEASURES

In the interest of reducing the potential impact to the point where the net effect of the Project is insignificant, mitigation measures are recommended. A discussion of the potential impacts of interest and the associated mitigation measures is provided below.

AIR QUALITY

Impact: Buildout of the 2012 Facilities Master Plan would result in short-term air pollution emissions as a result of construction activities during each development phase.

Mitigation Measure:

AIR-1 Project reactive organic gases (ROG) emissions from architectural coating application shall be reduced to 54 lbs/day or less through the implementation of any of the following measures or some combination thereof as required:

- Stretch out the architectural coating applications phases for any building constructed under the FMP to 3 weeks or more, and assure that the finishing phases of any two concurrently constructed buildings do not overlap;
- Use architectural coatings with a lower ROG content than BAAQMD regulations require; and/or
- Use building components that have had their surfaces factory-finished and so reduce the need for on-site painting or finishing with ROG-containing paints.

Prior to the beginning of any construction, final plans shall be submitted for CLPCCD approvals that demonstrate attainment of the BAAQMD 54 lbs. /day limit on ROG emissions during construction.

Residual Impact: Less than significant with implementation of the recommended mitigation measure.

BIOLOGICAL RESOURCES

Impact: 2012 Facilities Master Plan buildout would result in permanent impacts to 15.5 acres of non-native annual grassland/ruderal habitat and 12.5 acres of disturbed/developed habitat and will adversely affect federally listed wildlife species due to the loss of habitat.

Mitigation Measures:

BIO-1 **Compensatory Habitat Mitigation for California Tiger Salamander, California Red-legged Frog, and Burrowing Owl.** Implementation of the 2012 FMP will permanently impact 15.5 acres of non-native grassland that provides potential habitat for the California tiger salamander and California red-legged frog, and that could possibly be used as nesting habitat by burrowing owls. Compensatory mitigation for impacts to habitat of the California tiger salamander and California red-legged frog is being provided at Murray Ranch, located north and northwest of the Campus, and the mitigation provided for those two amphibians would also be suitable to compensate for loss of burrowing owl habitat in the event that nesting burrowing owls are impacted by the 2012 FMP.

Murray Ranch was identified as a mitigation site for impacts of Las Positas College activities on the California tiger salamander and California red-legged frog during planning for the 2006 FMP. That earlier plan included activities that would result in permanent impacts to 50.2 ac of habitat and temporary impacts to 7.3 acres of habitat for these species. Per the 2006 DEIR (PLACEMAKERS 2006), compensatory mitigation for the permanent impacts was to be provided via the preservation and management of suitable habitat off-site, necessitating a total of 100.4 acres of mitigation. However, when discussing the 2007 Biological Opinion with the USFWS, the District agreed to provide mitigation as though all then-undeveloped portions of the Las Positas College campus (totaling 85.2 acres) would eventually be developed. These 85.2 acres included the 2006 FMP impact areas, the 15.5 acres of potential habitat being impacted by 2012 FMP, and additional areas of potential habitat, primarily along the eastern and western edges of the campus, where no development activities are currently proposed. As mitigation for impacts to 85.2 acres of habitat, the District proposed (and the USFWS approved) preservation and management of 209 acres of suitable habitat at Murray Ranch.

The EACCS guides development and corresponding efforts to avoid, minimize, and compensate for impacts to biological resources in eastern Alameda County, including the Livermore area (ICF International 2010). Although the EACCS was not established when the 2006 FMP was built out, and therefore would not have influenced mitigation ratios for development constructed under the 2006 FMP, the EACCS is applicable to the 2012 FMP. The EACCS identifies appropriate mitigation ratios indicating the amount of land that should be preserved and managed to compensate for impacts to special-status species habitat. The EACCS-recommended standard mitigation ratio for impacts to the California tiger salamander and California red-legged frog from the Las Positas College 2012 Master Plan was determined to be 2.5:1 (mitigation acres: impacted acres). Applying the EACCS's scoring system for both the impact site and Murray Ranch mitigation site demonstrates the relatively higher quality of habitat on the mitigation site, compared to the habitat impacted by the 2012 FMP. Therefore, appropriate mitigation for 2012 FMP impacts on the California tiger salamander and California red-legged frog total 27.51 and 29.06 acres, respectively.

Adding the 100.4 acres of mitigation required under CEQA for the 2006 FMP to the mitigation being required under CEQA to compensate for buildout of the 2012 FMP, the

CEQA mitigation requirements for both the 2006 FMP and 2012 FMP total 129.46 acres, which will be covered in the 209 acres of habitat being preserved and managed at Murray Ranch.

The District is currently finalizing its Murray Ranch mitigation. To complete this mitigation, the District will finalize the details of the conservation easement protecting the mitigation lands; the endowment that will pay for the management and monitoring of the mitigation lands in perpetuity; and the agreement with a land manager and conservation easement holder to ensure that the lands are managed properly for these special-status species.

BIO-2 **Implementation of General East Alameda County Conservation Strategy (EACCS) Avoidance and Minimization Measures**. The District will implement the following Avoidance and Minimization Measures (AMMs) prescribed by the EACCS to avoid and minimize effects on sensitive species during 2012 FMP construction activities. This mitigation measure addresses general measures that apply to multiple species.

EACCS Measure GEN-01. Employees and contractors performing construction activities will receive environmental sensitivity training. Training will include review of environmental laws and AMMs that must be followed by all personnel to reduce or avoid effects on covered species during construction activities.

ACCS Measure GEN-02. Environmental tailboard trainings (i.e., brief, on-site training sessions for construction personnel) will take place on an as-needed basis in the field. The environmental tailboard trainings will include a brief review of the biology of the covered species and guidelines that must be followed by all personnel to reduce or avoid negative effects on these species during construction activities. Directors, managers, superintendents, and the crew foremen and forewomen will be responsible for ensuring that crewmembers comply with the guidelines.

EACCS Measure GEN-03. Contracts with contractors, construction management firms, and subcontractors will obligate all contractors to comply with these AMMs.

ACCS Measure GEN-04. The following will not be allowed at or near work sites for covered activities: trash dumping, firearms, open fires (such as barbecues) not required by the activity, hunting, and pets (except for safety in remote locations).

EACCS Measure GEN-05. Vehicles and equipment will be parked on pavement, existing roads, and previously disturbed areas to the extent practicable.

EACCS Measure GEN-06. Off-road vehicle travel will be minimized.

EACCS Measure GEN-07. Vehicles will not exceed a speed limit of 15 miles per hour on unpaved roads within natural land-cover types, or during off-road travel.

EACCS Measure GEN-08. Vehicles or equipment will not be refueled within 100 feet of a wetland, stream, or other waterway unless a bermed and lined refueling area is constructed.

EACCS Measure GEN-09. Vehicles shall be washed only at approved areas. No washing of vehicles shall occur at job sites.

EACCS Measure GEN-10. To discourage the introduction and establishment of invasive plant species, seed mixtures/straw used within natural vegetation will be either rice straw or weed-free straw.

EACCS Measure GEN-11. Pipes, culverts, and similar materials greater than four inches in diameter will be stored so as to prevent covered wildlife species from using these as temporary refuges, and these materials will be inspected each morning for the presence of animals prior to being moved.

EACCS Measure GEN-12. Erosion control measures will be implemented to reduce sedimentation in wetland habitat occupied by covered animal and plant species when activities are the source of potential erosion problems. Plastic monofilament netting (erosion control matting) or similar material containing netting shall not be used at the project. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

EACCS Measure GEN-13. Stockpiling of material will occur such that direct effects on covered species are avoided. Stockpiling of material in riparian areas will occur outside of the top of bank, and preferably outside of the outer riparian dripline and will not exceed 30 days.

EACCS Measure GEN-14. Grading will be restricted to the minimum area necessary.

EACCS Measure GEN-15. Prior to ground disturbing activities in sensitive habitats, project construction boundaries and access areas will be flagged and temporarily fenced during construction to reduce the potential for vehicles and equipment to stray into adjacent habitats.

EACCS Measure GEN-16. Significant earth-moving activities will not be conducted in riparian areas within 24 hours of predicted storms or after major storms (defined as one inch of rain or more).

EACCS Measure GEN-17. Trenches will be backfilled as soon as possible. Open trenches will be searched each day prior to construction to ensure no covered species are trapped. Earthen escape ramps will be installed at intervals prescribed by a qualified biologist.

BIO-3 **Implementation of EACCS Avoidance and Minimization Measures for the California Tiger Salamander and California Red-legged Frog.** The District will implement the following AMMs prescribed by the EACCS to avoid and minimize effects on sensitive species during 2012 FMP construction activities.

EACCS Measure AMPH-1. If aquatic habitat is present, a qualified biologist will stake and flag an exclusion zone prior to activities. The exclusion zone will be fenced with orange construction zone and erosion control fencing (to be installed by construction crew). The exclusion zone will encompass the maximum practicable distance from the work site and at least 500 feet from the aquatic feature wet or dry. [*Because the proposed Athletic Field Improvements are located in close proximity to a seasonal wetland, the complete exclusion of activity within 500 feet of aquatic habitat is not feasible. However, in order to comply with this measure to the greatest extent practicable, the limits of project activities in and adjacent to aquatic habitats will be clearly marked, and construction fencing will prevent equipment from entering aquatic habitats outside the designated impact areas.*]

EACCS Measure AMPH-2.

- A qualified biologist will conduct pre-construction surveys prior to activities. If individuals are found, work will not begin until they are moved out of the construction zone to a USFWS/CDFW approved relocation site.
- A USFWS/CDFW-approved biologist will be present for initial ground disturbing activities.

- If the work site is within the typical dispersal distance (contact USFWS/CDFW for latest research on this distance for species of interest) of potential breeding habitat, barrier fencing will be constructed around the worksite to prevent amphibians from entering the work area. Barrier fencing will be removed within 72 hours of completion of work. [*The project area is known to be within dispersal distance of potential breeding habitat for California tiger salamanders and California red-legged frogs, and therefore barrier fencing consisting of silt fencing will be installed on the northern and eastern boundaries of the project area where construction activities border grassland habitat. The barrier fencing will be at least 3 feet high and the lower 6 inches of the fence will be buried in the ground to prevent animals from crawling under. The remaining 2.5 feet will be left above ground to serve as a barrier for animals moving on the ground surface.*]

- No monofilament plastic will be used for erosion control.

- Construction personnel will inspect open trenches in the morning and evening for trapped amphibians.

- A qualified biologist possessing a valid FESA Section 10(a)(1)(A) permit or USFWS-approved under an active biological opinion, will be contracted to trap and to move amphibians to nearby suitable habitat if amphibians are found inside a fenced area. [*No trapping, such as the use of upland traplines for California tiger salamanders, is proposed for this project. However, a biologist approved by the USFWS under the project's Biological Opinion will survey for and relocate any individuals found within the impact area.*]

- Work will be avoided within suitable habitat from October 15 (or the first measurable fall rain of one inch or greater) to May 1.

BIO-4 Implementation of Avoidance and Minimization Measures for the Burrowing Owl.

- Pre-construction surveys for burrowing owls shall be conducted prior to the initiation of all project activities within, and within 250 feet of, the ruderal/ grassland habitat in the northeastern part of the project area. Pre-construction surveys will be completed in conformance with the CDFW's 2012 guidelines (California Department of Fish and Game 2012). A qualified biologist will conduct two surveys, the first anytime within 30 days prior to the start of construction and the second within 48 hours prior to construction, to determine whether owls are present in areas where they could be affected by proposed activities.

- If burrowing owls are present during the non-breeding season (generally September 1 to January 31), a 160-foot buffer zone shall be maintained around the occupied burrow(s), if feasible. If maintaining such a buffer is not feasible, then the buffer must be great enough to avoid injury or mortality of individual owls, or else the owls should be passively relocated as described in the last bullet in this mitigation measure. During the breeding season (generally February 1 to August 31), a 250-foot buffer, within which no new project-related activities will be permissible, will be maintained between project activities and occupied burrows. Owls present between February 1 and August 31 will be assumed to be nesting, and the 250-foot protected area will remain in effect until August 31. If monitoring evidence indicates that the owls are no longer nesting or the young owls are foraging independently, the buffer may be reduced or the owls may be relocated prior to August 31, in consultation with the CDFW.

- Any owls occupying the project area are likely habituated to some level of human disturbance throughout the year due to campus activities. As a result, they may exhibit a tolerance of greater levels of human disturbance than owls in more natural settings, and work within the standard 250-foot buffer during the nesting season may be able to proceed without disturbing the owls. Therefore, if nesting owls are determined to be present on the site, and project construction activities cannot feasibly avoid disturbance of the area within 250 feet of the occupied burrow during the nesting season (i.e., February 1 through August 31) due to other seasonal constraints, a qualified biologist will be present during all activities within 250 of the nest to monitor the owls' behavior. If in the opinion of the qualified biologist, the owls are unduly disturbed (i.e., disturbed to the point of harm or reduced reproductive success), all work within 250 feet of the occupied burrow will cease until the nest is no longer active.

- If construction will directly impact occupied burrows, a qualified biologist will passively evict owls from burrows during the nonbreeding season (September 1 to January 31). No burrowing owls will be evicted during the nesting season (February 1 through August 31) except with the CDFW's concurrence that evidence demonstrates that nesting is not actively occurring (e.g., because the owls have not yet begun nesting early in the season, or because young have already fledged late in the season). Eviction will occur through the use of one-way doors inserted into the occupied burrow and all burrows within impact areas that are within 250 feet of the occupied burrow (to prevent occupation of other burrows that will be impacted). One-way doors will be installed by a qualified biologist and left in place for at least 48 hours before they are removed. The burrows will then be back-filled to prevent re-occupation. Although relocation of owls may be necessary to avoid the direct injury or mortality of owls during construction, relocated owls may suffer predation, competition with other owls, or reduced health or reproductive success as a result of being relegated to more marginal habitat. However, the benefits of such relocation, in terms of avoiding direct injury or mortality, would outweigh any adverse effects.

Residual Impact: Less than significant with implementation of the recommended mitigation measures.

GEOLOGY AND SOILS

Impact: Strong ground shaking may be expected at the Las Positas College campus during the design lifetime of the proposed buildings identified in the 2012 Facilities Master Plan.

Impact: Near-surface soils generally have a high expansion characteristic.

Mitigation Measure:

GEO-1 Detailed geotechnical investigations shall be performed prior to the design of each of the six proposed new buildings. The geotechnical investigations shall include borings and laboratory testing to provide supporting data for geotechnical design recommendations.

Residual Impact: Less than significant with implementation of the recommended mitigation measure.

HAZARDS

Impact: There is the potential that buildings proposed for demolition may contain asbestos-containing building materials, lead-containing building materials, loose & peeling lead containing paint, and/or polychlorinated biphenyl (PCB)-containing building materials.

Impact: Grading and excavation and potential off-haul of soil during each development phase may disturb soils containing hazardous substances or materials based on historical or current use at the building sites.

Mitigation Measures:

HAZ-1 Prior to the demolition of the five buildings identified in the 2012 FMP, a Hazardous Materials Building Survey of these shall be prepared. The Hazardous Materials Building Survey shall include identification of suspect asbestos-containing building materials, lead-containing building materials, loose & peeling lead containing paint, mercury light tubes, mercury thermostat switches, and polychlorinated biphenyl (PCB)-light ballasts, and PCB-containing building materials that may be impacted during the demolition of the five buildings. If the inspection confirms the presence of asbestos-contain materials (ACMs) or other hazardous building materials in any of the building, the hazardous materials shall be removed from these buildings prior to demolition and be transported in compliance with State and federal requirements.

HAZ-2 Prior to the initiation of grading and excavation activities, a Phase I Environmental Site Assessment (Phase I ESA) for the subject property shall be prepared in accordance with the American Society for Testing and Materials *Standard Practice for Environmental Site Assessments: Phase I Site Assessment Process* E 1527-13 and the United States Environmental Protection Agency (US EPA) 40 CFR Part 312 *Standards and Practices for All Appropriate Inquiries (AAI) – Final Rule* adopted November 1, 2006 and amended December 30, 2013.

Residual Impact: Less than significant with implementation of the recommended mitigation measures.

NOISE

Impact: During Project construction activities, noise levels in on-campus areas adjacent to the construction sites would temporarily increase with potential adverse noise and vibration impacts on instruction/research/work activities.

Mitigation Measures:

NOISE-1 The following Best Management Practices shall be incorporated into the Project construction documents:

- Provide enclosures and noise mufflers for stationary equipment, shrouding or shielding for impact tools, and barriers around particularly noisy activity areas on the site.
- Use quietest type of construction equipment whenever possible, particularly air compressors.
- Provide sound-control devices on equipment no less effective than those provided by the manufacturer.

- Locate stationary equipment, material stockpiles, and vehicle staging areas as far as practicable from sensitive receptors.
- Prohibit unnecessary idling of internal combustion engines.
- Require applicable construction-related vehicles and equipment to use designated truck routes when entering/leaving the site.
- Designate a noise (and vibration) disturbance coordinator at the CLPCCD who shall be responsible for responding to complaints about noise (and vibration) during construction. The telephone number of the noise disturbance coordinator shall be conspicuously posted at the construction site. Copies of the project purpose, description and construction schedule shall also be distributed to the surrounding residences.
- Prohibit project construction activity between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday or at all on city-observed holidays.

NOISE-2 To the extent feasible, in instances where vibration-intensive construction equipment is located next to on-campus vibration-sensitive receptors that would result in major disruption, the District shall temporarily re-locate the vibration-sensitive receptors to minimize disruption.

Residual Impact: Less-than-significant

TRANSPORTATION AND CIRCULATION

Impact: The Project would result in deficient intersection operations with the installation of the proposed roundabout at the Campus Hill/Campus Loop both as a Project impact and as a Project contribution to a significant cumulative impact.

Mitigation Measure:

TRAFFIC-1 The proposed design for the roundabout at the intersection of Campus Hill Drive/ Campus Loop shall be modified to add a northbound right-turn slip lane, which would result in LOS B or better operations, reducing the Project impact to a less-than-significant level.

Residual Impact: Less than significant with implementation of the recommended mitigation measure.

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LAS POSITAS COLLEGE 2012 FACILITIES MASTER PLAN INITIAL STUDY

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PROJECT INFORMATION

Project Title:	Las Positas College 2012 Facilities Master Plan
Lead Agency Name and Address:	Chabot Las Positas Community College District 7600 Dublin Boulevard, 3rd Floor Dublin, CA 94568
Contact Person and Email Address:	Doug Horner, Vice Chancellor Facilities/Bond Programs and Operations Facilities & Bond Program Email: dhorner@clpccd.org Phone: 925.485.5277
Project Location:	Las Positas College 3000 Campus Hill Drive Livermore, CA 94551
Project Sponsor's Name and Address:	Chabot Las Positas Community College District 7600 Dublin Boulevard, 3rd Floor Dublin, CA 94568
General Plan Designation:	Community College (CF-JC)
Zoning Designation:	Education and Institutions (E)

PROJECT DESCRIPTION

BACKGROUND

Las Positas College was established in 1975. In 2006 a Facilities Master Plan (2006 FMP) was prepared for the campus identifying new buildings and infrastructure and renovation of existing buildings (Chabot-Las Positas Community College District 2006a). An Environmental Impact Report (EIR) was completed for the 2006 FMP and concluded all potentially significant impacts, except for cumulative traffic impacts, would be reduced to less than significant with implementation of the recommended mitigation measures identified in the EIR (Chabot-Las Positas Community College District 2006b). A Statement of Overriding Considerations was prepared for the 2006 FMP. In 2012, the District updated the 2006 FMP for the next ten to 20 years. The Las Positas College 2012 Facilities Master Plan (2012 FMP) builds upon the facilities and infrastructure completed under the 2006 FMP, identifying a range of new facilities and improvements to complete the campus. Measure A was passed in June 2016 and will provide funds to implement the 2012 FMP for Las Positas College.

In 2010-11, Las Positas College had an enrollment (headcount) of 8,870 students. For the 2015-16 school year, peak enrollment (headcount) was 8,282 students[1]. The projected enrollment (headcount) for the year 2025 is 10,375 students, which represents an increase of 2,093 students over existing conditions at the campus.

PROJECT LOCATION

Las Positas College is located in Livermore, California. The campus is located about 0.5 mile north of I-580 with access via Collier Canyon Road and Campus Hill Drive. **Figure 1** shows the Project and regional location.

EXISTING CONDITIONS

Campus Site

The Las Positas College campus comprises approximately 147 acres. Access to the campus is from Collier Canyon Road and Campus Hill Drive (**Figure 2**, **Existing Las Positas College Campus Plan**).

Campus Operations

Campus hours of operation are 7:00 am to 10:30 pm Monday through Friday. Competitive athletic events occur during the school year. **Table 1** generally presents the type of sports events by season, day and general start time.

TABLE 1: LAS POSITAS COLLEGE ATHLETIC EVENTS

Season	Sport	Day	Start Time
Fall	Women's & Men's Soccer	Weekdays	Ranging in time from 2:00 pm to 6:30 pm
Winter	Women's & Men's Basketball	Weekdays & Saturdays	Evenings, time varies
Spring	Women's & Men's Swimming	Weekdays & Saturdays	Daytime, time varies

Additionally, the existing Theater, which seats 520, is used by the College and leased to community groups on Saturdays and Sundays.

Surrounding Land Uses

The College campus is bounded by Collier Canyon Road and Collier Creek to the west and northwest, agricultural lands to the north and east and residential development to the south across Campus Loop. Farther west across Collier Canyon Road is Comcast Place which includes office, retail and residential development.

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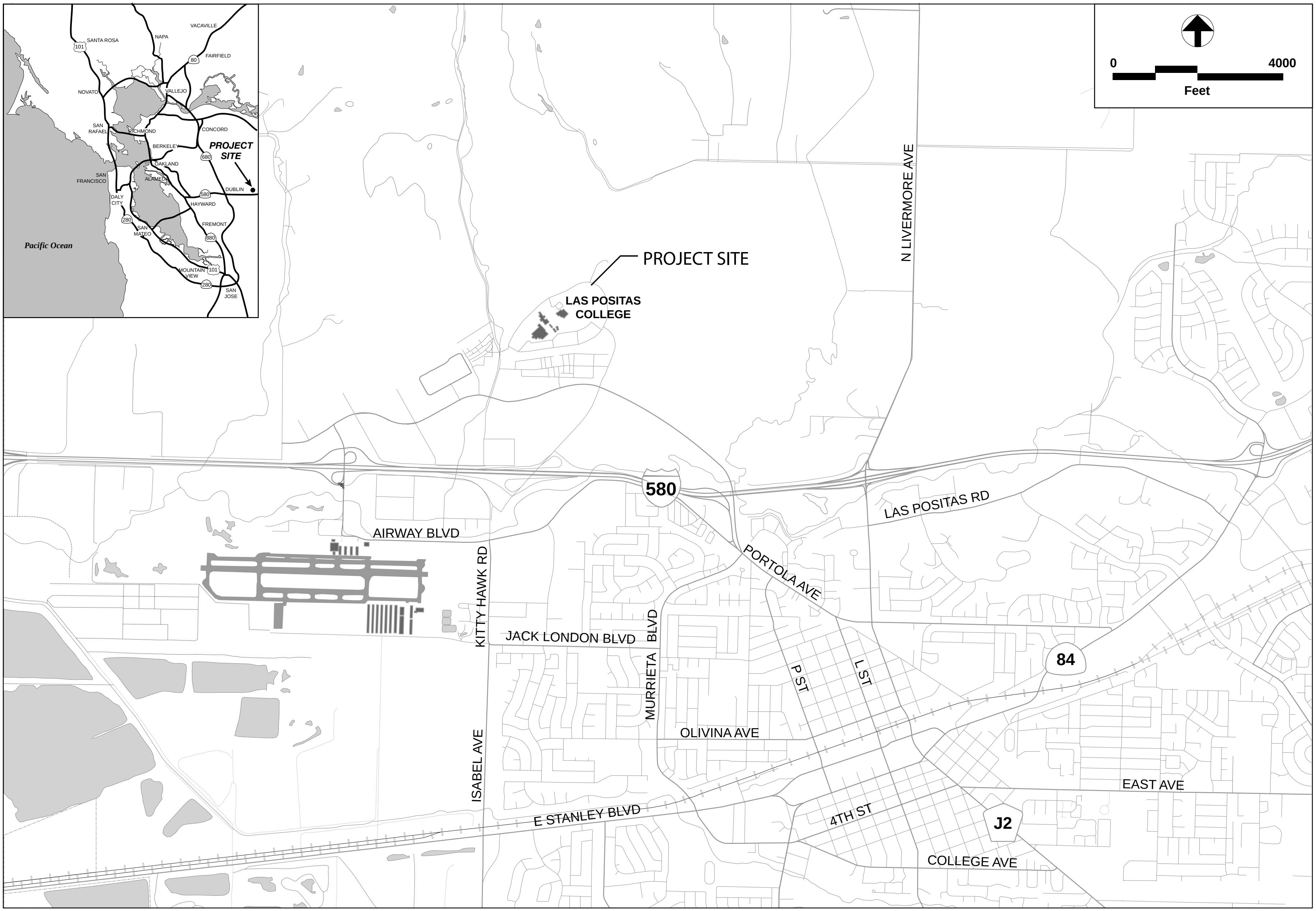
1 Rajinder Samra, M.S., Director, Institutional Research and Planning and Chair, Institutional Planning and Effectiveness Committee, Las Positas College. Email dated November 29, 2016.



Source: Placemakers

Figure 1
Project and Regional Location

Source: Chabot-Las Positas Community College District 2012 Facilities Master Plan

Figure 2
Existing Las Positas College Campus Plan

PROPOSED FACILITIES MASTER PLAN PROGRAM

Presented below are the proposed elements of the 2012 FMP. **Figure 3**, **Proposed Las Positas Campus Plan**, shows the proposed construction of new buildings and renovation of existing buildings.

Library and Learning Center (B2100)

The existing B2100 and B2200 buildings will be demolished and a new building constructed at the site. The building will house library functions, Integrated Learning Center, Writing Center, Language Arts Programs, Math Center, tutoring, faculty offices, computer labs, student serving spaces and general education classrooms.

Horticulture/Viticulture Building (B3400)

This new building will include greenhouses, planting beds, viticulture barrels and tanks.

Academic Buildings (B600 and B800)

The two new buildings will contain classrooms, faculty offices, computer information systems, computer technology, computer networking, work-based learning and an outdoor area for welding.

Academic Building (B300)

This new building will contain classrooms, faculty offices and the first floor may include the bookstore, copy center, campus security and student health.

Academic Building (B100)

This building may house the Applied Arts programs such as graphic arts, journalism, photography, art studio, interior design, ceramics sculpture and printmaking. Additionally, general education classrooms, computer labs and a lecture hall may be accommodated.

Rebuilding of Vehicle Circulation, Parking Lots and Entries

This will include campus entrance improvements to the Campus Hill Drive entry and the Collier Canyon entry, Campus Loop improvements, bus drop-off at B1600 and parking improvements at Lots A-A, B and C.

Athletic Field Improvements Phase I

Installation of bleachers and locker rooms.

Athletic Field Improvements Phase II

Installation of new athletic fields.

Source: Chabot-Las Positas Community College District 2012 Facilities Master Plan

Figure 3
Proposed Las Positas College 2012 Facilities Master Plan

PLANNED DEVELOPMENT SCHEDULE

Buildout of the 2012 FMP will occur in three development phases (**Table 2**). Phase 1 is planned to begin in Spring 2017. Presented below is the anticipated schedule for each development phase.

TABLE 2: LAS POSITAS COLLEGE FACILITIES MASTER PLAN BUILDING PROGRAM

Development Phase	Use	Gross Building Area (sf)	Building Footprint (sf)
1 (Timeline 2017 – 2022)	Library and Learning Center (B2100)	57,365	26,600
	Horticulture/Viticulture (B3400)	8,615	10,300
	Entrance, Road, and Parking Improvements (Lots A-A, B,C)	n/a	n/a
	Bleachers and Locker Rooms (Athletic Field Improvements – (Phase 1)	n/a	22,300
2 (Timeline 2021 – 2026)	Academic Building (B800)	31,723	17,100
	Sports Recreational Area (Athletic Fields – Phase 2)	n/a	n/a
3 (Timeline 2025 – 2030)	Academic Building (B600)	32,602	14,300
	Academic Building (B300)	21,969	16,700
	Academic Building (B100)	45,985	20,600

Source: Chabot-Las Positas Community College District, Facilities & Bond Program

Site grading will be balanced with no off-haul of spoils. Construction hours would 7:00 am to 4:00 pm Monday through Friday. If it is necessary to occasionally conduct construction activities on Saturdays, construction activities will start at 9:00 am.

PROJECT APPROVALS

- Division of the State Architect (DSA) for building, disabled access, fire and life safety systems.
- San Francisco Bay Regional Water Quality Control Board for Storm Water Pollution Prevention Plan (SWPPP).
- Livermore-Pleasanton Fire Department for site access and fire hydrants/water pressure.

REFERENCES

Chabot-Las Positas Community College District. 2006a. *Las Positas College Facilities Master Plan*.

Chabot-Las Positas Community College District. 2006b. Las Positas College Facilities Development Plan EIR (SCH#2006012123). Prepared by PLACEMAKERS.

Chabot-Las Positas Community College District. 2012. *Las Positas College 2012 Facilities Master Plan*. Prepared by Steinberg Architects. July 17, 2012. www.clpccd.org/facilities/.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by the project, involving at least one impact that is a potentially significant impact as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agricultural and Forestry Resources	☒ Air Quality
☒ Biological Resources	☐ Cultural Resources	☒ Geology and Soils
☐ Greenhouse Gas Emissions	☒ Hazards and Hazardous Materials	☐ Hydrology and Water Quality
☐ Land Use/Planning	☐ Mineral Resources	☒ Noise
☐ Population and Housing	☐ Public Services	☐ Recreation
☒ Transportation/Traffic	☐ Utilities/Service Systems	☒ Mandatory Findings of Significance

DETERMINATION:

On the basis of this initial evaluation:

☐ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☒ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because the revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

12 APRIL 2017

Doug Horner, Vice Chancellor
Facilities/Bond Programs and Operations

Date

EVALUATION OF ENVIRONMENTAL IMPACTS

CEQA requires a brief explanation to answer all questions listed in the Environmental Checklist. All answers must consider the entire project action including on-site, off-site, indirect and cumulative project impacts and, as applicable, temporary project construction impacts.

Once the Lead Agency (Chabot Las Positas Community College District) has determined a particular physical impact may occur, the checklist answers must indicate whether the impact is potentially significant, potentially significant unless mitigation is incorporated, or less than significant. A brief explanation is required for all answers except "No Impact" answers if these answers are adequately supported by the information sources listed in the References section for each environmental issue.

ENVIRONMENTAL ISSUES

1. AESTHETICS. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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?	☐	☐	☒	☐
d) Create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?	☐	☐	☒	☐

Environmental Setting

The Las Positas College campus is situated within the scenic Altamont Hills to the north and east. West and south of the campus is urban development. The campus gently slopes downward from northeast to southwest. South of the campus across Campus Loop is three-story residential development. West of the campus across Collier Canyon Road is two story residential development and commercial development. To the north/northwest and east are agricultural lands.

The campus is developed with one to three story buildings, athletic facilities, landscaped areas, parking lots and roadway network. At the southern boundary of the campus, buildings are set back from Campus Loop with parking lots fronting the road. At the northern boundary of the campus, there is a mix of buildings with landscaping and parking lots fronting on Campus Loop. To the northeast across Campus Loop is the track complex and maintenance and operations buildings.

Impact Discussion

The proposed Project would not adversely affect scenic vistas, damage scenic resources, degrade the visual quality of the site or surrounding area. The Project would introduce a new light source associated with the new athletic fields, but it would be less than significant. A discussion of each environmental issue included under Section 1 is presented below.

a) Would the project have a substantial adverse effect on a scenic vista?

There are no designated scenic vistas identified in either the City of Livermore General Plan (City of Livermore) or the County of Alameda General Plan (County of Alameda). To the west and south of the campus is urban development in foreground and middle ground views and the East Bay Hills in background views. To the north and east of the campus is agricultural lands and the Altamont Hills. The proposed Project would locate the new buildings identified in the 2012 FMP at the sites of existing buildings and the new buildings would be within the general heights and massing of the existing campus buildings. Therefore, views of the campus with buildout of the 2012 FMP from existing residential development to the south and west would be similar to existing views of the campus available from existing residential development. The proposed Project would construct new athletic facilities adjacent to the existing track. These new facilities would not adversely affect views from the existing residential development located south and west of the campus due to intervening campus development west of the location of the proposed athletic facilities and topography. The proposed Project would result in less than significant impacts to scenic resources.

b) Would the project substantially damage scenic resources, including but not limited to, trees, rock outcroppings, and historic buildings within a scenic highway?

The Las Positas College campus is not within a designated scenic highway (County of Alameda). There are no rock outcroppings or historic buildings on the campus. The proposed Project would not impact scenic resources.

c) Would the project substantially degrade the existing visual character or quality of the site and its surroundings?

The proposed Project represents the planned buildout of the Las Positas College campus as identified in the 2012 FMP. Development proposed would be similar in scale to existing campus facilities. The Project will follow the *Las Positas College Design Guidelines* (Chabot Las Positas Community College District 2006) adopted by the Chabot Las Positas Community College District Board of Trustees (Chabot Las Positas Community College District 2012). The Design Guidelines address:

- Site organization to include views, gateways and circulation.
- Landscape themes that have contextual relevance and help to visually organize the campus.
- Landscape and site elements to include planting, irrigation, paving, site furniture, plaza areas, streetscapes, parking lot design, lighting, and signage.
- General and specific guidelines to ensure campus-wide sustainable practices.

The proposed Project would not substantially degrade the existing visual quality or character of the campus or surrounding area. New campus buildings and landscaping would be designed to complement the existing campus and visual impacts would be less than significant.

d) Would the project create a new source of substantial light or glare, which would adversely affect day or nighttime views in the area?

The proposed Project would construct additional athletic facilities to the east and south of the existing track complex. The new facilities include athletic fields and a parking lot which would all include light standards. This would result in an increase in night lighting at the campus. The *Las Positas College Design Guidelines* (Chabot Las Positas Community College District 2006) emphasize reducing light pollution to preserve views of the night sky and recommend light fixtures be "cut off" to limit the amount of light emitted into the sky and to focus light on the ground. The lighting would be designed and oriented to minimize the effects of light and glare from this new lighting. Additionally, this lighting would be turned off by 10:30 pm consistent with campus hours of operation. Potential increases in night lighting resulting from the Project would be less than significant.

Mitigation Measures

None required.

References

City of Livermore. *City of Livermore General Plan 2003 – 2025*. Available on the City of Livermore website at: www.ci.livermore.ca.us/citygov/cd/planning/general.asp.

County of Alameda. *Alameda County General Plan, Scenic Route Element.* Available on the Alameda County website at: https://www.acgov.org/cda/planning/generalplans/documents/Scenic_Route_Element_General_Plan_1966.pdf)

Chabot Las Positas Community College District. 2006. *Las Positas College Design Guidelines*. December 20, 2006. Prepared by Royston Hanamoto Alley & Abey Carducci & Associates, Inc. Available on the District website at: www.clpccd.org/facilities/documents/LPCDG_FINAL_072910.pdf)

Chabot Las Positas Community College District. 2012. *Resolution 14-1112 Authorizing the Adoption of District Standards and College Design Guidelines*. June 26, 2012.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
2. AGRICULTURE AND FORESTRY RESOURCES. In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. In determining whether impacts to forest resources, including timberland are significant environmental effects, lead agencies may refer to information compiled by the California Department of Forestry and Fire Protection regarding the state's inventory of forest land, including the Forest and Range Assessment Project and the Forest Legacy Assessment project; and forest carbon measurement methodology provided in Forest protocols adopted by the California Air Resources Board. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?	☐	☐	☐	☒
d) Result in the loss of forest land or conversion of forest land to non-forest use?	☐	☐	☐	☒
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland, to non-agricultural use or conversion of forest land to non-forest use?	☐	☐	☐	☒

Environmental Setting

The project site is the Las Positas College campus. The campus is surrounded by residential and commercial development to the west and south and agricultural lands to the north and east. The campus includes a small vineyard which is part of the College's viticulture program. The Las Positas College campus does contain any forest land.

Impact Discussion

There would be no impacts to agricultural and forestry resources due to the proposed Project. A discussion of each environmental issue included under Section 2 is presented below.

a) Would the project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps and prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

The Project site is developed with the Las Positas College campus. Buildout of the 2012 FMP would not affect any agricultural land. The existing vineyard on the campus would not be affected. It is noted the vineyard is not identified as prime farmland or farmland of statewide importance nor is surrounding agricultural land (Association of Bay Area Governments).

b) Would the project conflict with existing zoning for agricultural use, or a Williamson Act contract?

The Las Positas College campus is zoned Education and Institution (City of Livermore). The campus is not under a Williamson Act contract.

c) Would the project conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?

The site is zoned Education and Institution. Lands surrounding the Las Positas College campus are zoned Planned Development Industrial (PDI) and Planned Development Residential (PDR) to the west and south of the campus within the City of Livermore (City of Livermore) and Agriculture (A) to the north and east within the unincorporated lands of Alameda County. The proposed Project would not adversely affect any lands zoned forest land or timberland.

d) Would the project result in the loss of forest land or conversion of forest land to non-forest use?

The Project contains no forest land.

e) Would the project involve other changes in the existing environment which, due to their location or nature, could result in conversion of farmland, to non-agricultural use or conversion of forest land to non-forest use?

The Project would not result in the conversion of any farmland or forest land for other uses. See **Subsections 2a** - **2d** above.

Mitigation Measures

None required.

Reference

Association of Bay Area Governments. www.abag.ca.gov/planning/smartgrowth/Publications/Final%20Report/Final%20Comparison%20map.pdf.

City of Livermore. Zoning Map. Available on the City of Livermore website at: www.ci.livermore.ca.us/civicax/filebank/documents/13792.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
3. AIR QUALITY. Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☒	☐	☐
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?	☐	☐	☒	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☒	☐

Environmental Setting

According to the Bay Area Air Quality Management District (BAAQMD), the City of Livermore and its environs are in the Livermore Valley (Valley) climatological sub-region of the Bay Area (BAAQMD, 2010a). Air pollution potential is high in the Valley, especially in the summer and fall when high temperatures increase the potential for ozone build up. The Valley not only traps locally generated pollutants, but can receive ozone and ozone precursor intrusions from San Francisco, Alameda, Contra Costa and Santa Clara counties. During the winter, strong surface-based temperature inversions often occur. Then, pollutants such as carbon monoxide and particulate matter, generated by motor vehicles, fireplaces/woodstoves and agricultural burning, can become concentrated. Two types of particulate matter are of particular concern as air pollutants: particulate matter less than ten microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).

The Bay Area is currently designated “nonattainment” for state and national (1-hour and 8-hour) ozone standards, for the state PM_{10} standards, for state and national (annual average and 24-hour) $PM_{2.5}$ standards, and “attainment” or “unclassifiable” with respect to ambient air quality standards for other pollutants. The BAAQMD maintains a number of air quality monitoring stations, which continually measure the ambient concentrations of major air pollutants throughout the Bay Area. The closest such monitoring station to the Project site is at 793 Rincon Avenue in Livermore, about two miles to the southeast. Violations of both the ozone and particulate standards have been recorded at the Livermore monitoring station on a few days in each year over the last three years, as shown in **Table 3**.

TABLE 3: LIVERMORE – RINCON AVENUE STATION AMBIENT AIR QUALITY MONITORING SUMMARY

Pollutant	Air Quality Standard	Maximum Concentrations and Number of Days Standards Exceeded		
		2013	2014	2015
Ozone				
Maximum 8-hour concentration (ppm)		77	80	81
# Days 8-hour California standard exceeded	70 ppb	2	7	7
Nitrogen Dioxide				
Maximum 1-hour concentration (ppb)		51	49	50
# Days 1-hour California standard exceeded	180 ppb	0	0	0
# Days 8-hour national standard exceeded	100 ppb	0	0	0
Suspended Fine Particulates ($PM_{2.5}$)				
Maximum 24-hour concentration ($\mu g/m^3$)		40.1	42.9	31.1
# Days national 24-hour standard exceeded	35 $\mu g/m^3$	4	1	0

Notes: $\mu g/m^3$ = micrograms per cubic meter
ppb = parts per billion.

Source: BAAQMD Annual Bay Area Air Quality Summaries http://www.baaqmd.gov/about-air-quality/air-quality-summaries

The City of Livermore contains a considerable number of stationary industrial/commercial air pollution sources (most clustered along the I-580 freeway corridor) that have air pollutant emissions substantial enough to require that they operate under BAAQMD air permits, but none of these are located closer than 1,000 feet from the Las Positas College campus. I-580, a major source of air pollutants, is located about 0.55 mile south of the campus at its closest approach. (BAAQMD Stationary Source Screening Analysis Tool)

Many other chemical compounds, generally termed toxic air contaminants (TACs), pose a present or potential hazard to human health through airborne exposure. A wide variety of sources, both stationary (e.g., dry cleaning facilities, gasoline stations, and emergency diesel-powered generators) and mobile (e.g., motor vehicles, construction equipment), emit TACs. The health effects associated with TACs are quite diverse. TACs can cause long-term health effects (e.g., cancer, birth defects, neurological damage, asthma, bronchitis, or genetic damage) and/or short-term acute effects (e.g., eye watering, respiratory irritation, running nose, throat pain, and headaches). In the Bay Area, the majority of the estimated carcinogenic/chronic health risk can be attributed to relatively few airborne compounds, the most important being particulate matter from diesel-fueled engines (DPM). The California Air Resources Board (CARB) has identified DPM as being responsible for about 80 percent of the cumulative cancer risk from all airborne TAC exposures in California. (California Air Resources Board, 1998)

Regulatory Setting

This air quality analysis addressing the Initial Study air quality checklist items above was performed using the methodologies recommended in *CEQA Air Quality Guidelines*.[2] (BAAQMD, 2012a). The criteria air pollutants evaluated in this Initial Study are: carbon monoxide (CO), reactive organic compounds (ROG) and nitrogen dioxide (NO_2) (both being precursors to ozone formation), inhalable particulates (PM_{10}), and fine particulates ($PM_{2.5}$). Health risks associated with Project-specific and cumulative exposures to DPM are also evaluated.

According to the *CEQA Air Quality Guidelines*, any project would have a significant potential for causing/contributing to a local air quality standard violation or making a cumulatively considerable contribution to a regional air quality problem if its criteria pollutant emissions would exceed any of the following thresholds during construction or operation as presented in **Table 4**.

TABLE 4: CEQA AIR QUALITY SIGNIFICANCE THRESHOLDS FOR CRITERIA AIR POLLUTANT EMISSIONS

Pollutant	Construction Average Daily (lbs./day)	Operational	
		Average Daily (lbs./day)	Maximum Annual (tons/year)
Reactive Organic Gases (ROG)	54	54	10
Oxides of Nitrogen (NO_x)	54	54	10
Inhalable Particulate Matter (PM_{10})	82 (exhaust)	82	15
Fine Inhalable Particulate Matter ($PM_{2.5}$)	54 (exhaust)	54	10
PM_{10}/$PM_{2.5}$ (Fugitive Dust)	BMPs[a]	N/A	N/A

Notes: BMPs = Best Management Practices
N/A = Not Applicable

[a] If BAAQMD Best Management Practices (BMPs) for fugitive dust control are implemented during construction, the impacts of such residual emissions are considered to be less than significant.

Source: Bay Area Air Quality Management District, *2011 May (Revised), California Environmental Quality Act Air Quality Guidelines*.

Additionally, there would be significant operational CO impacts if CO emissions from Project motor vehicle traffic or from cumulative traffic congestion would exceed the ambient air quality standards of 9.0 ppm (8-hour average) or 20.0 ppm (1-hour average).

Finally, the *CEQA Air Quality Guidelines* establish a relevant zone of influence for an assessment of project-level and cumulative health risk from TAC exposure to an area within 1,000 feet of a project site. Project construction-related or project operational TAC impacts to sensitive receptors within the zone that exceed any of the following thresholds are considered significant:

[2] The Air District's June 2010 adopted thresholds of significance were challenged in a lawsuit. Although the BAAQMD's adoption of significance thresholds for air quality analysis has been subject to judicial actions, the County of Alameda has determined that BAAQMD's *Proposed Thresholds of Significance* (May 2010) provide substantial evidence to support the BAAQMD recommended thresholds. Therefore, the County of Alameda has determined the BAAQMD 2010 thresholds are appropriate for use in this analysis.

- An excess cancer risk level of more than 10 in one million, or a non-cancer hazard index greater than 1.0.
- An incremental increase of greater than 0.3 micrograms per cubic meter (µg/m3) for annual average $PM_{2.5}$ concentrations.

Cumulative impacts from TACs emitted from freeways, state highways or high volume roadways (i.e., the latter defined as having traffic volumes of 10,000 vehicles or more per day or 1,000 trucks per day), and from all BAAQMD-permitted stationary sources sources within the zone to sensitive receptors within the zone that exceed any of the following thresholds are considered cumulatively significant:

- A combined excess cancer risk levels of more than 100 in one million.
- A combined non-cancer hazard index greater than 10.0.
- A combined incremental increase in annual average $PM_{2.5}$ concentrations greater than 0.8 $\mu g/m^3$.

Impact Discussion

During construction activities for each development phase, there could be significant air quality impacts, but with implementation of **Mitigation Measure AIR-1** potential air quality impacts would be less than significant. No significant operational or cumulative air quality impacts are expected during or after FMP implementation. A discussion of each environmental issue included under Section 3 is presented below.

a) Would the project conflict with or obstruct implementation of the applicable air quality plan?

The Bay Area Air Quality Management District (BAAQMD) adopted its 2010 *Bay Area Clean Air Plan* (CAP) in accordance with the requirements of the California Clean Air Act (CCAA) to implement all feasible measures to reduce ozone; provide a control strategy to reduce ozone, particulate matter and air toxics (TACs) in a single, integrated plan; and establish emission control measures to be adopted or implemented. The primary goals of the 2010 Bay Area CAP are to:

- Attain/maintain air quality standards;
- Reduce population exposure to air pollutants and protect public health in the Bay Area.

Compliance with BAAQMD-approved CEQA thresholds of significance are necessary conditions for determining that a project would be consistent with all adopted control measures and would not interfere with the attainment of CAP goals. Also, as a community college, the Project does not have the potential to substantially affect housing, employment, transportation and/or population projections within the Bay Area Air Basin. Rather, implementation of the 2012 FMP would better serve the future Bay Area population anticipated in regional development, transportation and air quality improvement plans. As the analysis below demonstrates, the Project would not have significant and unavoidable air quality impacts because it meets all BAAQMD CEQA thresholds with implementation of **Mitigation Measure AIR-1**.

b) Would the project violate any air quality standard or contribute substantially to an existing or projected air quality violation?

Project Construction-Related Impacts

Construction of new facilities and improvements as outlined in the 2012 FMP is planned to take place over the next ten years. Each such facility would generate temporary emissions of criteria pollutants in construction equipment exhaust and fugitive dust from equipment and material movement. The *CEQA Air Quality Guidelines* recommend quantification of construction-related exhaust emissions and comparison of those emissions to the CEQA significance thresholds. Thus, the CalEEMod (California Emissions Estimator Model, Version 2016.3.1) was used to quantify construction-related emissions of criteria pollutants.

Table 5 provides the estimated pollutant emissions from construction equipment, material delivery trucks and worker commute vehicles associated with each facility proposed under the FMP. The maximum daily construction period emissions were compared to the CEQA significance thresholds, as shown. With the exception of ROG emissions associated with application of architectural coating during the final stages of each facility's construction, daily emissions of criteria air pollutants from construction activities would be below the CEQA significance thresholds.

TABLE 5: PROJECT CONSTRUCTION CRITERIA POLLUTANT EMISSIONS (maximum pounds per day)

Master Plan Development Phase/ New Campus Land Use	ROG	NOx	PM_{10} (Exhaust)	$PM_{2.5}$ (Exhaust)
Phase 1 (2017-2021)/ Library and Learning Center (B2100)	**60.2**	26.8	6.9	3.9
Phase 1 (2017-2021)/ Horticulture/Viticulture (B3400)	18.2	10.0	1.4	0.9
Phase 2 (2020-2024)/ Academic Building (B800)	**66.3**	8.6	1.2	0.8
Phase 3 (2023-2027)/ Academic Building (B600)	**68.2**	6.8	1.1	0.7
Phase 3 (2023-2027)/ Academic Building (B300)	46.1	5.8	1.0	0.6
Phase 3 (2023-2027)/ Academic Building (B100)	48.2	12.9	6.3	3.4
Significance Thresholds	**54**	**54**	**82**	**54**
Significant Impact?	**Yes**	**No**	**No**	**No**

The CalEEMod model default settings specify that all architectural coatings would be applied during a short period in the final stages of construction; in this case, for buildings of the size and type proposed for construction under the FMP, the model specifies that coatings for each of the buildings would be applied in the last 1-2 work weeks (i.e., over 5-10 work days) of construction. **Table 5** presents the Project's construction criteria pollutant emissions by each development phase. As shown in **Table 5**, the maximum daily ROG emissions from the Library and Learning Center, Academic Building B800 and Academic Building B600 would each exceed the 54 lbs. /day BAAQMD threshold. These potentially significant impacts would be reduced to less-than-significant levels by implementation of **Mitigation Measure AIR-1**.

The *CEQA Air Quality Guidelines* require a number of construction Best Management Practices (BMPs) to control fugitive dust, and the use of paints and coatings compliant with BAAQMD volatile organic compounds (VOC) control regulations. Thus, the following measures must be implemented by the Project construction contractor:

***BAAQMD Required Dust Control Measures*:** The construction contractor shall reduce construction-related air pollutant emissions by implementing BAAQMD's basic fugitive dust control measures, including:

- 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 surfaces 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 publically visible sign shall be posted with the telephone number and person to contact at the CLPCCD regarding dust complaints. This person shall respond and take corrective action with 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.

BAAQMD Regulation 8, Rule 3 for Architectural Coatings: Emissions of volatile organic compounds (VOC) due to the use of architectural coatings are regulated by the limits contained in Regulation 8: Organic Compounds, Rule 3: Architectural Coatings (Rule 8-3). Rule 8-3 was revised to include more stringent VOC limit requirements. The revised VOC architectural coating limits, which went into effect on November 21, 2001.

- The construction contractor shall use paints and solvents with a VOC content of 100 grams per liter or less for interior and 150 grams per liter or less for exterior surfaces.

Project Operational Impacts

Air Pollutant Emissions. CalEEMod was also used to estimate the on-going operational emissions that would be associated with each facility proposed under the 2012 FMP after its construction is complete and the cumulative operational emissions of all completed facilities in each year during buildout of the 2012 FMP.

The estimated net new operational daily and annual emissions from campus sources of each pollutant regulated under CEQA with buildout of the 2012 FMP are presented in **Tables 6** and **7** respectively, and compared to the CEQA thresholds of significance. As indicated, the estimated daily and annual operational emissions associated with net new campus emissions in the year 2030 after completion of all demolition and new construction proposed would be below all thresholds and less than significant.

TABLE 6: PROJECT DAILY OPERATIONAL CRITERIA POLLUTANT EMISSIONS (pounds per day)

Operational Source of Criteria Air Pollutants	Las Positas College Baseline 2020 Emissions (lbs/day)			
	ROG	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Area	11.71	0.00	0.00	0.00
Energy Use	0.35	3.14	0.24	0.24
Motor Vehicles	29.63	169.17	73.23	20.53
Peak Daily Total	41.69	172.31	73.47	20.77
	Las Positas College Buildout Emissions under FMP 2030 (lbs/day)			
	ROG	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Area	14.00	0.00	0.00	0.00
Energy Use	0.59	5.33	0.40	0.40
Motor Vehicles	17.70	118.36	86.41	23.50
Peak Daily Total	32.29	123.69	86.81	23.91
	Las Positas College Net New Emissions with FMP 2030 (lbs/day)			
	ROG	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Area	2.29	0.00	0.00	0.00
Energy Use	0.24	2.18	0.17	0.17
Motor Vehicles	**-11.93**	**-50.81**	13.18	2.97
Peak Daily Total	**-9.40**	**-48.63**	**13.35**	**3.13**
Significance Threshold	**54**	**54**	**82**	**54**
Significant Impact?	**No**	**No**	**No**	**No**

TABLE 7: PROJECT DAILY OPERATIONAL CRITERIA POLLUTANT EMISSIONS (tons/year)

Operational Source of Criteria Air Pollutants	Las Positas College Baseline Emissions 2020 (tons/year)			
	ROG	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Area	2.14	0.00	0.00	0.00
Energy Use	0.06	0.57	0.04	0.04
Motor Vehicles	3.70	23.62	10.01	2.82
Peak Daily Total	5.90	24.19	10.05	2.86
	Las Positas College Buildout Emissions under FMP 2030 (tons/year)			
	ROG	**NO_X**	**PM_{10}**	**$PM_{2.5}$**
Area	2.55	0.00	0.00	0.00
Energy Use	0.11	0.97	0.07	0.07
Motor Vehicles	2.18	16.67	11.80	3.22
Peak Daily Total	4.84	17.64	11.88	3.30

TABLE 7: PROJECT DAILY OPERATIONAL CRITERIA POLLUTANT EMISSIONS (tons/year)

	Las Positas College Net New Emissions with FMP 2030 (tons/year)			
	ROG	**NOX**	**PM10**	**PM2.5**
Area	0.42	0.00	0.00	0.00
Energy Use	0.04	0.40	0.03	0.03
Motor Vehicles	-1.53	-6.95	1.80	0.40
Annual Total	**-1.07**	**-6.55**	**1.83**	**0.43**
Significance Threshold	**10**	**10**	**15**	**10**
Significant Impact?	**No**	**No**	**No**	**No**

Carbon Monoxide Impacts. The BAAQMD has identified the following screening criteria for determining whether a project's motor vehicle CO emissions would likely cause ambient air quality standards to be exceeded:

- The Project is consistent with an applicable congestion management program established by the county congestion management agency for designated roads or highways, the regional transportation plan, and local congestion management agency plans.
- The Project traffic would increase traffic volumes at affected intersections to more than 44,000 vehicles per day.
- The Project traffic would increase traffic volumes at affected intersections to more than 24,000 vehicles per day where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, below-grade roadway).

Since traffic added to local streets with buildout of the 2012 FMP would fall far short of these thresholds, it would have a less-than-significant effect on traffic flow locally and regionally. Thus, the operational ambient CO impacts would be less than significant.

c) Would the project result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?

As discussed in **Subsection 3b** above, Project-related criteria pollutant emissions would be below the BAAQMD significance thresholds. And as discussed below in **Subsection 3d**, Project-related and cumulative TAC impacts would also be below BAAQMD health risk significance thresholds Therefore, the Project would not make cumulatively considerable contributions to the Bay Area's regional problems with ozone, particulate matter or TACs. Thus, cumulative emission impacts would be less than significant.

d) Would the project expose sensitive receptors to substantial pollutant concentrations?

Ambient TAC concentrations produced by project and other significant local TAC sources within 1,000 feet of a project site are considered "substantial" if they exceed the project-level and cumulative CEQA health risk thresholds at senstive receptors within this zone. Nearby land uses include agriculture to the north and east, and residential to the south and west. The nearest existing residential land uses are just south of Campus Loop and just west of Collier Canyon Road.

Following health risk assessment (HRA) guidelines in *Recommended Methods for Screening and Modeling Local Risks and Hazards* (BAAQMD, 2012b), incremental cancer and other health risks were estimated by modeling concentrations of TACs emitted from local sources using the SCREEN3 dispersion model and then applying established toxicity factors for the TACs of concern to those concentrations.

Project Construction-Related TAC Impacts

Six building are proposed for construction on the Las Positas College campus under the 2012 FMP. Using the building type and total floor area specifications contained in the FMP, the total DPM emitted by the equipment used for their construction was estimated by using CalEEMod. The emissions for each building were then assigned to its on-campus construction site of known building footprint area. The SCREEN3 model was used to estimate the resultant DPM concentrations at the closest residential receptors just south of Campus Loop. Their individual health risk impacts are shown in **Table 8**.

TABLE 8: PROJECT DAILY OPERATIONAL CRITERIA POLLUTANT EMISSIONS (pounds per day)

Master Plan Construction Emission Source/ Year of Maximum Construction Activity	Cancer Risk	Hazard Index	Annual $PM_{2.5}$ Concentration
Library and Learning Center (B2100)/2017	1.5	0.04	0.19
Horticulture/Viniculture (B3400)/2019	0*	0*	0*
Academic (B800)/2021	0.4	0.01	0.05
Academic (B600)/2023	0.4	0.01	0.05
Academic (B300)/2025	0.5	0.01	0.06
Academic (B100)/2027	2.1	0.05	0.26
Significance Thresholds	**10**	**1**	**0.3**
Significant Impact?	**No**	**No**	**No**

* The Horticulture/Viticulture building would be located in the extreme northeast corner of the campus, more than 1,000 feet from the residential areas south of Campus Loop Road. Under these condition its health risk to these receptors would be negligible.

Cancer risk is the lifetime probability of developing cancer from exposure to carcinogenic substances. Incremental cancer risks from the construction of each FMP building were estimated by applying established DPM toxicity factors to modeled TAC concentrations associated with that building. The maximum cancer risk from Project construction, 2.1 per million, would result from DPM emitted during the construction of Academic Building 100 because of its large size (46,000 square feet) and proximity (400-500 feet) to the closest residential receptors south of the campus. But its cancer risk and that of all other project buildings' construction would fall short of the BAAQMD project-level threshold of ten per million.

Adverse health impacts unrelated to cancer are measured using a hazard index (HI), which is defined as the ratio of the Project's incremental TAC exposure concentration to an accepted reference exposure level (REL). If the HI is greater than 1.0, then the impact is considered to be significant. The HIs at the residential receptors from all buildings' construction DPM would fall far short of the BAAQMD project-level threshold of 1.0. Similarly, the resultant maximum annual $PM_{2.5}$ (almost all DPM) concentration increments would fall short of the BAAQMD threshold of 0.3 $\mu g/m^3$. Thus, all Project construction-related TAC impacts are less than significant.

Cumulative TAC Impacts

The *CEQA Air Quality Guidelines* method for determining cumulative TAC health risk requires the tallying of risk from project sources and all permitted stationary sources and major roadways within 1,000 feet of a project site and adding them for comparison with the cumulative health risk thresholds.

A database of permitted stationary emissions sources, major roadways and their associated health risks is available online from the BAAQMD through the Stationary Source Screening Analysis Tool and the Highway Screening Analysis Tool. There are no listed stationary TAC source located within 1,000 feet of the Las Positas College campus. I-580, the strongest local mobile source of TACs, is more than half a mile south of campus. Portola Avenue and the portion of Isabel Avenue closest to I-580 currently have ADT greater than 10,000 vehicles per day, but they are outside the 1,000-foot zone of influence for cumulative TAC evaluation. Thus, cumulative TAC impacts would be less than significant.

e) Would the project create objectionable odors affecting a substantial number of people?

The BAAQMD's significance criteria for odors are subjective and are based on the number of odor complaints generated by a project. Generally, the BAAQMD considers any project with the potential to frequently expose members of the public to objectionable odors to cause a significant impact. With respect to the proposed Project, diesel-fueled construction equipment exhaust would be odorous close by. However, these emissions typically dissipate quickly. With at least 400-500 feet separating the Project construction areas from the closest residences, substantial odor impacts would be unlikely. Therefore, odor impacts associated with the Project would be less than significant.

Mitigation Measures

AIR-1 Project reactive organic gases (ROG) emissions from architectural coating application shall be reduced to 54 lbs/day or less through the implementation of any of the following measures or some combination thereof as required:

- Stretch out the architectural coating applications phases for any building constructed under the FMP to 3 weeks or more, and assure that the finishing phases of any two concurrently constructed buildings do not overlap;
- Use architectural coatings with a lower ROG content than BAAQMD regulations require; and/or
- Use building components that have had their surfaces factory-finished and so reduce the need for on-site painting or finishing with ROG-containing paints.

Prior to the beginning of any construction, final plans shall be submitted for CLPCCD approvals that demonstrate attainment of the BAAQMD 54 lbs. /day limit on ROG emissions during construction.

References

BAAQMD (Bay Area Air Quality Management District). 2010a *California Environmental Quality Act Guidelines Update, Proposed Thresholds of Significance*. http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/proposed_thresholds_report_-may_3_2010_final.pdf?la=en

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BAAQMD. *Highway Screening Analysis Tool*. http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/updated-ceqa-guidelines

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BAAQMD. *Current Rules*. http://www.baaqmd.gov/rules-and-compliance/current-rules

CAPCOA (California Air Pollution Control Officers Association). 2016. California Emissions Estimator Model [CalEEMod], Version 2016.3.1. *User's Guide* and *Appendix D - Default Data Tables*. http://www.caleemod.com/

CARB (California Air Resources Board). 1998. *Fact Sheet - The Toxic Air Contaminant Identification Process: Toxic Air Contaminant Emissions from Diesel-fueled Engines*. http://www.arb.ca.gov/toxics/dieseltac/factsht1.pdf

4. BIOLOGICAL RESOURCES. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☒	☐	☐
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 California Department of Fish and Game or US Fish and Wildlife Service?	☐	☐	☒	☐
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☒	☐

4. BIOLOGICAL RESOURCES (cont.)	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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?	☐	☐	☒	☐
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?	☐	☐	☒	☐

Environmental Setting

Las Positas College is located in the Livermore Valley, within the foothills of the Diablo Range. According to habitat mapping included in the Chabot-Las Positas Community College District's Draft Environmental Impact Report (DEIR) (PLACEMAKERS 2006) for the Facilities Master Plan, updated through habitat mapping for the current 2012 FMP evaluation, the following vegetation communities occur on and adjacent to the Las Positas College Campus: non-native annual grassland, seasonal wetland, seasonal drainage, and disturbed/developed areas (see **Figure 4**). Collier Creek, a seasonal drainage that conveys water during the rainy season, is located immediately adjacent to the southwestern property boundary, and unnamed seasonal drainages are located along the western/northwestern and eastern property boundaries. Surrounding uses of the site include suburban residential development to the south and southwest, and agricultural lands to the east, west, and north.

During preparation of the 2006 DEIR, H. T. Harvey & Associates biologists characterized the existing biological conditions on the Las Positas College campus, including the presence and distribution of biotic habitats, potentially regulated habitats, and special-status species. That assessment involved a review of relevant background information combined with reconnaissance-level surveys conducted in April, May, and July 2005. Surveys were conducted to: 1) describe existing biotic habitats; 2) assess the site for its potential to support special-status species and their habitats; and 3) identify potentially jurisdictional habitats, including Waters of the U.S., and riparian habitat. In addition, focused surveys for special-status plants were conducted.

Due to the time that has elapsed since the surveys were performed for the 2006 DEIR, H. T. Harvey & Associates botanist Greg Sproull, M.S., and ecologist Bridget Sousa, Ph.D., conducted reconnaissance-level surveys of the 2012 FMP development areas on November 10, 2016 to identify existing biological conditions. The purpose of these surveys was to document any changes in the biotic resources or habitats associated with the campus since completion of the 2006 DEIR. In addition, a review of the relevant background information was conducted to identify any changes in the regulatory status or occurrence of special-status species that could occur in the project region. Construction to implement the 2006 FMP

Source: H.T. Harvey & Associates

Figure 4
Biotic Habitats/Impacts Map

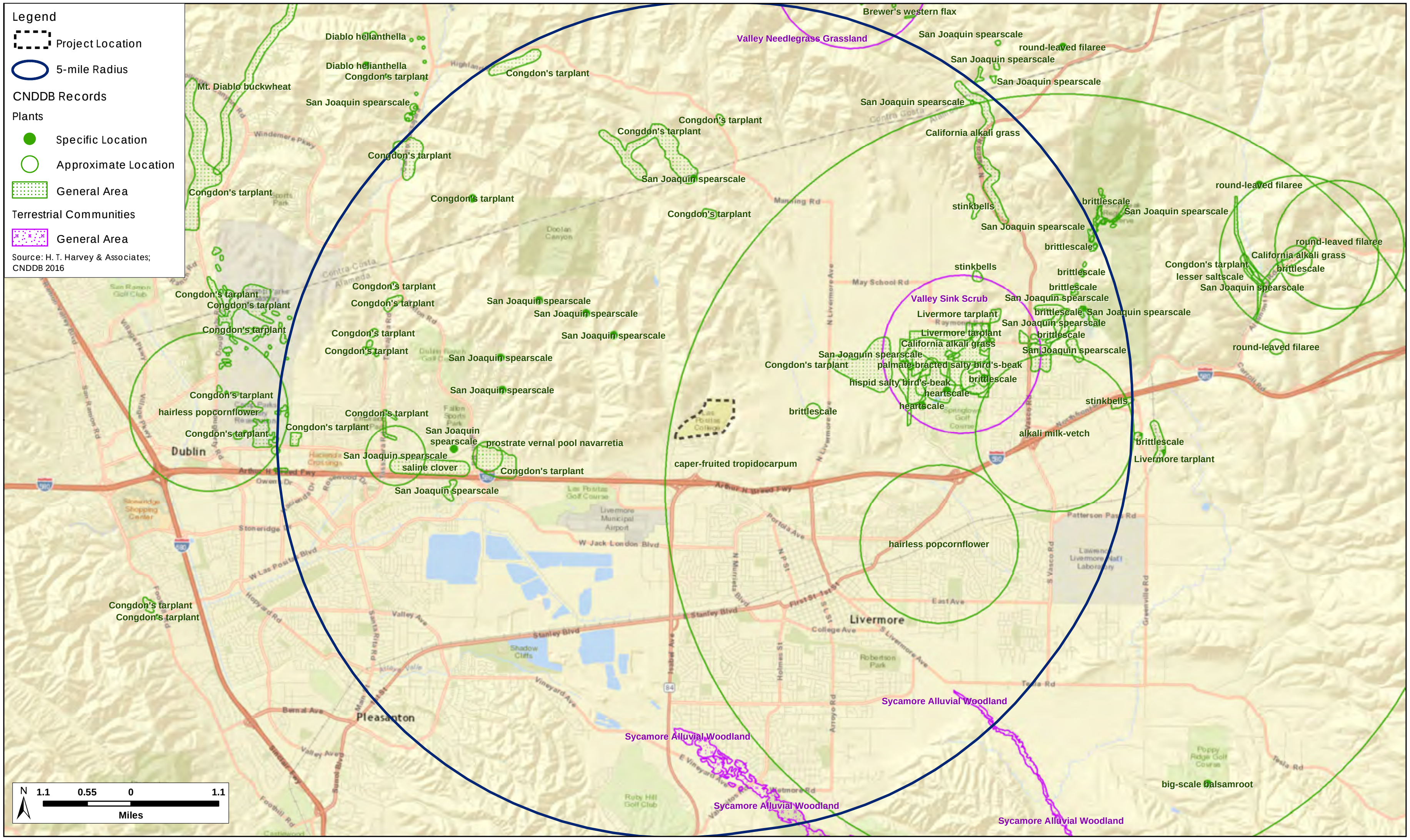
described in the 2006 DEIR has resulted in replacement of previously natural or ruderal habitat with constructed or landscaped features in some areas, whereas in other areas, natural habitat is still present. **Figure 4**, **Biotic Habitats/Impacts Map**, describes the currently existing habitat conditions on the campus.

Special-Status Plant Species

Figure 5, **CNDDB Plant Records**, depicts the locations of special-status plants mapped by the California Natural Diversity Database (CNDDB) (California Department of Fish and Wildlife [CDFW] 2016) in the vicinity of the 2012 FMP site. Based on analysis in the 2006 DEIR and a review of more current information on potential for occurrence of special-status plants, H. T. Harvey & Associates identified 39 special-status plant species as occurring locally in habitats similar to those located on the campus. Thirty-eight of these species were removed from consideration due to absence of suitable microhabitats (e.g. vernal pools, serpentine substrates). Only one species, Congdon's tarplant (*Centromadia parryi congdonii*), with a California Rare Plant Rank (CRPR) of 1B.1, was considered to have some potential to occur on the campus, specifically in undeveloped areas dominated by non-native annual grassland outside the campus loop road. However, the project site lacks high-quality substrates (i.e., alkaline clay soils) needed to support Congdon's tarplant (H. T. Harvey & Associates 2005), and Congdon's tarplant was not recorded during focused floristic surveys conducted within the Congdon's tarplant blooming period of May through October and in accordance with CNPS Botanical Survey Guidelines in 2005 (CNPS 2001, PLACEMAKERS 2006). Furthermore, no evidence of the presence of Congdon's tarplant or any other special-status plant was observed on the campus during November 2016 surveys. Special-status plants are therefore determined to be absent from the Las Positas College campus.

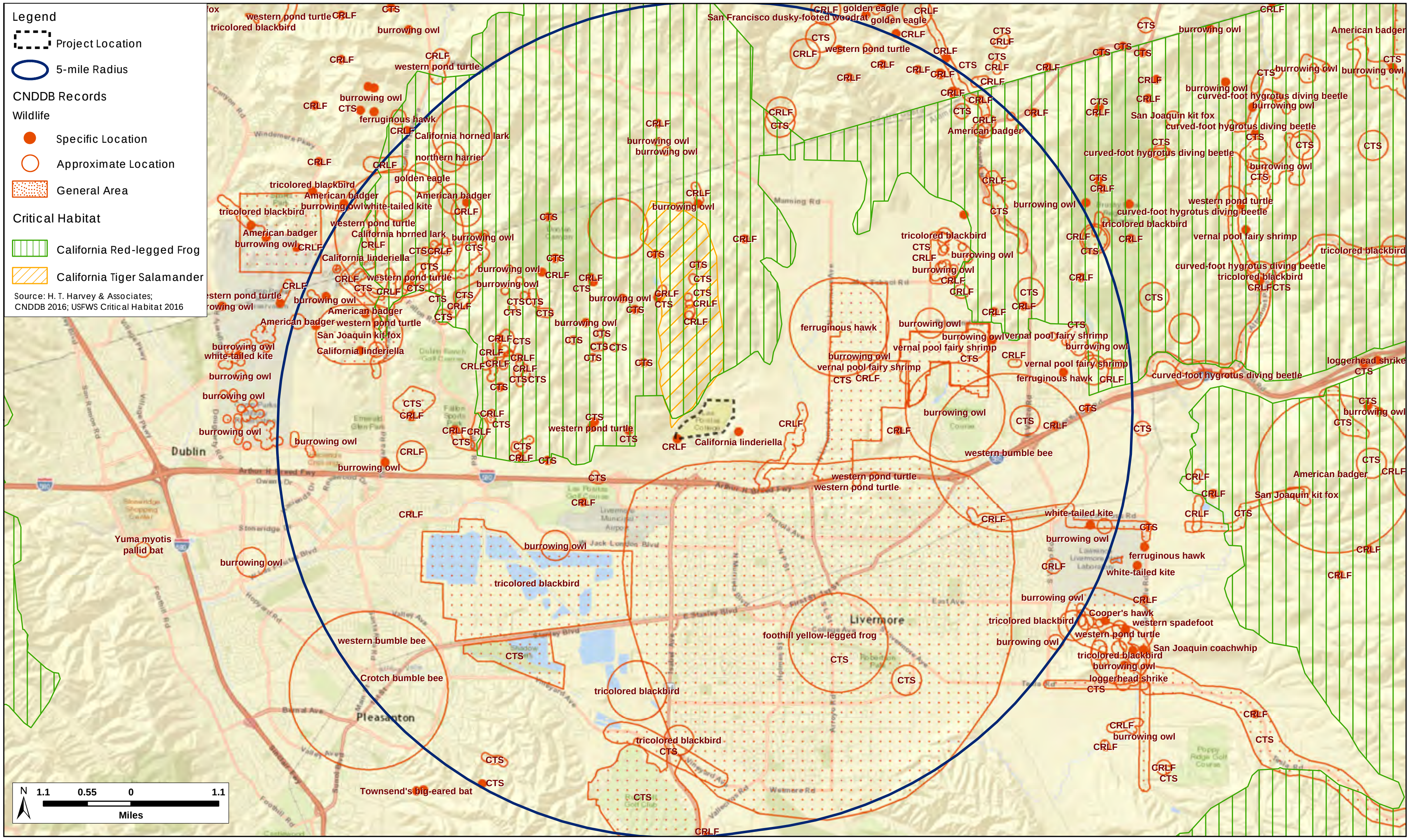
Special-Status Animal Species

Figure 6, **CNDDB Animal Records**, depicts the locations of special-status animals mapped by the CNDDB (CDFW 2016) in the vicinity of Las Positas College campus. Based on analysis in the 2006 DEIR and a review of more current information on potential for occurrence of special-status animals, H. T. Harvey & Associates determined that five special-status wildlife species have the potential to breed on, or directly adjacent to, the campus: the California tiger salamander (*Ambystoma californiense*), California red-legged frog (*Rana aurora draytonii*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), and American badger (*Taxidea taxus*). H. T. Harvey & Associates determined that the San Joaquin kit fox (*Vulpes macrotis mutica*) was absent from the campus, based on a review of the scientific literature and numerous surveys for the species in the Livermore area. However, the U. S. Fish and Wildlife Service (USFWS) determined in its 2007 Biological Opinion covering 2006 FMP activities (including future build-out of the areas that will be impacted by the 2012 FMP) that the campus was within the range of the San Joaquin kit fox and considered the species as potentially occurring at Las Positas College. Two fully protected species, the white-tailed kite (*Elanus leucurus*) and the golden eagle (*Aquila chrysaetos*), may occasionally forage on the campus, but are not expected to nest there. No other special-status animal species were identified as potentially occurring as a resident or breeder on or immediately adjacent to the campus. Special-status species with potential to reside or breed on the project site are discussed in greater detail below.



Source: H.T. Harvey & Associates

Figure 5
CNDDB Plant Records



Source: H.T. Harvey & Associates

Figure 6
CNDDB Animal Records

California Tiger Salamander (*Ambystoma californiense*). Federal Status: Threatened; State Status: Threatened. The California tiger salamander's preferred breeding habitat is temporary ponded environments surrounded by uplands that support small mammal burrows. Tiger salamanders utilize upland grassland habitats for dispersal and use small mammal burrows, especially those of California ground squirrels (*Otospermophilus beecheyi*), as refugia within these habitats. The California tiger salamander was listed as Threatened under the Federal Endangered Species Act (FESA) by the USFWS in July 2004 (USFWS 2004), and was listed as Threatened under the California Endangered Species Act (CESA) by the CDFW in August 2010 (CDFW 2010). The USFWS designated Critical Habitat for the California tiger salamander in August 2005 (USFWS 2005). The action addressed within this report falls just outside the southern boundary of Unit 18 (Doolan Canyon Unit) of the Central Valley Region of Critical Habitat for the California tiger salamander (**Figure 6**).

Suitable upland habitat for California tiger salamanders is available in the northern and eastern portions of the campus, outside the campus loop road (**Figure 4**). All non-native grasslands located within the campus loop road in 2006 have been developed, and reconnaissance-level surveys did not detect any suitable grassland habitat or small mammal burrows within that area.

No suitable breeding habitat is available for California tiger salamanders on the campus. The seasonal wetland in the eastern portion of the campus does not pond for a sufficient duration to support California tiger salamander breeding, as it was dry in April 2005 (PLACEMAKERS 2006) and in April 2015 (Google 2016), after wet seasons that saw above-average precipitation. Similarly, the drainage ditch located along the eastern border of the photovoltaic array does not hold water for a sufficient duration to support tiger salamander breeding.

Thus, for California tiger salamanders to be present on the campus, potential breeding ponds in nearby upland areas must be close enough for individuals to disperse between these ponds and the campus. Further, there must be no barriers to dispersal between the breeding ponds and the campus. California tiger salamanders are known to be able to disperse considerable distances over land; individuals have been found up to 1.0 mi from the nearest breeding locations (Austin and Shaffer 1992) and there is evidence that some individuals may move distances up to 1.3 mi (Orloff 2007).

California tiger salamanders have been found breeding at several locations within 1.3 mi of the Las Positas College campus (CDFW 2016; **Figure 6**). The closest documented occurrence is approximately 0.25 mile to the east; tiger salamanders were documented breeding in this seasonal pond in 1998 (H. T. Harvey & Associates 1998). In addition, an off-site pond immediately adjacent to the campus (**Figure 6**) held water long enough during 2016 to provide suitable breeding habitat for California tiger salamanders. Although no tiger salamanders have been observed breeding in this pond, the species is known to breed on Murray Ranch, just north/northwest of the campus (H. T. Harvey & Associates 2012). Murray Ranch is owned by the Chabot-Las Positas Community College District and is used in part as mitigation for impacts to California tiger salamanders and California red-legged frogs from Las Positas College projects.

Due to the proximity of known and potential breeding ponds, as well as the lack of barriers to dispersal between these ponds and upland habitats on the project site, tiger salamanders could occur within the non-native grassland habitats on site as dispersants and may use ground squirrel burrows within those habitats as upland refugia.

California Red-legged Frog (*Rana aurora draytonii*). Federal Status: Threatened; State Status: Species of Special Concern. The California red-legged frog breeds in deep perennial pools and may be found near streams and ponds and in upland grassland habitat in the non-breeding season (Jennings and Hayes 1994). The USFWS listed the California red-legged frog as threatened in 1996, and Critical Habitat was designated for the California red-legged frog in 2010 (USFWS 2010a). The Las Positas College campus is located outside the southern boundary of subunit CCS-2B of the Northern California Region of Critical Habitat for the California red-legged frog (**Figure 6**).

The campus lacks suitable aquatic breeding habitat for this species; however, several records for this species exist in the immediate vicinity of the campus. The species is known to breed at Murray Ranch (H. T. Harvey & Associates 2012), and it has been recorded within Collier Creek (CDFW 2016; **Figure 6**). At Las Positas College itself, suitable breeding habitat for red-legged frogs is present only within the culvert at the campus entrance road over Collier Creek. Small numbers of tadpoles were found within this culvert during construction associated with the nearby residential development (H. T. Harvey & Associates 2000). The off-site pond adjacent to Collier Creek and west of the existing athletic fields held water into June in recent, exceptionally dry years (Google Earth 2016), and contained water during reconnaissance-level surveys conducted in November 2016. Therefore, this pond may provide suitable breeding habitat for California red-legged frogs. A small detention basin at the campus entrance and the aforementioned seasonal wetland depression in the northeastern part of the campus do not retain water for a sufficient duration to support breeding red-legged frogs.

Suitable upland dispersal habitat for California red-legged frogs is present throughout the non-native grassland habitat on campus; these locations are shown on Figure 4, and are located in currently undeveloped areas outside the loop road. Red-legged frogs can move considerable distances overland; however, dispersal distances of less than a mile are more typical for the species (USFWS 2010a). Collier Creek immediately west of the site, Murray Ranch to the north/northwest, and Cayetano Creek to the southeast all have populations of California red-legged frogs. Thus, California red-legged frogs could disperse between these creeks (albeit infrequently and in low numbers), particularly during the wet season.

San Joaquin Kit Fox (*Vulpes macrotis mutica*). Federal Status: Endangered; State Status: Threatened. The kit fox is the smallest canid species in North America. The San Joaquin kit fox typically occurs in annual grassland or mixed shrub/grassland habitats throughout low, rolling hills and in the valleys. The kit fox requires underground dens for temperature regulation, shelter, reproduction, and predator avoidance. Kit foxes commonly modify and use dens constructed by other animals as well as human-made structures (USFWS 1998). The San Joaquin kit fox was listed as endangered by the USFWS in 1967 (USFWS 1967) and by the State of California in 1971. Loss of habitat from urban, agricultural, and industrial development are the principal factors in the decline of the San Joaquin kit fox. Critical habitat has not been designated for this species.

Sproul and Flett (1993) reviewed historical records and presented survey results from northern Alameda County. They found that there were confirmed sightings of kit fox in the Altamont Hills near Altamont Pass, but there were only unconfirmed reports west of Vasco Road. Since this review, there have been additional records of kit foxes in the region, but all were located east of Vasco Road, primarily near the Altamont Pass (CDFW 2016). A more recent review (Clark et al. 2007) likewise concluded that San Joaquin kit foxes in Alameda County are restricted to the Altamont hills and the western edge of the San Joaquin Valley. They examined several surveys conducted in Alameda County in the 1990s and early 2000s, all of which failed to detect kit foxes west of Vasco Road, even in areas where they had previously been observed. The authors concluded that if kit foxes still exist in the area, they occur in very low numbers.

A number of surveys have been conducted for kit fox in the eastern Dublin area and the adjacent north Livermore Valley (H. T. Harvey & Associates 1997). None of these surveys detected kit fox, with the exception of a single kit fox detected on two separate nights during spotlight surveys in Contra Costa County on Morgan Territory Road more than five miles north of Las Positas College. Despite more intense efforts to detect kit fox in the eastern Dublin and north Livermore Valley areas since 1997, none have been detected. In the 1990s, intensive surveys were also previously conducted on the Las Positas College campus, on properties immediately to the southeast of the College, and in the north Livermore Valley (H. T. Harvey & Associates 1992, 1993, 1994, 1997). None of these surveys detected kit foxes, and all available data indicate that the current range of the San Joaquin kit fox does not extend as far south/west as the College (H. T. Harvey & Associates 1997, CDFW 2016). Furthermore, the USFWS (2010b) five-year review noted that recent surveys in the northern portion of the kit fox's range suggest that the kit fox is either absent, occurs only intermittently, or occurs at extremely low densities in the northern portion of its range.

While there is limited evidence that the San Joaquin kit fox still occurs in the campus vicinity, the USFWS (2007) determined in its Biological Opinion for the 2006 FMP that kit foxes were "reasonably certain to occur" on the campus. They based this opinion on the availability of suitable habitat on and surrounding the campus, and on observations of kit foxes in the area in the 1980s and 1990s. Nevertheless, surveys conducted in the area over the past 30 years indicate that the likelihood of a San Joaquin kit fox occurring on the Las Positas College campus or in the campus vicinity is extremely low.

Burrowing Owl (*Athene cunicularia*). Federal Status: None; State Status: Species of Special Concern. The burrowing owl is a small, terrestrial owl of open country. Burrowing owls favor annual and perennial grasslands, typically with sparse, or nonexistent, tree or shrub canopies. In California, burrowing owls are found in close association with California ground squirrels. The owls use ground squirrel burrows for shelter and nesting. Ground squirrels provide nesting and refuge burrows, and maintain areas of short vegetation height, which provide foraging habitat and allow for visual detection of avian predators by burrowing owls. In the absence of ground squirrel populations, habitats soon become unsuitable for occupancy by owls. The nesting season, as recognized by the CDFW, runs from February 1 through August 31. Burrowing owls often disperse after breeding, but they spend time in burrows year-round, and occupied burrows are protected year-round.

Burrowing owls are found in a number of areas in the Livermore Valley, and there are several records within five miles of the project site (CDFW 2016, **Figure 6**). This species has not been observed recently at Las Positas College, and there is therefore a low probability that the species is present in 2012 FMP activity areas. Ground squirrel burrows are present in the non-native annual grassland on the site of the proposed expansion, and burrowing owls could potentially nest, roost, and forage on the site. However, none were observed during our reconnaissance-level surveys, and it is likely that the number of individuals that may occur on the campus is low, if the species occurs there at all.

Loggerhead Shrike (*Lanius ludovicianus*). Federal Status: None; State Status: Species of Special Concern. This predatory songbird inhabits much of the lower 48 states; however, loggerhead shrike populations have declined significantly over the last 30 years. Loggerhead shrikes prefer open habitats interspersed with shrubs, trees, poles, fences, or other perches from which they can hunt. Nests are built in densely foliated shrubs or trees, often containing thorns, which offer protection from predators and upon which prey items are impaled. Shrikes breed between February and July, with the peak of breeding between mid March and late June. Loggerhead shrikes have nested at Las Positas College. Reconnaissance-level surveys in 2016 did not detect any loggerhead shrikes; however, these surveys were conducted outside of the nesting season. A small number of loggerhead shrikes may nest in trees and shrubs on the property, and forage in the nonnative grassland habitat on the site.

American Badger (*Taxidea taxus*). Federal Status: None; State Status: Species of Special Concern. American badgers are stocky, burrowing mammals that occur in grassland habitats throughout the western United States. They are strong diggers, and feed primarily on other burrowing mammals, such as ground squirrels. Badgers are primarily nocturnal. They breed during late summer, and females give birth to a litter of young the following spring. American badgers have been found in grasslands within five miles of the project site (CDFW 2016), and could potentially occur on-site. However, no potential badger burrows were found on the site during kit fox surveys conducted in 1994 (H. T. Harvey & Associates 1994) or during reconnaissance-level surveys conducted in 2016. Nevertheless, there is a moderate potential for American badgers to occur on the campus, at least as occasional dispersants.

White-tailed Kite (*Elanus leucurus*) and Golden Eagle (*Aquila chrysaetos*). Federal Status: None; State Status: Fully Protected. In California, white-tailed kites can be found in the Central Valley and along the coast, in grasslands, agricultural fields, cismontane woodlands, and other open habitats (Polite et al. 1990). White-tailed kites are year-round residents of the state, establishing breeding territories that encompass open areas with healthy prey populations, as well as snags, shrubs, trees, or other nesting substrates (Dunk 1995). Non-breeding birds typically remain in the same area over the winter, although some movements do occur (Polite et al. 1990). The presence of white-tailed kites is closely tied to the presence of prey species, particularly voles, and prey base may be the most important factor in determining habitat quality for white-tailed kites (Dunk and Cooper 1994, Skonieczny and Dunk 1997).

In California, the golden eagle is an uncommon permanent resident and migrant throughout the state. The species' breeding range in California excludes only the Central Valley, the immediate coast in the far north, and the southeastern corner of the state (Zeiner et al. 1990). Nesting habitat is characterized by large, remote patches of grassland or open woodland; a hilly topography that generates lift; an abundance of small mammal prey; and tall structures that serve as nest platforms and hunting perches. Golden eagles typically nest in tall trees or snags, cliffs, or utility towers (Zeiner et al. 1990, Kochert et al. 2002). The nesting season begins in late January and continues through August. Following nesting, adult eagles usually remain in or near their breeding territory (Zeiner et al. 1990). Young birds in California tend to be sedentary, remaining in or near their parental home ranges (Kochert et al. 2002). In addition to their fully protected status, golden eagles are protected under the federal Bald and Golden Eagle Protection Act.

The non-native grasslands on the Las Positas College campus provide suitable foraging habitat for white-tailed kites and golden eagles. Individuals of both species have been recorded in the project vicinity (eBird 2016). However, the campus lacks suitable nesting substrates, such as large trees or snags. Thus, individual kites or eagles may forage on the campus and surrounding grasslands, but they are not expected to occur on site as breeders.

Habitats

Conditions on the Las Positas College campus during H. T. Harvey & Associates' November 2016 survey were similar to those described in the 2006 DEIR, though some habitat changes were evident (**Figure 4**). Changes included the conversion of non-native annual grassland/ruderal habitat to disturbed/developed habitat, modification to the seasonal wetland/creek habitat through the creation of a 0.036-acre (ac) mitigation wetland, and the construction of a small drainage ditch near a solar energy facility.

At the time of the November 2016 surveys, habitat acreages within the impact areas for the 2012 FMP activities totaled approximately 15.5 acres of non-native annual grassland/ruderal habitat and 12.5 acres of disturbed/developed habitat.

Vegetation composition in non-native annual grassland/ruderal and disturbed/developed habitats has not changed since 2006. Roadsides and other unmaintained areas in the disturbed/developed habitat were dominated by ruderal weedy species, such as milk thistle (*Silybum marianum*) and black mustard (*Brassica nigra*), whereas developed portions of the disturbed/developed habitat were managed with landscaped trees, forbs, and turf grass. The non-native annual grassland/ruderal habitat had been recently disced and mown at the time of the November 2016 survey, and was composed of non-native weedy forbs, including stinkwort (*Dittrichia graveolens*), bristly oxtongue (*Helminthotheca echioides*), black mustard, and California burclover (*Medicago polymorpha*), and non-native annual grasses, such as foxtail barley (*Hordeum murinum* ssp. *leporinum*), ripgut brome (*Bromus diandrus*), and Italian ryegrass (*Festuca perennis*). The majority of the new development proposed in the 2012 FMP would occur in the non-native annual grassland/ruderal habitat in the eastern portion of the site, where athletic facilities will be expanded, with the remainder occurring in the disturbed/developed habitat within the existing athletic facilities area outside the loop road and in the campus area within the loop road.

