Public Review Draft

INTERSTATE 80/RICHARDS BOULEVARD INTERCHANGE IMPROVEMENTS PROJECT

03-YOL-80 – PM 0.0/0.5 - 04-SOL-80 PM 44.5/44.7

Initial Study/Mitigated Negative Declaration

Prepared for
City of Davis

February 2022

Public Review Draft

INTERSTATE 80/RICHARDS BOULEVARD INTERCHANGE IMPROVEMENTS PROJECT

Initial Study/Mitigated Negative Declaration

Prepared for
City of Davis
Department of Public Works
Engineering & Transportation Department
1717 Fifth Street
Davis, CA 95616

February 2022

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Introduction

The City of Davis, in cooperation with the California Department of Transportation (Caltrans), proposes to reconstruct the westbound ramps at the Interstate 80 (I-80)/Richards Boulevard interchange in the City of Davis by converting from a cloverleaf to a tight diamond configuration, construct a grade-separated bicycle and pedestrian path along the west side of Richards Boulevard, close the isolated westbound off-ramp to Olive Drive, and make other related improvements to relieve existing congestion at the interchange to accommodate increased traffic demand generated by approved and/or proposed developments in the project area and to reduce conflicts between bicyclists, pedestrians, and vehicles. The City of Davis is the lead agency under California Environmental Quality Act (CEQA). Caltrans is a Responsible Agency for the proposed project under CEQA. As defined in Public Resources Code Section 21069, a Responsible Agency is a public agency, other than the lead agency, which has responsibility for carrying out or approving a project.

Project Description

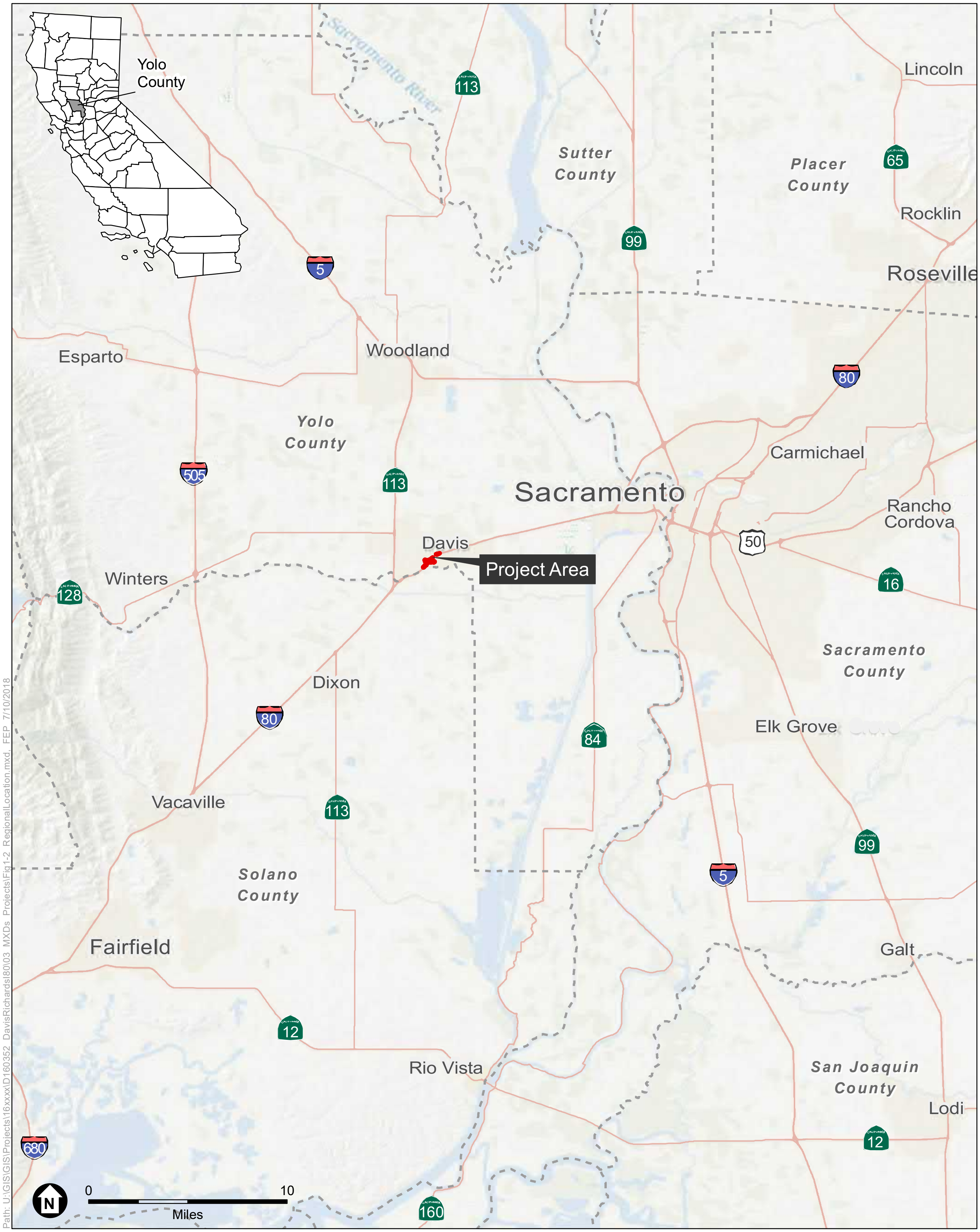
Project Components

The proposed project would reconfigure the westbound I-80 ramps from a full cloverleaf to a tight diamond configuration by consolidating the two off-ramps into a single diagonal off-ramp and the two on-ramps into a single diagonal on-ramp. The resulting westbound I-80 ramp terminal intersection would include new traffic signals. The westbound I-80 on-ramp would require widening of I-80 over the existing bike and pedestrian tunnel. **Figure 1** shows the project location, **Figure 2** shows the project footprint, and **Figure 3** shows the project design.

The eastbound I-80 ramp intersection would remain as a cloverleaf. Project improvements include widening the eastbound off-ramp to include a right-turn lane and two left-turn lanes. Richards Boulevard would be widened to provide two southbound through movements at the Research Park Drive/Richards Boulevard intersection.

The project would modify the Olive Drive/Richards Boulevard intersection providing the width, lane geometry, and right-of-way necessary for future developments on Olive Drive. The existing nearside bus stop on Richards Boulevard near Olive Drive would be relocated to the north of the Olive Drive/Richards Boulevard intersection. Along Eastbound Richards Boulevard, improvements would connect the mixed-use paths; include a left-turn lane, a through lane, and a combination through-right lane on the intersection entrance; and include two through lanes on the eastbound intersection egress.

Between the Olive Drive/Richards Boulevard intersection and the westbound I-80 ramp terminal intersection, improvements would include widening Richards Boulevard and installing a raised median to restrict let turn movements.

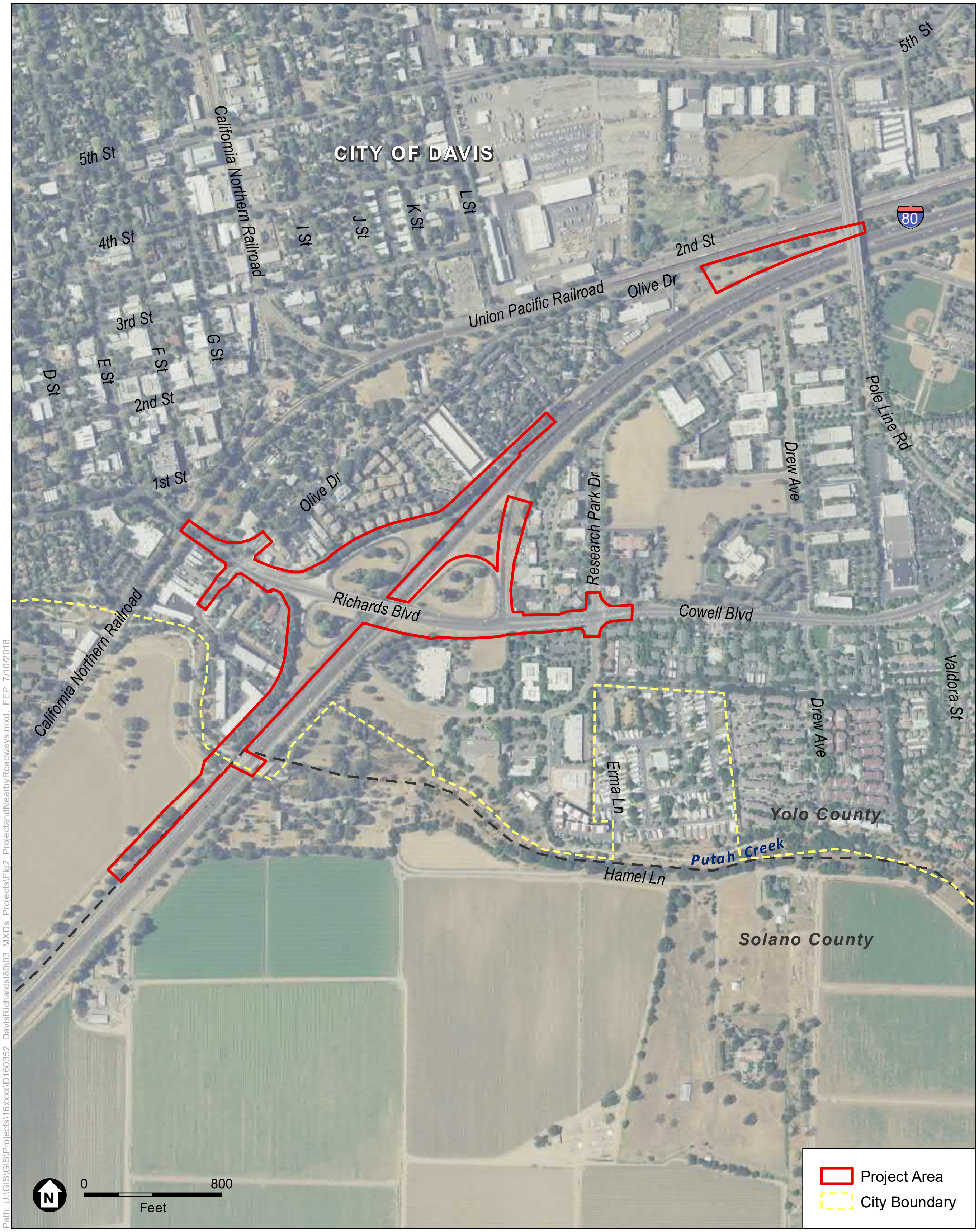


SOURCE: Esri, 2015; ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 1
Project Location

ESA



SOURCE: USDA, 2016; ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 2
Project Footprint

ESA

#

SOURCE: USDA, 2016; ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 3
Project Design

ESA

The project would include construction of a shared-use path along the west side of Richards Boulevard replacing the existing sidewalk, and serving both bicyclists and pedestrians. The shared-use path would connect to the existing path south of Olive Drive, diverge from Richards Boulevard to pass under the westbound I-80 on-ramp, then loop up to connect with the Richards Boulevard overcrossing. After passing over the existing structure, the shared-use path would terminate at the Research Park Drive/Richards Boulevard intersection. The project would widen the existing Class II bicycle lanes along Richards Boulevard between Olive Drive and Research Park Drive to a minimum of 7 feet.

The project would close the isolated westbound off-ramp to Olive Drive.

The elements of the interchange reconstruction and associated intersection widening are listed below.

- Install a traffic signal at the new westbound ramp terminal intersection
- Install a ramp meter signal on the new westbound on-ramp with two metered lanes and an HOV bypass lane
- At Richards Boulevard/Olive Drive, widen the northbound approach to provide a second left-turn lane, the southbound approach to provide a second through lane, and the east leg to provide two receiving lanes and eastbound left, through, and right lanes (one each)
- At Richards Boulevard/I 80 eastbound Ramps, widen the eastbound off-ramp approach to provide a second left-turn lane
- At Richards Boulevard/Cowell Boulevard/Research Park Drive, widen southbound Richards Boulevard to provide a second through lane.

Construction Activities and Schedule

Construction is anticipated to last a total of approximately 18 months. The project would be completed in a single phase and construction activities would include clearing vegetation, grading, hauling materials, excavation, placing embankment, drainage, and paving roadway surfaces.

ENVIRONMENTAL CHECKLIST

Initial Study

1. **Project Title:**	Interstate 80/Richards Boulevard Interchange Improvements Project
2. **Lead Agency Name and Address:**	City of Davis Department of Public Works Engineering & Transportation Department 1717 Fifth Street Davis, CA 95616
3. **Contact Person and Phone Number:**	Kevin Fong, P.E. Senior Civil Engineer 530-747-8285
4. **Project Location:**	City of Davis
5. **Project Sponsor's Name and Address:**	City of Davis Department of Public Works Engineering & Transportation Department 1717 Fifth Street Davis, CA 95616
6. **General Plan Designation(s):**	The land southeast of I-80 is designated as Business Park and General Commercial in the City of Davis General Plan. To the northwest of I-80, the land is mainly designated as Commercial Service. A small portion of the area (north of the westbound off-ramp) is designated as East Olive Mixed Use.
7. **Zoning:**	Planned Development (PD)

8. Description of Project:

The City of Davis, in cooperation with Caltrans, proposes to reconstruct the westbound ramps at the I-80/Richards Boulevard interchange in the City of Davis by converting from a cloverleaf to a tight diamond configuration, construct a grade-separated bicycle and pedestrian path along the west side of Richards Boulevard, close the isolated westbound off-ramp to Olive Drive, and make other related improvements to relieve existing congestion at the interchange to accommodate increased traffic demand generated by approved and/or proposed developments in the project area and to reduce conflicts between bicyclists, pedestrians, and vehicles.

9. Surrounding Land Uses and Setting:

Land uses to the south and south east of the project site include retail and commercial establishments, restaurants, hotels, and UC Davis Extension buildings. Land uses to the west and northwest of the project site include retail and commercial establishments, restaurants, a gas station, a hotel, and apartments, including Cesar Chavez Plaza Permanent Supportive Housing.

10. Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)

Caltrans is a Responsible Agency for the proposed project. As defined in Public Resources Code Section 21069, a Responsible Agency is a public agency, other than the lead agency, which has responsibility for carrying out or approving a project. Caltrans is a participant in the City of Davis CEQA process for the proposed project and will use the City's CEQA document when making decisions on the proposed project.

11. Have California Native American tribes traditionally and culturally affiliated with the project area requested consultation pursuant to Public Resources Code section 21080.3.1? If so, is there a plan for consultation that includes, for example, the determination of significance of impacts to tribal cultural resources, procedures regarding confidentiality, etc.?

The City of Davis has consulted with California Native American tribes pursuant to Public Resources Code section 21080.3.1. The details of this consultation are provided in the *Cultural Resources* and *Tribal Cultural Resource*s sections of this initial study,

Environmental Factors Potentially Affected

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

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

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial study:

☐ 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 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.

Kevin Fong Digitally signed by Kevin Fong
DN: cn=Kevin Fong, c=US, ou=City of Davis, email=kfong@cityofdavis.org
Date: 2022.02.23 09:23:26 -08'00'

Signature

2/23/22

Date

Environmental Checklist

Aesthetics

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
I. AESTHETICS — Except as provided in Public Resources Code Section 21099, would the project:				
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 public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic Quality?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area?	☐	☐	☒	☐

Discussion

a, b) There are no known scenic resources visible from the project site nor are any of the roadways in the project area classified as scenic corridors by the State, the City of Davis, or any other entity with jurisdiction in this area (Caltrans, 2018). Implementation of the proposed project would result in **no impact** to a scenic vista or scenic resources.

c) The project site includes areas within the City of Davis at two primary locations: the intersection of Richards Boulevard and I-80 and the area between Olive Drive and I-80, just west of Pole Line Road. **Figure 4** shows the locations photos taken of typical viewpoints of the project site. **Figure 5** through **Figure 7** show public views of the project site locations. Views are of urbanized areas, consisting of roads, street trees and other landscaping, street lights, fencing, street signs, commercial and industrial buildings, and a few residences.

Viewpoints 1 through 5 show typical public views of the project site from different viewpoints. The area is suburban with mostly commercial and transportation uses. Viewpoint 1 shows a view from the southeast corner of the Olive Drive/Richards Boulevard intersection, looking north. The view is urban, with wide asphalt right-of-way, cement sidewalks, light poles, a few commercial buildings, and associated landscaping. Viewpoint 2 shows a view towards the east from Olive Drive. The area is industrial in nature with street trees lining the road on one side and a chain link fence on the other. Views of the project site are limited due to the presence of trees. Viewpoint 3 shows the view of the I-80 north on- and off-ramps. Trees and other landscaping block views of the freeway from this location but the foreground views are dominated by asphalt, cement, and light poles.

SOURCE: USDA, 2016; ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 4
Viewpoint Locations

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Viewpoint 1: View looking north across Olive Drive intersection with Richards Boulevard.

Viewpoint 2: View from Olive Drive near Interstate 80 off-ramp looking east.

D160352.01 - I-80_Richard Interchange TO 10\05 Graphics-GIS-Modeling\Illustrator

SOURCE: ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 5
Viewpoints 1 and 2

ESA

Viewpoint 3: View from Richards Boulevard overpass looking north towards Interstate 80 north on-/off-ramp.

Viewpoint 4: View from Richards Boulevard overpass looking south towards Interstate 80 south off-ramp.

D160352.01 - I-80_Richard Interchange TO 10\05 Graphics-GIS-Modeling\Illustrator

SOURCE: ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 6
Viewpoints 3 and 4

ESA

Viewpoint 5: View looking northeast across Research Park Drive intersection with Richards Boulevard.

D160352.01 - I-80_Richard Interchange TO 10\05 Graphics-GIS-Modeling\Illustrator

SOURCE: ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 7
Viewpoint 5

Viewpoint 4 shows the view from the Richards Boulevard overpass south over the I-80 south off-ramp. The interior of the off-ramp is planted with full-grown trees that block the view of the off-ramp and some farther views. The paved freeway is easily seen from this viewpoint, but further views are blocked by trees on either side. Viewpoint 5 shows the view of the Research Park Drive/Richards Boulevard intersection looking north from the southwest corner. Wide expanses of asphalt dominate the view, with trees blocking views of commercial buildings beyond. Light poles and cement sidewalks are also present.

Visual impacts are determined by assessing changes to the visual resources and predicting viewer response to those changes. The location of the proposed ramps would require the removal of some trees. This would constitute a change in the visual character as these trees would be removed. While removal of trees could affect the views experienced by travelers along I-80 and Richards Boulevard, the typical viewers of these areas are travelers in cars whose sensitivity to small changes in the aesthetic environment is low. Very few residences are within the project vicinity. As shown in Figure 3, the project would reduce the amount of asphalt by consolidating and reconfiguring on- and off-ramps. This would provide greater space for vegetation which generally softens the view and provides relief for the eye.

The visual character of the proposed project would be compatible with the existing visual character of the project site and vicinity. The existing on- and off-ramps are comprised of asphalt with high-visibility paint markings and metal light poles. The proposed on- and off-ramps would use the same types of materials. The project site does not include any elements of special visual character or design.

The visual quality of the project site and vicinity would not be altered by the proposed project. The same types of materials already present in the project site (e.g., asphalt, high-visibility paint, street signs) would be used to accomplish the project goals. The visual character of the proposed project would be compatible with the visual character of the project site and its surroundings. Consequently, implementation of the proposed project would not substantially degrade the existing visual character or quality of public views of the site and its surroundings or conflict with applicable zoning and other regulations governing scenic quality. The impact would be **less than significant**.

d) The materials used in the construction of the proposed project (e.g., asphalt, cement, paint) would not include any surfaces likely to produce glare. Future street lighting would comply with the City of Davis' Dark Sky Ordinance (Chapter 8, Buildings, of the Municipal Code. Article 8.17, Outdoor Lighting Control) which requires that outdoor light fixtures shall be fully shielded.

Construction of the proposed project could introduce new temporary sources of light, as construction may occur during nighttime hours. However, consistent with normal procedures, the City of Davis and Caltrans would require project contractors to direct lighting onto the immediate area under construction only and to avoid shining lights towards residences and towards traffic. Consequently, implementation of the proposed project would not create a new source of substantial light or glare which would adversely affect daytime or nighttime views in the area, and this impact would be **less than significant**.

References

California Department of Transportation (Caltrans), 2018. Visual Impact Assessment Technical Memorandum, Interstate 80/ Richards Boulevard Interchange Improvements Project. August 2018.

Agriculture and Forestry Resources

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
II. 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?	☐	☐	☐	☒

Discussion

a–e) The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts among bicyclists, pedestrians, and vehicles. There are no forested lands or lands being used for agriculture or forestry production on the project site or that would be affected by project construction or operation. For these reasons, there is no potential for the proposed project to cause loss to agriculture or forestry resources, and there would be **no impact**.

Air Quality

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
III. AIR QUALITY — Where available, the significance criteria established by the applicable air quality management district 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) 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?	☐	☒	☐	☐
c) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☒	☐
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?	☐	☐	☒	☐

Environmental Setting

The project site is located in Yolo County within the Sacramento Valley Air Basin (SVAB). Air quality within Yolo County is regulated by the United States Environmental Protection Agency (U.S. EPA), and the California Air Resources Board (CARB) at the federal and state levels, respectively, and locally by the Yolo-Solano Air Quality Management District (YSAQMD). Yolo County is currently designated as a nonattainment area for the state and national ambient air quality standards for ozone (O_3). Yolo County is designated as unclassified and nonattainment for the national and state PM_{10} (i.e., respirable particulate matter with an aerodynamic diameter of 10 micrometers or less) standards, respectively. In addition, the eastern portion of Yolo County, including Davis, where the project site is located, is designated nonattainment for the national $PM_{2.5}$ (i.e., respirable particulate matter with an aerodynamic diameter of 2.5 micrometers or less) standard (YSAQMD, 2019).

On October 11, 2017, the YSAQMD Board of Director's adopted the Sacramento Regional 2008 National Ambient Air Quality Standard (NAAQS) 8-Hour Ozone Attainment and Reasonable Further Progress Plan (Plan). The Plan geographically covers the Sacramento Federal Nonattainment Area (SFNA) which includes all of Yolo County. The Plan documents how the region is meeting requirements under the Clean Air Act (CAA) in demonstrating reasonable further progress and attainment of the 2008 NAAQS of 75 parts of ozone per billion.

In May 2019, the YSAQMD adopted its most recent Triennial Plan Update. The Triennial Plan Update is a requirement of the California Clean Air Act (CCAA). The document summarizes emission trends, forecasts future emissions, and reviews efforts made by the YSAQMD to improve air quality (YSAQMD, 2019).

Although the YSAQMD generally does not experience unhealthy levels of particulates, the U.S. EPA has included the YSAQMD in the Sacramento Federal Non-Attainment Area for fine particulate pollution. In order to show attainment of the 24-hour fine particulate standard, an area must demonstrate that it has met the standard during three consecutive years. The Sacramento region was able to show that the standard had been achieved during the 2010–2012 period. The YSAQMD and the other air districts of the region subsequently submitted a request to the U.S. EPA for a redesignation to attainment of the standard. The districts also developed and submitted a "clean data finding" and a maintenance plan to the U.S. EPA. The clean data finding demonstrates that the standard has been met during a given three-year period, and the maintenance plan demonstrates how the standard will continue to be met in future years.

Because operation of the proposed project can potentially generate additional air pollutant emissions within the region, this analysis estimates the net increase in operational air pollutants in comparison to the existing level of air pollutants from the project site. This analysis also evaluates construction-related impacts to air quality. YSAQMD has established the following standard for evaluating construction and operational impacts as shown below.

- 10 tons per year (tons/yr) of ROG,
- 10 tons/yr of NOx,
- 80 pounds per day (lb/day) of PM_{10}, and
- Violation of a state ambient air quality standard for carbon monoxide (CO)

Discussion

a) In order to evaluate how a project would affect attainment of concentration-based ambient air quality standards, local air pollution control districts and air quality management districts frequently rely on mass-emission-based significance criteria. This is the case with YSAQMD's standard levels, as discussed above, as such are based on achieving concentration-based standards for these pollutants. For example, YSAQMD considers a project that would result in less than 10 tons/yr of ROG or NOx, and less than 80 lb/day of PM_{10} to have a less-than-significant contribution to a violation of an ambient air quality standard. These mass-emission standards are tied to YSAQMD air quality attainment planning efforts of the ambient air quality standards. Thus, it is appropriate to use YSAQMD significance criteria to evaluate how emissions from the proposed project would affect attainment planning efforts.

The proposed project involves constructing improvements to the existing I-80/Richards Boulevard interchange. Proposed land uses would be similar to existing land uses on the project site and therefore would be consistent with the city General Plan land use designations. In addition, as shown in Tables AQ-2 and AQ-3, long-term operational emissions would not exceed applicable YSAQMD standard levels. As stated above, the YSAQMD emission standards are tied to attainment planning efforts, and projects resulting in emissions less than the standard levels would have a less than significant contribution to a violation of the NAAQS. Therefore, implementation of the proposed project would not conflict with or obstruct implementation of any air quality planning efforts. This impact would be **less than significant**.

b) On behalf of Caltrans District 3 and the City of Davis, ESA staff conducted an air quality analysis for the proposed project that included an emissions inventory estimation for the construction and operation of the proposed project. The analysis was conducted in accordance with Caltrans guidance and requirements (Caltrans, 2019).

Construction and operational emissions of criteria air pollutants and precursors were modeled in accordance with Caltrans recommended methodologies using traffic volumes and truck percentages provided by the project's traffic engineers and construction schedule provided by the City. Caltrans CT-EMFAC2014 was utilized to conduct a precursor emissions burden analysis for NOx and reactive organic compounds (ROGs) (for ozone). In addition to its role in ozone formation, NO_X forms NO_2. Thus, modeling NOx emissions can serve as a useful analysis surrogate for NO_2 emissions. For PM_{10}, a comparative emissions analysis was conducted and relied on modeling exhaust emissions from CT-EMFAC and road dust emissions estimates. For $PM_{2.5}$ direct vehicle emissions (exhaust, tire wear, and brake wear from on-road vehicles), follow the same requirements for PM_{10}. Non-direct vehicle emissions of $PM_{2.5}$ (road dust) are typically considered as well. SO_2 and lead are not typically a concern for transportation sources and therefore were not analyzed.

Construction

Site preparation and roadway construction would involve clearing, cut-and-fill activities, grading, removing or improving existing roadways, and paving roadway surfaces. During construction, short-term degradation of air quality is expected from the release of particulate emissions (airborne dust) generated from excavation, grading, hauling, and other activities related to construction. Emissions from construction equipment powered by gasoline and diesel engines are also anticipated and would include CO, NO_X, ROGs, directly emitted PM_{10} and $PM_{2.5}$, and toxic air contaminants (TACs) such as diesel exhaust particulate matter. Construction activities are expected to increase traffic congestion in the area, resulting in an increase in emissions from traffic delays. These emissions would be temporary and limited to the immediate area surrounding the construction site.

The construction period for the proposed project is expected to last for approximately 18 months. Construction emissions were estimated using the latest SMAQMD's Road Construction Emissions Model (RCEM), Version 8.1.0. Construction emissions were estimated for the proposed project using default equipment inventories provided in RCEM, project construction scheduling information provided by the City, and emissions factors from the EMFAC 2014 and OFFROAD models. Construction-related emissions for the proposed project are presented in **Table AQ-1** below.

Based on the modeling conducted, short-term construction emissions would not exceed YSAQMD's applicable standard levels for ROGs and PM_{10}. Although YSAQMD does not have a standard level for $PM_{2.5}$, estimated emissions would be lower than estimated emissions of PM_{10}, and are also included in Table AQ-1. However, NO_X emissions generated by construction activities for the proposed project would exceed the YSAQMD standard level of 10 tons/yr. As a result, this impact would be potentially significant. Implementation of **Mitigation Measure AQ-1** (see page 28) would ensure that NO_X

emissions generated from the construction of the proposed project would not exceed the YSAQMD standard levels and would result in a **less-than-significant-impact**.

TABLE AQ-1
CONSTRUCTION EMISSIONS INVENTORY

Construction Activity	ROG (ton/yr)	NO_x (ton/yr)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Clearing/Grubbing	>1	>1	21	5
Grading/Excavation	2	22	25	9
Drainage/Utilities	>1	4	23	7
Paving	>1	>1	>1	>1
Maximum daily or average daily	2	27	25	9
YSAQMD Standard Levels	**10**	**10**	**80**	**NA**
Exceed Standard Levels	**No**	**Yes**	**No**	**NA**

NOTES:
Totals may not add up exactly due to rounding in the modeling calculations.
Standard levels established by the YSAQMD.
lb/day = pounds per day; NA = No; NO_X = oxides of nitrogen; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; ROG = reactive organic gases; YSAQMD = Yolo Solano Air Quality Management District; yr = year

SOURCE: ESA, 2019.