The seasonal wetland/creek habitat has expanded since 2006 through the creation of a 0.036-ac wetland mitigation site. This wetland mitigation was performed, as a condition of state and federal permits, to compensate for minor impacts to the intermittent drainage on the west side of the campus that occurred during construction of a stormwater retention facility associated with the 2006 FMP. The wetland mitigation area is located less than 100 feet south of the shallow seasonal wetland depression along the eastern intermittent drainage on the campus, which was previously mapped as non-native annual grassland/ruderal habitat. The wetland mitigation area was added to mitigate the temporary and permanent impacts to the wetland habitat in Collier Creek and the eastern intermittent drainage, as described in the *Las Positas College Facilities Development Plan Submittal for Section 401 Water Quality Certification* (Development Plan, H. T. Harvey & Associates 2006). In November 2016, the seasonal wetland/creek habitat, including the wetland mitigation site, was dominated by weakly hydrophytic ("water-loving") plants, including Italian ryegrass, dwarf barley (*Hordeum depressum),* Mediterranean barley (*Hordeum marinum* var. *gussoneanum*), and curly dock (*Rumex crispus*); no wetland obligate plants (i.e., plants that are typically found only in wetlands) were observed. Portions of the eastern intermittent drainage contained up to two feet of water, whereas other sections of the drainage were dry. Bare, cracked soil was evident in the wetland mitigation area. No new development is proposed in the seasonal wetland/creek habitat.

An approximately 700-foot by four-foot excavated upland drainage ditch (as measured from top of bank to top of bank) is located along the eastern border of the photovoltaic array. This area was formerly mapped as non-native annual grassland/ruderal habitat. The drainage ditch ranges from six inches to one foot deep, contains moderately steep banks, and was created to collect rainwater runoff from the photovoltaic array and the adjacent gravel dirt road (which slopes steeply downward towards the ditch). Roughly 400 feet of the drainage ditch contained up to one foot of stagnant water during the November 2016 surveys. A large drainage structure, intended to remove rainwater from the ditch, was situated in the middle of the ditch where the water level was highest. Pooled water in the drainage ditch habitat was likely facilitated by a malfunction of the drainage structure. No vegetation was present in portions of the ditch that collected water. Common, non-native herbs, such as black mustard, yellow star thistle (*Centaurea solstitialis*), and prickly lettuce (*Lactuca serriola*) grew along the upper bank edges and in the dry portions of the ditch. Stinkwort, Italian ryegrass, and small patches of curly dock lined the lower banks of the ditch, particularly near areas pooled with water. Soil in the drainage ditch habitat was dry and cracked in areas that were not saturated with water. The presence of weakly hydrophytic plants, such as Italian ryegrass and curly dock, in the drainage ditch habitat, along with the occurrence of soil cracking, suggests that water has been pooled in the ditch for a prolonged period. If left unaltered, the drainage ditch habitat would likely evolve into a wetland and may then fall under U.S. Army Corps of Engineers (USACE) jurisdiction. This habitat abuts the newly proposed construction area situated to the north, but is not directly located in an area proposed for new construction.

The horticultural/arboretum habitat, located in the southwestern portion of the project site and composed of a small section of Collier Creek and native California vegetation, was unchanged since 2006. No new construction would occur in the horticultural/arboretum habitat.

Regulatory Setting

Federal Regulations

Federal Endangered Species Act. The FESA protects listed wildlife species from harm or "take" which is broadly defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct. Take can also include habitat modification or degradation that directly results in death or injury of a listed wildlife species. An activity can be defined as "take" even if it is unintentional or accidental. Listed plant species are provided less protection than listed wildlife species. Listed plant species are legally protected from take under the FESA only if they occur on federal lands or if the project requires a federal action, such as a Clean Water Act Section 404 fill permit from the USACE. The USFWS has jurisdiction over federally listed threatened and endangered wildlife species under the FESA, while the National Marine Fisheries Service has jurisdiction over federally listed, threatened and endangered, marine species and anadromous fish.

***Project applicability*:** Species protected under FESA that may occur in the 2012 Master Plan area are the California tiger salamander and California red-legged frog; the San Joaquin kit fox, which the USFWS considers potentially present but which is likely absent, has been recorded historically in the Las Positas College vicinity.

Following certification of the 2006 DEIR, the District consulted with the USFWS (through the USACE during Clean Water Act permitting) on potential effects of the 2006 FMP on federally listed species. The USFWS determined that the consultation should include the effects of potential buildout of the entire Las Positas College property, including 2006 FMP activities as well as future development, such as that included in the 2012 FMP. On May 22, 2007, the USFWS (2007) issued a Biological Opinion (BO) to the District providing incidental take approval for those effects and describing the conditions that the District will follow for subsequent development, including projects stemming from the 2006 FMP as well as 2012 FMP activities. Such conditions include providing compensatory habitat mitigation for the California tiger salamander, California red-legged frog, and San Joaquin kit fox. As mitigation for impacts to up to 85.2 acres of habitat from buildout of the entire Las Positas College property, the District proposed (and the USFWS approved) preservation and management of 209 acres of suitable habitat at Murray Ranch. The District obtained USFWS approval of a Habitat Mitigation and Monitoring Plan (H. T. Harvey & Associates 2012) describing management of the mitigation lands and is in the process of finalizing the details of this mitigation, such as the endowment to support long-term management and monitoring and the conservation easement to protect these mitigation lands.

Waters of the United States. Areas meeting the regulatory definition of "Waters of the United States" are subject to the regulatory jurisdiction of the USACE. The USACE, under provisions of Section 404 of the Clean Water Act (1972), has jurisdiction over "Waters of the United States" (jurisdictional waters). These waters may include all waters used, or potentially used, for interstate commerce, including all waters subject to the ebb and flow of the tide, all interstate waters, all other waters (intrastate lakes, rivers, streams, mudflats, sand flats, playa lakes, natural ponds, etc.), all impoundments of waters otherwise defined as

"Waters of the U. S.," tributaries of waters otherwise defined as "Waters of the U.S.," the territorial seas, and wetlands adjacent to "Waters of the U.S." (33 CFR, Part 328, Section 328.3).

***Project applicability*:** Although areas meeting the definition of Waters of the U.S. are present on the campus in general, no jurisdictional features are present within areas of proposed construction under the 2012 FMP.

Migratory Bird Treaty Act. The federal Migratory Bird Treaty Act (MBTA; 16 U.S.C., §703, Supp. I, 1989) prohibits the killing, possessing, or trading of migratory birds except in accordance with regulations prescribed by the Secretary of the Interior. The trustee agency that addresses issues related to the MBTA is the USFWS. Migratory birds protected under this law include all native birds and certain game birds (e.g., turkeys and pheasants; USFWS 2005). This act encompasses whole birds, parts of birds, and bird nests and eggs. The MBTA protects active nests from destruction and all nests of species protected by the MBTA, whether active or not, cannot be possessed. An active nest under the MBTA, as described by the Department of the Interior in its 16 April 2003 Migratory Bird Permit Memorandum, is one having eggs or young. Nest starts, prior to egg laying, are not protected from destruction.

***Project applicability*:** All native bird species present on the campus are protected by the MBTA.

Bald and Golden Eagle Protection Act. The Bald and Golden Eagle Protection Act provides for the protection of the bald eagle (*Haliaeetus leucocephalus*) and the golden eagle as amended in 1962, by prohibiting the take; possession; sale; purchase; barter; offer to sell, purchase or barter; transport; export; or import of any bald or golden eagle, alive or dead, including any part, nest, or egg, unless allowed by permit (16U.S.C 668(a); 50 CFR 22). "Take" is broadly defined as to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb (16U.S.C. 688(c); 50 CFR 22.3). For the purposes of these guidelines, "disturb" means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, any of the following: (1) injury to an eagle; (2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior. In addition to immediate impacts, this Act also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death, or nest abandonment.

***Project applicability*:** Bald eagles do not occur on the campus. Golden eagles may occasionally forage in grasslands on the campus, but they do not nest on or close enough to the campusfor take of eagles to occur.

State Regulations

California Environmental Quality Act. The CDFW ranks certain rare or threatened plant communities, such as wetlands, meadows, and riparian forest and scrub, as 'threatened' or 'very threatened'. These communities are tracked in the CNDDB. Impacts on CDFW sensitive plant communities, or any such community identified in local or regional plans, policies, and regulations, must be considered and evaluated under the California Environmental Quality Act (CEQA) (California Code of Regulations: Title 14, Div. 6, Chap. 3, Appendix G). Furthermore, aquatic, wetland and riparian habitats are also afforded protection under applicable federal, state, or local regulations, and are generally subject to regulation, protection, or consideration by the USACE, the Regional Water Quality Control Board, CDFW, and/or the USFWS.

The CEQA and the State CEQA Guidelines provide guidance in evaluating impacts of projects on biological resources and determining which impacts would be significant. The Act defines "significant effect on the environment" as "a substantial adverse change in the physical conditions which exist in the area affected by the proposed project." Under State CEQA Guidelines section 15065, a project's effects on biotic resources are deemed significant where the project would:

A. "substantially reduce the habitat of a fish or wildlife species"
B. "cause a fish or wildlife population to drop below self-sustaining levels"
C. "threaten to eliminate a plant or animal community"
D. "reduce the number or restrict the range of a rare or endangered plant or animal"

In addition to the section 15065 criteria that trigger mandatory findings of significance, Appendix G of State CEQA Guidelines provides a checklist of other potential impacts to consider when analyzing the significance of project effects. The impacts listed in Appendix G may or may not be significant, depending on the level of the impact. For biological resources, these impacts include whether the project would:

E. "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 California Department of Fish and Game or U.S. Fish and Wildlife Service"

F. "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 California Department of Fish and Game or U.S. Fish and Wildlife Service"

G. "have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act"

H. "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"

I. "conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance"

J. "conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan"

Project applicability: All sensitive biological resources are being considered as part of the current CEQA evaluation.

California Endangered Species Act. The CESA (Fish and Game Code of California, Chapter 1.5, Sections 2050-2116) prohibits the take of any plant or animal listed or proposed for listing as rare (plants only), threatened, or endangered. In accordance with CESA, the CDFW has jurisdiction over state-listed species. The CDFW regulates activities that may result in "take" of individuals listed under the Act (i.e., "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill"). Habitat degradation or modification is not expressly included in the definition of "take" under the California Fish and Game Code. The CDFW, however, has interpreted "take" to include the "killing of a member of a species which is the proximate result of habitat modification."

***Project applicability*:** The California tiger salamander is the only species protected under CESA that is likely to occur in the 2012 FMP development area; the San Joaquin kit fox, which the USFWS considers potentially present but which is likely absent, has been recorded historically in the project vicinity. The District is in the process of applying to the CDFW for a CESA incidental take permit to cover 2012 FMP activities that might result in take of the California tiger salamander.

Porter-Cologne Water Quality Control Act. The State Water Board works in coordination with the nine RWQCBs to preserve, protect, enhance, and restore water quality. Each RWQCB makes decisions related to water quality for its region, and may approve, with or without conditions, or deny projects that could affect waters of the State. Their authority comes from CWA and the State's Porter-Cologne Water Quality Control Act. The Porter-Cologne Water Quality Control Act broadly defines waters of the State as "any surface water or groundwater, including saline waters, within the boundaries of the state." Because Porter-Cologne applies to any water, whereas the CWA applies only to certain waters, California's jurisdictional reach overlaps and may exceed the boundaries of Waters of the U.S. For example, Water Quality Order No. 2004-0004-DWQ states that "shallow" waters of the State include headwaters, wetlands, and riparian areas. Moreover, the San Francisco Bay Region RWQCB's Assistant Executive Director has stated that, in practice, the RWQCBs claim jurisdiction over riparian areas. Where riparian habitat is not present, such as may be the case at headwaters, jurisdiction is taken to the top of bank.

***Project applicability*:** Although areas meeting the definition of waters of the State are present on the Las Positas College campus, in general, no jurisdictional features are present within proposed development areas of proposed 2012 FMP.

California Fish and Game Code Section 1600 et seq. The California Fish and Game Code includes regulations governing the use of, or impacts on, many of the state's fish, wildlife, and sensitive habitats. The CDFW exerts jurisdiction over the bed and banks of rivers, lakes, and streams according to provisions of §§1601–1603 of the Fish and Game Code. Ephemeral and intermittent streams, rivers, creeks, dry washes, sloughs, blue line streams on USGS maps, and watercourses with subsurface flows fall under CDFW jurisdiction. Canals, aqueducts, irrigation ditches, and other means of water conveyance may also be considered streams if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife. Streams and riparian habitat are defined in Title 14, California Code of Regulations, Section 1.72, and Fish and Game Code Section 2786; respectively. Using these definitions, the lateral extent of a stream and associated riparian habitat would fall under the jurisdiction of CDFW. These areas can be measured in several ways, depending on the particular situation and the type of fish or wildlife at risk. At minimum, CDFW would claim jurisdiction over a stream's bed and bank.

Pursuant to Fish and Game Code Section 1603, the CDFW regulates any project proposed by any person that will "substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by the department, or use any material from the streambeds." Fish and Game Code Section 1602 requires an entity to notify CDFW of any proposed activity that may modify a river, stream, or lake. If CDFW determines that proposed activities may substantially adversely affect fish and wildlife resources, a Streambed Alteration Agreement must be prepared. This permit sets reasonable conditions necessary to protect fish and wildlife, and must comply with CEQA. The applicant may then proceed with the activity in accordance with the final permit.

Certain sections of the Fish and Game Code describe regulations pertaining to certain wildlife species. For example, Fish and Game Code §§3503, 2513, and 3800 (and other sections and subsections) protect native birds, including their nests and eggs, from all forms of take. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered "take" by the CDFW. Raptors (i.e., eagles, falcons, hawks, and owls) and their nests are specifically protected in California under Fish and Game Code §3503.5. Section 3503.5 states that it is "unlawful to take, possess, or destroy any birds in the order Falconiformes or Strigiformes (birds of prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto." Non-game mammals are protected by Fish and Game Code §4150, and other sections of the Code protect other taxa.

***Project applicability*:** Although areas subject to CDFW jurisdiction are present along creeks on the campus in general, no jurisdictional features are present within areas of proposed construction under the 2012 FMP. All native bird species, and many other native animals, on the project site have some protection under the Fish and Game Code.

Local Ordinances

City of Livermore Tree Preservation Ordinance. The City of Livermore Tree Preservation Ordinance in the City of Livermore Municipal Code (Chapter 12.2, Article II, Ord. 1830 § 3, 2007) establishes the regulations, standards, and policies for the protection of trees within the City of Livermore (City of Livermore 2007). The ordinance is intended to assist in the continuous development and maintenance of urban forest diversity and sustainable tree cover, preserve and enhance the environmental benefits (e.g. provision of wildlife habitat and the reduction of air and noise pollution) and the aesthetic and quality of life values provided by the urban forest.

The City requires the preservation of "protected trees", unless a reasonable and conforming use of a property justifies the removal, relocation, and/or encroachment into the "protected zone" of such trees, defined as an area encompassing five feet beyond the dripline of a protected tree (City of Livermore 2007). A protected tree is defined as a single-trunk, multi-trunk, or stand of trees dependent on one another for survival that meet the following criteria:

- any tree located on private property occupied by single family residential development with a circumference at breast height of 60 inches or greater, or if defined as a California native tree, 24 inches in circumferences or greater;
- any tree located on private property occupied by industrial, commercial, institutional, mixed-use or multi-family residential development with a circumference of 24 inches or greater;
- any tree located on an undeveloped or underdeveloped property for which new development is proposed with a circumference of 18 inches or greater;
- any tree located in an open space, riparian or habitat area with a circumference of 18 inches or greater;
- any tree newly designated by the City Council as an ancestral tree;
- any tree listed on the City's Ancestral Tree Inventory;
- or any "California native" protected tree. California native protected trees include the following species: white alder (*Alnus rhombifolia*), California bay (*Umbellularia californica*), California buckeye (*Aesculus californica*), madrone (*Arbutus menziesii*), big leaf maple (*Acer macrophyllum*), blue oak (*Quercus douglasii*), California black oak (*Quercus kelloggii*), canyon live oak (*Quercus chrysolepis*), coast live oak (*Quercus agrifolia*), interior live oak (*Quercus wislizenii*), scrub oak (*Quercus berberidifolia*), valley oak (*Quercus lobata*), grey pine (*Pinus sabiniana*), California sycamore (*Platanus racemosa*), and California black walnut (*Juglans hindsii californica*) (City of Livermore 2007).

Removal or encroachment into the protected zone of any protected tree or trees requires a tree permit issued by the City of Livermore. If construction or development activities may potentially endanger a protected tree, the director or deciding body may seek professional consultation at the expense of the developing entity to determine measures necessary to safeguard the tree (City of Livermore 2007). Exemptions to the *City of Livermore Tree Preservation Ordinance* may apply to the following circumstances, among others: routine maintenance of private property in accordance with the most recent pruning standards established by the International Society of Arboriculture, landscaping activities on private property (e.g. planting and maintenance activities), and trees damaged by severe weather that are or may become dangerous to humans.

***Project applicability*:** Although trees subject to the City of Livermore tree ordinance are present in several areas of the campus, the only two ordinance-sized trees very close to 2012 FMP activity areas are two fan palms (*Washingtonia* sp.) in the northeastern portion of the campus, north of the proposed Sports Recreational Area. These trees are far enough from the proposed Sports Recreational Area that it appears these trees will not be impacted by proposed 2012 FMP activities.

Impact Discussion

Project buildout would result in permanent impacts to 15.5 acres of non-native annual grassland/ruderal habitat and 12.5 acres of disturbed/developed habitat. A discussion of each environmental issue included under Section 4 is presented below.

a) **Would the project 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 California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?**

Several special-status animal species may occur on the project site. Potential impacts to these species from project implementation are discussed below.

a.1 Impacts to Special-status Plants

As described above, no special-status plant species are considered to have potential to occur on the campus, therefore the proposed Project would have no impact on special-status plants.

a.2 Impacts to Special-status Animals

A number of special-status species may potentially be present on the Las Positas College campus, but would not be significantly impacted by buildout of the 2012 FMP. These species occur on the campus only as uncommon to rare visitors, migrants or transients, or may forage on the site while breeding in adjacent areas. These species include the American peregrine falcon (*Falco peregrinus anatum*), prairie falcon (*Falco mexicanus*), merlin (*Falco columbarius*), northern harrier (*Circus cyaneus*), grasshopper sparrow (*Ammodramus savannarum*), pallid bat (*Antrozous pallidus*), and California mastiff bat (*Eumops perotis californicus*).

As discussed above, the San Joaquin kit fox is not expected to occur on the campus. Thus, 2012 FMP implementation would not impact the San Joaquin kit fox. Nevertheless, measures to protect San Joaquin kit fox would be implemented as required by the Biological Opinion (USFWS 2007).

A number of common migratory birds may nest on the campus. These species are widespread and abundant; thus, disturbance or even loss of the nests of such common species would not be considered a significant impact. Nevertheless, the nests of migratory birds are protected by the federal Migratory Bird Species Act. Disturbance or destruction of the active nests of migratory birds should therefore be avoided.

Impacts to the loggerhead shrike, American badger, white-tailed kite, and golden eagle are less than significant. Impacts to the California tiger salamander, California red-legged frog, and burrowing owl are potentially significant; however, institution of the measures outlined in the “Mitigation Measures” section below would reduce such impacts to less-than-significant levels.

Impacts to the Loggerhead Shrike, American Badger, White-tailed Kite, and Golden Eagle. ***Less than significant.*** Loggerhead shrikes and American badgers are California Species of Special Concern that could occur on the project site, and white-tailed kites and golden eagles may forage on the project site in low numbers. Up to one pair of nesting loggerhead shrikes could potentially be displaced by project implementation. Displacement of one pair of this species, or even loss of active nests, would not be a significant impact. Loggerhead shrikes are relatively common locally and regionally, and are not at risk of local extirpation. The American badger is unlikely to den on the site, and therefore no individuals or dens would be destroyed by project activities. Similarly, the white-tailed kite and golden eagle are not expected to nest in or very close to impact areas, instead using the grassland impact areas as occasional foraging habitat. The Project may disturb occasional foraging individuals of the American badger, white-tailed kite, and golden eagle and would result in the loss of 15.5 acres of grassland foraging habitat for all four of the special-status animals addressed here. Habitat for these species is regionally abundant, and the Project's impacts to these species and their habitats would affect only a very small proportion of regionally available habitat. Therefore, impacts would be considered less than significant.

Impacts to the California Tiger Salamander and California Red-legged Frog. ***Significant unless mitigation incorporated.*** Neither California tiger salamanders nor California red-legged frogs breed on the project site. However, both species may utilize the non-native grassland habitat on the campus for dispersal and possibly refugia. If either species is present on the site, the proposed project may cause the injury or mortality of individual California tiger salamanders or California red-legged frogs during construction, the loss of upland habitat, restriction on dispersal between off-site ponds and on site aestivation habitat that would remain impacted, and the death or injury of individuals on the project site following construction (e.g., due to traffic or harassment by humans). Due to the rarity of these species, Project impacts to California tiger salamanders or California red-legged frogs would be considered significant under CEQA. With buildout of the 2012 FMP, the District will comply with all applicable avoidance and minimization measures in the USFWS's 2007 Biological Opinion. In addition, implementation of **Mitigation Measures BIO-1**, **2**, and **3** would reduce impacts to these species to less-than-significant levels.

Impacts to Burrowing Owl. ***Significant unless mitigation incorporated.*** Burrowing owls could occur on the campus in grassland habitat where ground squirrels are present. This species has not been observed recently at Las Positas College, and there is therefore a low probability that the species is present in Project impact areas. If the species occurs on the campus, it likely does so only as a nonbreeding visitor. For that reason, and because the 15.5 acres of grassland habitat on the campus represents such a small proportion of regionally available habitat, loss of non-native annual grassland and ruderal habitat is not considered a significant impact to nonbreeding burrowing owls. However, if burrowing owls nest on the Project impact areas, the loss of occupied nesting habitat would be considered significant, and would require compensatory mitigation (**Mitigation Measure BIO-1**) to reduce habitat impacts to less-than-significant levels.

Construction-related disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment if a nest were present. Construction during any season could result in the injury or death of a burrowing owl if owls are occupying burrows on the project site during construction. In addition, if owls are present on the site, construction could result in a loss of breeding, roosting, or foraging habitat. Any loss of burrowing owls or fertile eggs, any activities resulting in nest abandonment, or the destruction of occupied burrowing owl burrows would constitute a significant impact. Implementation of **Mitigation Measures BIO-1** and **4** would reduce impacts on burrowing owls to less-than-significant levels.

a.3 Impacts to Sensitive Habitats

Impacts to Disturbed/Developed and Non-native Grassland/Ruderal Habitat. ***Less than significant.*** As currently proposed, the Project would affect areas within the disturbed/developed habitat and non-native annual grassland/ruderal habitat. These areas are dominated by nonnative ornamental and weedy plants, and the species that occur on the site are urban-adapted species that are common and widespread in the San Francisco Bay Area. Because the campus supports only a very small proportion of the regional availability of these habitats and the regional populations of common plant and wildlife species that inhabit these habitats, the proposed Project would have very limited impacts on the regional abundance of resources associated with these habitats (except as noted for special-status species above). As a result, potential Project impacts on common plant and animal communities do not meet the CEQA standard of having a substantial adverse effect, and would be considered less than significant under CEQA.

b) Would the project 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 California Department of Fish and Game or U.S. Fish and Wildlife Service?

FMP 2012 buildout would not result in impacts to any riparian habitat or other sensitive natural community, as none exist within, or immediately adjacent to, the campus.

c) Would the project have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

Buildout of the 2012 FMP would not impact state or federally protected wetlands through direct removal, filling, hydrological interruption, or other means. All project activities would occur west of the seasonal wetland/creek habitat and north of the drainage ditch habitat.

The Las Positas College campus is bordered to the east by an unnamed ephemeral drainage, and to the west by an unnamed intermittent tributary to Collier Creek. No Project activities are planned near the creek on the west side of the campus; the nearest Project activities are located approximately 300 feet from that creek, within previously developed areas. Likewise, no Project activities are planned in the unnamed drainage on the eastern side of the campus, and the drainage is separated from proposed development by a berm that would preclude the potential for soil or other materials from the proposed development to enter that wetland.

d) Would the project 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?

For many species, the landscape is a mosaic of suitable and unsuitable habitat types. Environmental corridors are segments of land that provide a link between these different habitats while also providing cover. Development that fragments natural habitats (i.e., breaks them into smaller, disjunct pieces) can have a twofold impact on wildlife: first, as habitat patches become smaller they are unable to support as many individuals (patch size); and second, the area between habitat patches may be unsuitable for wildlife species to traverse (connectivity).

Las Positas College is located at the northern edge of urban development, with residential and commercial development bordering the College to the south and southwest. Non-native grassland habitat is located in the northeast of the project site (**Figure 4**). This grassland habitat is bordered by College infrastructure to the west and south, and is surrounded by extensive grasslands to the north, east, and southeast. As a result, the campus does not provide narrow connectivity between large areas of open space on a local or regional scale.

The campus is bordered to the east by an unnamed ephemeral drainage, and to the west by an unnamed intermittent tributary to Collier Creek. Creeks and other drainages are important movement corridors for a number of animals, including special-status amphibians. Water and vegetation associated with these areas provide both food and cover for individuals utilizing these corridors. No Project activities are planned near the creek on the west side of the campus; the nearest Project activities are located approximately 300 feet from that creek, within previously developed areas. Likewise, no Project activities are planned in the unnamed drainage on the eastern side of the site, and the drainage is separated from proposed development by a berm that would preclude the potential for soil or other materials from the proposed development to enter that wetland. Therefore, 2012 FMP buildout is not expected to impede animal movement within Collier Creek or the unnamed drainage.

2012 FMP buildout 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. Thus, this impact is determined to be less than significant.

e) Would the project conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Two trees on the campus would qualify as protected trees under the City of Livermore Tree Preservation Ordinance. Both trees are fan palms (*Washingtonia* sp.), greater than 60 inches in circumference at breast height, located next to one another approximately 350 feet northeast of the track and field stadium in the disturbed/developed habitat. As of the November 2016 survey date, orange fencing surrounded these trees to protect them during construction activities. These trees are far enough from the proposed Sports Recreational Area that it appears these trees will not be impacted by proposed 2012 FMP activities.

f) Would the project conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

Proposed Project activities are among the types of activities considered by the East Alameda County Conservation Strategy (EACCS) (ICF International 2010), which guides the implementation of projects, and particularly avoidance, minimization, and compensatory mitigation measures. The Project is within the geographic area considered by the EACCS and therefore should comply with EACCS conditions.

The proposed Project would comply with the conditions of the EACCS. Therefore, the proposed Project would not conflict with the EACCS or any other adopted Habitat Conservation Plans (HCP) or Natural Community Conservation Plans (NCCP), or with any other approved local, regional, or state habitat conservation plans, and thus the impact associated with conflicts between the Project and any adopted HCP or NCCP would be less than significant.

Mitigation Measures

BIO-1 **Compensatory Habitat Mitigation for California Tiger Salamander, California Red-legged Frog, and Burrowing Owl.** Implementation of the 2012 FMP will permanently impact 15.5 acres of non-native grassland that provides potential habitat for the California tiger salamander and California red-legged frog, and that could possibly be used as nesting habitat by burrowing owls. Compensatory mitigation for impacts to habitat of the California tiger salamander and California red-legged frog is being provided at Murray Ranch, located north and northwest of the Campus, and the mitigation provided for those two amphibians would also be suitable to compensate for loss of burrowing owl habitat in the event that nesting burrowing owls are impacted by the 2012 FMP.

Murray Ranch was identified as a mitigation site for impacts of Las Positas College activities on the California tiger salamander and California red-legged frog during planning for the 2006 FMP. That earlier plan included activities that would result in permanent impacts to 50.2 ac of habitat and temporary impacts to 7.3 acres of habitat for these species. Per the 2006 DEIR (PLACEMAKERS 2006), compensatory mitigation for the permanent impacts was to be provided via the preservation and management of suitable habitat off-site, necessitating a total of 100.4 acres of mitigation. However, when discussing the 2007 Biological Opinion with the USFWS, the District agreed to provide mitigation as though all then-undeveloped portions of the Las Positas College campus (totaling 85.2 acres) would eventually be developed. These 85.2 acres included the 2006 FMP impact areas, the 15.5 acres of potential habitat being impacted by 2012 FMP, and additional areas of potential habitat, primarily along the eastern and western edges of the campus, where no development activities are currently proposed. As mitigation for impacts to 85.2 acres of habitat, the District proposed (and the USFWS approved) preservation and management of 209 acres of suitable habitat at Murray Ranch.

The EACCS guides development and corresponding efforts to avoid, minimize, and compensate for impacts to biological resources in eastern Alameda County, including the Livermore area (ICF International 2010). Although the EACCS was not established when the 2006 FMP was built out, and therefore would not have influenced mitigation ratios for development constructed under the 2006 FMP, the EACCS is applicable to the 2012 FMP. The EACCS identifies appropriate mitigation ratios indicating the amount of land that should be preserved and managed to compensate for impacts to special-status species habitat. The EACCS-recommended standard mitigation ratio for impacts to the California tiger salamander and California red-legged frog from the Las Positas College 2012 Master Plan was determined to be 2.5:1 (mitigation acres:impacted acres). Applying the EACCS's scoring system for both the impact site and Murray Ranch mitigation site demonstrates the relatively higher quality of habitat on the mitigation site, compared to the habitat impacted by the 2012 FMP. Therefore, appropriate mitigation for 2012 FMP impacts on the California tiger salamander and California red-legged frog total 27.51 and 29.06 acres, respectively.

Adding the 100.4 acres of mitigation required under CEQA for the 2006 FMP to the mitigation being required under CEQA to compensate for buildout of the 2012 FMP, the CEQA mitigation requirements for both the 2006 FMP and 2012 FMP total 129.46 acres, which will be covered in the 209 acres of habitat being preserved and managed at Murray Ranch.

The District is currently finalizing its Murray Ranch mitigation. To complete this mitigation, the District will finalize the details of the conservation easement protecting the mitigation lands; the endowment that will pay for the management and monitoring of the mitigation lands in perpetuity; and the agreement with a land manager and conservation easement holder to ensure that the lands are managed properly for these special-status species.

BIO-2 **Implementation of General East Alameda County Conservation Strategy (EACCS) Avoidance and Minimization Measures**. The District will implement the following Avoidance and Minimization Measures (AMMs) prescribed by the EACCS to avoid and minimize effects on sensitive species during 2012 FMP construction activities. This mitigation measure addresses general measures that apply to multiple species.

EACCS Measure GEN-01. Employees and contractors performing construction activities will receive environmental sensitivity training. Training will include review of environmental laws and AMMs that must be followed by all personnel to reduce or avoid effects on covered species during construction activities.

ACCS Measure GEN-02. Environmental tailboard trainings (i.e., brief, on-site training sessions for construction personnel) will take place on an as-needed basis in the field. The environmental tailboard trainings will include a brief review of the biology of the covered species and guidelines that must be followed by all personnel to reduce or avoid negative effects on these species during construction activities. Directors, managers, superintendents, and the crew foremen and forewomen will be responsible for ensuring that crewmembers comply with the guidelines.

EACCS Measure GEN-03. Contracts with contractors, construction management firms, and subcontractors will obligate all contractors to comply with these AMMs.

ACCS Measure GEN-04. The following will not be allowed at or near work sites for covered activities: trash dumping, firearms, open fires (such as barbecues) not required by the activity, hunting, and pets (except for safety in remote locations).

EACCS Measure GEN-05. Vehicles and equipment will be parked on pavement, existing roads, and previously disturbed areas to the extent practicable.

EACCS Measure GEN-06. Off-road vehicle travel will be minimized.

EACCS Measure GEN-07. Vehicles will not exceed a speed limit of 15 miles per hour on unpaved roads within natural land-cover types, or during off-road travel.

EACCS Measure GEN-08. Vehicles or equipment will not be refueled within 100 feet of a wetland, stream, or other waterway unless a bermed and lined refueling area is constructed.

EACCS Measure GEN-09. Vehicles shall be washed only at approved areas. No washing of vehicles shall occur at job sites.

EACCS Measure GEN-10. To discourage the introduction and establishment of invasive plant species, seed mixtures/straw used within natural vegetation will be either rice straw or weed-free straw.

EACCS Measure GEN-11. Pipes, culverts, and similar materials greater than four inches in diameter will be stored so as to prevent covered wildlife species from using these as temporary refuges, and these materials will be inspected each morning for the presence of animals prior to being moved.

EACCS Measure GEN-12. Erosion control measures will be implemented to reduce sedimentation in wetland habitat occupied by covered animal and plant species when activities are the source of potential erosion problems. Plastic monofilament netting (erosion control matting) or similar material containing netting shall not be used at the project. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds.

EACCS Measure GEN-13. Stockpiling of material will occur such that direct effects on covered species are avoided. Stockpiling of material in riparian areas will occur outside of the top of bank, and preferably outside of the outer riparian dripline and will not exceed 30 days.

EACCS Measure GEN-14. Grading will be restricted to the minimum area necessary.

EACCS Measure GEN-15. Prior to ground disturbing activities in sensitive habitats, project construction boundaries and access areas will be flagged and temporarily fenced during construction to reduce the potential for vehicles and equipment to stray into adjacent habitats.

EACCS Measure GEN-16. Significant earth-moving activities will not be conducted in riparian areas within 24 hours of predicted storms or after major storms (defined as one inch of rain or more).

EACCS Measure GEN-17. Trenches will be backfilled as soon as possible. Open trenches will be searched each day prior to construction to ensure no covered species are trapped. Earthen escape ramps will be installed at intervals prescribed by a qualified biologist.

BIO-3 **Implementation of EACCS Avoidance and Minimization Measures for the California Tiger Salamander and California Red-legged Frog.** The District will implement the following AMMs prescribed by the EACCS to avoid and minimize effects on sensitive species during 2012 FMP construction activities.

EACCS Measure AMPH-1. If aquatic habitat is present, a qualified biologist will stake and flag an exclusion zone prior to activities. The exclusion zone will be fenced with orange construction zone and erosion control fencing (to be installed by construction crew). The exclusion zone will encompass the maximum practicable distance from the work site and at least 500 feet from the aquatic feature wet or dry. [*Because the proposed Athletic Field Improvements are located in close proximity to a seasonal wetland, the complete exclusion of activity within 500 feet of aquatic habitat is not feasible. However, in order to comply with this measure to the greatest extent practicable, the limits of project activities in and adjacent to aquatic habitats will be clearly marked, and construction fencing will prevent equipment from entering aquatic habitats outside the designated impact areas.*]

EACCS Measure AMPH-2.

- A qualified biologist will conduct pre-construction surveys prior to activities. If individuals are found, work will not begin until they are moved out of the construction zone to a USFWS/CDFW approved relocation site.
- A USFWS/CDFW-approved biologist will be present for initial ground disturbing activities.
- If the work site is within the typical dispersal distance (contact USFWS/CDFW for latest research on this distance for species of interest) of potential breeding habitat, barrier fencing will be constructed around the worksite to prevent amphibians from entering the work area. Barrier fencing will be removed within 72 hours of completion of work. [*The project area is known to be within dispersal distance of potential breeding habitat for California tiger salamanders and California red-legged frogs, and therefore barrier fencing consisting of silt fencing will be installed on the northern and eastern boundaries of the project area where construction activities border grassland habitat. The barrier fencing will be at least 3 feet high and the lower 6 inches of the fence will be buried in the ground to prevent animals from crawling under. The remaining 2.5 feet will be left above ground to serve as a barrier for animals moving on the ground surface.*]
- No monofilament plastic will be used for erosion control.
- Construction personnel will inspect open trenches in the morning and evening for trapped amphibians.
- A qualified biologist possessing a valid FESA Section 10(a)(1)(A) permit or USFWS-approved under an active biological opinion, will be contracted to trap and to move amphibians to nearby suitable habitat if amphibians are found inside a fenced area. [*No trapping, such as the use of upland traplines for California tiger salamanders, is proposed for this project. However, a biologist approved by the USFWS under the project's Biological Opinion will survey for and relocate any individuals found within the impact area.*]
- Work will be avoided within suitable habitat from October 15 (or the first measurable fall rain of one inch or greater) to May 1.

BIO-4 Implementation of Avoidance and Minimization Measures for the Burrowing Owl.

- Pre-construction surveys for burrowing owls shall be conducted prior to the initiation of all project activities within, and within 250 feet of, the ruderal/ grassland habitat in the northeastern part of the project area. Pre-construction surveys will be completed in conformance with the CDFW's 2012 guidelines (California Department of Fish and Game 2012). A qualified biologist will conduct two surveys, the first anytime within 30 days prior to the start of construction and the second within 48 hours prior to construction, to determine whether owls are present in areas where they could be affected by proposed activities.
- If burrowing owls are present during the non-breeding season (generally September 1 to January 31), a 160-foot buffer zone shall be maintained around the occupied burrow(s), if feasible. If maintaining such a buffer is not feasible, then the buffer must be great enough to avoid injury or mortality of individual owls, or else the owls should be passively relocated as described in the last bullet in this mitigation measure. During the

breeding season (generally February 1 to August 31), a 250-foot buffer, within which no new project-related activities will be permissible, will be maintained between project activities and occupied burrows. Owls present between February 1 and August 31 will be assumed to be nesting, and the 250-foot protected area will remain in effect until August 31. If monitoring evidence indicates that the owls are no longer nesting or the young owls are foraging independently, the buffer may be reduced or the owls may be relocated prior to August 31, in consultation with the CDFW.

- Any owls occupying the project area are likely habituated to some level of human disturbance throughout the year due to campus activities. As a result, they may exhibit a tolerance of greater levels of human disturbance than owls in more natural settings, and work within the standard 250-foot buffer during the nesting season may be able to proceed without disturbing the owls. Therefore, if nesting owls are determined to be present on the site, and project construction activities cannot feasibly avoid disturbance of the area within 250 feet of the occupied burrow during the nesting season (i.e., February 1 through August 31) due to other seasonal constraints, a qualified biologist will be present during all activities within 250 of the nest to monitor the owls' behavior. If in the opinion of the qualified biologist, the owls are unduly disturbed (i.e., disturbed to the point of harm or reduced reproductive success), all work within 250 feet of the occupied burrow will cease until the nest is no longer active.

- If construction will directly impact occupied burrows, a qualified biologist will passively evict owls from burrows during the nonbreeding season (September 1 to January 31). No burrowing owls will be evicted during the nesting season (February 1 through August 31) except with the CDFW's concurrence that evidence demonstrates that nesting is not actively occurring (e.g., because the owls have not yet begun nesting early in the season, or because young have already fledged late in the season). Eviction will occur through the use of one-way doors inserted into the occupied burrow and all burrows within impact areas that are within 250 feet of the occupied burrow (to prevent occupation of other burrows that will be impacted). One-way doors will be installed by a qualified biologist and left in place for at least 48 hours before they are removed. The burrows will then be back-filled to prevent re-occupation. Although relocation of owls may be necessary to avoid the direct injury or mortality of owls during construction, relocated owls may suffer predation, competition with other owls, or reduced health or reproductive success as a result of being relegated to more marginal habitat. However, the benefits of such relocation, in terms of avoiding direct injury or mortality, would outweigh any adverse effects.

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5. **CULTURAL RESOURCES.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☐	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☐	☐	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☐	☐	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☐	☐	☒

Environmental Setting

An archival research and field inspection report was prepared by Miley Paul Holman & Associates in 2005 and incorporated into the *Las Positas College Facilities Development Plan Draft Environmental Impact Report* (Chabot Las Positas Community College District, 2006). This report concluded there were no historical resources found to be present at the Las Positas College campus and no evidence of archaeological and paleontological resources.

Impact Discussion

The 2012 FMP improvements are located within the boundaries of Las Positas College. Base on the conclusions of the 2005 archival research and field report prepared by Miley Paul Holman & Associates, there would be no impacts to cultural resources. A discussion of each environmental issue included under Section 5 is presented below.

a) Would the project cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?

As concluded in the Miley Paul Holman & Associates report prepared in 2005, there would be no impacts to historical resources with implementation of the 2012 FMP.

b) Would the project cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

As concluded in the Miley Paul Holman & Associates report prepared in 2005, there would be no impacts to archaeological resources with buildout of the 2012 FMP.

c) Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic formation?

As concluded in the Miley Paul Holman & Associates report prepared in 2005, there would be no impacts to paleontological resources with buildout of the 2012 FMP.

d) Would the project disturb any human remains, including those interred outside of formal cemeteries?

As concluded in the Miley Paul Holman & Associates report prepared in 2005, there would be no impacts to human remains with buildout of the 2012 FMP.

Mitigation Measures

None required.

References

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6. **GEOLOGY AND SOILS.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) 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 know fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☒	☐	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in substantial soil erosion or the loss of topsoil?	☐	☒	☐	☐
c) Be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site 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 where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒

Environmental Setting

The Las Positas College campus is located east of the San Francisco Bay in the Livermore Valley. The campus and surrounding area are located in the Altamont Hills which are part of the northern Diablo Range. The Altamont Hills are underlain by folded marine and sedimentary rocks of the Upper Cretaceous Panoche formation. The overall geologic structure of the hills is of northwest-southwest oriented anticlines and synclines. The Panoche formation is described as being primarily micaceous with few thin sandstone beds. Alluvial stream sediments may be locally deep in valleys. Terraces of Livermore Gravel are present at the bases of the foothills of Livermore Valley. The Livermore Gravel is described as light reddish-gray cobble-pebble gravel containing debris from Franciscan rocks, pebbly sand, silt and clay with proportionately more clay silt and sand north of Livermore. Based on previous borings taken on the campus, groundwater was not present at 37 feet below the ground surface (Chabot Las Positas Community College District 2006). However, fluctuations in the groundwater level may occur due to variations in ground surface topography, subsurface geologic conditions and structure, rainfall, irrigation, and other factors (Ninyo-Moore, 2014).

Regulatory Setting

As a result of California's Field Act, the California Building Code (Title 24 of the California code of Regulations) contains special provisions for the design and construction of schools in California. The design and construction of the six buildings identified in the 2012 FMP will be overseen by the California Division of the State Architect (DSA) and the California Geological Survey (CGS).

Construction sites disturbing one acre or more are required to obtain coverage under the National Pollution Discharge Elimination System (NPDES) Construction General Permit (CGP) for Discharges of Storm Water Associated with Construction Activity. As buildout of the 2012 FMP will disturb more than one acre of land, the Project is subject to the CGP and requires the preparation of a Storm Water Pollution Prevention Plan (SWPPP). See **Section 9**, **Hydrology and Water Quality**, for a discussion of the Project's responsibilities under the CGP.

Impact Discussion

The Las Positas College campus could be subject to strong ground shaking during a seismic event; and near surface soils have high expansion characteristics, however with implementation of **Mitigation Measure GEO-1** potential adverse impacts associated with strong ground shaking at the campus would be less than significant. A discussion of each environmental issue included under Section 6 is presented below.

a) Would the project expose people or structures to potential substantial adverse affects, including the risk of loss, injury, or death?

(i) The Las Positas College campus is not located within an Alquist-Priolo Fault Rupture Hazard Zone. The closest known active fault is the Mount Diablo Thrust fault located about 1.8 miles northwest of the campus. Major known active faults in the region include the Calaveras, Hayward and San Andreas faults, located west of the campus and the Greenville fault located east of the campus. The potential for ground surface rupture due to faulting at the campus is considered low (Ninyo-Moore, 2014).

(ii) There is the potential that strong seismic ground shaking could occur at the campus With implementation of **Mitigation Measure GEO-1**, potentially significant ground shaking impacts would be less than significant.

(iii) Liquefaction is the process by which loose to medium dense granular, saturated soils, becomes fluid due to ground shaking. Liquefaction can result in ground failure. The campus is not located within a liquefaction hazard zone on the Seismic Hazard Zones Map prepared by the California Geological Survey (CGS) (Ninyo & Moore 2014). Previous borings at the campus indicated soils did not conform to the characteristics of liquefiable soils (Chabot Las Positas Community College District, 2006 and Ninyo & Moore 2014).

(iv) The campus is not located within a hazard zone for earthquake-induced landslides on the Seismic Hazard Zones Map (Ninyo & Moore 2014). The potential for landslides at the campus is remote.

b) Would the project result in substantial soil erosion or the loss of topsoil?

The Project would result in soil disturbance associated with buildout of the 2012 FMP resulting in the potential for soil erosion during construction activities. Soil erosion may occur and small quantities of pollutants may enter the storm drainage system, potentially degrading water quality. The District or its contractors will prepare a SWPPP to address accidental releases of chemicals and other pollutants, therefore Project construction activities for each development phase would be less than significant. See **Section 9**, **Hydrology and Water Quality**.

c) Would the project be located on a geologic unit of soil that is unstable, or that would become unstable as a result of the project, and potentially result in on-or-offsite landslide, lateral spreading, subsidence, liquefaction or collapse?

The Las Positas College campus is not located on unstable soil or would be subject to landslides, lateral spreading, subsidence, liquefaction or collapse (see **Subsection 9a**).

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

Geotechnical evaluations for other projects on the Las Positas College campus found that near-surface soils generally have a high expansion characteristic and represents a potentially significant impact. With implementation of **Mitigation Measure GEO-1**, potentially significant impacts associated with expansive soils would be less than significant.

e) Would the project have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

The Las Positas College campus is connected to the City of Livermore sanitary sewer system.

Mitigation Measures

GEO-1 Detailed geotechnical investigations shall be performed prior to the design of each of the six proposed new buildings. The geotechnical investigations shall include borings and laboratory testing to provide supporting data for geotechnical design recommendations.

References

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7. **GREENHOUSE GAS EMISSIONS.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐

Environmental Setting

Greenhouse gases (GHGs) are atmospheric gases that capture and retain a portion of the heat radiated from the earth after it has been heated by the sun. The primary GHGs are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), ozone, and water vapor. While GHGs are natural components of the atmosphere, CO_2, CH_4 and N_2O are also emitted from human activities and their accumulation in the atmosphere over the past 200 years has substantially increased their concentrations. This accumulation of GHGs has been implicated as the driving force behind global climate change.

Human emissions of CO_2 are largely by-products of fossil fuel combustion, whereas CH_4 results from off-gassing associated with organic decay processes in agriculture, landfills, etc. Other GHGs, including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, are generated by certain industrial processes. The global warming potential of GHGs are typically reported in comparison to that of CO_2, the most common and influential GHG, in units of "carbon dioxide-equivalents" (CO_2e).[3]

There is international scientific consensus that human-caused increases in GHGs have and will continue to contribute to global warming. Potential global warming impacts in California may include, but are not limited to, loss in snow pack, sea level rise, more extreme heat days per year, more high ozone days, increased forest fires, and more drought years. Secondary effects are likely to include a global rise in sea level, impacts to agriculture, changes in disease vectors, and changes in habitat and biodiversity.

[3] Because of the differential heat absorption potential of various GHGs, GHG emissions are frequently measured in "carbon dioxide-equivalents," which present a weighted average based on each gas's heat absorption (or "global warming") potential.

The California Air Resources Board (CARB) estimated that in 2011 California produced 448 million gross metric tons of CO_2e, or about 535 million U.S. tons. CARB found that transportation is the source of 37.6 percent of the state's GHG emissions, followed by industrial sources at 20.8 percent and electricity generation (both in-state and out-of-state) at 19.3 percent. Commercial and residential fuel use (primarily for heating) accounted for 10.1 percent of GHG emissions.

In the San Francisco Bay Area, fossil fuel consumption in the transportation sector (on-road motor vehicles, off-highway mobile sources, and aircraft) and the industrial and commercial sectors are the two largest sources of GHG emissions, each accounting for approximately 36 percent of the San Francisco Bay Area's 95.8 million metric tons of CO_2e emitted in 2007. Electricity generation accounts for approximately 16 percent of the San Francisco Bay Area's GHG emissions followed by residential fuel usage at 7 percent, off-road equipment at 3 percent and agriculture at 1 percent.

The Bay Area Air Quality Management District (BAAQMD) is the primary agency responsible for air quality regulation in the nine-county San Francisco Bay Area Air Basin. As part of that role, the BAAQMD has prepared *CEQA Air Quality Guidelines* that provide CEQA thresholds of significance for operational GHG emissions from land use projects: 1) 1,100 metric tons of CO_2e per year; or 2) 4.6 metric tons of CO_2e per year per project "service population" (i.e., project residents + project employees), which are also considered the definition of a cumulatively considerable contribution to the global GHG burden and, therefore, of a significant cumulative impact. The BAAQMD has not defined thresholds for project construction GHG emissions. The *CEQA Air Quality Guidelines* methodology and thresholds of significance have been used in this Initial Study's analysis of potential GHG impacts associated with the Project.

Regulatory Setting

Assembly Bill 32 (AB 32 - Núñez, Chapter 488, Statutes of 2006), the California Global Warming Solutions Act, requires the CARB to lower State GHG emissions to 1990 levels by 2020—a 25 percent reduction statewide with mandatory caps for significant GHG emission sources. AB 32 directed CARB to develop discrete early actions to reduce GHG while preparing the Climate Change Scoping Plan to identify how best to reach the 2020 goal.

Statewide strategies to reduce GHG emissions to attain the 2020 goal include the Low Carbon Fuel Standard (LCFS), the California Appliance Energy Efficiency regulations, the California Renewable Energy Portfolio standard, changes in the motor vehicle corporate average fuel economy (CAFE) standards, and other early action measures that would ensure the state is on target to achieve the GHG emissions reduction goals of AB 32.

In an effort to make further progress in attaining the longer-range GHG emissions reductions required by AB 32, Governor Brown identified in his January 2015 inaugural address an additional goal (i.e., reducing GHG emissions to 40% below 1990 levels by 2030) to be attained by implementing several key climate change strategy "pillars:" (1) reducing present petroleum use in cars and trucks by up to 50 percent; (2) increasing from one-third to 50 percent the share of California's electricity derived from renewable sources; (3) doubling the energy efficiency savings achieved at existing buildings and making heating fuels cleaner; (4) reducing the release of methane, black carbon, and other short-lived GHGs; (5) managing farm and rangelands, forests and wetlands to more efficiently store carbon; and (6) periodically updating the State's climate adaptation strategy.

In January 2010, the State Building Standards Commission adopted updates to the California Green Building Standards Code (CALGreen), which went into effect in January 2011. CALGreen contains requirements for construction site selection, storm water control during construction, construction waste reduction, indoor water use reduction, material selection, natural resource conservation, and site irrigation conservation. CALGreen provides for design options allowing the designer to determine how best to achieve compliance for a given site or building condition. CALGreen also requires building commissioning, which is a process for verifying that all building systems, like heating and cooling equipment and lighting systems, are functioning at their maximum efficiency. CALGreen provides the minimum standard that buildings need to meet to be certified for occupancy, but does not prevent a local jurisdiction from adopting more stringent requirements. CALGreen is intended to (1) reduce GHG emissions from buildings; (2) promote environmentally responsible, cost-effective, healthier places to live and work; and (3) reduce energy and water consumption.

Las Positas College Climate Action Plan (CAP)

In 2007, the District became a signatory to the American College and University Presidents Climate Commitment (ACUJPCC). In 2010, Las Positas College adopted the *Las Positas Climate Action Plan 2010* (Chabot Las Positas Community College District 2010).

Presented below is a summary of key elements of the CAP:

Buildings and Energy

- All new buildings will be a minimum of Leadership in Energy and Environmental Design (LEED) Silver Certified and all building renovations LEED Silver equivalent.
- Sustainability guidelines for campus buildings were adopted in the 2005 FMP (Chabot Las Positas Community College District 2005).
- Products must be Energy Star certified.
- Conversion from T-12 to T-8 fluorescent lighting.
- Installation of solar panels. In 2009, more than 6,600 solar panels were installed with capacity of producing 1.1 megawatts of electricity, meeting more than 20 percent of the campus's current electricity needs. In 2012 an additional 1.3 megawatts of photo voltaic panels were installed. The College now meets more than 50 percent of its annual electrical needs through solar.

Transportation

- Twelve plug-in electric charging stations located near the solar panels are provided for electric vehicles.
- To encourage use of public transportation, Las Positas College students ride free of charge on Livermore-Amador Valley Transit, BART and ACE.

- To encourage ridesharing, the College maintains a website with information on ridesharing opportunities (http://www.laspositascollege.edu/green/index.php).

Water and Waste

- New water fountains have been installed around campus that allow the refill of water bottles.
- New bathroom fixtures are to be low flow/water efficient. For new construction, waterless urinals are the standard.
- The College uses reclaimed water for lawns and landscaping; and weather sensor systems have been installed to maximize water efficiency throughout the year.
- A comprehensive storm water management plan has been adopted requiring storm water flows will be at no greater rate and no less quality than outflows prior to the initiation of the District bond program in 2005.
- A comprehensive recycling and composting program was initiated in 2003 which includes on-site composting of organic material, construction waste diversion and single-stream recycling.
- On-going efforts to reduce the consumption of paper including on-line admission applications, registration, grades and course materials through Blackboard and instructional websites; electronic curriculum development; GoPrint stations in the library, computer labs and classrooms; online job postings and using recycled scratch paper and "Green Books".

Education and Community Outreach

- Established a Sustainability Committee in 2007. The "Las Positas Goes Green" website was released in 2010 ((http://www.laspositascollege.edu/green/index.php). The website includes information about the College's sustainability initiatives, real-time information about renewable energy generated from the solar panels and alternative transportation opportunities.

Impact Discussion

The *Las Positas College Climate Action Plan* (CAP) addresses a comprehensive approach to reduce GHG emissions. The proposed 2012 FMP must comply with the CAP. Potential GHG emissions would be less than significant. A brief discussion of each environmental issue included under Section 7 is presented below.

a) Would the project generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

The CalEEMod (California Emissions Estimator Model, Version 2016.3.1) model was used to quantify long-term net new GHG operational emissions produced by additional motor vehicles, energy and water use, and solid waste generation attributable to FMP implementation. CalEEMod incorporates GHG emission factors for motor vehicles, electricity generation, water use and solid waste generation, and mitigation strategies based on the California Air Pollution Control Officer's Association (CAPCOA) *Quantifying Greenhouse Gas Mitigation Measures* and the *California Climate Action Registry General Reporting Protocol*.

The Project's estimated operational GHG emissions are presented in **Table 9**. The Project's net new GHG operational emissions in the year 2030 would be about 354 metric tons per year. About 80 percent of the GHG emitted by campus sources are associated with motor vehicle use. These emissions from all College motor vehicle sources are expected to decline by about 20 percent over the period of FMP implementation. Thus, even though the FMP would increase motor vehicle use by 2,758 trips per day, there would be a net decrease of about 785 metric tons of CO2e from all College motor vehicle sources because the fuel efficiency of the California fleet is increasing over time. This decrease would be offset by the growth of GHG emissions from stationary sources associated with 2012 FMP buildout, but the total net new GHG emissions in 2030 would be about 354 metric tons, which is substantially below the BAAQMD threshold of 1,100 metric tons and, thus, less than significant. This 354-metric-ton total increment calculated by CalEEMod is a worst-case estimate. Implementation of the *Las Positas College CAP* will reduce GHG emissions from stationary sources further from the about 1,143 metric tons estimated by CalEEMod and the resultant future GHG emissions from all campus sources will be even further below the 1,100 metric ton significance threshold.

TABLE 9: PROJECT GREENHOUSE GAS EMISSIONS

Operational Source of Greenhouse Gases	Las Positas College Baseline Emissions 2020 (metric tons/year)			
	CO_2	**CH_4**	**N_2O**	**CO_2e**
Area	0.0	0.00	0	0.0
Energy Use	1,765.4	0.06	0.02	1,773.6
Motor Vehicles	12,394.3	0.58	0	12,408.8
Solid Waste Transport/Disposal	127.4	7.53	0	315.5
Water Use	82.5	0.77	0.02	107.5
Annual Total	14,369.5	8.94	0.04	14,605.4
	Las Positas College Buildout Emissions under FMP 2030 (metric tons/year)			
	CO_2	**CH_4**	**N_2O**	**CO_2e**
Area	0.0	0.00	0	0.0
Energy Use	2,820.3	0.10	0.04	2,833.5
Motor Vehicles	11,609.7	0.42	0	11,620.1
Solid Waste Transport/Disposal	152.2	9.00	0	377.2
Water Use	98.6	0.93	0.02	128.5
Annual Total	14,680.9	10.44	0.06	14,959.2
	Las Positas College Net New Emissions with FMP 2030 (metric tons/year)			
	CO_2	**CH_4**	**N_2O**	**CO_2e**
Area	0.00	0.00	0.00	0.00
Energy Use	1054.88	0.04	0.01	1059.89
Motor Vehicles	-784.55	-0.16	0.00	-788.66
Solid Waste Transport/Disposal	24.88	1.47	0.00	61.65
Water Use	16.11	0.15	0.00	21.00
Net Annual Total	**311.33**	**1.49**	**0.02**	**353.88**
Significance Threshold				**1,100**
Significant Impact?				**No**

b) Would the project conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

The proposed 2012 FMP will be constructed consistent with the *Las Positas College CAP*, which is compatible with CALGreen, and the adopted CAP would promote and comply with the GHG reduction strategies of AB 32.

Mitigation Measures

None required.

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8. **HAZARDS AND HAZARDOUS MATERIALS.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 it create a significant hazard to the public or the environment?	☐	☐	☐	☒
e) 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, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☒	☐

Environmental Setting

The Las Positas College campus was opened in 1975. By 2012, eight new buildings were added, existing buildings renovated, new athletic fields and restrooms installed, infrastructure improvements addressing storm water management and energy efficiency constructed, a central utility plant and distribution system constructed, a maintenance and operations building constructed, a photovoltaic array field constructed, and parking lot improvements were completed.

The proposed 2012 FMP would construct six new buildings with five of the new buildings constructed at the sites of existing campus buildings and requiring demolition. Hazardous Building Materials Surveys and Environmental Site Assessments have not yet been completed for the five buildings proposed for demolition. Therefore, it is unknown if these buildings contain hazardous materials.

Las Positas College is located about 1.3 miles northeast of the Livermore Municipal Airport.

Impact Discussion

Operation of the Project would not emit hazardous emissions. Limited quantities of potentially hazardous materials may be used and stored in art and photography studios, and the viticulture building, but such materials would be limited to quantities allowed by the California Fire Code and is considered a less than significant impact. Las Positas College is within two miles of the Livermore Municipal Airport, however it does not represent a hazard based on the *Livermore Municipal Airport Land Use Compatibility Plan*. There is the potential that buildings proposed for demolition may contain hazardous building materials and soils may be impacted with hazardous substances, but with implementation of **Mitigation Measure HAZ-1** and **Mitigation Measure HAZ-2** potential impacts would be less than significant. A brief discussion of each environmental issue included under Section 8 is presented below.

a) Would the project create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

During Construction. Building demolitions would occur during each development phase identified in the 2012 FMP: Phase I one building would be demolished; Phase 2 one building would be demolished; and Phase 3 three buildings would be demolished. Some or all of the buildings proposed for demolition may contain asbestos-containing building materials (ACM), lead-containing building materials, loose & peeling lead containing paint, and/or polychlorinated biphenyl (PCB)-containing building materials. This represents a potentially significant impact. If found in any of the five buildings proposed for demolition, these materials would require removal in accordance with Federal, State, and local regulatory requirements prior to demolition. Transportation and disposal of the materials would be conducted in accordance with Federal and State waste disposal and transportation regulations. Dust from removal of ACM and lead based paint would also be controlled by performing the work under full containment and the effectiveness of the containment and other dust mitigation measures would be monitored in accordance with BAAQMD Dust Control measures. This is considered a potentially significant impact; however, with implementation of **Mitigation Measure HAZ-1**, potential impacts associated with hazardous building materials would be less than significant.

Buildout of the 2012 FMP will include grading and excavation, and potentially off-haul of soil during each development phase. A Phase I Environmental Site Assessment (ESA) in accordance with ASTM International and California Department of Toxic Substances Control (DTSC) regulations and standards will be necessary to identify the presence or likely presence of hazardous substances or materials based on historical or current site use. With implementation of **Mitigation Measure HAZ-2**, the potential impacts associated with potentially hazardous waste soil would be less than significant.

During Facilities Operations. Limited quantities of hazardous materials may be used and stored in art and photography studios, and the viticulture building. Potential hazardous materials storage would be limited to quantities allowed by the *California Fire Code* (State of California). The potential for Project-related emissions of hazardous materials is considered less than significant.

b) Would the project 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?

Project operations would not create significant hazards to the public or environment.

c) Would the project emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

There are no schools within one-quarter mile of the Las Positas College campus. The nearest school is Blossom Pre-School which is located about 2.7 miles northwest of the campus.

d) Would the project 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 it create a significant hazard to the public or the environment?

The Project site is not included on the DTSC's site cleanup list (as per Government Code Section 65962.5 (Department of Toxic Substance Control 2017)).

e) Would the project be 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, would the project result in a safety hazard for people residing or working in the project area?

The nearest airport is the Livermore Municipal Airport which generally serves regional aviation and is located about 1.3 miles southwest of the campus. The *Livermore Municipal Airport Land Use Compatibility Plan* does not identify the Las Positas College campus as within a safety hazard area (Alameda County 2012). Potential safety hazard impacts are less than significant.

f) Would the project be within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

The Project site is not located within two miles of a private airstrip.

g) Would the project impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

The *Las Positas College Emergency Preparedness Plan* (Chabot Las Positas Community College District) will be updated to incorporate the 2012 FMP.

h) Would the project expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

According to the Association of Bay Area Governments *Wildland-Urban Interface Threat Map*, the campus is not located within a Wildland Urban Interface Fire Threat Zone (Association of Bay Area Governments).

Mitigation Measures

HAZ-1 Prior to the demolition of the ten buildings identified in the 2012 FMP, a Hazardous Materials Building Survey of these shall be prepared. The Hazardous Materials Building Survey shall include identification of suspect asbestos-containing building materials, lead-containing building materials, loose & peeling lead containing paint, mercury light tubes, mercury thermostat switches, and polychlorinated biphenyl (PCB)-light ballasts, and PCB-containing building materials that may be impacted during the demolition of the five buildings. If the inspection confirms the presence of asbestos-contain materials (ACMs) or other hazardous building materials in any of the building, the hazardous materials shall be removed from these buildings prior to demolition and be transported in compliance with State and federal requirements.

HAZ-2 Prior to the initiation of grading and excavation activities, a Phase I Environmental Site Assessment (Phase I ESA) for the subject property shall be prepared in accordance with the American Society for Testing and Materials *Standard Practice for Environmental Site Assessments: Phase I Site Assessment Process* E 1527-13 and the United States Environmental Protection Agency (US EPA) 40 CFR Part 312 *Standards and Practices for All Appropriate Inquiries (AAI) – Final Rule* adopted November 1, 2006 and amended December 30, 2013.

References

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9. HYDROLOGY AND WATER QUALITY. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 (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?)	☐	☐	☒	☐

9. HYDROLOGY AND WATER QUALITY (cont.)	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 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 as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒

Environmental Setting

Las Positas College is located within the Alameda Creek watershed. More specifically, the campus is located in the Collier Creek sub-basin of the Livermore Drainage Unit. Collier Creek, which conveys water during the rainy season, flows along the outside of the southwestern boundary of the Las Positas College campus. An unnamed intermittent creek is located just outside the western and northwestern property boundary and is a tributary to Collier Creek. An ephemeral drainage is located within the campus along the eastern property boundary, and is a tributary to Arroyo Las Positas. Collier Creek also connects to Arroyo Las Positas, which flows approximately nine miles to the west, parallel to Interstate 580, until it discharges into Arroyo Mocho. The confluence of Arroyo Mocho and Arroyo de la Laguna is just east of Interstate 680 in Pleasanton. Ultimately, runoff from the campus drains into San Francisco Bay through Alameda Creek.

Annual precipitation for the Livermore area ranges from 12 to 22 inches. Most of the rain falls between November and April and typically, all precipitation occurs in the form of rain (Zone 7 Water Agency 2017a).

Most of the flood control channels in the Project area and directly downstream are operated and maintained by Zone 7 of the Alameda County Flood Control and Water Conservation District (Zone 7) or by the City of Livermore. Zone 7 has initiated the development of a *Stream Management Master Plan* (SMMP) (Zone 7 Water Agency 2017b); the Las Positas College campus is located within the Reach 5 area as designated by Zone 7's SMMP. Reach 5 is located in the City of Livermore north of the Chain of Lakes area and includes Arroyo Las Positas from its confluence with Cayetano Creek to its confluence with Arroyo Mocho. Several smaller drainages are also within Reach 5: Cayetano Creek (Line N), Collier Creek (Line M) and Cottonwood Creek (Line L). Arroyo Las Positas runs through Las Positas Golf Course in this reach. The SMMP creates a flood-protection program to detain stormwater in the Chain of Lakes, which are a series of mined-out gravel pits between Livermore and Pleasanton (Zone 7 Water Agency 2017b). The SMMP has identified the following projects to improve flood control in Reach 5: Trail System North of I-580, Airway Improvement Project, and Arroyo Las Positas Diversion Project (Zone 7 Water Agency 2017a).

The elevation at Las Positas College ranges from about 440 feet above mean sea level (msl) at the western entrance to the campus to about 568 feet above msl east of the Campus Loop. Slopes are mostly about 3:1 horizontal to vertical or shallower, except for undeveloped slopes in the far eastern portion of the campus adjacent to the track complex and solar array field, which are 2.5:1.

Stormwater runoff from the campus is collected in a system of storm drain pipes from three large drainage areas. Area 1 in the northwestern portion of the campus drains to various stormwater mitigation facilities with five outfalls to Collier Creek. Area 2 in the southern portion of the campus drains to either a storage pipe system or underground vault to reduce stormwater flow rate prior to discharging into a 30-inch outfall south of Campus Loop. Runoff from Area 3, which encompasses part of the track complex, undeveloped lands and the solar array in the eastern portion of the campus, is collected in a separate storm drain system from the campus and discharges into the seasonal drainage along the eastern site boundary (Sandis 2012).

Approximately 34 percent of the campus is covered in impervious surfaces, such as buildings, roads, parking lots, amphitheater, and a pool. The five and a half-acre solar array field has a gravel base and is assumed to be pervious. Pervious areas are the soccer field, track field, recreational fields, landscaped areas, and undeveloped lands (Sandis 2016).

The Las Positas College campus is located within the Livermore-Amador Valley Groundwater Basin. The California Department of Water Resources (DWR) and Zone 7 have mapped 13 individual groundwater sub-basins that are classified for planning purposes into two divisions: the central Main Basin and the surrounding Fringe Basins.

The Main Basin underlies the majority of the Livermore Valley and includes the Amador, Bernal, Mocho II, and Castle sub-basins. The Main Basin has high groundwater capacity in several sand and gravel aquifers, abundant well yields, and generally offers high groundwater quality (Chabot-Las Positas Community College District 2006). The Valley's Main Groundwater Basin meets approximately 25 percent of the region's annual demand. Zone 7 stores water in the groundwater basin, which can provide a reliable supply to Valley communities even during a prolonged drought. The agency currently uses several arroyos and will, in the future, use the Chain of Lakes to convey untreated water supplies and to recharge groundwater supplies (Zone 7 Water Agency 2017b).

The Fringe Basins have thinner sandy aquifers with less storage capacity, lower well yield, and poorer water quality than the Main Basin. Groundwater recharge is primarily a function of infiltrated rainfall and runoff. Where the County's soils are dominated by clay and surface runoff is greater, more groundwater recharge occurs from direct percolation beneath creeks and stream channels. Groundwater recharge is enhanced through the use of percolation ponds and releases from Lake Del Valle into Arroyo Valle.

Regulatory Setting

As part of Section 402 of the Clean Water Act (CWA), the U.S. EPA established regulations under the National Pollution Discharge Elimination System (NPDES) storm water program to control storm water discharges, including those associated with construction activities as well as on-going operation of facilities. The State Water Resource Control Board (SWRCB) implements the NPDES program in California.

The State NPDES storm water permitting program regulates storm water quality from construction sites. Dischargers whose projects disturb one or more acres of soil or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the State Construction General Permit (CGP) for Discharges of Storm Water Associated with Construction Activity (CGP Order 2009-0009-DWQ amended by 2010-0014-DWQ and 2012-0006-DWQ). The CGP requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP), which requires the use of appropriate best management practices (BMPs) for erosion control (e.g. gravel bags, silt fence, straw wattle, sediment basin, and soil stabilizers), spill prevention during construction (e.g. concrete waste management, material waste management, and good housekeeping practices), and permanent post-construction storm water management measures following construction. Site inspections with visual and chemical monitoring of pollutants and BMP maintenance are required, with penalties for non-compliance.

The CWA Section 402 also requires permits for municipal storm water discharges, which are regulated under the NPDES General Permit for Municipal Separate Storm Sewer Systems (MS4s). Regulated MS4s are required to reduce the discharge of pollutants from its MS4 to the maximum extent practicable (MEP) and to meet the water quality requirements of the Clean Water Act. EPA refers to these requirements collectively as "the MS4 permit standard." MS4 permits generally implement this standard through requirements to develop and implement storm water management programs (SWMPs) which include the following types of controls: public education and outreach, public participation and involvement, illicit discharge detection and elimination, construction site runoff control, post-construction runoff control, pollution prevention and good housekeeping. The permit may also include water quality-related requirements to address issues such as Total Maximum Daily Loads (TMDLs) and protecting designated uses such as swimming.

Under Phase I[4] of the NPDES program the Regional Water Quality Control Board (RWQCB) for the San Francisco Bay Region governs municipal storm drain systems (Order No. R2-2015-0049), including the storm drains in the City of Livermore. This permit defines requirements for new development and re-development in Section C.3 of the Municipal Regional Permit (MRP). The MRP requires post-construction controls to protect water quality for projects creating or replacing 10,000 square feet of impervious surface, or 5,000 square feet for projects, such as auto service facilities, with higher pollutant loads. Controls include treatment controls, source controls, site design, and hydromodification management. Treatment controls remove pollutants from storm water before it reaches the public storm water drains or creeks. The measures may include bio-retention areas, vegetated swales, harvesting and reuse, infiltration trenches, and evapotranspiration. Additional requirements for low impact development (LID) went into effect December 1, 2011. Source controls, such as enclosed trash areas and covered car wash areas that are connected to the sanitary sewer system keep pollution away from storm water drains. Site design features may include reducing impervious areas, increasing landscaped areas between impervious areas to treat storm water. Hydromodification management ensures that after development is completed operational runoff flow durations (volume and rate) match those of pre-project runoff (Alameda Countywide Clean Water Program 2011).

Community college districts were listed as small non-traditional MS4s under the 2003 Phase II[5] General Permit (WQO No. 2003 – 0005 – DWQ, Attachment 3). However, the permit was revised, effective July 1, 2013 (WQO No. 2013-0001 DWQ), and the list of non-traditional small MS4s no longer includes community college districts (Section XVII). The General Permit states that Regional Water Boards may continue to make case by case determinations of designation during the permit term by notification to the discharger and public review and comment. Although the District is not required to use the treatment controls, such as LID, which are included in the Phase II permit and C.3 of the MRP, these are successful methods to reduce stormwater runoff and improve water quality, and the District may use these techniques as described in the 2012 FMP and *Las Positas College Design Guidelines* (Chabot Las Positas Community College District 2006). It is noted that bio-retention basins and an underground vault that meet storm water quality requirements have already been installed on the Las Positas College campus.

The District has not adopted a comprehensive SWPPP for the entire Las Positas College campus, but has applied the MRP requirements with the buildout of the 2006 FMP on a project-by-project basis or for several projects at a time. The District evaluates how BMPs will address storm water quality and runoff volume in an efficient manner. Projects may share a BMP, such as expanding one of the existing underground chambers (Michael Kuykendall 2016 and 2017). The Las Positas College campus implements a campus-wide stormwater treatment and retention program with pervious pavement, flow-through planters, and bio-retention basins and swales. The campus also uses underground storage pipes and vaults to help reduce the stormwater flow rate before entering the storm drains and local creeks.

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[4] Phase I regulations were promulgated in 1990 to permit discharges from industrial sites (including construction sites that disturb five or more acres) and MS4s serving a population of 100,000 people or more.

[5] Phase II regulations were promulgated in 1999 to require permits for storm water discharges from small MS4s and from construction sites disturbing between one and five acres of land.

Application of the Bay Area Hydrology Model (BAHM)[6] to ensure that stormwater runoff leaving the Campus will not unacceptably increase due to the proposed new development. The 2012 FMP proposes storm water mitigation measures to meet C.3 requirements for master plan buildout. These measures include bio-retention facilities, green roof, flow-through planters, and pervious pavement (Sandis 2012).

While the Phase II General Permit does not apply to community colleges, the CGP does apply and includes post-construction standards for dischargers, such as community colleges, which are not covered under a MS4 permit (Fred Hetzel 2017; Christine Boschen 2017). These standards require the use of non-structural controls (e.g. porous pavement, vegetated swales, green roof, tree planting, rain barrels and cisterns) rather than structural controls (e.g. storm drain pipes, weirs, channel control structures) to the extent feasible to "replicate the pre-project water balance" (volume of runoff from rainfall). Dischargers should also implement BMPs to reduce pollutants in storm water after the completion of construction.

The *Las Positas College Design Guidelines* were prepared to provide a framework for future development that recognizes the needs of a growing campus. The guidelines recommend that all future development be designed sustainably in accordance with green building practices. In accordance with sustainability principles, the design guidelines include measures to address stormwater management, paving, and grading and drainage, as summarized below:

- Whenever possible, existing parking lots should be redesigned to incorporate bioswales to capture and treat runoff on-site. These swales should run in between rows of parked cars and be planted with species specifically chosen for their water filtration abilities. Future construction of parking lots shall comply with the above.
- Where possible, existing lots should be repaved with permeable surfaces to reduce stormwater runoff.
- Impervious surface shall be kept to a minimum, with planting areas breaking up large spans of impervious paving wherever possible.
- Grading plan to allow for drainage into infiltration and retention areas, as indicated in Technical Section 9.0.
- For parking lot projects, LEED standards state, "Use an open-grid pavement system (less than 50 percent impervious) for a minimum of 50 percent of the lot area," in order to earn Credit 7.1[7].
- Evaluate use of permeable paving with geotechincal engineer to develop solutions for stormwater management and pavement use.

[6] The BAHM is a tool for analyzing the potential hydrograph modification effects of land development projects and sizing structural solutions to mitigate the increased stormwater runoff from these projects. This software was developed for use in three counties in the San Francisco Bay Area: Alameda, San Mateo and Santa Clara.

[7] Credit 7.1 references U.S Green Building Council's Leadership in Energy and Design (LEED) standards to reduce heat islands to minimize impacts on microclimates and human and wildlife habitats. One option is to have an open grid pavement system. Projects pursuing LEED certification earn points, or credits, across several areas that address sustainability issues. Based on the number of points achieved, a project receives one of four LEED rating levels: Certified, Silver, Gold and Platinum (U.S. Green Building Council 2017).

- Drain surface runoff from vehicular paving into bioswales and biobasins. Incorporate stormwater detention in drainage systems.
- Slope bioswales and detention basins at one to two percent and include subsurface drainage.
- There should be no residual standing water for more than 48 hours in bioswales, in order to prevent the formation of mosquito larvae.
- Contractor shall provide Storm Water Pollution Prevention Program (including erosion control plans) for all projects.
- Avoid rainwater leaders and roof drains from daylighting directly onto walks, paving, or drainage inlets. Water should go into storm drains, planting areas or bioswaless/biobasins, while implementing necessary erosion control.
- Planting areas should self drain and and/or have sub-surface drainage.
- Use deeply rooted plant materials on slopes for erosion control and drought tolerance.
- Consider water features that utilize rain or runoff to display, direct, and celebrate water. Water features should be non-treated and non-mechanically dependent.
- Provide engineered base of rock or gravel for synthetic turf fields.
- The civil engineer shall provide sub-surface drainage and hydraulic calculations.

2012 FMP projects at the Las Positas College campus will be developed consistent with the applicable design guidelines.

Impact Discussion

Buildout of the 2012 FMP would not result in potential violations of water quality standards or waste discharge requirements. Project construction activities could result in temporary water quality impacts associated with soil erosion and chemicals (gasoline, diesel fuel, solvents, etc.), but with required compliance with the CGP for each construction project that disturbs over one acre and development and implementation of a SWPPP impacts from construction would be less than significant. The CGP also addresses post-construction storm water impacts and the 2012 FMP includes stormwater BMPs, such as bioretention facilities, green roof, flow-through planters, and pervious pavements. Buildout of the FMP would result in a net increase in impervious surfaces, which would result in a potential increase in runoff. The proposed Project would not adversely affect existing drainage patterns on or off campus. 2012 FMP buildout would not generate a significant increase in water demand that could not be served by existing water facilities, or require the use of groundwater, and bioretention/infiltration areas identified in the 2012 FMP, as well as measures described in the *Las Positas College Design Guidelines*, would capture storm water runoff associated with master plan buildout and would replenish local groundwater supplies.

A brief discussion of each environmental issue included under Section 9 is presented below.

a) Would the project violate any water quality standards or waste discharge requirements?

The proposed Project is not anticipated to violate any water quality standards or waste discharge requirements. Development of the Project would require disturbance of approximately five acres (three percent) of the campus land area in Phase 1 and another 23 acres (16 percent) with completion of Phases 2 and 3 and, therefore, would be subject to the requirements of the CGP. Over half of the disturbance area for buildout of the FMP, or 17 acres, would be developed for the athletic fields during Phase 2. The proposed Project includes demolition and renovation of existing campus buildings as well as construction of new buildings. Demolition and construction activities would include the use of gasoline and diesel-powered heavy equipment, such as bulldozers, excavators, dump trucks, backhoes, pick-up trucks and air compressors. Chemicals such as gasoline, diesel fuel, lubricating oil, hydraulic oil, lubricating grease, automatic transmission fluid, paints, solvents, glues, and other substances could be utilized during construction. An accidental release of any of these substances could degrade the water quality of surface water runoff from the site and add pollution into local waterways. On-site portable toilets could leak or tip over and spill, releasing sanitary waste, bacteria, solids, nutrients, and pathogens. During construction there would be a potential for surface water to carry sediment from on-site erosion and small quantities of pollutants into nearby drainages, such as Collier Creek and unnamed tributaries along the west and east boundaries. Soil erosion may occur along Project boundaries during construction in areas where temporary soil storage may be required. Small quantities of pollutants may enter the storm drainage system, potentially degrading water quality. The District or its contractors will prepare a SWPPP to address accidental releases of chemicals and other pollutants, therefore Project construction activities for each development phase would be less than significant.

Each 2012 FMP development phase (Phases 1 – 3) would result in an area of disturbance greater than one acre, therefore, the District or its contractors would be required to file a Notice of Intent with the RWQCB indicating compliance with the CGP and develop a SWPPP. Because the Project would be required to comply with the CGP and would develop SWPPPs prior to ground disturbance, the Project impact from construction-related activities on water quality would be less than significant.

Buildout of the 2012 FMP would result in a four-acre increase in the impervious surface area at the campus from approximately 50 acres to 54 acres, or an increase of about eight percent. The increased impervious area is primarily due to the addition of tennis courts and a parking lot in the open area in the eastern portion of the campus (Sandis 2016). Therefore, peak runoff flows, volumes, and durations would be similar to or slightly more than existing conditions. The 2012 FMP proposes storm water mitigation measures to meet C.3 requirements for 2012 FMP buildout. These measures include bio-retention facilities, green roof, flow-through planters, and pervious pavement (Sandis 2012). In addition, the campus design would adhere to the *Las Positas College Design Guidelines* which include a variety of measures to reduce stormwater, such as keeping impervious surfaces to a minimum and draining to bioswales and biobasins, as listed above in the Regulatory Setting. Therefore, there would be no significant impact related to waste discharge requirements.

Phase 2 of the FMP would include development of new athletic fields (baseball and softball fields) in the northeastern corner of the campus. The new athletic fields would most likely be artificial turf. Standard design for artificial turf is permeable and runoff is collected for transfer to drain outlets and ultimately the storm drain system. Artificial turf is totally porous and would not increase runoff from the site (SCVWD 2010). With artificial turf, fertilizers, herbicides, and pesticides would not be used. However, there are other water quality concerns associated with leachates from artificial turf. Water quality impacts of synthetic turf fields have been evaluated in a number of studies, including a detailed study in the Bay Area by the Santa Clara Valley Water District in June 2010 (SCVWD 2010). The study identified zinc as the only pollutant of concern from the artificial turfs to be detected at significant concentrations. Lowering the pH levels was shown to reduce zinc leachate by about 40 percent. Rock materials underlying artificial turf fields also lowered the zinc in runoff on receiving water ecosystems.

Another study concluded there is a potential risk to surface water and aquatic organisms associated with zinc toxicity of storm water runoff from artificial turf fields (Connecticut Department of Environmental Protection (DEP) 2010). Zinc concentrations in the storm water may cause exceedances of the acute aquatic toxicity criteria for receiving surface water. However, zinc concentrations in runoff from turf fields were similar to that which is found in urban runoff (e.g. higher than residential and open space, but lower than commercial and industrial) and no metal concentrations exceeded Environmental Protection Agency's or DEP's drinking water standards. There was no significant risk to groundwater protection criteria in the storm water runoff from artificial turf fields.

Based on the conclusions of the studies discussed above, the installation of artificial turf for the new athletic fields would not result in significant water quality impacts.

b) Would the project 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 (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?)

The Project would not substantially deplete groundwater supplies or interfere substantially with groundwater recharge that would result in a net deficit in aquifer volume or a lowering of the local groundwater table.

Groundwater has been observed at 30 feet below ground surface or deeper at the campus. In areas adjacent to local recharge sources like creeks, springs, and other surface water bodies, groundwater depth is shallower (Chabot-Las Positas Community College District 2006a).

Construction activities may temporarily affect groundwater levels if dewatering is necessary. Any groundwater impact from dewatering would be temporary and minor, and is considered less than significant.

With buildout of the 2012 FMP, there would be an eight percent increase in impervious surfaces at the campus. The resulting increase in impervious surfaces could result in a slight decrease in recharge to groundwater. Recommended bioretention/infiltration areas identified in the 2012 FMP would capture storm water runoff associated with buildout and would replenish local groundwater supplies. Compliance with the CGP and implementation and monitoring of BMPs (such as measures to manage chemicals and waste during construction, routine maintenance of equipment to prevent leaks, and cleanup of spills on dirt areas by digging up and properly disposing of affected soil) would protect groundwater. Therefore, Project-related impacts on groundwater supplies would be less than significant.

The Las Positas College campus is served by three separate water systems: domestic water, reclaimed fire water, and reclaimed irrigation. The campus is served with water by the City of Livermore, which purchases water from the Zone 7 Water Agency. Project buildout would not generate a significant increase in water demand that could not be served by existing water facilities, or adversely affect groundwater recharge (City of Livermore 2017).

c) Would the project 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 proposed Project would not substantially alter existing drainage patterns on or off-site but could result in erosion or siltation off-site due to construction activities. Stormwater runoff from the campus is collected in a system of storm drain pipes from three large drainage areas that discharge into to Collier to the west and an unnamed drainage to the west. No drainage problems with regard to flooding or backages within the storm drain system have been reported. During annual maintenance, debris is removed from inlets and structures (Sandis 2012).

Project construction would entail demolition of buildings and pavement, re-grading and associated earthwork, including minor excavation, and construction of new buildings and pavement. This could temporarily affect the quality of runoff and result in potential pollution of Collier Creek, the unnamed drainage to the east and waterways to which they connect. Standard erosion control measures would be included in site grading and construction activities as specified in the SWPPP that will be prepared for the Project. Temporary impacts to the creeks (soil erosion, siltation/sedimentation) associated with construction activities would be less than significant.

Buildout of the 2012 FMP would result in modifications to the existing site surface and result in minor changes to on-site drainage patterns. There are no water courses on the campus that would be affected by the buildout of the 2012 FMP and the Project would not result in the alteration of the course of a stream or river. Project development activities are approximately 300 feet from the unnamed intermittent tributary to Collier Creek and 500 feet from Collier Creek and are within previously developed areas. There are also no Project activities proposed for the unnamed ephemeral drainage on the east side of the campus, and the drainage is separated from proposed development by a berm that would prevent soil or other materials from entering the creek. Therefore, significant adverse alterations to existing drainage patterns in the surrounding area are not expected.

d) Would the project substantially alter the existing drainage pattern of the site 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?

Project development would result in minor alterations to existing on-site drainage patterns through proposed grading and drainage improvements (see **Subsection**s **9a** and **9c** above) and would not result in a significant increase in surface runoff. The campus is relatively flat and most of the area proposed to be developed would be within areas already occupied by buildings or paved areas. All of the storm water runoff would be retained in bioretention/infiltration areas on-site (Sandis 2012). Because the Project would not increase runoff and because the bioretention/infiltration areas would be included in Project design, runoff that may have previously entered storm drains would be retained on-site, and no flooding is expected on- or off-site. No streams or rivers would be altered. Impacts would be less than significant and no mitigation is required.

e) Would the project 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?

The proposed Project would not result in an increase in off-site storm water runoff. Project construction would result in minor alterations to existing drainage patterns due to grading. The quality of campus runoff may be temporarily affected by site construction activities. The long-term rate and volume of surface water runoff at the campus would remain the same or be slightly increased by the Project due to the minor increase (four acres) in impervious surfaces. Proposed bioretention/infiltration areas and other stormwater retention and treatment methods would help reduce the stormwater flow rate before entering the storm drain campus mains as well as treat the water before it enters adjacent creeks (see above discussion under **Subsection 9a and 9d**).

Construction-Period Impacts. Project grading and excavation would temporarily disturb surface soils. Vegetation may be removed. During the construction period, grading and excavation activities would result in exposure of soil to runoff, potentially causing erosion and entrainment of sediment in the runoff. Soil stockpiles and excavated areas on the campus would be exposed to runoff and, if not managed properly, the runoff could cause erosion and increased sedimentation in water courses away from the campus. The accumulation of sediment could result in blockage of flows, potentially resulting in increased localized ponding or flooding. There is the potential for chemical releases during construction activity. Once released, substances such as fuels, oils, paints, and solvents could be transported to nearby surface waterways and/or groundwater in storm water runoff, wash water, and dust control water, potentially reducing the quality of the receiving waters, which is considered a potentially significant impact. Compliance with the CGP and development and implementation of a SWPPP would address construction-period impacts, and therefore, water quality impacts would be less than significant.

Post-Construction Operation-Period Impacts. The proposed Project would result in an increase in impervious surfaces of approximately four acres. The existing bioretention/infiltration areas would slow and filter runoff flows. Peak runoff flows, volumes, and durations would be similar to or slightly less than existing conditions. Any need for additional means to slow and filter runoff would be assessed on a project-by-project or multi-project basis, such as those described in the 2012 FMP and the design guidelines for the campus. The Project would not adversely affect capacity in the municipal storm drain system. Therefore, there would be no impact from operation of the proposed Project on the capacity of storm drains and there would be no additional polluted runoff.

f) Would the project otherwise substantially degrade water quality?

As discussed in **Subsections 9a**, **9c** and **9e**, the overall water quality of the local receiving waters could be adversely affected during Project construction activities. Impacts would be less than significant.

g) Would the project 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?

There is no housing proposed on the Project site.

h) Would the project place within a 100-year flood hazard area structures which would impede or redirect flood flows?

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) to provide flood insurance to communities complying with FEMA regulations that limit development in floodplains. FEMA issues flood insurance rate maps for communities participating in the NFIP. These maps delineate flood hazard zones for each project site. Executive Order 11988 (Floodplain Management) addresses floodplain issues related to public safety, conservation, and economics. It requires:

- Avoidance of incompatible floodplain development;
- Consistency with the standards and criteria of the NFIP; and
- Restoration and preservation of natural and beneficial floodplain values.

The Las Positas College campus is located outside any designated flood zone. Along the northeastern boundary of the campus, the flood zone for a tributary to Collier Creek is bounded by Zone AE on the FEMA Flood Insurance Rate Map (FIRM), which has one percent annual chance of flood (100-year flood) (FEMA 2009). Approximately one mile to the south of the campus just before the confluence of Collier Creek and Arroyo Las Positas is a 500-foot-wide floodway area (at its widest segment) with a one percent annual chance of flood (FEMA 2009). The proposed Project does not place buildings in the 100-year flood area or adversely affect nearby flood areas.

i) Would the project 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?

The Project would not expose people or structures to a significant risk due to flooding. The Livermore-Amador Valley's flood-protection system begins at City-owned storm drains on local streets. Storm water flows through underground pipelines into creeks or man-made channels feeding into Arroyo Mocho, Arroyo las Positas, and Arroyo del Valle. These larger channels converge with Arroyo de la Laguna, which ultimately drains into San Francisco Bay through Alameda Creek. In addition to flood protection, the channels also have recreational benefits and protect natural habitat (Zone 7 Water Agency 2017b). Flooding is known to have occurred at the confluence of Arroyo Las Positas and Arroyo Mocho, which is approximately three miles downstream of the campus. Causes of flooding are primarily due to overflowing of streams due to lack of capacity. As described in the environmental setting, there are creeks surrounding most of the property boundaries, and Zone 7 has developed a SMMP to address flood protection and drainage as well as water quality and supply, and habitat restoration and recreation (Zone 7 Water Agency 2017b).

The campus is approximately 20 miles east of the San Francisco Bay shoreline and would be far from being inundated by sea level rise (National Oceanic and Atmospheric Administration 2016).