Operation

The purpose of the proposed project is to reduce congestion, improve traffic operations, accommodate travel demand due to planned and approved developments, and improve safety for all modes of travel, including bicycles and pedestrians. An air quality analysis has been conducted to assess changes in air quality created by the operation of the project on the surrounding area. Potential air quality impacts from the operation of the project are primarily associated with the redistribution of vehicles on the new interchange along I-80 at Richards Boulevard, local street improvements, and the closing of the Olive Drive off-ramp. Impacts generated from the redistribution of traffic include incremental changes to VMT and average daily traffic (ADT). Changes in these traffic patterns along the roadway could potentially change the overall concentrations of pollutant levels from vehicle exhaust emissions throughout the project area.

Operation-related emissions have been assessed on a regional and project level. Operational emissions take into account long-term changes in emissions due to the project (excluding the construction phase). The operational emissions analysis compares forecasted emissions for existing/baseline and future analysis years 2022 (opening year) and 2042 (design year) with the proposed project. CT-EMFAC was used to calculate operational emissions. CT-EMFAC is a California-specific project-level analysis tool for modeling emissions of criteria pollutants, MSATs, and carbon dioxide from on-road vehicles. This model reflects CARB's current understanding of how vehicles travel and how much they pollute. The results of the comparative emissions analysis are provided below in **Table AQ-2** and **Table AQ-3**.

TABLE AQ-2
2022 PROPOSED PROJECT OPERATIONAL EMISSIONS INVENTORY

Scenario/Analysis Year	ROG (ton/yr)	NO_x (ton/yr)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Baseline (Existing Conditions) 2016	42	165	70	35
2022 with Project	27	100	70	31
Net Change in Emissions (With Project minus Baseline)	(15)	(65)	0	(3)
YSAMQD Standard Levels	**10**	**10**	**80**	**NA**

NOTES:
Totals may not add up exactly due to rounding in the modeling calculations.
Standard levels established by the YSAQMD.
lb/day = pounds per day; NA = No; NO_X = oxides of nitrogen; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; ROG = reactive organic gases; YSAQMD = Yolo Solano Air Quality Management District; yr = year
SOURCE: ESA, 2019.

TABLE AQ-3
2042 PROPOSED PROJECT OPERATIONAL EMISSIONS INVENTORY

Scenario/Analysis Year	ROG (ton/yr)	NO_x (ton/yr)	PM_{10} (lb/day)	$PM_{2.5}$ (lb/day)
Baseline (Existing Conditions) 2016	42	165	70	35
2042 with Project	18	58	82	34
Net Change in Emissions (With Project minus Baseline)	(25)	(107)	12	(<1)
YSAMQD Standard Levels	**10**	**10**	**80**	**NA**

NOTES:
Totals may not add up exactly due to rounding in the modeling calculations.
Standard levels established by the YSAQMD.
lb/day = pounds per day; NA = No; NO_X = oxides of nitrogen; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; ROG = reactive organic gases; YSAQMD = Yolo Solano Air Quality Management District; yr = year
SOURCE: ESA, 2019.

Existing (2016) emissions in the project corridor were estimated using CT-EMFAC2014 emission factors, for comparison to the future analysis years 2022 and 2042. Based on the modeling conducted, the net increase in long-term operational emissions would not exceed YSAQMD's applicable standard levels. Although YSAQMD does not have a standard level for $PM_{2.5}$, estimated emissions would be lower than estimated emissions of PM_{10} and would not contribute substantially to existing or projected air quality. Future with project emissions would be less than existing conditions for ROG, NO_2, and $PM_{2.5}$. This decrease is due to the decrease in delays on the I-80 travel lanes and local roadway intersections, which generally result in lower emission rates. Thus, operational emissions generated by the proposed project would not violate or contribute substantially to an existing or projected air quality violation, including the nonattainment status of Yolo County for ozone, PM_{10}, and $PM_{2.5}$. As a result, this impact would be **less than significant**.

c) ***Construction***

As previously discussed, the proposed project would not exceed the YSAQMD standard levels during construction with implementation of **Mitigation Measure AQ-1** (see page 27) and would likely not cause or contribute to the exposure of sensitive receptors to ground-level concentrations in excess of health-protective levels.

Toxic Air Contaminants

Intermittent construction activities associated with the proposed project would result in short-term emissions of diesel particulate matter, which the state has identified as a toxic air contaminant (TAC). During construction, the exhaust of off-road heavy-duty diesel equipment would emit diesel particulate matter during general construction activities, such as site grading, excavation, materials transport and handling, and paving.

Diesel particulate matter poses a carcinogenic health risk that is generally measured using an exposure period of 30 years for sensitive residential receptors, according to the California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA) *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (OEHHA Guidance), which was updated in 2015 with new exposure parameters including age sensitivity factors (OEHHA 2015). The closest sensitive receptors (multi-family residences) are located approximately 50 feet from the westbound I-80/Richards Boulevard off-ramp. However, as presented in Table AQ-1 above, diesel particulate matter emissions (strongly correlated with $PM_{2.5}$ emissions) are less than significant. Although the localized analysis does not directly measure health risk impacts, it does provide data that can be used to evaluate the potential to cause health risk impacts. The very low level of $PM_{2.5}$ emissions coupled with the short-term duration of construction activity resulted in an overall low level of diesel particulate matter concentrations in the project area. Furthermore, compliance with the CARB airborne toxic control measures (ATCM) anti-idling measure, which limits idling to no more than 5 minutes at any location for diesel-fueled commercial vehicles, would further minimize diesel particulate matter emissions in the project area. Sensitive receptors would be exposed to emissions below standard levels, and construction TAC impacts would be **less than significant**.

Operation

Carbon Monoxide Hotspot Analysis

The Caltrans CO Protocol has been recommended for use by several air pollution control districts in their CEQA analysis guidance documents and is used for the proposed project since the key criterion (8-hour concentration) is similar: 9 ppm for the federal standard and 9.0 ppm for the state’s standard. The CO Protocol was developed for project-level conformity (hot-spot) analysis and was approved for use by the U.S. EPA in 1997. It provides qualitative and quantitative screening procedures, as well as quantitative (modeling) analysis methods to assess project-level CO impacts. The qualitative screening step is designed to avoid the use of detailed modeling for projects that clearly cannot cause a violation, or worsen an existing violation, of the CO standards.

The project is located in a CO attainment area. However, future traffic volumes would increase from existing conditions; therefore, a CO hot-spot analysis was conducted to demonstrate that the transportation activities associated with the project would not cause new air quality violations, worsen existing violations, or delay timely attainment of the NAAQS. The proposed project is not included in the exempt projects list from Table 2 of 40 CFR 93.126. Therefore, to determine the CO modeling requirements for new projects the proposed project must utilize the first flow chart provided in the Caltrans guidance document, *Transportation Project-Level Carbon Monoxide Protocol* (CO Protocol) (UCD, 1997).

Sections 3 and 4 of the CO Protocol describe the methodology for determining whether a CO hot-spot analysis is required. The Protocol provides two conformity requirement decision flowcharts that are designed to assist project sponsors in evaluating the requirements that apply to their project. The flowchart for the CO Protocol applies to new projects and was used for the proposed project. The flowchart can be found in Appendix C of the CO Protocol. Below is a step-by-step explanation of the applicable flowchart. Each level cited is followed by a response, which in turn determines the next applicable level of the flowchart for the project.

3.1.1: Is the project exempt from all emissions analysis?

Response: No, this project is not exempt from all emissions analysis. This proposed project type is not listed in Table 2 of the 40 CFR 93.126.

3.1.2: Is the project exempt from regional emissions analysis?

Response: Yes, this project is exempt from all regional emissions analysis. This proposed project type is listed in Table 3 of the 40 CFR 93.127.

3.1.9: Examine local impacts. Proceed to Section 4.

On the basis of the answers to the first flow chart, a second flow chart is used to determine the level of local CO impact analysis required for the project. The questions applicable to the project in the second flowchart and the answers to those questions are as follows:

Level 1: Is the project in a CO nonattainment area?

Response: No, as shown previously stated, the Basin is classified as an attainment area for the federal CO standards.

Level 1: Was the area redesignated as “attainment” after the 1990 Clean Air Act?

Response: Yes, the Sacramento urbanized area was redesignated to attainment in 1998.

Level 1: Has "continued attainment" been verified with the local Air District, if appropriate?

Response: Yes, "continued attainment" has been verified with the local Air District. (Proceed to Level 7)

Level 7: Does the project worsen air quality?

Response: According to the CO Protocol, the following criteria should be used to determine whether a project is likely to worsen air quality for the area substantially affected by the project:

1. The project significantly increases the percentage of vehicles operating in cold start mode. Increasing the number of vehicles operating in cold start mode by as little as 2 percent should be considered potentially significant.
   a. The proposed project is not expected to increase the percentage of vehicles operating in cold start mode. The traffic study developed for the proposed project found that the average annual daily traffic (AADT) for the no project and with project conditions in the future opening year (2022) will remain the same. Traffic volumes will increase from opening year to design year. However, no project and with project traffic volumes in the design year (2042) are the same. The proposed project is not expected to increase the number of vehicles traveling on the road; rather the proposed project is expected to relieve congestion, improve traffic flow, and provide safer travel through the I-80/Richards Boulevard Interchange area.

2. The project significantly increases traffic volumes. Increase in traffic volumes in excess of 5 percent should be considered potentially significant. Increasing the traffic volumes by less than 5 percent may still be potentially significant if there is also a reduction in average speeds.
   a. The implementation of the proposed project would not increase traffic volumes within the proposed project area in comparison to the no project conditions. As stated previously, the AADT for the no project and with project conditions in the future opening year (2022) and design year (2042) are the same are the same.

3. The project worsens traffic flow. For uninterrupted roadway segments, a reduction in average speeds (within a range of 3 to 50 mph) should be regarded as worsening traffic flow. For intersection segments, a reduction in average speed or an increase in average delay should be considered as worsening traffic flow.
   a. According to the project's traffic analysis the traffic volumes for the with-project conditions are the same as the no project conditions except for reassigning traffic based on the new roadway configuration.

      Compared to baseline (existing) conditions, the opening year volumes for the no project conditions show an increase of about 200 vehicles per hour during the peak hours for Richards Boulevard between I-80 and Olive Drive.

      Under the no project conditions, the higher forecasted volumes at Richards Boulevard/Olive Drive would worsen operations from level of service (LOS) E to F during the AM peak hour for construction year conditions. The other study intersections would continue to operate with the same LOS as under existing conditions. During the PM peak hour, increasing volume on the eastbound off-ramp would result in worse operations with LOS E degrading to LOS F at the I-80 Eastbound Ramps intersection. Similarly, the Research Park Drive intersection operations would worsen from LOS D to E, and the other study intersections would operate the same or better than under existing conditions.

Under the with-project conditions, additional capacity at the Richards Boulevard/ Olive Drive intersection would reduce vehicle delays compared to the proposed project. Operations would improve from LOS F to D during the AM peak hour and LOS E to D during the PM peak hour. The reconstructed and signalized I-80 Westbound Ramps intersection would operate with LOS C conditions during both peak hours. The addition of a second left-turn lane on the eastbound off-ramp would improve the I-80 Eastbound Ramps intersection from LOS F to C during the PM peak hour. All study intersections would have LOS D or better operations under the proposed project.

The results of the CO Protocol flowchart demonstrate that the proposed project does not require a quantitative hot-spot analysis to demonstrate conformity.

In addition, a PM Conformity Hot Spot Analysis Project Summary Form was drafted and submitted by email to Shengyi Gao of the Sacramento Area Council of Governments (SACOG) on June 25, 2018. Mr. Gao then distributed the PM Conformity Form to the members of the Interagency Group for review. The Interagency Group determined the proposed project is not a Project of Air Quality Concern (POAQC). Mr. Gao emailed the Interagency Group determination on September 10, 2018 (see **Appendix A**).

Thus, the project would not contribute considerably to the formation of CO hotspots and no further CO analysis is required. The project would result in a **less-than-significant impact** with respect to CO hotspots.

Mobile Source Air Toxics Analysis (MSATs)

FHWA released updated guidance in October 2016 (FHWA, 2016) for determining when and how to address MSAT impacts in the NEPA process for transportation projects. FHWA identified three levels of analysis:

- No analysis for exempt projects or projects with no potential for meaningful MSAT effects;
- Qualitative analysis for projects with low potential MSAT effects; and
- Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

Projects with high potential MSAT effects include those that:

- Create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of Diesel Particulate Matter in a single location; or
- Create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the AADT

is projected to be in the range of 140,000 to 150,000, or greater, by the design year; and

- Are proposed to be located in proximity to populated areas or, in rural areas, in proximity to concentrations of vulnerable populations (i.e., schools, nursing homes, hospitals).

Upon review of the traffic data from the project's traffic study and the FHWA guidance categories described above, the project could potentially have a high MSAT effect. The future design year (2042) AADT volumes remain the same between future No Build and Build conditions; however, AADT volumes increase from existing (2016) conditions to future design year (2042) by nearly 50,000 vehicles. Additionally, the AADT in the future design year conditions (2042) is estimated to be greater than 150,000. Therefore, a quantitative analysis is appropriate for assessing air quality impacts from operation of the project.

The latest version of CT-EMFAC, CT-EMFAC2014 released in May 2017, was used to estimate emissions of benzene, 1,3-butadiene, formaldehyde, acrolein, naphthalene, DPM, and POM. Traffic activity data were estimated for each different period of a representative day in the baseline, opening (2022), and horizon (2042) years. Emissions were estimated for all MSATs using CT-EMFAC, based on EMFAC and speciation factors provided by CARB and U.S. EPA. The results of the comparative MSAT emissions analysis are provided below in **Table AQ-4**. The result of the comparative MSAT emission analysis show that future toxic emissions will decrease from baseline (existing) conditions. Thus, the project would result in a **less-than-significant impact** with respect to MSATs.

TABLE AQ-4
SUMMARY OF COMPARATIVE MSAT EMISSIONS ANALYSIS

Scenario/ Analysis Year	1,3-butadiene (lbs/day)	Acetal-dehyde (lbs/day)	Acrolein (lbs/day)	Benzene (lbs/day)	Diesel PM (lbs/day)	Ethyl-benzene (lbs/day)	Formal-dehyde (lbs/day)	Naph-thalene (lbs/day)	Polycyclic Organic Matter (lbs/day)
Baseline (Existing Conditions) 2016	4	6	4	8	10	5	10	4	4
2022 with Project	4	4	4	4	4	4	6	4	4
2042 with Project	4	4	4	4	4	4	6	4	4

NOTES:
MSAT = mobile source air toxic; lb/day = pounds per day; PM = particulate matter

SOURCE: ESA, 2019.

d) Projects that are typically associated with odor complaints typically include agricultural uses, wastewater treatment plants, food processing plants, chemical plants, composting, refineries, landfills, dairies, and fiberglass molding. The proposed project does not include these elements that are typically associated with odor generation.