To help local jurisdictions develop evacuation plans for areas below dams, the State Office of Emergency Services and the Department of Water Resources have identified areas of potential inundation in the event of dam failures throughout California and have estimated when flood waters would arrive at downstream locations should a failure occur. Projected inundation limits are approximate and assume a severe hypothetical dam failure and resulting flooding. Inundation maps for Del Valle Dam indicate that land up to the approximate 500-foot elevation contour on both sides of Arroyo Valle could be flooded should Del Valle Dam fail. The Las Positas College campus is outside that contour and would not be inundated as a result of a failure of Del Valle Dam (Chabot Las Positas Community College District 2006). Based on a review of the Dam Failure Inundation Maps prepared by the Association of Bay Area Governments, the site is not located within an inundation area following an estimated catastrophic dam failure (Chabot Las Positas College 2014).

j) Would the project expose the site to inundation by seiche, tsunami, or mudflow?

The Las Positas College campus would not be exposed to inundation by seiche, tsunami or mudflow. A seiche is a standing-wave oscillation of the surface of water in an enclosed or semi-enclosed basin (such as a lake, bay, or harbor) that is initiated by landslides, earthquakes, or other geologic phenomena, and continues after cessation of the originating force. Seiches do not pose an appreciable risk because the Project site is not close to any major surface water bodies, and inundation risk is described below for tsunami.

A tsunami is a sea wave produced by any large scale, short duration disruption of the ocean floor, principally by a shallow submarine earthquake, but also by submarine earth movement, subsidence, or volcanic eruption. The campus is approximately 20 miles east of the San Francisco Bay shoreline and is not within a tsunami evacuation area as shown on the Tsunami Evacuation Planning Map for Alameda presented by the Association of Bay Area Governments (ABAG 2009). Based on the inland location of the site and considering that there are no large enclosed bodies of water nearby, the geotechnical report for the campus stated that "the potential for damage due to tsunamis or seiches is not a design consideration" (Chabot Las Positas Community College District 2014). It is unlikely that the campus would be inundated by a tsunami.

The terrain where construction would occur is relatively flat. Thus, there is low risk of landslide or mudflow impacting the campus (Chabot Las Positas College District 2014). The risk of inundation by seiche, tsunami or mudflow is insignificant because the campus is not within an inundation area and is not susceptible to hazards associated with hillside sites. Risks associated with inundation by seiche, tsunami, or mudflow would not occur beyond existing conditions. The risk of seiche, tsunami or mudflow at the Las Positas College campus is considered minimal.

Mitigation Measures

None required.

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10. LAND USE PLANNING. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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 plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

Environmental Setting

The Las Positas College campus was established in 1975 and comprises approximately 147 acres. The campus is surrounded by agricultural lands to the north-northwest and east; and residential and commercial lands to the west and south.

In 2006, the District approved the 2005 Las Positas College Facilities Master Plan (2005 FMP). In 2006, the District acquired the 400-acre Murray Ranch, located adjacent to the northern boundary of the campus, as an off-site mitigation area for impacts to state and federally listed species associated with buildout of the 2005 FMP and for future campus development projects. The District completed the improvements identified in the 2005 FMP MP) in 2012.

In response to future student enrollment projections and the need to upgrade facilities, the District prepared the *2012 Las Positas College Facilities Master Plan* (2012 FMP). With the passing of Measure A in June 2016, the District intends to move forward with implementation of the 2012 FMP.

Regulatory Setting

The District is not subject to local land use regulations, therefore the *City of Livermore General Plan* (City of Livermore 2004) and *Development and Municipal Codes* (2016) do not apply to the 2012 FMP.

The District planning documents for Las Positas College listed below identify the District's commitment to develop the Las Positas College campus in a responsible and sustainable manner.

2012 Facilities Master Plan Chabot Las Positas Community College District

The 2012 FMP for Las Positas College presents a plan for new facilities and renovation of existing facilities within the campus boundaries on the campus. The 2012 FMP reflects the need to upgrade existing campus facilities and construct new facilities in response to student enrollment projections to 2025.

Las Positas College Climate Action Plan 2010

The Las Positas College Climate Action Plan (CAP) outlines actions designed to move the campus towards carbon neutrality. Mitigation strategies outlined in the CAP cover five major areas: building and energy; transportation; waste and recycling; water; and research, education and community outreach.

Las Positas College Design Guidelines 2006

The design guidelines for Las Positas College provide a framework for future development on the campus. The design guidelines were developed based on the following principles: enhanced learning environment; a sustainable campus; campus core as relaxed, comfortable and beautiful; and campus as focal point of the local community.

Updated Habitat Mitigation and Management Plan Las Positas College 2005 Facilities Development Plan and 2012 Facilities Master Plan Murray Ranch Mitigation Site 2017

Proposed campus development identified in the 2012 FMP and the 2005 FMP will adversely affect federally listed wildlife species. Thus, as mitigation for the loss of habitat, a *Habitat Mitigation and Management Plan* (HMMP) was prepared (see **Section 4**, **Biological Resources**, of this Initial Study). As mitigation for loss of habitat due to the future buildout of the campus, the District acquired Murray Ranch, a 400-acre parcel of agricultural land contiguous with the north boundary of the Las Positas

College campus. The HMMP presents a monitoring and adaptive management program consistent with U.S. Fish and Wildlife Service (USFW) and California Department of Fish and Wildlife (CDFW).

Impact Discussion

The 2012 FMP would not physically divide an established community or conflict with local or regional plans. A brief discussion of each environmental issue included under Section 10 is presented below.

a) Would the project physically divide an established community?

The 2012 FMP addresses improvements to the existing Las Positas College campus all of which will occur within the current campus boundaries. Buildout of the 2012 FMP will not divide an established community.

b) Would the project 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 plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

The campus is located in the City of Livermore and is designated in the *City of Livermore General Plan* as a Public Use and is zoned Education and Institution (City of Livermore 2004).

Las Positas College is not subject to local land use and zoning regulations. However, the District has adopted plans and design guidelines for the campus consistent with sustainable planning principles.

c) Would the project conflict with any applicable habitat conservation plan or natural community conservation plan?

A *Habitat Mitigation and Management Plan* (HMMP) has been prepared for the campus to address impacts to wildlife habitat consistent with USFW and CDFW requirements. See **Section 4 Biological Resources**.

Mitigation Measures

None required.

References

City of Livermore. 2014. *City of Livermore General Plan 2003 – 2025*. Adopted February 9, 2004, amended December 2014. Available on the City website at: www.ci.livermore.ca.us/cd/planning/general.asp.

City of Livermore. 2016. Development and Municipal Codes. Current through Ordinance 2048 passed December 14, 2016. Available on the City website at: www.codepublishing.com/CA/Livermore/.

11. **MINERAL RESOURCES.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒

Environmental Setting

The Las Positas College campus is not identified in the *City of Livermore General Plan* as containing known mineral resources of value to the region or State (City of Livermore 2014).

Impact Discussion

The Project would not affect mineral resources. A brief discussion of each environmental issue included under Section 11 is presented below.

a) Would the project result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

There are no known mineral resources on the Las Positas College campus (City of Livermore 2014).

b) Would the project result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?

See **Subsection 11a** above.

Mitigation Measures

None required.

References

City of Livermore. 2014. *City of Livermore General Plan 2003 – 2025*. Adopted February 9, 2004, amended December 2014. Available on the City website at: www.ci.livermore.ca.us/cd/planning/general.asp.

12. **NOISE.** Would the project result in:	Potentially Significant Impact	Potentially Significant Impact Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan, specific plan, noise ordinance or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☒	☐	☐
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☒	☐	☐
e) 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, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒

Environmental Setting

Sound is created when vibrating objects produce pressure variations that move rapidly outward into the surrounding air. The more powerful the pressure variations, the louder the sound perceived by a listener. The decibel (dB) is the standard measure of loudness relative to the human threshold of perception. Noise is a sound or series of sounds that are intrusive, objectionable or disruptive to daily life. Many factors influence how a sound is perceived and whether it is considered disturbing to a listener; these include the physical characteristics of sound (e.g., loudness, pitch, duration, etc.) and other factors relating to the situation of the listener (e.g., the time of day when it occurs, the acuity of a listener's hearing, the activity of the listener during exposure, etc.). Environmental noise has many documented undesirable effects on human health and welfare, either psychological (e.g., annoyance and speech interference) or physiological (e.g., hearing impairment and sleep disturbance).

The Las Positas College campus was surveyed on a mid-week day (January 25, 2017) to observe influential on-/near-campus noise sources and to measure typical noise levels on campus and off, for the latter at nearby noise-sensitive areas potentially affected by College operation. The survey found that the sources contributing most characteristically to the College's on-campus ambient noise environment are those associated with the activities of its students, faculty, staff and visitors: conversation of people sitting/walking in campus outdoor spaces, sounds of sports activity in areas close to in-use outdoor athletic facilities, sounds from vehicles/machinery used for grounds-keeping and other maintenance work, etc. Campus Hill Drive is the College's main access route, which as the campus' main vehicular entrance connects with Campus Loop providing vehicle access around the campus perimeter. In areas of the campus adjacent to Campus Loop (residential and commercial development), the noise of motor vehicles using it are audible. But either acoustical shielding provided by College buildings or buffer zones provided by the peripheral parking lots protects most of the campus area from substantial noise intrusions from motor vehicles using the access roads. At quieter intervals during the survey, traffic noise from I-580, which is located about 0.57 mile south of the campus, was sometimes perceptible as a low hum. Livermore Municipal Airport, located approximately 1.3 miles southwest of the campus, across I-580.

During the survey, short-term (i.e., 15 minute duration) noise measurements were made at four locations on campus and at two locations off site. **Figure 7**, **Noise Measurement Locations Map**, shows locations where the sound measurements were taken. A summary of the measurement locations, noise level data taken and observations made during the survey is presented in **Table 10**.

TABLE 10: LAS POSITAS COLLEGE CAMPUS/VICINITY NOISE MEASUREMENT DATA (dBA) (WEEKDAY AFTERNOON – JANUARY 25, 2017)

Measurement Location	L_{min}	L_{90}	L_{eq}	L_{10}	L_{max}	Observations during Measurement Period
#1: Central campus plaza, south of Science Technology (1800) Begin 14:10	53.8	54.4	56.4	57.7	65.2	Students passing through/lingering in the plaza. Steady background sound from laboratory ventilation outlets on roof of Building 1800 produced L_{min}. Small plane flyover produced L_{max}.
#2: Campus plaza outside the Arts Center (4000) & Amphitheater Begin 14:30	43.4	44.5	48.9	50.9	60.4	Very light foot traffic and no students lingering/sitting in the plaza. Small plane flyover produced L_{max}.
#3: Area fronting bus stop/parking lots outside Administration (1600) Begin 14:54	46.8	49.0	58.5	61.9	74.2	Moderate foot traffic associated with campus arrivals/departures. Strongest influence from two bus arrivals/idling, also responsible for L_{max}.
#4: Between soccer field and swimming pool Begin 15:02	48.4	52.3	55.4	56.7	68.5	Swimming practice in progress had the primary influence on ambient levels. No activity on soccer field.
#5: Campus Loop south of Parking Lot C near residential. Begin 16:46	46.9	52.8	62.8	64.4	76.8	All due to motor vehicle traffic on Campus Loop.
#6: Campus Hill Drive south of campus entrance and near residential east end of Selby Lane. Begin 17:07	47.6	51.4	66.3	70.1	80.1	All due to motor vehicle traffic on Campus Hill Drive. L_{max} from one car moving downhill at high speed.

The **decibel (dB)** is the standard measure of a sound's loudness relative to the human threshold of perception. Decibels are said to be **A–weighted (dBA)** when corrections are made to a sound's frequency components during a measurement to reflect the known, varying sensitivity of the human ear to different frequencies. The **Equivalent Sound Level (L_{eq})** is a constant sound level that carries the same sound energy as the actual time–varying sound over the measurement period. **Statistical Sound Levels** – **L_{min}, L_{90}, L_{10} and L_{max}** – are the minimum sound level, the sound level exceeded 90 percent of the time, the sound level exceeded ten percent of the time and the maximum sound level, respectively; all as recorded during the full measurement periods, which for all cases above was 15 minutes.

Source: Geoffrey H. Hornek

Figure 7
Noise Measurement Locations Map

Regulatory Setting

Although the District is exempt from local land use regulations, the noise analysis applied the noise policies and standards identified in the *Noise Element of the City of Livermore General Plan* (amended 2013) and the *Livermore Municipal Code* (Chapter 9.36 Noise) because the noise-sensitive existing residential uses to the south and west of the campus could be affected by Project noise impacts.

The following noise control policies and standards of the *City of Livermore Noise Element* are relevant in assessing the potential for noise impacts from the Project.

Objective N-1.1 Establish appropriate noise levels, design standards, and noise reduction techniques for all areas to minimize the adverse effects of noise.

Policy P2: "*Noise analysis shall be measured in dBA CNEL or dBA L_{dn} as defined in this Element.*"[8]

Policy P4: *Review development proposals with respect to the Land Use Compatibility Guidelines for Exterior Noise in Table 9-7* [of the Noise Element]"

The following are excerpts of standards from the *Noise Element Land Use Compatibility Standards* for the noise-sensitive land use types occurring on/near the Las Positas College campus.

- **Residential Multifamily**
  Normally Acceptable: less than or equal to 65 dBA L_{dn}/CNEL
  Conditionally Acceptable: 60-70 dBA L_{dn}/CNEL
  Normally Unacceptable: 70-75 dBA L_{dn}/CNEL
  Clearly Unacceptable: greater than 75 dBA L_{dn}/CNEL

- **Schools**
  Normally Acceptable: less than or equal to 70 dBA L_{dn}/CNEL
  Conditionally Acceptable: 60-70 dBA L_{dn}/CNEL
  Normally Unacceptable: 70-80 dBA L_{dn}/CNEL
  Clearly Unacceptable: greater than 80 dBA L_{dn}/CNEL

Objective N-1.2 Adopt design standards and identify effective noise attenuation programs.

Policy P5: "*During all phases of construction, the City shall take measures to minimize the exposure of neighboring properties to excessive noise levels from construction-related activity to prevent noise or reduce noise to acceptable levels.*"

According to the **Livermore Municipal Code** (Section 9.36.080 Hammers, pile drivers, pneumatic tools and similar equipment) shall be limited

> *"The operation between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday or at all on city-observed holidays of any pile driver, pneumatic tools, derrick, electric hoist, sandblaster or other equipment used in construction, demolition or other repair work, the use of which is attended by loud or unusual noise, is prohibited."*

[8] The **Day–Night Average Sound Level** (L_{dn}) is a 24–hour average, A–weighted L_{eq} with a 10–decibel penalty added to sound levels occurring at night between 10:00 p.m. and 7:00 a.m. **The Community Noise Equivalent Sound Level** (CNEL) is an L_{dn} with an additional 5–decibel penalty added to sound levels occurring in the evening between 7:00 p.m. and 11:00 p.m.

Impact Discussion

During Project construction activities, noise levels on most of the Las Positas College campus and in most of the adjacent residential areas south and west of the campus will remain well within acceptable limits for school and residential uses under the *Livermore Noise Element Land Use Compatibility Guidelines*. During Project construction activities, noise levels in on-campus areas adjacent to the construction sites would temporarily increase with potential adverse noise and vibration impacts on instruction/research/work activities. With implementation of **Mitigation Measure NOISE-1**, residual construction noise impacts would be reduced to the maximum feasible extent and would be a less than significant noise impact. With implementation of **Mitigation Measure NOISE-2**, potential adverse vibration impacts would be less than significant. Substantial Project-related operational stationary source and traffic noise impacts are not expected to adversely affect existing residential areas south and west of campus. A brief discussion of each environmental issue included under Section 12 is presented below.

a) Would the project expose persons to or generate noise levels in excess of standards established in the local general plan, specific plan, noise ordinance or applicable standards of other agencies?

Schools and residential neighborhoods function best in low-noise environments. According to the *Noise Element* noise exposure map (City of Livermore 2013), noise levels on the Las Positas College campus and in the residential areas south and west of the campus are in the Normally Acceptable range (i.e., less than 65 dBA L_{dn}) now and are expected to remain so at least until the year 2030. Short-term noise measurements taken during the Project site survey found peak commute daytime noise levels close to Campus Hill Drive and Loop Road in the mid to low 60's dBA, which would correspond to L_{dn} levels in the low 60s dBA close to roadside.[9] The residential area south of the campus is protected from traffic noise intrusion by sound walls along their north boundary (Campus Loop) and by additional setbacks from the roadside along the east boundary (Campus Hill Drive). Campus buildings are protected from traffic noise intrusion by the wide parking lots along the southern campus boundary. Noise increments from Project sources (i.e., construction, motor vehicle traffic, HVAC equipment on the new campus buildings, and outdoor campus activities) would not be great enough to shift overall noise exposure to unacceptable levels under *Noise Element* standards, as discussed in **Subsections 12c – 12d** below. Thus, post-Project noise levels at on-campus sensitive receptors and at the nearest residential uses would be within established standards and less than significant.

b) Would the project expose persons to or generate excessive ground-borne vibration or ground-borne noise levels?

There are no recommended vibration assessment methodologies, impact standards or reduction strategies in the *Noise Element*. Standards developed by the Federal Transit Administration (FTA) (2006) are the ones most commonly applied and were used in assessing vibration impacts. According to the FTA, limiting vibration levels to 94 vibration decibels (VdB - the common measure of vibration

[9] According to Federal Transit Administration (FTA) guidelines for estimating L_{dn} from short-term noise measurements (FTA 2006, Appendix D), L_{dn} is usually two dBA less than the daytime peak hourly L_{eq}.

magnitude, similar to the dB for noise) or less would avoid structural damage to wood and masonry buildings (which are typical of most residential structures), while limiting vibration levels to 80 VdB or less at residential locations would avoid significant annoyance to the occupants.

The most vibration-intensive piece of construction equipment is a pile driver; other types of construction equipment are far less vibration-intensive. Yet all construction equipment has the potential for causing structural damage and/or annoyance if the construction activity is too close to vibration-sensitive receptors. The closest residential area south of campus is 400 feet or more from any of the sites proposed for new buildings identified in the 2012 FMP and according to FTA vibration screening methodology would be outside the range where there would be a potential for on-going annoyance or structural damage from Project construction vibration. Thus, the Project's construction vibration impact severity on off-campus receptors would be less than significant.

This would not be the case for on-campus vibration sensitive receptors. Construction of the new buildings would take place near vibration sensitive receptors (classrooms, offices, library). This could cause significant disruption to sensitive receptors and is considered a potentially significant impact; however, with implementation of **Mitigation Measure NOISE-2**, impacts would be less than significant.

c) Would the project cause a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

The only Project noise source that could permanently change the noise exposure circumstance of nearby off-campus sensitive uses is the Project-related motor vehicle traffic added to local roadways. The FTA has the most authoritative criteria for what constitute substantial permanent traffic noise increments, as shown in **Table 11**. For noise sensitive receptors in the vicinity of the campus; i.e. residential development to the south and west of the campus, Project-induced L_{dn} increments for the residences fronting on Campus Loop and Campus Hill Drive would have to be two dBA or greater to be considered significant.

TABLE 11: FTA INCREMENTAL TRANSPORTATION SOURCE NOISE IMPACT CRITERIA (dBA)

Residential and other buildings where people normally sleep[1]		Institutional land uses with primarily daytime and evening uses[2]	
Existing L_{dn}	**Allowable Noise Increment**	**Existing Peak Hour L_{eq}**	**Allowable Noise Increment**
50	5	50	9
55	3	55	6
60	2	60	5
65	1	65	3
70	1	70	3

Notes:
1 This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
2 This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material.

Source: Federal Transit Administration, *Transit Noise Impact and Vibration Assessment*, May 2006.

Future motor vehicle PM peak hour traffic volumes would increase by about 30 percent on Campus Hill Drive and Campus Loop (see **Section 16**, **Transportation and Traffic**). According to FTA traffic noise modeling methodology; these volume increases would increase roadside traffic noise by about one decibel. The FTA significance criteria for traffic noise increases for residential receptors currently exposed to noise levels at or below 60 dBA L_{dn} is two dBA or more. Thus, Project-related motor vehicle noise levels along Campus Hill Drive and Campus Loop would increase, but not significantly under FTA criteria.

2012 FMP implementation would include the construction of six buildings on campus with heating, ventilation and air conditioning (HVAC) equipment[10] and result in an increase in the campus population, both of which are noise sources. Noise from both existing HVAC equipment and from outdoor activities were observed and measured during the site survey. Operating ventilation ducts on the roof of the Science and Technology Center (Building 1800) produced noise levels in the adjacent plaza in the mid-50s dBA. Noise from outdoor student activities averaged at about this level and sometimes higher. Noise from HVAC and student activities was never noticed/measured on-campus at levels that seemed to interfere with the compatibility of the campus as a learning environment. During the off-campus stages of the survey, noise from on-campus HVAC equipment or student outdoor activities was not noticeable at all. Noise impacts from HVAC equipment and student population added by FMP implementation would be less than significant.

d) Would the project cause a substantial temporary or periodic increase in ambient noise levels?

Construction equipment/activity is widely recognized as a major noise source and for its potential to cause substantial disturbance when a construction site is located near noise-sensitive receptors (e.g., residential areas, schools, hospitals/nursing homes, public parks, etc.). Buildout of the 2012 FMP will require a substantial fleet of construction equipment and supply delivery trucks operating over an extended period. Construction of all the proposed improvements will happen sequentially over at least a ten-year period, not simultaneously, thus limiting the areas exposed to elevated noise levels at any given time. Also, the existing campus buildings will shield more distant on-campus receptors from construction noise and the wide parking lots along the campus' southern border will attenuate construction noise reaching the residential areas south of campus.

The Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM) was used to estimate the noise levels at various distances from the locus of work produced by a small working group of construction equipment (i.e., a dump truck, a backhoe and a crane) likely to be used for construction of the Project buildings, as shown in **Table 12**.[11]

[10] It is noted that of the six new buildings proposed in the 2012 FMP, five of the new buildings will replace existing buildings on campus.

[11] All pieces of equipment operating at any one time during the construction of a particular project component will not have comparable noise impacts at any one place. The noise impact of the closest piece of equipment to a receptor is dominant and only a limited number of additional equipment can operate effectively in close proximity to the closest piece. The FTA recommends that construction noise impacts be estimated using a 2-3 piece working group of equipment characteristic of a particular project's construction type or phase.

TABLE 12: MODELED CONSTRUCTION NOISE LEVELS

Distance from Area of Construction Activity (feet)	Average Construction Daytime Noise Level L_{eq} (dBA)	Maximum Construction Daytime Noise Level Lmax (dBA)
50	82	85
100	76	79
200	70	73
400	64	67
800	58	61

Source: Federal Highway Administration, Roadway Construction Noise Model (RCNM).

During construction of each Project component, noise levels close to construction activity (i.e., within about 200 feet) would rise to levels incompatible with leisure activities in outdoor areas and possibly to interference with instruction, study and work in indoor spaces. However, since the campus is large and densely built-up (i.e., building would block noise propagation), noise levels in large outdoor areas of the campus would remain acceptable for many leisure and recreational activities during construction.

The nearest off-campus sensitive receptor to Project construction sites is existing residential development south of Campus Loop. At this distance, worst case Project construction noise levels (i.e., when work is in progress on the proposed Academic Building 100 and Academic Building 300) would reach the mid-60s dBA. At this level, construction noise could disrupt the ability for relaxed conversation and the tranquility of receptors in the outdoor areas of the residences. Residents inside their homes could be protected from such adverse impacts by closing windows and doors facing the College at times when noise from construction activity is judged disruptive.

Noise Element Policy 5 specifies imposition of measures to reduce project construction noise impacts to the maximum feasible extent. **Mitigation Measure NOISE-1** would provide maximum feasible noise reduction.

e) 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, would the project expose people residing or working in the project area to excessive noise levels?

The Las Positas College campus site is about 1.3 miles northeast of the Livermore Municipal Airport. Noise contour maps in the *Noise Element* show that aircraft operation noise at the campus is less than 55 dBA L_{dn}, which supports the observation during the noise survey that aircraft noise has a minimal impact at the campus. Aircraft noise impacts are less than significant.

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

The proposed Project site is not located in the vicinity of a private airstrip.

Mitigation Measures

NOISE-1 The following Best Management Practices shall be incorporated into the Project construction documents:

- Provide enclosures and noise mufflers for stationary equipment, shrouding or shielding for impact tools, and barriers around particularly noisy activity areas on the site.
- Use quietest type of construction equipment whenever possible, particularly air compressors.
- Provide sound-control devices on equipment no less effective than those provided by the manufacturer.
- Locate stationary equipment, material stockpiles, and vehicle staging areas as far as practicable from sensitive receptors.
- Prohibit unnecessary idling of internal combustion engines.
- Require applicable construction-related vehicles and equipment to use designated truck routes when entering/leaving the site.
- Designate a noise (and vibration) disturbance coordinator at the CLPCCD who shall be responsible for responding to complaints about noise (and vibration) during construction. The telephone number of the noise disturbance coordinator shall be conspicuously posted at the construction site. Copies of the project purpose, description and construction schedule shall also be distributed to the surrounding residences.
- Prohibit project construction activity between the hours of 6:00 p.m. Saturday to 7:00 a.m. Monday; 8:00 p.m. to 7:00 a.m. on Monday, Tuesday, Wednesday and Thursdays; 8:00 p.m. Friday to 9:00 a.m. on Saturday or at all on city-observed holidays.

NOISE-2 To the extent feasible, in instances where vibration-intensive construction equipment is located next to on-campus vibration-sensitive receptors that would result in major disruption, the District shall temporarily re-locate the vibration-sensitive receptors to minimize disruption.

References

City of Livermore. *City of Livermore General Plan 2003-202, Noise Element*. http://www.cityoflivermore.net/citygov/cd/planning/general.asp

FTA (Federal Transit Administration). 2006. *Transit Noise and Vibration Impact Assessment*. http://www.fta.dot.gov/documents/FTA_Noise_and_Vibration_Manual.pdf

FHWA (Federal Highway Administration). 2006. *Roadway Construction Noise Model User's Guide*. https://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/rcnm.pdf

13. **POPULATION AND HOUSING.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and business) or indirectly (for example, through extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒

Environmental Setting

Las Positas College serves the Livermore Valley residents. The District projects that by 2025, College enrollment will be 10,375 students, an increase of 2,093 students over the existing student enrollment in 2016.

Impact Discussion

The 2012 FMP is proposed in response to projected increases in the Livermore Valley population. The proposed Project would not affect existing housing or the need for new housing. A brief discussion of each environmental issue included under Section 13 is presented below.

a. Would the project induce substantial population growth in an area, either directly (for example, by proposing new homes and business) or indirectly (for example, through extension of roads or other infrastructure)?

The 2012 FMP will not induce population growth, it is, in part, a response to the projected population growth in the Livermore Valley.

b) Would the project displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?

The 2012 FMP will not affect any existing housing. There are no housing units on the Las Positas College campus.

c) Would the project displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?

The 2012 FMP will not displace any persons.

Mitigation Measures

None required.

14. **PUBLIC SERVICES.** Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, 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:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Fire protection?	☐	☐	☒	☐
b) Police protection?	☐	☐	☒	☐
c) Schools?	☐	☐	☐	☒
d) Parks?	☐	☐	☐	☒
e) Other public facilities?	☐	☐	☐	☒

Environmental Setting

Police protection services are provided by the Livermore Police Department. The campus is located in the Department's Northwest Area Command. The College's Campus Safety and Security staff provide safety and security services on campus. While not sworn officers, the campus safety officers have authority to make arrests on campus for any misdemeanor or felony within their presence; and can issue citations for violations of District parking regulations. Campus Safety and Security is located in Building 1700.

Fire protection services are provided by the Livermore-Pleasanton Fire Department. The nearest fire station is Station #10 located south of the campus at 330 Airway Boulevard. Las Positas College's *Emergency Preparedness Handbook* (Las Positas College) includes procedures to implement in the event there is a fire on campus.

The City of Livermore provides water, wastewater and storm drain systems services to the Las Positas College campus (City of Livermore. 2014). Flood control and stream management is the responsibility of Zone 7 Water Agency.

Impact Discussion

The 2012 FMP addresses the projected increases in student enrollment of 2,093 by 2025 based on population projections for the Livermore Valley. The increase in student population on the Las Positas College would not adversely affect public services. A brief discussion of each environmental issue included under Section 14 is presented below.

a) Fire protection?

As required by the Division of the State Architect, which has jurisdiction over school construction, the proposed buildings will be in compliance with current State fire code requirements. The College will update the *Emergency Preparedness Handbook* to add the new buildings and other facilities. Buildout of the 2012 FMP would not adversely affect the ability of the Livermore-Pleasanton Fire Department to protect the campus.

b) Police protection?

Campus Safety and Security will continue to provide first response for safety and security needs on the Las Positas College campus. As needed, the College will add campus safety officers in response to increasing student population on the campus. Buildout of the 2012 FMP would not adversely affect the ability of the Livermore Police Department to protect the campus.

c) Schools?

The 2012 FMP would not adversely affect Livermore K-12 schools.

d) Parks?

Buildout of the 2012 FMP would not adversely affect nearby public parks. Recreational facilities on campus include the Aquatic Center, Physical Education Complex, soccer field, track, native plant trail and landscaped outdoor seating areas and pathways. The 2012 FMP includes two ball fields and tennis courts. There are more than adequate recreation facilities on campus to serve students, faculty and staff.

e) Other public facilities?

Buildout of the 2012 FMP would not adversely affect other public facilities.

Mitigation Measures

None required.

References

Las Positas College. *Emergency Preparedness Handbook*. Available on the Las Positas College website at: www.laspositascollege.edu/safety/documents/EmergencyResponseHandbookLPC.pdf.

City of Livermore. 2014. *City of Livermore General Plan 2003-2025, Chapter 7 Infrastructure and Public Services Element*. Adopted February 9, 2004, amended December 2014. Available on the City website at: www.ci.livermore.ca.us/cd/planning/generalasp.

15. **RECREATION.** Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☒	☐
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	☐	☐	☒	☐

Environmental Setting

The Las Positas College campus offers a range of recreational and open space facilities to serve students, faculty and staff.

Impact Discussion

Buildout of the 2012 FMP would not adversely affect neighborhood or regional parks. A brief discussion of each environmental issue included under Section 15 is presented below.

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Buildout of the 2012 FMP would not significantly increase the use of existing and regional parks nor cause substantial physical deterioration of these facilities. See **Section Public Services 14d Parks** above.

b) Would the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?

Existing recreational facilities are currently provided on the Las Positas College campus; and the 2012 FMP includes construction of two ball fields and tennis courts. See **Section Public Services 14d Parks** above.

Mitigation Measures

None required.

	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
16. TRANSPORTATION/CIRCULATION. Would the proposal result in:				
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 non-motorized 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 county 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?	☐	☐	☐	☒

16. TRANSPORTATION/CIRCULATION (cont.)	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
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?	☐	☐	☐	☒
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?	☐	☐	☐	☒

Environmental Setting

Overview

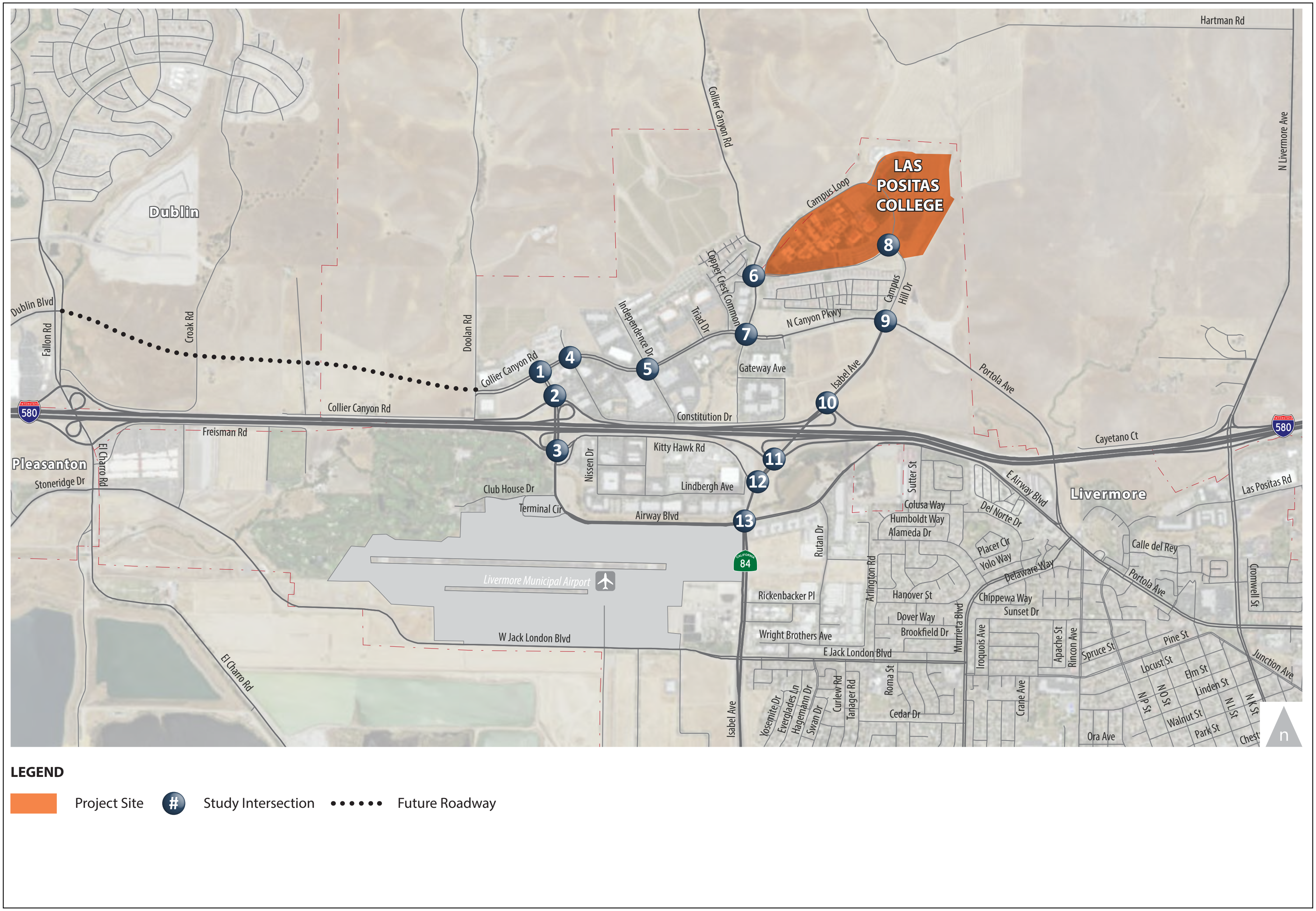
This transportation and circulation analysis evaluates potential impacts associated with the implementation of the *Las Positas College 2012 Facilities Master Plan*. Potential impacts to the surrounding roadway network, on-site circulation and access, pedestrian conditions, and parking conditions are evaluated.

As shown in **Figure 8**, **Project Study Intersections**, the traffic analysis focuses on the following thirteen study intersections:

1. Airway Boulevard / North Canyons Parkway (signal control);
2. Airway Boulevard / I-580 Westbound Ramps (signal control);
3. Airway Boulevard / I-580 Eastbound Ramps / Kitty Hawk Road (signal control);
4. North Canyons Parkway / Constitution Drive (signal control);
5. North Canyons Parkway / Independence Drive (signal control);
6. Collier Canyon Road / Campus Loop (all-way stop controlled);
7. North Canyons Parkway / Portola Avenue/Collier Canyon Road (signal control);
8. Campus Hill Drive / Campus Loop (all-way stop controlled);
9. Campus Hill Drive / Isabel Avenue / Portola Avenue (signal control);
10. Isabel Avenue / I-580 Westbound Ramps (signal control);
11. Isabel Avenue / I-580 Eastbound Ramps (signal control);
12. Isabel Avenue / Kitty Hawk Road (side-street stop controlled); and
13. Isabel Avenue / Airway Boulevard (signal control).

Also included in the analysis are the following nine freeway segments:

1. I-580 EB On-Ramp from Livermore Avenue to Off-Ramp to Isabel Avenue (weave);
2. I-580 EB On-Ramp from Northbound Isabel Avenue (merge);
3. I-580 EB On-Ramp from Southbound Isabel Avenue to Off-Ramp to Airway Boulevard (weave);
4. I-580 EB On-Ramp from Northbound Airway Boulevard (merge);



Source: Fehr and Peers

Figure 8
Project Study Intersections

5. I-580 EB On-Ramp from Southbound Airway Boulevard to Off-Ramp to Fallon Road/El Charro Road (weave);
6. I-580 WB On-Ramp from Northbound El Charro Road to Off-Ramp to Airway Boulevard (weave);
7. I-580 WB On-Ramp from Airway Boulevard to Off-Ramp to Isabel Avenue (weave);
8. I-580 WB On-Ramp from Southbound Isabel Avenue (merge); and
9. I-580 WB On-Ramp from Northbound Isabel Avenue to Off-Ramp to Livermore Avenue (weave).

The traffic analysis was conducted following the guidelines established by the City of Livermore and using the latest Alameda Countywide Transportation Model. Traffic impacts were evaluated using intersection LOS calculations for the morning (7AM-9AM) peak hour and evening (4PM-6PM) peak hour. Evaluations were conducted for the following four scenarios.

- Existing Conditions;
- Existing plus Project Conditions;
- Cumulative without Project Conditions (year 2040); and
- Cumulative with Project Conditions (year 2040).

Roadway Network

Local access to the Las Positas College campus is provided via Collier Canyon Road and Campus Hill Drive.

Collier Canyon Road. Collier Canyon Road provides direct access to Las Positas College, extending from Constitution Drive north of I-580 to Highland Road. Collier Canyon Road runs as a four-lane, east-west roadway from Constitution Drive to the vicinity of the entrance to Las Positas College. Thereafter, the north-south Collier Canyon Road becomes a two-lane rural highway through Collier Canyon, terminating at Highland Road. A half-mile stretch of Collier Canyon Road is designated as a Class II Bike Lane, stretching from Constitution Drive to Campus Loop. It is also designated as a major street, in the City's *General Plan*, between North Canyons Parkway and the west entrance to Las Positas College.

Campus Hill Drive. Campus Hill Drive is a four-lane, north-south collector that provides direct access to Las Positas College, extending from Portola Avenue in the south to Campus Loop in the north. A 0.3-mile Class I bike trail runs parallel to Campus Hill Drive between Portola Avenue and the west entrance to Las Positas College.

North Canyons Parkway. North Canyons Parkway is an east-west four-lane divided roadway extending from Doolan Road in the west to Collier Canyon Road in the east. North Canyons Parkway connects Las Positas College to Airway Boulevard, providing access to I-580. The section of the roadway between Doolan Road and Collier Canyon Road is designated as a major street. The 1.0-mile stretch of North Canyons Parkway between Doolan Road to Collier Canyon Road is designated as a Class II bike lane.

Portola Avenue. Portola Avenue is an east-west roadway extending from Collier Canyon Road in the west to First Street in the east. Portola Avenue is a six-lane divided roadway between Collier Canyon Road and

Isabel Avenue and reduces to two lanes east of Cayetano Park. At the west terminus, Portola Avenue connects Las Positas College to Isabel Avenue, providing access to I-580. The section of Portola Avenue between Collier Canyon Road and First Street is designated as a major street. The 3.4-mile stretch of Portola Avenue between Collier Canyon Road and First Street is designated as a Class II bike lane.

Airway Boulevard. Airway Boulevard is a major four-lane roadway extending from North Canyons Parkway in the west to Portola Avenue in the east. Airway Boulevard is initially a north-south road, providing access to Las Positas College and I-580 via a partial clover-leaf interchange. South of I-580, Airway Boulevard follows an east-west alignment and provides direct access to Livermore Municipal Airport. A 1.2-mile stretch of Airway Boulevard between North Canyons Parkway and Isabel Avenue is designated as a Class II designated bike lane.

Isabel Avenue. Isabel Avenue is a major north-south roadway extending from Campus Hill Drive in the north to Vallecitos Road in the south. Isabel Avenue is initially a four-lane major street, providing access to Las Positas College and I-580 via a new constructed partial clover-leaf interchange. South of I-580, Isabel Avenue is signed State Highway 84 and becomes six-lane divided highway. A 1.4-mile stretch of Isabel Avenue between Campus Hill Drive and Jack London Boulevard is designated as a Class II designated bike lane.

Kitty Hawk Road. Kitty Hawk Road is a local, two-lane east-west roadway extending between the I-580/Airway Boulevard interchange in the east to Isabel Avenue in the west. The 0.8-mile stretch of Kitty Hawk Road between Airway Boulevard and Isabel Avenue Boulevard is designated as a Class II bike lane.

Independence Drive. Independence Drive is a local, two-lane, north-south roadway, extending from Constitution Drive in the south and terminating north of North Canyons Parkway.

Constitution Drive. Constitution Drive is a local, two-lane roadway, extending from Shea Center Drive in the east, and terminating north of North Canyons Parkway in the west.

Interstate 580. Interstate 580 is an east-west regional freeway bisecting the City of Livermore. It is located directly south of Las Positas College, extending between U.S. Highway 101 in San Rafael in Marin County and I-5 near the City of Tracy in San Joaquin. Six lanes of travel, two of which are high-occupancy toll lanes, are provided in each direction through the City of Livermore. The closest ramp from I-580 to the campus is at Isabel Avenue in the form of a partial cloverleaf interchange.

Public Transit

Several transit services operate in the City of Livermore. The Livermore Amador Valley Transit Authority operates the public transit service WHEELS, serving the three major cities of Dublin, Livermore, and Pleasanton. Route 30R operates between Las Positas College and the Dublin/Pleasanton BART stations. The Altamont Commuter Express (ACE) connects Stockton to San José via passenger rail. Two ACE stations are located within the city limits of Livermore. The San Joaquin Regional Transit District (SJRTD) operates eight interregional routes that connect Stockton and other surrounding cities to the Lawrence

Livermore and Sandia Laboratories. Bay Area Rapid Transit (BART) is a commuter train system that connects Livermore via Dublin/Pleasanton to other destinations throughout the San Francisco Bay Area.

Planned Transportation Improvements

A number of future roadway improvements are being implemented that will affect travel patterns of trips to and from the Las Positas campus. The *Livermore General Plan* (City of Livermore 2014) outlines the following planned transportation improvements.

- Widening North Canyon Parkway to six-lanes from Airways Boulevard to Isabel Avenue;
- Widening Isabel Avenue to six-lanes from I-580 to Portola Avenue;
- Widening Isabel Avenue to four-lanes from Stanley Road to Vallecitos Road; and
- Extending North Canyon Parkway to join with Dublin Road, constructing a new four-lane roadway between Doolan Road and Fallon Road.

Regional roadway improvements include the widening of SR 84 to four-lanes from I-680 to Isabel Avenue and improvements to the I-680/SR 84 interchange. These transportation improvements are included in the Cumulative and Cumulative plus Project forecasts.

Data Collection

Existing turning movement counts were collected at each of the study intersections during the morning (7AM-9PM) and evening (4PM-6PM) peak hour during the fall of 2016 when school was in session. These periods were selected to coincide with peak traffic generation of the proposed Project uses and the adjacent roadway network.

Analysis Methodology

The traffic analysis was conducted following the guidelines established by the City of Livermore. Evaluated traffic impacts for study intersections, freeway segments, and freeway ramps use a grading system called Level of Service (LOS). The LOS grading system qualitatively characterizes traffic conditions associated with varying levels of vehicle traffic, ranging from LOS A (indicating free-flow traffic conditions with little or no delay experienced by motorists) to LOS F (indicating congested conditions where traffic flows exceed design capacity and result in long queues and delays). This LOS grading system applies to both signalized and unsignalized intersections. LOS A, B, and C are generally considered satisfactory service levels, while the influence of congestion becomes more noticeable (though still considered acceptable) at the midpoint of LOS D. Any LOS greater than the midpoint of LOS D, E, and F are generally considered to be unacceptable, though exceptions are made for select intersections in Livermore.

Signalized Intersections. At the signalized study intersections, traffic conditions were evaluated using the 2010 *Highway Capacity Manual* (HCM) operations methodology. The operation analysis uses various intersection characteristics (e.g., traffic volumes, lane geometry, and signal phasing/timing) to estimate the average control delay experienced by motorists traveling through an intersection. **Table 13** summarizes the relationship between control delay and LOS.

TABLE 13: LEVEL OF SERVICE METHODOLOGY – SIGNALIZED INTERSECTIONS

LOS	Description	Average Total Vehicle Delay (seconds)
A	Progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	>10.0 and ≤20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	>20.0 and ≤35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	>35.0 and ≤55.0
E	These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	>55.0 and ≤80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	>80.0

Source: Highway Capacity Manual, 2010.

Unsignalized Intersections. For the unsignalized (all-way stop-controlled and side-street stop-controlled) study intersections, traffic conditions were evaluated using the 2010 *Highway Capacity Manual* operations methodology. With this methodology, the LOS is related to the total delay per vehicle for the intersection as a whole (for all-way stop-controlled intersections), and for each stop-controlled movement or approach only (for side-street stop-controlled intersections). Total delay is defined as the total elapsed time from when a vehicle stops at the end of the queue until the vehicle departs from the stop line. This time includes the time required for a vehicle to travel from the last-in-queue position to the first-in-queue position. **Table 14** summarizes the relationship between delay and LOS for unsignalized intersections.

TABLE 14: LEVEL OF SERVICE METHODOLOGY – UNSIGNALIZED INTERSECTIONS

Level of Service	Description	Average Total Delay (seconds/vehicle)
		Unsignalized Intersections
A	Little or no delay	≤ 10.0
B	Short traffic delay	> 10.0 and ≤ 15.0
C	Average traffic delay	> 15.0 and ≤ 25.0
D	Long traffic delay	> 25.0 and ≤ 35.0
E	Very long traffic delay	> 35.0 and ≤ 50.0
F	Extreme traffic delay	> 50.0

Source: Highway Capacity Manual, 2010.

Freeway Segment Analysis. Table 15 summarizes the freeway segment level of service criteria based on vehicle density using the 2010 *Highway Capacity Manual*. (Transportation Research Board 2010) Only general purpose freeway lanes were analyzed (i.e. the existing high occupancy toll lanes operate independently of the general purpose lanes and ramps).

TABLE 15: CRITERIA FOR FREEWAY LEVEL OF SERVICE

Level of Service	Vehicle Density (pc/mi/ln)[b]		
	Basic Segment	**Weaving Segment**	**Merge/Diverge Segment**
A	≤11	≤10	≤10
B	>11 and ≤18	>10 and ≤20	>10 and ≤20
C	>18 and ≤26	>20 and ≤28	>20 and ≤28
D	>26 and ≤35	>28 and ≤35	>28 and ≤35
E	>35 and ≤45	>35	>35
F	>45	Demand exceeds capacity	Demand exceeds capacity

[a] Free-flow speed is assumed to be 65 mile/hr.
[b] Passenger car equivalents per mile per lane.

Source: Highway Capacity Manual, 2010.

Roadway Segment Analysis. Roadway segment analysis of the Alameda County Transportation Commission (Alameda CTC) Metropolitan Transportation System (MTS) designated facilities was also conducted. Operations of the MTS freeway and surface street segments were assessed based on volume-to-capacity (V/C) ratios. For freeway segments, a per-lane capacity of 2,000 vehicles per hour was used. For surface streets, a per-lane capacity of 800 vehicles per hour was used. This methodology is consistent with the approach used for other projects within Alameda County. These capacities do not reflect additional capacity provided at intersections through turn pockets. Roadway segments with a V/C ratio greater than 1.0 are assigned LOS F. Volume-to-capacity ratios and the corresponding levels of service are shown in **Table 16**.

TABLE 16: CRITERIA FOR ROADWAY SEGMENT LEVEL OF SERVICE

Level of Service	Volume-to-Capacity Ratio
A	≤ 0.60
B	0.61 to 0.70
C	0.71 to 0.80
D	0.81 to 0.90
E	0.90 to 1.00
F	> 1.00

Source: Highway Capacity Manual, 2010.

Intersection Operations

The operation of each intersection was analyzed using existing intersection volume and configurations. These results are summarized in **Table 17**. As presented in **Table 17**, most intersections operate at an overall acceptable LOS. In the morning peak hour, the intersection of Campus Hill Drive/Campus Loop operates at an overall LOS E due to high delays from the northbound approach (i.e. inbound traffic). In the evening peak hour North Canyon Parkway/Independence Drive operates at an overall LOS E due largely to high minor approach delays as a result of signal coordination which favor the major street approaches.

TABLE 17: INTERSECTION LOS SUMMARY – EXISTING CONDITIONS

	AM Peak		**PM Peak**	
Signalized Intersections	**LOS**	**Delay[1]**	**LOS**	**Delay[1]**
Airway Blvd. / North Canyon Pkwy.	C	20.5	C	23.2
Airway Blvd. / I-580 Westbound Ramps	A	7.7	C	20.2
Airway Blvd. / I-580 Eastbound Ramps / Kitty Hawk Rd.	D	39.6	D	37.2
North Canyons Pkwy. / Constitution Dr.	D	37.8	D	44.1
North Canyons Pkwy. / Independence Dr.	C	24.9	E	56.0
North Canyons Pkwy. / Collier Canyon Rd.	B	17.5	B	15.2
Campus Hill Dr. / Isabel Ave. / Portola Ave.	C	25.5	C	23.0
Isabel Ave. / I-580 Westbound Ramps	B	14.9	B	12.1
Isabel Ave. / I-580 Eastbound Ramps	B	13.0	B	13.8
Isabel Ave. / Airway Blvd.	C	22.1	C	23.1
Unsignalized Intersections	LOS	Delay[1]	LOS	Delay[1]
Collier Canyon Rd. / Campus Loop	A	9.3	A	10.0
	A	*9.9*	*B*	*11.4*
Campus Hill Dr. / Campus Loop	E	36.2	B	10.5
	E	*39.8*	*B*	*10.5*
Isabel Ave. / Kitty Hawk Rd.	A	0.7	A	4.7
	C	*21.4*	*F*	*59.9*

Note: *Italicized* values represent worst minor approach

[1] "Delay" refers to average delay experienced per vehicle in seconds per vehicle.

Source: Fehr & Peers, 2017.

Freeway Segment Operations

The operation of each freeway mainline segment within the vicinity of the Las Positas College campus was analyzed using the mainline volumes and corresponding configurations. These results are summarized in **Table 18**. As presented in **Table 18**, during the morning peak period most of the westbound freeway mainline segments function at unacceptable levels of service based on the established LOS criteria (LOS F). During the evening peak period most of the eastbound freeway mainline segments function at unacceptable levels of service.

TABLE 18: FREEWAY SEGMENT LOS SUMMARY – EXISTING CONDITIONS

Direction	Location	Segment Type	Peak Hour	Density Methodology	
				Pc/mi/ln	LOS
Westbound I-580	On-Ramp from Livermore Avenue to Off-Ramp to Isabel Avenue	Weaving	AM	-	F
			PM	-	B
	On-Ramp from Northbound Isabel Avenue	Merge	AM	36.6	F
			PM	24.6	C
	On-Ramp from Southbound Isabel Avenue to Off-Ramp to Airway Boulevard	Weaving	AM	-	E
			PM	-	B
	On-Ramp from Northbound Airway Boulevard	Merge	AM	35.9	F
			PM	24.4	C
	On-Ramp from Southbound Airway Boulevard to Off-Ramp to Fallon Road/El Charro Road	Weaving	AM	-	F
			PM	-	C
Eastbound I-580	On-Ramp from Northbound El Charro Road to Off-Ramp to Airway Boulevard	Weaving	AM	-	B
			PM	-	F
	On-Ramp from Airway Boulevard to Off-Ramp to Isabel Avenue	Weaving	AM	-	A
			PM	-	F
	On-Ramp from Southbound Isabel	Merge	AM	13.2	B
			PM	30.2	D
	On-Ramp from Northbound Isabel Avenue to Off-Ramp to Livermore Avenue	Weaving	AM	-	A
			PM	-	F

Source: Fehr & Peers, 2017.

Existing Site Access

Access to the campus is provided by a west entrance on Collier Canyon Road and an east entrance on Campus Hill Drive. Both entrances intersect with Campus Loop, an existing loop road that encircles the campus and provides access to parking and the campus facilities. Both entrances are currently all-way stop sign controlled. At the Collier Canyon Road/Campus Loop intersection, northbound right turn traffic has an exclusive, free right turn lane. At the Campus Hill Drive/Campus Loop intersection, eastbound right turn traffic has an exclusive, free right turn lane.

Existing Parking

Currently the school provides 2,413 parking spaces for students, staff, and visitors. Seventeen parking spaces are dedicated to fuel efficient clean-air vehicles.

Regulatory Setting

The effects of buildout of the 2012 FMP on the transportation system were evaluated based on applicable policies, regulations, goals, and guidelines defined by Alameda County and the City of Livermore. The evaluation criteria considered in this assessment are presented below. For purposes of this analysis, traffic impacts are considered significant if the Project would result in any of the conditions presented below.

Signalized Intersections

An impact would be significant if an intersection previously mitigated to an acceptable level would now-exceed acceptable levels. The *Livermore General Plan* standard requires that the City strive for mid-LOS D (the average vehicle delay is less than 45 seconds) at intersections (City of Livermore 2014). The Project may cause an impact if one of the two following criteria are met:

- The addition of project traffic to a signalized intersection results in the degradation of intersection operations from acceptable operations (Mid-level LOS D or better) to unacceptable operations (Greater than Mid-level LOS D; LOS E or F).
- The addition of project traffic to a signalized intersection results in the exacerbation of unacceptable operations (Greater than Mid-level LOS D; LOS E or F) by increasing the average control delay at the intersection by more than 5.0 seconds.

At several intersections near freeway interchanges the upper limit of acceptable level of service is LOS E. These intersections include (*City of Livermore General Plan, Circulation Element, Objective CIR-5.1, Policy P3*):

- Airway Boulevard / North Canyons Parkway;
- Airway Boulevard / I-580 Westbound Ramps;
- Airway Boulevard / I-580 Eastbound Ramp-Kitty Hawk Road;
- Isabel Avenue / Portola Avenue
- Isabel Avenue / I-580 westbound ramps; and
- Isabel Avenue / I-580 eastbound ramps.
- Isabel Avenue / Airway Boulevard

Additionally, the City of Livermore accepts the need to balance competing objectives, including providing a safe and efficient transportation system, minimizing cut-through traffic, and minimizing physical and environmental constraints. Therefore, several intersections may exceed the established LOS standard (City of Livermore 2014). These intersections include:

- Isabel Avenue / Airway Boulevard

Unsignalized Intersections

The Project may cause an impact if specific criteria are met, including:

- The addition of project traffic to an intersection results in the degradation of overall intersection operations from acceptable operations (Mid-level LOS D or better) to unacceptable operations (Greater than Mid-level LOS D; LOS E or F).
- The Peak Hour Signal Warrant (Warrant 3) is met.
- The addition of project traffic to the roadway system results in the need to provide a left or right-turn lane.

Roadway Segment

The Alameda CTC does not have adopted thresholds of significance for Congestion Management Plan (CMP) land use analysis purposes. Past analyses within Alameda County have used the following criteria to assess roadway segment impacts:

- For a roadway segment of the Alameda CTC Congestion Management Program (CMP) Network, the project would cause (a) the LOS to degrade from LOS E or better to LOS F or (b) the V/C ratio to increase 0.02 or more for a roadway segment that would operate at LOS F without the project.

Freeway Segments

Caltrans endeavors to maintain a target LOS at the transition between LOS C and LOS D on State Highway facilities (State of California 2002); however, Caltrans recognizes that achieving LOS C/LOS D may not always be feasible. A standard of LOS E or better on a peak hour basis was used as the planning objective for the evaluation of potential impacts of buildout of the 2012 FMP on Caltrans facilities as that is the standard set for Caltrans facilities in the study area by the Alameda CTC. The following criteria were used to evaluate potential impacts to Caltrans facilities:

- If a Caltrans facility (mainline/ramp merge/ramp diverge) is projected to operate at LOS E or better without project and the project is expected to cause the facility to operate at LOS F, the impact may be considered significant.
- If a Caltrans facility is projected to operate at LOS F without project and the project is expected to increase density, the impact may be considered significant.

Public Transit

Public transit impacts would be significant if the demand for public transit service would be increased above that which could be accommodated by local transit operators or agencies.

Traffic Safety

CEQA allows for consideration of increased hazards on roadway facilities as part of the basis for identifying standards of significance in an EIR. A significant traffic safety impact would include a design feature, such as a sharp curve or dangerous intersection that would not be consistent with City of Livermore engineering design standards or standards published by other traffic engineering professional organizations.

Impact Discussion

The Project would result in deficient intersection operations with the installation of the proposed roundabout at the Campus Hill/Campus Loop both as a Project impact and as a Project contribution to a significant cumulative impact. But with implementation of **Mitigation Measure TRAFFIC-1**, impacts would be less than significant. A brief discussion of each environmental issue included under Section 16 is presented below.

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 non-motorized 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 proposed Project includes a number of transportation improvements that are reflected in the "with Project" analyses. These include the following:

- Campus Hill Drive Entry improvement (including a new one-lane roundabout at Campus Hill Drive/Campus Loop)
- Collier Canyon Entry improvement
- Loop Road improvement with modifications and improved spacing to parking lot entrances
- Bus drop-off at B1600
- Re-paving of lots C, B, AA, A, F

Student enrollment at Las Positas College is expected to increase by 2,242 students, from a Spring 2016 enrollment of 8,133 to a year 2025 enrollment of 10,375. The number of trips which would be generated by the Project was estimated using information from the Institute of Transportation Engineers (ITE) (Institute of Transportation Engineers 2012 The ITE land use #540 – Junior/Community College was used to calculate the Project's trip generation. Trip generation for the proposed Project is summarized in **Table 19**.

TABLE 19: PROJECT TRIP GENERATION SUMMARY

Land Use/Number of Students	Daily	AM Peak Hour			PM Peak Hour		
		In	Out	Total	In	Out	Total
Community College /2,242 Students	2,758	226	43	269	169	100	269

As presented in **Table 18**, buildout of the 2012 FM would generate approximately 269 new vehicle trips in both the AM and PM peak hour of travel. Project trip distribution was developed based on a review of existing travel patterns and the trip making characteristics of the proposed project, considering the location of complementary land uses and the existing transportation system. A select zone analysis using the Alameda Countywide Transportation Model and a review of existing travel patterns in the area informed the overall trip distribution percentages. **Figure 9**, **Project Trip Distribution**, presents the overall trip distribution percentages for Project generated trips.

Existing plus Project Conditions

Table 20 presents the LOS results for the study intersections under Existing plus Project Conditions. As presented in **Table 20**, most intersections will continue to operate at an overall acceptable LOS. In the morning peak hour, the proposed roundabout at Campus Hill Drive/Campus Loop will operate at an overall LOS F due to high delays from the northbound approach, resulting in a significant existing plus Project impact. The addition of Project-generated vehicle trips with buildout of the 2012 FMP would

Source: Fehr and Peers

Figure 9
Project Trip Distribution

TABLE 20: INTERSECTION LOS SUMMARY EXISTING AND EXISTING PLUS PROJECT CONDITIONS

	Existing				Existing Plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
Signalized Intersections	**LOS**	**Delay[1]**	**LOS**	**Delay[1]**	**LOS**	**Delay[1]**	**LOS**	**Delay[1]**
Airway Blvd. / North Canyon Pkwy.	C	20.5	C	23.2	C	20.5	C	23.0
Airway Blvd. / I-580 Westbound Ramps	A	7.7	C	20.2	A	7.5	B	19.8
Airway Blvd. / I-580 Eastbound Ramps / Kitty Hawk Rd.	D	39.6	D	37.2	D	40.5	D	37.5
North Canyons Pkwy. / Constitution Dr.	D	37.8	D	44.1	D	38.6	D	44.4
North Canyons Pkwy. / Independence Dr.	C	24.9	E	56.0	C	24.9	E	55.5
North Canyons Pkwy. / Collier Canyon Rd.	B	17.5	B	15.2	B	18.1	B	15.5
Campus Hill Dr. / Isabel Ave. / Portola Ave.	C	25.5	C	23.0	C	27.3	C	23.5
Isabel Ave. / I-580 Westbound Ramps	B	14.9	B	12.1	B	16.4	B	12.0
Isabel Ave. / I-580 Eastbound Ramps	B	13.0	B	13.8	B	13.0	B	13.8
Isabel Ave. / Airway Blvd.	C	22.1	C	23.1	C	22.0	C	23.4
Unsignalized Intersections	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]
Collier Canyon Rd. / Campus Loop	A	9.3	**A**	**10.0**	**B**	**10.2**	**B**	**10.9**
	A	*9.9*	***B***	***11.4***	***B***	***10.6***	***B***	***10.1***
Campus Hill Dr. / Campus Loop	E	36.2	**B**	**10.5**	**F**	**58.3**	**A**	**5.9**
	E	*39.8*	***B***	***10.5***				
Isabel Ave. / Kitty Hawk Rd.	A	0.7	A	4.7	A	0.7	A	4.8
	C	*21.4*	*F*	*59.9*	*C*	*21.6*	*F*	*62.4*

Note: *Italicized* values represent worst minor approach

[1] "Delay" refers to average delay experienced per vehicle in seconds per vehicle.

Source: Fehr & Peers, 2017.

result in deficient overall intersection operations at the Campus Hill Drive/Campus Loop single-lane roundabout. Based on the City of Livermore level of service standards and impact criteria, this is considered a significant impact. With implementation of **Mitigation Measure TRAFFIC-1**, potentially significant impacts associated with deficient operations at the Campus Hill Drive/Campus Loop roundabout would be less than significant.

In the evening peak hour North Canyon Parkway/Independence Drive will continue to operate at an overall LOS E, however overall average delay decreases due to increased traffic along the major approach (the major street approach experiences less delay than other movements at the intersection, thus an addition of traffic to this movement can result in overall delay going down).

Table 21 presents the impact of Project-related traffic on the freeway segments. There are no changes in level of service.

TABLE 21: FREEWAY SEGMENT LOS SUMMARY EXISTING AND EXISTING PLUS PROJECT CONDITIONS

Direction	Location	Segment Type	Peak Hour	Density Methodology			
				Existing		Existing Plus Project	
				Pc/mi/ln	LOS	Pc/mi/ln	LOS
Westbound I-580	On-Ramp from Livermore Avenue to Off-Ramp to Isabel Avenue	Weaving	AM	-	F	-	F
			PM	-	B	-	B
	On-Ramp from Northbound Isabel Avenue	Merge	AM	36.6	F	36.6	F
			PM	24.6	C	24.6	C
	On-Ramp from Southbound Isabel Avenue to Off-Ramp to Airway Boulevard	Weaving	AM	-	E	-	E
			PM	-	B	-	B
	On-Ramp from Northbound Airway Boulevard	Merge	AM	35.9	F	36.0	F
			PM	24.4	C	24.5	C
	On-Ramp from Southbound Airway Boulevard to Off-Ramp to Fallon Road/El Charro Road	Weaving	AM	-	F	-	F
			PM	-	C	-	C
Eastbound I-580	On-Ramp from Northbound El Charro Road to Off-Ramp to Airway Boulevard	Weaving	AM	-	B	-	B
			PM	-	F	-	F
	On-Ramp from Airway Boulevard to Off-Ramp to Isabel Avenue	Weaving	AM	-	A	-	A
			PM	-	F	-	F
	On-Ramp from Southbound Isabel Avenue	Merge	AM	13.2	B	13.2	B
			PM	30.2	D	30.3	D
	On-Ramp from Northbound Isabel Avenue to Off-Ramp to Livermore Avenue	Weaving	AM	-	A	-	A
			PM	-	F	-	F

Source: Fehr & Peers, 2017.

Cumulative and Cumulative plus Project Conditions

Cumulative baseline conditions reflect the buildout of the City's *General Plan*. Traffic volumes for the cumulative baseline condition were developed using the latest Alameda Countywide Transportation Model. In the Cumulative plus Project scenario, the entire increase in Las Positas College's student population was assumed to have occurred by the year 2040 (i.e. 2,242 student increase).

As indicated in **Table 22**, level of service ratings are expected to deteriorate to unacceptable levels with the addition of Project-related traffic at two study intersections. The Airway Boulevard / North Canyon Parkway and North Canyon Parkway / Constitution Drive intersections are expected to operate at an unacceptable level of service regardless of the addition of Project-related traffic during both morning and evening peak hours. The additional control delay due to Project-related traffic does not exceed five seconds, therefore this is a less than significant cumulative impact.

TABLE 22: INTERSECTION LOS SUMMARY CUMULATIVE AND CUMULATIVE PLUS PROJECT CONDITIONS

	Cumulative				Cumulative Plus Project			
	AM Peak		PM Peak		AM Peak		PM Peak	
	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]	LOS	Delay[1]
Signalized Intersections								
Airway Blvd. / North Canyon Pkwy.	D	48.0	F	134.1	D	47.9	F	136.1
Airway Blvd. / I-580 Westbound Ramps	C	26.9	B	14.2	C	27.0	B	14.2
Airway Blvd. / I-580 Eastbound Ramps / Kitty Hawk Rd.	C	27.6	C	31.9	C	28.1	C	32.1
North Canyons Pkwy. / Constitution Dr.	D	45.4	F	94.6	D	45.2	F	99.6
North Canyons Pkwy. / Independence Dr.	C	22.9	D	38.2	C	23.1	D	40.9
North Canyons Pkwy. / Collier Canyon Rd.	C	32.7	B	18.6	D	35.0	B	19.5
Campus Hill Dr. / Isabel Ave. / Portola Ave.	D	35.2	D	37.0	D	38.5	D	41.5
Isabel Ave. / I-580 Westbound Ramps	C	30.6	B	14.2	D	39.8	B	15.5
Isabel Ave. / I-580 Eastbound Ramps	D	35.6	B	16.3	D	35.2	B	16.4
Isabel Ave. / Airway Blvd.	C	29.8	C	31.7	C	29.8	C	31.8
Unsignalized Intersections								
Collier Canyon Rd. / Campus Loop	A	10.0	B	10.9	B	11.0	B	12.1
	A	*10.6*	*B*	*12.8*	*B*	*11.2*	*B*	*14.6*
Campus Hill Dr. / Campus Loop	E	36.2	B	10.8	F	63.8	A	6.2
	E	*40.7*	*B*	*11.8*				
Isabel Ave. / Kitty Hawk Rd.	A	0.9	A	9.1	A	0.9	A	9.4
	D	*34.5*	*F*	*128.4*	*D*	*34.8*	*F*	*133.3*

Note: *Italicized* values represent worst minor approach

1 "Delay" refers to average delay experienced per vehicle in seconds per vehicle.

Source: Fehr & Peers, 2017.

In the morning peak hour, the roundabout at Campus Hill Drive/Campus Loop will operate at an overall LOS F due to high delays from the northbound approach. The addition of project-generated vehicle trips in the cumulative condition would result in deficient overall intersection operations at the Campus Hill Drive/ Campus Loop single-lane roundabout. Based on the City Livermore level of service standards and impact criteria, this is considered a Project contribution to a significant cumulative impact. With implementation of **Mitigation Measure TRAFFIC-1**, these impacts would be less than significant.

Table 23 presents the level of service for freeway segments in the Cumulative and Cumulative plus Project scenarios. In the Cumulative scenario during the morning peak period the eastbound freeway mainline segments function at unacceptable levels of service based on the established LOS criteria (LOS F). During the evening peak period all but two freeway mainline segments function at unacceptable levels of service. With the addition of Project traffic, the weaving segment on eastbound I-580 between Isabel Avenue and Airways Boulevard deteriorates from LOS C to D. There are no additional changes in LOS.

TABLE 23: FREEWAY SEGMENT LOS SUMMARY CUMULATIVE AND CUMULATIVE PLUS PROJECT CONDITIONS

Direction	Location	Segment Type	Peak Hour	Density Methodology			
				Cumulative		Cumulative Plus Project	
				Pc/mi/ln	LOS	Pc/mi/ln	LOS
Westbound I-580	On-Ramp from Livermore Avenue to Off-Ramp to Isabel Avenue	Weaving	AM	-	F	-	F
			PM	-	C	-	C
	On-Ramp from Northbound Isabel Avenue	Merge	AM	40.1	F	40.1	F
			PM	30.4	D	30.4	D
	On-Ramp from Southbound Isabel Avenue to Off-Ramp to Airway Boulevard	Weaving	AM	-	F	-	F
			PM	-	C	-	D
	On-Ramp from Northbound Airway Boulevard	Merge	AM	37.2	F	37.3	F
			PM	29.3	D	29.4	D
	On-Ramp from Southbound Airway Boulevard to Off-Ramp to Fallon Road/El Charro Road	Weaving	AM	-	F	-	F
			PM	-	D	-	D
Eastbound I-580	On-Ramp from Northbound El Charro Road to Off-Ramp to Airway Boulevard	Weaving	AM	-	B	-	B
			PM	-	F	-	F
	On-Ramp from Airway Boulevard to Off-Ramp to Isabel Avenue	Weaving	AM	-	B	-	B
			PM	-	F	-	F
	On-Ramp from Southbound Isabel Avenue	Merge	AM	15.2	B	15.4	B
			PM	32.5	D	32.7	D
	On-Ramp from Northbound Isabel Avenue to Off-Ramp to Livermore Avenue	Weaving	AM	-	B	-	B
			PM	-	F	-	F

Source: Fehr & Peers, 2017.

Parking

As illustrated in **Table 24**, the addition of 2,093 students to the site would generate the demand for an additional 450 parking spaces. At buildout, the 10,375 students would generate a total demand for 2,075 parking spaces.

TABLE 24: PARKING DEMAND SUMMARY

Land Use / Number of Students	Rate	Weekday Peak Hour
Junior/Community College / 10,375 Students	0.20 Vehicles per Student	450

Source: ITE Parking Generation Manual, 4rd Edition (LU Code 540).

The existing site provides 2,413 spaces for roughly 8,200 students (0.29 spaces per student) without resulting in substantial off-site spillover. With 2012 FMP buildout, the campus would provide 0.23 spaces per student (2,413 spaces/10,375 students), which would satisfy future demands.

Neither the *City of Livermore Planning and Zoning Code* nor the *General Plan* provide specific information regarding parking space requirements for community colleges. For the purposes of this study the 85th percentile average ITE peak period parking demand will be considered adequate for student, staff, and visitor parking requirements.

Site Access

Access to the Las Positas College campus is provided by one entrance on Collier Canyon Road and one entrance on Campus Hill Drive via Isabel Avenue. The Project plans to address the existing congestion at the Campus Hill Drive / Campus Loop intersection by replacing the all-way stop intersection with a single-lane roundabout. In addition, the entrance to Parking Lot P will be realigned to Campus Hill Drive. In order to relieve congestion during the morning, the roundabout should be constructed with a slip/by-pass northbound right-turn lane. At the Collier Canyon entrance, the Project will install wayfinding signs on the northbound approach of the Collier Canyon Road to ease identification of the campus entrance.

Transit

The Project will improve transit circulation at the campus by expanding the existing pick-up/drop-off area in front of Building 1600. The additional amount of transit ridership produced by the expansion of Las Positas College is not forecast to result in a significant adverse impact on the area transit system. The school expansion is not expected to result in the exceedances of available capacities on area transit facilities.

Bicycle and Pedestrian

The Project will establish three 'Major Arrival' points and two 'Activity Nodes' that designate pedestrian entry points within the campus and athletic. The arrival points aim to create an attractive environment that provide intuitive wayfinding to the campus from vehicular areas. Arrival points will be characterized by landscaped islands, drop-off areas with seating, and information kiosks with wayfinding signage.

The additional amount of pedestrian and bicycle traffic produced by the expansion of Las Positas College is not forecast to result in a significant adverse impact on the area pedestrian and bicycle network. No features are proposed by the project which would be unsafe for bicycle and pedestrian travel.

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 county congestion management agency for designated roads or highways?

An analysis of regional roadways is required to comply with requirements of the Alameda County Transportation Commission (Alameda CTC). The Alameda CTC requires the analysis of project impacts to Metropolitan Transportation System (MTS) roadways identified in the congestion management plan (CMP) for development projects that would generate more than 100 PM peak hour trips. The only two roadways in the Project study area on the MTS network are I-580 and Isabel Avenue. As shown in **Table 19**, the proposed Project would generate more than 100 PM peak hour trips. **Table 25** presents the results of the required CMP roadway network analysis on these two roadways. The CMP analysis indicates that the proposed Project would not cause a significant impact.

TABLE 25: CMP ROADWAY SEGMENT ANALYSIS

Link Location at Segment Limits		Lanes	Cumulative No Project			Cumulative Plus Project		
			Volume	V/C	LOS	Volume	V/C	LOS
I-580 Eastbound								
El Charro Road	Airway Boulevard	6	9,990	.83	D	10,032	.84	D
Airway Boulevard	Isabel Avenue	6	9,260	.77	C	9,285	.77	C
Isabel Avenue	Livermore Avenue	6	9,750	.81	D	9,780	.82	D
I-580 Westbound								
Livermore Avenue	Isabel Avenue	5	6,770	.68	B	6,821	.68	B
Isabel Avenue	Airway Boulevard	5	6,890	.69	B	6,905	.69	B
Airway Boulevard	Fallon Road	5	7,540	.75	C	7,565	.76	C
Isabel Avenue Northbound								
Jack London Boulevard	Airway Boulevard	3	1,770	.74	C	1,795	.75	C
Airway Boulevard	I-580	3	1,700	.71	C	1,725	.72	C
Isabel Avenue Southbound								
I-580	Airway Boulevard	3	1,570	.65	B	1,585	.66	B
Airway Boulevard	Jack London Boulevard	3	1,740	.73	C	1,755	.73	C

Source: Fehr & Peers, 2017.

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?

The Project would not result in a change in air traffic patterns, air traffic levels or 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)?

There are no design features in the Project that substantially increase hazards.

e) Result in inadequate emergency access?

The Project would continue to provide adequate emergency service access. The proposed Project would not affect emergency access to the campus.

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?

Transit

The additional amount of transit ridership produced by the projected increase in student population at Las Positas College is not forecast to result in a significant adverse impact on the area transit system. The school expansion not expected to result in the exceedances of available capacities on area transit facilities.

Bicycle and Pedestrian

The additional amount of pedestrian and bicycle traffic produced by the projected increase in student population at Las Positas College is not forecast to result in a significant adverse impact on the area pedestrian and bicycle network. No features are proposed by the project which would be unsafe for bicycle and pedestrian travel.

Mitigation Measures

TRAFFIC-1 The proposed design for the roundabout at the intersection of Campus Hill Drive/ Campus Loop shall be modified to add a northbound right-turn slip lane, which would result in LOS B or better operations, reducing the Project impact to a less-than-significant level.

References

State of California, Department of Transportation. 2002. *Guide for the Preparation of Traffic Impact Studies*.

Institute of Transportation Engineers. 2010. *Highway Capacity Manual*. Washington D.C *Parking Generation*. Fourth Edition. Washington D.C.: Institute of Transportation Engineers, 2010.

Institute of Transportation Engineers, 2012. *Trip Generation*. Ninth Edition. Washington D.C.

City of Livermore. 2014. *Livermore General Plan, Circulation Element, Objective CIR-5.1, Policy P4*)

City of Livermore. 2014. *Livermore General Plan, Circulation Element, Level of Service.* Available on the City of Livermore website: http://www.ci.livermore.ca.us/civicax/filebank/documents/6095/

Transportation Research Board. 2010. *Highway Capacity Manual.* Washington D.C.

17. UTILITIES AND SERVICE SYSTEMS. Would the project:	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☒	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☐	☒
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐
e) Result in a determination by the wastewater treatment provider, which serves or may serve the project, that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	☐	☐	☒	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☐	☒

Impact Discussion

The proposed Project would not adversely affect utilities and service systems. A discussion of each environmental issue included under Section 17 is presented below.

a) Would the project exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?

Although there would be an increase in wastewater generation at the Las Positas College campus due to the increase in student population, increases in wastewater generation at the campus are accounted for in the *Water Quality Control Plan for the San Francisco Bay Basin* which addresses project growth and development within the Bay Area.

The College has established standards for water efficient sinks and toilets; and waterless urinals are the standard for new building construction.

b) Would the project require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

The proposed Project would not require expansion of existing water and wastewater treatment facilities.

c) Would the project require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

As discussed in **Section 9 Hydrology and Water Quality**, the Project would not require the expansion of existing storm water drainage facilities or the construction of new facilities.

d) Would the project have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?

With the projected increase in student population on the campus over the next ten years, there would be an increase in water consumption at the campus. However, there would be sufficient water supplies to serve Las Positas College.

Las Positas College has initiated a comprehensive system to conserve water on the campus: reclaimed water is used for lawns and landscaping and weather sensor systems have been installed to maximize water efficiency throughout the year; and reclaimed water replaces domestic potable water in toilets.

e) Would the project result in a determination by the wastewater treatment provider, which serves or may serve the project's projected demand in addition to the provider's existing commitments?

With the projected increase in student population on the campus over the next ten years, there would be an increase in wastewater generation at the campus. However, there would be sufficient capacity in the Livermore Water Reclamation Plant to serve Las Positas College.

f) Would the project be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?

Construction waste would be transported to a landfill with adequate capacity, most likely either Altamont Landfill or Vasco Landfill. Garbage service is provided by Alameda County Waste Management.

Las Positas College has an integrated waste management system that includes on-site composting of organic material, construction waste diversion and single-stream recycling. To improve waste management through better separation of construction debris, trash and dirt fill generated during current and future construction activity, the College requires construction bid documents include a "Debris

Recycling Statement" Through this program, overall waste diversion of construction debris has been as high as 85 percent (Chabot Las Positas Community College District. 2010).

g) Comply with federal, state, and local statutes and regulations related to solid waste?

The Project would comply with Federal, State and local statutes and regulations related to solid waste.

Mitigation Measures

None required.

References

Chabot Las Positas Community College District. 2010. *Las Positas College Climate Action Plan 2010*.

San Francisco Bay Regional Water Quality Control Board. *Water Quality Control Plan for the San Francisco Bay Basin* (www.waterboards.ca.gov/sanfranciscobay/basin_pplanning.shtml).

18. MANDATORY FINDINGS OF SIGNIFICANCE.	Potentially Significant Impact	Potentially Significant Unless Mitigation Incorporated	Less Than Significant Impact	No Impact
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☒	☐	☐
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)	☐	☐	☒	☐
c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

Discussion

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?

Buildout of the 2012 FMP will adversely affect federally listed wildlife species due to the loss of habitat. However, with implementation of **Mitigation Measures BIO-1** through **BIO-4**, significant biological resources impacts would be less than significant. Buildout of the 2012 FMP would not adversely affect any known cultural resource.

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

The proposed Project would not result in cumulatively considerable impacts.

c) Does the project have environmental effects, which will cause substantial adverse effects on human beings, either directly or indirectly?

The proposed Project could result in potentially significant air quality and noise/vibration construction impacts, but with implementation of **Mitigation Measure AIR-1** and **Mitigation Measure NOISE-1** and **Mitigation Measure NOISE-2** air and noise construction impacts would be less than significant. The campus could experience strong seismic ground shaking and near surface soils expansive in nature are known to be present on the campus and represents potentially significant impacts, but with implementation of **Mitigation Measure GEO-1** and **GEO-2**, impacts would be less than significant. There is the potential for the presence of asbestos and lead-based paint in buildings proposed for demolition and impacted soils which are potentially significant impacts, however, **Mitigation Measure HAZ-1** and **Mitigation Measure HAZ-2**, will adequately address potentially significant impacts associated with hazardous materials present in the buildings or soil. The planned roundabout to be installed at the Campus Hill Drive/Campus Loop intersection would result in deficient intersection operations, but with implementation of **Mitigation Measure TRAFFIC-1**, significant impacts would be less than significant.