During construction, exhaust from equipment and activities associated with the application of pavement, finishes, or paints may produce discernible odors typical of most construction sites. Such odors would be temporary sources of nuisance to adjacent uses and would not affect a substantial number of people. Odors associated with construction would be temporary and intermittent in nature. Consequently, this impact would be **less than significant**.

Mitigation Measures

Mitigation Measure AQ-1: Construction Equipment Requirements.

All construction equipment shall be CARB Tier 4 Certified or better.

References

California Department of Transportation (Caltrans), 2019. Air Quality Report for Richards Boulevard/Interstate-80 Interchange Improvements Project in the City of Davis, Yolo County (EA: 03-0H360; EFIS Project ID: 0315000148). Prepared by ESA for Caltrans District 3. June 2019.

California Environmental Protection Agency, Office of Environmental Health Hazard Assessment (OEHHA), 2015. Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. Available: https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf.

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Federal Highway Administration (FHWA), 2016. Updated Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents. Available: https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/msat/.

Fehr & Peers, 2018. Transportation Analysis Report, Interstate 80/Richards Boulevard Interchange. Prepared for City of Davis. June 2018.

Sacramento Area Council of Governments (SACOG), 2019. 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy, Adopted November 18, 2019. Available: https://www.sacog.org/2020-metropolitan-transportation-plansustainable-communities-strategy.

University of California, Davis (UCD), 1997. Transportation Project-Level Carbon Monoxide Protocol. December 1997. Available: https://dot.ca.gov/-/media/dot-media/programs/environmental-analysis/documents/env/co-protocol-searchable-a11y.pdf.

Yolo-Solano Air Quality Management District (YSAQMD), 2019. Triennial Assessment and Plan Update. May 2019. Available: https://www.ysaqmd.org/wp-content/uploads/2021/01/2015-17-Triennial-Plan-Final-Board-Approved.pdf.

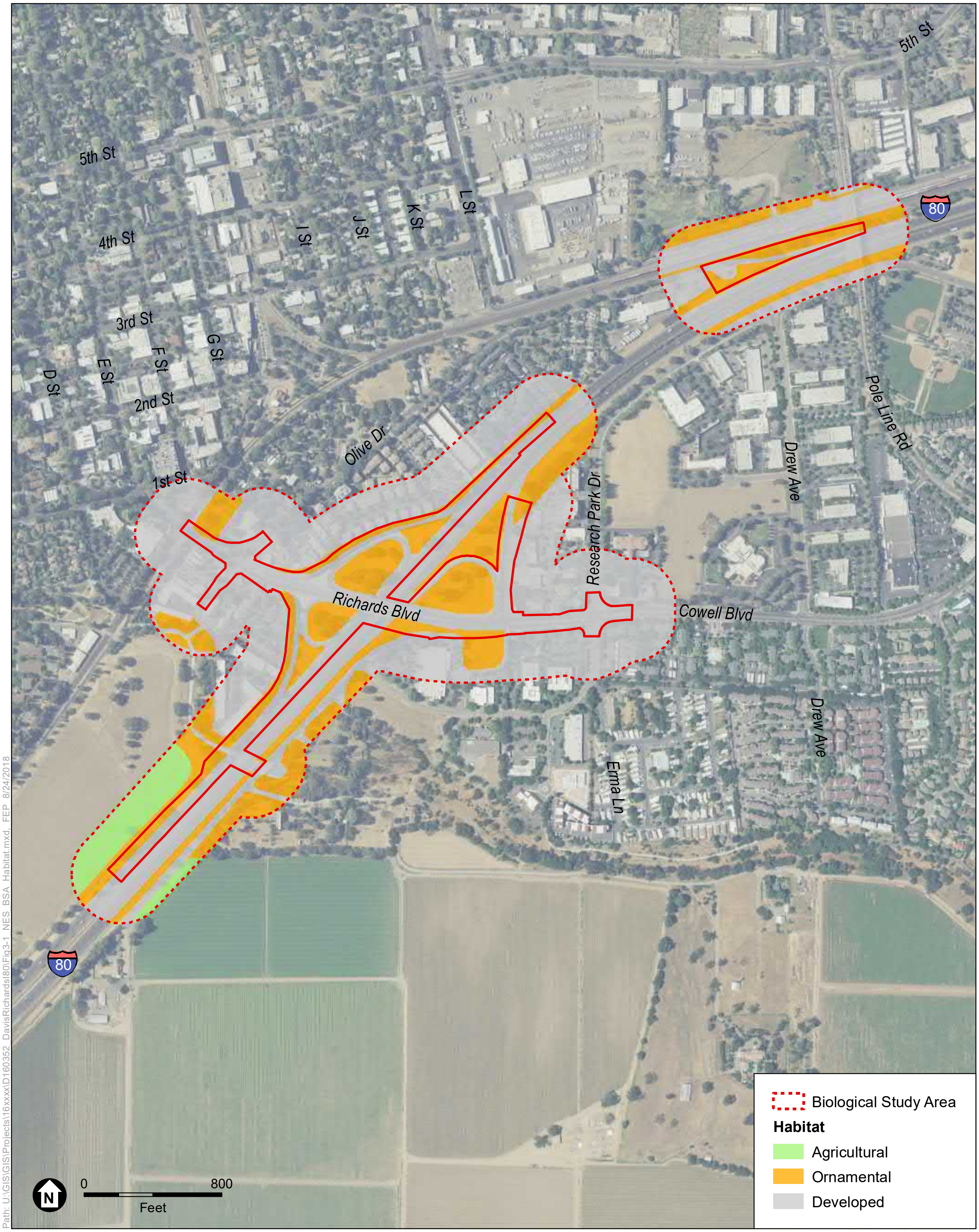
Biological Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES — Would the project:				
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 U.S. Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	☐	☒	☐	☐
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☒	☐	☐
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?	☐	☒	☐	☐

Study Methods

On May 4, 2018, an Environmental Science Associates biologist conducted a general biological survey within the Biological Study Area (BSA) for the proposed project. The BSA includes the Project Impact Area (PIA) and a surrounding 250-foot area (see **Figure 8**). Prior to field surveys, satellite imagery and aerial photographs were analyzed to locate potential sensitive biological resources. Surveys were conducted by walking the entire BSA where entry was permitted and evaluating the potential for regionally occurring sensitive habitats (including jurisdictional waters of the U.S. and state) and special-status species to occur within the BSA. Plant communities and habitats were recorded onto a rectified aerial photograph, and all plant species encountered were identified and recorded. There were a number of locations within the BSA that were not accessible to biologists during the field surveys, including most private properties throughout the BSA. Biologists used a combination of aerial interpretation and binoculars to survey habitats within these locations.

Prior to field surveys, wetland spatial data was obtained from the portions of a previously U.S. Army Corps of Engineers (USACE)-verified wetland delineation for the USACE Six County Aquatic Resource Inventory (SCARI) (USACE, 2011). The boundaries of these features were then examined in the field to determine if they were present in the BSA.



SOURCE: USDA, 2016; ESRI, 2012; ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 8
Habitats within the Biological Study Area

ESA

Queries of the United States Fish and Wildlife Service (USFWS) Information, Planning, and Consultation System (IPaC); National Marine Fisheries Service (NMFS); California Natural Diversity Database (CNDDB); and California Native Plant Society (CNPS) databases were conducted to create a list of special-status species with the potential to occur in the project area and surrounding area. The results of the database inquiries are included in **Appendix B** to this initial study.

For the purposes of this initial study, special-status species are generally defined as follows:

- Plant and wildlife species listed or proposed for listing as threatened or endangered under the federal Endangered Species Act (FESA).
- Plant and wildlife species that are candidates for possible future listing as threatened or endangered under the FESA (80 FR 80584-80614, December 24, 2015).
- Plant and wildlife species that meet the definition of rare or endangered species under the California Environmental Quality Act (CEQA), or are considered sensitive or unique by the scientific community, or occur at the limits of its natural range (CEQA Guidelines, Section 15380).
- Plants considered by the CNPS and the California Department of Fish and Wildlife (CDFW) to be “rare, threatened, or endangered” in California (California Rare Plant Rank 1A, 1B and 2 [CNPS, 2022]).
- Plants listed or proposed for listing by the State of California as threatened or endangered under the California Endangered Species Act (CESA) (14 CCR 670.5).
- Plants listed under the California Native Plant Protection Act (California Fish and Game Code [CFGC] 1900 et seq.).
- Plants considered sensitive by other federal agencies (i.e., U.S. Forest Service, Bureau of Land Management) or state and local agencies or jurisdictions.
- Wildlife species that are listed or proposed for listing under CESA (CFGC 1992 Sections 2050 et seq.; 14 CCR Sections 670.1 et seq.).
- Wildlife species that are designated as Species of Special Concern (SSC) by CDFW.
- Wildlife species that are designated as Fully Protected by CDFW (CFGC, Section 3511, 4700, 5050, and 5515).
- Species addressed in the Yolo Habitat Conservation Plan/Natural Community Conservation Plan (Yolo HCP/NCCP) (Yolo Habitat Conservancy, 2018).

Environmental Setting

The BSA is located within the southern portion of the City of Davis. Land uses within and adjacent to the BSA consist of a mix of residential, commercial, industrial, agriculture, and open space/public parks.

The BSA is situated on the broad, flat alluvial plain of the Sacramento River, and terrain is generally flat. Elevations of the BSA range from approximately 35 to 50 feet above mean sea level. Climate is typically hot and sub-humid. Data from the Western Regional Climate Center for the Davis 2 WSW Exp Farm weather station indicates that average annual precipitation is

17.55 inches. The average maximum annual temperature is 74.7 degrees (F) and average minimum annual temperature is 46.0 degrees (F).

The project site is located in the City of Davis within the Sacramento Valley floristic province of the Great Central Valley. Historically, the region supported extensive marshes, riparian woodland intermixed with oak woodland, vernal pool complexes, and native grasslands. Intensive agricultural and urban development has resulted in substantial changes and conversions of these habitats. The remaining native vegetative communities exist now as isolated remnant patches within urban and agricultural landscapes.

Habitat

Developed habitat comprises the majority of the BSA and consists of paved or otherwise developed areas where native vegetation does not grow. Ornamental vegetation associated with the BSA consists of trees and understory grassland along road shoulders and within undeveloped lots and open areas. In addition, some areas of agricultural land were noted within the BSA. Habitat types within the BSA are depicted on Figure 8. Acreages for habitat types within the BSA and project site are provided in **Table BIO-1**.

TABLE BIO-1
HABITAT TYPES WITHIN THE BSA AND PROJECT SITE

Habitat Type	BSA[1] (acres)	Project Site (acres)
Developed	85.21	18.48
Ornamental	34.97	11.75
Agricultural	4.74	0.00

NOTES:
1 Habitat acreages in the BSA include acreages from the project site.
SOURCE: Caltrans, 2019.

Special-Status Plants

Based on the review of existing information, including a search of the CNDDB, CNPS, and USFWS species lists, and species distribution and habitat requirements data, 21 special-status plant species were identified as having potential to occur in the vicinity of the project. Special-status plant species and rationale for their presence or absence and likelihood of occurrence within the BSA is provided in **Table BIO-2**. None of the species have the potential to occur within the project area or be affected by project construction. There is no critical habitat for any special-status plant species in the BSA.

Special-Status Wildlife

Based on the review of existing information, including a search of the CNDDB, USFWS, and NMFS species lists, and species distribution and habitat requirements data, 42 special-status wildlife species were identified during the pre-field review as occurring or having the potential to occur within the BSA. The listing status, preferred habitat, and potential for occurrence in the BSA for each of these species are provided in **Table BIO-3**.

TABLE BIO-2
SPECIAL-STATUS PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1] Federal/State/ CRPR	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rationale
Ferris' milk-vetch *Astragalus tener var. ferrisiae*	--/--/1B.1	Butte, Colusa, Glenn, Solano, Sutter, and Yolo counties.	Meadows and seeps (vernally mesic); subalkaline flats in grasslands. 0 – 250 feet.	April - May	Habitat Absent	Absent	No suitable habitat within the BSA. There are two CNDDB occurrences within five miles of the BSA.
alkali milk-vetch *Astragalus tener var. tener*	--/--/1B.2	Alameda, Contra Costa, Merced, Monterey, Napa, San Benito, Santa Clara, San Francisco, San Joaquin, Solano, Sonoma, Stanislaus, and Yolo counties.	Adobe clay soils in playas and vernal pools in valley and foothill grasslands. 0 – 200 feet.	March - June	Habitat Absent	Absent	No suitable habitat within the BSA. There are five CNDDB occurrences within five miles of the BSA.
Heartscale *Atriplex cordulata var. cordulata*	--/--/1B.2	Alameda, Butte, Colusa, Contra Costa, Fresno, Glenn, Kern, Madera, San Joaquin, Solano, Stanislaus, Tulare, and Yolo counties.	Saline or alkaline soils in chenopod scrub, meadows and seeps, and sandy grasslands. 0 – 1850 feet.	April - October	Habitat Absent	Absent	No suitable habitat within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Brittlescale *Atriplex depressa*	--/--/1B.2	Alameda, Contra Costa, Colusa, Fresno, Glenn, Kern, Merced, Solano, Stanislaus, Tulare, and Yolo counties.	Alkaline clay soils in vernal pools, playas, chenopod scrub, meadows and seeps, and grasslands. 0 – 1050 feet.	April - October	Habitat Absent	Absent	No suitable habitat within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Bristly sedge *Carex comosa*	--/--/2B.1	Known occurrences in Contra Costa, Lake, Mendocino, Sacramento, San Bernardino, Santa Cruz, San Francisco, Shasta, San Joaquin, and Sonoma counties.	Marshes and swamps. Lake margins, wet places. 0 – 2050 feet.	May - September	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Pappose tarplant *Centromadia parryi subsp. parryi*	--/--/1B.2	Butte, Los Angeles, Merced, San Bernardino, Sonoma and Sutter counties.	Marshes and swamps (freshwater). 50 – 900 feet.	July - October	Habitat Absent	Absent	No suitable habitat within the BSA. There is one CNDDB occurrences within five miles of the BSA.
Palmate-bracted bird's-beak *Chloropyron palmatum*[2]	FE/SE/1B.1	Alameda, Colusa, Fresno, Glenn, Madera, San Joaquin, and Yolo counties.	Alkaline soils in chenopod scrub and grasslands. 15 – 500 feet.	May - October	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Jepson's coyote-thistle *Eryngium jepsonii*	--/--/1B.2	Alameda, Amador, Calaveras, Contra Costa, Fresno, Napa, San Mateo, Solano, Stanislaus, Tuolumne, and Yolo counties.	Clay soil in vernal pools. 10 – 1000 feet.	April - August	Habitat Absent	Absent	No suitable habitat within the BSA. There is one CNDDB occurrence within five miles of the BSA.