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APPENDIX A
TRANSPORTATION MODELING DATA

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	14	25	599	8	0	131	0	866	0	0	0
Future Volume (veh/h)	0	14	25	599	8	0	131	0	866	0	0	0
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1776	1696	1845	1863	1863	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	0	18	4	768	10	0	168	0	831	0	0	0
Adj No. of Lanes	0	2	1	2	1	1	0	1	2	0	1	0
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Percent Heavy Veh, %	7	7	12	3	2	2	2	2	2	2	2	2
Cap, veh/h	0	862	368	1347	1318	1121	346	0	1645	0	2	0
Arrive On Green	0.00	0.26	0.26	0.40	0.71	0.00	0.20	0.00	0.20	0.00	0.00	0.00
Sat Flow, veh/h	0	3463	1440	3408	1863	1583	1774	0	2787	0	1863	0
Grp Volume(v), veh/h	0	18	4	768	10	0	168	0	831	0	0	0
Grp Sat Flow(s),veh/h/ln	0	1687	1440	1704	1863	1583	1774	0	1393	0	1863	0
Q Serve(g_s), s	0.0	0.4	0.2	18.5	0.2	0.0	8.8	0.0	18.3	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.4	0.2	18.5	0.2	0.0	8.8	0.0	18.3	0.0	0.0	0.0
Prop In Lane	0.00		1.00	1.00		1.00	1.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h	0	862	368	1347	1318	1121	346	0	1645	0	2	0
V/C Ratio(X)	0.00	0.02	0.01	0.57	0.01	0.00	0.49	0.00	0.51	0.00	0.00	0.00
Avail Cap(c_a), veh/h	0	862	368	1347	1318	1121	351	0	1653	0	284	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.90	0.90	0.00	0.93	0.00	0.93	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	29.3	29.2	24.8	4.5	0.0	37.6	0.0	12.6	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.3	0.0	0.0	0.4	0.0	0.1	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.2	0.1	8.7	0.1	0.0	4.4	0.0	6.9	0.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	29.3	29.2	25.1	4.5	0.0	37.9	0.0	12.7	0.0	0.0	0.0
LnGrp LOS		C	C	C	A		D		B			
Approach Vol, veh/h		22			778			999			0	
Approach Delay, s/veh		29.2			24.9			16.9			0.0	
Approach LOS		C			C			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	47.5	32.8		0.0		80.3		24.7
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	24.0	24.0		16.0		54.0		20.8
Max Q Clear Time (g_c+I1), s	20.5	2.4		0.0		2.2		20.3
Green Ext Time (p_c), s	0.7	0.1		0.0		0.1		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	20.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	26	3	112	0	917	141	0	287	414
Future Volume (veh/h)	0	0	0	26	3	112	0	917	141	0	287	414
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1827	1610	1743	0	1863	1863	1900	1834	1900
Adj Flow Rate, veh/h				34	0	11	0	1105	0	0	346	0
Adj No. of Lanes				2	0	2	0	2	1	0	3	0
Peak Hour Factor				0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %				4	67	9	0	2	2	3	3	3
Cap, veh/h				131	0	27	0	3093	1383	0	4375	0
Arrive On Green				0.04	0.00	0.04	0.00	1.00	0.00	0.00	1.00	0.00
Sat Flow, veh/h				3480	0	2963	0	3632	1583	0	5172	0
Grp Volume(v), veh/h				34	0	11	0	1105	0	0	346	0
Grp Sat Flow(s),veh/h/ln				1740	0	1482	0	1770	1583	0	1669	0
Q Serve(g_s), s				1.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s				1.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				131	0	27	0	3093	1383	0	4375	0
V/C Ratio(X)				0.26	0.00	0.41	0.00	0.36	0.00	0.00	0.08	0.00
Avail Cap(c_a), veh/h				398	0	254	0	3093	1383	0	4375	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	2.00	2.00	1.67	1.67	1.67
Upstream Filter(I)				1.00	0.00	1.00	0.00	0.75	0.00	0.00	0.93	0.00
Uniform Delay (d), s/veh				49.1	0.0	864.1	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh				0.4	0.0	3.7	0.0	0.2	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
LnGrp Delay(d),s/veh				49.5	0.0	867.8	0.0	0.2	0.0	0.0	0.0	0.0
LnGrp LOS				D		F		A			A	
Approach Vol, veh/h					45			1105			346	
Approach Delay, s/veh					249.5			0.2			0.0	
Approach LOS					F			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	97.0				97.0		8.0
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	12.0	68.7				83.7		12.0
Max Q Clear Time (g_c+I1), s	0.0	2.0				2.0		5.4
Green Ext Time (p_c), s	0.0	22.0				22.9		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	7.7
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	660	201	123	11	44	80	29	318	147	95	88	130
Future Volume (veh/h)	660	201	123	11	44	80	29	318	147	95	88	130
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1845	1776	1863	1863	1827	1776	1851	1900	1827	1845	1900
Adj Flow Rate, veh/h	733	223	37	12	49	15	32	353	121	106	98	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	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
Percent Heavy Veh, %	2	3	7	2	2	4	7	2	2	4	3	3
Cap, veh/h	812	435	356	73	77	181	812	1265	427	131	267	0
Arrive On Green	0.24	0.24	0.24	0.04	0.04	0.04	0.48	0.49	0.49	0.08	0.08	0.00
Sat Flow, veh/h	3442	1845	1509	1774	1863	1553	1691	2580	871	1740	3597	0
Grp Volume(v), veh/h	733	223	37	12	49	15	32	239	235	106	98	0
Grp Sat Flow(s),veh/h/ln	1721	1845	1509	1774	1863	1553	1691	1759	1692	1740	1752	0
Q Serve(g_s), s	21.7	11.0	2.0	0.7	2.7	0.9	1.1	8.4	8.6	6.3	2.8	0.0
Cycle Q Clear(g_c), s	21.7	11.0	2.0	0.7	2.7	0.9	1.1	8.4	8.6	6.3	2.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.51	1.00		0.00
Lane Grp Cap(c), veh/h	812	435	356	73	77	181	812	862	830	131	267	0
V/C Ratio(X)	0.90	0.51	0.10	0.16	0.64	0.08	0.04	0.28	0.28	0.81	0.37	0.00
Avail Cap(c_a), veh/h	901	483	395	456	479	516	812	862	830	133	868	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.00
Uniform Delay (d), s/veh	38.9	34.9	31.4	48.6	49.6	41.4	14.5	15.8	15.8	47.8	46.1	0.0
Incr Delay (d2), s/veh	10.8	0.3	0.0	0.4	3.2	0.1	0.0	0.8	0.9	27.2	3.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	11.5	5.7	0.8	0.3	1.5	0.4	0.5	4.2	4.2	4.0	1.5	0.0
LnGrp Delay(d),s/veh	49.8	35.2	31.5	49.0	52.8	41.4	14.5	16.6	16.7	75.0	49.9	0.0
LnGrp LOS	D	D	C	D	D	D	B	B	B	E	D	
Approach Vol, veh/h		993			76			506			204	
Approach Delay, s/veh		45.8			50.0			16.5			63.0	
Approach LOS		D			D			B			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.9	56.5		28.3	55.4	13.0		8.3
Change Period (Y+Rc), s	4.0	5.0		3.5	5.0	* 5		4.0
Max Green Setting (Gmax), s	8.0	26.0		27.5	8.5	* 26		27.0
Max Q Clear Time (g_c+I1), s	8.3	10.6		23.7	3.1	4.8		4.7
Green Ext Time (p_c), s	0.0	2.7		1.1	1.4	0.6		0.1

Intersection Summary		
HCM 2010 Ctrl Delay		39.6
HCM 2010 LOS		D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	149	619	182	25	350	259	85	18	25	124	5	166
Future Volume (veh/h)	149	619	182	25	350	259	85	18	25	124	5	166
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.97	1.00		1.00	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1696	1810	1863	1863	1842	1900	1863	1863	1900
Adj Flow Rate, veh/h	216	897	163	36	507	139	123	26	4	180	7	40
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	0
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Percent Heavy Veh, %	2	2	2	12	5	2	2	2	2	2	2	2
Cap, veh/h	242	1077	472	43	603	269	155	136	21	450	57	324
Arrive On Green	0.27	0.61	0.61	0.03	0.18	0.18	0.09	0.09	0.09	0.25	0.25	0.25
Sat Flow, veh/h	1774	3539	1552	1616	3438	1534	1774	1560	240	1774	224	1279
Grp Volume(v), veh/h	216	897	163	36	507	139	123	0	30	180	0	47
Grp Sat Flow(s),veh/h/ln	1774	1770	1552	1616	1719	1534	1774	0	1799	1774	0	1503
Q Serve(g_s), s	12.3	21.1	5.5	2.3	15.0	8.6	7.1	0.0	1.6	8.9	0.0	2.5
Cycle Q Clear(g_c), s	12.3	21.1	5.5	2.3	15.0	8.6	7.1	0.0	1.6	8.9	0.0	2.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.13	1.00		0.85
Lane Grp Cap(c), veh/h	242	1077	472	43	603	269	155	0	157	450	0	381
V/C Ratio(X)	0.89	0.83	0.35	0.83	0.84	0.52	0.79	0.00	0.19	0.40	0.00	0.12
Avail Cap(c_a), veh/h	253	1077	472	169	688	307	216	0	219	608	0	515
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	0.90	0.93	0.93	0.93	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.4	18.4	15.4	50.9	41.9	39.2	47.0	0.0	44.5	32.6	0.0	30.2
Incr Delay (d2), s/veh	26.0	6.9	1.8	12.9	7.8	1.4	12.7	0.0	0.6	0.6	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.7	11.1	2.5	1.2	7.8	3.8	4.0	0.0	0.8	4.4	0.0	1.1
LnGrp Delay(d),s/veh	63.5	25.3	17.2	63.8	49.6	40.7	59.7	0.0	45.1	33.1	0.0	30.3
LnGrp LOS	E	C	B	E	D	D	E		D	C		C
Approach Vol, veh/h		1276			682			153			227	
Approach Delay, s/veh		30.7			48.6			56.8			32.6	
Approach LOS		C			D			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.3	24.4		32.6	6.8	37.9		13.4
Change Period (Y+Rc), s	6.0	* 6		6.0	4.0	6.0		4.2
Max Green Setting (Gmax), s	15.0	* 21		36.0	11.0	25.0		12.8
Max Q Clear Time (g_c+I1), s	14.3	17.0		10.9	4.3	23.1		9.1
Green Ext Time (p_c), s	0.1	1.3		0.8	0.0	1.2		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	37.8
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	493	169	225	477	38	150	8	93	46	5	24
Future Volume (veh/h)	47	493	169	225	477	38	150	8	93	46	5	24
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		1.00	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1681	1863	1900
Adj Flow Rate, veh/h	59	624	105	285	604	26	190	10	15	58	6	1
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	13	2	2
Cap, veh/h	76	1469	634	332	2053	917	229	97	146	73	95	16
Arrive On Green	0.04	0.41	0.41	0.19	0.58	0.58	0.13	0.14	0.14	0.05	0.06	0.06
Sat Flow, veh/h	1774	3539	1528	1774	3539	1581	1774	671	1007	1601	1550	258
Grp Volume(v), veh/h	59	624	105	285	604	26	190	0	25	58	0	7
Grp Sat Flow(s),veh/h/ln	1774	1770	1528	1774	1770	1581	1774	0	1678	1601	0	1808
Q Serve(g_s), s	3.2	12.1	2.5	15.0	8.3	0.7	10.1	0.0	1.2	3.5	0.0	0.4
Cycle Q Clear(g_c), s	3.2	12.1	2.5	15.0	8.3	0.7	10.1	0.0	1.2	3.5	0.0	0.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.60	1.00		0.14
Lane Grp Cap(c), veh/h	76	1469	634	332	2053	917	229	0	243	73	0	110
V/C Ratio(X)	0.77	0.42	0.17	0.86	0.29	0.03	0.83	0.00	0.10	0.79	0.00	0.06
Avail Cap(c_a), veh/h	368	1469	634	552	2053	917	552	0	627	498	0	694
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	45.7	20.0	6.4	37.9	10.3	8.6	40.9	0.0	35.8	45.6	0.0	42.7
Incr Delay (d2), s/veh	6.1	0.9	0.6	3.4	0.4	0.1	7.5	0.0	0.2	17.3	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	6.1	1.7	7.7	4.1	0.3	5.4	0.0	0.6	1.9	0.0	0.2
LnGrp Delay(d),s/veh	51.8	20.9	7.0	41.3	10.6	8.7	48.4	0.0	36.0	62.9	0.0	42.9
LnGrp LOS	D	C	A	D	B	A	D		D	E		D
Approach Vol, veh/h		788			915			215			65	
Approach Delay, s/veh		21.4			20.1			46.9			60.7	
Approach LOS		C			C			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.1	46.0	16.5	9.9	8.1	61.9	8.4	18.0
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	30.0	* 40	30.0	37.0	20.0	40.0	30.0	36.0
Max Q Clear Time (g_c+I1), s	17.0	14.1	12.1	2.4	5.2	10.3	5.5	3.2
Green Ext Time (p_c), s	1.1	4.4	0.5	0.1	0.0	4.2	0.1	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	24.9
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	9.3
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	1	0	30	0	45	1	3	0	10	56	164	0	8	130	0
Future Vol, veh/h	0	1	0	30	0	45	1	3	0	10	56	164	0	8	130	0
Peak Hour Factor	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78
Heavy Vehicles, %	2	2	2	2	2	9	2	2	2	2	11	3	2	2	3	2
Mvmt Flow	0	1	0	38	0	58	1	4	0	13	72	210	0	10	167	0
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	8.3	9.9	8.9	9.9
HCM LOS	A	A	A	A

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	3%	98%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	0%	2%	0%	0%	100%	100%
Vol Right, %	0%	0%	100%	97%	0%	100%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	56	164	31	46	3	8	130	0
LT Vol	10	0	0	1	45	0	8	0	0
Through Vol	0	56	0	0	1	0	0	130	0
RT Vol	0	0	164	30	0	3	0	0	0
Lane Flow Rate	13	72	210	40	59	4	10	167	0
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.02	0.108	0.267	0.058	0.105	0.005	0.017	0.251	0
Departure Headway (Hd)	5.756	5.408	4.568	5.235	6.426	5.113	5.91	5.424	5.407
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	621	661	784	678	554	694	603	660	0
Service Time	3.503	3.154	2.314	3.014	4.204	2.891	3.667	3.181	3.164
HCM Lane V/C Ratio	0.021	0.109	0.268	0.059	0.106	0.006	0.017	0.253	0
HCM Control Delay	8.6	8.8	9	8.3	10	7.9	8.8	10	8.2
HCM Lane LOS	A	A	A	A	A	A	A	A	N
HCM 95th-tile Q	0.1	0.4	1.1	0.2	0.3	0	0.1	1	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	192	318	60	152	731	89	7	3	14	94	6	124
Future Volume (veh/h)	192	318	60	152	731	89	7	3	14	94	6	124
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1863	1863	1863	1863	1827	1863	1465	1900	1845	1863	1827
Adj Flow Rate, veh/h	246	408	30	195	937	59	9	4	12	121	8	31
Adj No. of Lanes	2	2	1	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Percent Heavy Veh, %	3	2	2	2	2	4	2	33	33	3	2	4
Cap, veh/h	496	1357	603	253	1264	544	17	15	46	161	241	201
Arrive On Green	0.15	0.38	0.38	0.14	0.36	0.36	0.01	0.05	0.05	0.09	0.13	0.13
Sat Flow, veh/h	3408	3539	1573	1774	3539	1523	1774	323	970	1757	1863	1553
Grp Volume(v), veh/h	246	408	30	195	937	59	9	0	16	121	8	31
Grp Sat Flow(s),veh/h/ln	1704	1770	1573	1774	1770	1523	1774	0	1293	1757	1863	1553
Q Serve(g_s), s	3.6	4.4	0.7	5.8	12.7	0.8	0.3	0.0	0.7	3.7	0.2	0.6
Cycle Q Clear(g_c), s	3.6	4.4	0.7	5.8	12.7	0.8	0.3	0.0	0.7	3.7	0.2	0.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.75	1.00		1.00
Lane Grp Cap(c), veh/h	496	1357	603	253	1264	544	17	0	61	161	241	201
V/C Ratio(X)	0.50	0.30	0.05	0.77	0.74	0.11	0.54	0.00	0.26	0.75	0.03	0.15
Avail Cap(c_a), veh/h	2183	2590	1151	812	2590	1115	812	0	947	804	1023	852
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	21.5	11.7	10.6	22.6	15.4	4.1	27.0	0.0	25.1	24.2	20.8	8.0
Incr Delay (d2), s/veh	0.8	0.0	0.0	4.9	0.3	0.0	24.8	0.0	0.8	7.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	2.1	0.3	3.2	6.2	0.6	0.2	0.0	0.2	2.1	0.1	0.4
LnGrp Delay(d),s/veh	22.3	11.8	10.6	27.4	15.7	4.2	51.8	0.0	25.9	31.2	20.8	8.2
LnGrp LOS	C	B	B	C	B	A	D		C	C	C	A
Approach Vol, veh/h		684			1191			25			160	
Approach Delay, s/veh		15.5			17.0			35.2			26.2	
Approach LOS		B			B			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.3	24.8	9.0	7.6	11.8	26.3	4.5	12.1
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	35.0	* 40	25.0	* 40	25.0	40.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	5.6	14.7	5.7	2.7	7.8	6.4	2.3	2.6
Green Ext Time (p_c), s	2.5	4.2	0.3	0.1	0.5	2.5	0.0	0.1

Intersection Summary		
HCM 2010 Ctrl Delay		17.5
HCM 2010 LOS		B

Notes

Intersection	
Intersection Delay, s/veh	36.2
Intersection LOS	E

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Traffic Vol, veh/h	0	10	52	0	21	2	0	365	247
Future Vol, veh/h	0	10	52	0	21	2	0	365	247
Peak Hour Factor	0.92	0.54	0.54	0.92	0.54	0.54	0.92	0.54	0.54
Heavy Vehicles, %	2	2	2	2	29	2	2	2	3
Mvmt Flow	0	19	96	0	39	4	0	676	457
Number of Lanes	0	1	1	0	0	1	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	10.2	10.7	39.8
HCM LOS	B	B	E

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	100%	0%	0%	0%	91%
Vol Thru, %	0%	0%	100%	0%	9%
Vol Right, %	0%	100%	0%	100%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	365	247	10	52	23
LT Vol	365	0	0	0	21
Through Vol	0	0	10	0	2
RT Vol	0	247	0	52	0
Lane Flow Rate	676	457	19	96	43
Geometry Grp	7	7	7	7	4
Degree of Util (X)	1	0.551	0.036	0.168	0.085
Departure Headway (Hd)	5.52	4.334	6.977	6.266	7.179
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	656	828	520	580	509
Service Time	3.277	2.09	4.622	3.925	5.088
HCM Lane V/C Ratio	1.03	0.552	0.037	0.166	0.084
HCM Control Delay	58.4	12.3	9.9	10.2	10.7
HCM Lane LOS	F	B	A	B	B
HCM 95th-tile Q	15.6	3.4	0.1	0.6	0.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	209	236	298	445	195	445	438	48	39	125	7
Future Volume (veh/h)	8	209	236	298	445	195	445	438	48	39	125	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1759	1863	1792	1863
Adj Flow Rate, veh/h	11	275	78	392	586	221	586	576	22	51	164	1
Adj No. of Lanes	1	1	2	3	2	0	2	2	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	8	2	6	2
Cap, veh/h	44	470	702	628	884	333	694	1000	422	142	549	255
Arrive On Green	0.02	0.25	0.25	0.13	0.35	0.35	0.20	0.28	0.28	0.08	0.16	0.16
Sat Flow, veh/h	1774	1863	2787	5003	2505	943	3442	3539	1493	1774	3406	1583
Grp Volume(v), veh/h	11	275	78	392	414	393	586	576	22	51	164	1
Grp Sat Flow(s),veh/h/ln	1774	1863	1393	1668	1770	1679	1721	1770	1493	1774	1703	1583
Q Serve(g_s), s	0.4	9.3	1.5	5.3	14.1	14.2	11.7	10.0	0.8	2.0	3.0	0.0
Cycle Q Clear(g_c), s	0.4	9.3	1.5	5.3	14.1	14.2	11.7	10.0	0.8	2.0	3.0	0.0
Prop In Lane	1.00		1.00	1.00		0.56	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	44	470	702	628	625	592	694	1000	422	142	549	255
V/C Ratio(X)	0.25	0.59	0.11	0.62	0.66	0.66	0.84	0.58	0.05	0.36	0.30	0.00
Avail Cap(c_a), veh/h	495	780	1167	1746	741	703	961	1482	625	495	1426	663
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.3	23.5	20.6	29.7	19.6	19.6	27.5	22.0	18.7	31.2	26.5	25.2
Incr Delay (d2), s/veh	1.1	1.2	0.1	0.4	1.7	1.8	3.8	0.5	0.1	0.6	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	4.9	0.6	2.5	7.2	6.9	5.9	5.0	0.3	1.0	1.5	0.0
LnGrp Delay(d),s/veh	35.4	24.7	20.7	30.1	21.3	21.4	31.3	22.5	18.8	31.8	26.8	25.2
LnGrp LOS	D	C	C	C	C	C	C	C	B	C	C	C
Approach Vol, veh/h		364			1199			1184			216	
Approach Delay, s/veh		24.1			24.2			26.8			28.0	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	9.7	25.6	13.0	23.4	18.4	16.9	5.8	30.6
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	20.0	30.0	25.0	30.0	20.0	* 30	20.0	30.0
Max Q Clear Time (g_c+I1), s	4.0	12.0	7.3	11.3	13.7	5.0	2.4	16.2
Green Ext Time (p_c), s	0.0	4.2	0.7	6.4	0.7	4.7	0.0	5.5

Intersection Summary	
HCM 2010 Ctrl Delay	25.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	800	0	487	0	444	546	0	340	319
Future Volume (veh/h)	0	0	0	800	0	487	0	444	546	0	340	319
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1863	0	1792	1792	1900	1845	1776
Adj Flow Rate, veh/h				909	0	491	0	505	0	0	386	362
Adj No. of Lanes				2	0	1	0	2	2	0	2	1
Peak Hour Factor				0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %				8	0	2	0	6	6	3	3	7
Cap, veh/h				1436	0	541	0	1103	868	0	1135	487
Arrive On Green				0.44	0.00	0.44	0.00	0.32	0.00	0.00	0.32	0.32
Sat Flow, veh/h				3250	0	1583	0	3495	2682	0	3505	1505
Grp Volume(v), veh/h				909	0	491	0	505	0	0	386	362
Grp Sat Flow(s),veh/h/ln				1625	0	1583	0	1703	1341	0	1752	1505
Q Serve(g_s), s				10.2	0.0	18.6	0.0	5.5	0.0	0.0	3.9	10.1
Cycle Q Clear(g_c), s				10.2	0.0	18.6	0.0	5.5	0.0	0.0	3.9	10.1
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				1436	0	541	0	1103	868	0	1135	487
V/C Ratio(X)				0.63	0.00	0.91	0.00	0.46	0.00	0.00	0.34	0.74
Avail Cap(c_a), veh/h				2423	0	1022	0	2539	1999	0	2613	1122
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				10.1	0.0	25.2	0.0	12.6	0.0	0.0	12.1	14.1
Incr Delay (d2), s/veh				0.2	0.0	2.5	0.0	0.1	0.0	0.0	0.1	0.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				4.6	0.0	12.3	0.0	2.6	0.0	0.0	1.9	4.2
LnGrp Delay(d),s/veh				10.3	0.0	27.7	0.0	12.7	0.0	0.0	12.1	15.0
LnGrp LOS				B		C		B			B	B
Approach Vol, veh/h					1400			505			748	
Approach Delay, s/veh					16.4			12.7			13.5	
Approach LOS					B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	21.5				21.5		25.4
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 25	35.0				* 35		35.0
Max Q Clear Time (g_c+I1), s	10.0	7.5				12.1		20.6
Green Ext Time (p_c), s	0.0	3.2				3.1		0.2

Intersection Summary	
HCM 2010 Ctrl Delay	14.9
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	180	0	336	0	0	0	0	810	450	0	1020	120
Future Volume (veh/h)	180	0	336	0	0	0	0	810	450	0	1020	120
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	0	1727				1900	1827	1727	0	1810	1845
Adj Flow Rate, veh/h	202	0	378				0	910	0	0	1146	0
Adj No. of Lanes	2	0	2				0	2	1	0	2	1
Peak Hour Factor	0.89	0.89	0.89				0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	12	0	10				4	4	10	0	5	3
Cap, veh/h	1048	0	490				0	1415	599	0	1335	609
Arrive On Green	0.33	0.00	0.33				0.00	0.41	0.00	0.00	0.39	0.00
Sat Flow, veh/h	3134	0	2584				0	3471	1468	0	3529	1568
Grp Volume(v), veh/h	202	0	378				0	910	0	0	1146	0
Grp Sat Flow(s),veh/h/ln	1567	0	1292				0	1736	1468	0	1719	1568
Q Serve(g_s), s	1.9	0.0	11.8				0.0	8.7	0.0	0.0	12.7	0.0
Cycle Q Clear(g_c), s	1.9	0.0	11.8				0.0	8.7	0.0	0.0	12.7	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1048	0	490				0	1415	599	0	1335	609
V/C Ratio(X)	0.19	0.00	0.77				0.00	0.64	0.00	0.00	0.86	0.00
Avail Cap(c_a), veh/h	3780	0	2742				0	8958	3789	0	4146	1891
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	9.8	0.0	23.3				0.0	9.9	0.0	0.0	11.6	0.0
Incr Delay (d2), s/veh	0.0	0.0	1.0				0.0	0.2	0.0	0.0	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	3.7				0.0	4.1	0.0	0.0	6.0	0.0
LnGrp Delay(d),s/veh	9.9	0.0	24.3				0.0	10.0	0.0	0.0	12.3	0.0
LnGrp LOS	A		C					B			B	
Approach Vol, veh/h		580						910			1146	
Approach Delay, s/veh		19.3						10.0			12.3	
Approach LOS		B						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		22.9		18.6	0.0	22.9		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 1.1E2		* 50	50.0	50.0		
Max Q Clear Time (g_c+I1), s		10.7		13.8	0.0	14.7		
Green Ext Time (p_c), s		1.1		0.1	0.0	1.3		

Intersection Summary	
HCM 2010 Ctrl Delay	13.0
HCM 2010 LOS	B

Notes

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	85	0	1260	1187	169
Future Vol, veh/h	0	85	0	1260	1187	169
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	9	2	7	8	2
Mvmt Flow	0	89	0	1326	1249	178

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	715	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.28	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.99	-	-	-	-
Pot Cap-1 Maneuver	0	308	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	308	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	21.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	308	-	-
HCM Lane V/C Ratio	-	0.29	-	-
HCM Control Delay (s)	-	21.4	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	1.2	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	36	129	58	135	116	262	1140	22	268	998	6
Future Volume (veh/h)	4	36	129	58	135	116	262	1140	22	268	998	6
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1520	1863	1863	1863	1863	1827	1863	1827	1667	1845	1810	1900
Adj Flow Rate, veh/h	4	40	41	64	150	37	291	1267	13	298	1109	6
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	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
Percent Heavy Veh, %	25	2	2	2	2	4	2	4	14	3	5	5
Cap, veh/h	8	121	399	83	198	343	332	2893	822	394	2577	14
Arrive On Green	0.01	0.06	0.06	0.05	0.11	0.11	0.19	0.58	0.58	0.12	0.51	0.51
Sat Flow, veh/h	1448	1863	1583	1774	1863	1531	1774	4988	1417	3408	5071	27
Grp Volume(v), veh/h	4	40	41	64	150	37	291	1267	13	298	720	395
Grp Sat Flow(s),veh/h/ln	1448	1863	1583	1774	1863	1531	1774	1663	1417	1704	1647	1804
Q Serve(g_s), s	0.3	1.9	1.9	3.3	7.3	1.8	14.9	13.4	0.4	7.9	12.9	12.9
Cycle Q Clear(g_c), s	0.3	1.9	1.9	3.3	7.3	1.8	14.9	13.4	0.4	7.9	12.9	12.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	8	121	399	83	198	343	332	2893	822	394	1674	917
V/C Ratio(X)	0.52	0.33	0.10	0.77	0.76	0.11	0.88	0.44	0.02	0.76	0.43	0.43
Avail Cap(c_a), veh/h	240	518	737	294	349	466	522	2893	822	1003	1674	917
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.4	41.8	26.8	44.0	40.6	29.0	36.9	11.1	8.3	40.0	14.5	14.5
Incr Delay (d2), s/veh	46.1	1.6	0.1	13.8	5.8	0.1	9.9	0.5	0.0	3.0	0.8	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	0.8	2.0	4.1	0.8	8.2	6.2	0.1	3.9	6.0	6.7
LnGrp Delay(d),s/veh	92.4	43.3	26.9	57.8	46.4	29.1	46.8	11.5	8.4	43.0	15.3	15.9
LnGrp LOS	F	D	C	E	D	C	D	B	A	D	B	B
Approach Vol, veh/h		85			251			1571			1413	
Approach Delay, s/veh		37.7			46.7			18.0			21.3	
Approach LOS		D			D			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.3	58.7	8.9	10.6	22.0	52.0	5.0	14.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	27.5	47.5	15.5	26.0	27.5	47.5	15.5	17.5
Max Q Clear Time (g_c+I1), s	9.9	15.4	5.3	3.9	16.9	14.9	2.3	9.3
Green Ext Time (p_c), s	0.9	21.0	0.1	1.1	0.6	21.2	0.0	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	22.1
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	12	81	836	15	0	144	0	599	0	1	0
Future Volume (veh/h)	7	12	81	836	15	0	144	0	599	0	1	0
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1827	1863	1863	1863	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	8	13	18	919	16	0	158	0	416	0	1	0
Adj No. of Lanes	0	2	1	2	1	1	0	1	2	0	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	4	2	2	2	2	2	2	2	2	2
Cap, veh/h	319	550	402	1491	1396	1187	203	0	1526	0	2	0
Arrive On Green	0.26	0.26	0.26	0.43	0.75	0.00	0.11	0.00	0.11	0.00	0.00	0.00
Sat Flow, veh/h	1006	2124	1551	3442	1863	1583	1774	0	2787	0	1863	0
Grp Volume(v), veh/h	12	9	18	919	16	0	158	0	416	0	1	0
Grp Sat Flow(s),veh/h/ln	1519	1610	1551	1721	1863	1583	1774	0	1393	0	1863	0
Q Serve(g_s), s	0.0	0.5	0.9	21.7	0.2	0.0	9.1	0.0	8.3	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.5	0.5	0.9	21.7	0.2	0.0	9.1	0.0	8.3	0.0	0.1	0.0
Prop In Lane	0.69		1.00	1.00		1.00	1.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h	452	417	402	1491	1396	1187	203	0	1526	0	2	0
V/C Ratio(X)	0.03	0.02	0.04	0.62	0.01	0.00	0.78	0.00	0.27	0.00	0.56	0.00
Avail Cap(c_a), veh/h	452	417	402	1491	1396	1187	301	0	1680	0	284	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.00	0.97	0.00	0.97	0.00	1.00	0.00
Uniform Delay (d), s/veh	29.0	29.0	29.1	23.0	3.3	0.0	45.2	0.0	12.6	0.0	52.4	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.5	0.0	0.0	3.7	0.0	0.0	0.0	75.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.2	0.4	10.3	0.1	0.0	4.6	0.0	3.2	0.0	0.1	0.0
LnGrp Delay(d),s/veh	29.0	29.0	29.2	23.5	3.3	0.0	48.9	0.0	12.7	0.0	128.3	0.0
LnGrp LOS	C	C	C	C	A		D		B		F	
Approach Vol, veh/h		39			935			574			1	
Approach Delay, s/veh		29.1			23.2			22.6			128.3	
Approach LOS		C			C			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	51.5	33.2		4.1		84.7		16.2
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	24.0	27.0		16.0		57.0		17.8
Max Q Clear Time (g_c+I1), s	23.7	2.9		2.1		2.2		11.1
Green Ext Time (p_c), s	0.1	0.1		0.0		0.1		0.9

Intersection Summary	
HCM 2010 Ctrl Delay	23.2
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	47	4	166	0	636	222	0	262	748
Future Volume (veh/h)	0	0	0	47	4	166	0	636	222	0	262	748
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1863	1863	1863	0	1845	1863	1900	1858	1900
Adj Flow Rate, veh/h				54	0	180	0	691	0	0	285	0
Adj No. of Lanes				2	0	2	0	2	1	0	3	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	0	3	2	3	3	3
Cap, veh/h				375	0	244	0	2824	1276	0	4087	0
Arrive On Green				0.11	0.00	0.11	0.00	0.81	0.00	0.00	0.27	0.00
Sat Flow, veh/h				3548	0	3167	0	3597	1583	0	5240	0
Grp Volume(v), veh/h				54	0	180	0	691	0	0	285	0
Grp Sat Flow(s),veh/h/ln				1774	0	1583	0	1752	1583	0	1691	0
Q Serve(g_s), s				1.5	0.0	8.8	0.0	5.0	0.0	0.0	4.4	0.0
Cycle Q Clear(g_c), s				1.5	0.0	8.8	0.0	5.0	0.0	0.0	4.4	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				375	0	244	0	2824	1276	0	4087	0
V/C Ratio(X)				0.14	0.00	0.74	0.00	0.24	0.00	0.00	0.07	0.00
Avail Cap(c_a), veh/h				608	0	452	0	2824	1276	0	4087	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)				1.00	0.00	1.00	0.00	0.85	0.00	0.00	0.85	0.00
Uniform Delay (d), s/veh				42.6	0.0	96.8	0.0	2.5	0.0	0.0	9.1	0.0
Incr Delay (d2), s/veh				0.1	0.0	1.6	0.0	0.2	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.7	0.0	0.1	0.0	2.5	0.0	0.0	2.1	0.0
LnGrp Delay(d),s/veh				42.7	0.0	98.5	0.0	2.6	0.0	0.0	9.1	0.0
LnGrp LOS				D		F		A			A	
Approach Vol, veh/h					234			691			285	
Approach Delay, s/veh					85.6			2.6			9.1	
Approach LOS					F			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	89.9				89.9		15.1
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	12.0	62.7				77.7		18.0
Max Q Clear Time (g_c+I1), s	0.0	7.0				6.4		10.8
Green Ext Time (p_c), s	0.0	11.3				11.6		0.3

Intersection Summary		
HCM 2010 Ctrl Delay		20.2
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	486	166	336	13	123	191	29	181	83	85	120	104
Future Volume (veh/h)	486	166	336	13	123	191	29	181	83	85	120	104
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1845	1863	1863	1900	1827	1845	1900
Adj Flow Rate, veh/h	523	178	91	14	132	57	31	195	43	91	129	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	3	2	2	2	4	3	3
Cap, veh/h	617	334	284	164	172	247	40	1457	314	113	1930	0
Arrive On Green	0.18	0.18	0.18	0.09	0.09	0.09	0.02	0.50	0.50	0.11	0.92	0.00
Sat Flow, veh/h	3442	1863	1583	1774	1863	1568	1774	2895	625	1740	3597	0
Grp Volume(v), veh/h	523	178	91	14	132	57	31	118	120	91	129	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1774	1863	1568	1774	1770	1750	1740	1752	0
Q Serve(g_s), s	15.4	9.1	5.3	0.8	7.3	3.3	1.8	3.7	3.9	5.4	0.3	0.0
Cycle Q Clear(g_c), s	15.4	9.1	5.3	0.8	7.3	3.3	1.8	3.7	3.9	5.4	0.3	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.36	1.00		0.00
Lane Grp Cap(c), veh/h	617	334	284	164	172	247	40	891	881	113	1930	0
V/C Ratio(X)	0.85	0.53	0.32	0.09	0.77	0.23	0.77	0.13	0.14	0.80	0.07	0.00
Avail Cap(c_a), veh/h	901	488	415	456	479	505	144	891	881	133	1930	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	41.7	39.1	37.5	43.6	46.6	38.7	51.0	13.9	13.9	46.1	1.9	0.0
Incr Delay (d2), s/veh	3.5	0.5	0.2	0.1	2.7	0.2	10.9	0.3	0.3	21.3	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.6	4.7	2.3	0.4	3.9	1.5	1.0	1.9	1.9	3.2	0.2	0.0
LnGrp Delay(d),s/veh	45.2	39.6	37.8	43.7	49.3	38.8	62.0	14.2	14.2	67.4	2.0	0.0
LnGrp LOS	D	D	D	D	D	D	E	B	B	E	A	
Approach Vol, veh/h		792			203			269			220	
Approach Delay, s/veh		43.1			46.0			19.7			29.0	
Approach LOS		D			D			B			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	10.8	58.1		22.3	5.9	63.1		13.7				
Change Period (Y+Rc), s	4.0	5.3		3.5	3.5	5.3		4.0				
Max Green Setting (Gmax), s	8.0	25.7		27.5	8.5	25.7		27.0				
Max Q Clear Time (g_c+I1), s	7.4	5.9		17.4	3.8	2.3		9.3				
Green Ext Time (p_c), s	0.0	2.4		1.4	0.0	2.5		0.4				
Intersection Summary												
HCM 2010 Ctrl Delay			37.2									
HCM 2010 LOS			D									

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	392	224	37	608	13	210	1	18	48	6	28
Future Volume (veh/h)	52	392	224	37	608	13	210	1	18	48	6	28
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1845	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	57	426	122	40	661	7	228	1	4	52	7	2
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	2	2	2	2
Cap, veh/h	679	2024	902	69	809	360	250	46	184	95	74	21
Arrive On Green	0.26	0.38	0.38	0.01	0.08	0.08	0.14	0.14	0.14	0.05	0.05	0.05
Sat Flow, veh/h	1774	3539	1578	1757	3539	1576	1774	326	1306	1774	1388	397
Grp Volume(v), veh/h	57	426	122	40	661	7	228	0	5	52	0	9
Grp Sat Flow(s),veh/h/ln	1774	1770	1578	1757	1770	1576	1774	0	1632	1774	0	1785
Q Serve(g_s), s	2.6	8.5	5.3	2.4	19.3	0.4	13.3	0.0	0.3	3.0	0.0	0.5
Cycle Q Clear(g_c), s	2.6	8.5	5.3	2.4	19.3	0.4	13.3	0.0	0.3	3.0	0.0	0.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.80	1.00		0.22
Lane Grp Cap(c), veh/h	679	2024	902	69	809	360	250	0	230	95	0	96
V/C Ratio(X)	0.08	0.21	0.14	0.58	0.82	0.02	0.91	0.00	0.02	0.55	0.00	0.09
Avail Cap(c_a), veh/h	679	2024	902	134	809	360	250	0	230	639	0	643
HCM Platoon Ratio	0.67	0.67	0.67	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	0.96	0.98	0.98	0.98	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.1	16.5	15.5	51.0	46.4	37.6	44.5	0.0	38.9	48.4	0.0	47.3
Incr Delay (d2), s/veh	0.0	0.2	0.3	7.3	8.8	0.1	34.4	0.0	0.0	4.8	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	4.2	2.4	1.3	10.5	0.2	8.9	0.0	0.1	1.6	0.0	0.3
LnGrp Delay(d),s/veh	25.1	16.7	15.8	58.2	55.2	37.7	78.8	0.0	38.9	53.3	0.0	47.7
LnGrp LOS	C	B	B	E	E	D	E		D	D		D
Approach Vol, veh/h		605			708			233			61	
Approach Delay, s/veh		17.3			55.2			78.0			52.4	
Approach LOS		B			E			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	46.2	30.0		9.8	10.1	66.0		19.0
Change Period (Y+Rc), s	6.0	* 6		* 4.2	6.0	6.0		4.2
Max Green Setting (Gmax), s	10.0	* 24		* 38	8.0	24.0		14.8
Max Q Clear Time (g_c+I1), s	4.6	21.3		5.0	4.4	10.5		15.3
Green Ext Time (p_c), s	0.8	1.1		0.2	0.0	2.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	44.1
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	139	293	16	23	307	125	79	20	138	180	6	169
Future Volume (veh/h)	139	293	16	23	307	125	79	20	138	180	6	169
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1827	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	151	318	10	25	334	68	86	22	14	196	7	21
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	4	2	2	2	2	2	2	2	2
Cap, veh/h	180	775	345	193	876	391	111	84	53	186	49	147
Arrive On Green	0.10	0.22	0.22	0.11	0.25	0.25	0.06	0.08	0.08	0.10	0.12	0.12
Sat Flow, veh/h	1774	3539	1576	1740	3539	1580	1774	1064	677	1774	405	1215
Grp Volume(v), veh/h	151	318	10	25	334	68	86	0	36	196	0	28
Grp Sat Flow(s),veh/h/ln	1774	1770	1576	1740	1770	1580	1774	0	1740	1774	0	1619
Q Serve(g_s), s	8.8	8.1	0.2	1.4	8.2	3.6	5.0	0.0	2.0	11.0	0.0	1.6
Cycle Q Clear(g_c), s	8.8	8.1	0.2	1.4	8.2	3.6	5.0	0.0	2.0	11.0	0.0	1.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.39	1.00		0.75
Lane Grp Cap(c), veh/h	180	775	345	193	876	391	111	0	137	186	0	196
V/C Ratio(X)	0.84	0.41	0.03	0.13	0.38	0.17	0.77	0.00	0.26	1.05	0.00	0.14
Avail Cap(c_a), veh/h	186	775	345	232	876	391	389	0	646	186	0	416
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.98	0.98	0.98	0.95	0.95	0.95	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	46.3	35.2	5.7	42.1	32.8	31.1	48.5	0.0	45.5	47.0	0.0	41.3
Incr Delay (d2), s/veh	24.9	1.6	0.2	0.1	1.2	0.9	10.7	0.0	1.0	81.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	4.1	0.1	0.7	4.2	1.6	2.8	0.0	1.0	9.6	0.0	0.7
LnGrp Delay(d),s/veh	71.2	36.8	5.8	42.2	34.0	32.0	59.2	0.0	46.5	128.2	0.0	41.6
LnGrp LOS	E	D	A	D	C	C	E		D	F		D
Approach Vol, veh/h		479			427			122			224	
Approach Delay, s/veh		47.0			34.2			55.5			117.4	
Approach LOS		D			C			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.7	29.0	10.6	16.7	14.7	32.0	15.0	12.3
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	14.0	* 23	23.0	27.0	11.0	26.0	11.0	39.0
Max Q Clear Time (g_c+I1), s	3.4	10.1	7.0	3.6	10.8	10.2	13.0	4.0
Green Ext Time (p_c), s	1.6	1.5	0.2	0.3	0.0	1.9	0.0	0.3

Intersection Summary	
HCM 2010 Ctrl Delay	56.0
HCM 2010 LOS	E

Notes

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	0	2	8	0	154	0	14	0	29	118	125	0	8	77	0
Future Vol, veh/h	0	0	2	8	0	154	0	14	0	29	118	125	0	8	77	0
Peak Hour Factor	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	3	2	2	2	2	3	3	2	2	2	2
Mvmt Flow	0	0	2	9	0	181	0	16	0	34	139	147	0	9	91	0
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	8.5	11.4	9.2	9.7
HCM LOS	A	B	A	A

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	20%	0%	0%	0%	100%	100%
Vol Right, %	0%	0%	100%	80%	0%	100%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	29	118	125	10	154	14	8	77	0
LT Vol	29	0	0	0	154	0	8	0	0
Through Vol	0	118	0	2	0	0	0	77	0
RT Vol	0	0	125	8	0	14	0	0	0
Lane Flow Rate	34	139	147	12	181	16	9	91	0
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.057	0.211	0.195	0.019	0.31	0.023	0.017	0.147	0
Departure Headway (Hd)	5.964	5.478	4.773	5.666	6.164	4.945	6.354	5.849	5.849
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	597	651	746	636	578	715	558	607	0
Service Time	3.736	3.249	2.544	3.366	3.953	2.733	4.151	3.647	3.647
HCM Lane V/C Ratio	0.057	0.214	0.197	0.019	0.313	0.022	0.016	0.15	0
HCM Control Delay	9.1	9.7	8.7	8.5	11.7	7.9	9.3	9.7	8.6
HCM Lane LOS	A	A	A	A	B	A	A	A	N
HCM 95th-tile Q	0.2	0.8	0.7	0.1	1.3	0.1	0.1	0.5	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	211	472	10	29	222	93	26	7	132	127	11	132
Future Volume (veh/h)	211	472	10	29	222	93	26	7	132	127	11	132
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1667	1863	1845	1863	1812	1900	1863	1743	1810
Adj Flow Rate, veh/h	234	524	5	32	247	49	29	8	19	141	12	27
Adj No. of Lanes	2	2	1	1	2	1	1	1	0	1	1	1
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
Percent Heavy Veh, %	2	2	2	14	2	3	2	2	2	2	9	5
Cap, veh/h	559	1330	579	47	756	332	48	39	92	189	281	248
Arrive On Green	0.16	0.38	0.38	0.03	0.21	0.21	0.03	0.08	0.08	0.11	0.16	0.16
Sat Flow, veh/h	3442	3539	1541	1587	3539	1555	1774	477	1133	1774	1743	1538
Grp Volume(v), veh/h	234	524	5	32	247	49	29	0	27	141	12	27
Grp Sat Flow(s),veh/h/ln	1721	1770	1541	1587	1770	1555	1774	0	1611	1774	1743	1538
Q Serve(g_s), s	2.7	4.9	0.1	0.9	2.7	0.7	0.7	0.0	0.7	3.5	0.3	0.4
Cycle Q Clear(g_c), s	2.7	4.9	0.1	0.9	2.7	0.7	0.7	0.0	0.7	3.5	0.3	0.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.70	1.00		1.00
Lane Grp Cap(c), veh/h	559	1330	579	47	756	332	48	0	131	189	281	248
V/C Ratio(X)	0.42	0.39	0.01	0.69	0.33	0.15	0.60	0.00	0.21	0.74	0.04	0.11
Avail Cap(c_a), veh/h	2677	3146	1370	882	3146	1382	986	0	1432	986	1162	1025
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	16.9	10.3	8.8	21.6	15.0	5.2	21.7	0.0	19.3	19.5	15.9	4.6
Incr Delay (d2), s/veh	0.5	0.1	0.0	16.5	0.1	0.1	11.6	0.0	0.3	5.7	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	2.3	0.0	0.6	1.3	0.3	0.5	0.0	0.3	2.0	0.1	0.2
LnGrp Delay(d),s/veh	17.4	10.4	8.8	38.1	15.1	5.3	33.3	0.0	19.6	25.2	16.0	4.7
LnGrp LOS	B	B	A	D	B	A	C		B	C	B	A
Approach Vol, veh/h		763			328			56			180	
Approach Delay, s/veh		12.5			15.8			26.7			21.5	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.6	14.9	8.8	8.7	5.3	22.2	5.2	12.3
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	35.0	* 40	25.0	* 40	25.0	40.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	4.7	4.7	5.5	2.7	2.9	6.9	2.7	2.4
Green Ext Time (p_c), s	3.0	1.0	0.3	0.2	0.0	3.0	0.0	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	15.2
HCM 2010 LOS	B

Notes

Intersection	
Intersection Delay, s/veh	10.3
Intersection LOS	B

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Traffic Vol, veh/h	0	11	180	0	102	6	0	151	125
Future Vol, veh/h	0	11	180	0	102	6	0	151	125
Peak Hour Factor	0.92	0.76	0.76	0.92	0.76	0.76	0.92	0.76	0.76
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2
Mvmt Flow	0	14	237	0	134	8	0	199	164
Number of Lanes	0	1	1	0	0	1	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	10	10.5	10.5
HCM LOS	A	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	100%	0%	0%	0%	94%
Vol Thru, %	0%	0%	100%	0%	6%
Vol Right, %	0%	100%	0%	100%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	151	125	11	180	108
LT Vol	151	0	0	0	102
Through Vol	0	0	11	0	6
RT Vol	0	125	0	180	0
Lane Flow Rate	199	164	14	237	142
Geometry Grp	7	7	7	7	4
Degree of Util (X)	0.332	0.219	0.023	0.325	0.227
Departure Headway (Hd)	6.012	4.804	5.652	4.945	5.744
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	594	740	629	722	621
Service Time	3.792	2.583	3.422	2.715	3.823
HCM Lane V/C Ratio	0.335	0.222	0.022	0.328	0.229
HCM Control Delay	11.8	8.9	8.6	10.1	10.5
HCM Lane LOS	B	A	A	B	B
HCM 95th-tile Q	1.4	0.8	0.1	1.4	0.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	355	471	181	161	95	244	259	98	97	230	6
Future Volume (veh/h)	5	355	471	181	161	95	244	259	98	97	230	6
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	5	374	165	191	169	45	257	273	21	102	242	1
Adj No. of Lanes	1	1	2	3	2	0	2	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	21	501	739	664	1084	281	467	709	317	205	638	285
Arrive On Green	0.01	0.27	0.27	0.13	0.39	0.39	0.14	0.20	0.20	0.12	0.18	0.18
Sat Flow, veh/h	1774	1863	2751	5003	2783	721	3442	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	5	374	165	191	106	108	257	273	21	102	242	1
Grp Sat Flow(s),veh/h/ln	1774	1863	1375	1668	1770	1735	1721	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.2	12.1	3.1	2.3	2.6	2.7	4.6	4.4	0.7	3.5	4.0	0.0
Cycle Q Clear(g_c), s	0.2	12.1	3.1	2.3	2.6	2.7	4.6	4.4	0.7	3.5	4.0	0.0
Prop In Lane	1.00		1.00	1.00		0.42	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	21	501	739	664	689	676	467	709	317	205	638	285
V/C Ratio(X)	0.24	0.75	0.22	0.29	0.15	0.16	0.55	0.39	0.07	0.50	0.38	0.00
Avail Cap(c_a), veh/h	539	849	1255	1901	807	791	1046	1614	722	539	1614	722
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.2	22.0	18.7	25.7	13.0	13.1	26.6	22.8	21.3	27.3	23.7	22.1
Incr Delay (d2), s/veh	2.1	2.2	0.2	0.1	0.1	0.1	0.4	0.3	0.1	0.7	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	6.5	1.2	1.0	1.3	1.3	2.2	2.2	0.3	1.8	1.9	0.0
LnGrp Delay(d),s/veh	34.3	24.3	18.9	25.8	13.1	13.2	26.9	23.1	21.4	28.0	24.1	22.1
LnGrp LOS	C	C	B	C	B	B	C	C	C	C	C	C
Approach Vol, veh/h		544			405			551			345	
Approach Delay, s/veh		22.7			19.1			24.8			25.2	
Approach LOS		C			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.6	18.5	12.7	23.0	12.9	17.2	4.8	30.9
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	20.0	30.0	25.0	30.0	20.0	* 30	20.0	30.0
Max Q Clear Time (g_c+I1), s	5.5	6.4	4.3	14.1	6.6	6.0	2.2	4.7
Green Ext Time (p_c), s	0.1	3.1	0.3	3.5	0.4	3.1	0.0	4.0

Intersection Summary	
HCM 2010 Ctrl Delay	23.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations				↰↰		↱		↑↑	↱↱		↰↑	↱
Traffic Volume (veh/h)	0	0	0	659	0	193	0	408	485	0	606	276
Future Volume (veh/h)	0	0	0	659	0	193	0	408	485	0	606	276
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1863	0	1863	1827	1900	1863	1863
Adj Flow Rate, veh/h				694	0	98	0	429	0	0	638	291
Adj No. of Lanes				2	0	1	0	2	2	0	2	1
Peak Hour Factor				0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %				3	0	2	0	2	4	2	2	2
Cap, veh/h				929	0	196	0	1343	1037	0	1343	600
Arrive On Green				0.27	0.00	0.27	0.00	0.38	0.00	0.00	0.38	0.38
Sat Flow, veh/h				3408	0	1583	0	3632	2733	0	3539	1581
Grp Volume(v), veh/h				694	0	98	0	429	0	0	638	291
Grp Sat Flow(s),veh/h/ln				1704	0	1583	0	1770	1367	0	1770	1581
Q Serve(g_s), s				5.9	0.0	6.5	0.0	2.7	0.0	0.0	4.3	4.4
Cycle Q Clear(g_c), s				5.9	0.0	6.5	0.0	2.7	0.0	0.0	4.3	4.4
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				929	0	196	0	1343	1037	0	1343	600
V/C Ratio(X)				0.75	0.00	0.50	0.00	0.32	0.00	0.00	0.47	0.48
Avail Cap(c_a), veh/h				3773	0	1517	0	3918	3026	0	7299	3261
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				10.5	0.0	84.8	0.0	6.9	0.0	0.0	7.4	7.5
Incr Delay (d2), s/veh				0.5	0.0	0.7	0.0	0.1	0.0	0.0	0.1	0.2
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.8	0.0	3.6	0.0	1.3	0.0	0.0	2.1	1.9
LnGrp Delay(d),s/veh				11.0	0.0	85.5	0.0	7.0	0.0	0.0	7.5	7.7
LnGrp LOS				B		F		A			A	A
Approach Vol, veh/h					792			429			929	
Approach Delay, s/veh					20.2			7.0			7.6	
Approach LOS					C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	18.3				18.3		13.3
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 4.8	35.0				* 65		35.0
Max Q Clear Time (g_c+I1), s	0.0	4.7				6.4		8.5
Green Ext Time (p_c), s	0.0	3.8				3.8		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	12.1
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	185	0	472	0	0	0	0	708	758	0	919	346
Future Volume (veh/h)	185	0	472	0	0	0	0	708	758	0	919	346
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	0	1863				1900	1845	1810	0	1845	1863
Adj Flow Rate, veh/h	201	0	513				0	770	0	0	999	0
Adj No. of Lanes	2	0	2				0	2	1	0	2	1
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	2				3	3	5	0	3	2
Cap, veh/h	1269	0	629				0	1319	579	0	1253	566
Arrive On Green	0.37	0.00	0.37				0.00	0.38	0.00	0.00	0.36	0.00
Sat Flow, veh/h	3442	0	2787				0	3505	1538	0	3597	1583
Grp Volume(v), veh/h	201	0	513				0	770	0	0	999	0
Grp Sat Flow(s),veh/h/ln	1721	0	1393				0	1752	1538	0	1752	1583
Q Serve(g_s), s	1.6	0.0	13.3				0.0	7.4	0.0	0.0	10.8	0.0
Cycle Q Clear(g_c), s	1.6	0.0	13.3				0.0	7.4	0.0	0.0	10.8	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1269	0	629				0	1319	579	0	1253	566
V/C Ratio(X)	0.16	0.00	0.82				0.00	0.58	0.00	0.00	0.80	0.00
Avail Cap(c_a), veh/h	4100	0	2921				0	8935	3921	0	4175	1886
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	8.9	0.0	22.0				0.0	10.5	0.0	0.0	12.1	0.0
Incr Delay (d2), s/veh	0.0	0.0	1.0				0.0	0.2	0.0	0.0	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.1				0.0	3.6	0.0	0.0	5.2	0.0
LnGrp Delay(d),s/veh	8.9	0.0	23.0				0.0	10.6	0.0	0.0	12.6	0.0
LnGrp LOS	A		C					B			B	
Approach Vol, veh/h		714						770			999	
Approach Delay, s/veh		19.0						10.6			12.6	
Approach LOS		B						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		21.8		20.2	0.0	21.8		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 1.1E2		* 50	50.0	50.0		
Max Q Clear Time (g_c+I1), s		9.4		15.3	0.0	12.8		
Green Ext Time (p_c), s		0.9		0.1	0.0	1.1		

Intersection Summary			
HCM 2010 Ctrl Delay			13.8
HCM 2010 LOS			B

Notes

Intersection	
Int Delay, s/veh	4.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	243	0	1466	1278	113
Future Vol, veh/h	0	243	0	1466	1278	113
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	40	2	2	4	2	3
Mvmt Flow	0	261	0	1576	1374	122

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	749	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.14	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.92	-	-	-	-
Pot Cap-1 Maneuver	0	304	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	304	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	59.9	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	304	-	-
HCM Lane V/C Ratio	-	0.86	-	-
HCM Control Delay (s)	-	59.9	-	-
HCM Lane LOS	-	F	-	-
HCM 95th %tile Q(veh)	-	7.6	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	102	305	33	55	192	205	1265	43	261	1252	8
Future Volume (veh/h)	9	102	305	33	55	192	205	1265	43	261	1252	8
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	10	110	191	35	59	58	220	1360	24	281	1346	8
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	22	250	445	56	287	416	260	2097	838	375	2600	15
Arrive On Green	0.01	0.13	0.13	0.03	0.15	0.15	0.15	0.54	0.54	0.11	0.50	0.50
Sat Flow, veh/h	1774	1863	1583	1774	1863	1583	1774	3912	1564	3442	5216	31
Grp Volume(v), veh/h	10	110	191	35	59	58	220	1360	24	281	875	479
Grp Sat Flow(s),veh/h/ln	1774	1863	1583	1774	1863	1583	1774	1304	1564	1721	1695	1857
Q Serve(g_s), s	0.5	5.2	9.4	1.9	2.6	2.7	11.5	23.6	0.7	7.5	16.6	16.6
Cycle Q Clear(g_c), s	0.5	5.2	9.4	1.9	2.6	2.7	11.5	23.6	0.7	7.5	16.6	16.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	22	250	445	56	287	416	260	2097	838	375	1690	926
V/C Ratio(X)	0.46	0.44	0.43	0.62	0.21	0.14	0.85	0.65	0.03	0.75	0.52	0.52
Avail Cap(c_a), veh/h	289	508	664	289	342	463	512	2097	838	993	1690	926
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.8	37.9	28.0	45.6	35.2	26.9	39.6	15.7	10.4	41.2	16.2	16.2
Incr Delay (d2), s/veh	14.5	1.2	0.7	10.7	0.4	0.2	7.4	1.6	0.1	3.0	1.1	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.7	4.2	1.1	1.4	1.2	6.2	8.7	0.3	3.7	8.0	9.1
LnGrp Delay(d),s/veh	61.3	39.1	28.7	56.3	35.6	27.0	47.1	17.3	10.5	44.2	17.3	18.2
LnGrp LOS	E	D	C	E	D	C	D	B	B	D	B	B
Approach Vol, veh/h		311			152			1604			1635	
Approach Delay, s/veh		33.4			37.1			21.3			22.2	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	55.6	7.5	17.3	18.5	52.0	5.7	19.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	27.5	47.5	15.5	26.0	27.5	47.5	15.5	17.5
Max Q Clear Time (g_c+I1), s	9.5	25.6	3.9	11.4	13.5	18.6	2.5	4.7
Green Ext Time (p_c), s	0.8	17.7	0.0	1.4	0.5	22.0	0.0	1.3

Intersection Summary		
HCM 2010 Ctrl Delay		23.3
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	14	25	606	8	0	131	0	902	0	0	0
Future Volume (veh/h)	0	14	25	606	8	0	131	0	902	0	0	0
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1776	1696	1845	1863	1863	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	0	18	4	777	10	0	168	0	877	0	0	0
Adj No. of Lanes	0	2	1	2	1	1	0	1	2	0	1	0
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Percent Heavy Veh, %	7	7	12	3	2	2	2	2	2	2	2	2
Cap, veh/h	0	854	364	1345	1313	1116	351	0	1652	0	2	0
Arrive On Green	0.00	0.25	0.25	0.39	0.70	0.00	0.20	0.00	0.20	0.00	0.00	0.00
Sat Flow, veh/h	0	3463	1440	3408	1863	1583	1774	0	2787	0	1863	0
Grp Volume(v), veh/h	0	18	4	777	10	0	168	0	877	0	0	0
Grp Sat Flow(s),veh/h/ln	0	1687	1440	1704	1863	1583	1774	0	1393	0	1863	0
Q Serve(g_s), s	0.0	0.4	0.2	18.8	0.2	0.0	8.8	0.0	19.6	0.0	0.0	0.0
Cycle Q Clear(g_c), s	0.0	0.4	0.2	18.8	0.2	0.0	8.8	0.0	19.6	0.0	0.0	0.0
Prop In Lane	0.00		1.00	1.00		1.00	1.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h	0	854	364	1345	1313	1116	351	0	1652	0	2	0
V/C Ratio(X)	0.00	0.02	0.01	0.58	0.01	0.00	0.48	0.00	0.53	0.00	0.00	0.00
Avail Cap(c_a), veh/h	0	854	364	1345	1313	1116	351	0	1652	0	284	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.89	0.89	0.00	0.92	0.00	0.92	0.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	29.5	29.4	24.9	4.6	0.0	37.3	0.0	12.7	0.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.4	0.0	0.0	0.3	0.0	0.2	0.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	0.2	0.1	8.9	0.1	0.0	4.3	0.0	7.6	0.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	29.5	29.4	25.3	4.6	0.0	37.6	0.0	12.9	0.0	0.0	0.0
LnGrp LOS		C	C	C	A		D		B			
Approach Vol, veh/h		22			787			1045			0	
Approach Delay, s/veh		29.4			25.0			16.8			0.0	
Approach LOS		C			C			B				

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	47.4	32.6		0.0		80.0		25.0
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	24.0	24.0		16.0		54.0		20.8
Max Q Clear Time (g_c+I1), s	20.8	2.4		0.0		2.2		21.6
Green Ext Time (p_c), s	0.7	0.1		0.0		0.1		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	20.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	26	3	112	0	953	141	0	287	421
Future Volume (veh/h)	0	0	0	26	3	112	0	953	141	0	287	421
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1827	1610	1743	0	1863	1863	1900	1834	1900
Adj Flow Rate, veh/h				34	0	11	0	1148	0	0	346	0
Adj No. of Lanes				2	0	2	0	2	1	0	3	0
Peak Hour Factor				0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Percent Heavy Veh, %				4	67	9	0	2	2	3	3	3
Cap, veh/h				131	0	27	0	3093	1383	0	4375	0
Arrive On Green				0.04	0.00	0.04	0.00	1.00	0.00	0.00	1.00	0.00
Sat Flow, veh/h				3480	0	2963	0	3632	1583	0	5172	0
Grp Volume(v), veh/h				34	0	11	0	1148	0	0	346	0
Grp Sat Flow(s),veh/h/ln				1740	0	1482	0	1770	1583	0	1669	0
Q Serve(g_s), s				1.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s				1.0	0.0	3.4	0.0	0.0	0.0	0.0	0.0	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				131	0	27	0	3093	1383	0	4375	0
V/C Ratio(X)				0.26	0.00	0.41	0.00	0.37	0.00	0.00	0.08	0.00
Avail Cap(c_a), veh/h				398	0	254	0	3093	1383	0	4375	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	2.00	2.00	1.67	1.67	1.67
Upstream Filter(I)				1.00	0.00	1.00	0.00	0.72	0.00	0.00	0.93	0.00
Uniform Delay (d), s/veh				49.1	0.0	864.1	0.0	0.0	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh				0.4	0.0	3.7	0.0	0.2	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.5	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
LnGrp Delay(d),s/veh				49.5	0.0	867.8	0.0	0.2	0.0	0.0	0.0	0.0
LnGrp LOS				D		F		A			A	
Approach Vol, veh/h					45			1148			346	
Approach Delay, s/veh					249.5			0.2			0.0	
Approach LOS					F			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	97.0				97.0		8.0
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	12.0	68.7				83.7		12.0
Max Q Clear Time (g_c+I1), s	0.0	2.0				2.0		5.4
Green Ext Time (p_c), s	0.0	23.2				24.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	7.5
HCM 2010 LOS	A

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	696	201	123	11	44	80	29	318	147	95	88	130
Future Volume (veh/h)	696	201	123	11	44	80	29	318	147	95	88	130
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1845	1776	1863	1863	1827	1776	1851	1900	1827	1845	1900
Adj Flow Rate, veh/h	773	223	37	12	49	15	32	353	121	106	98	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	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
Percent Heavy Veh, %	2	3	7	2	2	4	7	2	2	4	3	3
Cap, veh/h	845	453	370	73	77	181	796	1240	419	131	267	0
Arrive On Green	0.25	0.25	0.25	0.04	0.04	0.04	0.47	0.48	0.48	0.08	0.08	0.00
Sat Flow, veh/h	3442	1845	1509	1774	1863	1553	1691	2580	871	1740	3597	0
Grp Volume(v), veh/h	773	223	37	12	49	15	32	239	235	106	98	0
Grp Sat Flow(s),veh/h/ln	1721	1845	1509	1774	1863	1553	1691	1759	1692	1740	1752	0
Q Serve(g_s), s	22.9	10.9	2.0	0.7	2.7	0.9	1.1	8.6	8.8	6.3	2.8	0.0
Cycle Q Clear(g_c), s	22.9	10.9	2.0	0.7	2.7	0.9	1.1	8.6	8.8	6.3	2.8	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.51	1.00		0.00
Lane Grp Cap(c), veh/h	845	453	370	73	77	181	796	846	814	131	267	0
V/C Ratio(X)	0.92	0.49	0.10	0.16	0.64	0.08	0.04	0.28	0.29	0.81	0.37	0.00
Avail Cap(c_a), veh/h	901	483	395	456	479	516	796	846	814	133	868	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.00
Uniform Delay (d), s/veh	38.6	34.0	30.6	48.6	49.6	41.4	15.0	16.4	16.4	47.8	46.1	0.0
Incr Delay (d2), s/veh	12.7	0.3	0.0	0.4	3.2	0.1	0.0	0.8	0.9	27.2	3.8	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	12.3	5.6	0.8	0.3	1.5	0.4	0.5	4.4	4.3	4.0	1.5	0.0
LnGrp Delay(d),s/veh	51.3	34.3	30.7	49.0	52.8	41.4	15.0	17.2	17.3	75.0	49.9	0.0
LnGrp LOS	D	C	C	D	D	D	B	B	B	E	D	
Approach Vol, veh/h		1033			76			506			204	
Approach Delay, s/veh		46.9			50.0			17.1			62.9	
Approach LOS		D			D			B			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	11.9	55.5		29.3	54.4	13.0		8.3
Change Period (Y+Rc), s	4.0	5.0		3.5	5.0	* 5		4.0
Max Green Setting (Gmax), s	8.0	26.0		27.5	8.5	* 26		27.0
Max Q Clear Time (g_c+I1), s	8.3	10.8		24.9	3.1	4.8		4.7
Green Ext Time (p_c), s	0.0	2.7		0.8	1.4	0.6		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	40.5
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	149	655	182	25	357	259	85	18	25	124	5	166
Future Volume (veh/h)	149	655	182	25	357	259	85	18	25	124	5	166
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.97	1.00		1.00	1.00		0.92
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1696	1810	1863	1863	1842	1900	1863	1863	1900
Adj Flow Rate, veh/h	216	949	163	36	517	139	123	26	4	180	7	40
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	0
Peak Hour Factor	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Percent Heavy Veh, %	2	2	2	12	5	2	2	2	2	2	2	2
Cap, veh/h	242	1084	475	43	610	272	155	136	21	450	57	324
Arrive On Green	0.27	0.61	0.61	0.03	0.18	0.18	0.09	0.09	0.09	0.25	0.25	0.25
Sat Flow, veh/h	1774	3539	1552	1616	3438	1534	1774	1560	240	1774	224	1279
Grp Volume(v), veh/h	216	949	163	36	517	139	123	0	30	180	0	47
Grp Sat Flow(s),veh/h/ln	1774	1770	1552	1616	1719	1534	1774	0	1799	1774	0	1503
Q Serve(g_s), s	12.3	23.5	5.4	2.3	15.3	8.6	7.1	0.0	1.6	8.9	0.0	2.5
Cycle Q Clear(g_c), s	12.3	23.5	5.4	2.3	15.3	8.6	7.1	0.0	1.6	8.9	0.0	2.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.13	1.00		0.85
Lane Grp Cap(c), veh/h	242	1084	475	43	610	272	155	0	157	450	0	381
V/C Ratio(X)	0.89	0.88	0.34	0.83	0.85	0.51	0.79	0.00	0.19	0.40	0.00	0.12
Avail Cap(c_a), veh/h	253	1084	475	169	688	307	216	0	219	608	0	515
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.89	0.89	0.89	0.93	0.93	0.93	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	37.4	18.7	15.2	50.9	41.8	39.1	47.0	0.0	44.5	32.6	0.0	30.2
Incr Delay (d2), s/veh	25.8	8.9	1.7	12.9	8.3	1.4	12.7	0.0	0.6	0.6	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.7	12.5	2.5	1.2	8.0	3.7	4.0	0.0	0.8	4.4	0.0	1.1
LnGrp Delay(d),s/veh	63.2	27.6	16.9	63.8	50.1	40.4	59.7	0.0	45.1	33.1	0.0	30.3
LnGrp LOS	E	C	B	E	D	D	E		D	C		C
Approach Vol, veh/h		1328			692			153			227	
Approach Delay, s/veh		32.1			48.9			56.8			32.6	
Approach LOS		C			D			E			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	20.3	24.6		32.6	6.8	38.2		13.4
Change Period (Y+Rc), s	6.0	* 6		6.0	4.0	6.0		4.2
Max Green Setting (Gmax), s	15.0	* 21		36.0	11.0	25.0		12.8
Max Q Clear Time (g_c+I1), s	14.3	17.3		10.9	4.3	25.5		9.1
Green Ext Time (p_c), s	0.1	1.3		0.8	0.0	0.0		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	38.6
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	47	529	169	225	484	38	150	8	93	46	5	24
Future Volume (veh/h)	47	529	169	225	484	38	150	8	93	46	5	24
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.96	1.00		1.00	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1900	1681	1863	1900
Adj Flow Rate, veh/h	59	670	105	285	613	26	190	10	15	58	6	1
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	13	2	2
Cap, veh/h	76	1468	634	332	2053	917	229	97	146	73	95	16
Arrive On Green	0.04	0.41	0.41	0.19	0.58	0.58	0.13	0.14	0.14	0.05	0.06	0.06
Sat Flow, veh/h	1774	3539	1528	1774	3539	1581	1774	671	1007	1601	1550	258
Grp Volume(v), veh/h	59	670	105	285	613	26	190	0	25	58	0	7
Grp Sat Flow(s),veh/h/ln	1774	1770	1528	1774	1770	1581	1774	0	1678	1601	0	1808
Q Serve(g_s), s	3.2	13.2	2.5	15.0	8.5	0.7	10.1	0.0	1.2	3.5	0.0	0.4
Cycle Q Clear(g_c), s	3.2	13.2	2.5	15.0	8.5	0.7	10.1	0.0	1.2	3.5	0.0	0.4
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.60	1.00		0.14
Lane Grp Cap(c), veh/h	76	1468	634	332	2053	917	229	0	243	73	0	110
V/C Ratio(X)	0.77	0.46	0.17	0.86	0.30	0.03	0.83	0.00	0.10	0.79	0.00	0.06
Avail Cap(c_a), veh/h	368	1468	634	552	2053	917	552	0	627	498	0	694
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	45.7	20.4	6.4	37.9	10.3	8.6	40.9	0.0	35.8	45.6	0.0	42.7
Incr Delay (d2), s/veh	6.1	1.0	0.6	3.4	0.4	0.1	7.5	0.0	0.2	17.3	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	6.6	1.7	7.7	4.2	0.3	5.4	0.0	0.6	1.9	0.0	0.2
LnGrp Delay(d),s/veh	51.8	21.4	7.0	41.3	10.7	8.7	48.4	0.0	36.0	62.9	0.0	42.9
LnGrp LOS	D	C	A	D	B	A	D		D	E		D
Approach Vol, veh/h		834			924			215			65	
Approach Delay, s/veh		21.7			20.1			46.9			60.7	
Approach LOS		C			C			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	24.1	46.0	16.5	9.9	8.1	61.9	8.4	18.0
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	30.0	* 40	30.0	37.0	20.0	40.0	30.0	36.0
Max Q Clear Time (g_c+I1), s	17.0	15.2	12.1	2.4	5.2	10.5	5.5	3.2
Green Ext Time (p_c), s	1.1	4.7	0.5	0.1	0.0	4.3	0.1	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	24.9
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	10.2
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	1	0	30	0	61	1	3	0	10	56	239	0	8	130	0
Future Vol, veh/h	0	1	0	30	0	61	1	3	0	10	56	239	0	8	130	0
Peak Hour Factor	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78
Heavy Vehicles, %	2	2	2	2	2	9	2	2	2	2	11	3	2	2	3	2
Mvmt Flow	0	1	0	38	0	78	1	4	0	13	72	306	0	10	167	0
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	8.7	10.6	10.2	10.4
HCM LOS	A	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	3%	98%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	0%	2%	0%	0%	100%	100%
Vol Right, %	0%	0%	100%	97%	0%	100%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	10	56	239	31	62	3	8	130	0
LT Vol	10	0	0	1	61	0	8	0	0
Through Vol	0	56	0	0	1	0	0	130	0
RT Vol	0	0	239	30	0	3	0	0	0
Lane Flow Rate	13	72	306	40	79	4	10	167	0
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.021	0.11	0.397	0.062	0.15	0.006	0.018	0.263	0
Departure Headway (Hd)	5.855	5.506	4.665	5.644	6.773	5.456	6.167	5.681	5.664
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	607	646	763	638	533	660	575	625	0
Service Time	3.63	3.281	2.44	3.349	4.475	3.158	3.964	3.478	3.461
HCM Lane V/C Ratio	0.021	0.111	0.401	0.063	0.148	0.006	0.017	0.267	0
HCM Control Delay	8.8	9	10.5	8.7	10.7	8.2	9.1	10.5	8.5
HCM Lane LOS	A	A	B	A	B	A	A	B	N
HCM 95th-tile Q	0.1	0.4	1.9	0.2	0.5	0	0.1	1.1	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	228	318	60	152	731	128	7	3	14	103	6	131
Future Volume (veh/h)	228	318	60	152	731	128	7	3	14	103	6	131
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1863	1863	1863	1863	1827	1863	1465	1900	1845	1863	1827
Adj Flow Rate, veh/h	292	408	30	195	937	109	9	4	12	132	8	40
Adj No. of Lanes	2	2	1	1	2	1	1	1	0	1	1	1
Peak Hour Factor	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78	0.78
Percent Heavy Veh, %	3	2	2	2	2	4	2	33	33	3	2	4
Cap, veh/h	542	1391	618	252	1250	538	17	15	46	175	255	213
Arrive On Green	0.16	0.39	0.39	0.14	0.35	0.35	0.01	0.05	0.05	0.10	0.14	0.14
Sat Flow, veh/h	3408	3539	1573	1774	3539	1523	1774	323	970	1757	1863	1553
Grp Volume(v), veh/h	292	408	30	195	937	109	9	0	16	132	8	40
Grp Sat Flow(s),veh/h/ln	1704	1770	1573	1774	1770	1523	1774	0	1293	1757	1863	1553
Q Serve(g_s), s	4.5	4.5	0.7	6.1	13.4	1.7	0.3	0.0	0.7	4.2	0.2	0.8
Cycle Q Clear(g_c), s	4.5	4.5	0.7	6.1	13.4	1.7	0.3	0.0	0.7	4.2	0.2	0.8
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.75	1.00		1.00
Lane Grp Cap(c), veh/h	542	1391	618	252	1250	538	17	0	61	175	255	213
V/C Ratio(X)	0.54	0.29	0.05	0.77	0.75	0.20	0.54	0.00	0.26	0.76	0.03	0.19
Avail Cap(c_a), veh/h	2077	2465	1096	772	2465	1061	772	0	901	765	973	811
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	22.2	12.0	10.8	23.8	16.3	4.6	28.3	0.0	26.4	25.2	21.5	8.1
Incr Delay (d2), s/veh	0.8	0.0	0.0	5.0	0.3	0.1	25.1	0.0	0.8	6.5	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	2.2	2.2	0.3	3.3	6.6	1.1	0.3	0.0	0.3	2.3	0.1	0.5
LnGrp Delay(d),s/veh	23.0	12.0	10.8	28.8	16.7	4.7	53.4	0.0	27.2	31.7	21.5	8.3
LnGrp LOS	C	B	B	C	B	A	D		C	C	C	A
Approach Vol, veh/h		730			1241			25			180	
Approach Delay, s/veh		16.4			17.5			36.7			26.0	
Approach LOS		B			B			D			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.4	25.6	9.7	7.7	12.2	27.9	4.5	12.9
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	35.0	* 40	25.0	* 40	25.0	40.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	6.5	15.4	6.2	2.7	8.1	6.5	2.3	2.8
Green Ext Time (p_c), s	2.7	4.3	0.3	0.1	0.4	2.7	0.0	0.1

Intersection Summary	
HCM 2010 Ctrl Delay	18.1
HCM 2010 LOS	B

Notes

MOVEMENT SUMMARY

Site: 8 [Existing Plus Project AM]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	511	3.0	1.080	66.3	LOS F	232.8	5959.7	1.00	0.47	16.3
8	T1	454	3.0	1.080	66.3	LOS F	232.8	5959.7	1.00	0.47	16.1
18	R2	448	3.0	1.080	66.3	LOS F	232.8	5959.7	1.00	0.47	15.8
Approach		1413	3.0	1.080	66.3	LOS F	232.8	5959.7	1.00	0.47	16.0
East: Campus Loop											
1	L2	48	29.0	0.126	10.3	LOS B	0.4	11.4	0.65	0.65	25.3
6	T1	4	3.0	0.126	10.3	LOS B	0.4	11.4	0.65	0.65	22.3
16	R2	2	3.0	0.126	10.3	LOS B	0.4	11.4	0.65	0.65	21.8
Approach		54	26.3	0.126	10.3	LOS B	0.4	11.4	0.65	0.65	24.9
North: Campus Hill Drive											
7	L2	2	3.0	0.088	5.6	LOS A	0.3	8.8	0.55	0.48	24.9
4	T1	63	3.0	0.088	5.6	LOS A	0.3	8.8	0.55	0.48	28.7
14	R2	2	3.0	0.088	5.6	LOS A	0.3	8.8	0.55	0.48	23.8
Approach		67	3.0	0.088	5.6	LOS A	0.3	8.8	0.55	0.48	28.4
West: Campus Loop											
5	L2	2	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	25.2
2	T1	19	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	24.7
12	R2	76	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	28.5
Approach		96	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	27.6
All Vehicles		1630	3.8	1.080	58.3	LOS F	232.8	5959.7	0.93	0.45	17.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	8	216	238	298	479	229	450	555	48	46	146	7
Future Volume (veh/h)	8	216	238	298	479	229	450	555	48	46	146	7
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1759	1863	1792	1863
Adj Flow Rate, veh/h	11	284	80	392	630	265	592	730	22	61	192	1
Adj No. of Lanes	1	1	2	3	2	0	2	2	1	1	2	1
Peak Hour Factor	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	8	2	6	2
Cap, veh/h	44	483	723	608	862	362	695	994	419	154	565	263
Arrive On Green	0.02	0.26	0.26	0.12	0.36	0.36	0.20	0.28	0.28	0.09	0.17	0.17
Sat Flow, veh/h	1774	1863	2787	5003	2418	1016	3442	3539	1493	1774	3406	1583
Grp Volume(v), veh/h	11	284	80	392	461	434	592	730	22	61	192	1
Grp Sat Flow(s),veh/h/ln	1774	1863	1393	1668	1770	1664	1721	1770	1493	1774	1703	1583
Q Serve(g_s), s	0.5	9.9	1.6	5.5	16.8	16.8	12.3	13.8	0.8	2.4	3.7	0.0
Cycle Q Clear(g_c), s	0.5	9.9	1.6	5.5	16.8	16.8	12.3	13.8	0.8	2.4	3.7	0.0
Prop In Lane	1.00		1.00	1.00		0.61	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	44	483	723	608	631	593	695	994	419	154	565	263
V/C Ratio(X)	0.25	0.59	0.11	0.64	0.73	0.73	0.85	0.73	0.05	0.40	0.34	0.00
Avail Cap(c_a), veh/h	479	755	1129	1689	717	674	930	1434	605	479	1380	642
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.4	24.0	20.9	31.0	20.7	20.7	28.5	24.1	19.4	32.0	27.3	25.8
Incr Delay (d2), s/veh	1.1	1.1	0.1	0.4	3.3	3.5	4.6	1.1	0.1	0.6	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	5.2	0.6	2.6	8.8	8.3	6.3	6.8	0.3	1.2	1.8	0.0
LnGrp Delay(d),s/veh	36.6	25.1	21.0	31.4	24.1	24.3	33.1	25.3	19.5	32.6	27.7	25.8
LnGrp LOS	D	C	C	C	C	C	C	C	B	C	C	C
Approach Vol, veh/h		375			1287			1344			254	
Approach Delay, s/veh		24.5			26.4			28.6			28.8	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.4	26.1	13.0	24.5	19.0	17.6	5.8	31.7
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	20.0	30.0	25.0	30.0	20.0	* 30	20.0	30.0
Max Q Clear Time (g_c+I1), s	4.4	15.8	7.5	11.9	14.3	5.7	2.5	18.8
Green Ext Time (p_c), s	0.0	4.9	0.7	7.0	0.7	6.0	0.0	5.4

Intersection Summary	
HCM 2010 Ctrl Delay	27.3
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	800	0	521	0	532	546	0	352	330
Future Volume (veh/h)	0	0	0	800	0	521	0	532	546	0	352	330
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1863	0	1792	1792	1900	1845	1776
Adj Flow Rate, veh/h				909	0	530	0	605	0	0	400	375
Adj No. of Lanes				2	0	1	0	2	2	0	2	1
Peak Hour Factor				0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Percent Heavy Veh, %				8	0	2	0	6	6	3	3	7
Cap, veh/h				1477	0	574	0	1127	888	0	1160	498
Arrive On Green				0.45	0.00	0.45	0.00	0.33	0.00	0.00	0.33	0.33
Sat Flow, veh/h				3250	0	1583	0	3495	2682	0	3505	1505
Grp Volume(v), veh/h				909	0	530	0	605	0	0	400	375
Grp Sat Flow(s),veh/h/ln				1625	0	1583	0	1703	1341	0	1752	1505
Q Serve(g_s), s				10.9	0.0	21.1	0.0	7.4	0.0	0.0	4.4	11.4
Cycle Q Clear(g_c), s				10.9	0.0	21.1	0.0	7.4	0.0	0.0	4.4	11.4
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				1477	0	574	0	1127	888	0	1160	498
V/C Ratio(X)				0.62	0.00	0.92	0.00	0.54	0.00	0.00	0.34	0.75
Avail Cap(c_a), veh/h				2219	0	936	0	2325	1831	0	2393	1027
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				10.6	0.0	25.0	0.0	13.9	0.0	0.0	12.9	15.3
Incr Delay (d2), s/veh				0.2	0.0	6.4	0.0	0.1	0.0	0.0	0.1	0.9
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				4.8	0.0	14.6	0.0	3.5	0.0	0.0	2.1	4.8
LnGrp Delay(d),s/veh				10.7	0.0	31.4	0.0	14.1	0.0	0.0	13.0	16.2
LnGrp LOS				B		C		B			B	B
Approach Vol, veh/h					1439			605			775	
Approach Delay, s/veh					18.4			14.1			14.5	
Approach LOS					B			B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	23.3				23.3		28.0
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 25	35.0				* 35		35.0
Max Q Clear Time (g_c+I1), s	0.0	9.4				13.4		23.1
Green Ext Time (p_c), s	0.0	3.7				3.6		0.2

Intersection Summary		
HCM 2010 Ctrl Delay		16.4
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	234	0	336	0	0	0	0	844	450	0	1026	126
Future Volume (veh/h)	234	0	336	0	0	0	0	844	450	0	1026	126
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	0	1727				1900	1827	1727	0	1810	1845
Adj Flow Rate, veh/h	263	0	378				0	948	0	0	1153	0
Adj No. of Lanes	2	0	2				0	2	1	0	2	1
Peak Hour Factor	0.89	0.89	0.89				0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	12	0	10				4	4	10	0	5	3
Cap, veh/h	1046	0	490				0	1421	601	0	1342	612
Arrive On Green	0.33	0.00	0.33				0.00	0.41	0.00	0.00	0.39	0.00
Sat Flow, veh/h	3134	0	2584				0	3471	1468	0	3529	1568
Grp Volume(v), veh/h	263	0	378				0	948	0	0	1153	0
Grp Sat Flow(s),veh/h/ln	1567	0	1292				0	1736	1468	0	1719	1568
Q Serve(g_s), s	2.5	0.0	11.8				0.0	9.2	0.0	0.0	12.8	0.0
Cycle Q Clear(g_c), s	2.5	0.0	11.8				0.0	9.2	0.0	0.0	12.8	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1046	0	490				0	1421	601	0	1342	612
V/C Ratio(X)	0.25	0.00	0.77				0.00	0.67	0.00	0.00	0.86	0.00
Avail Cap(c_a), veh/h	3763	0	2730				0	8917	3772	0	4127	1882
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	10.1	0.0	23.4				0.0	10.0	0.0	0.0	11.7	0.0
Incr Delay (d2), s/veh	0.0	0.0	1.0				0.0	0.2	0.0	0.0	0.6	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	3.7				0.0	4.4	0.0	0.0	6.0	0.0
LnGrp Delay(d),s/veh	10.1	0.0	24.4				0.0	10.2	0.0	0.0	12.3	0.0
LnGrp LOS	B		C					B			B	
Approach Vol, veh/h		641						948			1153	
Approach Delay, s/veh		18.5						10.2			12.3	
Approach LOS		B						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		23.1		18.6	0.0	23.1		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 1.1E2		* 50	50.0	50.0		
Max Q Clear Time (g_c+I1), s		11.2		13.8	0.0	14.8		
Green Ext Time (p_c), s		1.2		0.1	0.0	1.4		

Intersection Summary	
HCM 2010 Ctrl Delay	13.0
HCM 2010 LOS	B

Notes

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	85	0	1294	1193	169
Future Vol, veh/h	0	85	0	1294	1193	169
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	250
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	2	9	2	7	8	2
Mvmt Flow	0	89	0	1362	1256	178

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	718	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.28	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.99	-	-	-	-
Pot Cap-1 Maneuver	0	306	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	306	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	21.6	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	306	-	-
HCM Lane V/C Ratio	-	0.292	-	-
HCM Control Delay (s)	-	21.6	-	-
HCM Lane LOS	-	C	-	-
HCM 95th %tile Q(veh)	-	1.2	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	36	129	58	135	116	262	1174	22	268	1004	6
Future Volume (veh/h)	4	36	129	58	135	116	262	1174	22	268	1004	6
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1520	1863	1863	1863	1863	1827	1863	1827	1667	1845	1810	1900
Adj Flow Rate, veh/h	4	40	41	64	150	37	291	1304	13	298	1116	6
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	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
Percent Heavy Veh, %	25	2	2	2	2	4	2	4	14	3	5	5
Cap, veh/h	8	121	399	83	198	343	332	2893	822	394	2577	14
Arrive On Green	0.01	0.06	0.06	0.05	0.11	0.11	0.19	0.58	0.58	0.12	0.51	0.51
Sat Flow, veh/h	1448	1863	1583	1774	1863	1531	1774	4988	1417	3408	5071	27
Grp Volume(v), veh/h	4	40	41	64	150	37	291	1304	13	298	725	397
Grp Sat Flow(s),veh/h/ln	1448	1863	1583	1774	1863	1531	1774	1663	1417	1704	1647	1804
Q Serve(g_s), s	0.3	1.9	1.9	3.3	7.3	1.8	14.9	13.9	0.4	7.9	13.0	13.0
Cycle Q Clear(g_c), s	0.3	1.9	1.9	3.3	7.3	1.8	14.9	13.9	0.4	7.9	13.0	13.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	8	121	399	83	198	343	332	2893	822	394	1674	917
V/C Ratio(X)	0.52	0.33	0.10	0.77	0.76	0.11	0.88	0.45	0.02	0.76	0.43	0.43
Avail Cap(c_a), veh/h	240	518	737	294	349	466	522	2893	822	1003	1674	917
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.4	41.8	26.8	44.0	40.6	29.0	36.9	11.2	8.3	40.0	14.5	14.5
Incr Delay (d2), s/veh	46.1	1.6	0.1	13.8	5.8	0.1	9.9	0.5	0.0	3.0	0.8	1.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	1.0	0.8	2.0	4.1	0.8	8.2	6.4	0.1	3.9	6.0	6.8
LnGrp Delay(d),s/veh	92.4	43.3	26.9	57.8	46.4	29.1	46.8	11.7	8.4	43.0	15.3	16.0
LnGrp LOS	F	D	C	E	D	C	D	B	A	D	B	B
Approach Vol, veh/h		85			251			1608			1420	
Approach Delay, s/veh		37.7			46.7			18.0			21.3	
Approach LOS		D			D			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	15.3	58.7	8.9	10.6	22.0	52.0	5.0	14.5
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	27.5	47.5	15.5	26.0	27.5	47.5	15.5	17.5
Max Q Clear Time (g_c+I1), s	9.9	15.9	5.3	3.9	16.9	15.0	2.3	9.3
Green Ext Time (p_c), s	0.9	21.2	0.1	1.1	0.6	21.6	0.0	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	22.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	12	81	852	15	0	144	0	626	0	1	0
Future Volume (veh/h)	7	12	81	852	15	0	144	0	626	0	1	0
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1900	1863	1827	1863	1863	1863	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	8	13	18	936	16	0	158	0	446	0	1	0
Adj No. of Lanes	0	2	1	2	1	1	0	1	2	0	1	0
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Percent Heavy Veh, %	2	2	4	2	2	2	2	2	2	2	2	2
Cap, veh/h	317	546	399	1496	1395	1186	204	0	1532	0	2	0
Arrive On Green	0.26	0.26	0.26	0.43	0.75	0.00	0.11	0.00	0.11	0.00	0.00	0.00
Sat Flow, veh/h	1006	2124	1551	3442	1863	1583	1774	0	2787	0	1863	0
Grp Volume(v), veh/h	12	9	18	936	16	0	158	0	446	0	1	0
Grp Sat Flow(s),veh/h/ln	1520	1610	1551	1721	1863	1583	1774	0	1393	0	1863	0
Q Serve(g_s), s	0.0	0.5	0.9	22.2	0.2	0.0	9.1	0.0	9.0	0.0	0.1	0.0
Cycle Q Clear(g_c), s	0.5	0.5	0.9	22.2	0.2	0.0	9.1	0.0	9.0	0.0	0.1	0.0
Prop In Lane	0.69		1.00	1.00		1.00	1.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h	449	414	399	1496	1395	1186	204	0	1532	0	2	0
V/C Ratio(X)	0.03	0.02	0.05	0.63	0.01	0.00	0.78	0.00	0.29	0.00	0.56	0.00
Avail Cap(c_a), veh/h	449	414	399	1496	1395	1186	301	0	1684	0	284	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	0.89	0.89	0.00	0.97	0.00	0.97	0.00	1.00	0.00
Uniform Delay (d), s/veh	29.2	29.1	29.3	23.0	3.3	0.0	45.2	0.0	12.7	0.0	52.4	0.0
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.6	0.0	0.0	3.6	0.0	0.0	0.0	75.9	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.2	0.4	10.6	0.1	0.0	4.6	0.0	3.4	0.0	0.1	0.0
LnGrp Delay(d),s/veh	29.2	29.1	29.3	23.6	3.3	0.0	48.8	0.0	12.7	0.0	128.3	0.0
LnGrp LOS	C	C	C	C	A		D		B		F	
Approach Vol, veh/h		39			952			604			1	
Approach Delay, s/veh		29.2			23.3			22.1			128.3	
Approach LOS		C			C			C			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	51.7	33.0		4.1		84.7		16.3
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	24.0	27.0		16.0		57.0		17.8
Max Q Clear Time (g_c+I1), s	24.2	2.9		2.1		2.2		11.1
Green Ext Time (p_c), s	0.0	0.1		0.0		0.1		1.0

Intersection Summary	
HCM 2010 Ctrl Delay	23.0
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	47	4	166	0	663	222	0	262	764
Future Volume (veh/h)	0	0	0	47	4	166	0	663	222	0	262	764
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1863	1863	1863	0	1845	1863	1900	1858	1900
Adj Flow Rate, veh/h				54	0	180	0	721	0	0	285	0
Adj No. of Lanes				2	0	2	0	2	1	0	3	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				2	2	2	0	3	2	3	3	3
Cap, veh/h				375	0	244	0	2824	1276	0	4087	0
Arrive On Green				0.11	0.00	0.11	0.00	0.81	0.00	0.00	0.27	0.00
Sat Flow, veh/h				3548	0	3167	0	3597	1583	0	5240	0
Grp Volume(v), veh/h				54	0	180	0	721	0	0	285	0
Grp Sat Flow(s),veh/h/ln				1774	0	1583	0	1752	1583	0	1691	0
Q Serve(g_s), s				1.5	0.0	8.8	0.0	5.3	0.0	0.0	4.4	0.0
Cycle Q Clear(g_c), s				1.5	0.0	8.8	0.0	5.3	0.0	0.0	4.4	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				375	0	244	0	2824	1276	0	4087	0
V/C Ratio(X)				0.14	0.00	0.74	0.00	0.26	0.00	0.00	0.07	0.00
Avail Cap(c_a), veh/h				608	0	452	0	2824	1276	0	4087	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)				1.00	0.00	1.00	0.00	0.83	0.00	0.00	0.84	0.00
Uniform Delay (d), s/veh				42.6	0.0	96.8	0.0	2.5	0.0	0.0	9.1	0.0
Incr Delay (d2), s/veh				0.1	0.0	1.6	0.0	0.2	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.7	0.0	0.1	0.0	2.6	0.0	0.0	2.1	0.0
LnGrp Delay(d),s/veh				42.7	0.0	98.5	0.0	2.7	0.0	0.0	9.1	0.0
LnGrp LOS				D		F		A			A	
Approach Vol, veh/h					234			721			285	
Approach Delay, s/veh					85.6			2.7			9.1	
Approach LOS					F			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	89.9				89.9		15.1
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	12.0	62.7				77.7		18.0
Max Q Clear Time (g_c+I1), s	0.0	7.3				6.4		10.8
Green Ext Time (p_c), s	0.0	11.8				12.1		0.3

Intersection Summary		
HCM 2010 Ctrl Delay		19.8
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	513	166	336	13	123	191	29	181	83	85	120	104
Future Volume (veh/h)	513	166	336	13	123	191	29	181	83	85	120	104
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1845	1863	1863	1900	1827	1845	1900
Adj Flow Rate, veh/h	552	178	91	14	132	57	31	195	43	91	129	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	3	2	2	2	4	3	3
Cap, veh/h	645	349	297	164	172	247	40	1433	309	113	1901	0
Arrive On Green	0.19	0.19	0.19	0.09	0.09	0.09	0.02	0.50	0.50	0.11	0.91	0.00
Sat Flow, veh/h	3442	1863	1583	1774	1863	1568	1774	2895	625	1740	3597	0
Grp Volume(v), veh/h	552	178	91	14	132	57	31	118	120	91	129	0
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1774	1863	1568	1774	1770	1750	1740	1752	0
Q Serve(g_s), s	16.3	9.0	5.2	0.8	7.3	3.3	1.8	3.8	3.9	5.4	0.4	0.0
Cycle Q Clear(g_c), s	16.3	9.0	5.2	0.8	7.3	3.3	1.8	3.8	3.9	5.4	0.4	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.36	1.00		0.00
Lane Grp Cap(c), veh/h	645	349	297	164	172	247	40	876	866	113	1901	0
V/C Ratio(X)	0.86	0.51	0.31	0.09	0.77	0.23	0.77	0.13	0.14	0.80	0.07	0.00
Avail Cap(c_a), veh/h	901	488	415	456	479	505	144	876	866	133	1901	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	41.3	38.3	36.8	43.6	46.6	38.7	51.0	14.3	14.4	46.1	2.3	0.0
Incr Delay (d2), s/veh	4.4	0.4	0.2	0.1	2.7	0.2	10.9	0.3	0.3	21.3	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.1	4.7	2.3	0.4	3.9	1.5	1.0	1.9	2.0	3.2	0.2	0.0
LnGrp Delay(d),s/veh	45.7	38.8	37.0	43.7	49.3	38.8	62.0	14.7	14.7	67.4	2.4	0.0
LnGrp LOS	D	D	D	D	D	D	E	B	B	E	A	
Approach Vol, veh/h		821			203			269			220	
Approach Delay, s/veh		43.2			46.0			20.1			29.2	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.8	57.3		23.2	5.9	62.2		13.7
Change Period (Y+Rc), s	4.0	5.3		3.5	3.5	5.3		4.0
Max Green Setting (Gmax), s	8.0	25.7		27.5	8.5	25.7		27.0
Max Q Clear Time (g_c+I1), s	7.4	5.9		18.3	3.8	2.4		9.3
Green Ext Time (p_c), s	0.0	2.4		1.4	0.0	2.5		0.4