TABLE BIO-2
SPECIAL-STATUS PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1] Federal/State/ CRPR	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rationale
San Joaquin spearscale *Extriplex joaquinana*	--/--/1B.2	Alameda, Contra Costa, Colusa, Fresno, Glenn, Merced, Monterey, Napa, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Solano, Tulare, and Yolo counties.	Alkaline soil in chenopod scrub, playas, meadows and seeps, and grasslands. 1 – 2750 feet.	April - October	Habitat Absent	Absent	No suitable habitat within the BSA. There are three CNDDB occurrences within five miles of the BSA.
Adobe-lily *Fritillaria pluriflora*	--/--/1B.2	Butte, Colusa, Glenn, Lake, Napa, Solano, Tehama, and Yolo counties.	Adobe soil in chaparral, cismontane woodland, and grasslands. 200 – 2300 feet.	February - April	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Woolly rose-mallow *Hibiscus lasiocarpos var. occidentalis*	--/--/1B.2	Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo counties.	Marshes and swamps (freshwater). Moist, freshwater-soaked river banks & low peat islands in sloughs; can also occur on riprap and levees). 0 – 390 feet.	June - September	Habitat Present	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Heckard's pepper-grass *Lepidium latipes var. heckardii*	--/--/1B.2	Glenn, Merced, Sacramento, Solano, and Yolo counties.	Alkaline flats in valley and foothill grasslands. 7 – 650 feet.	March - May	Habitat Absent	Absent	No suitable habitat within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Mason's lilaeopsis *Lilaeopsis masonii*	--/SR/1B.1	Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, Solano, and Yolo counties.	Marshes and swamps (freshwater or brackish) and riparian scrub. 0 – 30 feet.	April - November	Habitat Present	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Baker's navarretia *Navarretia leucocephala subsp. bakeri*	--/--/1B.1	Colusa, Glenn, Lake, Lassen, Mendocino, Marin, Napa, Solano, Sonoma, Sutter, Tehama, and Yolo counties.	Mesic sites in cismontane woodland, lower montane coniferous forest, meadows and seeps, vernal pools, and grasslands. 15 – 5700 feet.	April - July	Habitat Present	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Colusa grass *Neostapfia colusana*	FT/SE/1B.1	Colusa, Glenn, Merced, Solano, Stanislaus, and Yolo counties	Large, adobe vernal pools. 15 – 600 feet.	May - August	Habitat Absent	Absent	No suitable habitat within the BSA. There are three CNDDB occurrences within five miles of the BSA.

TABLE BIO-2
SPECIAL-STATUS PLANT SPECIES WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1] Federal/State/ CRPR	Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Survey Results/Rationale
Bearded popcornflower *Plagiobothrys hystriculus*	--/--/1B.1	Napa, Solano, and Yolo counties.	Vernal swales, vernal pool margins, and mesic sites in grasslands. 0 – 900 feet.	April - May	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
California alkali grass *Puccinellia simplex*	--/--/1B.2	Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Lake, Los Angeles, Madera, Merced, Napa, San Bernardino, Santa Clara, Santa Cruz, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo counties.	Alkaline, vernally mesic sinks, flats, and lake margins. 0 – 300 feet.	March - May	Habitat Absent	Absent	No suitable habitat within the BSA. There are five CNDDB occurrences within five miles of the BSA.
Keck's checkerbloom *Sidalcea keckii*	--/--/1B.2	Fresno, Glenn, Lake, Merced, and Tulare counties. Occurrence confirmed, but possibly extirpated from Colusa, Napa, Solano, and Yolo counties.	Serpentine, clay soils of cismontane woodland and valley and foothill grassland. 245 – 2135 feet.	April = May (sometimes June)	Habitat Absent	Absent	No suitable soils in the BSA. There are no CNDDB occurrences within five miles of the BSA.
Suisun Marsh aster *Symphyotrichum lentum*	--/--/1B.2	Contra Costa, Napa, Sacramento, San Joaquin, and Yolo counties.	Marshes and swamps (brackish and freshwater). 0 – 10 feet.	April - November	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Saline clover *Trifolium hydrophilum*	--/--/1B.2	Alameda, Contra Costa, Lake, Monterey, Napa, Sacramento, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Solano, Sonoma and Yolo counties.	Marshes and swamps, valley and foothill grassland (mesic, alkaline), and vernal pools. 0 – 985 feet.	April - June	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Solano grass *Tuctoria mucronata*	FE/SE/1B.1	Solano and Yolo counties.	Vernal pools. 15 – 30 feet.	April - August	Habitat Absent	Absent	No suitable habitat within the BSA. There are two CNDDB occurrences within five miles of the BSA.

Table BIO-2
Special-status Plant Species with the Potential to Occur in the Biological Study Area

NOTES:

[1] Status explanations:

-- = no listing.

Federal

FE = listed as endangered under the federal Endangered Species Act.
FT = listed as threatened under the federal Endangered Species Act.

State

SE = listed as endangered under the California Endangered Species Act.
SR = listed as rare under the California Endangered Species Act.
ST = listed as threatened under the California Endangered Species Act.

California Rare Plant Ranks

1B = Rank 1B species: rare, threatened, or endangered in California and elsewhere.
2B = Rank 2B species: rare, threatened, or endangered in California but more common elsewhere.
0.1 = Seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)
0.2 = Moderately threatened in California (20%-80% occurrences threatened/moderate degree and immediacy of threat)
0.3 = Not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known)

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Invertebrates								
Conservancy fairy shrimp *Branchinecta conservatio*	FE	--	Northern two-thirds of the Central Valley.	Large, turbid vernal pools.	November-April for active shrimp, April-November for cysts	Habitat Absent	Absent	Habitat not present within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Vernal pool fairy shrimp *Branchinecta lynchi*	FT	--	Central Valley, Central and South Coast Ranges from Tehama County to Santa Barbara County; isolated populations also in Riverside County and southern Oregon	Vernal pools and seasonal wetlands; also found in sandstone rock outcrop pools.	November-April for active shrimp, April-November for cysts	Habitat Absent	Absent	Habitat not present within the BSA. There are two CNDDB occurrences within five miles of the BSA.
Midvalley fairy shrimp *Branchinecta mesovallensis*	--	--	Central Valley.	Vernal pools in the Central Valley.	November-April for active shrimp, April-November for cysts	Habitat Absent	Absent	Habitat not present within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Monarch – California overwintering population *Danaus plexippus* pop. 1	FC	--	Overwintering sites occur along the Pacific coast from Mendocino County, CA to Baja California, Mexico, typically within 1.5 miles of the Pacific Ocean or San Francisco Bay. Small aggregations inland have been reported in Inyo and Kern counties, CA.	Overwintering sites include dappled sunlight, high humidity, access to fresh water, and an absence of freezing temperatures or high winds. Tree species most commonly used for roosting are blue gum eucalyptus (*Eucalyptus globulus*), Monterey pine (*Pinus radiata*), and Monterey cypress (*Cupressus macrocarpa*). Milkweed (*Asclepias* spp.) is it obligate larval host plant during the breeding season.	Year-round for adults; spring and summer for larva and pupa	Habitat Absent	Absent	Habitat not present within the BSA. There are no CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*[2]	FT	--	Central Valley and surrounding foothills below 1,500 feet elevations	Dependent on elderberry (*Sambucus nigra*) shrubs as a host plant; potential habitat is shrubs with stems one inch in diameter within Central Valley.	Year-round for host plant and exit holes	Habitat Present	Assumed Present	17 elderberry shrubs and shrub clusters are known to occur within the BSA, with 13 occurring in the PIA. There is one CNDDB occurrence within five miles of the BSA. However, elderberry shrubs will not be impacted by the project. No ground disturbing activities are proposed within 30 feet of elderberry shrubs.
Vernal pool tadpole shrimp *Lepidurus packardi*	FE	--	Central Valley from Shasta County south to Merced County	Vernal pools, vernal lakes, and other seasonal wetlands.	November-April for active shrimp, April-November for cysts	Habitat Absent	Absent	Habitat not present within the BSA. There are three CNDDB occurrences within five miles of the BSA.
California linderiella *Linderiella occidentalis*	--	--	Sacramento Valley	Seasonal pools in unplowed grasslands with old alluvial soils underlain by hardpan or in sandstone depressions. Water in the pools has very low alkalinity, conductivity, and total dissolved solids (TDS).	November-April for active shrimp, April-November for cysts	Habitat Absent	Absent	Habitat not present within the BSA. There are three CNDDB occurrences within five miles of the BSA.
Amphibians								
California tiger salamander *Ambystoma californiense* pop. 1[2]	FT	ST	Central Valley, including Sierra Nevada foothills up to 1,500 feet. The Cosumnes River marks the northern boundary of the species' range, with the exception of an isolated in the Dunnigan Hills in northern Yolo County.	Annual grasslands and valley-foothill woodlands; breeds in seasonal wetlands such as vernal pools and swales. Burrows in underground refugia such as small mammal burrows.	January-May (aquatic)	Habitat Absent	Absent	Habitat is not present within the BSA. There is one CNDDB occurrence within five miles of the BSA.
California red-legged frog *Rana draytonii*	FT	ST	Along the coast and coastal mountain ranges of California from Marin County to San Diego County and in the Sierra Nevada from Tehama County to Fresno County.	Permanent and semi-permanent aquatic habitats, such as creeks and ponds with emergent and submergent vegetation; may aestivate in upland burrow during dry periods.	Year-round	Habitat Absent	Absent	Habitat is not present within the BSA. Not within the known range for the species. There are no CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Western spadefoot *Spea hammondii*	--	SSC	Historically occurred in the Central Valley and bordering foothills across southern California from Shasta County south into northwestern Baja California, including the Coast Ranges south of Monterey, from sea level to 4,500 feet. Today, virtually extirpated from the Sacramento Valley.	Occurs in grasslands, oak woodlands, coastal sage scrub, and chaparral vegetation in washes, floodplains, alluvial fans, playas, and alkali flats. Ephemeral pools lasting approximately 11.5 weeks are essential for breeding and egg-laying.	Eggs and larvae in ephemeral water bodies in spring and early summer, dependent on rain year; adults after rain events in late winter or spring, typically at night as species is nocturnal.	Habitat Absent	Absent	No suitable habitat is present within the BSA. There are no CNDDB occurrence within five miles of the BSA.
Reptiles								
Western pond turtle *Actineymys marmorata*[2]	--	SSC	Populations extend throughout the coast and Central Valley of California.	Ponds, marshes, rivers, streams and irrigation ditches with aquatic vegetation below 6,000 feet in elevation.	Year-round	Habitat Absent	Absent	No suitable habitat is present within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Giant garter snake *Thamnophis gigas*[2]	FT	ST	Central Valley from Fresno County north to the Gridley/ Sutter Buttes area; has been extirpated from areas south of Fresno.	Sloughs, canals, and other small waterways where there is a prey base of small fish and amphibians; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter. Utilizes upland habitats within 200 feet from aquatic habitats.	April-October	Habitat Absent	Absent	No suitable habitat is present within the BSA. There are six CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Birds								
Tricolored blackbird *Agelaius tricolor*[2]	--	SCT, SSC	Largely endemic to California; permanent residents in the Central Valley from Butte County to Kern County; at scattered coastal locations from Marin County south to San Diego County; breeds at scattered locations in Lake, Sonoma, and Solano counties; rare nester in Siskiyou, Modoc, and Lassen counties. Sacramento-San Joaquin Valleys and low foothills of coast ranges and Sierra Nevada.	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grain fields; nesting habitat must be large enough to support 50 pairs; probably requires water at or near the nesting colony; requires large foraging areas, including marshes, pastures, agricultural wetlands, dairies, and feedlots, where insect prey is abundant.	March-August	Habitat Absent	Absent	No suitable habitat is present within the BSA. There are three CNDDB occurrences within five miles of the BSA.
Grasshopper sparrow *Ammodramus savannarum*	--	SSC	An uncommon and local, summer resident and breeder in foothills and lowlands west of the Cascade-Sierra Nevada crest from Trinity County south to San Diego County.	Dense grasslands on rolling hills, lowland plains, and in valleys and on hillsides on lower mountain slopes. Favors native grasslands with a mix of grasses, forbs and scattered shrubs. Loosely colonial when nesting.	March-August	Habitat Absent	Absent	No suitable habitat is present within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Great egret *Ardea alba* (rookery sites)	--	--	The great egret is a common yearlong resident throughout California, except for high mountains and deserts.	Colonial nester in large trees. Rookery sites located near marshes, tide-flats, irrigated pastures, and margins of rivers and lakes.	Year-round	Habitat Absent	Absent	No suitable habitat is present within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Great blue heron *Ardea Herodias* (rookery sites)	--	--	Fairly common throughout most of California.	Colonial nester in tall trees, cliff sides, and sequestered spots on marshes. Rookery sites in close proximity to foraging areas: marshes, lake margins, tide-flats, rivers and streams, wet meadows.	Year-round	Habitat Absent	Absent	No suitable rookery habitat is present within the BSA. There are no CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Burrowing owl *Athene cunicularia*[2]	--	SSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along south coast. Central and southern coastal habitats, and Central Valley.	Open annual grasslands or perennial grasslands, deserts, and scrublands characterized by low-growing vegetation. Dependent upon burrowing mammals (especially California ground squirrel [*Otospermophilus beecheyi*]) for burrows.	Year-round	Habitat Present	Assumed Present	The annual grassland habitat within the PIA and surrounding BSA provides suitable nesting and foraging habitat for this species. There are 24 CNDDB occurrences within five miles of the BSA.
Swainson's hawk *Buteo swainsoni*[2]	--	ST	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley; the state's highest nesting densities occur near Davis and Woodland, Yolo County.	Nests in oaks or cottonwoods in or near riparian habitats; requires adjacent suitable foraging areas such as grasslands, or alfalfa or grain fields supporting rodent populations.	March - September	Habitat Present	Assumed Present	Suitable nest trees are present within the BSA and the PIA. No suitable foraging habitat within the BSA. Annual grasslands in the BSA are very disturbed, small in area, and fragmented. There are 143 CNDDB occurrences within five miles of the BSA, including several within one mile of the BSA.
Mountain plover *Charadrius montanus*	--	SSC	Found in the Central Valley from Sutter County southward. Found in Imperial Valley, Los Angeles County, San Bernardino County, and along the central Colorado River valley.	Short grasslands, freshly plowed fields, newly sprouting grain fields, and sod farms. Short vegetation, bare ground, and flat topography. Prefers grazed areas and areas with burrowing rodents.	September - March	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Western snowy plover *Charadrius nivosus*	FT	SSC	Nests on sandy marine and estuarine shores on coastal California. Inland nesting areas occur at the Salton Sea, Mono Lake, northeastern California, the Central Valley, and southeastern deserts.	Sandy beaches, salt pond levees, and shores of large alkali lakes. Needs sandy, gravelly, or friable soils for nesting.	Year-round	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There is one CNDDB occurrence within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Northern harrier *Circus cyaneus*	--	SSC	Occurs throughout California as high as 10,000 feet. Breeds from sea level to 5,700 feet in the Central Valley and Sierra Nevada.	Coastal salt and freshwater marshes. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of stick in wet areas.	Year-round	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*[2]	FT	SE	More common locations include Sacramento River from Red Bluff to Colusa and the South Fork Kern River from Isabella Reservoir to Canebrake Ecological Reserve.	This species is a riparian obligate, nesting in low to moderate elevation riparian woodlands with native broadleaf trees and shrubs that are 20 hectares (50 acres) or more in extent.	May - September	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Snowy egret *Egretta thula* (rookery sites)	--	--	In northern California, common March to November in coastal lowlands. Locally common in the Central Valley all year.	Colonial nester, with nest sites situated in protected beds of dense tule. Rookery sites situated close to foraging areas: marshes, tidal-flats, streams, wet meadows, and borders of lakes.	Year-round	Habitat Absent	Absent	No suitable rookery habitat for this species within the BSA. There are no CNDDB occurrences of rookeries within five miles of the BSA.
White-tailed kite *Elanus leucurus*[2]	--	FP	Lowland areas west of Sierra Nevada from head of Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border. Central Valley and low foothills of Sierra Nevadas.	Rolling foothills and valley margins with scattered oaks and river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	Year-round	Habitat Present	Assumed Present	Potential nesting and foraging habitat present within the BSA. There are six CNDDB occurrences within five miles of the BSA.
Merlin *Falco columbarius*	--	WL	Common to uncommon, yearlong resident in coastal and valley lowlands; rarely found away from agricultural areas. Inhabits herbaceous and open stages of most habitats mostly in cismontane California.	Seacoast, tidal estuaries, open woodlands, savannahs, edges of grasslands & deserts, farms & ranches. Clumps of trees or windbreaks are required for roosting in open country.	Year-round	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
California black rail *Laterallus jamaicensis coturniculus*	--	ST, FP	Yearlong residence of saline, brackish, and freshwater wetlands in the San Francisco Bay area, Sacramento-San Joaquin Delta, coastal southern California, the Salton Sea, and lower Colorado River.	Inhabits freshwater marshes, wet meadows, and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about one inch that do not fluctuate during the year and dense vegetation for nesting habitat.	Year-round	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Song sparrow (“Modesto” population) *Melospiza melodia*	--	SSC	A common resident of most of California, but avoids higher mountains and occurs only locally in southern deserts.	Emergent freshwater marshes dominated by tule (*Scirpus* spp., *Schoenoplectus* spp.) and cattail (*Typha* spp.) as well as riparian willow (*Salix* spp.) thickets. Also nest in riparian forests of valley oak (*Quercus lobata*) with a sufficient understory of blackberry (*Rubus* spp.), along vegetated irrigation canals and levees, and in recently planted valley oak restoration sites.	Year-round	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Black-crowned night heron *Nycticorax* (rookery sites)	--	--	The black-crowned night-heron is a fairly common, yearlong resident in lowlands and foothills throughout most of California.	Forages in marshes swamps and wooded streams; nests in thickets, stands of trees or reedbeds.	Year-round	Habitat Absent	Absent	No suitable rookery habitat for this species within the BSA. There are no CNDDB occurrences of rookeries within five miles of the BSA.
White-faced ibis *Plegadis chihi*	--	WL	Uncommon summer resident in southern California and Central Valley.	Shallow freshwater marsh. Uses dense tule thickets for nesting, interspersed with areas of shallow water for foraging.	May - September	Habitat Absent	Absent	No suitable habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Purple martin *Progne subis*	--	SSC	Nests in Sacramento County; uncommon or absent elsewhere in the Central Valley; breeds in coastal areas from Del Norte County south to Santa Barbara County; rare in southern California.	Abandoned woodpecker holes in valley oak and cottonwood (*Populus* spp.) forests for nesting; also nests in vertical drainage holes under elevated freeways and highway bridges; open areas required for feeding.	Year-round	Habitat Present	Assumed Present	Potential nesting and foraging habitat present within the BSA. There are no CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Bank swallow *Riparia riparia*[2]	--	ST	Nests primarily in riparian and other lowland habitats west of the desert.	Colonial nester. Requires vertical banks/cliffs with fine-textured/sandy soils near streams, rivers, lakes, and oceans to dig nesting holes.	Spring – Fall	Habitat Absent	Absent	No suitable habitat is present within the BSA. There is one CNDDB occurrence within five miles of the BSA.
Least Bell's vireo *Vireo bellii pusillus*[2]	FE	SE	Summer resident throughout Sacramento and San Joaquin valleys.	Summer resident of Southern California in low riparian in vicinity of water or in dry river bottoms; below 2000 ft. Nests placed along margins of bushes or on twigs projecting into pathways, usually willow, *Baccharis* sp., and mesquite.	March - August	Habitat Absent	Absent	No suitable nesting habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Yellow-headed blackbird *Xanthocephalus*	--	SSC	Throughout the Central Valley, and along the eastern side of the Sierra Nevada Mountains. Yearlong distribution follows a limited area along the Sacramento River, though summer range is larger, and incorporates much of the Central Valley.	Nests in freshwater emergent wetlands with dense vegetation and deep water. Often along borders of lakes or ponds. Nests only where large insects such as Odonata are abundant, nesting timed with maximum emergence of aquatic insects.	Year-round	Habitat Absent	Absent	No suitable nesting or foraging habitat for this species within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Mammals								
Pallid bat *Antrozous pallidus*	--	SSC	Throughout California except for the high Sierra Nevada.	Deserts, grasslands, shrublands, woodlands, and forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There is one CNDDB occurrence within five miles of the BSA.
American badger *Taxidea taxus*	--	SSC	Central Valley and surrounding foothills.	Grasslands with friable soils; near California ground squirrel populations.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are two CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Fish								
Sacramento perch *Archoplites interruptus*	--	SSC	Historically found in the sloughs, slow-moving rivers, and lakes of the Central Valley.	Prefers warm water. Aquatic vegetation is essential for young. Tolerates wide range of physio-chemical water conditions.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Delta smelt *Hypomesus transpacificus*	FT	SE	Sacramento-San Joaquin Delta and the lower reaches of the two rivers. Seasonally in Suisun Bay, Carquinez Strait and San Pablo Bay.	Found in Delta estuaries with dense aquatic vegetation and low occurrence of predators. Estuarine or brackish waters to 14 parts per thousand (ppt); spawn in shallow brackish water upstream of the mixing zone (zone of saltwater-freshwater interface) where salinity is around 2 ppt.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Central Valley steelhead *Oncorhynchus mykiss*	FT	--	This ESU enters the Sacramento and San Joaquin Rivers and their tributaries from July to May; spawning from December to April. Young move to rearing areas in and through the Sacramento and San Joaquin Rivers, Delta, and San Pablo and San Francisco Bays.	Cool water with moderate size gravel for spawning and cover for rearing.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Central Valley spring-run chinook salmon *Oncorhynchus tshawytscha*	FT	ST	Sacramento and San Joaquin Rivers and tributaries, Sacramento-San Joaquin Delta, San Francisco Bay.	Cool water with moderate size gravel for spawning and cover for rearing.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Sacramento River winter-run chinook salmon *Oncorhynchus tshawytscha*	FE	SE	Sacramento and San Joaquin Rivers and tributaries, Sacramento-San Joaquin Delta, San Francisco Bay.	Cool water with moderate size gravel for spawning and cover for rearing.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.

TABLE BIO-3
SPECIAL-STATUS WILDLIFE WITH THE POTENTIAL TO OCCUR IN THE BIOLOGICAL STUDY AREA

Common and Scientific Name	Legal Status[1]		Distribution	Habitat Association	Identification Period	Habitat Present/ Absent	Species Present/ Absent	Rationale
	Federal	State						
Sacramento splitttail *gonichthys macrolepidotus*	--	SSC	Endemic to the lakes and rivers of the Central Valley, but now confined to the delta, Suisun Bay & associated marshes.	Slow moving river sections, dead end sloughs. Requires flooded vegetation for spawning & foraging for young.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.
Longfin smelt *Spirinchus thaleichthys*	FCT	ST, SSC	Scattered populations of longfin smelt occur along the Pacific coast from Alaska to the San Francisco Estuary. Sacramento-San Joaquin Delta and the lower reaches of the two rivers.	Longfin smelt larvae and small juveniles are rarely found in water warmer than 71.6 ºF (22 ºC). Competent-swimming young juveniles disperse toward more-saline and deeper-water habitats. Mature longfin smelt require cool-to-cold [less than 60.8 ºF (16 ºC)] freshwater habitats for spawning.	Year-round	Habitat Absent	Absent	No suitable habitat within the BSA. There are no CNDDB occurrences within five miles of the BSA.

NOTES:
1 Status explanations:
-- = no listing.
Delisted = removed from federal or California Endangered Species Act list.

Federal
FC = federal candidate for listing under the federal Endangered Species Act.
FE = listed as endangered under the federal Endangered Species Act.
FT = listed as threatened under the federal Endangered Species Act.
DL = delisted
BGPA = bald and golden eagle protection act

State
SCT = state candidate for listing as threatened under the California Endangered Species Act.
SE = listed as endangered under the California Endangered Species Act.
SSC = state species of special concern
ST = listed as threatened under the California Endangered Species Act.
DL = delisted
WL = species on the CDFW Watch List
FP = CDFW Fully Protected

2 Species covered by the Yolo HCP/NCCP.

Of the 42 special-status wildlife species listed in Table BIO-3, 37 species were determined to not have potential to occur within the BSA, because the BSA lacks suitable habitat for the species or the BSA is outside the species' known range. There is no critical habitat or Essential Fish Habitat for any special-status wildlife species in the BSA. There is habitat within the BSA for the remaining five species: valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), burrowing owl (*Athene cunicularia*), Swainson's hawk (*Buteo swainsoni*), white-tailed kite (*Elanus leucurus*), and purple martin (*Progne subis*). These species are addressed in the discussion of project impacts below. Rationale for presence or absence and likelihood of occurrence in the BSA for special-status wildlife is provided in Table BIO-3.

Wetlands and Other Waters

A formal delineation of potentially jurisdictional waters of the U.S. or state within the BSA has not been conducted. However, no potentially jurisdictional waters of the U.S. or state were noted during the reconnaissance survey of the BSA. The north fork of Putah Creek formerly flowed under Interstate 80 within the BSA. The north fork of Putah Creek was diverted to the south fork in 1948 to prevent flooding in the City of Davis. The remnant channel is still visible in the BSA, but no longer carries water. This remnant channel does not exhibit an ordinary high water mark or show any evidence of flowing water. This remnant channel does not meet the criteria as a jurisdictional water of the U.S or state.

Discussion

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, U.S. Fish and Wildlife Service, or NOAA Fisheries?*

Special-Status Plants Impacts

As shown in Table BIO-2, no special-status plant species have potential to be affected by the project because suitable habitat is not present within the project area. Consequently, the project would result in **no impacts** to special-status plant species

Special-Status Wildlife Impacts

The biological study conducted for the proposed project determined that the proposed project could result in direct and indirect impacts to habitat for valley elderberry longhorn beetle, Swainson's hawk, and other migratory birds and raptors. The impacts and mitigation measures to address potentially significant impacts are discussed below.

Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (VELB) occurs throughout the year in riparian woodlands and other Central Valley habitats containing elderberry shrubs (*Sambucus* spp.), upon which VELB is completely dependent for all stages of their life cycle. The females lay their eggs in crevices in the bark. After hatching, the larvae burrow into the stems of the tree where they feed on the interior wood for the next one to two years until they form pupae, from which the adults emerge. Prior to pupation, the larvae create an exit hole, plugs the hole with wood shavings, and returns to the gallery where it pupates. Approximately one month later, the adult beetle emerges from the stem through the previously created exit hole (Burke 1921). As the larvae and adults are rarely seen, these borer holes are often the only evidence of this species' presence. After emergence from the stems, the adults remain in association with the elderberry shrub, where they will feed on the elderberry foliage and eventually reproduce.

VELB utilize elderberry shrubs with a stem diameter of at least one-inch (at ground level) as a host plant. All elderberry shrubs within the known range of the VELB that have one or more stems with diameters of one inch or greater at ground level are considered potential habitat for this species. In the Central Valley, elderberry shrubs are fairly common in remaining riparian forests and adjacent uplands. Elderberry shrubs are typically found growing in association with other riparian species, but they can also occur as isolated shrubs in upland areas. Historically, VELB ranged throughout the Central Valley. Currently, they are locally common in scattered populations from Redding to Bakersfield where historical riparian forests still exist.

ESA conducted a survey for of the entire BSA on May 4, 2018 for suitable habitat and evidence of presence for VELB. A total of 15 elderberry shrubs providing suitable VELB were identified within the BSA in several locations and one species occurrence has been recorded in the CNDDB within five miles of the project site. Subsequent to the aforementioned survey conducted by ESA, two additional elderberry shrubs were identified within the BSA by CDFW and USFW during field surveys for the Yolo Corridor Improvement Project in August 2021. **Table BIO-4** details the 17 elderberry shrubs identified within the BSA.