Intersection Summary		
HCM 2010 Ctrl Delay		37.5
HCM 2010 LOS		D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	52	419	224	37	624	13	210	1	18	48	6	28
Future Volume (veh/h)	52	419	224	37	624	13	210	1	18	48	6	28
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1845	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	57	455	122	40	678	7	228	1	4	52	7	2
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	3	2	2	2	2	2	2	2	2
Cap, veh/h	679	2024	902	69	809	360	250	46	184	95	74	21
Arrive On Green	0.26	0.38	0.38	0.01	0.08	0.08	0.14	0.14	0.14	0.05	0.05	0.05
Sat Flow, veh/h	1774	3539	1578	1757	3539	1576	1774	326	1306	1774	1388	397
Grp Volume(v), veh/h	57	455	122	40	678	7	228	0	5	52	0	9
Grp Sat Flow(s),veh/h/ln	1774	1770	1578	1757	1770	1576	1774	0	1632	1774	0	1785
Q Serve(g_s), s	2.6	9.1	5.3	2.4	19.9	0.4	13.3	0.0	0.3	3.0	0.0	0.5
Cycle Q Clear(g_c), s	2.6	9.1	5.3	2.4	19.9	0.4	13.3	0.0	0.3	3.0	0.0	0.5
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.80	1.00		0.22
Lane Grp Cap(c), veh/h	679	2024	902	69	809	360	250	0	230	95	0	96
V/C Ratio(X)	0.08	0.22	0.14	0.58	0.84	0.02	0.91	0.00	0.02	0.55	0.00	0.09
Avail Cap(c_a), veh/h	679	2024	902	134	809	360	250	0	230	639	0	643
HCM Platoon Ratio	0.67	0.67	0.67	0.33	0.33	0.33	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.96	0.96	0.96	0.98	0.98	0.98	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	25.1	16.7	15.5	51.0	46.6	37.6	44.5	0.0	38.9	48.4	0.0	47.3
Incr Delay (d2), s/veh	0.0	0.2	0.3	7.3	9.9	0.1	34.4	0.0	0.0	4.8	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	4.5	2.4	1.3	10.8	0.2	8.9	0.0	0.1	1.6	0.0	0.3
LnGrp Delay(d),s/veh	25.1	16.9	15.8	58.2	56.5	37.7	78.8	0.0	38.9	53.3	0.0	47.7
LnGrp LOS	C	B	B	E	E	D	E		D	D		D
Approach Vol, veh/h		634			725			233			61	
Approach Delay, s/veh		17.4			56.4			78.0			52.4	
Approach LOS		B			E			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	46.2	30.0		9.8	10.1	66.0		19.0
Change Period (Y+Rc), s	6.0	* 6		* 4.2	6.0	6.0		4.2
Max Green Setting (Gmax), s	10.0	* 24		* 38	8.0	24.0		14.8
Max Q Clear Time (g_c+I1), s	4.6	21.9		5.0	4.4	11.1		15.3
Green Ext Time (p_c), s	0.8	0.9		0.2	0.0	2.6		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	44.4
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	139	320	16	23	323	125	79	20	138	180	6	169
Future Volume (veh/h)	139	320	16	23	323	125	79	20	138	180	6	169
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1827	1863	1863	1863	1863	1900	1863	1863	1900
Adj Flow Rate, veh/h	151	348	10	25	351	68	86	22	14	196	7	21
Adj No. of Lanes	1	2	1	1	2	1	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	4	2	2	2	2	2	2	2	2
Cap, veh/h	180	775	345	193	876	391	111	84	53	186	49	147
Arrive On Green	0.10	0.22	0.22	0.11	0.25	0.25	0.06	0.08	0.08	0.10	0.12	0.12
Sat Flow, veh/h	1774	3539	1576	1740	3539	1580	1774	1064	677	1774	405	1215
Grp Volume(v), veh/h	151	348	10	25	351	68	86	0	36	196	0	28
Grp Sat Flow(s),veh/h/ln	1774	1770	1576	1740	1770	1580	1774	0	1740	1774	0	1619
Q Serve(g_s), s	8.8	8.9	0.2	1.4	8.7	3.6	5.0	0.0	2.0	11.0	0.0	1.6
Cycle Q Clear(g_c), s	8.8	8.9	0.2	1.4	8.7	3.6	5.0	0.0	2.0	11.0	0.0	1.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.39	1.00		0.75
Lane Grp Cap(c), veh/h	180	775	345	193	876	391	111	0	137	186	0	196
V/C Ratio(X)	0.84	0.45	0.03	0.13	0.40	0.17	0.77	0.00	0.26	1.05	0.00	0.14
Avail Cap(c_a), veh/h	186	775	345	232	876	391	389	0	646	186	0	416
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.98	0.98	0.98	0.95	0.95	0.95	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	46.3	35.5	5.7	42.1	33.0	31.1	48.5	0.0	45.5	47.0	0.0	41.3
Incr Delay (d2), s/veh	24.8	1.8	0.2	0.1	1.3	0.9	10.7	0.0	1.0	81.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	4.5	0.1	0.7	4.4	1.6	2.8	0.0	1.0	9.6	0.0	0.7
LnGrp Delay(d),s/veh	71.2	37.3	5.8	42.2	34.3	32.0	59.2	0.0	46.5	128.2	0.0	41.6
LnGrp LOS	E	D	A	D	C	C	E		D	F		D
Approach Vol, veh/h		509			444			122			224	
Approach Delay, s/veh		46.8			34.4			55.5			117.4	
Approach LOS		D			C			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.7	29.0	10.6	16.7	14.7	32.0	15.0	12.3
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	14.0	* 23	23.0	27.0	11.0	26.0	11.0	39.0
Max Q Clear Time (g_c+I1), s	13.4	10.9	7.0	3.6	10.8	10.7	13.0	4.0
Green Ext Time (p_c), s	1.7	1.6	0.2	0.3	0.0	2.0	0.0	0.3

Intersection Summary	
HCM 2010 Ctrl Delay	55.5
HCM 2010 LOS	E

Notes

Intersection	
Intersection Delay, s/veh	10.9
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	0	2	8	0	190	0	14	0	29	118	181	0	8	77	0
Future Vol, veh/h	0	0	2	8	0	190	0	14	0	29	118	181	0	8	77	0
Peak Hour Factor	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	3	2	2	2	2	3	3	2	2	2	2
Mvmt Flow	0	0	2	9	0	224	0	16	0	34	139	213	0	9	91	0
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	8.8	13	9.9	10.1
HCM LOS	A	B	A	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	0%	100%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	20%	0%	0%	0%	100%	100%
Vol Right, %	0%	0%	100%	80%	0%	100%	0%	0%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	29	118	181	10	190	14	8	77	0
LT Vol	29	0	0	0	190	0	8	0	0
Through Vol	0	118	0	2	0	0	0	77	0
RT Vol	0	0	181	8	0	14	0	0	0
Lane Flow Rate	34	139	213	12	224	16	9	91	0
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.058	0.218	0.292	0.02	0.4	0.024	0.018	0.158	0
Departure Headway (Hd)	6.25	5.763	5.056	5.985	6.438	5.218	6.772	6.266	6.266
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	577	626	715	600	561	689	530	574	0
Service Time	3.95	3.463	2.756	3.707	4.149	2.929	4.491	3.985	3.985
HCM Lane V/C Ratio	0.059	0.222	0.298	0.02	0.399	0.023	0.017	0.159	0
HCM Control Delay	9.3	10.1	9.8	8.8	13.4	8.1	9.6	10.2	9
HCM Lane LOS	A	B	A	A	B	A	A	B	N
HCM 95th-tile Q	0.2	0.8	1.2	0.1	1.9	0.1	0.1	0.6	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	238	472	10	29	222	122	26	7	132	147	11	148
Future Volume (veh/h)	238	472	10	29	222	122	26	7	132	147	11	148
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.97	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1667	1863	1845	1863	1812	1900	1863	1743	1810
Adj Flow Rate, veh/h	264	524	5	32	247	82	29	8	19	163	12	44
Adj No. of Lanes	2	2	1	1	2	1	1	1	0	1	1	1
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
Percent Heavy Veh, %	2	2	2	14	2	3	2	2	2	2	9	5
Cap, veh/h	591	1336	582	46	734	322	48	39	92	218	309	272
Arrive On Green	0.17	0.38	0.38	0.03	0.21	0.21	0.03	0.08	0.08	0.12	0.18	0.18
Sat Flow, veh/h	3442	3539	1541	1587	3539	1554	1774	477	1133	1774	1743	1538
Grp Volume(v), veh/h	264	524	5	32	247	82	29	0	27	163	12	44
Grp Sat Flow(s),veh/h/ln	1721	1770	1541	1587	1770	1554	1774	0	1611	1774	1743	1538
Q Serve(g_s), s	3.2	5.1	0.1	0.9	2.8	1.2	0.8	0.0	0.7	4.2	0.3	0.6
Cycle Q Clear(g_c), s	3.2	5.1	0.1	0.9	2.8	1.2	0.8	0.0	0.7	4.2	0.3	0.6
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.70	1.00		1.00
Lane Grp Cap(c), veh/h	591	1336	582	46	734	322	48	0	130	218	309	272
V/C Ratio(X)	0.45	0.39	0.01	0.69	0.34	0.25	0.61	0.00	0.21	0.75	0.04	0.16
Avail Cap(c_a), veh/h	2563	3013	1312	844	3013	1323	944	0	1371	944	1113	982
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	17.5	10.7	9.1	22.6	15.9	5.5	22.6	0.0	20.2	19.9	16.0	4.5
Incr Delay (d2), s/veh	0.5	0.1	0.0	17.0	0.1	0.2	11.9	0.0	0.3	5.1	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	2.5	0.0	0.6	1.4	0.5	0.5	0.0	0.3	2.3	0.1	0.3
LnGrp Delay(d),s/veh	18.0	10.8	9.1	39.6	16.0	5.7	34.6	0.0	20.5	25.0	16.0	4.6
LnGrp LOS	B	B	A	D	B	A	C		C	C	B	A
Approach Vol, veh/h		793			361			56			219	
Approach Delay, s/veh		13.2			15.7			27.8			20.4	
Approach LOS		B			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.4	15.0	9.8	8.8	5.4	23.0	5.3	13.3
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	35.0	* 40	25.0	* 40	25.0	40.0	25.0	30.0
Max Q Clear Time (g_c+I1), s	5.2	4.8	6.2	2.7	2.9	7.1	2.8	2.6
Green Ext Time (p_c), s	3.1	1.0	0.4	0.2	0.0	3.1	0.0	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	15.5
HCM 2010 LOS	B

Notes

MOVEMENT SUMMARY

Site: 8 [Existing Plus Project PM]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	176	3.0	0.389	6.4	LOS A	2.5	64.3	0.13	0.03	28.5
8	T1	161	3.0	0.389	6.4	LOS A	2.5	64.3	0.13	0.03	27.8
18	R2	175	3.0	0.389	6.4	LOS A	2.5	64.3	0.13	0.03	27.0
Approach		512	3.0	0.389	6.4	LOS A	2.5	64.3	0.13	0.03	27.8
East: Campus Loop											
1	L2	134	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	27.1
6	T1	8	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	23.3
16	R2	1	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	22.8
Approach		143	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	26.9
North: Campus Hill Drive											
7	L2	1	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	25.0
4	T1	149	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	28.8
14	R2	1	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	23.9
Approach		151	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	28.7
West: Campus Loop											
5	L2	1	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	24.8
2	T1	14	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	24.3
12	R2	172	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	27.9
Approach		188	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	27.5
All Vehicles		995	3.0	0.389	5.9	LOS A	2.5	64.3	0.29	0.19	27.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	370	476	181	187	121	248	346	98	112	279	6
Future Volume (veh/h)	5	370	476	181	187	121	248	346	98	112	279	6
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1863	1863	1863	1863
Adj Flow Rate, veh/h	5	389	170	191	197	72	261	364	21	118	294	1
Adj No. of Lanes	1	1	2	3	2	0	2	2	1	1	2	1
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	21	520	768	654	1020	361	459	682	305	212	632	283
Arrive On Green	0.01	0.28	0.28	0.13	0.40	0.40	0.13	0.19	0.19	0.12	0.18	0.18
Sat Flow, veh/h	1774	1863	2751	5003	2564	908	3442	3539	1583	1774	3539	1583
Grp Volume(v), veh/h	5	389	170	191	134	135	261	364	21	118	294	1
Grp Sat Flow(s),veh/h/ln	1774	1863	1376	1668	1770	1702	1721	1770	1583	1774	1770	1583
Q Serve(g_s), s	0.2	12.7	3.2	2.3	3.3	3.5	4.8	6.2	0.7	4.2	5.0	0.0
Cycle Q Clear(g_c), s	0.2	12.7	3.2	2.3	3.3	3.5	4.8	6.2	0.7	4.2	5.0	0.0
Prop In Lane	1.00		1.00	1.00		0.53	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	21	520	768	654	704	677	459	682	305	212	632	283
V/C Ratio(X)	0.24	0.75	0.22	0.29	0.19	0.20	0.57	0.53	0.07	0.56	0.46	0.00
Avail Cap(c_a), veh/h	530	836	1234	1870	794	763	1029	1587	710	530	1587	710
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	32.7	22.0	18.5	26.3	13.1	13.2	27.2	24.3	22.1	27.8	24.6	22.6
Incr Delay (d2), s/veh	2.1	2.2	0.1	0.1	0.1	0.1	0.4	0.7	0.1	0.9	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.1	6.8	1.2	1.1	1.6	1.6	2.3	3.1	0.3	2.1	2.5	0.0
LnGrp Delay(d),s/veh	34.8	24.2	18.7	26.4	13.3	13.3	27.6	24.9	22.2	28.6	25.1	22.6
LnGrp LOS	C	C	B	C	B	B	C	C	C	C	C	C
Approach Vol, veh/h		564			460			646			413	
Approach Delay, s/veh		22.6			18.7			25.9			26.1	
Approach LOS		C			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	12.0	18.2	12.7	24.0	12.9	17.3	4.8	31.9
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	20.0	30.0	25.0	30.0	20.0	* 30	20.0	30.0
Max Q Clear Time (g_c+I1), s	6.2	8.2	4.3	14.7	6.8	7.0	2.2	5.5
Green Ext Time (p_c), s	0.1	4.0	0.3	3.8	0.4	4.0	0.0	4.4

Intersection Summary	
HCM 2010 Ctrl Delay	23.5
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	659	0	218	0	474	485	0	636	300
Future Volume (veh/h)	0	0	0	659	0	218	0	474	485	0	636	300
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1845	0	1863	0	1863	1827	1900	1863	1863
Adj Flow Rate, veh/h				694	0	124	0	499	0	0	669	316
Adj No. of Lanes				2	0	1	0	2	2	0	2	1
Peak Hour Factor				0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %				3	0	2	0	2	4	2	2	2
Cap, veh/h				970	0	219	0	1321	1020	0	1321	590
Arrive On Green				0.28	0.00	0.28	0.00	0.37	0.00	0.00	0.37	0.37
Sat Flow, veh/h				3408	0	1583	0	3632	2733	0	3539	1581
Grp Volume(v), veh/h				694	0	124	0	499	0	0	669	316
Grp Sat Flow(s),veh/h/ln				1704	0	1583	0	1770	1367	0	1770	1581
Q Serve(g_s), s				5.9	0.0	7.1	0.0	3.3	0.0	0.0	4.7	5.0
Cycle Q Clear(g_c), s				5.9	0.0	7.1	0.0	3.3	0.0	0.0	4.7	5.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				970	0	219	0	1321	1020	0	1321	590
V/C Ratio(X)				0.72	0.00	0.57	0.00	0.38	0.00	0.00	0.51	0.54
Avail Cap(c_a), veh/h				3711	0	1492	0	3854	2976	0	7179	3207
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				10.3	0.0	68.7	0.0	7.3	0.0	0.0	7.8	7.9
Incr Delay (d2), s/veh				0.4	0.0	0.9	0.0	0.1	0.0	0.0	0.1	0.3
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				2.7	0.0	4.0	0.0	1.6	0.0	0.0	2.3	2.2
LnGrp Delay(d),s/veh				10.7	0.0	69.6	0.0	7.4	0.0	0.0	7.9	8.2
LnGrp LOS				B		E		A			A	A
Approach Vol, veh/h					818			499			985	
Approach Delay, s/veh					19.6			7.4			8.0	
Approach LOS					B			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	18.3				18.3		13.8
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 4.8	35.0				* 65		35.0
Max Q Clear Time (g_c+I1), s	0.0	5.3				7.0		9.1
Green Ext Time (p_c), s	0.0	4.2				4.3		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	12.0
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	226	0	472	0	0	0	0	733	758	0	934	361
Future Volume (veh/h)	226	0	472	0	0	0	0	733	758	0	934	361
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	0	1863				1900	1845	1810	0	1845	1863
Adj Flow Rate, veh/h	246	0	513				0	797	0	0	1015	0
Adj No. of Lanes	2	0	2				0	2	1	0	2	1
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	0	2				3	3	5	0	3	2
Cap, veh/h	1269	0	629				0	1319	579	0	1252	566
Arrive On Green	0.37	0.00	0.37				0.00	0.38	0.00	0.00	0.36	0.00
Sat Flow, veh/h	3442	0	2787				0	3505	1538	0	3597	1583
Grp Volume(v), veh/h	246	0	513				0	797	0	0	1015	0
Grp Sat Flow(s),veh/h/ln	1721	0	1393				0	1752	1538	0	1752	1583
Q Serve(g_s), s	2.0	0.0	13.3				0.0	7.7	0.0	0.0	11.0	0.0
Cycle Q Clear(g_c), s	2.0	0.0	13.3				0.0	7.7	0.0	0.0	11.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1269	0	629				0	1319	579	0	1252	566
V/C Ratio(X)	0.19	0.00	0.82				0.00	0.60	0.00	0.00	0.81	0.00
Avail Cap(c_a), veh/h	4099	0	2921				0	8934	3921	0	4175	1886
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	9.0	0.0	22.0				0.0	10.6	0.0	0.0	12.2	0.0
Incr Delay (d2), s/veh	0.0	0.0	1.0				0.0	0.2	0.0	0.0	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	0.1				0.0	3.7	0.0	0.0	5.3	0.0
LnGrp Delay(d),s/veh	9.0	0.0	23.0				0.0	10.7	0.0	0.0	12.7	0.0
LnGrp LOS	A		C					B			B	
Approach Vol, veh/h		759						797			1015	
Approach Delay, s/veh		18.5						10.7			12.7	
Approach LOS		B						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		21.8		20.2	0.0	21.8		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 1.1E2		* 50	50.0	50.0		
Max Q Clear Time (g_c+I1), s		9.7		15.3	0.0	13.0		
Green Ext Time (p_c), s		1.0		0.1	0.0	1.1		

Intersection Summary		
HCM 2010 Ctrl Delay		13.8
HCM 2010 LOS		B

Notes

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	243	0	1491	1293	113
Future Vol, veh/h	0	243	0	1491	1293	113
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	93	93	93	93	93	93
Heavy Vehicles, %	40	2	2	4	2	3
Mvmt Flow	0	261	0	1603	1390	122

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	757	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.14	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.92	-	-	-	-
Pot Cap-1 Maneuver	0	300	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	300	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	62.4	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	300	-	-
HCM Lane V/C Ratio	-	0.871	-	-
HCM Control Delay (s)	-	62.4	-	-
HCM Lane LOS	-	F	-	-
HCM 95th %tile Q(veh)	-	7.8	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	9	102	305	33	55	192	205	1290	43	261	1267	8
Future Volume (veh/h)	9	102	305	33	55	192	205	1290	43	261	1267	8
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1863	1900
Adj Flow Rate, veh/h	10	110	191	35	59	58	220	1387	24	281	1362	8
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	0
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	22	250	445	56	287	416	260	2097	838	375	2600	15
Arrive On Green	0.01	0.13	0.13	0.03	0.15	0.15	0.15	0.54	0.54	0.11	0.50	0.50
Sat Flow, veh/h	1774	1863	1583	1774	1863	1583	1774	3912	1564	3442	5217	31
Grp Volume(v), veh/h	10	110	191	35	59	58	220	1387	24	281	885	485
Grp Sat Flow(s),veh/h/ln	1774	1863	1583	1774	1863	1583	1774	1304	1564	1721	1695	1857
Q Serve(g_s), s	0.5	5.2	9.4	1.9	2.6	2.7	11.5	24.3	0.7	7.5	16.9	16.9
Cycle Q Clear(g_c), s	0.5	5.2	9.4	1.9	2.6	2.7	11.5	24.3	0.7	7.5	16.9	16.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	22	250	445	56	287	416	260	2097	838	375	1690	926
V/C Ratio(X)	0.46	0.44	0.43	0.62	0.21	0.14	0.85	0.66	0.03	0.75	0.52	0.52
Avail Cap(c_a), veh/h	289	508	664	289	342	463	512	2097	838	993	1690	926
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	46.8	37.9	28.0	45.6	35.2	26.9	39.6	15.9	10.4	41.2	16.2	16.2
Incr Delay (d2), s/veh	14.5	1.2	0.7	10.7	0.4	0.2	7.4	1.7	0.1	3.0	1.2	2.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	2.7	4.2	1.1	1.4	1.2	6.2	9.1	0.3	3.7	8.1	9.2
LnGrp Delay(d),s/veh	61.3	39.1	28.7	56.3	35.6	27.0	47.1	17.6	10.5	44.2	17.4	18.3
LnGrp LOS	E	D	C	E	D	C	D	B	B	D	B	B
Approach Vol, veh/h		311			152			1631			1651	
Approach Delay, s/veh		33.4			37.1			21.4			22.2	
Approach LOS		C			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.9	55.6	7.5	17.3	18.5	52.0	5.7	19.2
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	27.5	47.5	15.5	26.0	27.5	47.5	15.5	17.5
Max Q Clear Time (g_c+I1), s	9.5	26.3	3.9	11.4	13.5	18.9	2.5	4.7
Green Ext Time (p_c), s	0.8	17.4	0.0	1.4	0.5	22.2	0.0	1.3

Intersection Summary	
HCM 2010 Ctrl Delay	23.4
HCM 2010 LOS	C

MOVEMENT SUMMARY

Site: 8 [Existing Plus Project AM Plus Mitigation]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	511	3.0	0.737	13.7	LOS B	10.0	254.8	0.31	0.10	25.9
8	T1	454	3.0	0.737	13.7	LOS B	10.0	254.8	0.31	0.10	25.3
18	R2	448	3.0	0.342	5.9	LOS A	2.1	52.7	0.14	0.04	27.6
Approach		1413	3.0	0.737	11.2	LOS B	10.0	254.8	0.25	0.08	26.2
East: Campus Loop											
1	L2	48	29.0	0.136	11.2	LOS B	0.4	12.1	0.67	0.67	25.0
6	T1	4	3.0	0.136	11.2	LOS B	0.4	12.1	0.67	0.67	22.1
16	R2	2	3.0	0.136	11.2	LOS B	0.4	12.1	0.67	0.67	21.6
Approach		54	26.3	0.136	11.2	LOS B	0.4	12.1	0.67	0.67	24.7
North: Campus Hill Drive											
7	L2	2	3.0	0.091	5.9	LOS A	0.4	9.1	0.56	0.50	24.8
4	T1	63	3.0	0.091	5.9	LOS A	0.4	9.1	0.56	0.50	28.6
14	R2	2	3.0	0.091	5.9	LOS A	0.4	9.1	0.56	0.50	23.7
Approach		67	3.0	0.091	5.9	LOS A	0.4	9.1	0.56	0.50	28.3
West: Campus Loop											
5	L2	2	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	25.2
2	T1	19	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	24.7
12	R2	76	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	28.5
Approach		96	3.0	0.082	3.7	LOS A	0.4	9.0	0.27	0.14	27.6
All Vehicles		1630	3.8	0.737	10.6	LOS B	10.0	254.8	0.28	0.12	26.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 8 [Existing Plus Project PM Plus Mitigation]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	176	3.0	0.256	5.0	LOS A	1.4	35.2	0.11	0.03	28.7
8	T1	161	3.0	0.256	5.0	LOS A	1.4	35.2	0.11	0.03	28.1
18	R2	175	3.0	0.133	3.8	LOS A	0.6	15.8	0.09	0.02	28.3
Approach		512	3.0	0.256	4.6	LOS A	1.4	35.2	0.10	0.03	28.4
East: Campus Loop											
1	L2	134	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	27.1
6	T1	8	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	23.3
16	R2	1	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	22.8
Approach		143	3.0	0.153	5.3	LOS A	0.7	16.9	0.47	0.37	26.9
North: Campus Hill Drive											
7	L2	1	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	25.0
4	T1	149	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	28.8
14	R2	1	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	23.9
Approach		151	3.0	0.158	5.2	LOS A	0.7	17.6	0.46	0.36	28.7
West: Campus Loop											
5	L2	1	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	24.8
2	T1	14	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	24.3
12	R2	172	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	27.9
Approach		188	3.0	0.189	5.4	LOS A	0.9	21.9	0.45	0.34	27.5
All Vehicles		995	3.0	0.256	4.9	LOS A	1.4	35.2	0.28	0.19	28.0

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	210	60	600	1540	10	690	10	870	10	10	10
Future Volume (veh/h)	0	210	60	600	1540	10	690	10	870	10	10	10
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1776	1696	1845	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	0	221	5	632	1621	10	726	11	754	11	11	0
Adj No. of Lanes	0	2	1	2	2	0	0	1	2	0	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	7	12	3	2	2	2	2	2	2	2	2
Cap, veh/h	0	765	327	788	1796	11	686	10	1737	14	14	0
Arrive On Green	0.00	0.23	0.23	0.23	0.50	0.50	0.39	0.39	0.39	0.02	0.02	0.00
Sat Flow, veh/h	0	3463	1442	3408	3606	22	1749	26	2787	909	909	0
Grp Volume(v), veh/h	0	221	5	632	795	836	737	0	754	22	0	0
Grp Sat Flow(s),veh/h/ln	0	1687	1442	1704	1770	1859	1775	0	1393	1817	0	0
Q Serve(g_s), s	0.0	8.1	0.4	26.3	61.4	61.6	58.8	0.0	21.0	1.8	0.0	0.0
Cycle Q Clear(g_c), s	0.0	8.1	0.4	26.3	61.4	61.6	58.8	0.0	21.0	1.8	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.01	0.99		1.00	0.50		0.00
Lane Grp Cap(c), veh/h	0	765	327	788	881	926	696	0	1737	28	0	0
V/C Ratio(X)	0.00	0.29	0.02	0.80	0.90	0.90	1.06	0.00	0.43	0.79	0.00	0.00
Avail Cap(c_a), veh/h	0	765	327	788	881	926	696	0	1737	400	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.35	0.35	0.35	0.71	0.00	0.71	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	48.0	45.0	54.4	34.3	34.4	45.6	0.0	14.6	73.6	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	0.0	2.0	5.9	5.7	45.6	0.0	0.0	16.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	3.8	0.2	12.6	31.5	33.0	37.6	0.0	8.0	1.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	48.1	45.0	56.4	40.2	40.0	91.2	0.0	14.6	89.7	0.0	0.0
LnGrp LOS		D	D	E	D	D	F		B	F		
Approach Vol, veh/h		226			2263			1491			22	
Approach Delay, s/veh		48.0			44.7			52.5			89.7	
Approach LOS		D			D			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	40.7	40.0		6.3		80.7		63.0
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	4.0	34.0		33.0		44.0		58.8
Max Q Clear Time (g_c+I1), s	28.3	10.1		3.8		63.6		60.8
Green Ext Time (p_c), s	0.0	8.8		0.0		0.0		0.0

Intersection Summary			
HCM 2010 Ctrl Delay			48.0
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	10	720	0	930	150	0	320	420
Future Volume (veh/h)	0	0	0	40	10	720	0	930	150	0	320	420
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1827	1465	1743	0	1863	1863	1900	1835	1900
Adj Flow Rate, veh/h				27	33	753	0	1011	0	0	348	0
Adj No. of Lanes				1	1	2	0	2	1	0	3	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				4	67	9	0	2	2	3	3	3
Cap, veh/h				558	470	832	0	1965	879	0	2781	0
Arrive On Green				0.32	0.32	0.32	0.00	0.18	0.00	0.00	0.93	0.00
Sat Flow, veh/h				1740	1465	2963	0	3632	1583	0	5173	0
Grp Volume(v), veh/h				27	33	753	0	1011	0	0	348	0
Grp Sat Flow(s),veh/h/ln				1740	1465	1482	0	1770	1583	0	1669	0
Q Serve(g_s), s				0.8	1.2	21.4	0.0	19.3	0.0	0.0	0.4	0.0
Cycle Q Clear(g_c), s				0.8	1.2	21.4	0.0	19.3	0.0	0.0	0.4	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				558	470	832	0	1965	879	0	2781	0
V/C Ratio(X)				0.05	0.07	0.91	0.00	0.51	0.00	0.00	0.13	0.00
Avail Cap(c_a), veh/h				603	508	909	0	1965	879	0	2781	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	0.33	0.33	1.67	1.67	1.67
Upstream Filter(I)				1.00	1.00	1.00	0.00	0.76	0.00	0.00	0.09	0.00
Uniform Delay (d), s/veh				17.6	17.7	34.7	0.0	21.5	0.0	0.0	1.2	0.0
Incr Delay (d2), s/veh				0.0	0.0	11.2	0.0	0.7	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.4	0.5	1.3	0.0	9.7	0.0	0.0	0.2	0.0
LnGrp Delay(d),s/veh				17.6	17.7	45.9	0.0	22.2	0.0	0.0	1.2	0.0
LnGrp LOS				B	B	D		C			A	
Approach Vol, veh/h					813			1011			348	
Approach Delay, s/veh					43.8			22.2			1.2	
Approach LOS					D			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	46.9				46.9		28.1
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	7.0	29.7				39.7		26.0
Max Q Clear Time (g_c+I1), s	0.0	21.3				2.4		23.4
Green Ext Time (p_c), s	0.0	6.0				16.3		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	26.9
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	670	210	130	20	50	90	30	320	150	100	90	170
Future Volume (veh/h)	670	210	130	20	50	90	30	320	150	100	90	170
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1845	1776	1863	1863	1827	1776	1851	1900	1827	1845	1900
Adj Flow Rate, veh/h	728	228	38	22	54	14	33	348	98	109	98	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	3	7	2	2	4	7	2	2	4	3	3
Cap, veh/h	835	447	366	84	88	197	45	1116	310	138	1649	0
Arrive On Green	0.24	0.24	0.24	0.05	0.05	0.05	0.03	0.41	0.41	0.08	0.47	0.00
Sat Flow, veh/h	3442	1845	1509	1774	1863	1553	1691	2717	754	1740	3597	0
Grp Volume(v), veh/h	728	228	38	22	54	14	33	223	223	109	98	0
Grp Sat Flow(s),veh/h/ln	1721	1845	1509	1774	1863	1553	1691	1759	1713	1740	1752	0
Q Serve(g_s), s	15.2	8.0	1.5	0.9	2.1	0.6	1.5	6.4	6.6	4.6	1.1	0.0
Cycle Q Clear(g_c), s	15.2	8.0	1.5	0.9	2.1	0.6	1.5	6.4	6.6	4.6	1.1	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.44	1.00		0.00
Lane Grp Cap(c), veh/h	835	447	366	84	88	197	45	723	704	138	1649	0
V/C Ratio(X)	0.87	0.51	0.10	0.26	0.62	0.07	0.74	0.31	0.32	0.79	0.06	0.00
Avail Cap(c_a), veh/h	941	504	413	166	174	268	101	723	704	232	1649	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	27.3	24.5	22.1	34.5	35.1	28.9	36.2	14.9	15.0	33.9	10.8	0.0
Incr Delay (d2), s/veh	7.6	0.3	0.0	0.6	2.6	0.1	8.4	1.1	1.2	3.6	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.1	4.1	0.6	0.5	1.2	0.3	0.8	3.3	3.3	2.3	0.6	0.0
LnGrp Delay(d),s/veh	34.9	24.9	22.1	35.1	37.7	28.9	44.6	16.0	16.1	37.5	10.9	0.0
LnGrp LOS	C	C	C	D	D	C	D	B	B	D	B	
Approach Vol, veh/h		994			90			479			207	
Approach Delay, s/veh		32.1			35.7			18.0			24.9	
Approach LOS		C			D			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	35.8		21.7	5.5	40.3		7.5
Change Period (Y+Rc), s	4.0	5.0		3.5	3.5	5.0		4.0
Max Green Setting (Gmax), s	10.0	21.0		20.5	4.5	27.0		7.0
Max Q Clear Time (g_c+I1), s	6.6	8.6		17.2	3.5	3.1		4.1
Green Ext Time (p_c), s	0.0	2.9		1.0	0.0	3.8		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		27.6
HCM 2010 LOS		C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	700	210	30	1840	260	120	20	30	130	10	170
Future Volume (veh/h)	150	700	210	30	1840	260	120	20	30	130	10	170
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.90
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1696	1816	1900	1863	1841	1900	1863	1863	1900
Adj Flow Rate, veh/h	163	761	199	33	2000	272	130	22	4	141	11	22
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	12	5	5	2	2	2	2	2	2
Cap, veh/h	177	2255	584	41	2090	280	116	99	18	354	102	205
Arrive On Green	0.20	1.00	1.00	0.03	0.47	0.47	0.07	0.07	0.07	0.20	0.20	0.20
Sat Flow, veh/h	1774	4017	1039	1616	4416	592	1774	1517	276	1774	514	1028
Grp Volume(v), veh/h	163	641	319	33	1489	783	130	0	26	141	0	33
Grp Sat Flow(s),veh/h/ln	1774	1695	1666	1616	1653	1703	1774	0	1792	1774	0	1541
Q Serve(g_s), s	13.5	0.0	0.0	3.0	64.8	67.2	9.8	0.0	2.1	10.4	0.0	2.6
Cycle Q Clear(g_c), s	13.5	0.0	0.0	3.0	64.8	67.2	9.8	0.0	2.1	10.4	0.0	2.6
Prop In Lane	1.00		0.62	1.00		0.35	1.00		0.15	1.00		0.67
Lane Grp Cap(c), veh/h	177	1904	936	41	1564	806	116	0	117	354	0	307
V/C Ratio(X)	0.92	0.34	0.34	0.81	0.95	0.97	1.12	0.00	0.22	0.40	0.00	0.11
Avail Cap(c_a), veh/h	177	1904	936	75	1564	806	116	0	117	423	0	368
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.91	0.91	0.91	0.61	0.61	0.61	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	59.4	0.0	0.0	72.8	37.9	38.5	70.1	0.0	66.5	52.2	0.0	49.1
Incr Delay (d2), s/veh	41.6	0.4	0.9	8.4	9.6	18.6	120.0	0.0	0.9	0.7	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.7	0.1	0.2	1.5	31.5	35.7	8.7	0.0	1.1	5.2	0.0	1.1
LnGrp Delay(d),s/veh	101.0	0.4	0.9	81.2	47.5	57.1	190.1	0.0	67.4	53.0	0.0	49.3
LnGrp LOS	F	A	A	F	D	E	F		E	D		D
Approach Vol, veh/h		1123			2305			156			174	
Approach Delay, s/veh		15.2			51.2			169.7			52.3	
Approach LOS		B			D			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.0	77.0		34.1	7.8	90.2		14.0
Change Period (Y+Rc), s	6.0	* 6		* 4.2	4.0	6.0		4.2
Max Green Setting (Gmax), s	15.0	* 71		* 36	7.0	79.0		9.8
Max Q Clear Time (g_c+I1), s	15.5	69.2		12.4	5.0	2.0		11.8
Green Ext Time (p_c), s	0.0	1.7		0.6	0.0	7.2		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.4
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↱		↰	↑↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	50	590	170	240	1970	40	160	10	100	50	10	30
Future Volume (veh/h)	50	590	170	240	1970	40	160	10	100	50	10	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		1.00	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1681	1863	1900
Adj Flow Rate, veh/h	54	641	151	261	2141	42	174	11	16	54	11	1
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	13	2	2
Cap, veh/h	69	935	216	643	2946	58	212	102	148	67	119	11
Arrive On Green	0.04	0.23	0.23	0.36	0.57	0.57	0.12	0.15	0.15	0.04	0.07	0.07
Sat Flow, veh/h	1774	4088	943	1774	5134	101	1774	684	996	1601	1679	153
Grp Volume(v), veh/h	54	529	263	261	1413	770	174	0	27	54	0	12
Grp Sat Flow(s),veh/h/ln	1774	1695	1641	1774	1695	1845	1774	0	1680	1601	0	1831
Q Serve(g_s), s	2.8	13.0	13.4	10.1	27.8	27.9	8.8	0.0	1.3	3.1	0.0	0.6
Cycle Q Clear(g_c), s	2.8	13.0	13.4	10.1	27.8	27.9	8.8	0.0	1.3	3.1	0.0	0.6
Prop In Lane	1.00		0.57	1.00		0.05	1.00		0.59	1.00		0.08
Lane Grp Cap(c), veh/h	69	775	375	643	1945	1059	212	0	250	67	0	130
V/C Ratio(X)	0.78	0.68	0.70	0.41	0.73	0.73	0.82	0.00	0.11	0.81	0.00	0.09
Avail Cap(c_a), veh/h	175	1558	754	660	2486	1353	369	0	827	193	0	742
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	43.5	32.2	32.4	21.8	14.2	14.3	39.3	0.0	33.7	43.4	0.0	39.7
Incr Delay (d2), s/veh	7.0	1.1	2.4	0.2	0.8	1.5	7.8	0.0	0.2	20.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	6.2	6.3	5.0	13.2	14.6	4.8	0.0	0.6	1.7	0.0	0.3
LnGrp Delay(d),s/veh	50.5	33.3	34.7	21.9	15.0	15.7	47.1	0.0	33.8	63.6	0.0	40.0
LnGrp LOS	D	C	C	C	B	B	D		C	E		D
Approach Vol, veh/h		846			2444			201			66	
Approach Delay, s/veh		34.8			16.0			45.3			59.3	
Approach LOS		C			B			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	39.1	26.9	14.9	10.5	7.6	58.4	7.8	17.6
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	34.0	* 42	19.0	37.0	9.0	67.0	11.0	45.0
Max Q Clear Time (g_c+I1), s	12.1	15.4	10.8	2.6	4.8	29.9	5.1	3.3
Green Ext Time (p_c), s	15.8	5.1	0.3	0.2	0.0	22.5	0.0	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	22.9
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	10
Intersection LOS	A

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	10	10	40	0	50	10	10	0	20	60	180	0	10	140	10
Future Vol, veh/h	0	10	10	40	0	50	10	10	0	20	60	180	0	10	140	10
Peak Hour Factor	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78
Heavy Vehicles, %	2	2	2	2	2	9	2	2	2	2	11	3	2	2	3	2
Mvmt Flow	0	13	13	51	0	64	13	13	0	26	77	231	0	13	179	13
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	9.4	10.3	9.7	10.6
HCM LOS	A	B	A	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	17%	83%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	17%	17%	0%	0%	100%	0%
Vol Right, %	0%	0%	100%	67%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	60	180	60	60	10	10	140	10
LT Vol	20	0	0	10	50	0	10	0	0
Through Vol	0	60	0	10	10	0	0	140	0
RT Vol	0	0	180	40	0	10	0	0	10
Lane Flow Rate	26	77	231	77	77	13	13	179	13
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.043	0.122	0.311	0.125	0.144	0.02	0.023	0.291	0.018
Departure Headway (Hd)	6.15	5.801	4.958	5.855	6.726	5.489	6.321	5.834	5.112
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	586	622	729	615	535	654	568	617	702
Service Time	3.85	3.501	2.658	3.571	4.441	3.205	4.036	3.549	2.826
HCM Lane V/C Ratio	0.044	0.124	0.317	0.125	0.144	0.02	0.023	0.29	0.019
HCM Control Delay	9.1	9.3	9.9	9.4	10.6	8.3	9.2	10.9	7.9
HCM Lane LOS	A	A	A	A	B	A	A	B	A
HCM 95th-tile Q	0.1	0.4	1.3	0.4	0.5	0.1	0.1	1.2	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	240	320	70	160	1930	90	150	10	20	100	20	280
Future Volume (veh/h)	240	320	70	160	1930	90	150	10	20	100	20	280
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1863	1900	1863	1861	1900	1863	1458	1900	1845	1863	1827
Adj Flow Rate, veh/h	261	348	56	174	2098	94	163	11	2	109	22	114
Adj No. of Lanes	2	3	0	1	3	0	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	2	2	2	2	33	33	3	2	4
Cap, veh/h	365	2175	340	207	2430	108	194	171	31	137	207	173
Arrive On Green	0.11	0.49	0.49	0.12	0.49	0.49	0.11	0.14	0.14	0.08	0.11	0.11
Sat Flow, veh/h	3408	4432	694	1774	4982	222	1774	1201	218	1757	1863	1553
Grp Volume(v), veh/h	261	264	140	174	1424	768	163	0	13	109	22	114
Grp Sat Flow(s),veh/h/ln	1704	1695	1736	1774	1694	1817	1774	0	1419	1757	1863	1553
Q Serve(g_s), s	7.9	4.6	4.7	10.2	39.4	39.8	9.6	0.0	0.8	6.5	1.1	5.8
Cycle Q Clear(g_c), s	7.9	4.6	4.7	10.2	39.4	39.8	9.6	0.0	0.8	6.5	1.1	5.8
Prop In Lane	1.00		0.40	1.00		0.12	1.00		0.15	1.00		1.00
Lane Grp Cap(c), veh/h	365	1663	852	207	1652	886	194	0	202	137	207	173
V/C Ratio(X)	0.71	0.16	0.16	0.84	0.86	0.87	0.84	0.00	0.06	0.80	0.11	0.66
Avail Cap(c_a), veh/h	546	1844	945	318	1907	1023	251	0	541	248	703	586
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	45.8	14.9	15.0	45.9	24.0	24.1	46.3	0.0	39.3	48.1	42.4	26.8
Incr Delay (d2), s/veh	2.6	0.0	0.0	11.6	3.4	6.5	17.7	0.0	0.0	10.1	0.1	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.8	2.1	2.3	5.6	19.2	21.4	5.6	0.0	0.3	3.5	0.6	3.0
LnGrp Delay(d),s/veh	48.4	14.9	15.0	57.5	27.5	30.6	64.1	0.0	39.4	58.2	42.5	28.4
LnGrp LOS	D	B	B	E	C	C	E		D	E	D	C
Approach Vol, veh/h		665			2366			176			245	
Approach Delay, s/veh		28.1			30.7			62.2			43.0	
Approach LOS		C			C			E			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	16.7	57.0	12.2	20.1	16.3	57.3	15.6	16.8
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	17.0	* 60	15.0	* 40	19.0	57.7	15.0	40.0
Max Q Clear Time (g_c+I1), s	9.9	41.8	8.5	2.8	12.2	6.7	11.6	7.8
Green Ext Time (p_c), s	1.5	9.9	0.1	0.3	0.2	2.5	0.1	0.3

Intersection Summary	
HCM 2010 Ctrl Delay	32.7
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	36.2
Intersection LOS	E

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Traffic Vol, veh/h	0	10	60	0	30	10	0	370	250
Future Vol, veh/h	0	10	60	0	30	10	0	370	250
Peak Hour Factor	0.92	0.54	0.54	0.92	0.54	0.54	0.92	0.54	0.54
Heavy Vehicles, %	2	2	2	2	29	2	2	2	3
Mvmt Flow	0	19	111	0	56	19	0	685	463
Number of Lanes	0	1	1	0	0	1	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	10.4	11.3	40.7
HCM LOS	B	B	E

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	100%	0%	0%	0%	75%
Vol Thru, %	0%	0%	100%	0%	25%
Vol Right, %	0%	100%	0%	100%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	370	250	10	60	40
LT Vol	370	0	0	0	30
Through Vol	0	0	10	0	10
RT Vol	0	250	0	60	0
Lane Flow Rate	685	463	19	111	74
Geometry Grp	7	7	7	7	4
Degree of Util (X)	1	0.577	0.036	0.193	0.145
Departure Headway (Hd)	5.672	4.484	6.96	6.262	7.057
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	637	801	515	573	510
Service Time	3.431	2.243	4.695	3.997	5.084
HCM Lane V/C Ratio	1.075	0.578	0.037	0.194	0.145
HCM Control Delay	59.2	13.3	10	10.5	11.3
HCM Lane LOS	F	B	A	B	B
HCM 95th-tile Q	15.3	3.8	0.1	0.7	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	210	310	430	1800	200	460	440	90	40	140	10
Future Volume (veh/h)	10	210	310	430	1800	200	460	440	90	40	140	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1759	1863	1792	1863
Adj Flow Rate, veh/h	11	228	124	467	1957	210	500	478	24	43	152	1
Adj No. of Lanes	1	2	2	2	3	0	2	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	8	2	6	2
Cap, veh/h	41	1361	1047	534	2405	256	567	847	347	104	453	202
Arrive On Green	0.02	0.38	0.38	0.16	0.52	0.52	0.16	0.24	0.24	0.06	0.13	0.13
Sat Flow, veh/h	1774	3539	2724	3442	4658	495	3442	3539	1452	1774	3406	1517
Grp Volume(v), veh/h	11	228	124	467	1419	748	500	478	24	43	152	1
Grp Sat Flow(s),veh/h/ln	1774	1770	1362	1721	1695	1764	1721	1770	1452	1774	1703	1517
Q Serve(g_s), s	0.7	4.8	3.4	15.2	39.8	40.7	16.2	13.6	1.5	2.7	4.6	0.1
Cycle Q Clear(g_c), s	0.7	4.8	3.4	15.2	39.8	40.7	16.2	13.6	1.5	2.7	4.6	0.1
Prop In Lane	1.00		1.00	1.00		0.28	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	41	1361	1047	534	1751	911	567	847	347	104	453	202
V/C Ratio(X)	0.27	0.17	0.12	0.87	0.81	0.82	0.88	0.56	0.07	0.41	0.34	0.00
Avail Cap(c_a), veh/h	140	1507	1160	722	1888	982	752	1507	618	155	1015	452
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	54.9	23.2	22.7	47.2	23.0	23.2	46.7	38.3	33.7	51.9	45.0	43.0
Incr Delay (d2), s/veh	1.3	0.1	0.0	7.3	2.6	5.3	7.9	0.6	0.1	1.0	0.4	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	2.4	1.3	7.7	19.2	21.1	8.3	6.7	0.6	1.3	2.2	0.0
LnGrp Delay(d),s/veh	56.2	23.2	22.8	54.6	25.6	28.5	54.6	38.9	33.7	52.9	45.4	43.0
LnGrp LOS	E	C	C	D	C	C	D	D	C	D	D	D
Approach Vol, veh/h		363			2634			1002			196	
Approach Delay, s/veh		24.1			31.6			46.6			47.1	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.7	32.7	21.7	49.3	22.8	20.5	6.7	64.4
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	10.0	48.7	24.0	48.7	25.0	* 34	9.0	63.7
Max Q Clear Time (g_c+I1), s	4.7	15.6	17.2	6.8	18.2	6.6	2.7	42.7
Green Ext Time (p_c), s	0.0	4.1	0.6	27.0	0.6	4.0	0.0	16.3

Intersection Summary	
HCM 2010 Ctrl Delay	35.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	810	0	740	0	560	560	0	560	370
Future Volume (veh/h)	0	0	0	810	0	740	0	560	560	0	560	370
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1863	0	1792	1792	1900	1845	1776
Adj Flow Rate, veh/h				880	0	789	0	609	0	0	609	402
Adj No. of Lanes				2	0	1	0	3	2	0	3	1
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				8	0	2	0	6	6	3	3	7
Cap, veh/h				1772	0	774	0	1577	864	0	1623	486
Arrive On Green				0.55	0.00	0.55	0.00	0.32	0.00	0.00	0.32	0.32
Sat Flow, veh/h				3250	0	1583	0	5055	2682	0	5036	1509
Grp Volume(v), veh/h				880	0	789	0	609	0	0	609	402
Grp Sat Flow(s),veh/h/ln				1625	0	1583	0	1631	1341	0	1679	1509
Q Serve(g_s), s				14.0	0.0	45.3	0.0	8.0	0.0	0.0	7.7	20.4
Cycle Q Clear(g_c), s				14.0	0.0	45.3	0.0	8.0	0.0	0.0	7.7	20.4
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				1772	0	774	0	1577	864	0	1623	486
V/C Ratio(X)				0.50	0.00	1.02	0.00	0.39	0.00	0.00	0.38	0.83
Avail Cap(c_a), veh/h				1772	0	774	0	1577	864	0	2073	621
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				11.8	0.0	26.3	0.0	21.8	0.0	0.0	21.7	26.0
Incr Delay (d2), s/veh				0.1	0.0	37.4	0.0	0.2	0.0	0.0	0.1	7.2
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				6.3	0.0	35.8	0.0	3.6	0.0	0.0	3.6	9.5
LnGrp Delay(d),s/veh				11.9	0.0	63.7	0.0	21.9	0.0	0.0	21.8	33.2
LnGrp LOS				B		F		C			C	C
Approach Vol, veh/h					1669			609			1011	
Approach Delay, s/veh					36.4			21.9			26.4	
Approach LOS					D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	33.1				33.1		50.0
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 10	18.7				* 34		45.3
Max Q Clear Time (g_c+I1), s	0.0	10.0				22.4		47.3
Green Ext Time (p_c), s	0.0	5.5				4.3		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		30.6
HCM 2010 LOS		C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	210	0	620	0	0	0	0	910	680	0	1110	260
Future Volume (veh/h)	210	0	620	0	0	0	0	910	680	0	1110	260
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	0	1727				1900	1827	1727	0	1810	1845
Adj Flow Rate, veh/h	228	0	674				0	989	0	0	1207	0
Adj No. of Lanes	2	0	2				0	3	1	0	3	1
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	12	0	10				4	4	10	0	5	3
Cap, veh/h	1089	0	567				0	2116	623	0	2012	639
Arrive On Green	0.35	0.00	0.35				0.00	0.42	0.00	0.00	0.41	0.00
Sat Flow, veh/h	3134	0	2584				0	4988	1468	0	5103	1568
Grp Volume(v), veh/h	228	0	674				0	989	0	0	1207	0
Grp Sat Flow(s),veh/h/ln	1567	0	1292				0	1663	1468	0	1647	1568
Q Serve(g_s), s	2.4	0.0	16.3				0.0	6.7	0.0	0.0	9.0	0.0
Cycle Q Clear(g_c), s	2.4	0.0	16.3				0.0	6.7	0.0	0.0	9.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1089	0	567				0	2116	623	0	2012	639
V/C Ratio(X)	0.21	0.00	1.19				0.00	0.47	0.00	0.00	0.60	0.00
Avail Cap(c_a), veh/h	1089	0	567				0	5658	1665	0	3286	1043
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	10.8	0.0	24.3				0.0	9.7	0.0	0.0	10.9	0.0
Incr Delay (d2), s/veh	0.0	0.0	101.2				0.0	0.2	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.0	0.0	12.5				0.0	3.1	0.0	0.0	4.1	0.0
LnGrp Delay(d),s/veh	10.8	0.0	125.6				0.0	9.9	0.0	0.0	11.2	0.0
LnGrp LOS	B		F					A			B	
Approach Vol, veh/h		902						989			1207	
Approach Delay, s/veh		96.5						9.9			11.2	
Approach LOS		F						A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		25.9		21.0	0.0	25.9		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 53		* 16	15.0	31.2		
Max Q Clear Time (g_c+I1), s		8.7		18.3	0.0	11.0		
Green Ext Time (p_c), s		8.1		0.0	0.0	8.0		

Intersection Summary			
HCM 2010 Ctrl Delay			35.6
HCM 2010 LOS			D

Notes

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	90	0	1590	1560	170
Future Vol, veh/h	0	90	0	1590	1560	170
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	9	2	7	8	2
Mvmt Flow	0	98	0	1728	1696	185

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	941	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.28	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.99	-	-	-	-
Pot Cap-1 Maneuver	0	217	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	217	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	34.5	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	217	-	-
HCM Lane V/C Ratio	-	0.451	-	-
HCM Control Delay (s)	-	34.5	-	-
HCM Lane LOS	-	D	-	-
HCM 95th %tile Q(veh)	-	2.2	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	40	130	140	140	120	270	1460	30	310	1330	10
Future Volume (veh/h)	10	40	130	140	140	120	270	1460	30	310	1330	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1520	1863	1863	1863	1863	1827	1863	1827	1667	1845	1810	1900
Adj Flow Rate, veh/h	11	43	82	152	152	68	293	1587	15	337	1446	10
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	25	2	2	2	2	4	2	4	14	3	5	5
Cap, veh/h	23	134	408	184	298	434	329	2471	702	415	2185	15
Arrive On Green	0.02	0.07	0.07	0.10	0.16	0.16	0.19	0.50	0.50	0.12	0.43	0.43
Sat Flow, veh/h	1448	1863	1583	1774	1863	1532	1774	4988	1417	3408	5062	35
Grp Volume(v), veh/h	11	43	82	152	152	68	293	1587	15	337	941	515
Grp Sat Flow(s),veh/h/ln	1448	1863	1583	1774	1863	1532	1774	1663	1417	1704	1647	1803
Q Serve(g_s), s	0.8	2.2	4.1	8.5	7.6	3.4	16.3	23.9	0.5	9.8	23.0	23.0
Cycle Q Clear(g_c), s	0.8	2.2	4.1	8.5	7.6	3.4	16.3	23.9	0.5	9.8	23.0	23.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	23	134	408	184	298	434	329	2471	702	415	1422	778
V/C Ratio(X)	0.48	0.32	0.20	0.83	0.51	0.16	0.89	0.64	0.02	0.81	0.66	0.66
Avail Cap(c_a), veh/h	103	482	703	268	631	708	443	2471	702	582	1422	778
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.4	44.7	29.5	44.5	38.9	27.4	40.2	18.9	13.0	43.4	22.9	22.9
Incr Delay (d2), s/veh	14.9	1.4	0.2	12.8	1.4	0.2	15.7	1.3	0.1	6.0	2.4	4.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	1.2	1.8	4.8	4.0	1.5	9.4	11.2	0.2	4.9	10.9	12.4
LnGrp Delay(d),s/veh	64.3	46.1	29.7	57.3	40.3	27.5	55.9	20.2	13.1	49.3	25.4	27.3
LnGrp LOS	E	D	C	E	D	C	E	C	B	D	C	C
Approach Vol, veh/h		136			372			1895			1793	
Approach Delay, s/veh		37.7			44.9			25.7			30.4	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.0	56.0	15.2	13.1	23.5	49.5	6.3	22.0
Change Period (Y+Rc), s	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8
Max Green Setting (Gmax), s	* 17	50.2	* 15	26.2	* 25	42.2	* 7.2	34.3
Max Q Clear Time (g_c+I1), s	11.8	25.9	10.5	6.1	18.3	25.0	2.8	9.6
Green Ext Time (p_c), s	0.6	20.8	0.1	1.4	0.5	15.3	0.0	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	29.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1800	340	840	40	10	190	10	600	10	10	10
Future Volume (veh/h)	0	1800	340	840	40	10	190	10	600	10	10	10
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1776	1696	1845	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	0	1837	259	857	41	7	194	10	317	10	10	10
Adj No. of Lanes	0	2	1	2	2	0	0	1	2	0	1	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
Percent Heavy Veh, %	0	7	12	3	2	2	2	2	2	2	2	2
Cap, veh/h	0	2084	891	500	2444	407	133	7	628	13	13	13
Arrive On Green	0.00	0.62	0.62	0.15	0.80	0.80	0.08	0.08	0.08	0.02	0.02	0.02
Sat Flow, veh/h	0	3463	1442	3408	3037	505	1691	87	2787	577	577	577
Grp Volume(v), veh/h	0	1837	259	857	23	25	204	0	317	30	0	0
Grp Sat Flow(s),veh/h/ln	0	1687	1442	1704	1770	1773	1778	0	1393	1732	0	0
Q Serve(g_s), s	0.0	68.5	12.6	22.0	0.4	0.4	11.8	0.0	11.8	2.6	0.0	0.0
Cycle Q Clear(g_c), s	0.0	68.5	12.6	22.0	0.4	0.4	11.8	0.0	11.8	2.6	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.29	0.95		1.00	0.33		0.33
Lane Grp Cap(c), veh/h	0	2084	891	500	1424	1427	140	0	628	38	0	0
V/C Ratio(X)	0.00	0.88	0.29	1.71	0.02	0.02	1.46	0.00	0.50	0.78	0.00	0.00
Avail Cap(c_a), veh/h	0	2084	891	500	1424	1427	140	0	628	393	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.79	0.79	0.79	0.96	0.00	0.96	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	24.0	13.4	64.0	2.9	2.9	69.1	0.0	50.8	73.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	5.8	0.8	328.2	0.0	0.0	239.9	0.0	0.2	12.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	33.3	5.2	33.1	0.2	0.2	15.1	0.0	5.8	1.4	0.0	0.0
LnGrp Delay(d),s/veh	0.0	29.8	14.2	392.2	2.9	2.9	309.0	0.0	51.0	85.0	0.0	0.0
LnGrp LOS		C	B	F	A	A	F		D	F		
Approach Vol, veh/h		2096			905			521			30	
Approach Delay, s/veh		27.9			371.5			152.0			85.0	
Approach LOS		C			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	28.0	98.7		7.3		126.7		16.0
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	22.0	62.0		34.0		90.0		11.8
Max Q Clear Time (g_c+I1), s	24.0	70.5		4.6		2.4		13.8
Green Ext Time (p_c), s	0.0	0.0		0.1		15.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	134.1
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	60	10	270	0	650	230	0	550	750
Future Volume (veh/h)	0	0	0	60	10	270	0	650	230	0	550	750
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1827	1554	1743	0	1863	1863	1900	1834	1900
Adj Flow Rate, veh/h				73	0	59	0	707	0	0	598	0
Adj No. of Lanes				2	0	2	0	2	1	0	3	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				4	67	9	0	2	2	3	3	3
Cap, veh/h				286	0	125	0	2809	1257	0	3975	0
Arrive On Green				0.08	0.00	0.08	0.00	0.26	0.00	0.00	1.00	0.00
Sat Flow, veh/h				3480	0	2963	0	3632	1583	0	5173	0
Grp Volume(v), veh/h				73	0	59	0	707	0	0	598	0
Grp Sat Flow(s),veh/h/ln				1740	0	1482	0	1770	1583	0	1669	0
Q Serve(g_s), s				1.5	0.0	4.5	0.0	11.8	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s				1.5	0.0	4.5	0.0	11.8	0.0	0.0	0.0	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				286	0	125	0	2809	1257	0	3975	0
V/C Ratio(X)				0.26	0.00	0.47	0.00	0.25	0.00	0.00	0.15	0.00
Avail Cap(c_a), veh/h				696	0	474	0	2809	1257	0	3975	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	0.33	0.33	1.67	1.67	1.67
Upstream Filter(I)				1.00	0.00	1.00	0.00	0.81	0.00	0.00	0.17	0.00
Uniform Delay (d), s/veh				32.3	0.0	182.4	0.0	10.1	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh				0.2	0.0	1.0	0.0	0.2	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.7	0.0	0.0	0.0	5.9	0.0	0.0	0.0	0.0
LnGrp Delay(d),s/veh				32.4	0.0	183.4	0.0	10.3	0.0	0.0	0.0	0.0
LnGrp LOS				C		F		B			A	
Approach Vol, veh/h					132			707			598	
Approach Delay, s/veh					99.9			10.3			0.0	
Approach LOS					F			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	64.8				64.8		10.2
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	8.0	39.7				50.7		15.0
Max Q Clear Time (g_c+I1), s	0.0	13.8				2.0		6.5
Green Ext Time (p_c), s	0.0	12.7				16.4		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	14.2
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	490	170	340	20	130	200	30	190	90	290	210	110
Future Volume (veh/h)	490	170	340	20	130	200	30	190	90	290	210	110
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1845	1776	1863	1863	1827	1776	1851	1900	1827	1845	1900
Adj Flow Rate, veh/h	533	185	77	22	141	115	33	207	30	315	228	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	3	7	2	2	4	7	2	2	4	3	3
Cap, veh/h	639	343	280	180	189	481	45	879	126	362	1658	0
Arrive On Green	0.19	0.19	0.19	0.10	0.10	0.10	0.03	0.28	0.28	0.07	0.16	0.00
Sat Flow, veh/h	3442	1845	1509	1774	1863	1553	1691	3088	441	1740	3597	0
Grp Volume(v), veh/h	533	185	77	22	141	115	33	117	120	315	228	0
Grp Sat Flow(s),veh/h/ln	1721	1845	1509	1774	1863	1553	1691	1759	1770	1740	1752	0
Q Serve(g_s), s	11.2	6.8	3.3	0.8	5.5	4.1	1.5	3.8	3.9	13.4	4.2	0.0
Cycle Q Clear(g_c), s	11.2	6.8	3.3	0.8	5.5	4.1	1.5	3.8	3.9	13.4	4.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.25	1.00		0.00
Lane Grp Cap(c), veh/h	639	343	280	180	189	481	45	501	504	362	1658	0
V/C Ratio(X)	0.83	0.54	0.27	0.12	0.75	0.24	0.74	0.23	0.24	0.87	0.14	0.00
Avail Cap(c_a), veh/h	757	406	332	213	224	509	133	501	504	441	1658	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.00
Uniform Delay (d), s/veh	29.4	27.6	26.2	30.7	32.8	19.3	36.2	20.5	20.6	33.9	18.5	0.0
Incr Delay (d2), s/veh	6.0	0.5	0.2	0.1	8.4	0.1	8.4	1.1	1.1	12.2	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.9	3.5	1.4	0.4	3.3	1.8	0.8	2.0	2.1	7.7	2.1	0.0
LnGrp Delay(d),s/veh	35.4	28.1	26.4	30.8	41.1	19.4	44.6	21.6	21.7	46.2	18.6	0.0
LnGrp LOS	D	C	C	C	D	B	D	C	C	D	B	
Approach Vol, veh/h		795			278			270			543	
Approach Delay, s/veh		32.8			31.3			24.5			34.6	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	19.6	26.4		17.4	5.5	40.5		11.6
Change Period (Y+Rc), s	4.0	5.0		3.5	3.5	5.0		4.0
Max Green Setting (Gmax), s	19.0	14.0		16.5	5.9	27.6		9.0
Max Q Clear Time (g_c+I1), s	15.4	5.9		13.2	3.5	6.2		7.5
Green Ext Time (p_c), s	0.2	2.0		0.7	0.0	3.3		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	31.9
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	60	2110	270	40	610	20	240	10	20	50	10	30
Future Volume (veh/h)	60	2110	270	40	610	20	240	10	20	50	10	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1696	1811	1900	1863	1839	1900	1863	1863	1900
Adj Flow Rate, veh/h	61	2153	268	41	622	18	245	10	4	51	10	2
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	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
Percent Heavy Veh, %	2	2	2	12	5	5	2	2	2	2	2	2
Cap, veh/h	382	1866	228	51	734	21	268	189	76	91	77	15
Arrive On Green	0.29	0.54	0.54	0.03	0.21	0.21	0.15	0.15	0.15	0.05	0.05	0.05
Sat Flow, veh/h	1774	4589	561	1616	3503	101	1774	1250	500	1774	1503	301
Grp Volume(v), veh/h	61	1580	841	41	321	319	245	0	14	51	0	12
Grp Sat Flow(s),veh/h/ln	1774	1695	1760	1616	906	1793	1774	0	1750	1774	0	1803
Q Serve(g_s), s	3.9	61.0	61.0	3.8	25.6	25.7	20.4	0.0	1.0	4.2	0.0	1.0
Cycle Q Clear(g_c), s	3.9	61.0	61.0	3.8	25.6	25.7	20.4	0.0	1.0	4.2	0.0	1.0
Prop In Lane	1.00		0.32	1.00		0.06	1.00		0.29	1.00		0.17
Lane Grp Cap(c), veh/h	382	1379	716	51	380	376	268	0	264	91	0	93
V/C Ratio(X)	0.16	1.15	1.17	0.80	0.85	0.85	0.91	0.00	0.05	0.56	0.00	0.13
Avail Cap(c_a), veh/h	382	1379	716	97	640	633	305	0	301	423	0	430
HCM Platoon Ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09	0.98	0.98	0.98	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	43.4	34.4	34.4	72.2	57.0	57.0	62.7	0.0	54.5	69.5	0.0	67.9
Incr Delay (d2), s/veh	0.0	66.7	79.9	10.1	5.2	5.4	28.4	0.0	0.1	5.3	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	41.0	45.2	1.8	6.7	13.3	12.1	0.0	0.5	2.2	0.0	0.5
LnGrp Delay(d),s/veh	43.4	101.2	114.3	82.3	62.2	62.4	91.2	0.0	54.6	74.8	0.0	68.6
LnGrp LOS	D	F	F	F	E	E	F		D	E		E
Approach Vol, veh/h		2482			681			259			63	
Approach Delay, s/veh		104.2			63.5			89.2			73.6	
Approach LOS		F			E			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	38.3	37.4		11.9	8.7	67.0		26.9
Change Period (Y+Rc), s	6.0	* 6		* 4.2	4.0	6.0		4.2
Max Green Setting (Gmax), s	17.0	* 53		* 36	9.0	61.0		25.8
Max Q Clear Time (g_c+I1), s	15.9	27.7		6.2	5.8	63.0		22.4
Green Ext Time (p_c), s	9.6	3.8		0.2	0.0	0.0		0.3

Intersection Summary		
HCM 2010 Ctrl Delay		94.6
HCM 2010 LOS		F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	140	2020	20	30	310	130	80	20	150	180	10	170
Future Volume (veh/h)	140	2020	20	30	310	130	80	20	150	180	10	170
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1681	1863	1900
Adj Flow Rate, veh/h	152	2196	22	33	337	109	87	22	64	196	11	27
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	13	2	2
Cap, veh/h	173	2180	22	379	2118	652	108	41	119	217	82	200
Arrive On Green	0.19	0.84	0.84	0.21	0.55	0.55	0.06	0.10	0.10	0.14	0.17	0.17
Sat Flow, veh/h	1774	5192	52	1774	3855	1187	1774	420	1222	1601	474	1164
Grp Volume(v), veh/h	152	1433	785	33	294	152	87	0	86	196	0	38
Grp Sat Flow(s),veh/h/ln	1774	1695	1853	1774	1695	1652	1774	0	1643	1601	0	1638
Q Serve(g_s), s	12.5	63.0	63.0	2.2	6.4	6.8	7.3	0.0	7.5	18.1	0.0	2.9
Cycle Q Clear(g_c), s	12.5	63.0	63.0	2.2	6.4	6.8	7.3	0.0	7.5	18.1	0.0	2.9
Prop In Lane	1.00		0.03	1.00		0.72	1.00		0.74	1.00		0.71
Lane Grp Cap(c), veh/h	173	1424	778	379	1863	908	108	0	161	217	0	282
V/C Ratio(X)	0.88	1.01	1.01	0.09	0.16	0.17	0.80	0.00	0.54	0.90	0.00	0.13
Avail Cap(c_a), veh/h	308	1424	778	379	1863	908	248	0	394	267	0	437
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.51	0.51	0.51	0.85	0.85	0.85	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	59.6	12.0	12.0	47.3	16.7	16.8	69.5	0.0	64.4	63.9	0.0	52.6
Incr Delay (d2), s/veh	3.0	18.6	25.0	0.0	0.2	0.3	12.9	0.0	2.8	27.7	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	31.0	35.2	1.1	3.0	3.2	4.0	0.0	3.5	9.7	0.0	1.4
LnGrp Delay(d),s/veh	62.5	30.6	37.0	47.3	16.8	17.1	82.4	0.0	67.2	91.6	0.0	52.8
LnGrp LOS	E	F	F	D	B	B	F		E	F		D
Approach Vol, veh/h		2370			479			173			234	
Approach Delay, s/veh		34.8			19.0			74.9			85.3	
Approach LOS		C			B			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	38.0	69.0	13.1	29.8	18.6	88.4	24.3	18.7
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	8.0	* 63	21.0	40.0	26.0	45.0	25.0	36.0
Max Q Clear Time (g_c+I1), s	14.2	65.0	9.3	4.9	14.5	8.8	20.1	9.5
Green Ext Time (p_c), s	0.1	0.0	0.1	0.8	0.1	2.8	0.2	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	38.2
HCM 2010 LOS	D

Notes

Intersection	
Intersection Delay, s/veh	10.9
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	10	10	20	0	160	10	20	0	30	120	180	0	10	80	10
Future Vol, veh/h	0	10	10	20	0	160	10	20	0	30	120	180	0	10	80	10
Peak Hour Factor	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	9	2	2	2	2	11	3	2	2	3	2
Mvmt Flow	0	12	12	24	0	188	12	24	0	35	141	212	0	12	94	12
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	9.6	12.8	10.2	10.2
HCM LOS	A	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	25%	94%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	25%	6%	0%	0%	100%	0%
Vol Right, %	0%	0%	100%	50%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	30	120	180	40	170	20	10	80	10
LT Vol	30	0	0	10	160	0	10	0	0
Through Vol	0	120	0	10	10	0	0	80	0
RT Vol	0	0	180	20	0	20	0	0	10
Lane Flow Rate	35	141	212	47	200	24	12	94	12
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.062	0.235	0.303	0.083	0.37	0.035	0.022	0.167	0.018
Departure Headway (Hd)	6.355	6.004	5.158	6.319	6.654	5.365	6.877	6.387	5.66
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	564	599	697	567	542	668	521	562	632
Service Time	4.086	3.735	2.889	4.057	4.382	3.094	4.617	4.127	3.399
HCM Lane V/C Ratio	0.062	0.235	0.304	0.083	0.369	0.036	0.023	0.167	0.019
HCM Control Delay	9.5	10.6	10.1	9.6	13.3	8.3	9.8	10.4	8.5
HCM Lane LOS	A	B	B	A	B	A	A	B	A
HCM 95th-tile Q	0.2	0.9	1.3	0.3	1.7	0.1	0.1	0.6	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	440	1810	160	30	230	100	50	20	140	130	20	150
Future Volume (veh/h)	440	1810	160	30	230	100	50	20	140	130	20	150
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1863	1900	1863	1852	1900	1863	1467	1900	1845	1863	1827
Adj Flow Rate, veh/h	478	1967	169	33	250	19	54	22	19	141	22	15
Adj No. of Lanes	2	3	0	1	3	0	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	2	2	2	2	33	33	3	2	4
Cap, veh/h	1466	2622	224	46	624	47	69	68	59	179	292	244
Arrive On Green	0.43	0.55	0.55	0.03	0.13	0.13	0.04	0.09	0.09	0.10	0.16	0.16
Sat Flow, veh/h	3408	4763	406	1774	4795	358	1774	727	628	1757	1863	1553
Grp Volume(v), veh/h	478	1396	740	33	174	95	54	0	41	141	22	15
Grp Sat Flow(s),veh/h/ln	1704	1695	1779	1774	1685	1783	1774	0	1355	1757	1863	1553
Q Serve(g_s), s	7.5	25.3	25.7	1.5	3.8	3.9	2.4	0.0	2.3	6.3	0.8	0.2
Cycle Q Clear(g_c), s	7.5	25.3	25.7	1.5	3.8	3.9	2.4	0.0	2.3	6.3	0.8	0.2
Prop In Lane	1.00		0.23	1.00		0.20	1.00		0.46	1.00		1.00
Lane Grp Cap(c), veh/h	1466	1866	979	46	438	232	69	0	128	179	292	244
V/C Ratio(X)	0.33	0.75	0.76	0.72	0.40	0.41	0.78	0.00	0.32	0.79	0.08	0.06
Avail Cap(c_a), veh/h	1466	2747	1441	177	1724	912	221	0	674	415	1127	939
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.2	13.8	13.9	38.8	32.1	32.1	38.3	0.0	34.0	35.2	28.9	3.3
Incr Delay (d2), s/veh	0.1	0.3	0.6	18.7	0.2	0.4	17.3	0.0	0.5	7.5	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	11.7	12.7	1.0	1.8	1.9	1.5	0.0	0.9	3.4	0.4	0.3
LnGrp Delay(d),s/veh	15.3	14.1	14.5	57.5	32.3	32.5	55.6	0.0	34.5	42.8	28.9	3.3
LnGrp LOS	B	B	B	E	C	C	E		C	D	C	A
Approach Vol, veh/h		2614			302			95			178	
Approach Delay, s/veh		14.4			35.1			46.5			37.7	
Approach LOS		B			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	39.9	15.8	12.2	12.6	6.1	49.5	7.1	17.6
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	32.0	* 41	19.0	* 40	8.0	65.1	10.0	48.6
Max Q Clear Time (g_c+I1), s	9.5	5.9	8.3	4.3	3.5	27.7	4.4	2.8
Green Ext Time (p_c), s	13.2	1.0	0.2	0.2	0.0	16.5	0.0	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	18.6
HCM 2010 LOS	B

Notes

Intersection	
Intersection Delay, s/veh	10.8
Intersection LOS	B

Movement	EBU	EBT	EBR	WBU	WBL	WBT	NBU	NBL	NBR
Traffic Vol, veh/h	0	20	180	0	110	10	0	160	130
Future Vol, veh/h	0	20	180	0	110	10	0	160	130
Peak Hour Factor	0.92	0.76	0.76	0.92	0.76	0.76	0.92	0.76	0.76
Heavy Vehicles, %	2	2	2	2	29	2	2	2	3
Mvmt Flow	0	26	237	0	145	13	0	211	171
Number of Lanes	0	1	1	0	0	1	0	1	1

Approach	EB	WB	NB
Opposing Approach	WB	EB	
Opposing Lanes	1	2	0
Conflicting Approach Left		NB	EB
Conflicting Lanes Left	0	2	2
Conflicting Approach Right	NB		WB
Conflicting Lanes Right	2	0	1
HCM Control Delay	10.2	11.8	10.9
HCM LOS	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1
Vol Left, %	100%	0%	0%	0%	92%
Vol Thru, %	0%	0%	100%	0%	8%
Vol Right, %	0%	100%	0%	100%	0%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	160	130	20	180	120
LT Vol	160	0	0	0	110
Through Vol	0	0	20	0	10
RT Vol	0	130	0	180	0
Lane Flow Rate	211	171	26	237	158
Geometry Grp	7	7	7	7	4
Degree of Util (X)	0.358	0.234	0.042	0.332	0.275
Departure Headway (Hd)	6.119	4.928	5.747	5.039	6.269
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	583	720	617	706	568
Service Time	3.913	2.721	3.535	2.827	4.367
HCM Lane V/C Ratio	0.362	0.237	0.042	0.336	0.278
HCM Control Delay	12.3	9.2	8.8	10.4	11.8
HCM Lane LOS	B	A	A	B	B
HCM 95th-tile Q	1.6	0.9	0.1	1.5	1.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	1740	560	280	170	100	250	260	250	100	260	10
Future Volume (veh/h)	10	1740	560	280	170	100	250	260	250	100	260	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.95	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1759	1863	1792	1863
Adj Flow Rate, veh/h	10	1776	435	286	173	51	255	265	85	102	265	2
Adj No. of Lanes	1	2	2	2	3	0	2	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	8	2	6	2
Cap, veh/h	37	2011	1553	342	2557	700	311	416	168	126	334	147
Arrive On Green	0.02	0.57	0.57	0.10	0.65	0.65	0.09	0.12	0.12	0.07	0.10	0.10
Sat Flow, veh/h	1774	3539	2733	3442	3955	1083	3442	3539	1426	1774	3406	1500
Grp Volume(v), veh/h	10	1776	435	286	146	78	255	265	85	102	265	2
Grp Sat Flow(s),veh/h/ln	1774	1770	1367	1721	1695	1648	1721	1770	1426	1774	1703	1500
Q Serve(g_s), s	0.7	56.2	10.6	10.5	2.1	2.3	9.4	9.2	7.2	7.3	9.8	0.2
Cycle Q Clear(g_c), s	0.7	56.2	10.6	10.5	2.1	2.3	9.4	9.2	7.2	7.3	9.8	0.2
Prop In Lane	1.00		1.00	1.00		0.66	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	37	2011	1553	342	2192	1066	311	416	168	126	334	147
V/C Ratio(X)	0.27	0.88	0.28	0.84	0.07	0.07	0.82	0.64	0.51	0.81	0.79	0.01
Avail Cap(c_a), veh/h	261	2156	1665	506	2192	1066	506	416	168	261	398	175
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	62.3	24.2	14.3	57.1	8.4	8.5	57.7	54.4	53.5	59.2	57.0	52.6
Incr Delay (d2), s/veh	1.4	4.5	0.1	5.0	0.0	0.0	2.2	3.2	2.5	4.7	9.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	28.4	4.0	5.2	1.0	1.0	4.6	4.7	3.0	3.8	5.1	0.1
LnGrp Delay(d),s/veh	63.7	28.7	14.4	62.2	8.4	8.5	60.0	57.6	56.0	63.9	66.0	52.7
LnGrp LOS	E	C	B	E	A	A	E	E	E	E	E	D
Approach Vol, veh/h		2221			510			605			369	
Approach Delay, s/veh		26.0			38.6			58.4			65.3	
Approach LOS		C			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.2	20.5	16.8	78.7	15.7	18.0	6.7	88.8
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	19.0	14.7	19.0	78.7	19.0	* 15	19.0	78.7
Max Q Clear Time (g_c+I1), s	9.3	11.2	12.5	58.2	11.4	11.8	2.7	4.3
Green Ext Time (p_c), s	0.1	1.1	0.3	15.2	0.3	0.5	0.0	34.5

Intersection Summary	
HCM 2010 Ctrl Delay	37.0
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	710	0	270	0	480	690	0	820	410
Future Volume (veh/h)	0	0	0	710	0	270	0	480	690	0	820	410
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1863	0	1792	1792	1900	1845	1776
Adj Flow Rate, veh/h				772	0	255	0	522	0	0	891	446
Adj No. of Lanes				2	0	1	0	3	2	0	3	1
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				8	0	2	0	6	6	3	3	7
Cap, veh/h				1024	0	326	0	2100	1151	0	2161	648
Arrive On Green				0.32	0.00	0.32	0.00	0.43	0.00	0.00	0.43	0.43
Sat Flow, veh/h				3250	0	1583	0	5055	2682	0	5036	1509
Grp Volume(v), veh/h				772	0	255	0	522	0	0	891	446
Grp Sat Flow(s),veh/h/ln				1625	0	1583	0	1631	1341	0	1679	1509
Q Serve(g_s), s				9.2	0.0	11.3	0.0	2.9	0.0	0.0	5.3	10.3
Cycle Q Clear(g_c), s				9.2	0.0	11.3	0.0	2.9	0.0	0.0	5.3	10.3
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				1024	0	326	0	2100	1151	0	2161	648
V/C Ratio(X)				0.75	0.00	0.78	0.00	0.25	0.00	0.00	0.41	0.69
Avail Cap(c_a), veh/h				1156	0	390	0	2100	1151	0	2833	849
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				13.2	0.0	40.7	0.0	7.8	0.0	0.0	8.5	9.9
Incr Delay (d2), s/veh				2.1	0.0	6.7	0.0	0.1	0.0	0.0	0.1	1.6
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				4.4	0.0	0.6	0.0	1.3	0.0	0.0	2.4	4.5
LnGrp Delay(d),s/veh				15.3	0.0	47.4	0.0	7.9	0.0	0.0	8.6	11.5
LnGrp LOS				B		D		A			A	B
Approach Vol, veh/h					1027			522			1337	
Approach Delay, s/veh					23.3			7.9			9.6	
Approach LOS					C			A			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	24.8				24.8		18.3
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 4.9	14.1				* 24		15.3
Max Q Clear Time (g_c+I1), s	0.0	4.9				12.3		13.3
Green Ext Time (p_c), s	0.0	6.4				6.2		0.3

Intersection Summary			
HCM 2010 Ctrl Delay			14.2
HCM 2010 LOS			B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	230	0	480	0	0	0	0	940	760	0	1090	440
Future Volume (veh/h)	230	0	480	0	0	0	0	940	760	0	1090	440
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	0	1727				1900	1827	1727	0	1810	1845
Adj Flow Rate, veh/h	250	0	522				0	1022	0	0	1185	0
Adj No. of Lanes	2	0	2				0	3	1	0	3	1
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	12	0	10				4	4	10	0	5	3
Cap, veh/h	1095	0	571				0	2101	618	0	1996	634
Arrive On Green	0.35	0.00	0.35				0.00	0.42	0.00	0.00	0.40	0.00
Sat Flow, veh/h	3134	0	2584				0	4988	1468	0	5103	1568
Grp Volume(v), veh/h	250	0	522				0	1022	0	0	1185	0
Grp Sat Flow(s),veh/h/ln	1567	0	1292				0	1663	1468	0	1647	1568
Q Serve(g_s), s	2.6	0.0	15.2				0.0	7.0	0.0	0.0	8.8	0.0
Cycle Q Clear(g_c), s	2.6	0.0	15.2				0.0	7.0	0.0	0.0	8.8	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1095	0	571				0	2101	618	0	1996	634
V/C Ratio(X)	0.23	0.00	0.91				0.00	0.49	0.00	0.00	0.59	0.00
Avail Cap(c_a), veh/h	1095	0	571				0	5688	1674	0	3410	1082
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	10.7	0.0	23.9				0.0	9.8	0.0	0.0	10.9	0.0
Incr Delay (d2), s/veh	0.0	0.0	19.1				0.0	0.2	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	9.2				0.0	3.2	0.0	0.0	4.0	0.0
LnGrp Delay(d),s/veh	10.8	0.0	43.0				0.0	10.0	0.0	0.0	11.2	0.0
LnGrp LOS	B		D					B			B	
Approach Vol, veh/h		772						1022			1185	
Approach Delay, s/veh		32.6						10.0			11.2	
Approach LOS		C						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		25.6		21.0	0.0	25.6		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 53		* 16	14.0	32.2		
Max Q Clear Time (g_c+I1), s		9.0		17.2	0.0	10.8		
Green Ext Time (p_c), s		8.4		0.0	0.0	8.1		

Intersection Summary	
HCM 2010 Ctrl Delay	16.3
HCM 2010 LOS	B

Notes

Intersection	
Int Delay, s/veh	9.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	250	0	1700	1450	120
Future Vol, veh/h	0	250	0	1700	1450	120
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	9	2	7	8	2
Mvmt Flow	0	272	0	1848	1576	130

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	854	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.28	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.99	-	-	-	-
Pot Cap-1 Maneuver	0	~ 248	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	~ 248	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	128.4	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	248	-	-
HCM Lane V/C Ratio	-	1.096	-	-
HCM Control Delay (s)	-	128.4	-	-
HCM Lane LOS	-	F	-	-
HCM 95th %tile Q(veh)	-	11.7	-	-

Notes			
~: Volume exceeds capacity	$: Delay exceeds 300s	+: Computation Not Defined	*: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	110	310	50	60	240	210	1370	190	300	1380	20
Future Volume (veh/h)	90	110	310	50	60	240	210	1370	190	300	1380	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1520	1863	1863	1863	1863	1827	1863	1827	1667	1845	1810	1900
Adj Flow Rate, veh/h	98	120	289	54	65	184	228	1489	89	326	1500	21
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	25	2	2	2	2	4	2	4	14	3	5	5
Cap, veh/h	117	330	510	76	259	393	258	2405	675	389	2267	32
Arrive On Green	0.08	0.18	0.18	0.04	0.14	0.14	0.15	0.48	0.48	0.11	0.45	0.45
Sat Flow, veh/h	1448	1863	1583	1774	1863	1553	1774	4988	1399	3408	5022	70
Grp Volume(v), veh/h	98	120	289	54	65	184	228	1489	89	326	984	537
Grp Sat Flow(s),veh/h/ln	1448	1863	1583	1774	1863	1553	1774	1663	1399	1704	1647	1798
Q Serve(g_s), s	7.6	6.5	17.3	3.4	3.6	11.5	14.4	25.2	4.0	10.7	26.7	26.7
Cycle Q Clear(g_c), s	7.6	6.5	17.3	3.4	3.6	11.5	14.4	25.2	4.0	10.7	26.7	26.7
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	117	330	510	76	259	393	258	2405	675	389	1487	811
V/C Ratio(X)	0.84	0.36	0.57	0.71	0.25	0.47	0.88	0.62	0.13	0.84	0.66	0.66
Avail Cap(c_a), veh/h	226	425	591	129	269	401	392	2405	675	578	1487	811
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.8	41.4	32.2	54.1	44.0	36.2	48.0	21.9	16.4	49.6	24.6	24.6
Incr Delay (d2), s/veh	5.8	0.3	0.4	4.4	0.2	0.3	10.3	1.2	0.4	4.5	2.3	4.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	3.4	7.6	1.8	1.9	5.0	7.8	11.9	1.6	5.3	12.6	14.2
LnGrp Delay(d),s/veh	57.7	41.7	32.5	58.5	44.1	36.5	58.3	23.1	16.8	54.1	26.9	28.8
LnGrp LOS	E	D	C	E	D	D	E	C	B	D	C	C
Approach Vol, veh/h		507			303			1806			1847	
Approach Delay, s/veh		39.6			42.1			27.2			32.2	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.8	61.0	9.6	26.1	21.3	57.5	14.0	21.7
Change Period (Y+Rc), s	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8
Max Green Setting (Gmax), s	* 19	55.2	* 8.3	26.1	* 25	49.3	* 18	16.5
Max Q Clear Time (g_c+I1), s	12.7	27.2	5.4	19.3	16.4	28.7	9.6	13.5
Green Ext Time (p_c), s	0.4	26.1	0.0	0.9	0.2	19.5	0.1	0.5

Intersection Summary	
HCM 2010 Ctrl Delay	31.7
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	233	60	604	1544	10	690	10	893	10	10	10
Future Volume (veh/h)	0	233	60	604	1544	10	690	10	893	10	10	10
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1776	1696	1845	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	0	245	5	636	1625	10	726	11	778	11	11	0
Adj No. of Lanes	0	2	1	2	2	0	0	1	2	0	1	0
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	0	7	12	3	2	2	2	2	2	2	2	2
Cap, veh/h	0	765	327	788	1796	11	686	10	1737	14	14	0
Arrive On Green	0.00	0.23	0.23	0.23	0.50	0.50	0.39	0.39	0.39	0.02	0.02	0.00
Sat Flow, veh/h	0	3463	1442	3408	3606	22	1749	26	2787	909	909	0
Grp Volume(v), veh/h	0	245	5	636	797	838	737	0	778	22	0	0
Grp Sat Flow(s),veh/h/ln	0	1687	1442	1704	1770	1859	1775	0	1393	1817	0	0
Q Serve(g_s), s	0.0	9.1	0.4	26.5	61.7	61.8	58.8	0.0	21.9	1.8	0.0	0.0
Cycle Q Clear(g_c), s	0.0	9.1	0.4	26.5	61.7	61.8	58.8	0.0	21.9	1.8	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.01	0.99		1.00	0.50		0.00
Lane Grp Cap(c), veh/h	0	765	327	788	881	926	696	0	1737	28	0	0
V/C Ratio(X)	0.00	0.32	0.02	0.81	0.90	0.91	1.06	0.00	0.45	0.79	0.00	0.00
Avail Cap(c_a), veh/h	0	765	327	788	881	926	696	0	1737	400	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.35	0.35	0.35	0.69	0.00	0.69	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	48.4	45.0	54.5	34.4	34.4	45.6	0.0	14.8	73.6	0.0	0.0
Incr Delay (d2), s/veh	0.0	0.1	0.0	2.1	5.9	5.7	45.4	0.0	0.0	16.1	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	4.3	0.2	12.7	31.6	33.1	37.6	0.0	8.4	1.0	0.0	0.0
LnGrp Delay(d),s/veh	0.0	48.5	45.0	56.6	40.3	40.1	91.0	0.0	14.8	89.7	0.0	0.0
LnGrp LOS		D	D	E	D	D	F		B	F		
Approach Vol, veh/h		250			2271			1515			22	
Approach Delay, s/veh		48.4			44.8			51.9			89.7	
Approach LOS		D			D			D			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	40.7	40.0		6.3		80.7		63.0
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	4.0	34.0		33.0		44.0		58.8
Max Q Clear Time (g_c+I1), s	28.5	11.1		3.8		63.8		60.8
Green Ext Time (p_c), s	0.0	8.8		0.0		0.0		0.0

Intersection Summary			
HCM 2010 Ctrl Delay			47.9
HCM 2010 LOS			D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	40	10	720	0	953	150	0	320	424
Future Volume (veh/h)	0	0	0	40	10	720	0	953	150	0	320	424
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1827	1465	1743	0	1863	1863	1900	1835	1900
Adj Flow Rate, veh/h				27	33	753	0	1036	0	0	348	0
Adj No. of Lanes				1	1	2	0	2	1	0	3	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				4	67	9	0	2	2	3	3	3
Cap, veh/h				558	470	832	0	1965	879	0	2781	0
Arrive On Green				0.32	0.32	0.32	0.00	0.18	0.00	0.00	0.93	0.00
Sat Flow, veh/h				1740	1465	2963	0	3632	1583	0	5173	0
Grp Volume(v), veh/h				27	33	753	0	1036	0	0	348	0
Grp Sat Flow(s),veh/h/ln				1740	1465	1482	0	1770	1583	0	1669	0
Q Serve(g_s), s				0.8	1.2	21.4	0.0	19.8	0.0	0.0	0.4	0.0
Cycle Q Clear(g_c), s				0.8	1.2	21.4	0.0	19.8	0.0	0.0	0.4	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				558	470	832	0	1965	879	0	2781	0
V/C Ratio(X)				0.05	0.07	0.91	0.00	0.53	0.00	0.00	0.13	0.00
Avail Cap(c_a), veh/h				603	508	909	0	1965	879	0	2781	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	0.33	0.33	1.67	1.67	1.67
Upstream Filter(I)				1.00	1.00	1.00	0.00	0.74	0.00	0.00	0.09	0.00
Uniform Delay (d), s/veh				17.6	17.7	34.7	0.0	21.7	0.0	0.0	1.2	0.0
Incr Delay (d2), s/veh				0.0	0.0	11.2	0.0	0.8	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.4	0.5	1.3	0.0	10.0	0.0	0.0	0.2	0.0
LnGrp Delay(d),s/veh				17.6	17.7	45.9	0.0	22.5	0.0	0.0	1.2	0.0
LnGrp LOS				B	B	D		C			A	
Approach Vol, veh/h					813			1036			348	
Approach Delay, s/veh					43.8			22.5			1.2	
Approach LOS					D			C			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	46.9				46.9		28.1
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	7.0	29.7				39.7		26.0
Max Q Clear Time (g_c+I1), s	0.0	21.8				2.4		23.4
Green Ext Time (p_c), s	0.0	5.8				16.7		0.7