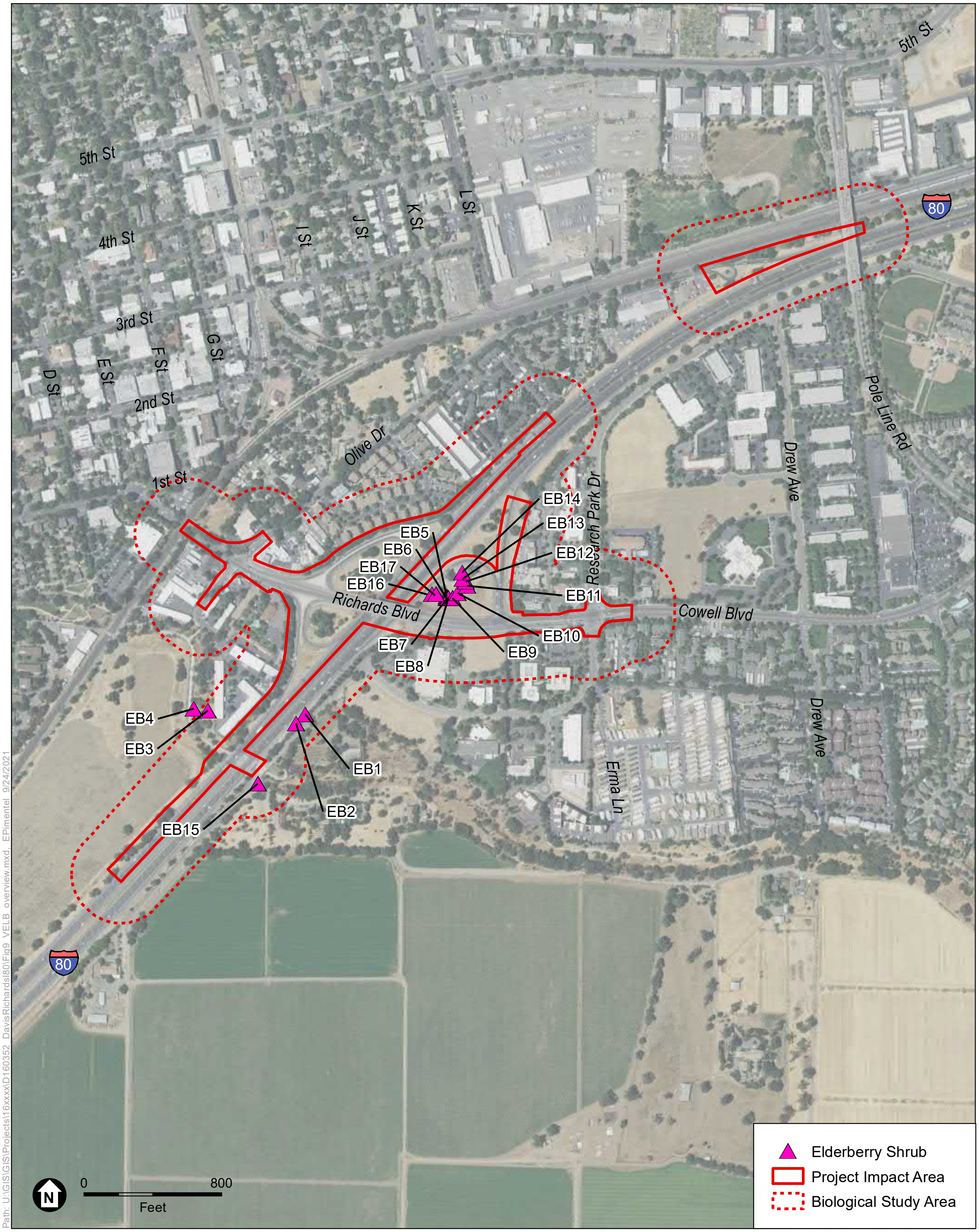
A total of 13 elderberry shrubs occur within the project site within 100 feet of proposed project activities (see **Figures 9, 10,** and **11**). However, none of these shrubs would be directly impacted based on current project design. No ground disturbing activities are proposed within 30 feet of any elderberry shrubs, and all but three of the 13 shrubs within the PIA are a minimum of 70 feet from proposed project activities. In addition, all of the elderberry shrubs within the PIA currently experience ongoing disturbance due to traffic and maintenance activities such as mowing (homeless encampments). The elderberry shrubs are not within riparian habitat, and no exit holes were observed on the shrubs. These shrubs are isolated from high quality suitable habitat for VELB. The nearest riparian habitat to the project site is associated with South Fork Putah Creek approximately 6,800 feet south of the project site. The nearest CNDDB occurrence of VELB is a 1934 collection of a single beetle with the location given as "Davis". No recent occurrences are documented in the CNDDB near the project site. According to the Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (USFWS, 2017), isolated, non-riparian elderberry clumps are less likely to be occupied or become colonized by VELB, and those beyond 800 meters (2,526 feet) from the nearest elderberry clumps or nearest VELB occurrences become increasingly less likely to be occupied. The project would not directly impact shrubs, no ground disturbing activities would occur within 30 feet of any elderberry shrubs, and the elderberry shrubs are non-riparian and isolated.

TABLE BIO-4
ELDERBERRY SHRUBS (EB) WITHIN THE BIOLOGICAL STUDY AREA

ID #	Stems ≥1” and ≤3”	Stems >3” and <5”	Stems ≥5”	Exit Holes (Y/N)	Riparian/ Non-Riparian	Impacts
EB-1	3	0	0	No	Non-Riparian	No
EB-2	4	1	1	No	Non-Riparian	No
EB-3	2	0	0	No	Non-Riparian	No
EB-4	7	2	5	No	Non-Riparian	No
EB-5	0	1	2	No	Non-Riparian	Indirect
EB-6	0	1	0	No	Non-Riparian	Indirect
EB-7	0	1	2	No	Non-Riparian	Indirect
EB-8	2	1	1	No	Non-Riparian	Indirect
EB-9	4	2	3	No	Non-Riparian	Indirect
EB-10	3	2	2	No	Non-Riparian	Indirect
EB-11	4	2	4	No	Non-Riparian	Indirect
EB-12	5	7	1	No	Non-Riparian	Indirect
EB-13	2	0	2	No	Non-Riparian	Indirect
EB-14	0	0	4	No	Non-Riparian	Indirect
EB-15	0	3	0	No	Non-Riparian	Indirect
EB-16*	20	3	0	No	Non-Riparian	Indirect
EB-17*	24	0	0	No	Non-Riparian	Indirect

NOTE:
EB-16 and EB-17 are the two elderberry shrubs identified within the BSA by CDFW and USFW during field surveys for the Yolo Corridor Improvement Project in August 2021.

SOURCE: ESA, 2021

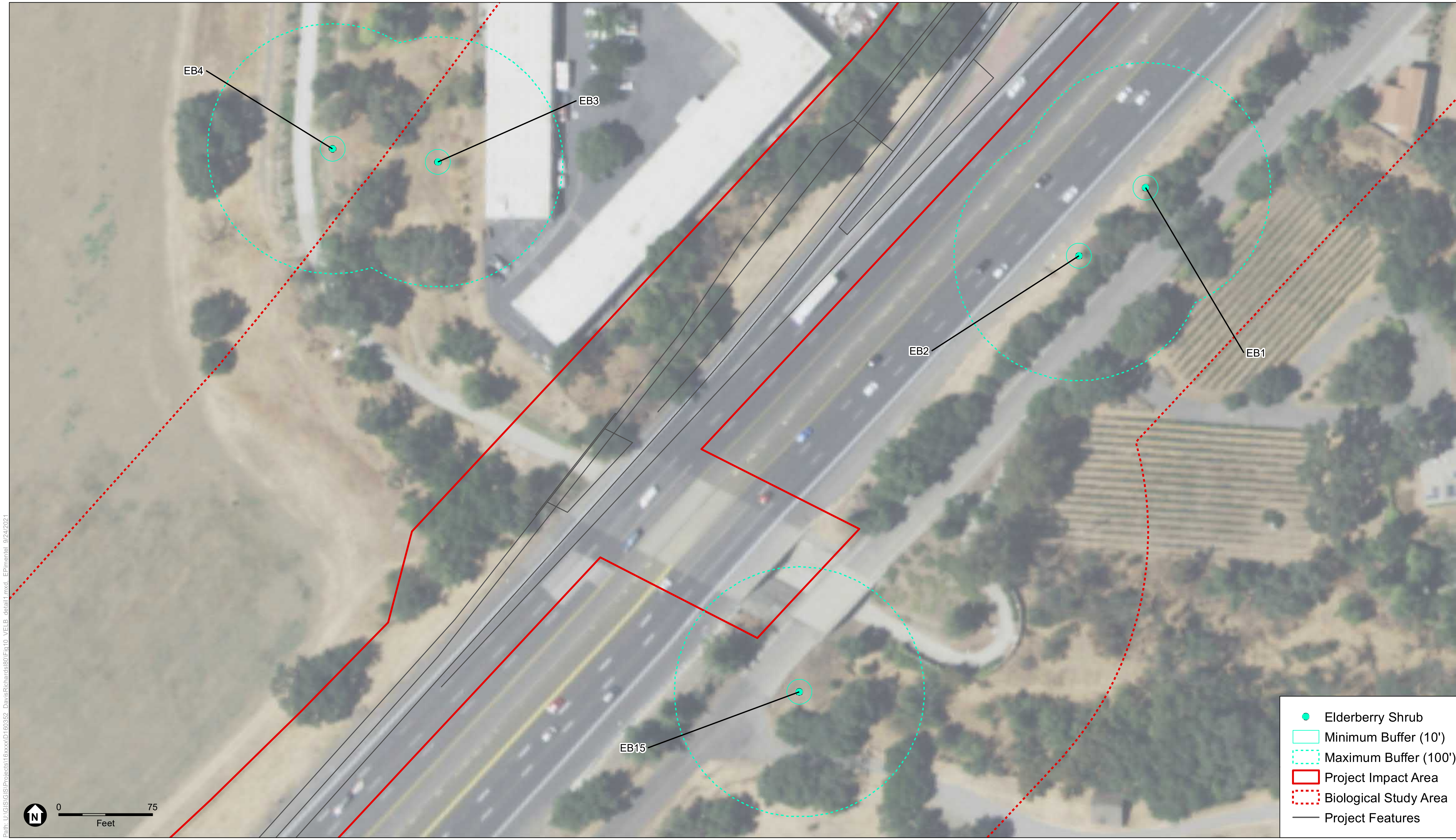


SOURCE: USDA, 2018; ESRI, 2021; ESA, 2021

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 9
Elderberry Shrub Location - Overview

ESA



SOURCE: USDA, 2018; ESRI, 2021; ESA, 2021

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 10
Elderberry Shrub Location - Detail Area 1

ESA

SOURCE: USDA, 2016; ESRI, 2012; ESA, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 11
Elderberry Shrub Location - Detail Area 2

ESA

Therefore, the proposed project would have no direct impacts on VELB. While all of the elderberry shrubs are located outside of the project impact footprint, shrubs may potentially be indirectly affected by project construction, resulting in potentially significant impacts to elderberry shrubs. Implementation of **Mitigation Measure BIO-1** (see page 58) would ensure that indirect impacts to elderberry shrubs would be **less than significant**.

Burrowing Owl

Burrowing owl (*Athene cunicularia*), a California Species of Special Concern, is a small diurnal owl that nests underground in the burrows of small mammals, especially those of ground squirrels. Culverts and other human-made structures may also be suitable habitat for the burrowing owl. Often a burrowing owl will occupy several burrows in an area. In the Central Valley, the burrowing owl is a year-round resident of open spaces such as grasslands, agricultural fields, air fields, and levees. Vegetation must be very short or very sparse to be suitable habitat for burrowing owl. Breeding peaks from April to May but can occur from March to August. The burrowing owl forages on insects and small mammals and will also consume reptiles, birds, and carrion.

Suitable nesting habitat is present within the PIA and surrounding BSA, however no burrowing owls or active nests were observed in the BSA during the May 4, 2018 biological survey. Some soils within the BSA are sandy and friable and burrows and burrow complexes were noted during the survey. While no soil mounds were visible during the field survey, surrounding fence posts would provide suitable perches above potential nests within suitable habitat. There are 24 reported occurrences of burrowing owl in the CNDDB within five miles of the BSA. The closest occurrence is approximately 600 feet south of the BSA.

Accordingly, the proposed project could potentially impact individual burrowing owls if they occupied the BSA prior to construction. Indirect impacts to nesting birds during construction could extend up to 500 feet from the limits of construction. Potential impacts could include abandonment of nest sites and the mortality of young. The proposed project could also result in a permanent loss of foraging opportunities for burrowing owl in and adjacent to the PIA during construction. The loss of nesting and/or foraging habitat in and adjacent to the PIA is not expected to significantly impact burrowing owl because these habitats are abundant in the vicinity.

Because the BSA occurs within an urban area subject to ongoing noise disturbances and human presence, any burrowing owls nesting in this area would likely be habituated to these existing disturbances. Based on the existing level of disturbance/noise in the project vicinity, and limited ground disturbance associated with the project, the project is not likely to result in adverse effects (nest abandonment and/or death of developing burrowing owl eggs or young). Nonetheless, project ground-disturbing and noise-producing construction activities could result in potentially significant impacts to nesting burrowing owls. Implementation of **Mitigation Measure BIO-2** (see page 59) would ensure that impacts to burrowing owls would be **less than significant**.

Swainson's Hawk

Swainson’s hawk (*Buteo swainsoni*) is listed as a threatened species under CESA. This raptor is found primarily in open country, foraging in grasslands and agricultural fields, especially after disking or harvest. They use tall riparian trees (typically oaks or cottonwoods) for nesting but will occasionally nest in large eucalyptus or other large ornamental trees if there is suitable foraging habitat nearby. The species has lost much of its former nesting habitat as a result of the significant reduction in riparian woodland and forest habitat throughout the state over the last 100 years and is losing foraging habitat to urban development. Swainson’s hawks can forage as far as 20 miles from the nest, but nests are generally more successful if suitable foraging habitat is present within an approximate ten-mile radius. Suitable foraging habitat is defined as annual grasslands, fallow fields, dry and irrigated pasture, and a variety of croplands including alfalfa, beet, tomato and other low growing row or field crops, rice (when not flooded), and cereal grain crops (including corn after harvest). When forced to travel greater distances from the nest, the adults must expend much more time and energy gathering food, leaving the eggs and young in the nests much more vulnerable to predation and the elements.

No Swainson’s hawks were observed at or within 0.25 mile of the BSA during the May 4, 2018 field survey. Within the BSA, suitable nesting habitat occurs in larger trees. The BSA does not support suitable foraging areas for Swainson's hawk; however, suitable foraging habitat for this species is available adjacent to the BSA. Annual grassland in the BSA is highly disturbed, small in area, and fragmented. There are over one hundred CNDDB recorded occurrences of Swainson’s hawk within five miles of the BSA, including several within one mile of the BSA (CDFW, 2019).

Noise associated with construction activities involving heavy equipment operation that occurs during the breeding season (generally between February 15 and August 31) could disturb nesting Swainson’s hawk if an active nest is located near these activities. Within urban areas, CDFW considers 0.25 mile to be a sufficient buffer to avoid disturbance of nesting Swainson's hawks. Any disturbance that causes Swainson's hawk nest abandonment and subsequent loss of eggs or developing young at active nests located near the project area would violate the CESA; CFGC Sections 2800, 3503, and 3503.5; and the Migratory Bird Treaty Act (MBTA).