Intersection Summary	
HCM 2010 Ctrl Delay	27.0
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	693	210	130	20	50	90	30	320	150	100	90	170
Future Volume (veh/h)	693	210	130	20	50	90	30	320	150	100	90	170
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1845	1776	1863	1863	1827	1776	1851	1900	1827	1845	1900
Adj Flow Rate, veh/h	753	228	38	22	54	14	33	348	98	109	98	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	3	7	2	2	4	7	2	2	4	3	3
Cap, veh/h	855	458	375	84	88	197	45	1100	305	138	1628	0
Arrive On Green	0.25	0.25	0.25	0.05	0.05	0.05	0.03	0.40	0.40	0.08	0.46	0.00
Sat Flow, veh/h	3442	1845	1509	1774	1863	1553	1691	2717	754	1740	3597	0
Grp Volume(v), veh/h	753	228	38	22	54	14	33	223	223	109	98	0
Grp Sat Flow(s),veh/h/ln	1721	1845	1509	1774	1863	1553	1691	1759	1713	1740	1752	0
Q Serve(g_s), s	15.8	7.9	1.5	0.9	2.1	0.6	1.5	6.5	6.7	4.6	1.2	0.0
Cycle Q Clear(g_c), s	15.8	7.9	1.5	0.9	2.1	0.6	1.5	6.5	6.7	4.6	1.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.44	1.00		0.00
Lane Grp Cap(c), veh/h	855	458	375	84	88	197	45	712	693	138	1628	0
V/C Ratio(X)	0.88	0.50	0.10	0.26	0.62	0.07	0.74	0.31	0.32	0.79	0.06	0.00
Avail Cap(c_a), veh/h	941	504	413	166	174	268	101	712	693	232	1628	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.97	0.00
Uniform Delay (d), s/veh	27.1	24.2	21.7	34.5	35.1	28.9	36.2	15.2	15.3	33.9	11.1	0.0
Incr Delay (d2), s/veh	8.5	0.3	0.0	0.6	2.6	0.1	8.4	1.2	1.2	3.6	0.1	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.4	4.1	0.6	0.5	1.2	0.3	0.8	3.4	3.4	2.3	0.6	0.0
LnGrp Delay(d),s/veh	35.6	24.5	21.8	35.1	37.7	28.9	44.6	16.4	16.5	37.5	11.1	0.0
LnGrp LOS	D	C	C	D	D	C	D	B	B	D	B	
Approach Vol, veh/h		1019			90			479			207	
Approach Delay, s/veh		32.6			35.7			18.4			25.0	
Approach LOS		C			D			B			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	10.0	35.4		22.1	5.5	39.8		7.5
Change Period (Y+Rc), s	4.0	5.0		3.5	3.5	5.0		4.0
Max Green Setting (Gmax), s	10.0	21.0		20.5	4.5	27.0		7.0
Max Q Clear Time (g_c+I1), s	6.6	8.7		17.8	3.5	3.2		4.1
Green Ext Time (p_c), s	0.0	2.9		0.9	0.0	3.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	28.1
HCM 2010 LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	150	746	210	30	1848	260	120	20	30	130	10	170
Future Volume (veh/h)	150	746	210	30	1848	260	120	20	30	130	10	170
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.99	1.00		0.99	1.00		1.00	1.00		0.90
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1696	1816	1900	1863	1841	1900	1863	1863	1900
Adj Flow Rate, veh/h	163	811	199	33	2009	272	130	22	4	141	11	22
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	12	5	5	2	2	2	2	2	2
Cap, veh/h	177	2287	557	41	2092	279	116	99	18	354	102	205
Arrive On Green	0.20	1.00	1.00	0.03	0.47	0.47	0.07	0.07	0.07	0.20	0.20	0.20
Sat Flow, veh/h	1774	4074	992	1616	4419	590	1774	1517	276	1774	514	1028
Grp Volume(v), veh/h	163	674	336	33	1495	786	130	0	26	141	0	33
Grp Sat Flow(s),veh/h/ln	1774	1695	1675	1616	1652	1704	1774	0	1792	1774	0	1541
Q Serve(g_s), s	13.5	0.0	0.0	3.0	65.2	67.7	9.8	0.0	2.1	10.4	0.0	2.6
Cycle Q Clear(g_c), s	13.5	0.0	0.0	3.0	65.2	67.7	9.8	0.0	2.1	10.4	0.0	2.6
Prop In Lane	1.00		0.59	1.00		0.35	1.00		0.15	1.00		0.67
Lane Grp Cap(c), veh/h	177	1904	941	41	1564	806	116	0	117	354	0	307
V/C Ratio(X)	0.92	0.35	0.36	0.81	0.96	0.97	1.12	0.00	0.22	0.40	0.00	0.11
Avail Cap(c_a), veh/h	177	1904	941	75	1564	806	116	0	117	423	0	368
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.90	0.90	0.90	0.60	0.60	0.60	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	59.4	0.0	0.0	72.8	38.0	38.6	70.1	0.0	66.5	52.2	0.0	49.1
Incr Delay (d2), s/veh	41.3	0.5	1.0	8.4	10.0	19.3	120.0	0.0	0.9	0.7	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.6	0.1	0.3	1.5	31.9	36.0	8.7	0.0	1.1	5.2	0.0	1.1
LnGrp Delay(d),s/veh	100.7	0.5	1.0	81.2	48.0	57.9	190.1	0.0	67.4	53.0	0.0	49.3
LnGrp LOS	F	A	A	F	D	E	F		E	D		D
Approach Vol, veh/h		1173			2314			156			174	
Approach Delay, s/veh		14.5			51.8			169.7			52.3	
Approach LOS		B			D			F			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	21.0	77.0		34.1	7.8	90.2		14.0
Change Period (Y+Rc), s	6.0	* 6		* 4.2	4.0	6.0		4.2
Max Green Setting (Gmax), s	15.0	* 71		* 36	7.0	79.0		9.8
Max Q Clear Time (g_c+I1), s	15.5	69.7		12.4	5.0	2.0		11.8
Green Ext Time (p_c), s	0.0	1.2		0.6	0.0	7.7		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	45.2
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	636	170	240	1978	40	160	10	100	50	10	30
Future Volume (veh/h)	50	636	170	240	1978	40	160	10	100	50	10	30
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.95	1.00		1.00	1.00		0.99	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1681	1863	1900
Adj Flow Rate, veh/h	54	691	151	261	2150	42	174	11	16	54	11	1
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	13	2	2
Cap, veh/h	69	990	213	627	2951	58	211	102	148	67	119	11
Arrive On Green	0.04	0.24	0.24	0.35	0.57	0.57	0.12	0.15	0.15	0.04	0.07	0.07
Sat Flow, veh/h	1774	4152	893	1774	5135	100	1774	684	996	1601	1679	153
Grp Volume(v), veh/h	54	562	280	261	1418	774	174	0	27	54	0	12
Grp Sat Flow(s),veh/h/ln	1774	1695	1654	1774	1695	1845	1774	0	1680	1601	0	1831
Q Serve(g_s), s	2.8	13.9	14.2	10.2	28.1	28.2	8.8	0.0	1.3	3.1	0.0	0.6
Cycle Q Clear(g_c), s	2.8	13.9	14.2	10.2	28.1	28.2	8.8	0.0	1.3	3.1	0.0	0.6
Prop In Lane	1.00		0.54	1.00		0.05	1.00		0.59	1.00		0.08
Lane Grp Cap(c), veh/h	69	808	394	627	1948	1060	211	0	249	67	0	130
V/C Ratio(X)	0.78	0.70	0.71	0.42	0.73	0.73	0.82	0.00	0.11	0.81	0.00	0.09
Avail Cap(c_a), veh/h	174	1552	758	658	2477	1348	368	0	824	192	0	739
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	43.7	31.9	32.0	22.5	14.3	14.3	39.4	0.0	33.8	43.6	0.0	39.8
Incr Delay (d2), s/veh	7.0	1.1	2.4	0.2	0.8	1.5	7.8	0.0	0.2	20.2	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	6.6	6.7	5.0	13.2	14.6	4.8	0.0	0.6	1.7	0.0	0.3
LnGrp Delay(d),s/veh	50.7	33.0	34.4	22.6	15.1	15.8	47.2	0.0	34.0	63.8	0.0	40.2
LnGrp LOS	D	C	C	C	B	B	D		C	E		D
Approach Vol, veh/h		896			2453			201			66	
Approach Delay, s/veh		34.5			16.1			45.5			59.5	
Approach LOS		C			B			D			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	38.4	27.9	14.9	10.5	7.6	58.7	7.8	17.6
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	34.0	* 42	19.0	37.0	9.0	67.0	11.0	45.0
Max Q Clear Time (g_c+I1), s	12.2	16.2	10.8	2.6	4.8	30.2	5.1	3.3
Green Ext Time (p_c), s	15.8	5.4	0.3	0.2	0.0	22.5	0.0	0.2

Intersection Summary	
HCM 2010 Ctrl Delay	23.1
HCM 2010 LOS	C

Notes

Intersection	
Intersection Delay, s/veh	11
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	10	10	40	0	64	10	10	0	20	60	248	0	10	140	10
Future Vol, veh/h	0	10	10	40	0	64	10	10	0	20	60	248	0	10	140	10
Peak Hour Factor	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78	0.92	0.78	0.78	0.78
Heavy Vehicles, %	2	2	2	2	2	9	2	2	2	2	11	3	2	2	3	2
Mvmt Flow	0	13	13	51	0	82	13	13	0	26	77	318	0	13	179	13
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	9.8	11	11.2	11.2
HCM LOS	A	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	17%	86%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	17%	14%	0%	0%	100%	0%
Vol Right, %	0%	0%	100%	67%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	60	248	60	74	10	10	140	10
LT Vol	20	0	0	10	64	0	10	0	0
Through Vol	0	60	0	10	10	0	0	140	0
RT Vol	0	0	248	40	0	10	0	0	10
Lane Flow Rate	26	77	318	77	95	13	13	179	13
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.044	0.126	0.446	0.132	0.184	0.02	0.024	0.305	0.019
Departure Headway (Hd)	6.246	5.896	5.052	6.155	6.992	5.739	6.599	6.111	5.387
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	574	608	712	582	513	623	543	589	664
Service Time	3.975	3.625	2.781	3.895	4.733	3.479	4.333	3.845	3.121
HCM Lane V/C Ratio	0.045	0.127	0.447	0.132	0.185	0.021	0.024	0.304	0.02
HCM Control Delay	9.3	9.5	11.8	9.8	11.3	8.6	9.5	11.5	8.2
HCM Lane LOS	A	A	B	A	B	A	A	B	A
HCM 95th-tile Q	0.1	0.4	2.3	0.5	0.7	0.1	0.1	1.3	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	280	326	70	160	1931	118	150	10	20	107	20	287
Future Volume (veh/h)	280	326	70	160	1931	118	150	10	20	107	20	287
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.98	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1863	1900	1863	1861	1900	1863	1458	1900	1845	1863	1827
Adj Flow Rate, veh/h	304	354	56	174	2099	124	163	11	2	116	22	122
Adj No. of Lanes	2	3	0	1	3	0	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	2	2	2	2	33	33	3	2	4
Cap, veh/h	400	2228	343	205	2393	141	193	162	29	144	201	167
Arrive On Green	0.12	0.50	0.50	0.12	0.49	0.49	0.11	0.13	0.13	0.08	0.11	0.11
Sat Flow, veh/h	3408	4444	684	1774	4902	288	1774	1201	218	1757	1863	1553
Grp Volume(v), veh/h	304	268	142	174	1446	777	163	0	13	116	22	122
Grp Sat Flow(s),veh/h/ln	1704	1695	1738	1774	1693	1804	1774	0	1419	1757	1863	1553
Q Serve(g_s), s	9.5	4.7	4.9	10.6	42.0	42.6	9.9	0.0	0.9	7.1	1.2	6.4
Cycle Q Clear(g_c), s	9.5	4.7	4.9	10.6	42.0	42.6	9.9	0.0	0.9	7.1	1.2	6.4
Prop In Lane	1.00		0.39	1.00		0.16	1.00		0.15	1.00		1.00
Lane Grp Cap(c), veh/h	400	1700	871	205	1653	880	193	0	191	144	201	167
V/C Ratio(X)	0.76	0.16	0.16	0.85	0.87	0.88	0.85	0.00	0.07	0.81	0.11	0.73
Avail Cap(c_a), veh/h	527	1779	912	306	1838	979	242	0	521	240	677	565
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	47.0	14.8	14.9	47.7	25.2	25.3	48.1	0.0	41.6	49.6	44.3	27.7
Incr Delay (d2), s/veh	4.6	0.0	0.0	13.1	4.3	8.2	19.5	0.0	0.1	10.2	0.1	2.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	2.2	2.3	5.9	20.5	23.2	5.9	0.0	0.3	3.9	0.6	2.8
LnGrp Delay(d),s/veh	51.7	14.9	14.9	60.8	29.5	33.5	67.6	0.0	41.6	59.8	44.4	30.0
LnGrp LOS	D	B	B	E	C	C	E		D	E	D	C
Approach Vol, veh/h		714			2397			176			260	
Approach Delay, s/veh		30.5			33.0			65.7			44.5	
Approach LOS		C			C			E			D	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2	3	4	5	6	7	8				
Phs Duration (G+Y+Rc), s	18.2	59.0	13.0	19.8	16.7	60.4	16.0	16.9				
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0				
Max Green Setting (Gmax), s	17.0	* 60	15.0	* 40	19.0	57.7	15.0	40.0				
Max Q Clear Time (g_c+I1), s	11.5	44.6	9.1	2.9	12.6	6.9	11.9	8.4				
Green Ext Time (p_c), s	1.4	9.1	0.1	0.3	0.2	2.7	0.1	0.3				
Intersection Summary												
HCM 2010 Ctrl Delay			35.0									
HCM 2010 LOS			D									
Notes												

MOVEMENT SUMMARY

Site: 8 [Cumulative Plus Project AM]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	528	3.0	1.102	74.2	LOS F	245.8	6291.7	1.00	0.50	15.4
8	T1	465	3.0	1.102	74.2	LOS F	245.8	6291.7	1.00	0.50	15.2
18	R2	450	3.0	1.102	74.2	LOS F	245.8	6291.7	1.00	0.50	15.0
Approach		1443	3.0	1.102	74.2	LOS F	245.8	6291.7	1.00	0.50	15.2
East: Campus Loop											
1	L2	59	29.0	0.182	11.0	LOS B	0.6	16.9	0.67	0.67	25.3
6	T1	19	3.0	0.182	11.0	LOS B	0.6	16.9	0.67	0.67	22.3
16	R2	2	3.0	0.182	11.0	LOS B	0.6	16.9	0.67	0.67	21.9
Approach		80	22.3	0.182	11.0	LOS B	0.6	16.9	0.67	0.67	24.5
North: Campus Hill Drive											
7	L2	2	3.0	0.106	6.0	LOS A	0.4	10.7	0.57	0.51	24.8
4	T1	74	3.0	0.106	6.0	LOS A	0.4	10.7	0.57	0.51	28.5
14	R2	2	3.0	0.106	6.0	LOS A	0.4	10.7	0.57	0.51	23.7
Approach		78	3.0	0.106	6.0	LOS A	0.4	10.7	0.57	0.51	28.3
West: Campus Loop											
5	L2	2	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	25.2
2	T1	19	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	24.7
12	R2	87	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	28.4
Approach		107	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	27.6
All Vehicles		1707	3.9	1.102	63.8	LOS F	245.8	6291.7	0.92	0.49	16.3

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	16	215	312	430	1823	223	465	571	90	45	164	11
Future Volume (veh/h)	16	215	312	430	1823	223	465	571	90	45	164	11
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.97	1.00		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1759	1863	1792	1863
Adj Flow Rate, veh/h	17	234	126	467	1982	235	505	621	24	49	178	2
Adj No. of Lanes	1	2	2	2	3	0	2	2	1	1	2	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	8	2	6	2
Cap, veh/h	58	1376	1059	530	2351	275	568	850	349	108	462	206
Arrive On Green	0.03	0.39	0.39	0.15	0.51	0.51	0.17	0.24	0.24	0.06	0.14	0.14
Sat Flow, veh/h	1774	3539	2724	3442	4605	540	3442	3539	1452	1774	3406	1518
Grp Volume(v), veh/h	17	234	126	467	1453	764	505	621	24	49	178	2
Grp Sat Flow(s),veh/h/ln	1774	1770	1362	1721	1695	1755	1721	1770	1452	1774	1703	1518
Q Serve(g_s), s	1.1	5.1	3.5	15.8	43.7	44.9	17.1	19.2	1.5	3.2	5.7	0.1
Cycle Q Clear(g_c), s	1.1	5.1	3.5	15.8	43.7	44.9	17.1	19.2	1.5	3.2	5.7	0.1
Prop In Lane	1.00		1.00	1.00		0.31	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	58	1376	1059	530	1731	896	568	850	349	108	462	206
V/C Ratio(X)	0.29	0.17	0.12	0.88	0.84	0.85	0.89	0.73	0.07	0.46	0.39	0.01
Avail Cap(c_a), veh/h	134	1448	1115	694	1815	939	723	1448	594	149	976	435
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	56.2	23.8	23.3	49.3	25.0	25.3	48.6	41.7	34.9	54.0	46.9	44.5
Incr Delay (d2), s/veh	1.0	0.1	0.0	8.6	3.6	7.4	9.5	1.2	0.1	1.1	0.5	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	2.5	1.3	8.2	21.2	23.5	8.9	9.5	0.6	1.6	2.7	0.1
LnGrp Delay(d),s/veh	57.3	23.9	23.4	57.8	28.5	32.7	58.1	42.9	35.0	55.1	47.4	44.5
LnGrp LOS	E	C	C	E	C	C	E	D	D	E	D	D
Approach Vol, veh/h		377			2684			1150			229	
Approach Delay, s/veh		25.2			34.8			49.4			49.1	
Approach LOS		C			C			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	11.2	33.9	22.3	51.6	23.7	21.4	7.9	66.0
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	10.0	48.7	24.0	48.7	25.0	* 34	9.0	63.7
Max Q Clear Time (g_c+I1), s	5.2	21.2	17.8	7.1	19.1	7.7	3.1	46.9
Green Ext Time (p_c), s	0.0	5.2	0.5	27.7	0.6	5.2	0.0	13.8

Intersection Summary	
HCM 2010 Ctrl Delay	38.5
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	810	0	808	0	628	560	0	579	377
Future Volume (veh/h)	0	0	0	810	0	808	0	628	560	0	579	377
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1863	0	1792	1792	1900	1845	1776
Adj Flow Rate, veh/h				880	0	863	0	683	0	0	629	410
Adj No. of Lanes				2	0	1	0	3	2	0	3	1
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				8	0	2	0	6	6	3	3	7
Cap, veh/h				1762	0	769	0	1597	875	0	1643	493
Arrive On Green				0.54	0.00	0.54	0.00	0.33	0.00	0.00	0.33	0.33
Sat Flow, veh/h				3250	0	1583	0	5055	2682	0	5036	1509
Grp Volume(v), veh/h				880	0	863	0	683	0	0	629	410
Grp Sat Flow(s),veh/h/ln				1625	0	1583	0	1631	1341	0	1679	1509
Q Serve(g_s), s				14.2	0.0	45.3	0.0	9.1	0.0	0.0	8.0	21.0
Cycle Q Clear(g_c), s				14.2	0.0	45.3	0.0	9.1	0.0	0.0	8.0	21.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				1762	0	769	0	1597	875	0	1643	493
V/C Ratio(X)				0.50	0.00	1.12	0.00	0.43	0.00	0.00	0.38	0.83
Avail Cap(c_a), veh/h				1762	0	769	0	1597	875	0	2061	618
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				12.0	0.0	26.6	0.0	22.0	0.0	0.0	21.7	26.0
Incr Delay (d2), s/veh				0.1	0.0	71.4	0.0	0.2	0.0	0.0	0.1	7.8
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				6.4	0.0	43.2	0.0	4.1	0.0	0.0	3.7	9.8
LnGrp Delay(d),s/veh				12.1	0.0	98.0	0.0	22.2	0.0	0.0	21.8	33.8
LnGrp LOS				B		F		C			C	C
Approach Vol, veh/h					1743			683			1039	
Approach Delay, s/veh					54.6			22.2			26.6	
Approach LOS					D			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs	1	2				6		8				
Phs Duration (G+Y+Rc), s	0.0	33.6				33.6		50.0				
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7				
Max Green Setting (Gmax), s	* 10	18.7				* 34		45.3				
Max Q Clear Time (g_c+I1), s	0.0	11.1				23.0		47.3				
Green Ext Time (p_c), s	0.0	5.2				4.3		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			39.8									
HCM 2010 LOS			D									
Notes												

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	244	0	620	0	0	0	0	944	680	0	1116	273
Future Volume (veh/h)	244	0	620	0	0	0	0	944	680	0	1116	273
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	0	1727				1900	1827	1727	0	1810	1845
Adj Flow Rate, veh/h	265	0	674				0	1026	0	0	1213	0
Adj No. of Lanes	2	0	2				0	3	1	0	3	1
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	12	0	10				4	4	10	0	5	3
Cap, veh/h	1087	0	566				0	2122	625	0	2018	640
Arrive On Green	0.35	0.00	0.35				0.00	0.43	0.00	0.00	0.41	0.00
Sat Flow, veh/h	3134	0	2584				0	4988	1468	0	5103	1568
Grp Volume(v), veh/h	265	0	674				0	1026	0	0	1213	0
Grp Sat Flow(s),veh/h/ln	1567	0	1292				0	1663	1468	0	1647	1568
Q Serve(g_s), s	2.8	0.0	16.3				0.0	7.0	0.0	0.0	9.0	0.0
Cycle Q Clear(g_c), s	2.8	0.0	16.3				0.0	7.0	0.0	0.0	9.0	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1087	0	566				0	2122	625	0	2018	640
V/C Ratio(X)	0.24	0.00	1.19				0.00	0.48	0.00	0.00	0.60	0.00
Avail Cap(c_a), veh/h	1087	0	566				0	5646	1662	0	3280	1041
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	10.9	0.0	24.4				0.0	9.8	0.0	0.0	10.9	0.0
Incr Delay (d2), s/veh	0.0	0.0	102.2				0.0	0.2	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	0.0	8.0				0.0	3.2	0.0	0.0	4.1	0.0
LnGrp Delay(d),s/veh	11.0	0.0	126.6				0.0	9.9	0.0	0.0	11.2	0.0
LnGrp LOS	B		F					A			B	
Approach Vol, veh/h		939						1026			1213	
Approach Delay, s/veh		94.0						9.9			11.2	
Approach LOS		F						A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		26.0		21.0	0.0	26.0		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 53		* 16	15.0	31.2		
Max Q Clear Time (g_c+I1), s		9.0		18.3	0.0	11.0		
Green Ext Time (p_c), s		8.5		0.0	0.0	8.1		

Intersection Summary	
HCM 2010 Ctrl Delay	35.2
HCM 2010 LOS	D

Notes

Intersection	
Int Delay, s/veh	0.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	90	0	1624	1566	170
Future Vol, veh/h	0	90	0	1624	1566	170
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	9	2	7	8	2
Mvmt Flow	0	98	0	1765	1702	185

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	944	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.28	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.99	-	-	-	-
Pot Cap-1 Maneuver	0	216	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	216	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	34.8	0	0
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	216	-	-
HCM Lane V/C Ratio	-	0.453	-	-
HCM Control Delay (s)	-	34.8	-	-
HCM Lane LOS	-	D	-	-
HCM 95th %tile Q(veh)	-	2.2	-	-

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	40	130	140	140	120	270	1494	30	310	1336	10
Future Volume (veh/h)	10	40	130	140	140	120	270	1494	30	310	1336	10
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		0.99	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1520	1863	1863	1863	1863	1827	1863	1827	1667	1845	1810	1900
Adj Flow Rate, veh/h	11	43	82	152	152	68	293	1624	15	337	1452	10
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	25	2	2	2	2	4	2	4	14	3	5	5
Cap, veh/h	23	134	408	184	298	434	329	2471	702	415	2185	15
Arrive On Green	0.02	0.07	0.07	0.10	0.16	0.16	0.19	0.50	0.50	0.12	0.43	0.43
Sat Flow, veh/h	1448	1863	1583	1774	1863	1532	1774	4988	1417	3408	5062	35
Grp Volume(v), veh/h	11	43	82	152	152	68	293	1624	15	337	945	517
Grp Sat Flow(s),veh/h/ln	1448	1863	1583	1774	1863	1532	1774	1663	1417	1704	1647	1803
Q Serve(g_s), s	0.8	2.2	4.1	8.5	7.6	3.4	16.3	24.7	0.5	9.8	23.2	23.2
Cycle Q Clear(g_c), s	0.8	2.2	4.1	8.5	7.6	3.4	16.3	24.7	0.5	9.8	23.2	23.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.02
Lane Grp Cap(c), veh/h	23	134	408	184	298	434	329	2471	702	415	1422	778
V/C Ratio(X)	0.48	0.32	0.20	0.83	0.51	0.16	0.89	0.66	0.02	0.81	0.66	0.66
Avail Cap(c_a), veh/h	103	482	703	268	631	708	443	2471	702	582	1422	778
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	49.4	44.7	29.5	44.5	38.9	27.4	40.2	19.1	13.0	43.4	22.9	22.9
Incr Delay (d2), s/veh	14.9	1.4	0.2	12.8	1.4	0.2	15.7	1.4	0.1	6.0	2.5	4.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	1.2	1.8	4.8	4.0	1.5	9.4	11.6	0.2	4.9	11.0	12.5
LnGrp Delay(d),s/veh	64.3	46.1	29.7	57.3	40.3	27.5	55.9	20.5	13.1	49.3	25.4	27.4
LnGrp LOS	E	D	C	E	D	C	E	C	B	D	C	C
Approach Vol, veh/h		136			372			1932			1799	
Approach Delay, s/veh		37.7			44.9			25.8			30.5	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.0	56.0	15.2	13.1	23.5	49.5	6.3	22.0
Change Period (Y+Rc), s	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8
Max Green Setting (Gmax), s	* 17	50.2	* 15	26.2	* 25	42.2	* 7.2	34.3
Max Q Clear Time (g_c+I1), s	11.8	26.7	10.5	6.1	18.3	25.2	2.8	9.6
Green Ext Time (p_c), s	0.6	20.4	0.1	1.4	0.5	15.3	0.0	1.5

Intersection Summary	
HCM 2010 Ctrl Delay	29.8
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	1817	340	850	50	10	190	10	617	10	10	10
Future Volume (veh/h)	0	1817	340	850	50	10	190	10	617	10	10	10
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	0	1776	1696	1845	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	0	1854	259	867	51	7	194	10	335	10	10	10
Adj No. of Lanes	0	2	1	2	2	0	0	1	2	0	1	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
Percent Heavy Veh, %	0	7	12	3	2	2	2	2	2	2	2	2
Cap, veh/h	0	2084	891	500	2523	339	133	7	628	13	13	13
Arrive On Green	0.00	0.62	0.62	0.15	0.80	0.80	0.08	0.08	0.08	0.02	0.02	0.02
Sat Flow, veh/h	0	3463	1442	3408	3136	422	1691	87	2787	577	577	577
Grp Volume(v), veh/h	0	1854	259	867	28	30	204	0	335	30	0	0
Grp Sat Flow(s),veh/h/ln	0	1687	1442	1704	1770	1788	1778	0	1393	1732	0	0
Q Serve(g_s), s	0.0	69.9	12.6	22.0	0.5	0.5	11.8	0.0	11.8	2.6	0.0	0.0
Cycle Q Clear(g_c), s	0.0	69.9	12.6	22.0	0.5	0.5	11.8	0.0	11.8	2.6	0.0	0.0
Prop In Lane	0.00		1.00	1.00		0.24	0.95		1.00	0.33		0.33
Lane Grp Cap(c), veh/h	0	2084	891	500	1424	1438	140	0	628	38	0	0
V/C Ratio(X)	0.00	0.89	0.29	1.73	0.02	0.02	1.46	0.00	0.53	0.78	0.00	0.00
Avail Cap(c_a), veh/h	0	2084	891	500	1424	1438	140	0	628	393	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.00	1.00	1.00	0.78	0.78	0.78	0.95	0.00	0.95	1.00	0.00	0.00
Uniform Delay (d), s/veh	0.0	24.3	13.4	64.0	2.9	2.9	69.1	0.0	51.2	73.0	0.0	0.0
Incr Delay (d2), s/veh	0.0	6.2	0.8	337.0	0.0	0.0	239.8	0.0	0.4	12.0	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.0	34.2	5.2	33.7	0.2	0.2	15.1	0.0	6.1	1.4	0.0	0.0
LnGrp Delay(d),s/veh	0.0	30.5	14.2	401.0	2.9	2.9	308.9	0.0	51.6	85.0	0.0	0.0
LnGrp LOS		C	B	F	A	A	F		D	F		
Approach Vol, veh/h		2113			925			539			30	
Approach Delay, s/veh		28.5			376.1			149.0			85.0	
Approach LOS		C			F			F			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4		6		8
Phs Duration (G+Y+Rc), s	28.0	98.7		7.3		126.7		16.0
Change Period (Y+Rc), s	6.0	6.0		4.0		6.0		4.2
Max Green Setting (Gmax), s	22.0	62.0		34.0		90.0		11.8
Max Q Clear Time (g_c+I1), s	24.0	71.9		4.6		2.5		13.8
Green Ext Time (p_c), s	0.0	0.0		0.1		15.8		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	136.1
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	60	10	270	0	667	230	0	550	760
Future Volume (veh/h)	0	0	0	60	10	270	0	667	230	0	550	760
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1827	1554	1743	0	1863	1863	1900	1834	1900
Adj Flow Rate, veh/h				73	0	59	0	725	0	0	598	0
Adj No. of Lanes				2	0	2	0	2	1	0	3	0
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				4	67	9	0	2	2	3	3	3
Cap, veh/h				286	0	125	0	2809	1257	0	3975	0
Arrive On Green				0.08	0.00	0.08	0.00	0.26	0.00	0.00	1.00	0.00
Sat Flow, veh/h				3480	0	2963	0	3632	1583	0	5173	0
Grp Volume(v), veh/h				73	0	59	0	725	0	0	598	0
Grp Sat Flow(s),veh/h/ln				1740	0	1482	0	1770	1583	0	1669	0
Q Serve(g_s), s				1.5	0.0	4.5	0.0	12.2	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s				1.5	0.0	4.5	0.0	12.2	0.0	0.0	0.0	0.0
Prop In Lane				1.00		1.00	0.00		1.00	0.00		0.00
Lane Grp Cap(c), veh/h				286	0	125	0	2809	1257	0	3975	0
V/C Ratio(X)				0.26	0.00	0.47	0.00	0.26	0.00	0.00	0.15	0.00
Avail Cap(c_a), veh/h				696	0	474	0	2809	1257	0	3975	0
HCM Platoon Ratio				1.00	1.00	1.00	1.00	0.33	0.33	1.67	1.67	1.67
Upstream Filter(I)				1.00	0.00	1.00	0.00	0.80	0.00	0.00	0.14	0.00
Uniform Delay (d), s/veh				32.3	0.0	182.4	0.0	10.2	0.0	0.0	0.0	0.0
Incr Delay (d2), s/veh				0.2	0.0	1.0	0.0	0.2	0.0	0.0	0.0	0.0
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				0.7	0.0	0.0	0.0	6.0	0.0	0.0	0.0	0.0
LnGrp Delay(d),s/veh				32.4	0.0	183.4	0.0	10.4	0.0	0.0	0.0	0.0
LnGrp LOS				C		F		B			A	
Approach Vol, veh/h					132			725			598	
Approach Delay, s/veh					99.9			10.4			0.0	
Approach LOS					F			B			A	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	64.8				64.8		10.2
Change Period (Y+Rc), s	3.0	5.3				5.3		4.0
Max Green Setting (Gmax), s	8.0	39.7				50.7		15.0
Max Q Clear Time (g_c+I1), s	0.0	14.2				2.0		6.5
Green Ext Time (p_c), s	0.0	12.8				16.8		0.1

Intersection Summary		
HCM 2010 Ctrl Delay		14.2
HCM 2010 LOS		B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	507	170	340	20	130	200	30	190	90	290	210	110
Future Volume (veh/h)	507	170	340	20	130	200	30	190	90	290	210	110
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1845	1776	1863	1863	1827	1776	1851	1900	1827	1845	1900
Adj Flow Rate, veh/h	551	185	77	22	141	115	33	207	30	315	228	0
Adj No. of Lanes	2	1	1	1	1	1	1	2	0	1	2	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	3	7	2	2	4	7	2	2	4	3	3
Cap, veh/h	655	351	287	180	189	481	45	865	124	362	1642	0
Arrive On Green	0.19	0.19	0.19	0.10	0.10	0.10	0.03	0.28	0.28	0.07	0.15	0.00
Sat Flow, veh/h	3442	1845	1509	1774	1863	1553	1691	3088	441	1740	3597	0
Grp Volume(v), veh/h	551	185	77	22	141	115	33	117	120	315	228	0
Grp Sat Flow(s),veh/h/ln	1721	1845	1509	1774	1863	1553	1691	1759	1770	1740	1752	0
Q Serve(g_s), s	11.6	6.8	3.3	0.8	5.5	4.1	1.5	3.8	3.9	13.4	4.2	0.0
Cycle Q Clear(g_c), s	11.6	6.8	3.3	0.8	5.5	4.1	1.5	3.8	3.9	13.4	4.2	0.0
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.25	1.00		0.00
Lane Grp Cap(c), veh/h	655	351	287	180	189	481	45	493	496	362	1642	0
V/C Ratio(X)	0.84	0.53	0.27	0.12	0.75	0.24	0.74	0.24	0.24	0.87	0.14	0.00
Avail Cap(c_a), veh/h	757	406	332	213	224	509	133	493	496	441	1642	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.00
Uniform Delay (d), s/veh	29.3	27.3	25.9	30.7	32.8	19.3	36.2	20.8	20.8	33.9	18.6	0.0
Incr Delay (d2), s/veh	6.7	0.5	0.2	0.1	8.4	0.1	8.4	1.1	1.2	12.2	0.2	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.1	3.5	1.4	0.4	3.3	1.8	0.8	2.0	2.1	7.7	2.1	0.0
LnGrp Delay(d),s/veh	35.9	27.8	26.1	30.8	41.1	19.4	44.6	21.9	22.0	46.2	18.8	0.0
LnGrp LOS	D	C	C	C	D	B	D	C	C	D	B	
Approach Vol, veh/h		813			278			270			543	
Approach Delay, s/veh		33.1			31.3			24.7			34.7	
Approach LOS		C			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	19.6	26.0		17.8	5.5	40.1		11.6
Change Period (Y+Rc), s	4.0	5.0		3.5	3.5	5.0		4.0
Max Green Setting (Gmax), s	19.0	14.0		16.5	5.9	27.6		9.0
Max Q Clear Time (g_c+I1), s	15.4	5.9		13.6	3.5	6.2		7.5
Green Ext Time (p_c), s	0.2	2.0		0.7	0.0	3.3		0.1

Intersection Summary	
HCM 2010 Ctrl Delay	32.1
HCM 2010 LOS	C

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	60	2144	270	40	630	20	240	10	20	50	10	30
Future Volume (veh/h)	60	2144	270	40	630	20	240	10	20	50	10	30
Number	1	6	16	5	2	12	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1696	1811	1900	1863	1839	1900	1863	1863	1900
Adj Flow Rate, veh/h	61	2188	268	41	643	18	245	10	4	51	10	2
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	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
Percent Heavy Veh, %	2	2	2	12	5	5	2	2	2	2	2	2
Cap, veh/h	371	1870	225	51	756	21	268	189	76	91	77	15
Arrive On Green	0.28	0.54	0.54	0.03	0.22	0.22	0.15	0.15	0.15	0.05	0.05	0.05
Sat Flow, veh/h	1774	4599	553	1616	3506	98	1774	1250	500	1774	1503	301
Grp Volume(v), veh/h	61	1602	854	41	332	329	245	0	14	51	0	12
Grp Sat Flow(s),veh/h/ln	1774	1695	1762	1616	906	1793	1774	0	1750	1774	0	1803
Q Serve(g_s), s	3.9	61.0	61.0	3.8	26.4	26.5	20.4	0.0	1.0	4.2	0.0	1.0
Cycle Q Clear(g_c), s	3.9	61.0	61.0	3.8	26.4	26.5	20.4	0.0	1.0	4.2	0.0	1.0
Prop In Lane	1.00		0.31	1.00		0.05	1.00		0.29	1.00		0.17
Lane Grp Cap(c), veh/h	371	1379	717	51	391	387	268	0	264	91	0	93
V/C Ratio(X)	0.16	1.16	1.19	0.80	0.85	0.85	0.91	0.00	0.05	0.56	0.00	0.13
Avail Cap(c_a), veh/h	371	1379	717	97	640	634	305	0	301	423	0	430
HCM Platoon Ratio	1.33	1.33	1.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09	0.98	0.98	0.98	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	44.2	34.4	34.4	72.2	56.5	56.5	62.7	0.0	54.5	69.5	0.0	67.9
Incr Delay (d2), s/veh	0.0	73.7	87.8	10.1	5.7	5.9	28.4	0.0	0.1	5.3	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	42.3	46.8	1.8	6.9	13.7	12.1	0.0	0.5	2.2	0.0	0.5
LnGrp Delay(d),s/veh	44.2	108.1	122.2	82.3	62.2	62.4	91.2	0.0	54.6	74.8	0.0	68.6
LnGrp LOS	D	F	F	F	E	E	F		D	E		E
Approach Vol, veh/h		2517			702			259			63	
Approach Delay, s/veh		111.4			63.5			89.2			73.6	
Approach LOS		F			E			F			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	37.4	38.4		11.9	8.7	67.0		26.9
Change Period (Y+Rc), s	6.0	* 6		* 4.2	4.0	6.0		4.2
Max Green Setting (Gmax), s	17.0	* 53		* 36	9.0	61.0		25.8
Max Q Clear Time (g_c+I1), s	5.9	28.5		6.2	5.8	63.0		22.4
Green Ext Time (p_c), s	9.7	3.9		0.2	0.0	0.0		0.3

Intersection Summary	
HCM 2010 Ctrl Delay	99.6
HCM 2010 LOS	F

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑↑↱		↰	↑↑↑↱		↰	↱		↰	↱	
Traffic Volume (veh/h)	140	2054	20	30	330	130	80	20	150	180	10	170
Future Volume (veh/h)	140	2054	20	30	330	130	80	20	150	180	10	170
Number	5	2	12	1	6	16	3	8	18	7	4	14
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1863	1863	1900	1681	1863	1900
Adj Flow Rate, veh/h	152	2233	22	33	359	109	87	22	64	196	11	27
Adj No. of Lanes	1	3	0	1	3	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	13	2	2
Cap, veh/h	173	2181	21	379	2151	625	108	41	119	217	82	200
Arrive On Green	0.19	0.84	0.84	0.21	0.55	0.55	0.06	0.10	0.10	0.14	0.17	0.17
Sat Flow, veh/h	1774	5193	51	1774	3914	1137	1774	420	1222	1601	474	1164
Grp Volume(v), veh/h	152	1457	798	33	309	159	87	0	86	196	0	38
Grp Sat Flow(s),veh/h/ln	1774	1695	1854	1774	1695	1661	1774	0	1643	1601	0	1638
Q Serve(g_s), s	12.5	63.0	63.0	2.2	6.8	7.2	7.3	0.0	7.5	18.1	0.0	2.9
Cycle Q Clear(g_c), s	12.5	63.0	63.0	2.2	6.8	7.2	7.3	0.0	7.5	18.1	0.0	2.9
Prop In Lane	1.00		0.03	1.00		0.68	1.00		0.74	1.00		0.71
Lane Grp Cap(c), veh/h	173	1424	779	379	1863	913	108	0	161	217	0	282
V/C Ratio(X)	0.88	1.02	1.02	0.09	0.17	0.17	0.80	0.00	0.54	0.90	0.00	0.13
Avail Cap(c_a), veh/h	308	1424	779	379	1863	913	248	0	394	267	0	437
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.49	0.49	0.49	0.83	0.83	0.83	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	59.6	12.0	12.0	47.3	16.7	16.8	69.5	0.0	64.4	63.9	0.0	52.6
Incr Delay (d2), s/veh	2.9	22.9	29.1	0.0	0.2	0.3	12.9	0.0	2.8	27.7	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	31.8	36.1	1.1	3.2	3.4	4.0	0.0	3.5	9.7	0.0	1.4
LnGrp Delay(d),s/veh	62.4	34.9	41.1	47.3	16.9	17.2	82.4	0.0	67.2	91.6	0.0	52.8
LnGrp LOS	E	F	F	D	B	B	F		E	F		D
Approach Vol, veh/h		2407			501			173			234	
Approach Delay, s/veh		38.7			19.0			74.9			85.3	
Approach LOS		D			B			E			F	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	38.0	69.0	13.1	29.8	18.6	88.4	24.3	18.7
Change Period (Y+Rc), s	6.0	* 6	4.0	4.0	4.0	6.0	4.0	4.0
Max Green Setting (Gmax), s	8.0	* 63	21.0	40.0	26.0	45.0	25.0	36.0
Max Q Clear Time (g_c+I1), s	4.2	65.0	9.3	4.9	14.5	9.2	20.1	9.5
Green Ext Time (p_c), s	0.1	0.0	0.1	0.8	0.1	2.9	0.2	0.7

Intersection Summary	
HCM 2010 Ctrl Delay	40.9
HCM 2010 LOS	D

Notes

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR	SBU	SBL	SBT	SBR
Traffic Vol, veh/h	0	10	10	20	0	193	10	20	0	30	120	230	0	10	80	10
Future Vol, veh/h	0	10	10	20	0	193	10	20	0	30	120	230	0	10	80	10
Peak Hour Factor	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85	0.92	0.85	0.85	0.85
Heavy Vehicles, %	2	2	2	2	2	9	2	2	2	2	11	3	2	2	3	2
Mvmt Flow	0	12	12	24	0	227	12	24	0	35	141	271	0	12	94	12
Number of Lanes	0	0	1	0	0	0	1	1	0	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	1	3	3
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	3	1	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	3	3	2	1
HCM Control Delay	10	14.6	11.3	10.6
HCM LOS	A	B	B	B

Lane	NBLn1	NBLn2	NBLn3	EBLn1	WBLn1	WBLn2	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	0%	25%	95%	0%	100%	0%	0%
Vol Thru, %	0%	100%	0%	25%	5%	0%	0%	100%	0%
Vol Right, %	0%	0%	100%	50%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	30	120	230	40	203	20	10	80	10
LT Vol	30	0	0	10	193	0	10	0	0
Through Vol	0	120	0	10	10	0	0	80	0
RT Vol	0	0	230	20	0	20	0	0	10
Lane Flow Rate	35	141	271	47	239	24	12	94	12
Geometry Grp	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.064	0.243	0.402	0.087	0.454	0.036	0.024	0.175	0.02
Departure Headway (Hd)	6.549	6.197	5.35	6.62	6.84	5.546	7.194	6.703	5.973
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	547	579	671	540	528	644	497	534	597
Service Time	4.292	3.94	3.092	4.379	4.583	3.29	4.951	4.459	3.729
HCM Lane V/C Ratio	0.064	0.244	0.404	0.087	0.453	0.037	0.024	0.176	0.02
HCM Control Delay	9.7	10.9	11.7	10	15.2	8.5	10.1	10.9	8.9
HCM Lane LOS	A	B	B	A	C	A	B	B	A
HCM 95th-tile Q	0.2	0.9	1.9	0.3	2.3	0.1	0.1	0.6	0.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	470	1814	160	30	233	121	50	20	140	145	20	168
Future Volume (veh/h)	470	1814	160	30	233	121	50	20	140	145	20	168
Number	1	6	16	5	2	12	7	4	14	3	8	18
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.99	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1845	1863	1900	1863	1850	1900	1863	1467	1900	1845	1863	1827
Adj Flow Rate, veh/h	511	1972	169	33	253	42	54	22	19	158	22	35
Adj No. of Lanes	2	3	0	1	3	0	1	1	0	1	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	3	2	2	2	2	2	2	33	33	3	2	4
Cap, veh/h	1465	2606	222	46	557	89	69	68	59	197	310	258
Arrive On Green	0.43	0.55	0.55	0.03	0.13	0.13	0.04	0.09	0.09	0.11	0.17	0.17
Sat Flow, veh/h	3408	4764	405	1774	4381	701	1774	727	628	1757	1863	1553
Grp Volume(v), veh/h	511	1399	742	33	192	103	54	0	41	158	22	35
Grp Sat Flow(s),veh/h/ln	1704	1695	1779	1774	1684	1715	1774	0	1355	1757	1863	1553
Q Serve(g_s), s	8.3	26.3	26.7	1.5	4.4	4.6	2.5	0.0	2.3	7.2	0.8	0.5
Cycle Q Clear(g_c), s	8.3	26.3	26.7	1.5	4.4	4.6	2.5	0.0	2.3	7.2	0.8	0.5
Prop In Lane	1.00		0.23	1.00		0.41	1.00		0.46	1.00		1.00
Lane Grp Cap(c), veh/h	1465	1855	973	46	428	218	69	0	126	197	310	258
V/C Ratio(X)	0.35	0.75	0.76	0.72	0.45	0.47	0.78	0.00	0.32	0.80	0.07	0.14
Avail Cap(c_a), veh/h	1465	2675	1404	172	1678	854	215	0	657	405	1097	915
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	15.8	14.4	14.5	39.9	33.3	33.4	39.3	0.0	35.0	35.7	29.0	3.3
Incr Delay (d2), s/veh	0.1	0.4	0.8	19.3	0.3	0.6	17.2	0.0	0.5	7.4	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.9	12.1	13.2	1.0	2.0	2.2	1.5	0.0	0.9	3.9	0.4	0.7
LnGrp Delay(d),s/veh	15.9	14.8	15.3	59.2	33.6	34.0	56.5	0.0	35.5	43.1	29.0	3.4
LnGrp LOS	B	B	B	E	C	C	E		D	D	C	A
Approach Vol, veh/h		2652			328			95			215	
Approach Delay, s/veh		15.1			36.3			47.4			35.2	
Approach LOS		B			D			D			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	40.8	15.8	13.3	12.7	6.1	50.4	7.2	18.7
Change Period (Y+Rc), s	5.3	* 5.3	4.0	* 5	4.0	5.3	4.0	5.0
Max Green Setting (Gmax), s	32.0	* 41	19.0	* 40	8.0	65.1	10.0	48.6
Max Q Clear Time (g_c+I1), s	10.3	6.6	9.2	4.3	3.5	28.7	4.5	2.8
Green Ext Time (p_c), s	13.1	1.1	0.3	0.3	0.0	16.4	0.0	0.3

Intersection Summary		
HCM 2010 Ctrl Delay		19.5
HCM 2010 LOS		B

Notes

MOVEMENT SUMMARY

Site: 8 [Cumulative Plus Project PM]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	188	3.0	0.414	6.8	LOS A	2.8	70.5	0.18	0.06	28.3
8	T1	171	3.0	0.414	6.8	LOS A	2.8	70.5	0.18	0.06	27.7
18	R2	179	3.0	0.414	6.8	LOS A	2.8	70.5	0.18	0.06	26.9
Approach		538	3.0	0.414	6.8	LOS A	2.8	70.5	0.18	0.06	27.6
East: Campus Loop											
1	L2	141	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	27.1
6	T1	13	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	23.3
16	R2	1	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	22.8
Approach		155	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	26.7
North: Campus Hill Drive											
7	L2	1	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	25.0
4	T1	154	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	28.8
14	R2	1	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	23.9
Approach		157	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	28.7
West: Campus Loop											
5	L2	1	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	24.7
2	T1	26	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	24.2
12	R2	176	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	27.8
Approach		204	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	27.2
All Vehicles		1054	3.0	0.414	6.2	LOS A	2.8	70.5	0.33	0.22	27.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	14	1750	565	280	187	117	254	357	250	110	315	13
Future Volume (veh/h)	14	1750	565	280	187	117	254	357	250	110	315	13
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		0.98	1.00		0.98	1.00		0.96	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1863	1863	1863	1900	1863	1863	1759	1863	1792	1863
Adj Flow Rate, veh/h	14	1786	441	286	191	68	259	364	85	112	321	5
Adj No. of Lanes	1	2	2	2	3	0	2	2	1	1	2	1
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
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	8	2	6	2
Cap, veh/h	48	1986	1534	340	2386	782	313	438	177	136	372	165
Arrive On Green	0.03	0.56	0.56	0.10	0.63	0.63	0.09	0.12	0.12	0.08	0.11	0.11
Sat Flow, veh/h	1774	3539	2733	3442	3772	1235	3442	3539	1429	1774	3406	1506
Grp Volume(v), veh/h	14	1786	441	286	170	89	259	364	85	112	321	5
Grp Sat Flow(s),veh/h/ln	1774	1770	1367	1721	1695	1617	1721	1770	1429	1774	1703	1506
Q Serve(g_s), s	1.0	59.5	11.2	10.9	2.6	2.8	9.8	13.4	7.4	8.3	12.3	0.4
Cycle Q Clear(g_c), s	1.0	59.5	11.2	10.9	2.6	2.8	9.8	13.4	7.4	8.3	12.3	0.4
Prop In Lane	1.00		1.00	1.00		0.76	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	48	1986	1534	340	2145	1023	313	438	177	136	372	165
V/C Ratio(X)	0.29	0.90	0.29	0.84	0.08	0.09	0.83	0.83	0.48	0.82	0.86	0.03
Avail Cap(c_a), veh/h	253	2092	1616	491	2145	1023	491	438	177	253	386	171
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	63.5	25.9	15.3	59.0	9.5	9.5	59.5	57.0	54.3	60.6	58.3	53.0
Incr Delay (d2), s/veh	1.2	5.6	0.1	6.0	0.0	0.0	3.4	12.7	2.0	4.7	17.3	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	30.6	4.3	5.4	1.2	1.3	4.8	7.3	3.0	4.3	6.7	0.2
LnGrp Delay(d),s/veh	64.7	31.4	15.4	64.9	9.5	9.5	62.9	69.7	56.4	65.3	75.6	53.1
LnGrp LOS	E	C	B	E	A	A	E	E	E	E	E	D
Approach Vol, veh/h		2241			545			708			438	
Approach Delay, s/veh		28.5			38.6			65.6			72.7	
Approach LOS		C			D			E			E	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	14.2	21.8	17.2	80.0	16.1	19.9	7.6	89.5
Change Period (Y+Rc), s	4.0	5.3	4.0	5.3	4.0	* 5.3	4.0	5.3
Max Green Setting (Gmax), s	19.0	14.7	19.0	78.7	19.0	* 15	19.0	78.7
Max Q Clear Time (g_c+I1), s	10.3	15.4	12.9	61.5	11.8	14.3	3.0	4.8
Green Ext Time (p_c), s	0.1	0.0	0.3	13.2	0.3	0.2	0.0	35.6

Intersection Summary	
HCM 2010 Ctrl Delay	41.5
HCM 2010 LOS	D

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	710	0	321	0	530	690	0	865	425
Future Volume (veh/h)	0	0	0	710	0	321	0	530	690	0	865	425
Number				3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh				0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)				1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln				1759	0	1863	0	1792	1792	1900	1845	1776
Adj Flow Rate, veh/h				772	0	311	0	576	0	0	940	462
Adj No. of Lanes				2	0	1	0	3	2	0	3	1
Peak Hour Factor				0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %				8	0	2	0	6	6	3	3	7
Cap, veh/h				1092	0	368	0	2062	1130	0	2122	636
Arrive On Green				0.34	0.00	0.34	0.00	0.42	0.00	0.00	0.42	0.42
Sat Flow, veh/h				3250	0	1583	0	5055	2682	0	5036	1509
Grp Volume(v), veh/h				772	0	311	0	576	0	0	940	462
Grp Sat Flow(s),veh/h/ln				1625	0	1583	0	1631	1341	0	1679	1509
Q Serve(g_s), s				9.4	0.0	13.2	0.0	3.5	0.0	0.0	6.0	11.6
Cycle Q Clear(g_c), s				9.4	0.0	13.2	0.0	3.5	0.0	0.0	6.0	11.6
Prop In Lane				1.00		1.00	0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h				1092	0	368	0	2062	1130	0	2122	636
V/C Ratio(X)				0.71	0.00	0.85	0.00	0.28	0.00	0.00	0.44	0.73
Avail Cap(c_a), veh/h				1097	0	370	0	2062	1130	0	2688	806
HCM Platoon Ratio				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)				1.00	0.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00
Uniform Delay (d), s/veh				13.1	0.0	36.0	0.0	8.6	0.0	0.0	9.3	10.9
Incr Delay (d2), s/veh				1.8	0.0	15.5	0.0	0.1	0.0	0.0	0.1	2.4
Initial Q Delay(d3),s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln				4.5	0.0	10.1	0.0	1.6	0.0	0.0	2.8	5.2
LnGrp Delay(d),s/veh				14.9	0.0	51.5	0.0	8.7	0.0	0.0	9.5	13.4
LnGrp LOS				B		D		A			A	B
Approach Vol, veh/h					1083			576			1402	
Approach Delay, s/veh					25.4			8.7			10.8	
Approach LOS					C			A			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2				6		8
Phs Duration (G+Y+Rc), s	0.0	25.4				25.4		19.9
Change Period (Y+Rc), s	* 4.7	6.3				* 6.3		4.7
Max Green Setting (Gmax), s	* 4.9	14.1				* 24		15.3
Max Q Clear Time (g_c+I1), s	0.0	5.5				13.6		15.2
Green Ext Time (p_c), s	0.0	6.3				5.5		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	15.5
HCM 2010 LOS	B

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	255	0	480	0	0	0	0	965	760	0	1105	470
Future Volume (veh/h)	255	0	480	0	0	0	0	965	760	0	1105	470
Number	7	4	14				5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0				0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00				1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1696	0	1727				1900	1827	1727	0	1810	1845
Adj Flow Rate, veh/h	277	0	522				0	1049	0	0	1201	0
Adj No. of Lanes	2	0	2				0	3	1	0	3	1
Peak Hour Factor	0.92	0.92	0.92				0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	12	0	10				4	4	10	0	5	3
Cap, veh/h	1089	0	567				0	2117	623	0	2012	639
Arrive On Green	0.35	0.00	0.35				0.00	0.42	0.00	0.00	0.41	0.00
Sat Flow, veh/h	3134	0	2584				0	4988	1468	0	5103	1568
Grp Volume(v), veh/h	277	0	522				0	1049	0	0	1201	0
Grp Sat Flow(s),veh/h/ln	1567	0	1292				0	1663	1468	0	1647	1568
Q Serve(g_s), s	3.0	0.0	15.3				0.0	7.2	0.0	0.0	8.9	0.0
Cycle Q Clear(g_c), s	3.0	0.0	15.3				0.0	7.2	0.0	0.0	8.9	0.0
Prop In Lane	1.00		1.00				0.00		1.00	0.00		1.00
Lane Grp Cap(c), veh/h	1089	0	567				0	2117	623	0	2012	639
V/C Ratio(X)	0.25	0.00	0.92				0.00	0.50	0.00	0.00	0.60	0.00
Avail Cap(c_a), veh/h	1089	0	567				0	5657	1665	0	3391	1076
HCM Platoon Ratio	1.00	1.00	1.00				1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00				0.00	1.00	0.00	0.00	1.00	0.00
Uniform Delay (d), s/veh	11.0	0.0	24.1				0.0	9.8	0.0	0.0	10.9	0.0
Incr Delay (d2), s/veh	0.0	0.0	20.0				0.0	0.2	0.0	0.0	0.3	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0				0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	9.3				0.0	3.2	0.0	0.0	4.1	0.0
LnGrp Delay(d),s/veh	11.0	0.0	44.1				0.0	10.0	0.0	0.0	11.2	0.0
LnGrp LOS	B		D					B			B	
Approach Vol, veh/h		799						1049			1201	
Approach Delay, s/veh		32.6						10.0			11.2	
Approach LOS		C						B			B	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4	5	6		
Phs Duration (G+Y+Rc), s		25.9		21.0	0.0	25.9		
Change Period (Y+Rc), s		* 6		* 4.7	6.0	6.8		
Max Green Setting (Gmax), s		* 53		* 16	14.0	32.2		
Max Q Clear Time (g_c+I1), s		9.2		17.3	0.0	10.9		
Green Ext Time (p_c), s		8.7		0.0	0.0	8.2		

Intersection Summary			
HCM 2010 Ctrl Delay			16.4
HCM 2010 LOS			B

Notes

Intersection	
Int Delay, s/veh	9.4

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	0	250	0	1725	1465	120
Future Vol, veh/h	0	250	0	1725	1465	120
Conflicting Peds, #/hr	0	0	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	9	2	7	8	2
Mvmt Flow	0	272	0	1875	1592	130

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	-	862	-	0	-	0
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	7.28	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.99	-	-	-	-
Pot Cap-1 Maneuver	0	~ 245	0	-	-	-
Stage 1	0	-	0	-	-	-
Stage 2	0	-	0	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	-	~ 245	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	133.3	0	0
HCM LOS	F		

Minor Lane/Major Mvmt	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	-	245	-	-
HCM Lane V/C Ratio	-	1.109	-	-
HCM Control Delay (s)	-	133.3	-	-
HCM Lane LOS	-	F	-	-
HCM 95th %tile Q(veh)	-	11.9	-	-

Notes

~: Volume exceeds capacity $: Delay exceeds 300s +: Computation Not Defined *: All major volume in platoon

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	90	110	310	50	60	240	210	1395	190	300	1395	20
Future Volume (veh/h)	90	110	310	50	60	240	210	1395	190	300	1395	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		0.99	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1520	1863	1863	1863	1863	1827	1863	1827	1667	1845	1810	1900
Adj Flow Rate, veh/h	98	120	289	54	65	184	228	1516	89	326	1516	21
Adj No. of Lanes	1	1	1	1	1	1	1	3	1	2	3	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	25	2	2	2	2	4	2	4	14	3	5	5
Cap, veh/h	117	330	510	76	259	393	258	2405	675	389	2267	31
Arrive On Green	0.08	0.18	0.18	0.04	0.14	0.14	0.15	0.48	0.48	0.11	0.45	0.45
Sat Flow, veh/h	1448	1863	1583	1774	1863	1553	1774	4988	1399	3408	5023	70
Grp Volume(v), veh/h	98	120	289	54	65	184	228	1516	89	326	994	543
Grp Sat Flow(s),veh/h/ln	1448	1863	1583	1774	1863	1553	1774	1663	1399	1704	1647	1798
Q Serve(g_s), s	7.6	6.5	17.3	3.4	3.6	11.5	14.4	25.9	4.0	10.7	27.1	27.1
Cycle Q Clear(g_c), s	7.6	6.5	17.3	3.4	3.6	11.5	14.4	25.9	4.0	10.7	27.1	27.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		0.04
Lane Grp Cap(c), veh/h	117	330	510	76	259	393	258	2405	675	389	1487	811
V/C Ratio(X)	0.84	0.36	0.57	0.71	0.25	0.47	0.88	0.63	0.13	0.84	0.67	0.67
Avail Cap(c_a), veh/h	226	425	591	129	269	401	392	2405	675	578	1487	811
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	51.8	41.4	32.2	54.1	44.0	36.2	48.0	22.0	16.4	49.6	24.7	24.7
Incr Delay (d2), s/veh	5.8	0.3	0.4	4.4	0.2	0.3	10.3	1.3	0.4	4.5	2.4	4.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.2	3.4	7.6	1.8	1.9	5.0	7.8	12.1	1.6	5.3	12.8	14.4
LnGrp Delay(d),s/veh	57.7	41.7	32.5	58.5	44.1	36.5	58.3	23.3	16.8	54.1	27.1	29.0
LnGrp LOS	E	D	C	E	D	D	E	C	B	D	C	C
Approach Vol, veh/h		507			303			1833			1863	
Approach Delay, s/veh		39.6			42.1			27.3			32.4	
Approach LOS		D			D			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	17.8	61.0	9.6	26.1	21.3	57.5	14.0	21.7
Change Period (Y+Rc), s	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8	* 4.7	5.8
Max Green Setting (Gmax), s	* 19	55.2	* 8.3	26.1	* 25	49.3	* 18	16.5
Max Q Clear Time (g_c+I1), s	12.7	27.9	5.4	19.3	16.4	29.1	9.6	13.5
Green Ext Time (p_c), s	0.4	25.6	0.0	0.9	0.2	19.2	0.1	0.5

Intersection Summary	
HCM 2010 Ctrl Delay	31.8
HCM 2010 LOS	C

Notes

MOVEMENT SUMMARY

Site: 8 [Cumulative Plus Project AM Plus Mitigation]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	528	3.0	0.758	14.6	LOS B	11.0	280.9	0.33	0.11	25.6
8	T1	465	3.0	0.758	14.6	LOS B	11.0	280.9	0.33	0.11	25.1
18	R2	450	3.0	0.344	5.9	LOS A	2.1	53.0	0.14	0.04	27.6
Approach		1443	3.0	0.758	11.9	LOS B	11.0	280.9	0.27	0.09	26.0
East: Campus Loop											
1	L2	59	29.0	0.201	12.3	LOS B	0.6	18.3	0.69	0.69	25.0
6	T1	19	3.0	0.201	12.3	LOS B	0.6	18.3	0.69	0.69	22.1
16	R2	2	3.0	0.201	12.3	LOS B	0.6	18.3	0.69	0.69	21.6
Approach		80	22.3	0.201	12.3	LOS B	0.6	18.3	0.69	0.69	24.1
North: Campus Hill Drive											
7	L2	2	3.0	0.111	6.4	LOS A	0.4	11.1	0.59	0.55	24.7
4	T1	74	3.0	0.111	6.4	LOS A	0.4	11.1	0.59	0.55	28.4
14	R2	2	3.0	0.111	6.4	LOS A	0.4	11.1	0.59	0.55	23.6
Approach		78	3.0	0.111	6.4	LOS A	0.4	11.1	0.59	0.55	28.2
West: Campus Loop											
5	L2	2	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	25.2
2	T1	19	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	24.7
12	R2	87	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	28.4
Approach		107	3.0	0.094	3.9	LOS A	0.4	10.4	0.30	0.17	27.6
All Vehicles		1707	3.9	0.758	11.1	LOS B	11.0	280.9	0.31	0.14	26.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 8 [Cumulative Plus Project PM Plus Mitigation]

Campus Hill Drive / Campus Loop
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance ft	Prop. Queued	Effective Stop Rate per veh	Average Speed mph
South: Campus Hill Drive											
3	L2	188	3.0	0.276	5.2	LOS A	1.5	38.8	0.15	0.05	28.6
8	T1	171	3.0	0.276	5.2	LOS A	1.5	38.8	0.15	0.05	28.0
18	R2	179	3.0	0.138	3.9	LOS A	0.6	16.4	0.12	0.04	28.3
Approach		538	3.0	0.276	4.8	LOS A	1.5	38.8	0.14	0.04	28.3
East: Campus Loop											
1	L2	141	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	27.1
6	T1	13	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	23.3
16	R2	1	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	22.8
Approach		155	3.0	0.169	5.6	LOS A	0.7	18.8	0.49	0.40	26.7
North: Campus Hill Drive											
7	L2	1	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	25.0
4	T1	154	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	28.8
14	R2	1	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	23.9
Approach		157	3.0	0.167	5.5	LOS A	0.7	18.7	0.48	0.38	28.7
West: Campus Loop											
5	L2	1	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	24.7
2	T1	26	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	24.2
12	R2	176	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	27.8
Approach		204	3.0	0.208	5.7	LOS A	0.9	24.3	0.47	0.36	27.2
All Vehicles		1054	3.0	0.276	5.2	LOS A	1.5	38.8	0.31	0.21	27.9

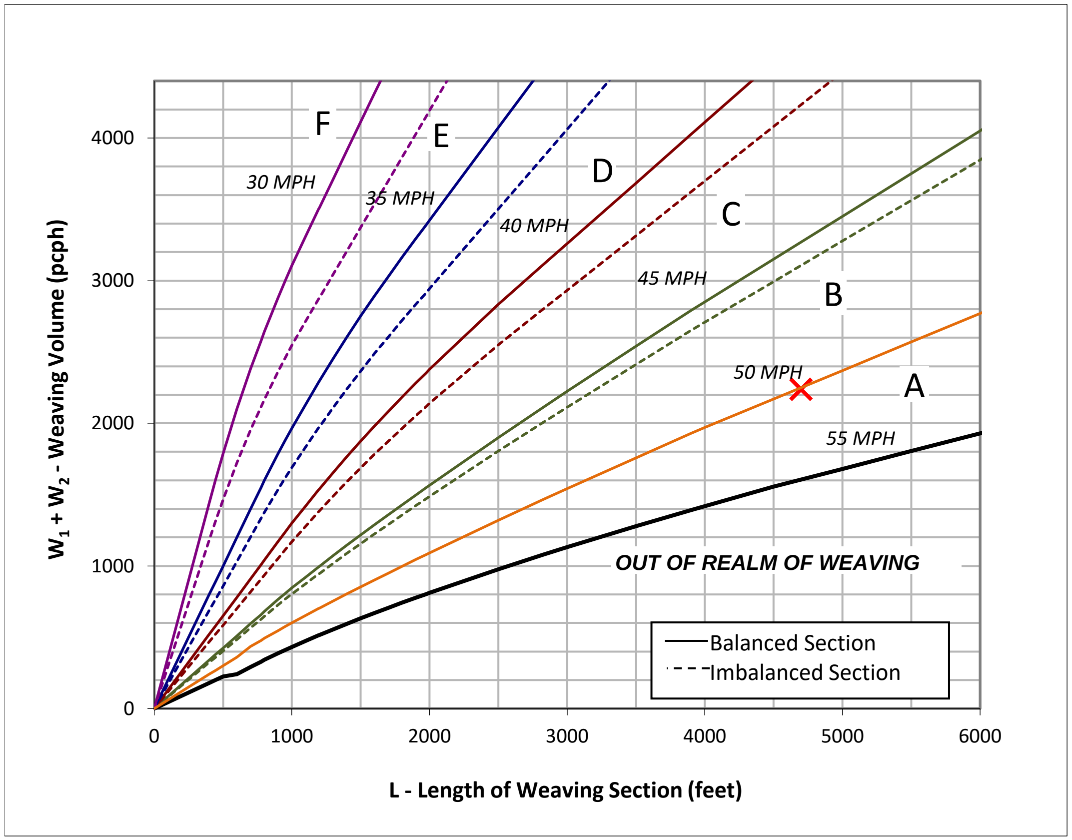
Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
Roundabout Capacity Model: US HCM 2010.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Leisch Method for Weaving Analysis

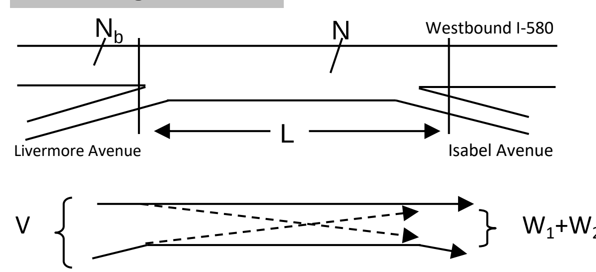
Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information	
Project	Las Positas CC
Scenario	Existing AM Peak Hour
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,492	Volume (vph)*	890	Volume (vph)*	1,287
Truck Percentage	27%	Truck Percentage	5%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,638	Volume (pcph)	912	Volume (pcph)	1,326



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 50.1
4. Weaving Intensity Factor (k) 0.96
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,920
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: AM Peak
Freeway/Dir of Travel: Eastbound I-580
Junction: NB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7205	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	546	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7205	546		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2001	152		v
Trucks and buses	27	8		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

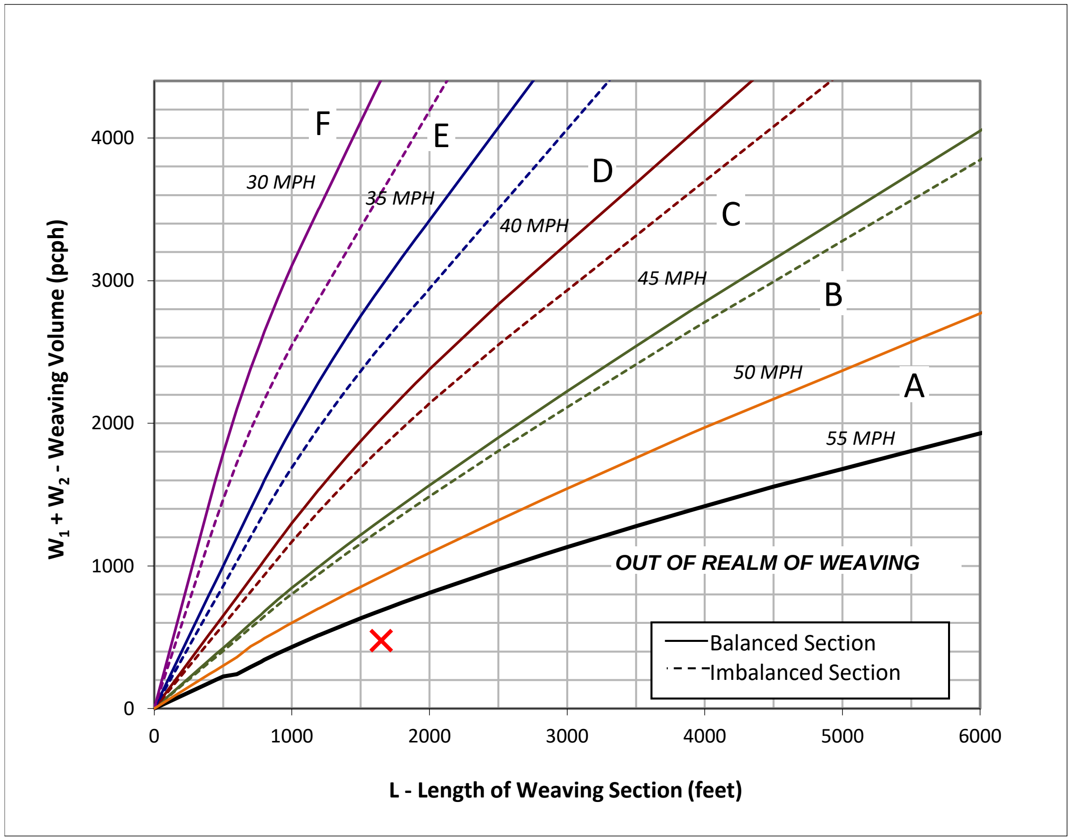
```
Heavy vehicle adjustment, fHV          0.881       0.962
Driver population factor, fP           1.00        1.00
Flow rate, vp                          9086        631                  pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.139   Using Equation  4
                   FM
                  v  = v  (P  ) =  1262   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     9717          9400            Yes
      FO
     v  or v               3912 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3634                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                9717          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   36.6    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.578
                                              S
Space mean speed in ramp influence area,     S  = 51.7    mph
                                              R
Space mean speed in outer lanes,             S  = 55.9    mph
                                              0
Space mean speed for all vehicles,           S  = 54.0    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Existing AM Peak Hour
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,070	Volume (vph)*	319	Volume (vph)*	141
Truck Percentage	27%	Truck Percentage	8%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,159	Volume (pcph)	332	Volume (pcph)	145

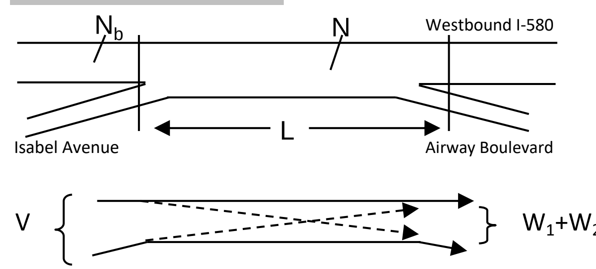


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 59.4
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,832
6. Level of Service (LOS) E

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Airway Boulevard On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7929	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	141	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7929	141		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2203	39		v
Trucks and buses	27	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

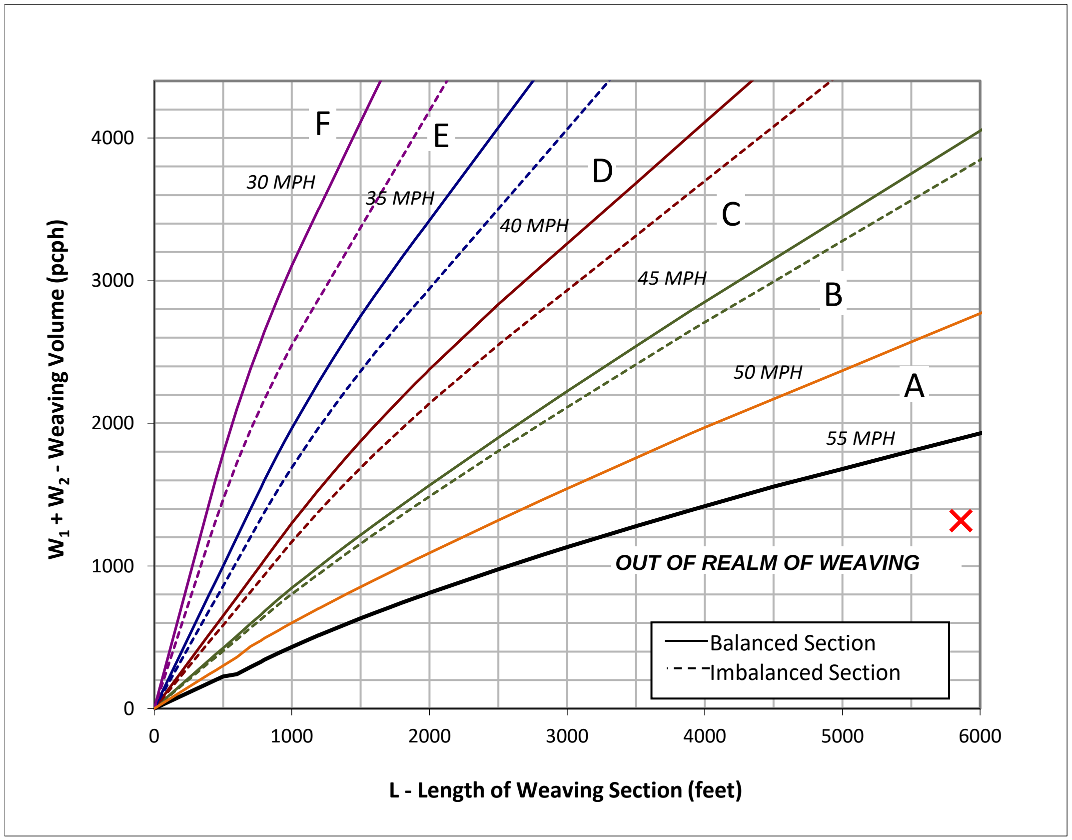
```
Heavy vehicle adjustment, fHV          0.881       0.990
Driver population factor, fP           1.00        1.00
Flow rate, vp                          9999        158                  pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.198   Using Equation  4
                   FM
                  v  = v  (P  ) =  1980   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                             Actual        Maximum         LOS F?
     v                       10157         9400            Yes
      FO
     v  or v                 4009 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?             Yes
      3     av34
Is   v  or v      > 1.5 v  /2              Yes
      3     av34         12
If yes, v    = 3999                     (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                        Actual        Max Desirable         Violation?
     v                  10157         4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   35.9    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.549
                                              S
Space mean speed in ramp influence area,     S  = 52.4    mph
                                              R
Space mean speed in outer lanes,             S  = 54.3    mph
                                              0
Space mean speed for all vehicles,           S  = 53.5    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

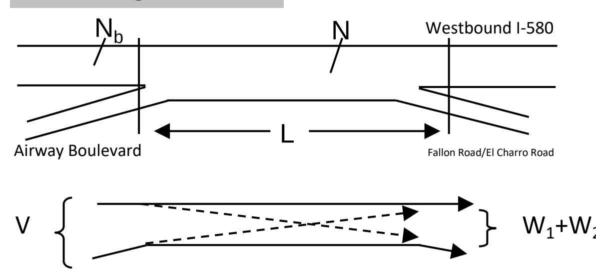
Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Project Information	
Project	Las Positas CC
Scenario	Existing AM Peak Hour
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,487	Volume (vph)*	417	Volume (vph)*	871
Truck Percentage	27%	Truck Percentage	4%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,633	Volume (pcph)	425	Volume (pcph)	893



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 58.5
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,927

6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

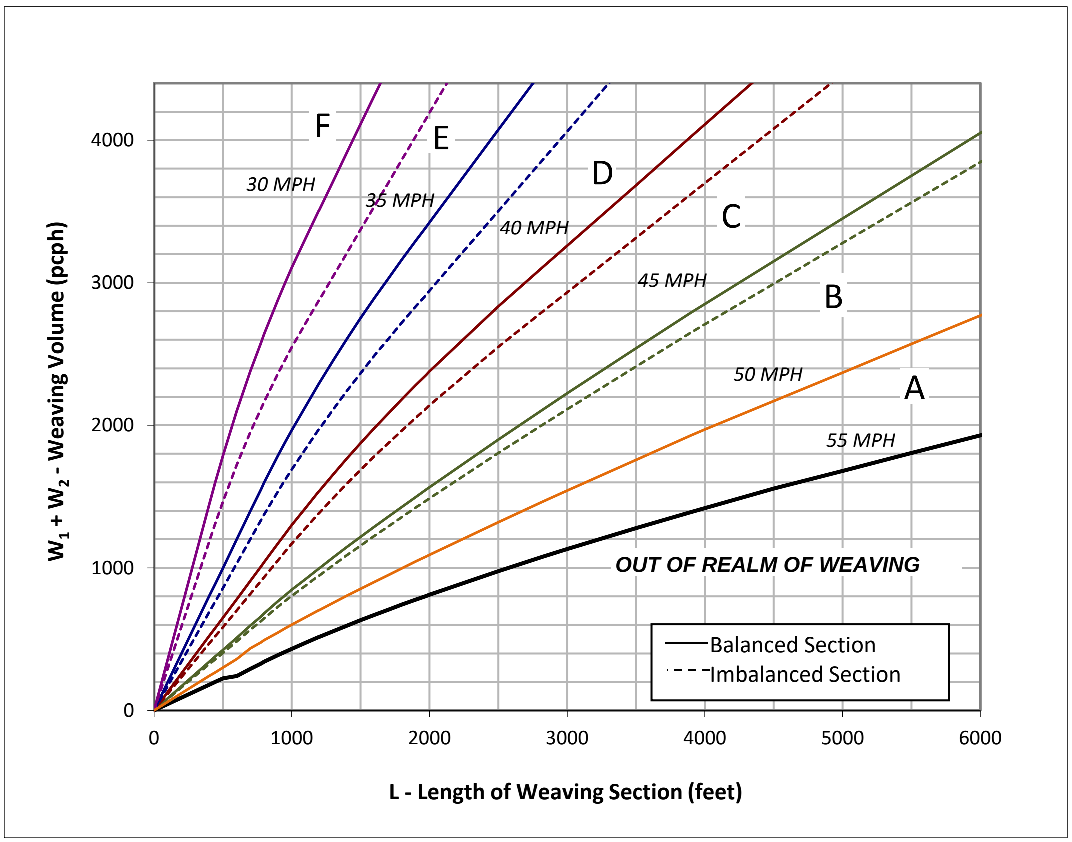
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information	
Project	Las Positas CC
Scenario	Existing AM Peak Hour
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,283	Volume (vph)*	99	Volume (vph)*	984
Truck Percentage	13%	Truck Percentage	8%	Truck Percentage	3%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	4,561	Volume (pcph)	103	Volume (pcph)	999



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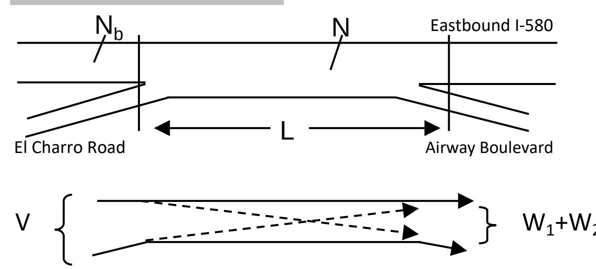


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 60.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 912
6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

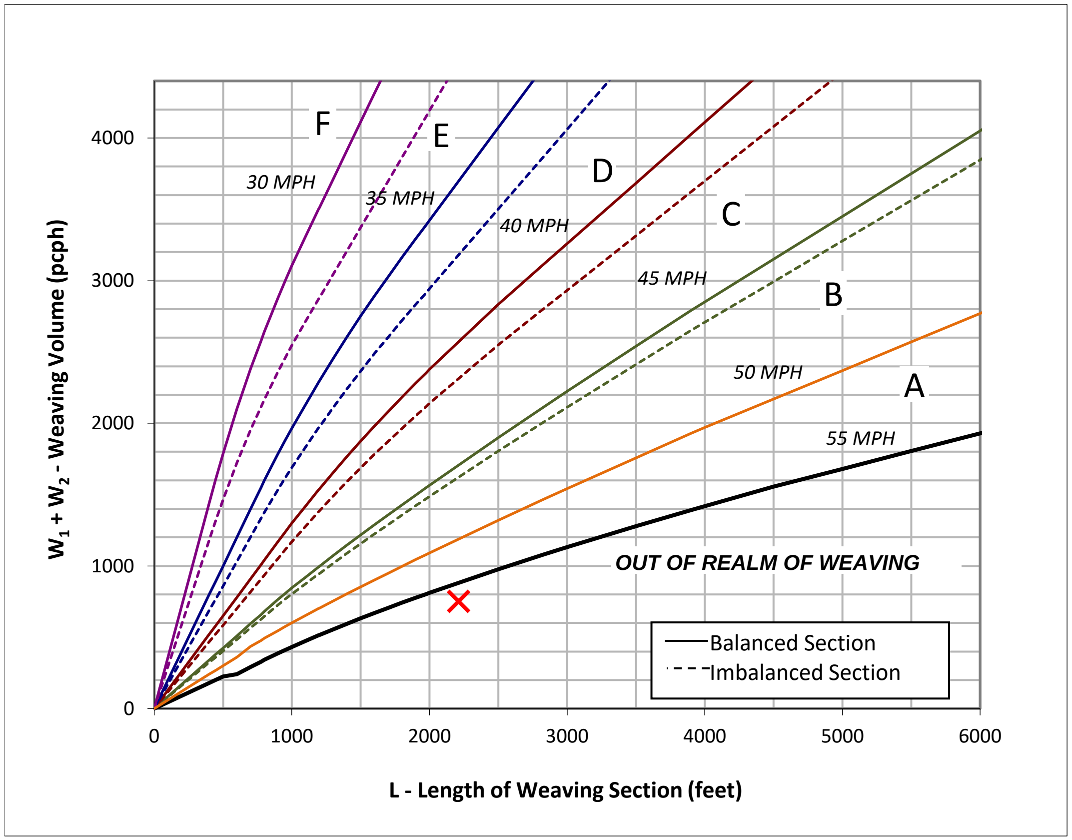
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Project Information	
Project	Las Positas CC
Scenario	Existing AM Peak Hour
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	3,502	Volume (vph)*	203	Volume (vph)*	516
Truck Percentage	13%	Truck Percentage	3%	Truck Percentage	11%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	3,730	Volume (pcph)	206	Volume (pcph)	544



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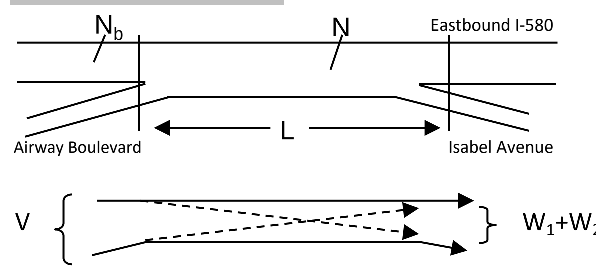


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 57.2
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 746

6. Level of Service (LOS) A

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: AM Peak
Freeway/Dir of Travel: Westbound I-580
Junction: SB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2986	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	120	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	2986	120		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	829	33		v
Trucks and buses	13	3		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

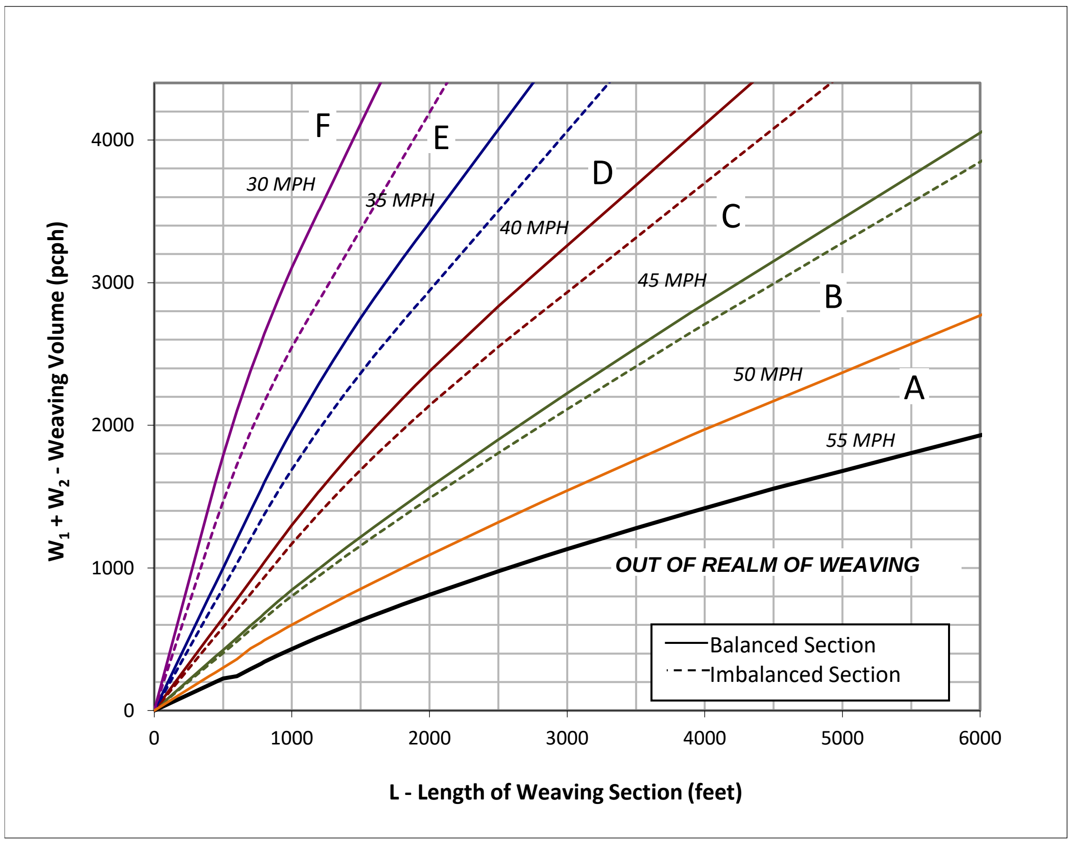
```
Heavy vehicle adjustment, fHV            0.939       0.985
Driver population factor, fP             1.00        1.00
Flow rate, vp                            3533        135                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.201   Using Equation  4
                   FM
                  v  = v  (P  ) =  554    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     2891          9400            No
      FO
     v  or v               1101 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1102                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                2891          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   13.2    pc/mi/ln
         R                    R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.313
                                              S
Space mean speed in ramp influence area,     S  = 57.8    mph
                                              R
Space mean speed in outer lanes,             S  = 63.8    mph
                                              0
Space mean speed for all vehicles,           S  = 61.1    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information	
Project	Las Positas CC
Scenario	Existing AM Peak Hour
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	3,556	Volume (vph)*	450	Volume (vph)*	470
Truck Percentage	13%	Truck Percentage	10%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	3,787	Volume (pcph)	473	Volume (pcph)	482



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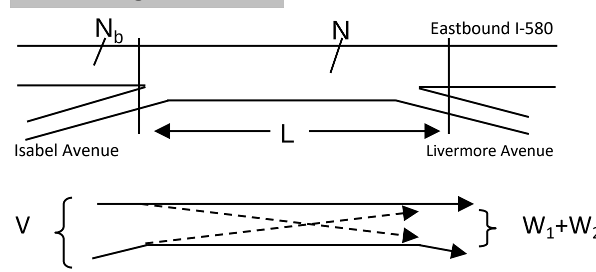


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 61.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 757

6. Level of Service (LOS) A

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

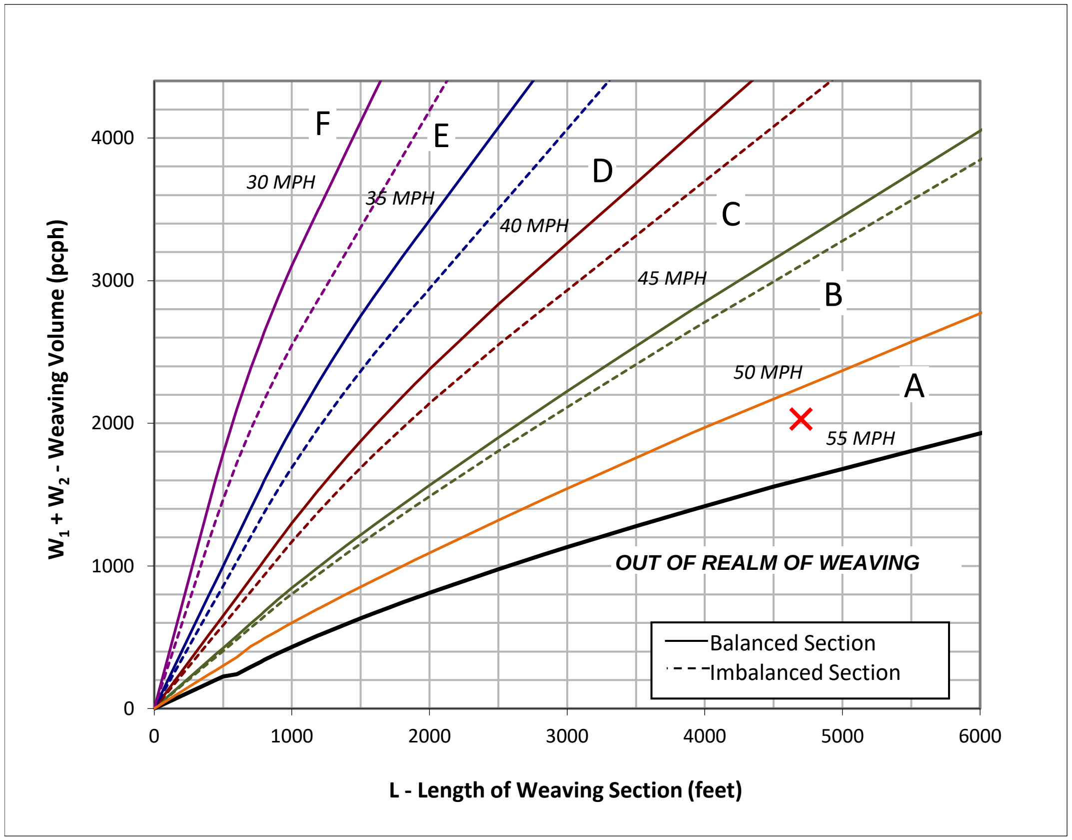
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

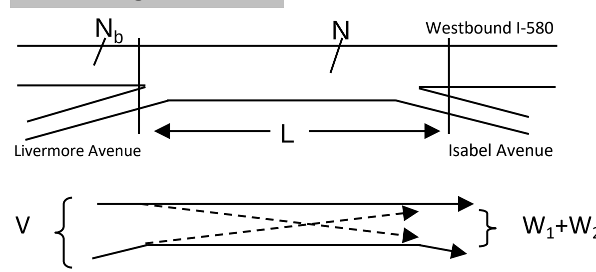
Data Input					
Number of Entering Mainline Lanes	N_b	4		Project	Las Positas CC
Number of Lanes in Weaving Section	N	5		Scenario	Existing PM Peak Hour
Length of Weaving Section (feet)	L	4,700		Freeway	Westbound I-580
				On-ramp	Livermore Avenue
				Off-ramp	Isabel Avenue

Project Information

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,514	Volume (vph)*	1,140	Volume (vph)*	852
Truck Percentage	10%	Truck Percentage	5%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	5,790	Volume (pcph)	1,169	Volume (pcph)	861



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 51.7
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,158

6. Level of Service (LOS) — B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: PM Peak
Freeway/Dir of Travel: Eastbound I-580
Junction: NB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4662	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4662	485		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1295	135		v
Trucks and buses	10	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.952	0.976	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	5439	552	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.149 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 809 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	5991	9400	No
v_3 or v_{av34}	2315 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	
If yes, v_{12A} = 2175		(Equation 13-15, 13-16, 13-18, or 13-19)	

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	5991	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$ = 24.6 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

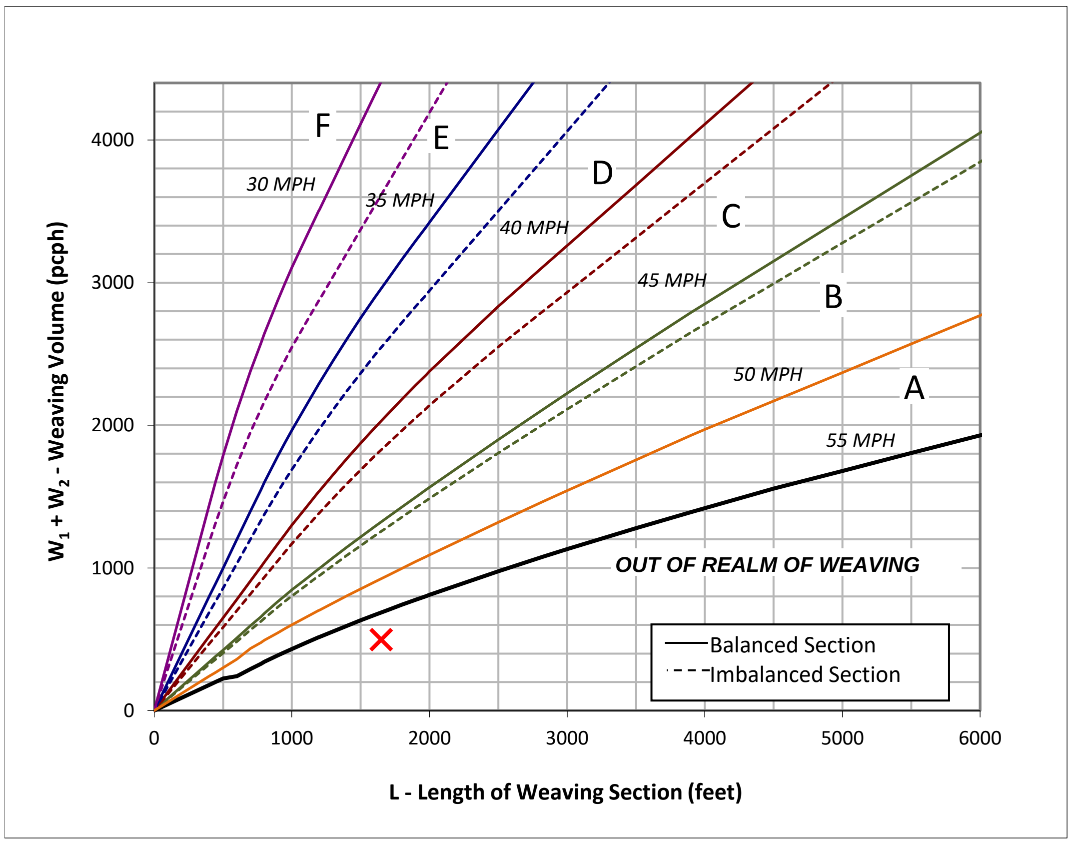
Intermediate speed variable,	M_S = 0.360	
Space mean speed in ramp influence area,	S_R = 56.7	mph
Space mean speed in outer lanes,	S_0 = 60.9	mph
Space mean speed for all vehicles,	S = 58.9	mph

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Existing PM Peak Hour
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,423	Volume (vph)*	276	Volume (vph)*	217
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	5,694	Volume (pcph)	279	Volume (pcph)	219



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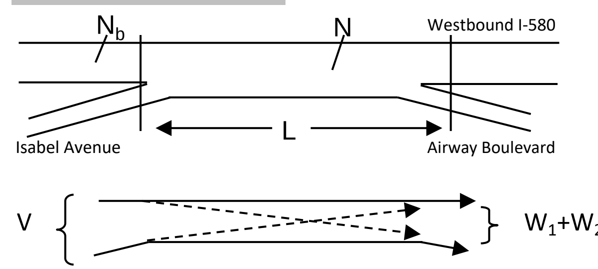


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 59.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,139

6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	PM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Airway Boulevard On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5206	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	222	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5206	222		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1446	62		v
Trucks and buses	10	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

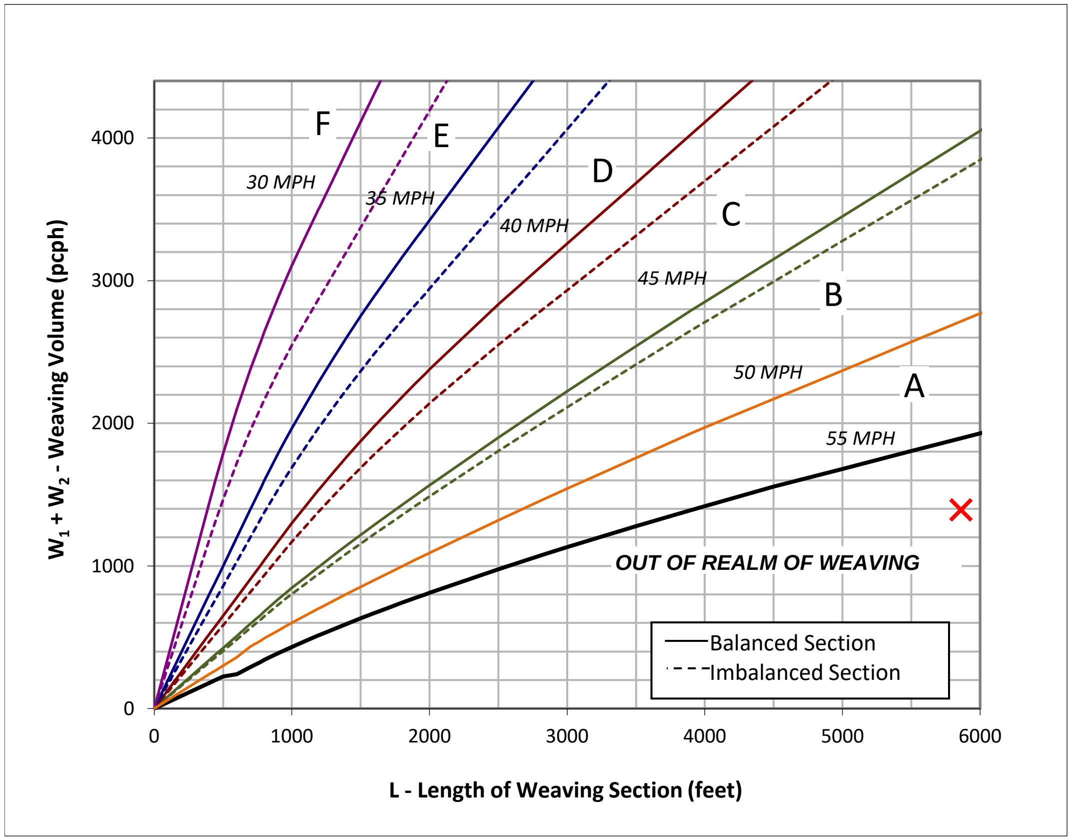
```
Heavy vehicle adjustment, fHV           0.952       0.980
Driver population factor, fP            1.00        1.00
Flow rate, vp                           6074        252                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.186   Using Equation  4
                   FM
                  v  = v  (P  ) =  1132   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     6326          9400            No
      FO
     v  or v               2471 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34        12
If yes, v    = 2429                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                6326          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   24.4    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.357
                                              S
Space mean speed in ramp influence area,     S  = 56.8    mph
                                              R
Space mean speed in outer lanes,             S  = 60.2    mph
                                              0
Space mean speed for all vehicles,           S  = 58.7    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

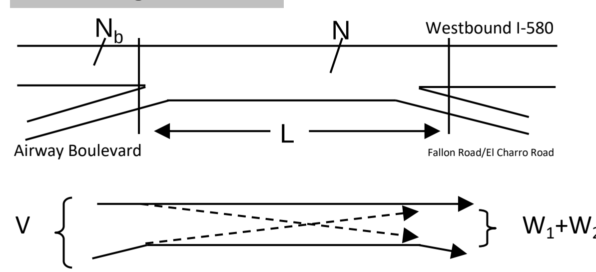
Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Project Information	
Project	Las Positas CC
Scenario	Existing PM Peak Hour
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,180	Volume (vph)*	752	Volume (vph)*	628
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	6,489	Volume (pcph)	760	Volume (pcph)	634



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.1
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,298
6. Level of Service (LOS) C

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

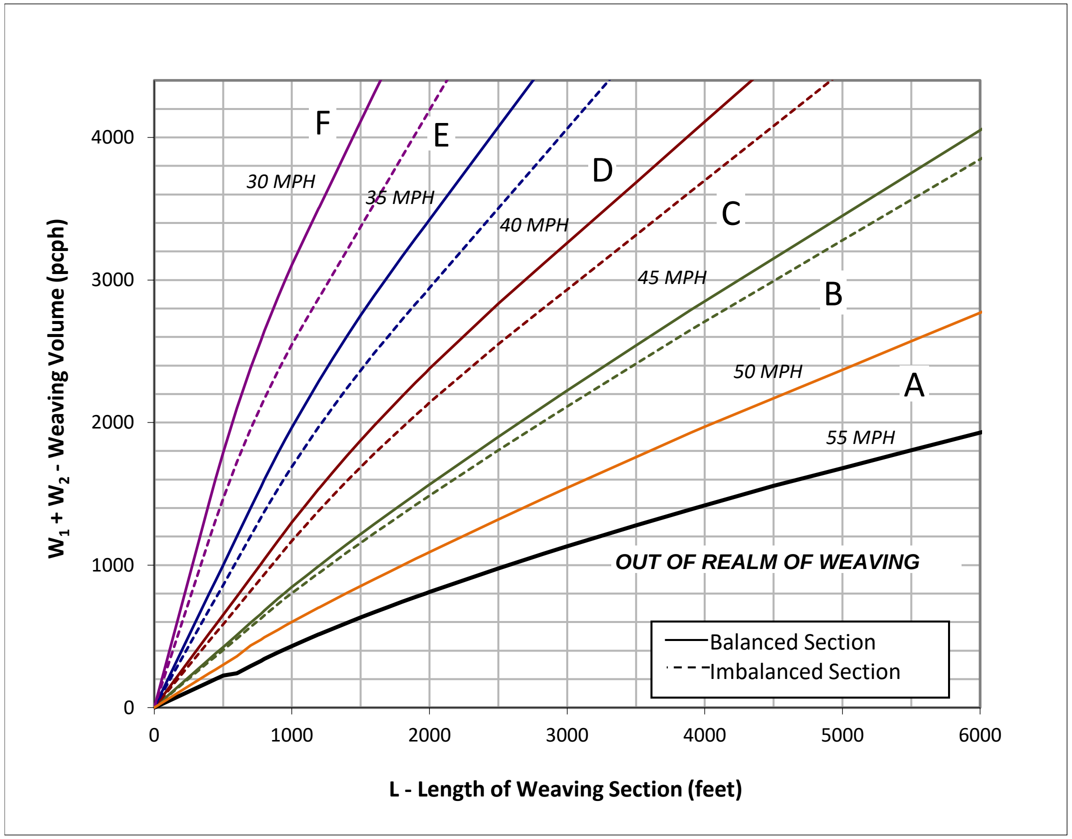
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information	
Project	Las Positas CC
Scenario	Existing PM Peak Hour
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,548	Volume (vph)*	270	Volume (vph)*	988
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,646	Volume (pcph)	273	Volume (pcph)	998



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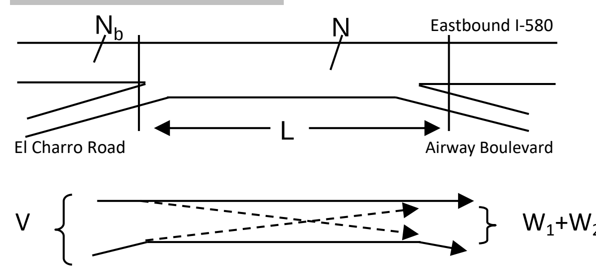


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 59.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,129
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

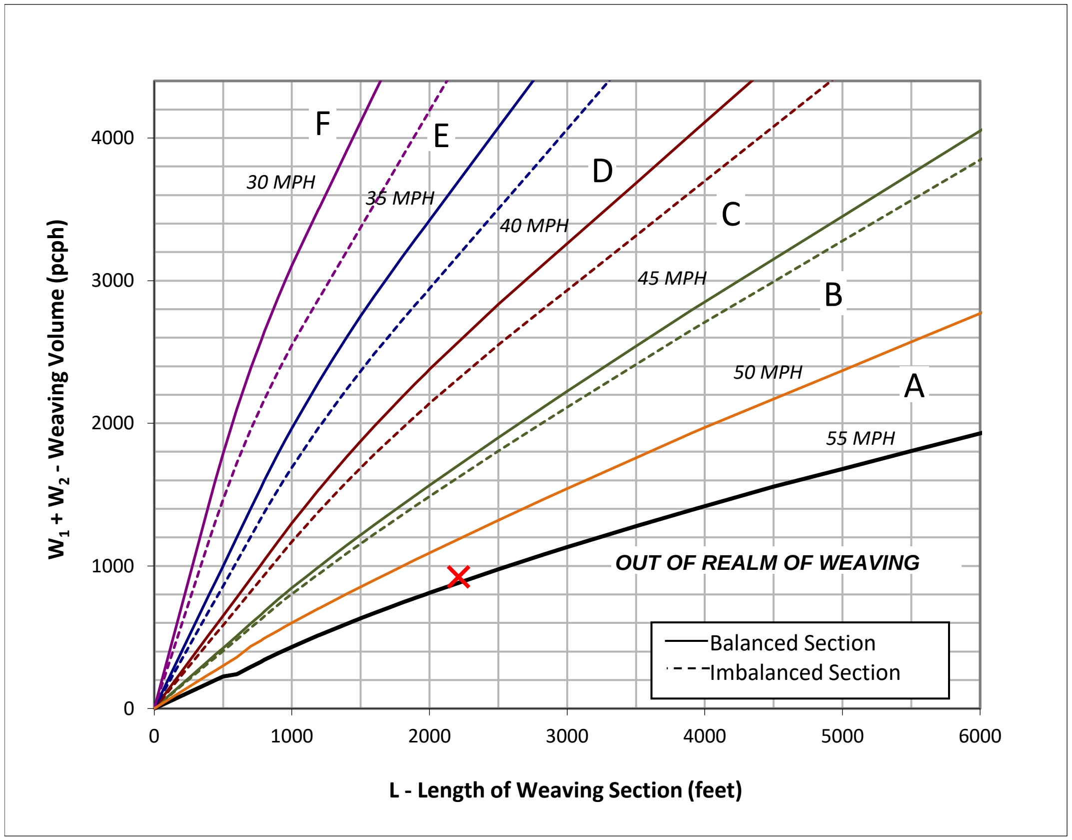
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Project Information	
Project	Las Positas CC
Scenario	Existing PM Peak Hour
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,816	Volume (vph)*	256	Volume (vph)*	657
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,830	Volume (pcph)	259	Volume (pcph)	664



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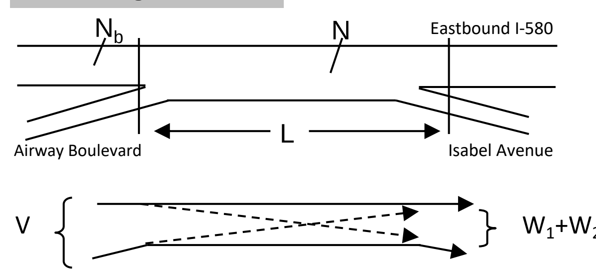


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 54.4
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,966

6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Fehr & Peers *1/23/2017*

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: PM Peak
Freeway/Dir of Travel: Westbound I-580
Junction: SB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Existing
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8159	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	346	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8159	346		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2266	96		v
Trucks and buses	23	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.897       0.990
Driver population factor, fP            1.00        1.00
Flow rate, vp                           10108       388                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.169   Using Equation  4
                   FM
                  v  = v  (P  ) =  1288   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     7996          9400            No
      FO
     v  or v               3160 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3043                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                7996          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   30.2    pc/mi/ln
         R                   R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.421
                                              S
Space mean speed in ramp influence area,     S  = 55.3    mph
                                              R
Space mean speed in outer lanes,             S  = 58.6    mph
                                              0
Space mean speed for all vehicles,           S  = 57.1    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

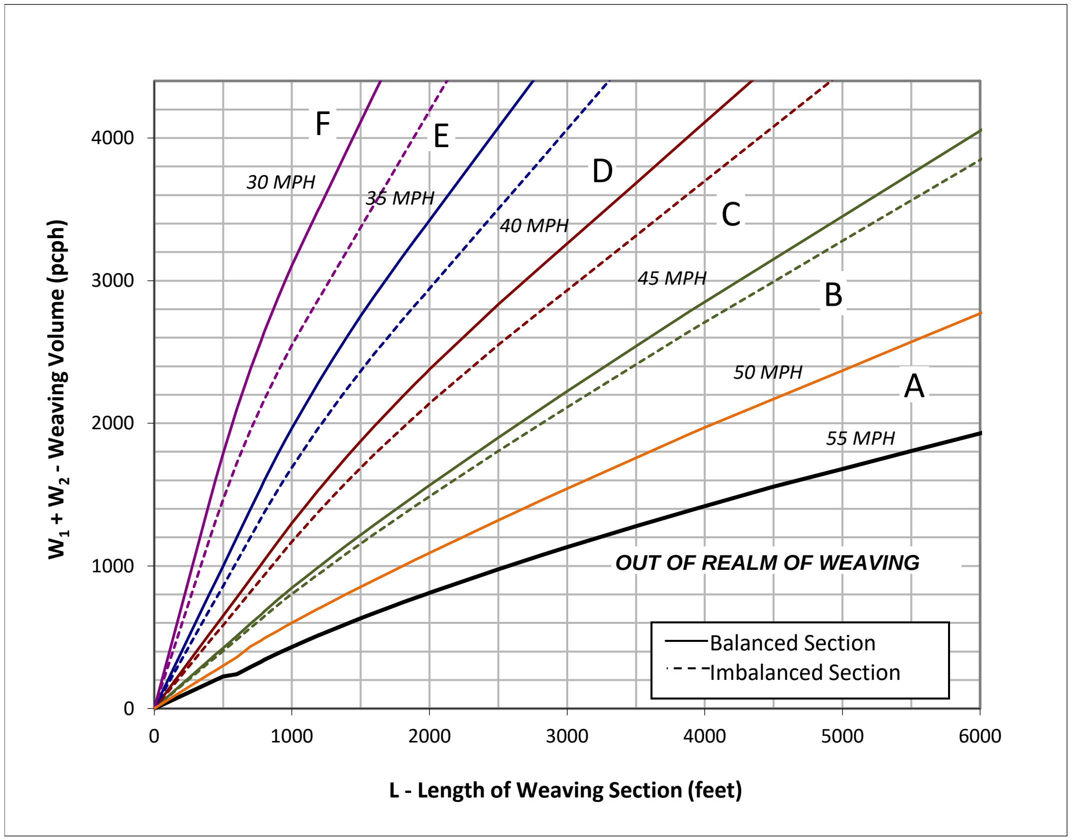
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information

Project	Las Positas CC
Scenario	Existing PM Peak Hour
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,261	Volume (vph)*	758	Volume (vph)*	1,430
Truck Percentage	23%	Truck Percentage	6%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,326	Volume (pcph)	781	Volume (pcph)	1,466



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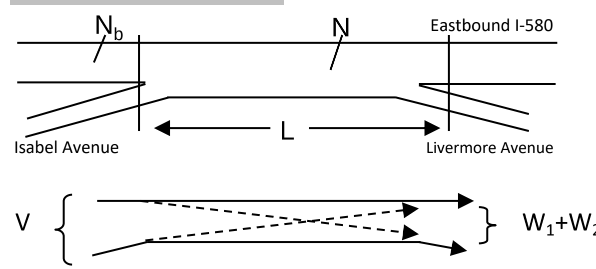


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 54.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   SV = $(1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,065
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

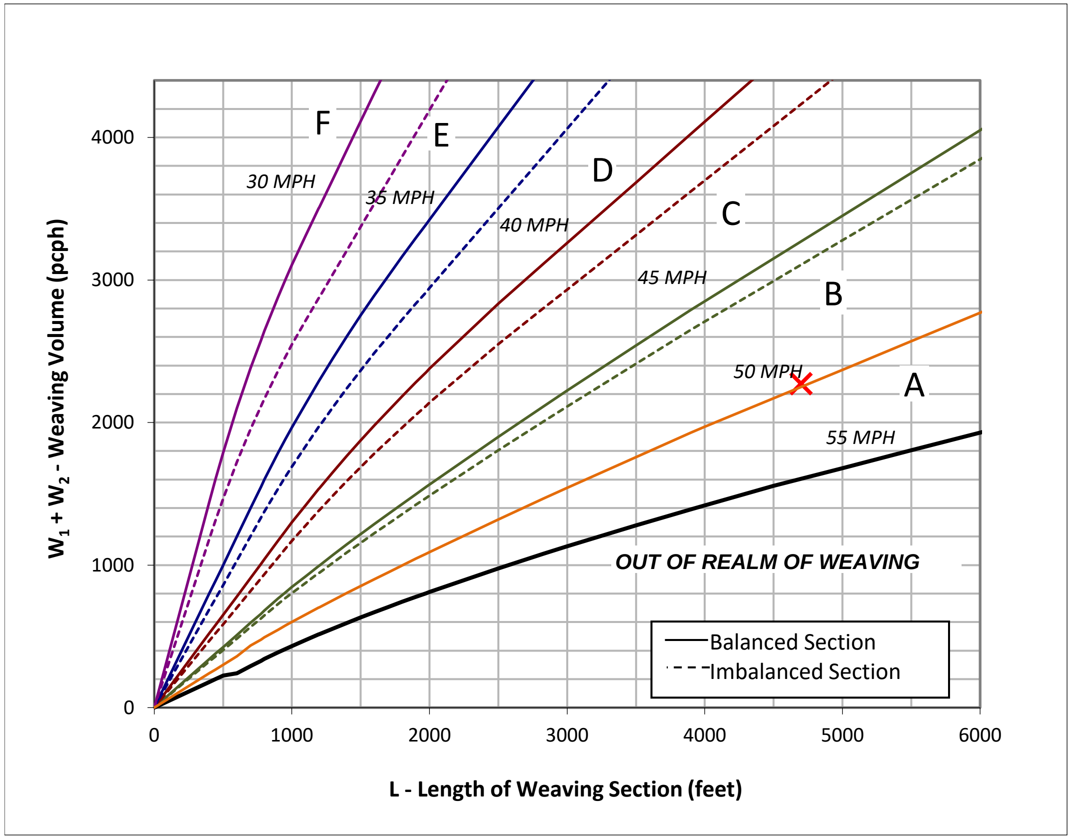
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information

Project	Las Positas CC
Scenario	Existing Plus Project AM Peak Hour
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,526	Volume (vph)*	890	Volume (vph)*	1,321
Truck Percentage	27%	Truck Percentage	5%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,677	Volume (pcph)	912	Volume (pcph)	1,361



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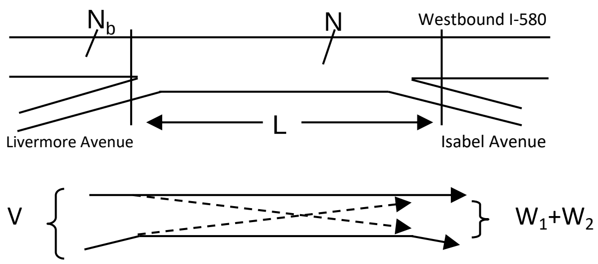


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   45 MPH and **50 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 49.9
4. Weaving Intensity Factor (k) 0.98
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 1,932
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing Plus Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7205	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	546	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7205	546		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2001	152		v
Trucks and buses	27	8		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

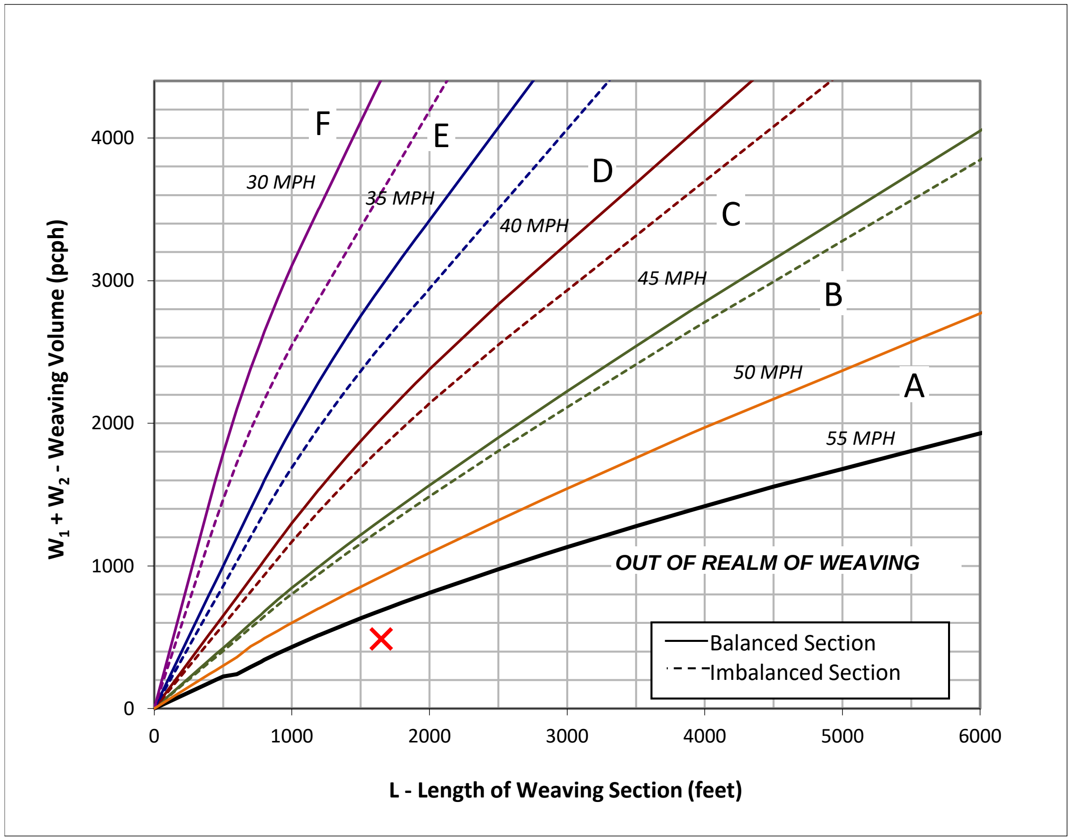
```
Heavy vehicle adjustment, fHV          0.881       0.962
Driver population factor, fP           1.00        1.00
Flow rate, vp                          9086        631                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.139   Using Equation  4
                   FM
                  v  = v  (P  ) =  1262   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     9717          9400            Yes
      FO
     v  or v               3912 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3634                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area______________________
                      Actual        Max Desirable        Violation?
     v                9717          4600                 No
      12A
_________________Level of Service Determination (if not F)______________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   36.6    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation___________________________________

Intermediate speed variable,                 M  = 0.578
                                              S
Space mean speed in ramp influence area,     S  = 51.7    mph
                                              R
Space mean speed in outer lanes,             S  = 55.9    mph
                                              0
Space mean speed for all vehicles,           S  = 54.0    mph
________________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Existing Plus Project AM Peak Hour
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,081	Volume (vph)*	330	Volume (vph)*	141
Truck Percentage	27%	Truck Percentage	8%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,172	Volume (pcph)	343	Volume (pcph)	145



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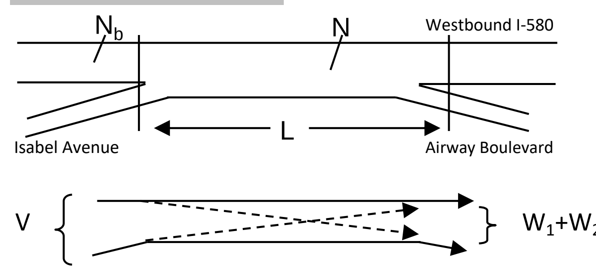


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 59.2
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,834
6. Level of Service (LOS) — E

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Airway Boulevard On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing Plus Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	7940	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	141	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	7940	141		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2206	39		v
Trucks and buses	27	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.881       0.990
Driver population factor, fP            1.00        1.00
Flow rate, vp                           10013       158                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.198   Using Equation  4
                   FM
                  v  = v  (P  ) =  1983   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     10171         9400            Yes
      FO
     v  or v               4015 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 4005                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                10171         4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   36.0    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  F

______________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.551
                                              S
Space mean speed in ramp influence area,     S  = 52.3    mph
                                              R
Space mean speed in outer lanes,             S  = 54.2    mph
                                              0
Space mean speed for all vehicles,           S  = 53.4    mph
________________________________________________________________________________
```

Leisch Method for Weaving Analysis

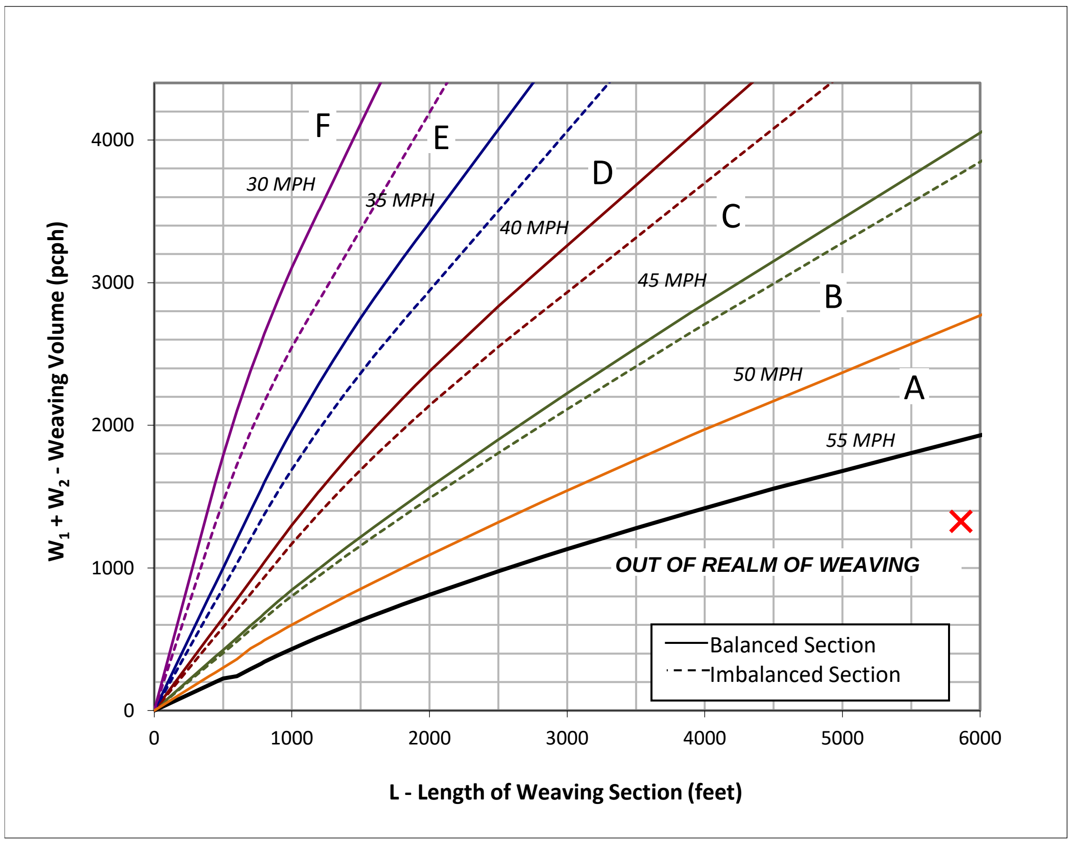
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,505	Volume (vph)*	424	Volume (vph)*	871
Truck Percentage	27%	Truck Percentage	4%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,653	Volume (pcph)	432	Volume (pcph)	893

Project Information

Project	Las Positas CC
Scenario	Existing AM Plus Project Peak Hour
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road



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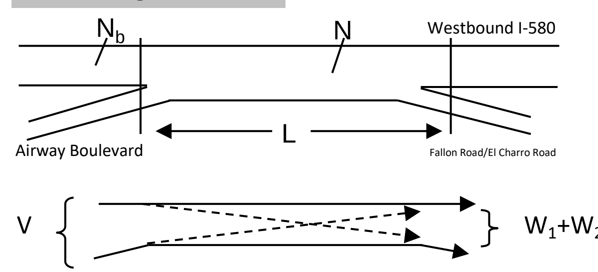


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.5
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 1,931

6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

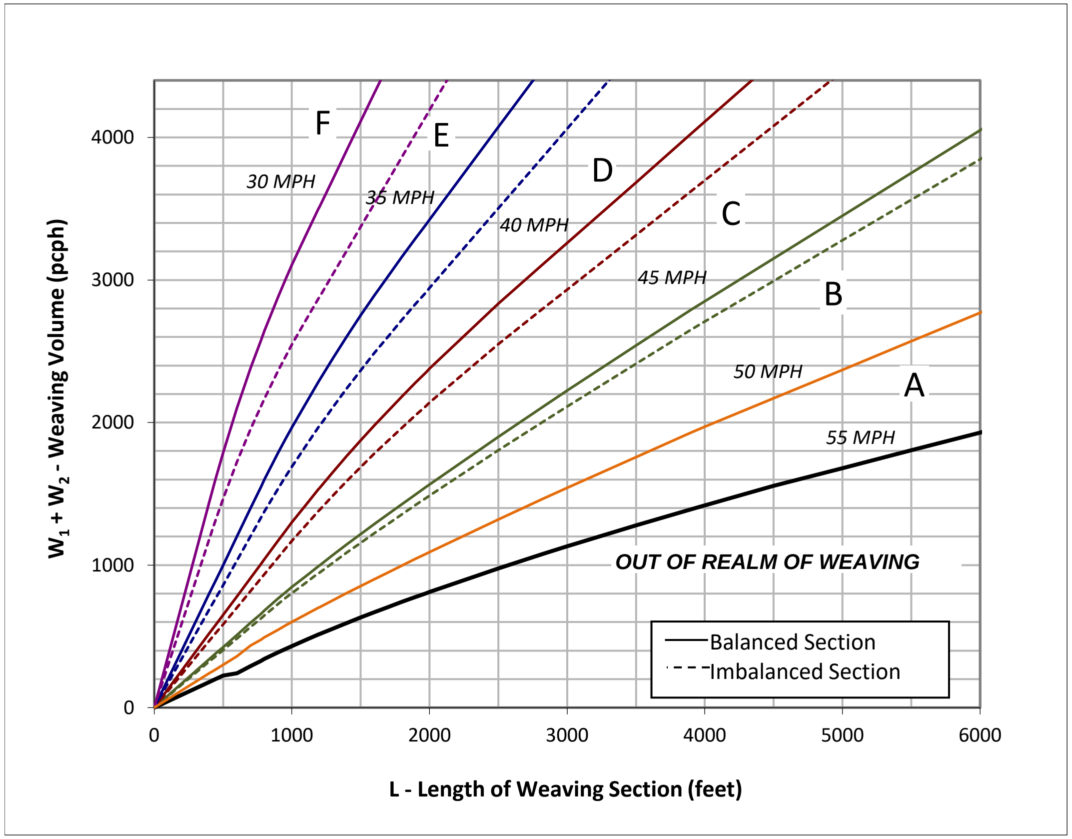
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information

Project	Las Positas CC
Scenario	Existing AM Plus Project Peak Hour
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,373	Volume (vph)*	99	Volume (vph)*	1,020
Truck Percentage	13%	Truck Percentage	8%	Truck Percentage	3%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	4,657	Volume (pcph)	103	Volume (pcph)	1,035



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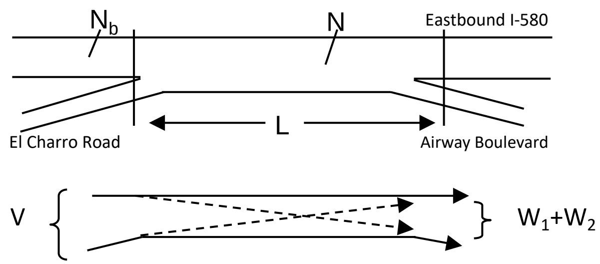


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 59.8
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 931

6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

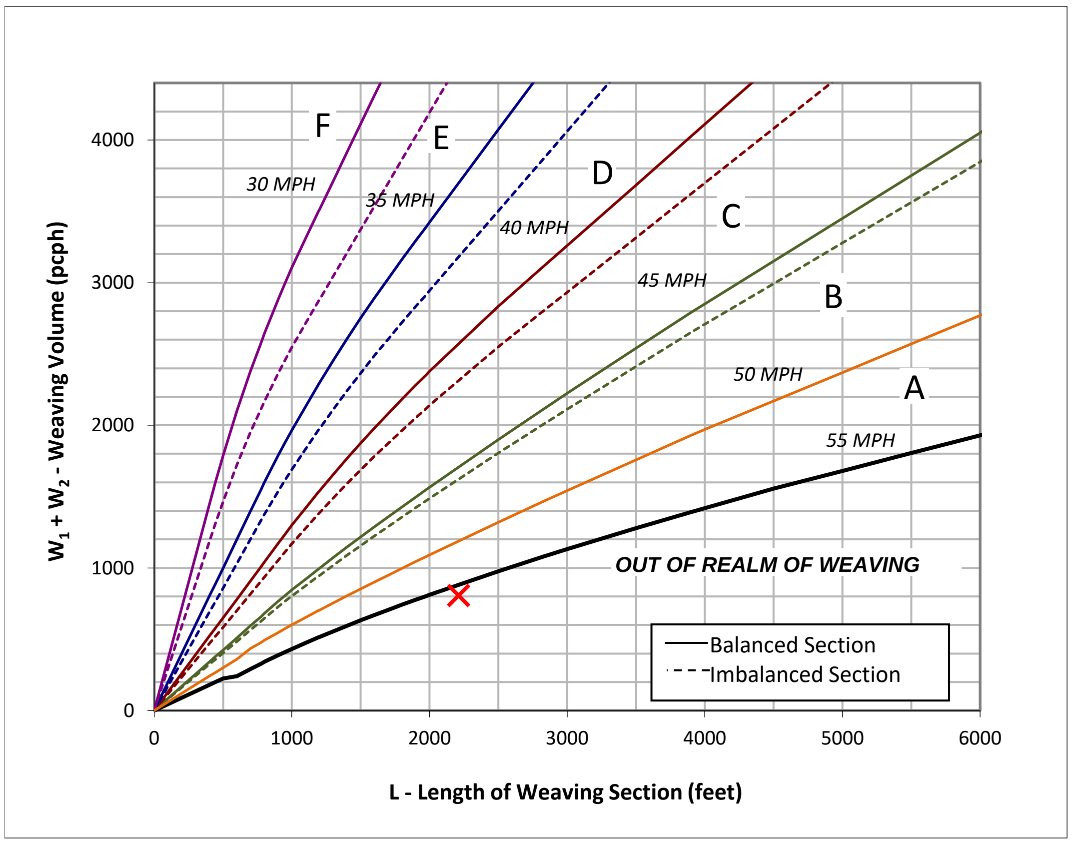
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Project Information	
Project	Las Positas CC
Scenario	Existing AM Plus Project Peak Hour
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	3,556	Volume (vph)*	203	Volume (vph)*	570
Truck Percentage	13%	Truck Percentage	3%	Truck Percentage	11%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	3,787	Volume (pcph)	206	Volume (pcph)	601



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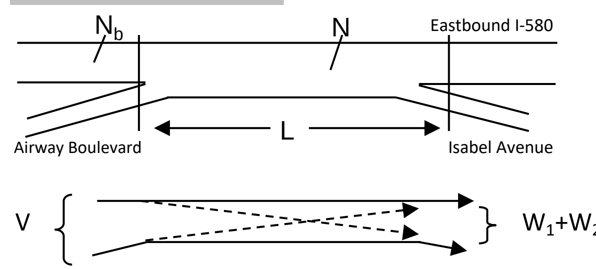


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 56.2
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 757
6. Level of Service (LOS) A

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: AM Peak
Freeway/Dir of Travel: Westbound I-580
Junction: SB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Existing Plus Project
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	2986	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	126	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	2986		126			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	829		35			v
Trucks and buses	13		3			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

Heavy vehicle adjustment, fHV	0.939	0.985	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	3533	142	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.200 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 551 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	2898	9400	No
v_3 or v_{av34}	1102 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 1102 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	2898	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 13.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence B

Speed Estimation

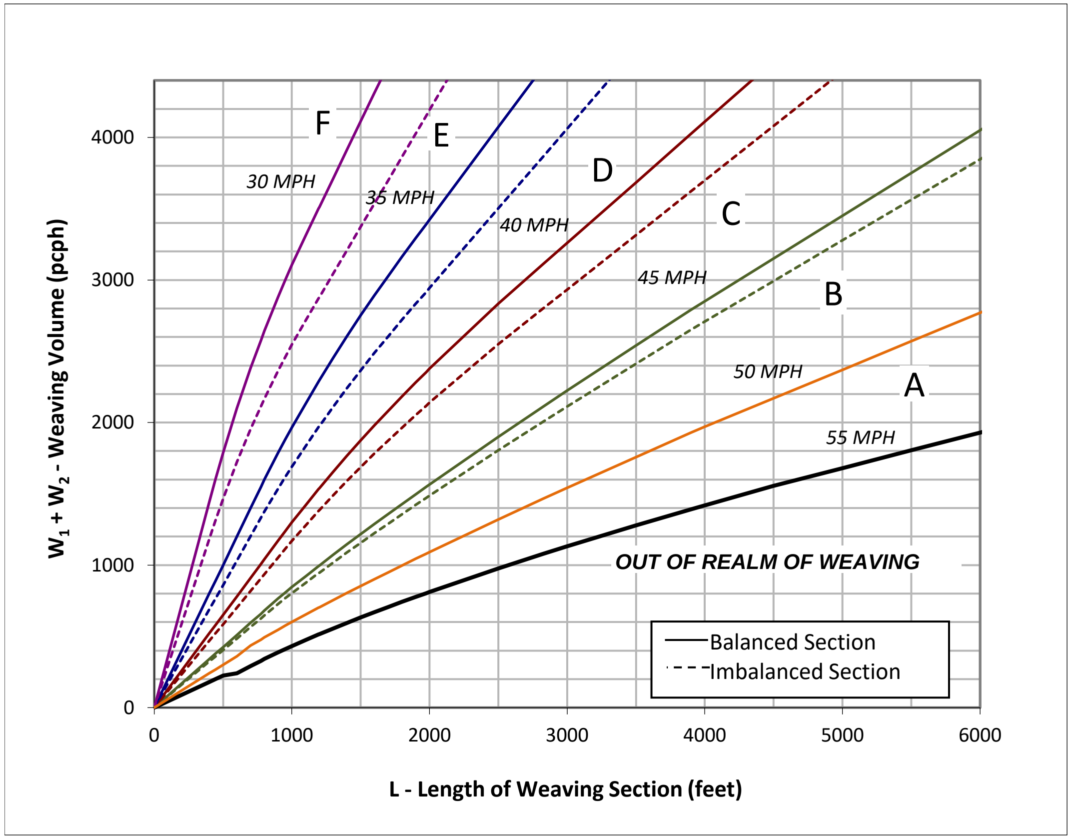
Intermediate speed variable,	M_S = 0.314	
Space mean speed in ramp influence area,	S_R = 57.8	mph
Space mean speed in outer lanes,	S_0 = 63.8	mph
Space mean speed for all vehicles,	S = 61.1	mph

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information	
Project	Las Positas CC
Scenario	Existing AM Plus Project Peak Hour
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	3,562	Volume (vph)*	450	Volume (vph)*	470
Truck Percentage	13%	Truck Percentage	10%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	3,794	Volume (pcph)	473	Volume (pcph)	482



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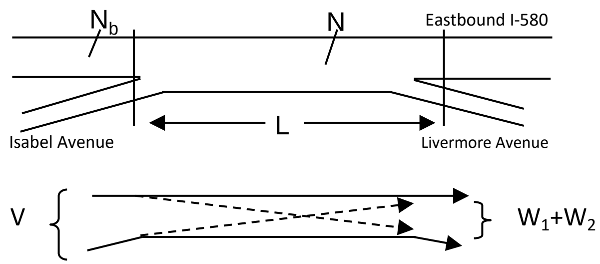


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 61.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 759

6. Level of Service (LOS) A

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

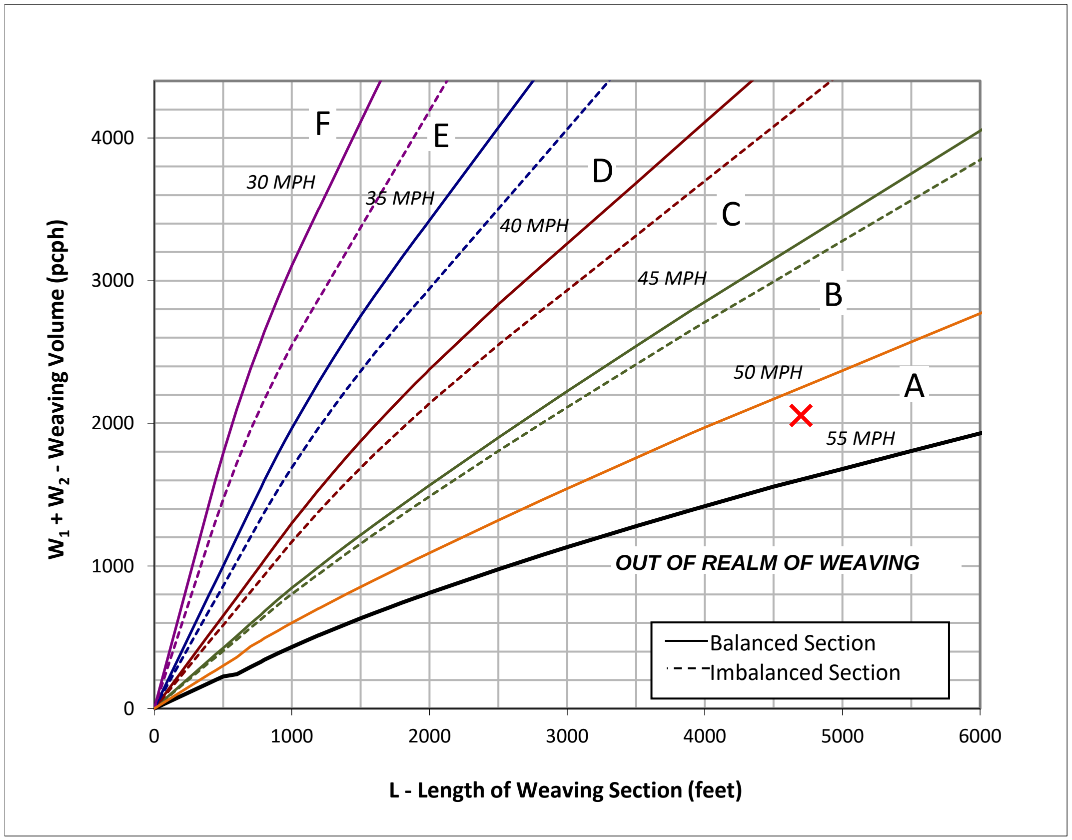
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information	
Project	Las Positas CC
Scenario	Existing PM Plus Project Peak Hour
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,539	Volume (vph)*	1,140	Volume (vph)*	877
Truck Percentage	10%	Truck Percentage	5%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	5,816	Volume (pcph)	1,169	Volume (pcph)	886



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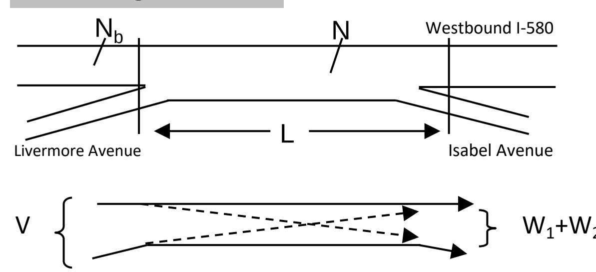


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**
   If optional exit lane, then "Y". Otherwise "N".
2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**
   If left of the 30 MPH curve, LOS is F. Select "-".
   If below the 55 MPH curve, out of the realm of weaving.
3. Interpolated Weaving Speed (S_w, mph) 51.5
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)
   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,163
6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

_____Merge Analysis_____

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	PM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing Plus Project

Description: Las Positas Community College

_____Freeway Data_____

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	4662	vph

_____On Ramp Data_____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	485	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

_____Adjacent Ramp Data (if one exists)_____

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

_____Conversion to pc/h Under Base Conditions_____

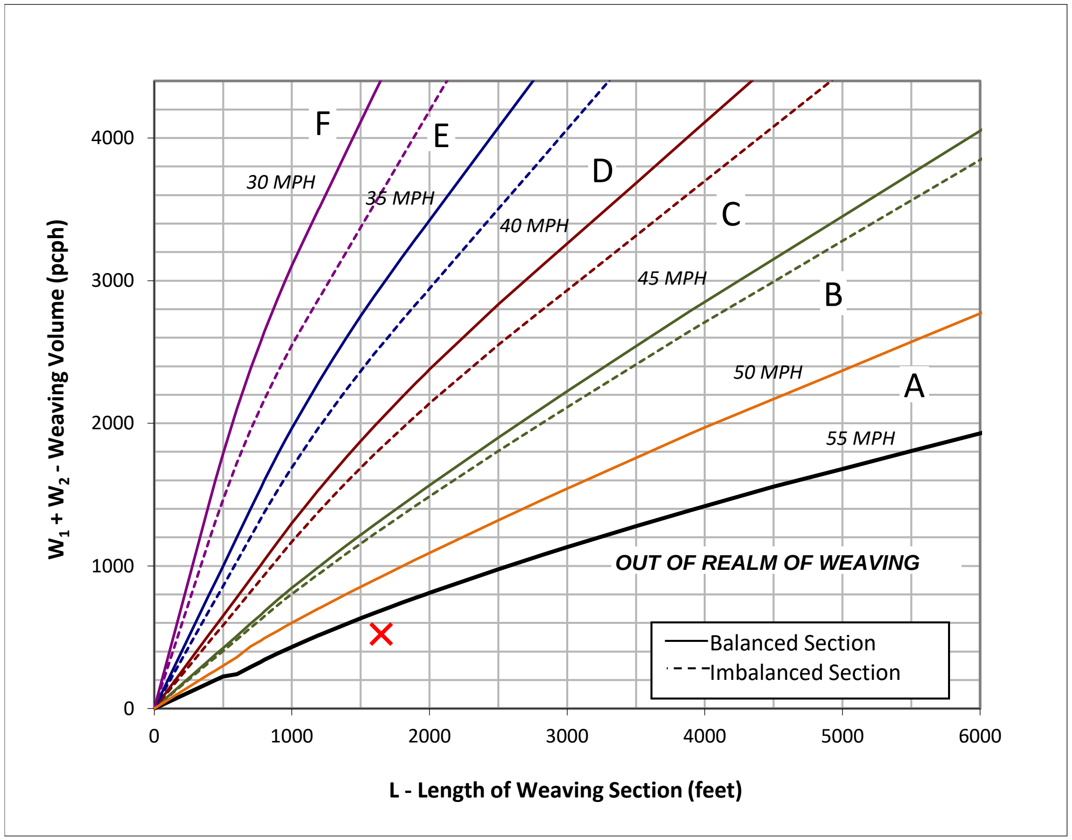
Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	4662	485		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1295	135		v
Trucks and buses	10	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.952       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          5439        552                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.149   Using Equation  4
                   FM
                  v  = v  (P  ) =  809    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     5991          9400            No
      FO
     v  or v               2315 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2175                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area______________________
                      Actual        Max Desirable          Violation?
     v                5991          4600                   No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   24.6    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  C

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.360
                                              S
Space mean speed in ramp influence area,     S  = 56.7    mph
                                              R
Space mean speed in outer lanes,             S  = 60.9    mph
                                              0
Space mean speed for all vehicles,           S  = 58.9    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input				Project Information	
Number of Entering Mainline Lanes	N_b	4		Project	Las Positas CC
Number of Lanes in Weaving Section	N	5		Scenario	Existing PM Plus Project Peak Hour
Length of Weaving Section (feet)	L	1,650		Freeway	Westbound I-580
				On-ramp	Isabel Avenue
				Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,447	Volume (vph)*	300	Volume (vph)*	217
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	5,719	Volume (pcph)	303	Volume (pcph)	219



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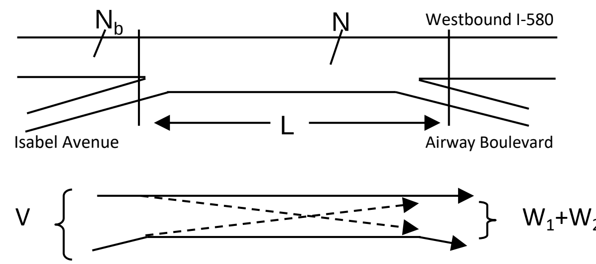


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.5
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,144

6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	PM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Airway Boulevard On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Existing Plus Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5230	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	222	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5230	222		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1453	62		v
Trucks and buses	10	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.952	0.980	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	6102	252	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.186 Using Equation 4

$v_{12} = v_F \, (P_{FM})$ = 1137 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	6354	9400	No
v_3 or v_{av34}	2482 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		No	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 2440 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	6354	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 24.5 pc/mi/ln

Level of service for ramp-freeway junction areas of influence C

Speed Estimation

Intermediate speed variable, M_S = 0.358

Space mean speed in ramp influence area, S_R = 56.8 mph

Space mean speed in outer lanes, S_0 = 60.2 mph

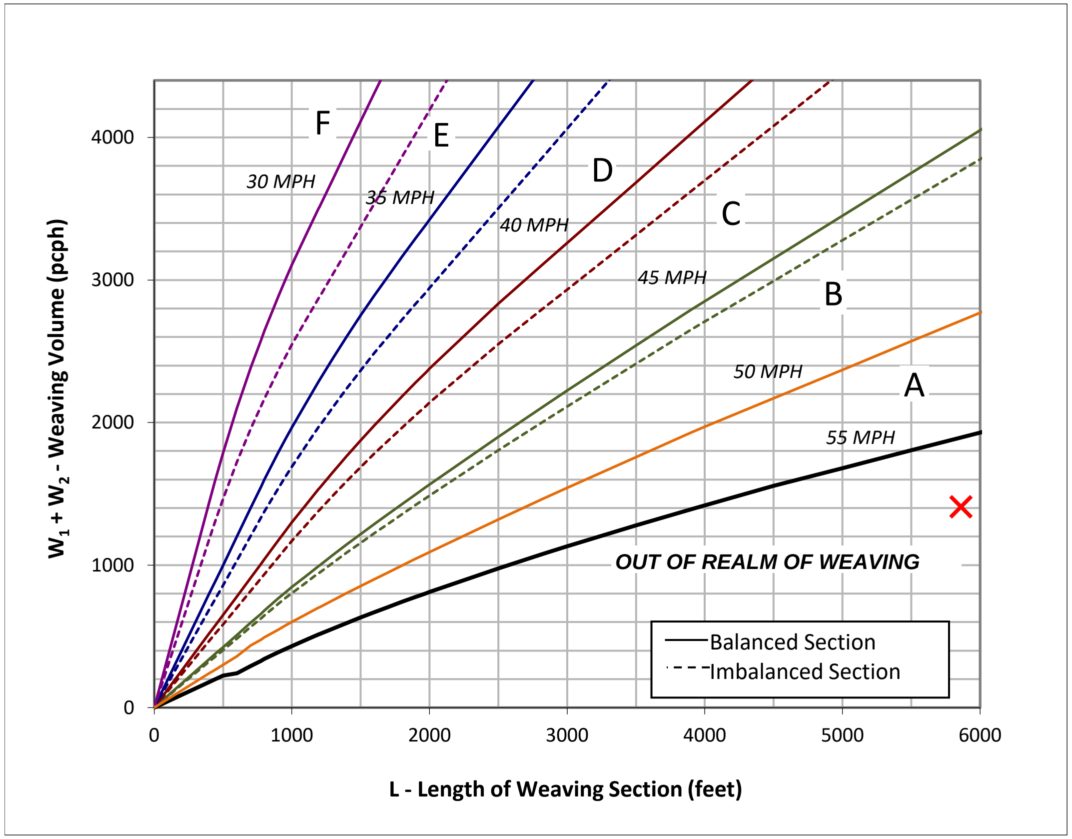
Space mean speed for all vehicles, S = 58.7 mph

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Project Information	
Project	Las Positas CC
Scenario	Existing PM Plus Project Peak Hour
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,220	Volume (vph)*	768	Volume (vph)*	628
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	6,531	Volume (pcph)	776	Volume (pcph)	634



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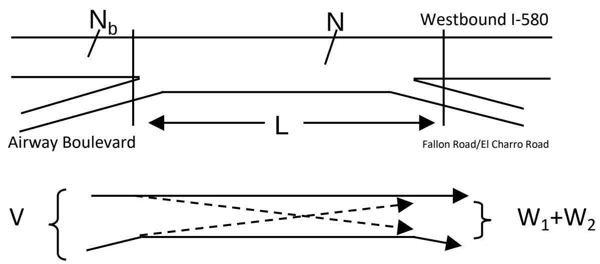


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 58.0
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,306

6. Level of Service (LOS) — C

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

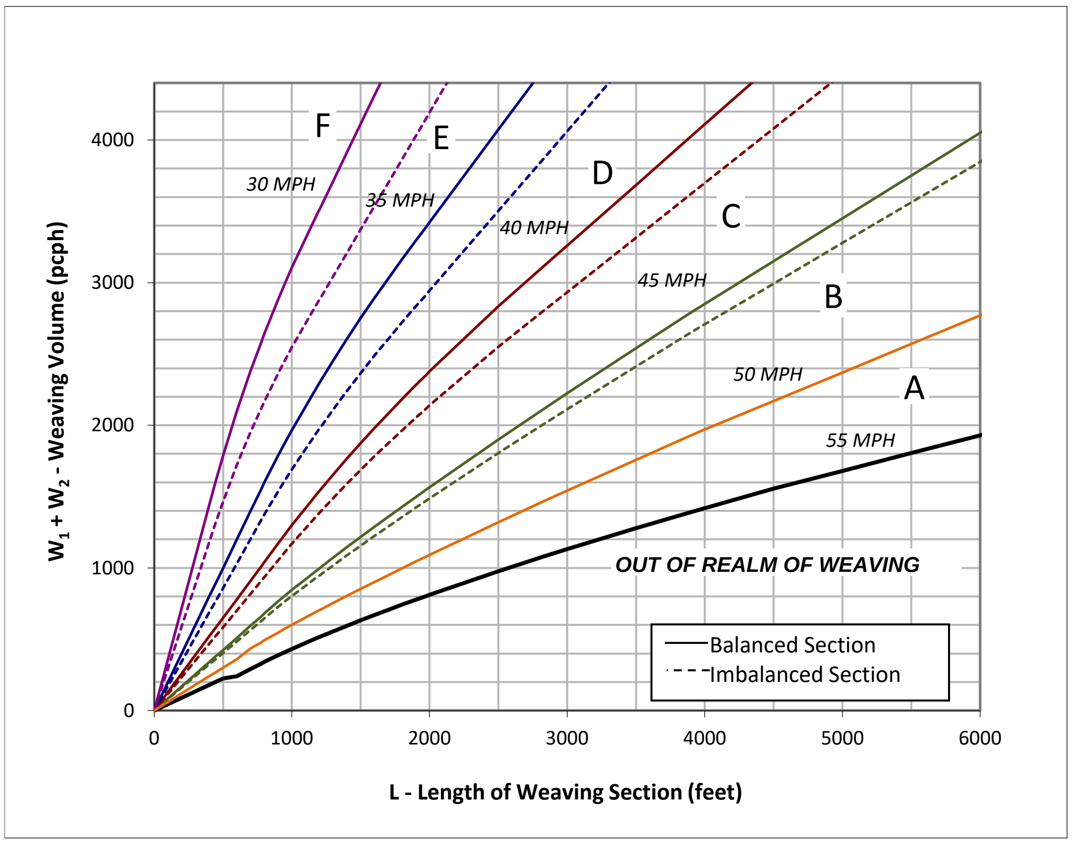
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information	
Project	Las Positas CC
Scenario	Existing PM Plus Project Peak Hour
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,614	Volume (vph)*	270	Volume (vph)*	1,015
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,720	Volume (pcph)	273	Volume (pcph)	1,025



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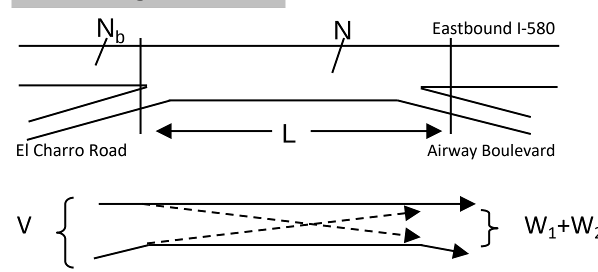


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.9
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 2,144
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

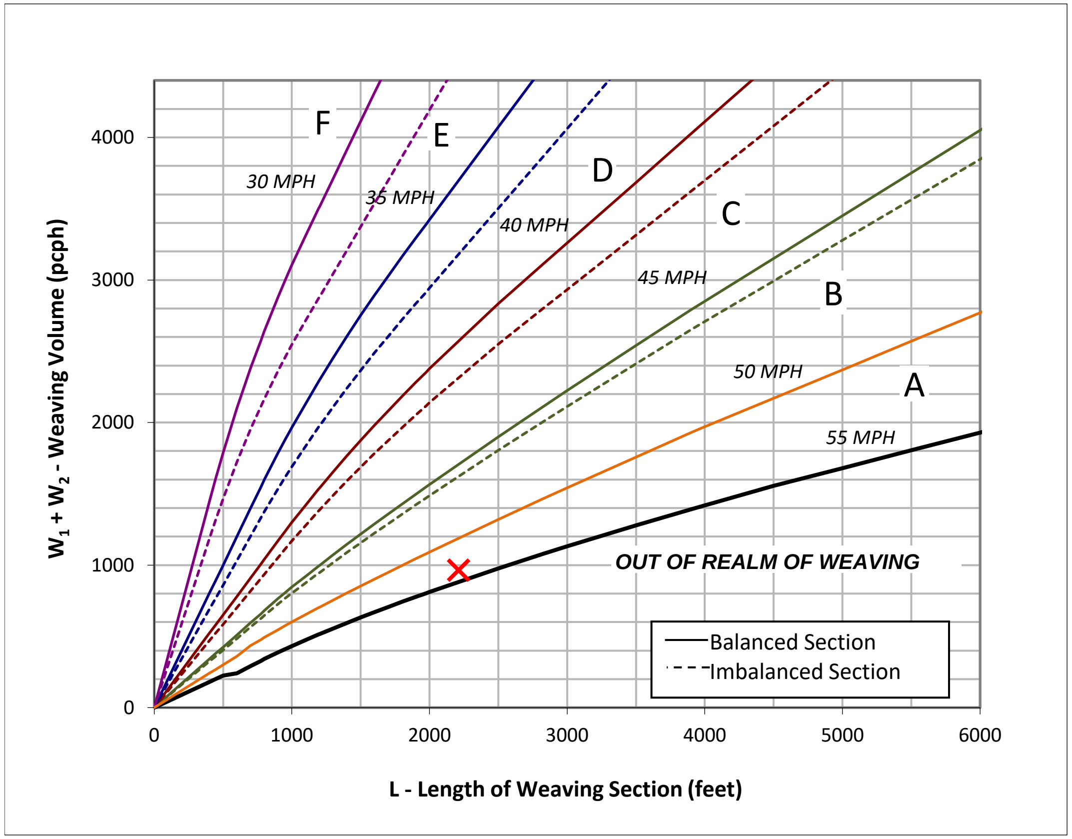
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Project Information	
Project	Las Positas CC
Scenario	Existing PM Plus Project Peak Hour
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,855	Volume (vph)*	256	Volume (vph)*	698
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	9,873	Volume (pcph)	259	Volume (pcph)	705



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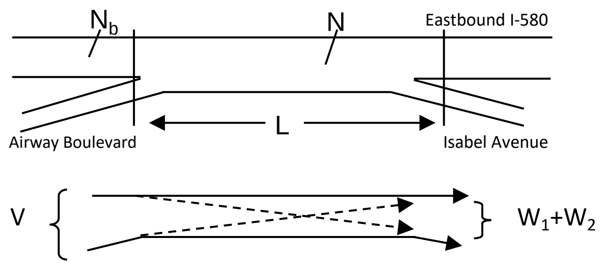


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 53.7
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,975

6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

____Merge Analysis____

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: PM Peak
Freeway/Dir of Travel: Westbound I-580
Junction: SB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Existing Plus Project
Description: Las Positas Community College

____Freeway Data____

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8157	vph

____On Ramp Data____

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	361	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

____Adjacent Ramp Data (if one exists)____

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

____Conversion to pc/h Under Base Conditions____

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8157	361		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2266	100		v
Trucks and buses	23	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.897	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	10106	405	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.167 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 1272 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	8011	9400	No
v_3 or v_{av34}	3167 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		Yes	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 3042 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	8011	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 30.3 pc/mi/ln

Level of service for ramp-freeway junction areas of influence D

Speed Estimation

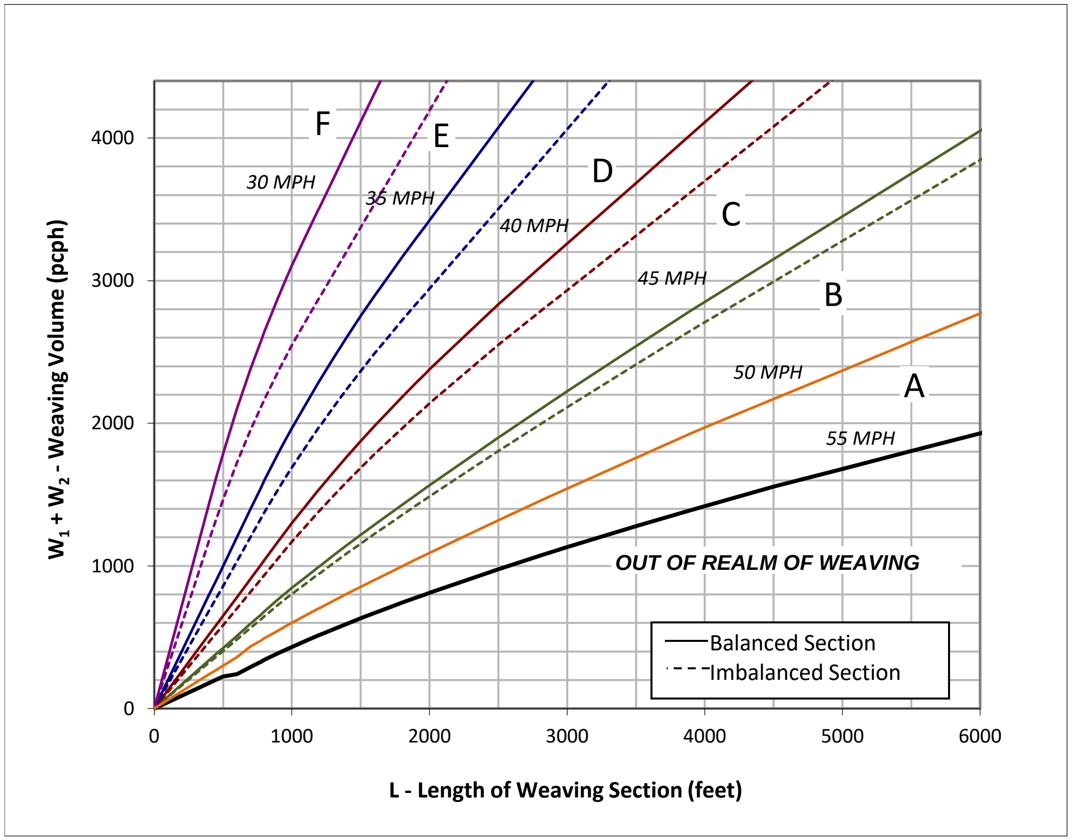
Intermediate speed variable,	M_S = 0.422	
Space mean speed in ramp influence area,	S_R = 55.3	mph
Space mean speed in outer lanes,	S_0 = 58.6	mph
Space mean speed for all vehicles,	S = 57.1	mph

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information	
Project	Las Positas CC
Scenario	Existing PM Plus Project Peak Hour
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,276	Volume (vph)*	758	Volume (vph)*	1,430
Truck Percentage	23%	Truck Percentage	6%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,343	Volume (pcph)	781	Volume (pcph)	1,466



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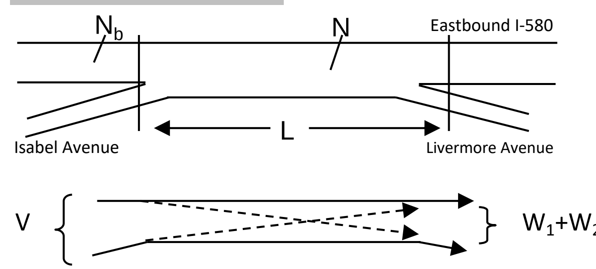


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 54.0
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 2,069
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

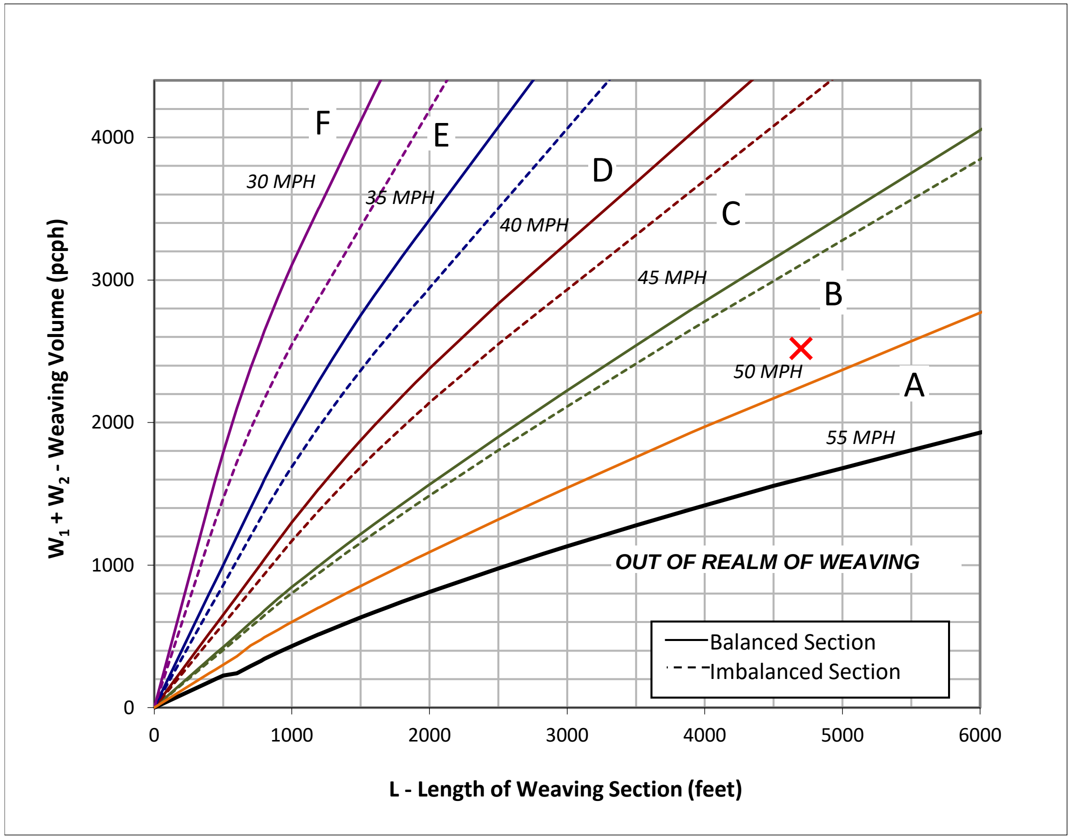
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project AM Peak
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,630	Volume (vph)*	900	Volume (vph)*	1,550
Truck Percentage	27%	Truck Percentage	5%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,930	Volume (pcph)	923	Volume (pcph)	1,597



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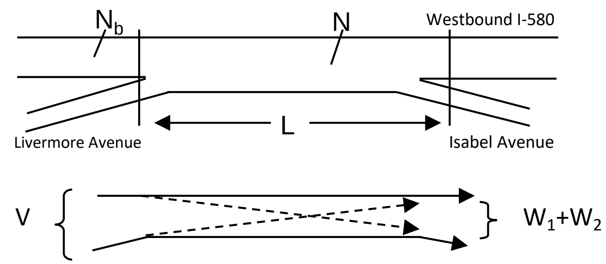

Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   45 MPH and **50 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 48.7
4. Weaving Intensity Factor (k) 1.13
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,211
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative No Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	560	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8080		560			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2244		156			v
Trucks and buses	27		8			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

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Heavy vehicle adjustment, fHV          0.881       0.962
Driver population factor, fP           1.00        1.00
Flow rate, vp                          10190       647                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.137   Using Equation  4
                   FM
                  v  = v  (P  ) =  1395   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     10837         9400            Yes
      FO
     v  or v               4397 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 4076                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                10837         4600                 Yes
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   40.1    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation__________________________________

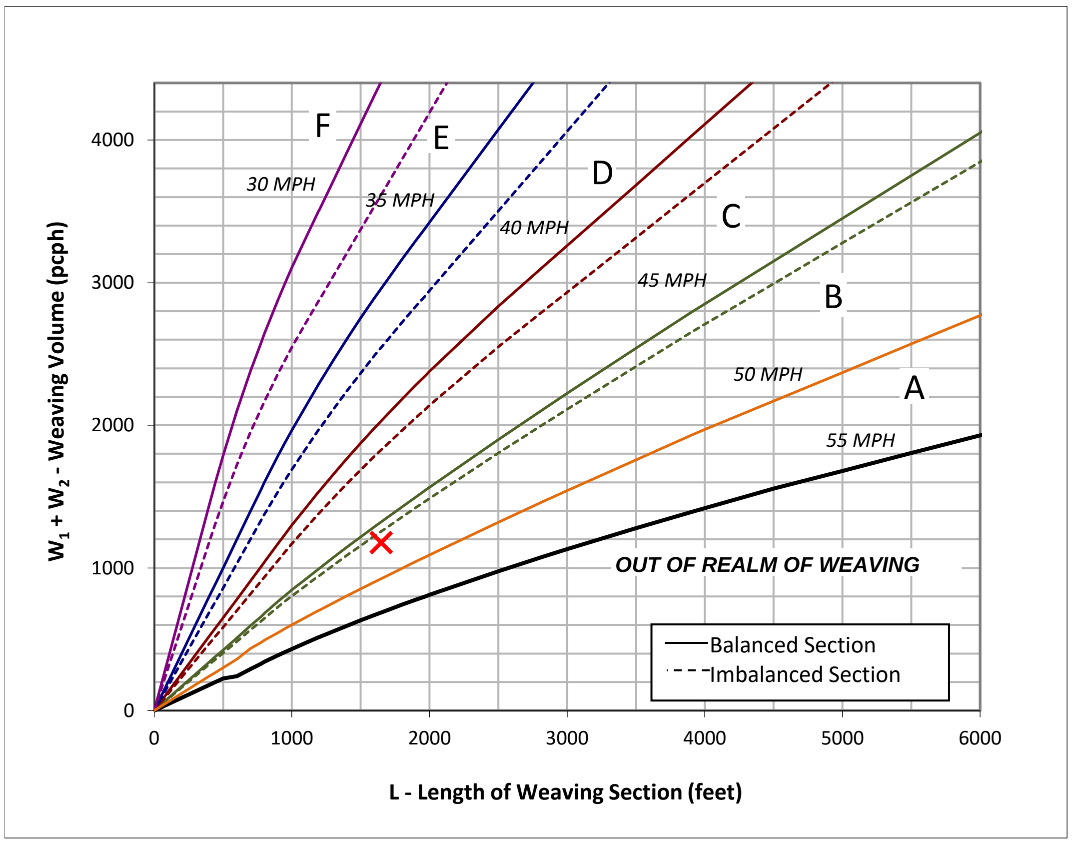
Intermediate speed variable,                 M  = 0.739
                                              S
Space mean speed in ramp influence area,     S  = 48.0    mph
                                              R
Space mean speed in outer lanes,             S  = 53.9    mph
                                              0
Space mean speed for all vehicles,           S  = 51.2    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project AM Peak
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,010	Volume (vph)*	370	Volume (vph)*	770
Truck Percentage	27%	Truck Percentage	8%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,226	Volume (pcph)	385	Volume (pcph)	793



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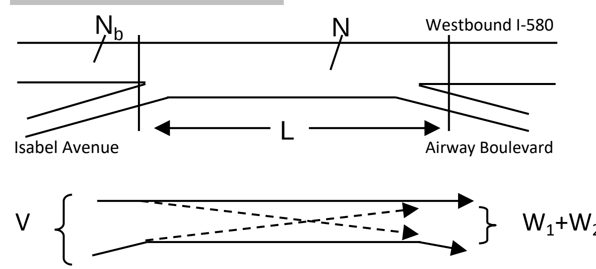


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   45 MPH and **50 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 46.8
4. Weaving Intensity Factor (k) — 1.45
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 2,080
6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: AM Peak
Freeway/Dir of Travel: Eastbound I-580
Junction: NB Airway Boulevard On-Ramp
Jurisdiction: Caltrans
Analysis Year: Cumulative No Project
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8240	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	150	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	8240	150		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	2289	42		v
Trucks and buses	27	2		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

Heavy vehicle adjustment, fHV	0.881	0.990	
Driver population factor, fP	1.00	1.00	
Flow rate, vp	10392	168	pcph

Estimation of V12 Merge Areas

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.197 Using Equation 4

$v_{12} = v_F (P_{FM})$ = 2045 pc/h

Capacity Checks

	Actual	Maximum	LOS F?
v_{FO}	10560	9400	Yes
v_3 or v_{av34}	4173 pc/h	(Equation 13-14 or 13-17)	
Is v_3 or v_{av34} > 2700 pc/h?		Yes	
Is v_3 or v_{av34} > 1.5 v_{12}/2		Yes	

If yes, v_{12A} = 4156 (Equation 13-15, 13-16, 13-18, or 13-19)

Flow Entering Merge Influence Area

	Actual	Max Desirable	Violation?
v_{12A}	10560	4600	No

Level of Service Determination (if not F)

Density, $D_R = 5.475 + 0.00734\, v_R + 0.0078\, v_{12} - 0.00627\, L_A$ = 37.2 pc/mi/ln

Level of service for ramp-freeway junction areas of influence F

Speed Estimation

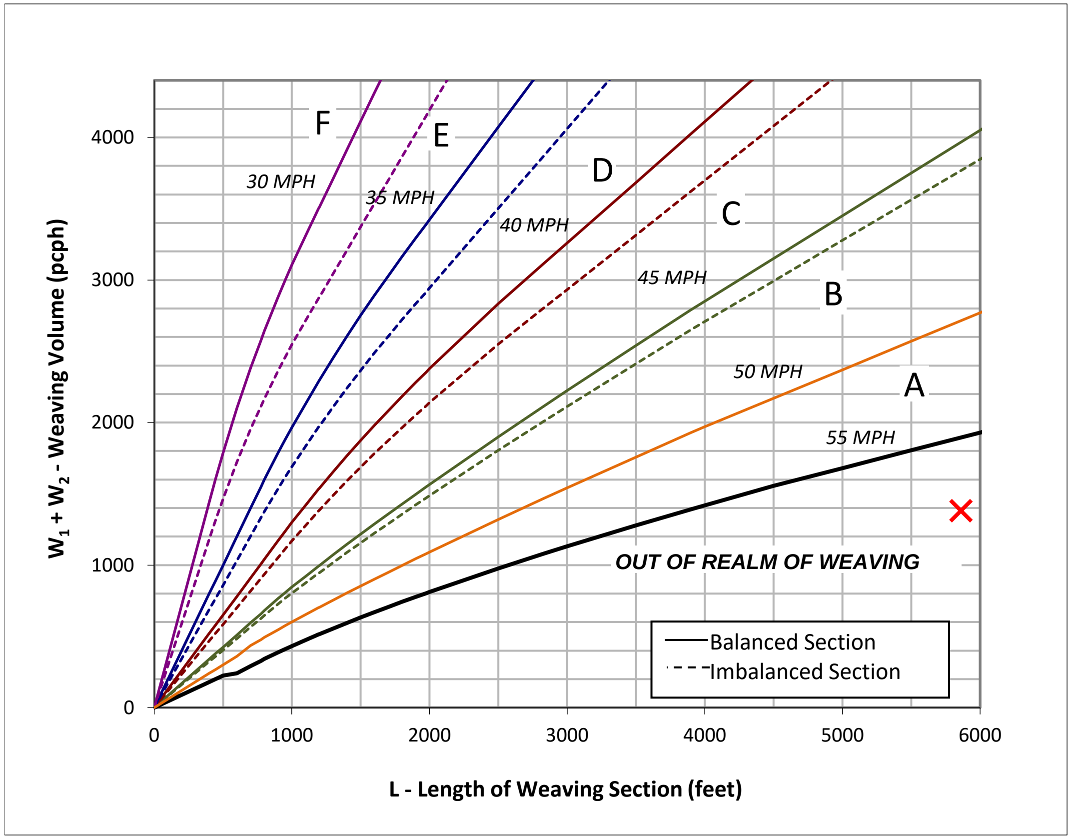
Intermediate speed variable,	M_S = 0.594	
Space mean speed in ramp influence area,	S_R = 51.3	mph
Space mean speed in outer lanes,	S_0 = 53.6	mph
Space mean speed for all vehicles,	S = 52.6	mph

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project AM Peak
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,820	Volume (vph)*	430	Volume (vph)*	920
Truck Percentage	27%	Truck Percentage	4%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,011	Volume (pcph)	439	Volume (pcph)	943



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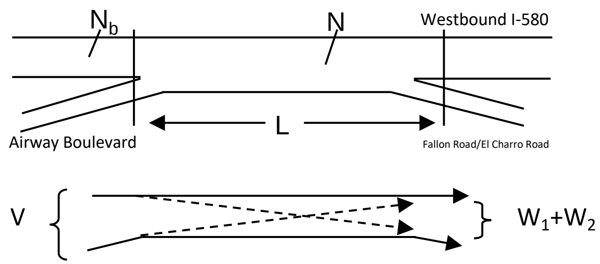


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.1
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,002

6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

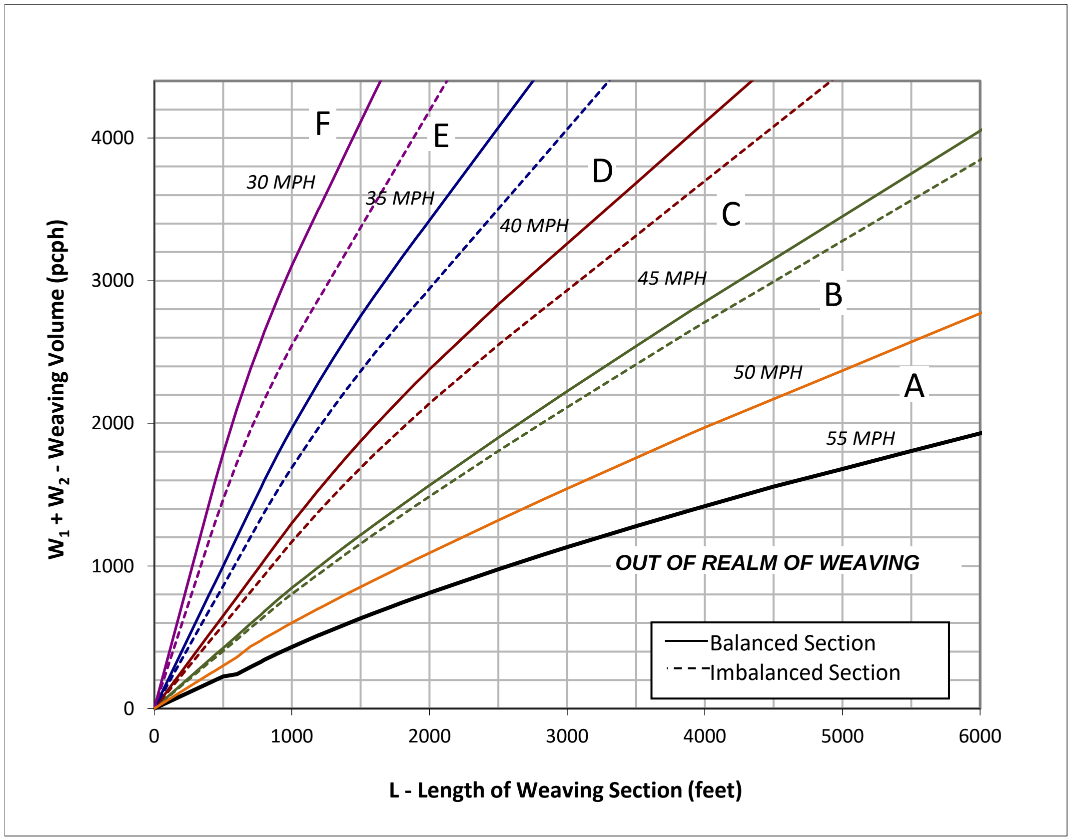
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

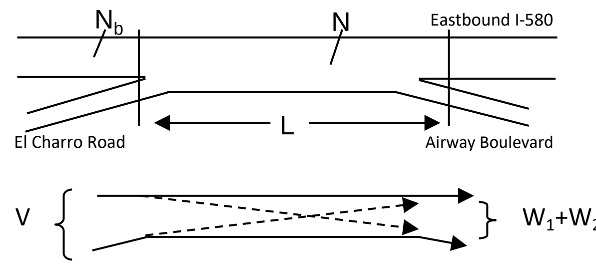
Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project AM Peak
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,890	Volume (vph)*	360	Volume (vph)*	1,010
Truck Percentage	13%	Truck Percentage	8%	Truck Percentage	3%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	5,208	Volume (pcph)	374	Volume (pcph)	1,025



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.3
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,042

6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

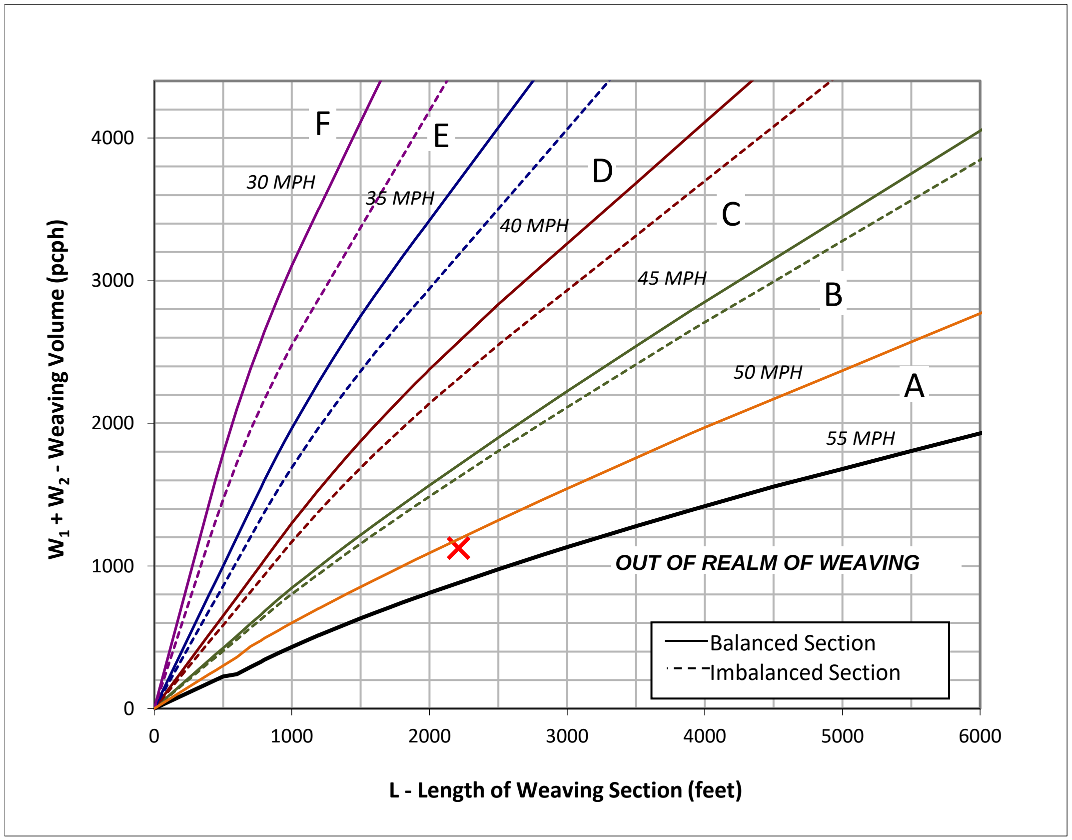
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project AM Peak
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,130	Volume (vph)*	250	Volume (vph)*	830
Truck Percentage	13%	Truck Percentage	3%	Truck Percentage	10%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	4,398	Volume (pcph)	254	Volume (pcph)	872



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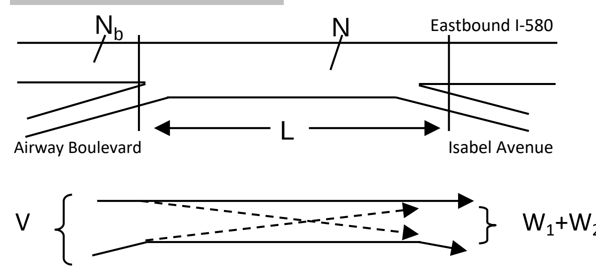


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 51.0
4. Weaving Intensity Factor (k): 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$: 880
6. Level of Service (LOS): B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Westbound I-580
Junction:	SB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative No Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3300	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	260	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3300		260			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	917		72			v
Trucks and buses	13		3			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.939       0.985
Driver population factor, fP            1.00        1.00
Flow rate, vp                           3905        293                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.181   Using Equation  4
                   FM
                  v  = v  (P  ) =  552    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     3339          9400            No
      FO
     v  or v               1247 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 1218                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3339          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.2    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

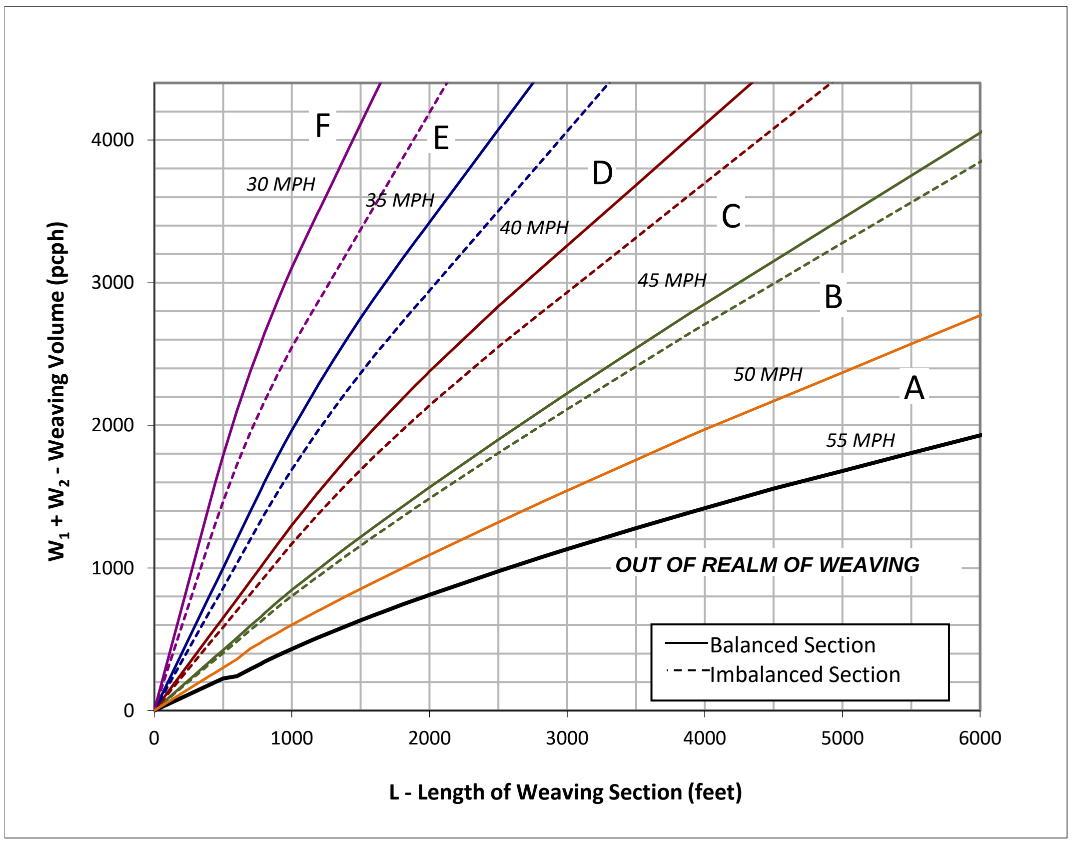
Intermediate speed variable,                 M  = 0.318
                                              S
Space mean speed in ramp influence area,     S  = 57.7    mph
                                              R
Space mean speed in outer lanes,             S  = 63.5    mph
                                              0
Space mean speed for all vehicles,           S  = 60.7    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project AM Peak
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,240	Volume (vph)*	680	Volume (vph)*	530
Truck Percentage	13%	Truck Percentage	10%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	4,516	Volume (pcph)	714	Volume (pcph)	543



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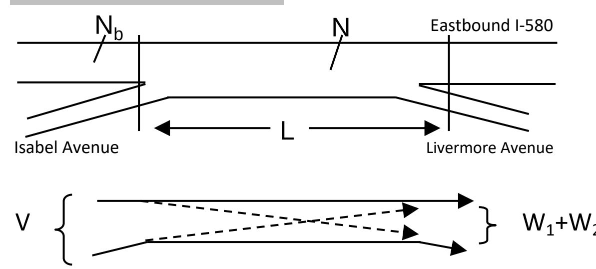


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 59.4
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 903
6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

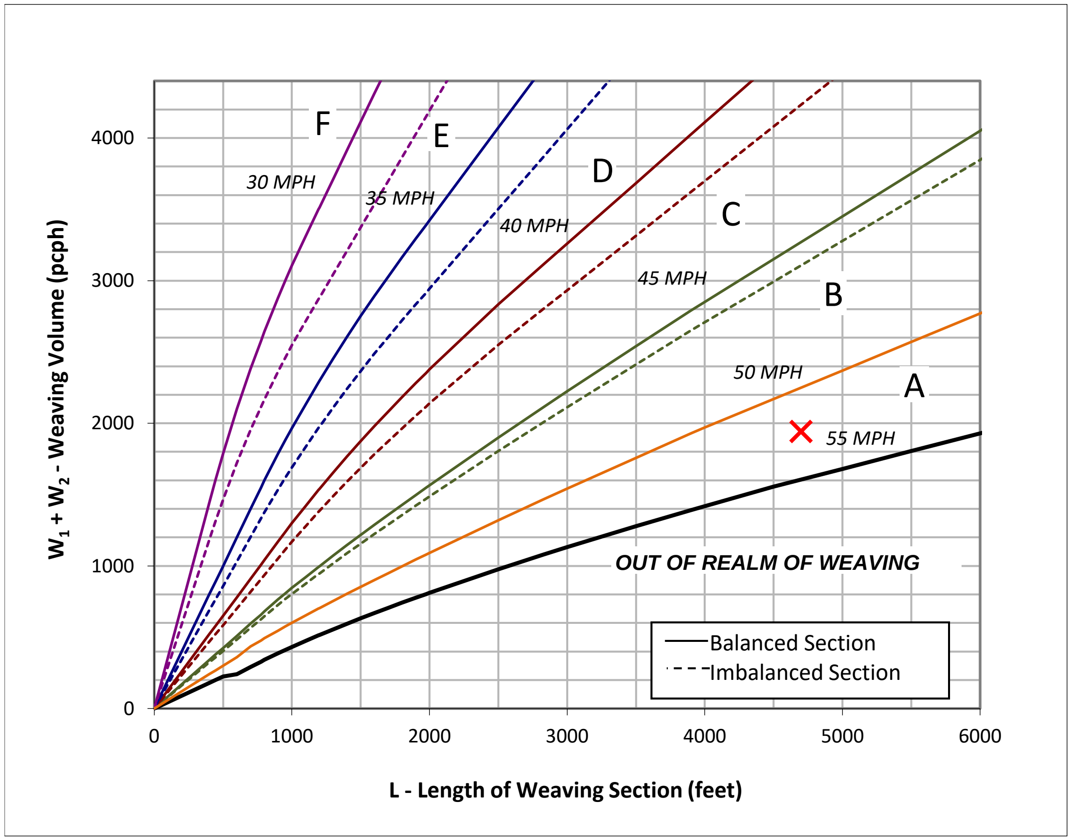
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project PM Peak
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,770	Volume (vph)*	930	Volume (vph)*	980
Truck Percentage	10%	Truck Percentage	5%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	7,109	Volume (pcph)	953	Volume (pcph)	990



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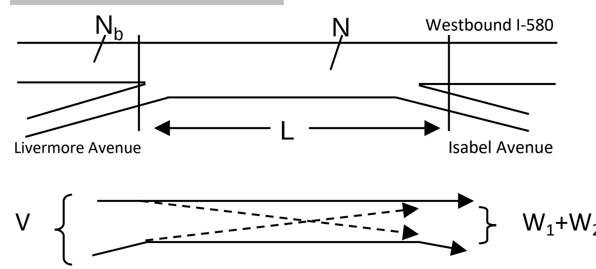


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 52.4
4. Weaving Intensity Factor (k): 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$: 1,422

6. Level of Service (LOS): C

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: PM Peak
Freeway/Dir of Travel: Eastbound I-580
Junction: NB Isabel Avenue On-Ramp
Jurisdiction: Caltrans
Analysis Year: Cumulative No Project
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5790	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	690	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5790	690		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1608	192		v
Trucks and buses	10	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.952       0.976
Driver population factor, fP            1.00        1.00
Flow rate, vp                           6755        786                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.120   Using Equation  4
                   FM
                  v  = v  (P  ) =  808    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     7541          9400            No
      FO
     v  or v               2973 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2702                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                7541          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   30.4    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

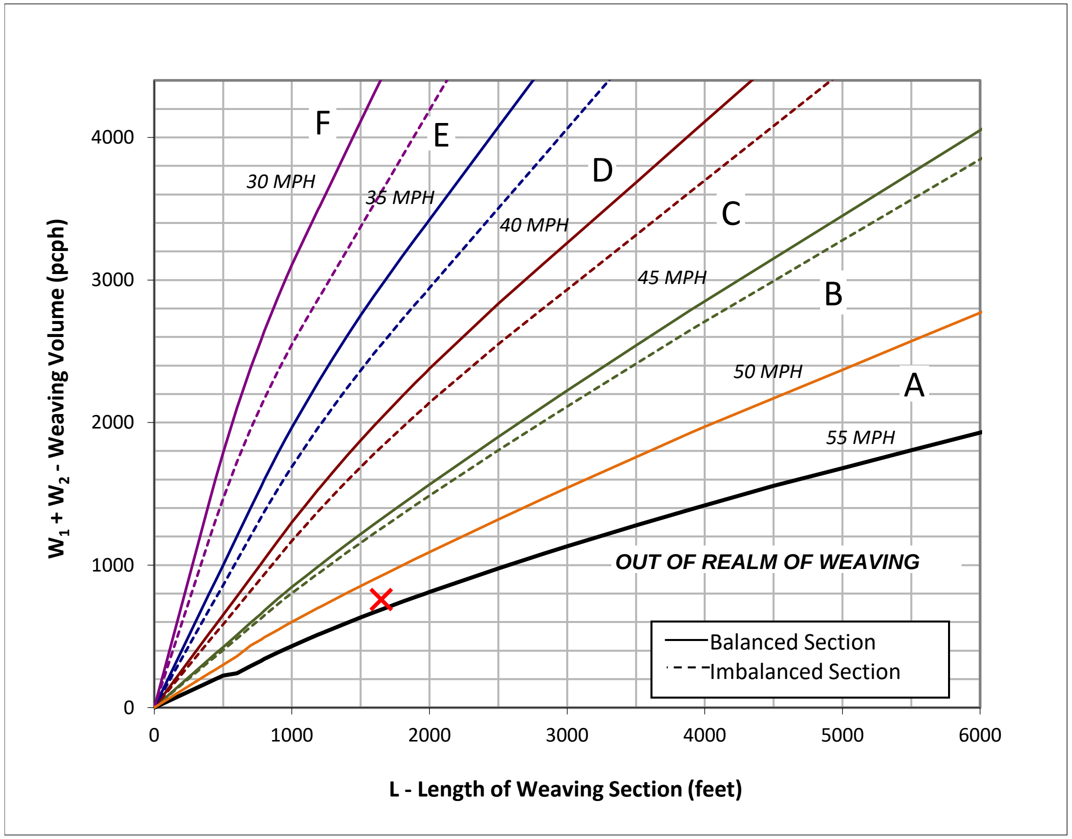
Intermediate speed variable,                 M  = 0.428
                                              S
Space mean speed in ramp influence area,     S  = 55.2    mph
                                              R
Space mean speed in outer lanes,             S  = 59.5    mph
                                              0
Space mean speed for all vehicles,           S  = 57.4    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project PM Peak
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,890	Volume (vph)*	410	Volume (vph)*	340
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	7,235	Volume (pcph)	414	Volume (pcph)	343

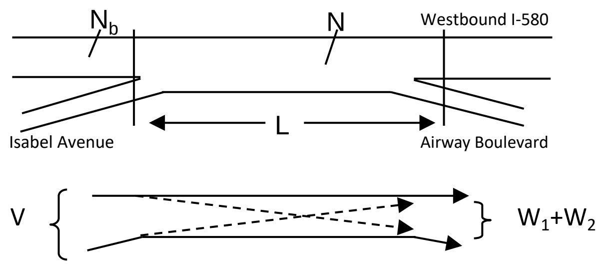


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 53.5
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ — 1,447

6. Level of Service (LOS) — C

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: PM Peak
Freeway/Dir of Travel: Eastbound I-580
Junction: NB Airway Boulevard On-Ramp
Jurisdiction: Caltrans
Analysis Year: Cumulative No Project
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6550	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	230	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	6550		230			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	1819		64			v
Trucks and buses	10		4			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.952       0.980
Driver population factor, fP            1.00        1.00
Flow rate, vp                           7642        261                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.185   Using Equation  4
                   FM
                  v  = v  (P  ) =  1415   pc/h
                   12   F   FM

_______________________________Capacity Checks________________________________

                           Actual        Maximum         LOS F?
     v                     7903          9400            No
      FO
     v  or v               3113 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3056                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual       Max Desirable        Violation?
     v                7903         4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   29.3    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation_________________________________

Intermediate speed variable,                 M  = 0.408
                                              S
Space mean speed in ramp influence area,     S  = 55.6    mph
                                              R
Space mean speed in outer lanes,             S  = 58.5    mph
                                              0
Space mean speed for all vehicles,           S  = 57.3    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

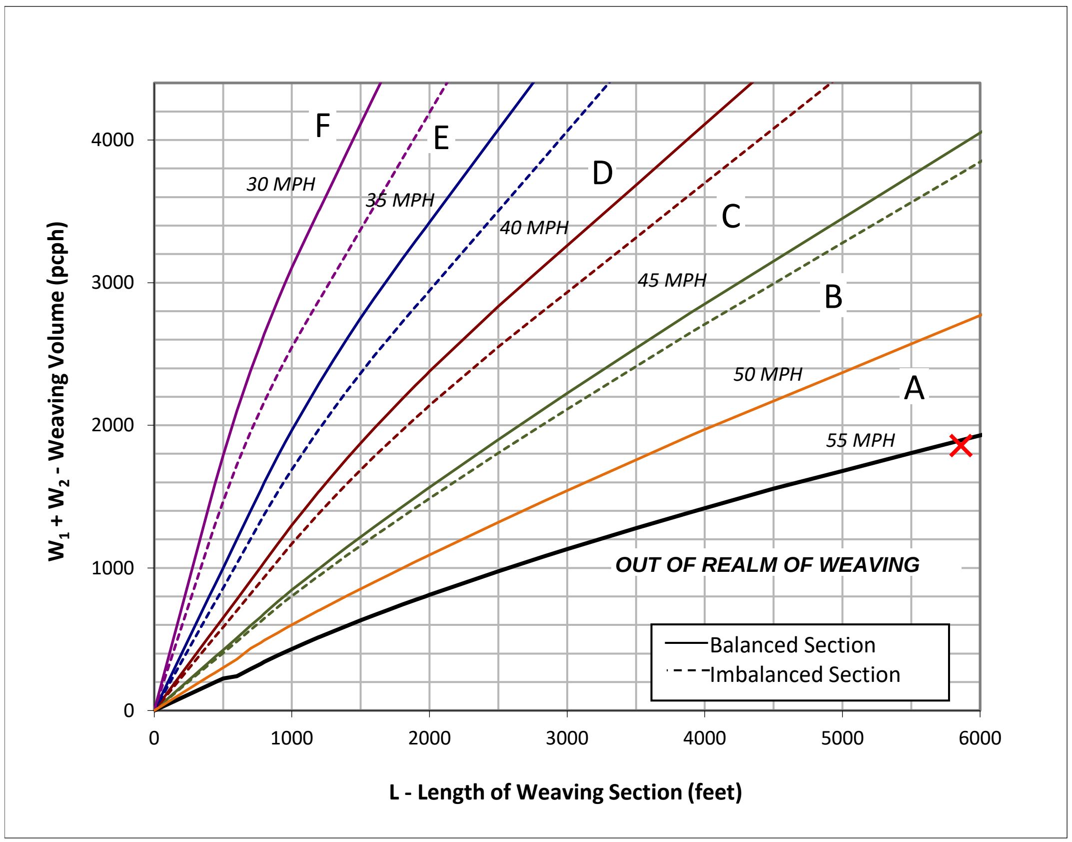
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	7,540	Volume (vph)*	760	Volume (vph)*	1,080
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	7,917	Volume (pcph)	768	Volume (pcph)	1,091

Project Information

Project	Las Positas CC
Scenario	Cumulative No Project PM Peak
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road



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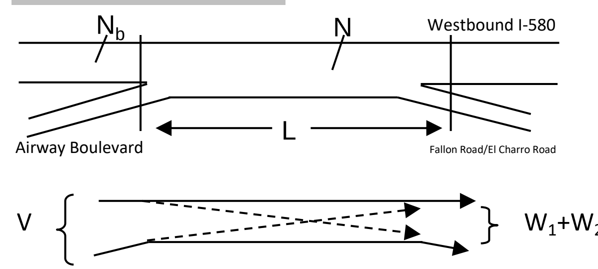


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 55.2
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,583
6. Level of Service (LOS) D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

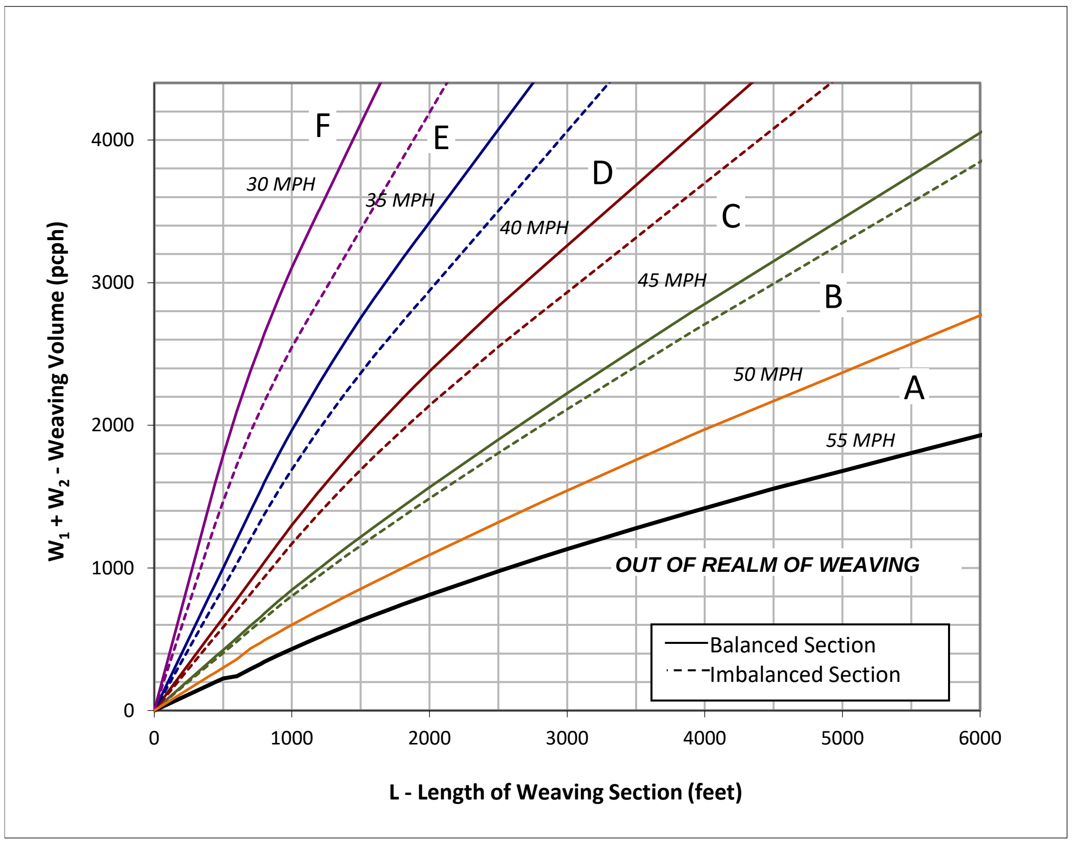
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information

Project	Las Positas CC
Scenario	Cumulative No Project PM Peak
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,990	Volume (vph)*	280	Volume (vph)*	1,000
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	11,139	Volume (pcph)	283	Volume (pcph)	1,010



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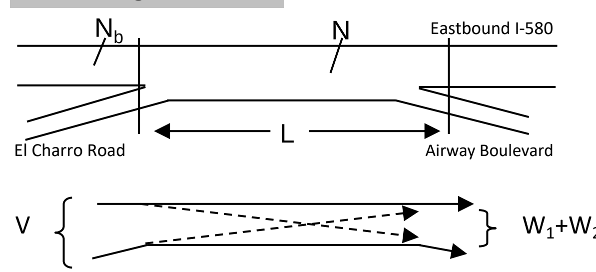


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.9
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 2,228
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

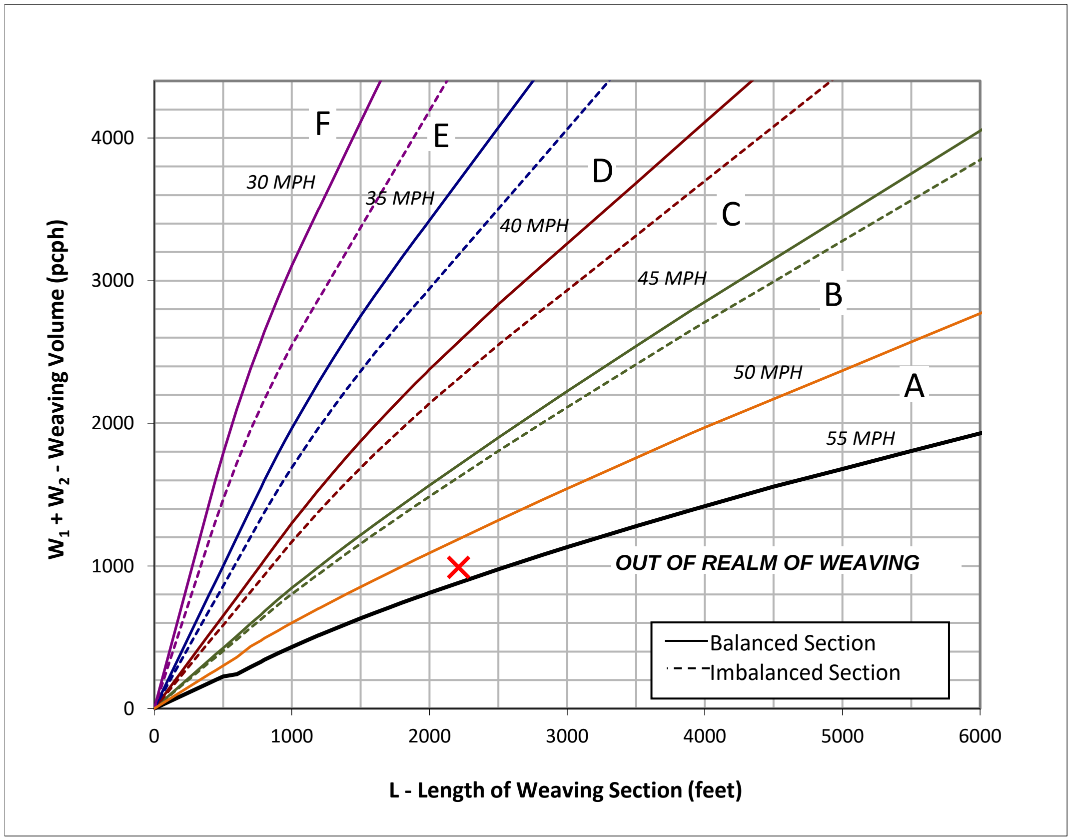
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input			
Number of Entering Mainline Lanes	N_b	4	
Number of Lanes in Weaving Section	N	5	
Length of Weaving Section (feet)	L	2,210	

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project PM Peak
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,260	Volume (vph)*	270	Volume (vph)*	710
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,325	Volume (pcph)	273	Volume (pcph)	717



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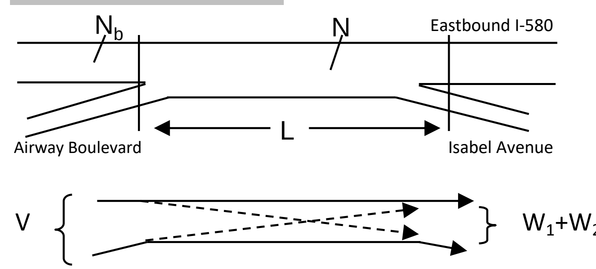


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 53.2
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,065

6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	PM Peak
Freeway/Dir of Travel:	Westbound I-580
Junction:	SB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative No Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8550	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	440	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8550		440			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2375		122			v
Trucks and buses	23		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.897       0.990
Driver population factor, fP           1.00        1.00
Flow rate, vp                          10592       494                    pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.156   Using Equation  4
                   FM
                  v  = v  (P  ) =  1263   pc/h
                   12   F   FM

_______________________________Capacity Checks_______________________________

                           Actual        Maximum         LOS F?
     v                     8586          9400            No
      FO
     v  or v               3414 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3236                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                8586          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   32.5    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

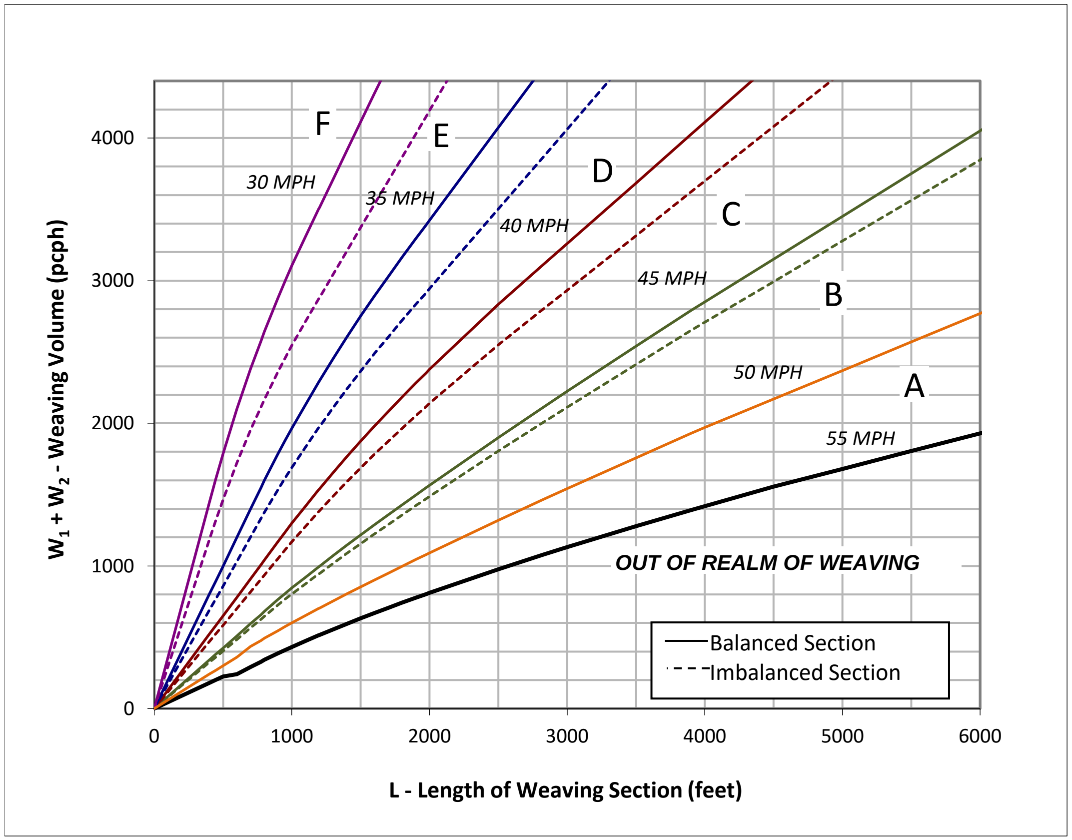
Intermediate speed variable,                 M  = 0.463
                                              S
Space mean speed in ramp influence area,     S  = 54.4    mph
                                              R
Space mean speed in outer lanes,             S  = 57.7    mph
                                              0
Space mean speed for all vehicles,           S  = 56.2    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,750	Volume (vph)*	760	Volume (vph)*	1,400
Truck Percentage	23%	Truck Percentage	6%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,871	Volume (pcph)	783	Volume (pcph)	1,435

Project Information	
Project	Las Positas CC
Scenario	Cumulative No Project PM Peak
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue



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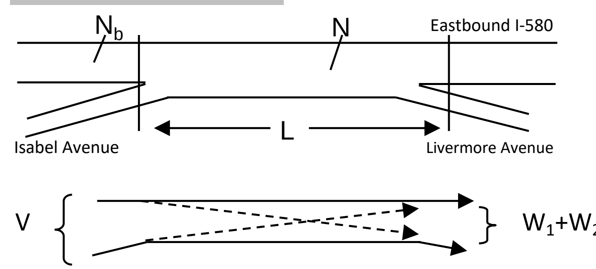


Capacity Analysis

1. Is the weaving section balanced (Y / N)? — N

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 54.1
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ — 2,174

6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

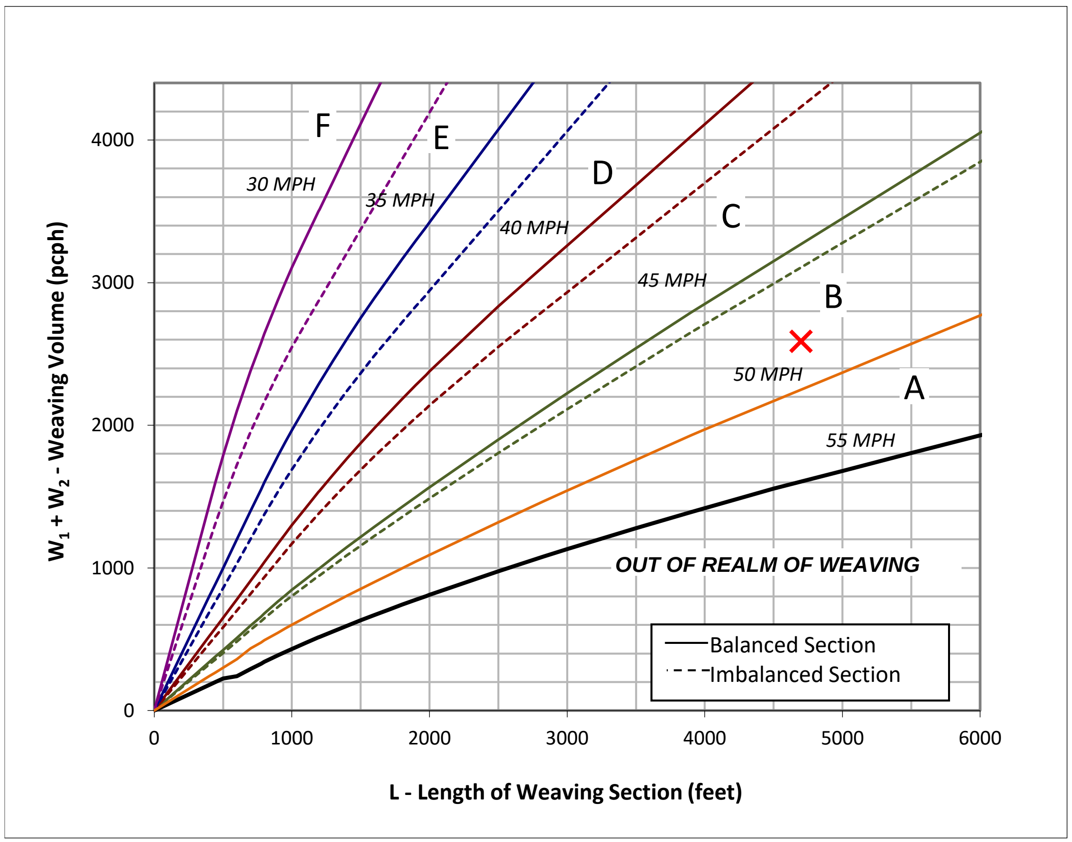
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project AM Peak
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,698	Volume (vph)*	900	Volume (vph)*	1,618
Truck Percentage	27%	Truck Percentage	5%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	11,007	Volume (pcph)	923	Volume (pcph)	1,667



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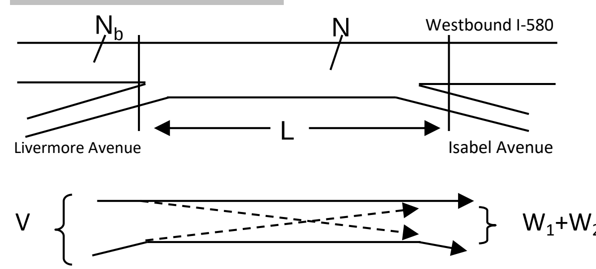


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   45 MPH and **50 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph): 48.3
4. Weaving Intensity Factor (k): 1.19
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$: 2,237
6. Level of Service (LOS): F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Plus Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8080	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	560	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8080		560			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2244		156			v
Trucks and buses	27		8			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.881       0.962
Driver population factor, fP           1.00        1.00
Flow rate, vp                          10190       647                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.137   Using Equation  4
                   FM
                  v  = v  (P  ) =  1395   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     10837         9400            Yes
      FO
     v  or v               4397 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 4076                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                10837         4600                 Yes
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   40.1    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation__________________________________

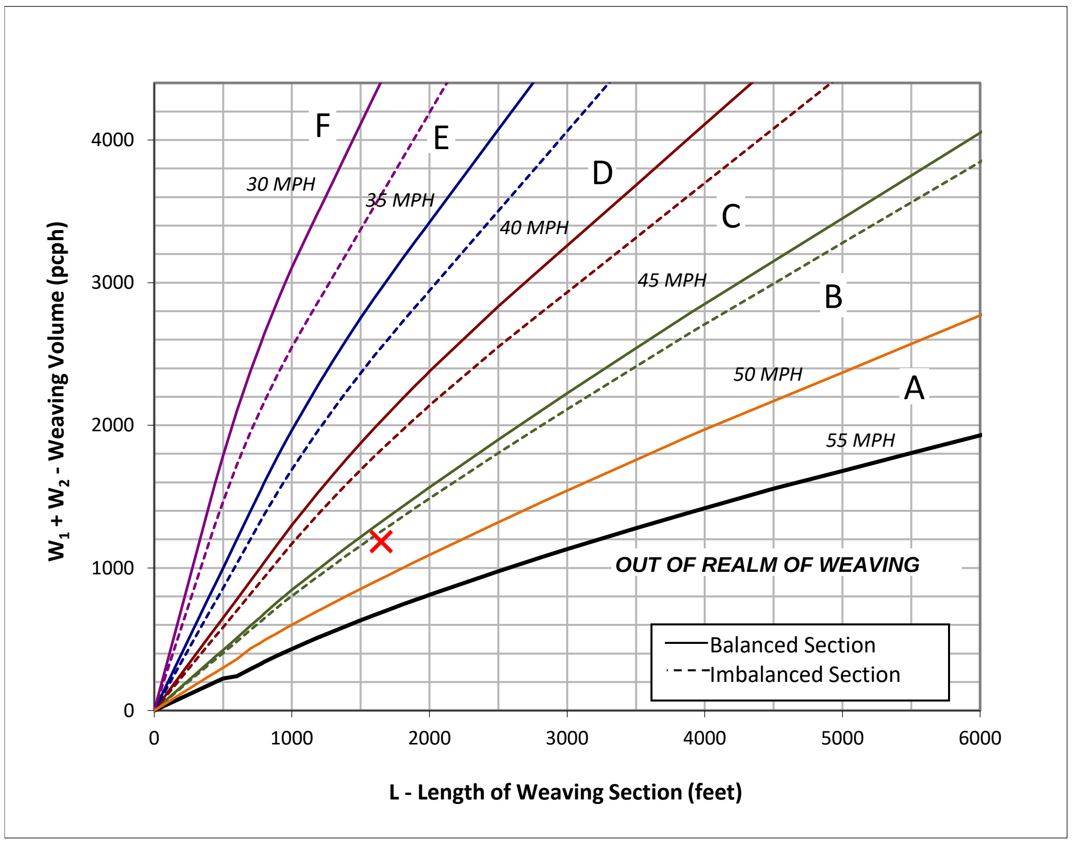
Intermediate speed variable,                 M  = 0.739
                                              S
Space mean speed in ramp influence area,     S  = 48.0    mph
                                              R
Space mean speed in outer lanes,             S  = 53.9    mph
                                              0
Space mean speed for all vehicles,           S  = 51.2    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project AM Peak
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,017	Volume (vph)*	377	Volume (vph)*	770
Truck Percentage	27%	Truck Percentage	8%	Truck Percentage	6%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,234	Volume (pcph)	392	Volume (pcph)	793



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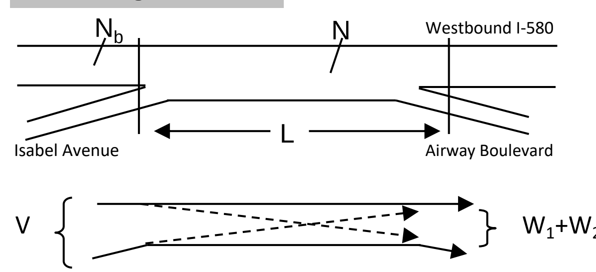


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   45 MPH and **50 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 46.7
4. Weaving Intensity Factor (k) 1.47
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,084

6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Airway Boulevard On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Plus Project
Description:	PlusLas Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8247	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	150	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8247		150			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2291		42			v
Trucks and buses	27		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.881       0.990
Driver population factor, fP            1.00        1.00
Flow rate, vp                           10400       168                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.197   Using Equation  4
                   FM
                  v  = v  (P  ) =  2047   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     10568         9400            Yes
      FO
     v  or v               4176 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 4160                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                10568         4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   37.3    pc/mi/ln
         R                    R           12            A
Level of service for ramp-freeway junction areas of influence  F

_____________________________Speed Estimation__________________________________

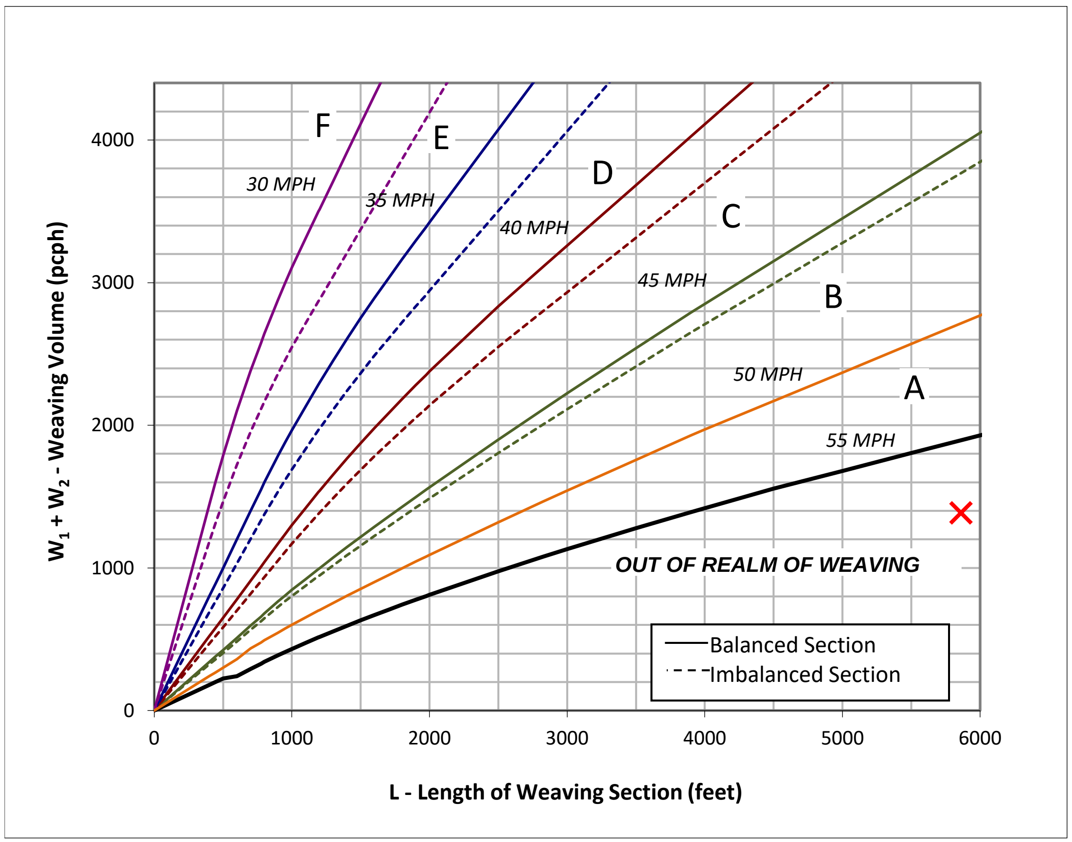
Intermediate speed variable,                 M  = 0.596
                                              S
Space mean speed in ramp influence area,     S  = 51.3    mph
                                              R
Space mean speed in outer lanes,             S  = 53.5    mph
                                              0
Space mean speed for all vehicles,           S  = 52.6    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project AM Peak
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	8,831	Volume (vph)*	434	Volume (vph)*	920
Truck Percentage	27%	Truck Percentage	4%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,023	Volume (pcph)	443	Volume (pcph)	943



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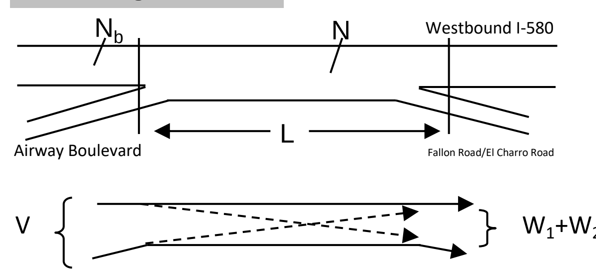


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.1
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,005
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

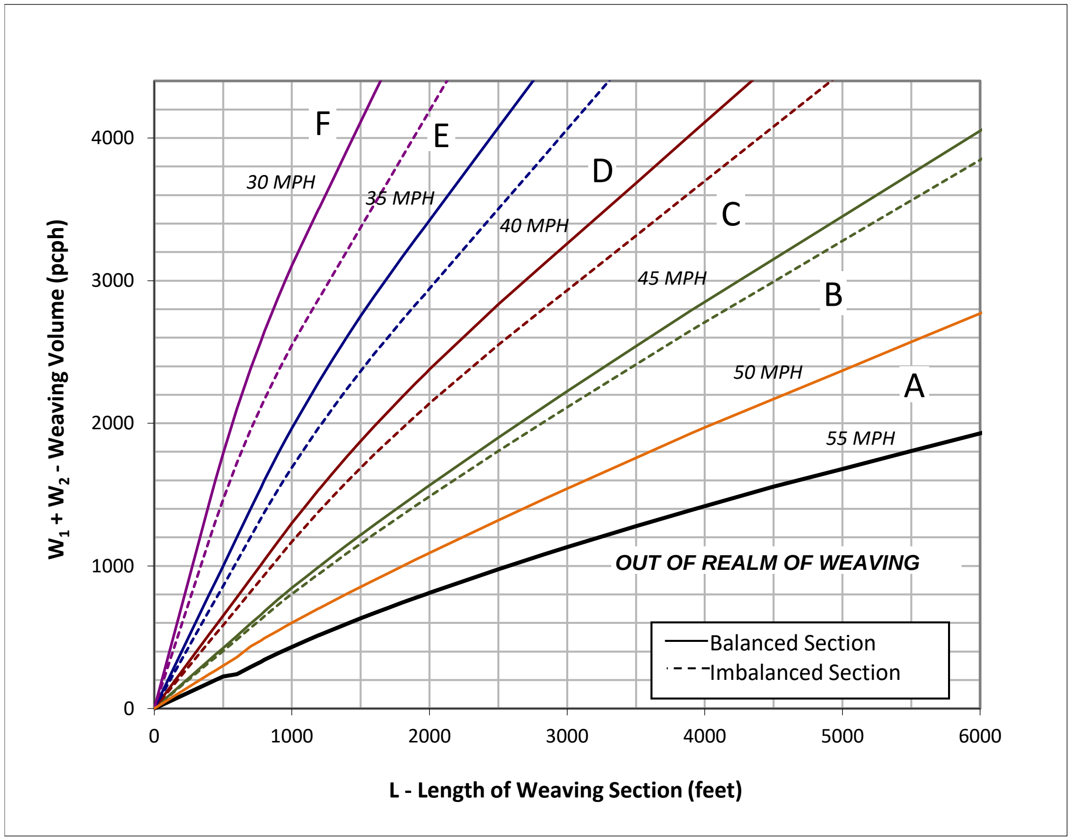
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project AM Peak
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,947	Volume (vph)*	360	Volume (vph)*	1,033
Truck Percentage	13%	Truck Percentage	8%	Truck Percentage	3%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	5,269	Volume (pcph)	374	Volume (pcph)	1,048



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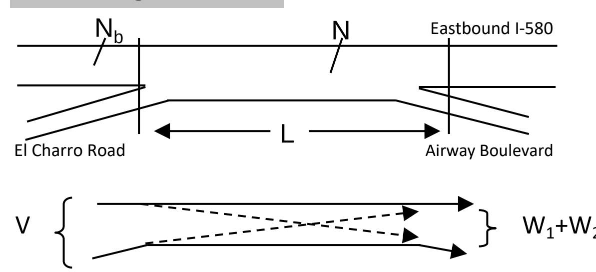


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.1
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*min(W_1, W_2)]$ 1,054
6. Level of Service (LOS) B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

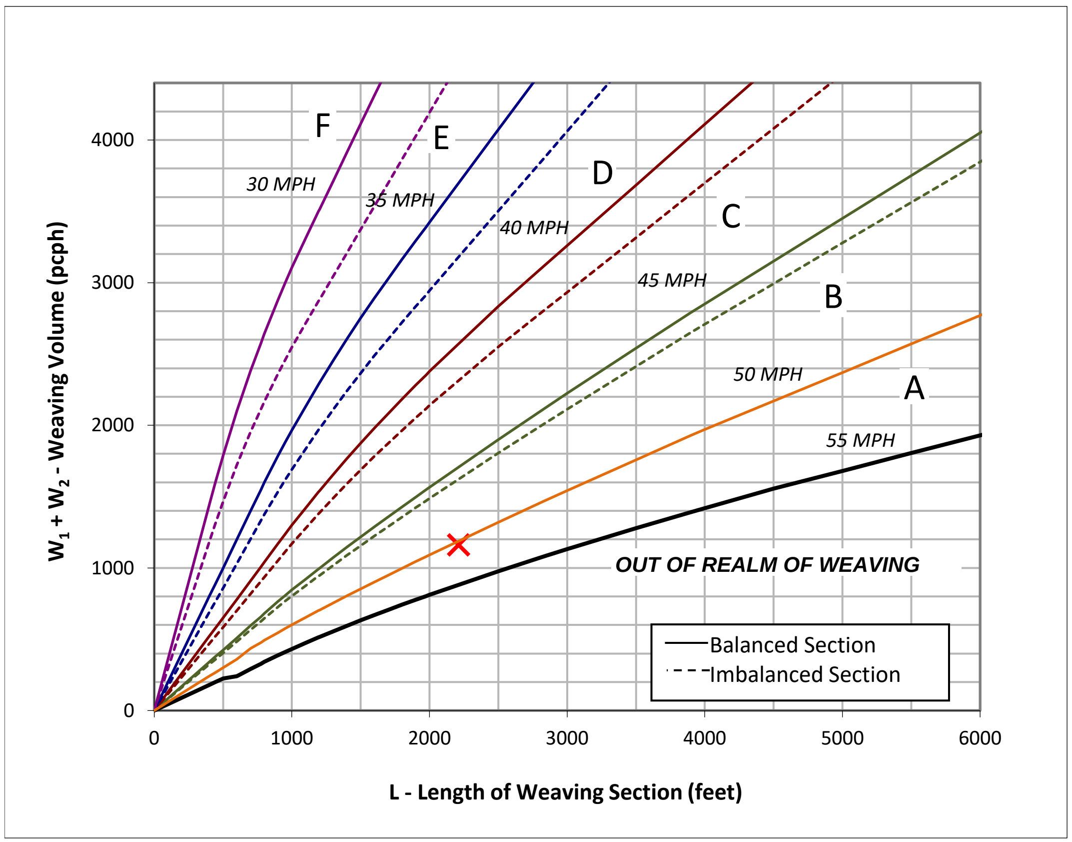
Data Input

Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,164	Volume (vph)*	250	Volume (vph)*	864
Truck Percentage	13%	Truck Percentage	3%	Truck Percentage	10%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	4,435	Volume (pcph)	254	Volume (pcph)	907

Project Information

Project	Las Positas CC
Scenario	Cumulative Plus Project AM Peak
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue



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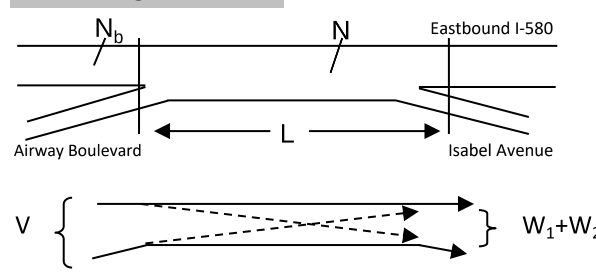


Capacity Analysis

1. Is the weaving section balanced (Y / N)? — Y

If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

50 MPH and **55 MPH**

If left of the 30 MPH curve, LOS is F. Select "-".

If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 50.4
4. Weaving Intensity Factor (k) — 0.95
5. Service Volume (SV, pcph)

$SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 885

6. Level of Service (LOS) — B

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	AM Peak
Freeway/Dir of Travel:	Westbound I-580
Junction:	SB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Plus Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	3300	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	273	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	3300		273			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	917		76			v
Trucks and buses	13		3			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV          0.939       0.985
Driver population factor, fP           1.00        1.00
Flow rate, vp                          3905        308                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =            (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.179   Using Equation  4
                   FM
                  v   = v  (P   ) =  546    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     3354          9400            No
      FO
     v  or v               1250 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           No
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34        12
If yes, v    = 1218                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                3354          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   15.4    pc/mi/ln
         R                    R           12            A
Level of service for ramp-freeway junction areas of influence  B

_____________________________Speed Estimation__________________________________

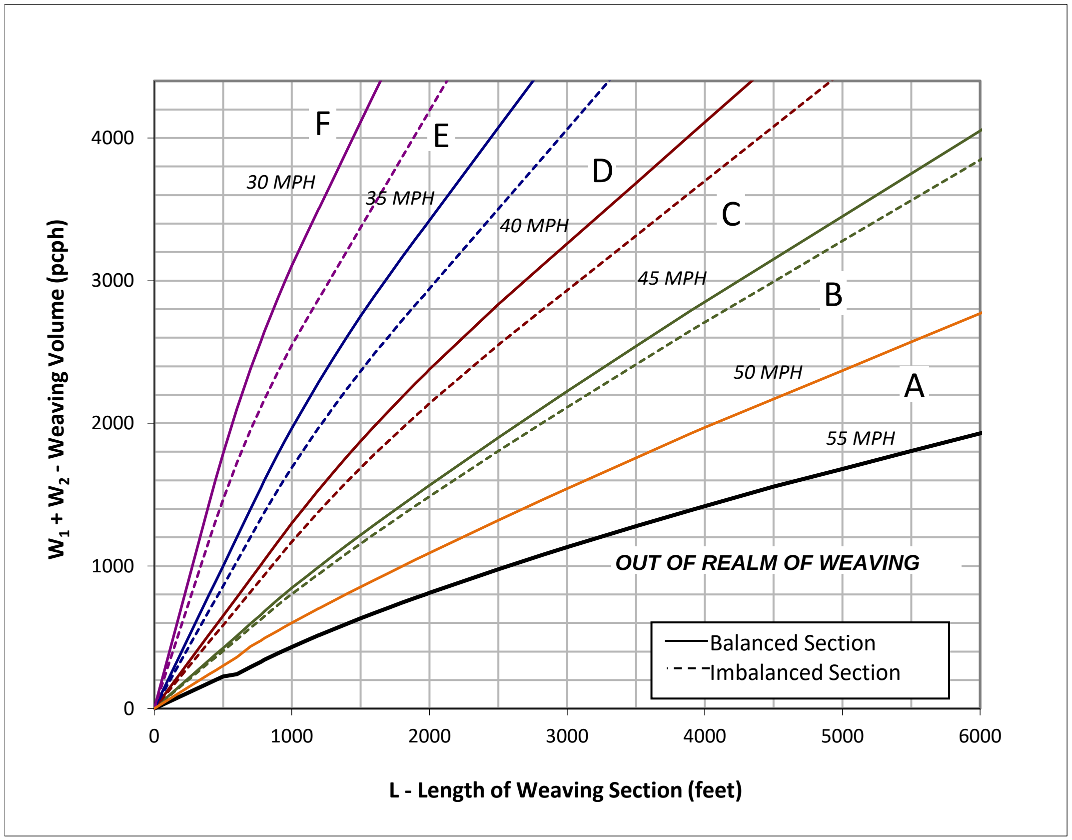
Intermediate speed variable,                 M  = 0.318
                                              S
Space mean speed in ramp influence area,     S  = 57.7    mph
                                              R
Space mean speed in outer lanes,             S  = 63.5    mph
                                              0
Space mean speed for all vehicles,           S  = 60.7    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project AM Peak
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,253	Volume (vph)*	680	Volume (vph)*	530
Truck Percentage	13%	Truck Percentage	10%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	4,529	Volume (pcph)	714	Volume (pcph)	543

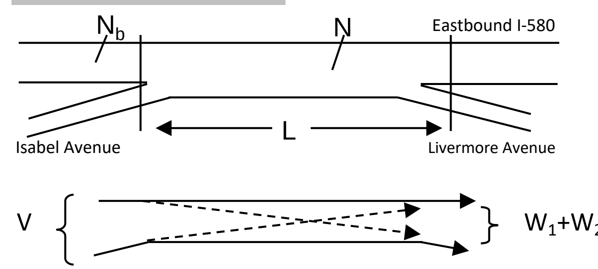


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? — N

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? — **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 59.4
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

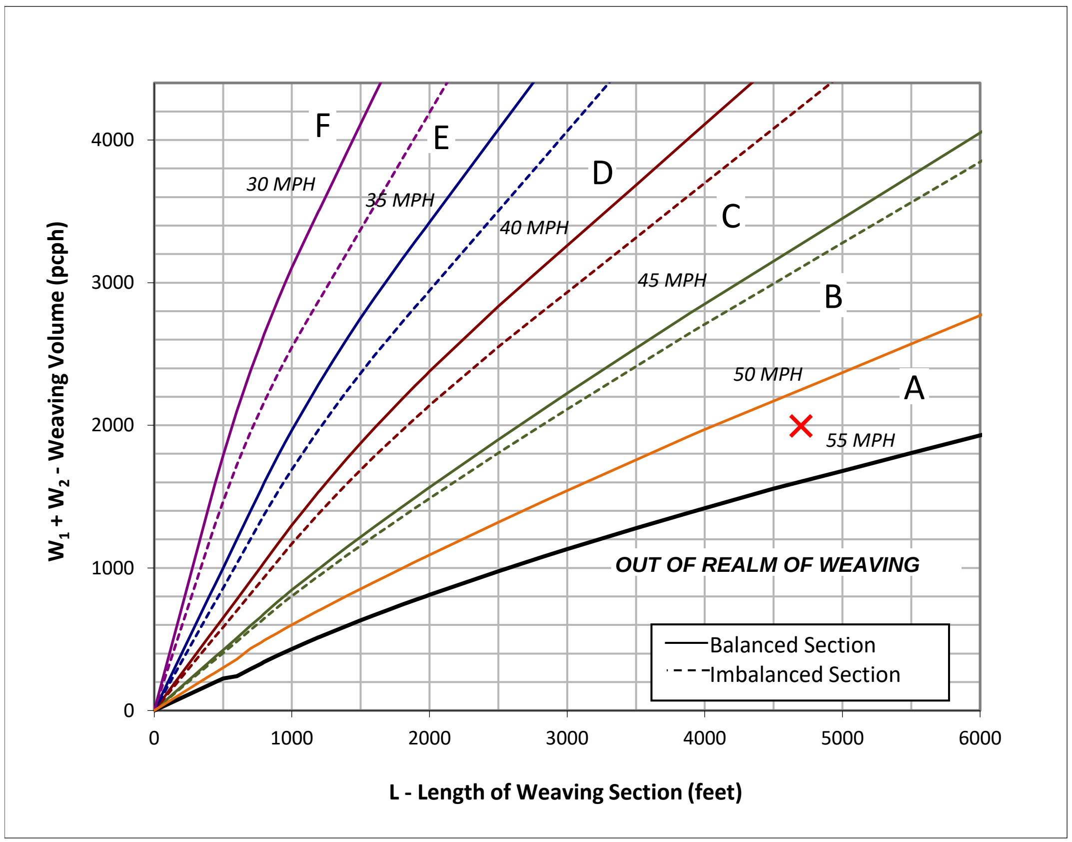
   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 906
6. Level of Service (LOS) — B

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	4,700

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project PM Peak
Freeway	Westbound I-580
On-ramp	Livermore Avenue
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,821	Volume (vph)*	930	Volume (vph)*	1,031
Truck Percentage	10%	Truck Percentage	5%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	7,162	Volume (pcph)	953	Volume (pcph)	1,041



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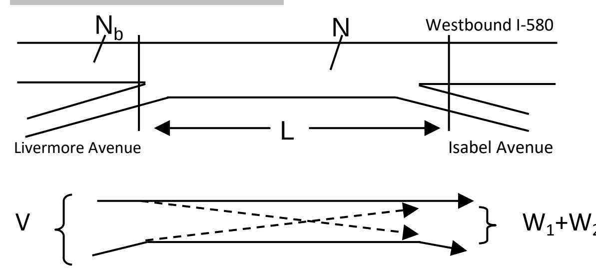


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph)	52.0
4. Weaving Intensity Factor (k)	1.00
5. Service Volume (SV, pcph) $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$	1,432
6. Level of Service (LOS)	C

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	PM Peak
Freeway/Dir of Travel:	Eastbound I-580
Junction:	NB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative Plus Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	5790	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	690	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	5790	690		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1608	192		v
Trucks and buses	10	5		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV          0.952       0.976
Driver population factor, fP           1.00        1.00
Flow rate, vp                          6755        786                  pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.120   Using Equation  4
                   FM
                  v  = v  (P  ) =  808    pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     7541          9400            No
      FO
     v  or v               2973 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 2702                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable        Violation?
     v                7541          4600                 No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   30.4    pc/mi/ln
          R                   R           12            A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

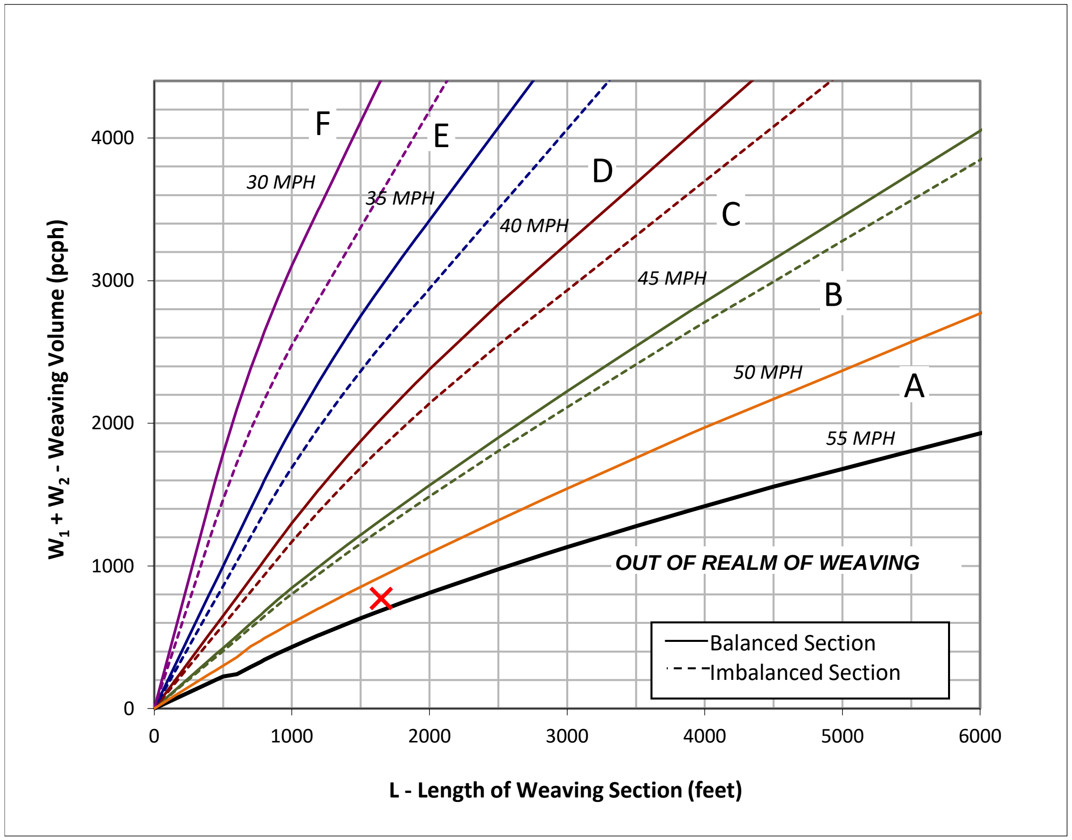
Intermediate speed variable,                 M  = 0.428
                                              S
Space mean speed in ramp influence area,     S  = 55.2    mph
                                              R
Space mean speed in outer lanes,             S  = 59.5    mph
                                              0
Space mean speed for all vehicles,           S  = 57.4    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	1,650

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project PM Peak
Freeway	Westbound I-580
On-ramp	Isabel Avenue
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	6,905	Volume (vph)*	425	Volume (vph)*	340
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	7,250	Volume (pcph)	429	Volume (pcph)	343



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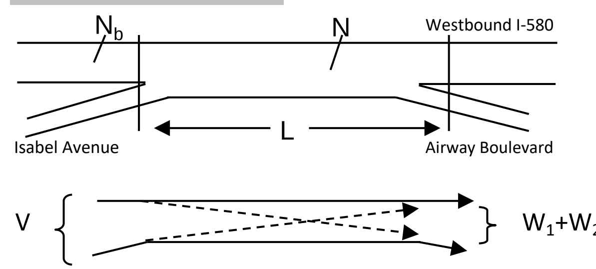


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 53.2
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 1,450

6. Level of Service (LOS) D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst: Diwu Zhou EIT
Agency/Co.: Fehr & Peers
Date performed: 1/20/2017
Analysis time period: PM Peak
Freeway/Dir of Travel: Eastbound I-580
Junction: NB Airway Boulevard On-Ramp
Jurisdiction: Caltrans
Analysis Year: Cumulative Plus Project
Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	4	
Free-flow speed on freeway	65.0	mph
Volume on freeway	6565	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	230	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway	Ramp	Adjacent Ramp	
Volume, V (vph)	6565	230		vph
Peak-hour factor, PHF	0.90	0.90		
Peak 15-min volume, v15	1824	64		v
Trucks and buses	10	4		%
Recreational vehicles	0	0		%
Terrain type:	Level	Level		
Grade	%	%	%	
Length	mi	mi	mi	
Trucks and buses PCE, ET	1.5	1.5		
Recreational vehicle PCE, ER	1.2	1.2		

```
Heavy vehicle adjustment, fHV           0.952       0.980
Driver population factor, fP            1.00        1.00
Flow rate, vp                           7659        261                   pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L   =             (Equation 13-6 or 13-7)
                   EQ
                  P   =    0.185   Using Equation  4
                   FM
                  v  = v  (P   ) =  1418   pc/h
                   12   F    FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     7920          9400            No
      FO
     v  or v               3120 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3063                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                7920          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   29.4    pc/mi/ln
         R                    R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

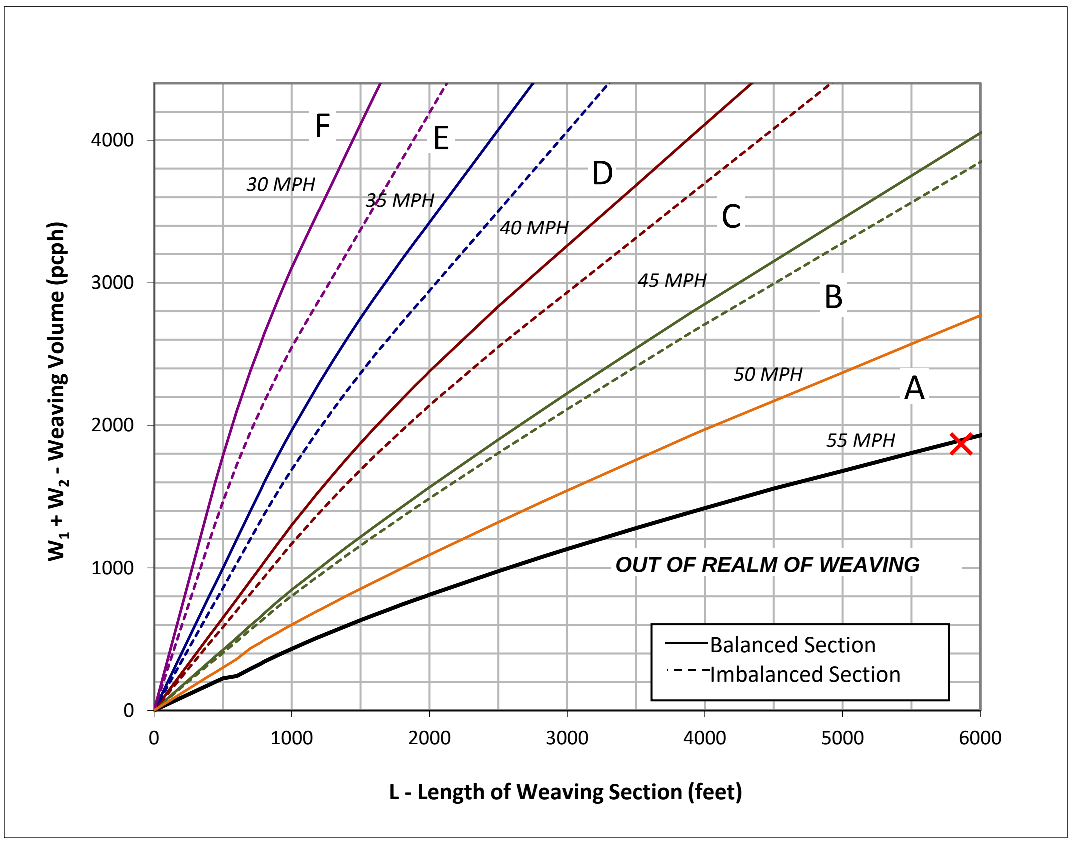
Intermediate speed variable,                 M  = 0.408
                                              S
Space mean speed in ramp influence area,     S  = 55.6    mph
                                              R
Space mean speed in outer lanes,             S  = 58.5    mph
                                              0
Space mean speed for all vehicles,           S  = 57.3    mph
_______________________________________________________________________________
```

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	5,860

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project PM Peak
Freeway	Westbound I-580
On-ramp	Airway Boulevard
Off-ramp	Fallon Road/El Charro Road

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	7,565	Volume (vph)*	770	Volume (vph)*	1,080
Truck Percentage	10%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	7,943	Volume (pcph)	778	Volume (pcph)	1,091



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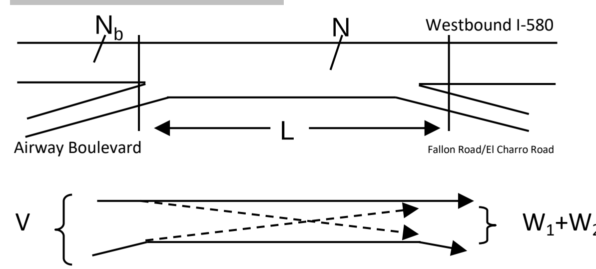


Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 55.2
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 1,589
6. Level of Service (LOS) — D

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

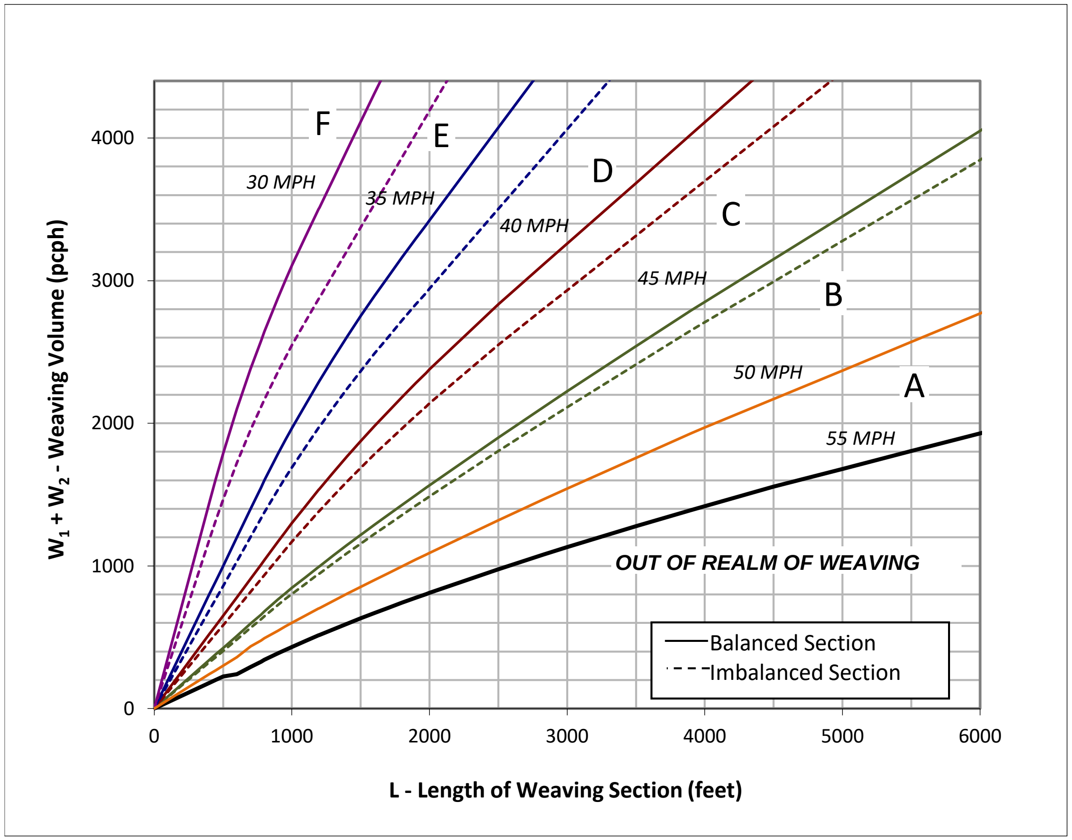
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014

Leisch Method for Weaving Analysis

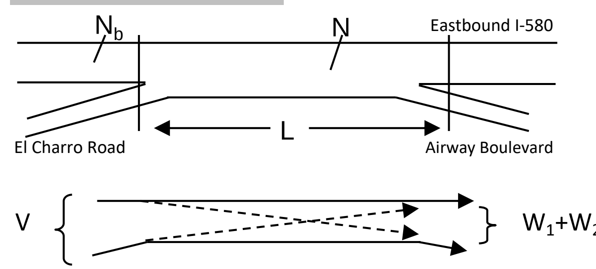
Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,120

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project PM Peak
Freeway	Eastbound I-580
On-ramp	El Charro Road
Off-ramp	Airway Boulevard

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	10,032	Volume (vph)*	280	Volume (vph)*	1,017
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	11,186	Volume (pcph)	283	Volume (pcph)	1,027



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 58.8
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 2,237

6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

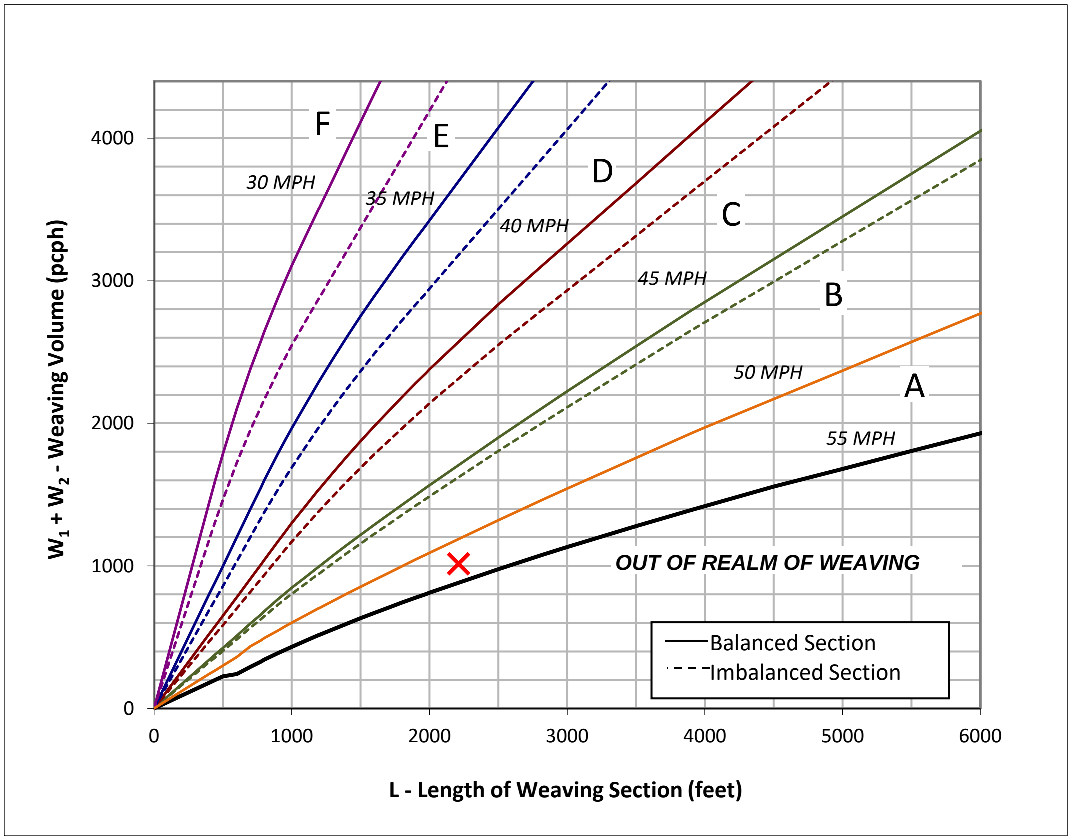
Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	2,210

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project PM Peak
Freeway	Eastbound I-580
On-ramp	Airway Boulevard
Off-ramp	Isabel Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,285	Volume (vph)*	270	Volume (vph)*	735
Truck Percentage	23%	Truck Percentage	2%	Truck Percentage	2%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,353	Volume (pcph)	273	Volume (pcph)	742



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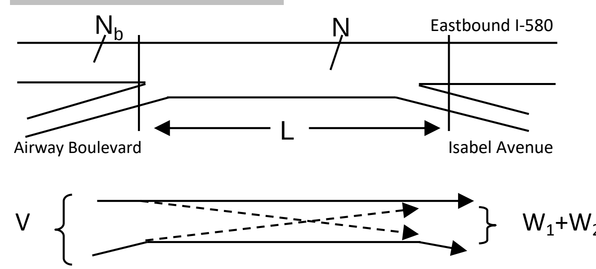

Capacity Analysis

1. Is the weaving section balanced (Y / N)? **Y**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between?

   50 MPH and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) 52.8
4. Weaving Intensity Factor (k) 1.00
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] 2,071
6. Level of Service (LOS) F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections* , Jack E. Leisch & Associates, September 1983 and *Highway Design Manual* , California Department of Transportation, 2014

HCS 2010: Freeway Merge and Diverge Segments Release 6.2

Phone: Fax:
E-mail:

Merge Analysis

Analyst:	Diwu Zhou EIT
Agency/Co.:	Fehr & Peers
Date performed:	1/20/2017
Analysis time period:	PM Peak
Freeway/Dir of Travel:	Westbound I-580
Junction:	SB Isabel Avenue On-Ramp
Jurisdiction:	Caltrans
Analysis Year:	Cumulative No Project

Description: Las Positas Community College

Freeway Data

Type of analysis	Merge	
Number of lanes in freeway	5	
Free-flow speed on freeway	65.0	mph
Volume on freeway	8550	vph

On Ramp Data

Side of freeway	Right	
Number of lanes in ramp	1	
Free-flow speed on ramp	35.0	mph
Volume on ramp	470	vph
Length of first accel/decel lane	300	ft
Length of second accel/decel lane		ft

Adjacent Ramp Data (if one exists)

Does adjacent ramp exist?	No	
Volume on adjacent Ramp		vph
Position of adjacent Ramp		
Type of adjacent Ramp		
Distance to adjacent Ramp		ft

Conversion to pc/h Under Base Conditions

Junction Components	Freeway		Ramp		Adjacent Ramp	
Volume, V (vph)	8550		470			vph
Peak-hour factor, PHF	0.90		0.90			
Peak 15-min volume, v15	2375		131			v
Trucks and buses	23		2			%
Recreational vehicles	0		0			%
Terrain type:	Level		Level			
Grade		%		%		%
Length		mi		mi		mi
Trucks and buses PCE, ET	1.5		1.5			
Recreational vehicle PCE, ER	1.2		1.2			

```
Heavy vehicle adjustment, fHV           0.897       0.990
Driver population factor, fP            1.00        1.00
Flow rate, vp                           10592       527                     pcph

_________________________Estimation of V12 Merge Areas_________________________

                  L  =            (Equation 13-6 or 13-7)
                   EQ
                  P  =    0.152   Using Equation  4
                   FM
                  v  = v  (P  ) =  1229   pc/h
                   12   F   FM

_______________________________Capacity Checks_________________________________

                           Actual        Maximum         LOS F?
     v                     8619          9400            No
      FO
     v  or v               3431 pc/h     (Equation 13-14 or 13-17)
      3     av34
Is   v  or v      > 2700 pc/h?           Yes
      3     av34
Is   v  or v      > 1.5 v  /2            Yes
      3     av34         12
If yes, v    = 3236                   (Equation 13-15, 13-16, 13-18, or 13-19)
         12A

________________________Flow Entering Merge Influence Area_____________________
                      Actual        Max Desirable         Violation?
     v                8619          4600                  No
      12A
_________________Level of Service Determination (if not F)_____________________

Density, D = 5.475 + 0.00734 v  + 0.0078 v   - 0.00627 L   =   32.7    pc/mi/ln
          R                   R           12             A
Level of service for ramp-freeway junction areas of influence  D

_____________________________Speed Estimation__________________________________

Intermediate speed variable,                 M  = 0.468
                                              S
Space mean speed in ramp influence area,     S  = 54.2    mph
                                              R
Space mean speed in outer lanes,             S  = 57.7    mph
                                              0
Space mean speed for all vehicles,           S  = 56.1    mph
_______________________________________________________________________________
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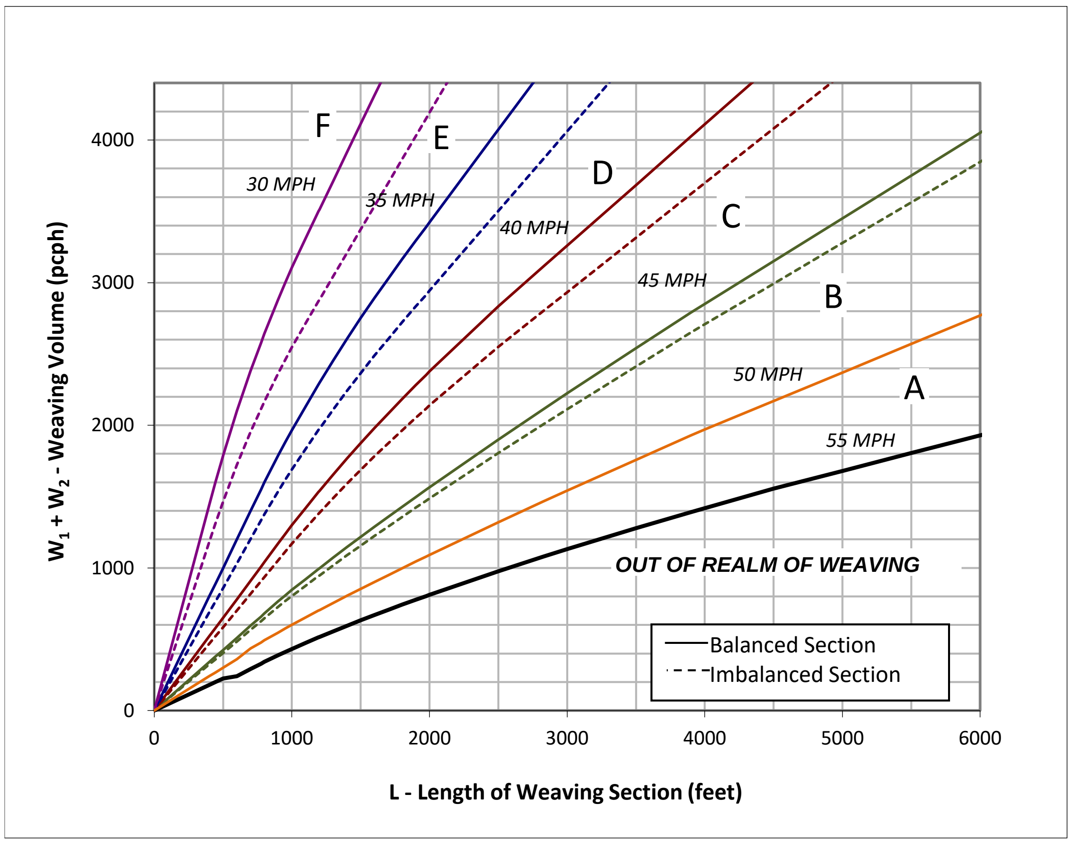
Leisch Method for Weaving Analysis

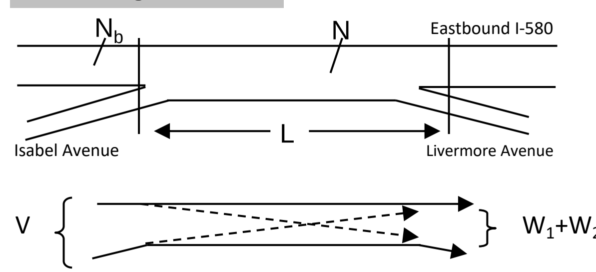
Data Input		
Number of Entering Mainline Lanes	N_b	4
Number of Lanes in Weaving Section	N	5
Length of Weaving Section (feet)	L	6,500

Project Information	
Project	Las Positas CC
Scenario	Cumulative Plus Project PM Peak
Freeway	Eastbound I-580
On-ramp	Isabel Avenue
Off-ramp	Livermore Avenue

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	9,780	Volume (vph)*	760	Volume (vph)*	1,400
Truck Percentage	23%	Truck Percentage	6%	Truck Percentage	5%
PCE for Trucks	1.5	PCE for Trucks	1.5	PCE for Trucks	1.5
Volume (pcph)	10,905	Volume (pcph)	783	Volume (pcph)	1,435



Figure



Capacity Analysis

1. Is the weaving section balanced (Y / N)? **N**

   If optional exit lane, then "Y". Otherwise "N".

2. In the chart to the left, which two speed curves is the red "x" between? **50 MPH** and **55 MPH**

   If left of the 30 MPH curve, LOS is F. Select "-".

   If below the 55 MPH curve, out of the realm of weaving.

3. Interpolated Weaving Speed (S_w, mph) — 54.1
4. Weaving Intensity Factor (k) — 1.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ — 2,181
6. Level of Service (LOS) — F

The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* Note: **Do not adjust by a Peak Hour Factor (PHF).** The methodology incorporates the PHF in the Service Volume tables.

Sources: *Completion of Procedures for Analysis and Design of Traffic Weaving Sections*, Jack E. Leisch & Associates, September 1983 and *Highway Design Manual*, California Department of Transportation, 2014