Because the BSA occurs within an urban area subject to ongoing noise disturbances and human presence, any Swainson's hawks nesting in this area would likely be habituated to these existing disturbances. Based on the existing level of disturbance/noise in the project vicinity, and limited ground disturbance associated with the project, the project is not likely to result in adverse effects (nest abandonment and/or death of developing Swainson's hawk eggs or young). Nonetheless, project ground-disturbing and noise-producing construction activities could result in potentially significant impacts to nesting Swainson's hawks. Implementation of **Mitigation Measure BIO-3** (see page 62) would ensure that impacts to Swainson's hawks would be **less than significant**.

White-Tailed Kite

The white-tailed kite (*Elanus leucurus*) is listed as a "fully protected" raptor under Section 3511 of the California Fish and Game Code. The white-tailed kite is a year-round resident in central California. It typically nests in oak woodlands or trees, especially along marshes or river margins, and may use any suitable tree or shrub that is of moderate height. Its nesting season may begin as early as February and extends into August. This raptor forages during the day for rodents—especially voles—in wet or dry grasslands and fields. White-tailed kites forage characteristically by hovering over the location of a potential prey item. Although, like other raptors, kites build solitary nests, they often roost, and occasionally nest communally, especially during the non-breeding season.

Suitable nesting habitat is present within the PIA and surrounding BSA, however no white-tailed kites or active nests were observed in the BSA during the May 4, 2018 biological survey. Within the BSA, suitable nesting habitat occurs in larger trees. There are six reported occurrences of white-tailed kite in the CNDDB within five miles of the BSA. The closest occurrence is approximately 0.96 mile northeast of the BSA.

Disturbance of a relatively small roost or nesting area could affect a large number of birds. Noise associated with construction activities involving heavy equipment operation that occurs during the breeding season (generally between February 15 and August 31) could disturb nesting white-tailed kites if an active nest is located near these activities.

Because the BSA occurs within an urban area subject to ongoing noise disturbances and human presence, any white-tailed kites nesting in this area would likely be habituated to these existing disturbances. Based on the existing level of disturbance/noise in the project vicinity, and limited ground disturbance associated with the project, the project is not likely to result in adverse effects (nest abandonment and/or death of developing white-tailed kite eggs or young). Nonetheless, project ground-disturbing and noise-producing construction activities could result in potentially significant impacts to nesting white-tailed kites. Implementation of **Mitigation Measure BIO-3** (see page 62) would ensure that impacts to white-tailed kites would be **less than significant**.

Purple Martin

The purple martin (*Progne subis*) can be found throughout nearly the entire U.S. east of the Rocky Mountains. Although declining in many western states, it is also found in isolated areas of Canada, Oregon, Washington, California, Utah, Colorado, Arizona, New Mexico and Mexico. In California it is a Species of Special Concern. It is an early spring migrant from its wintering grounds in South America. Generally, purple martins inhabit open areas with an open water source nearby. Martins adapt well in and around people, but people are out-competed by starlings (*Sturnus vulgaris*) and sparrows in urban areas. Purple martins are colonial cavity nesters in abandoned woodpecker holes, human-made nest boxes, or cavities in other structures such as bridges and overpasses. Once established at a nest location, martins usually come back to the same site every year.

There are numerous potential nesting sites for this urban-adapted species throughout the BSA, in particular the I-80/Richards Boulevard overpass. There are no CNDDB recorded occurrences of purple martin within five miles of the BSA. Disturbance of active nest sites which results in nest abandonment, loss of young, or reduced health and vigor of eggs and/or nestlings (resulting in reduced survival rates), or the direct removal of structures that supports nesting birds which result in killing of nestlings or fledgling bird species would be considered a potentially significant impact. Implementation of **Mitigation Measure BIO-4** (see page 62) would ensure that impacts to purple martins would be **less than significant**.

Other Nesting Migratory Birds and Raptors

Other migratory birds and raptors could nest within and surrounding the BSA in trees. The breeding season for most birds and raptors within the project region is generally from February 15 and August 31. The occupied nests and eggs of these birds are protected by federal and state laws, including MBTA and CFGC Sections 3503 and 3503.5.

Migratory birds and raptors that could potentially nest within or adjacent to the BSA include, but are not limited to, American kestrel (*Falco sparverius*), California towhee (*Melozone crissalis*), red-tailed hawk (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*), turkey vulture (*Cathartes aura*), American robin (*Turdus migratorius*), killdeer (*Charadrius vociferus*), mourning dove (*Zenaida macroura*), northern mockingbird (*Mimus polyglottos*), western meadowlark (*Sturnella neglecta*), and western scrub-jay (*Aphelocoma californica*).

Noise associated with construction activities involving heavy equipment operation that occurs during the breeding season (generally between February 1 and September 30) could disturb nesting migratory birds and raptors if an active nest is located near these activities. Any disturbance that causes migratory bird or raptor nest abandonment and subsequent loss of eggs or developing young at active nests located at or near the project area would violate CFGC Sections 3503 or 3503.5 and the MBTA. Consequently, impacts to other migratory birds and raptors are potentially significant. Implementation of **Mitigation Measure BIO-4** (see page 62) would ensure that impacts to other migratory birds and raptors would be **less than significant**.

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 Wildlife or U.S. Fish and Wildlife Service?*

Habitats and natural communities of special concern are those that are regulated by the federal, state, or local resource agencies. The BSA does not support any habitats that would be considered natural communities of special concern, including sensitive natural communities identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service. Similarly, the BSA does not support any potentially jurisdictional wetlands and other waters of the U.S or state or riparian habitat. Therefore, project would result in **no impact** to these resources.

c) *Would the project have a substantial adverse effect on state or federally protected wetlands (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?*

No state or federally protected wetlands or potentially jurisdictional waters of the U.S. or state were noted during the reconnaissance survey of the BSA. The north fork of Putah Creek formerly flowed under Interstate 80 within the BSA. The north fork of Putah Creek was diverted to the south fork in 1948 to prevent flooding in the City of Davis. The remnant channel is still visible in the BSA, but no longer carries water. This remnant channel does not exhibit an ordinary high water mark or show any evidence of flowing water. This remnant channel does not meet the criteria as a jurisdictional water of the U.S or state. Consequently, the project would result in **no impacts** to state or federally protected wetlands or potentially jurisdictional waters of the U.S. or state.

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?*

Developed uses comprise the majority of the BSA and consists of paved or otherwise developed areas. Ornamental vegetation associated with the BSA consists of trees and understory grassland along road shoulders and within undeveloped lots and open areas. In addition, some areas of agricultural land were noted within the BSA. Habitat types within the BSA do not support fish or serve as significant wildlife corridors or linkages for special-status terrestrial species. Therefore, impacts on movement of terrestrial species associated with the proposed project would be considered less than significant.

As discussed above under question a) noise associated with construction activities involving heavy equipment operation that occurs during the breeding season could disturb Swainson's hawks and other nesting migratory birds and raptors if an active nest is located near these activities. Any disturbance that causes migratory bird or raptor nest abandonment and subsequent loss of eggs or developing young at active nests located at or near the project area would violate CFGC Sections 3503 or 3503.5 and the MBTA. Consequently, impacts to migratory birds and raptors are potentially significant. Implementation of **Mitigation Measure BIO-4** (see page 62) would ensure that impacts to other migratory birds and raptors would 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?*

The City has acknowledged the importance of preserving mature trees through adoption of the City's tree preservation ordinance. The City adopted an ordinance on December 4, 2002 to protect landmark trees, trees of significance, street trees, city trees, and private trees. The loss of protected trees, including street trees, city trees (trees in parks, greenbelts, open spaces, or on city property or easements), landmark trees, and trees of significance is regulated by the City tree ordinance. The trees within the project area are ornamental trees within the Caltrans right-of-way and are not protected by the City's tree ordinance. Nonetheless, implementation of **Mitigation Measure BIO-5** (see page 63) would ensure that any unanticipated impacts to protected trees would be **less than significant**.

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?*

The project site is located within the boundaries of the Yolo Habitat Conservation Plan/ Natural Community Conservation Plan (Yolo HCP/NCCP). The Yolo Habitat Conservancy (Conservancy), which consists of Yolo County and the incorporated cities of Davis, West Sacramento, Winters, and Woodland, completed the Yolo HCP/NCCP in 2018 and began implementation on January 11, 2019. The Yolo HCP/NCCP is a countywide conservation plan that ensures compliance with the Federal Endangered Species Act, the California Natural Community Conservation Planning Act, and the California Endangered Species Act for covered activities that may affect the covered species. The City of Davis is participatory to the Yolo HCP/NCCP and, consequently, the proposed project is considered a “covered activity” under the HCP/NCCP. Mitigation for incidental take of covered species occurring under the HCP/NCCP is provided through the establishment and management of a habitat reserve system and the restoration of natural communities within the HCP/NCCP area. Mitigation of impacts to covered species is accomplished through the payment of fees in order to obtain coverage under the Yolo HCP/NCCP.

The Yolo HCP/NCCP coordinates mitigation to maximize benefits to 12 covered species, including the following species potentially impacted by the proposed project: VELB, Swainson’s hawk, white-tailed kite, and western burrowing owl. Therefore, implementation of the proposed project has the potential to result in impacts to covered species under the Yolo HCP/NCCP, and this impact is considered potentially significant. As described below, the project includes mitigation measures for impacts to these species that are consistent with the provisions of the Yolo HCP/NCCP (see Mitigation Measures BIO-1, BIO-2, and BIO-3). Implementation of these measures would reduce impacts to a **less-than-significant** level. In addition, implementation of **Mitigation Measure BIO-6** (see page 63) would ensure that the proposed project would obtain coverage under the Yolo HCP/NCCP.

Mitigation Measures

Mitigation Measure BIO-1: Implement Yolo HCP/NCCP Avoidance and Minimization Measures 12: Minimize Take and Adverse Effects on Habitat of Valley Elderberry Longhorn Beetle.

The following measures shall be implemented during project construction.

- *All suitable elderberry shrubs (i.e., shrubs with stem diameters of at least one inch when measured at ground level) shall be avoided. Shrubs shall not be removed or pruned.*

- *Shrubs shall be flagged or temporarily fenced, as needed, with guidance from a qualified biologist. These areas shall be avoided by all personnel and construction activities. When feasible, fencing shall be placed at least five feet from the dripline of each shrub.*

- *Timing of work near elderberry shrubs shall avoid the flight season of the beetle (March 15 – June 15) if feasible.*

- *The project proponent will maintain a buffer of at least 100 feet from any elderberry shrubs with stems greater than one inch in diameter at ground level. A lesser buffer may be approved by the Yolo Habitat Conservancy, USFWS, and CDFW if they determine that the shrubs are avoided to an extent that is consistent with the project purpose. In cases where the buffer is reduced, the maximum possible buffer will be implemented that accommodates project design, and consultation with the Conservancy, USFWS, and CDFW will occur to determine if further mitigation is required. Any temporarily disturbed habitat within the 100-foot buffer will be restored upon completion of construction activities.*

Mitigation Measure BIO-2: Implement Yolo HCP/NCCP Avoidance and Minimization Measures 18: Minimize Take and Adverse Effects on Western Burrowing Owl.

The project proponent will retain a qualified biologist to conduct planning-level surveys and identify western burrowing owl habitat (as defined in Appendix A, Covered Species Accounts, of the Yolo HCP/NCCP) within or adjacent to (i.e., within 500 feet of) a covered activity. If habitat for this species is present, additional surveys for the species by a qualified biologist are required, consistent with CDFW guidelines (CDFW, 2012).

*If burrowing owls are identified during the planning-level survey, the project proponent will minimize activities that will affect occupied habitat as follows. Occupied habitat is considered fully avoided if the project footprint does not impinge on a nondisturbance buffer around the suitable burrow. For occupied burrowing owl nest burrows, this nondisturbance buffer could range from 150 to 1,500 feet (**Table BIO-5**), depending on the time of year and the level of disturbance, based on current guidelines (CDFW, 2012). The Yolo HCP/NCCP generally defines low, medium, and high levels of disturbances of burrowing owls as follows.*

- *Low: Typically 71-80 dB, generally characterized by the presence of passenger vehicles, small gas-powered engines (e.g., lawn mowers, small chain saws, portable generators), and high-tension power lines. Includes electric hand tools (except circular saws, impact wrenches and similar). Management and enhancement activities would typically fall under this category. Human activity in the immediate vicinity of burrowing owls would also constitute a low level of disturbance, regardless of the noise levels.*

- *Moderate: Typically 81-90 dB, and would include medium- and large-sized construction equipment, such as backhoes, front end loaders, large pumps and generators, road graders, dozers, dump trucks, drill rigs, and other moderate to large diesel engines. Also includes power saws, large chainsaws, pneumatic drills and impact wrenches, and large gasoline-powered tools. Construction activities would normally fall under this category.*

- *High: Typically 91-100 dB, and is generally characterized by impacting devices, jackhammers, compression brakes on large trucks, and trains. This category includes both vibratory and impact pile drivers (smaller steel or wood piles) such as used to install piles and guard rails, and large pneumatic tools such as chipping machines. It may also include large diesel and gasoline engines, especially if in concert with other impacting devices. Felling of large trees (defined as dominant or subdominant trees in*

> *mature forests), truck horns, yarding tower whistles, and muffled or underground explosives are also included. Very few covered activities are expected to fall under this category, but some construction activities may result in this level of disturbance.*

The project proponent may qualify for a reduced buffer size, based on existing vegetation, human development, and land use, if agreed upon by CDFW and USFWS (CDFW, 2012).

TABLE BIO-5
RECOMMENDED RESTRICTED ACTIVITY DATES AND SETBACK DISTANCES BY LEVEL OF DISTURBANCE FOR BURROWING OWLS

Time of Year	Level of Disturbance (feet) from Occupied Burrows		
	Low	Medium	High
April 1 – August 15	600	1,500	1,500
August 16 – October 15	600	600	1,500
October 16 – March 31	150	300	1,500

SOURCE: Yolo Habitat Conservancy 2018

If the project does not fully avoid direct and indirect effects on nesting sites (i.e., if the project cannot adhere to the buffers described above), the project proponent will retain a qualified biologist to conduct preconstruction surveys and document the presence or absence of western burrowing owls that could be affected by the covered activity. Prior to any ground disturbance related to covered activities, the qualified biologist will conduct the preconstruction surveys within three days prior to ground disturbance in areas identified in the planning-level surveys as having suitable burrowing owl burrows, consistent with CDFW preconstruction survey guidelines (CDFW, 2012). The qualified biologist will conduct the preconstruction surveys three days prior to ground disturbance. Time lapses between ground disturbing activities will trigger subsequent surveys prior to ground disturbance.

If the biologist finds the site to be occupied[1] *by western burrowing owls during the breeding season (February 1 to August 31), the project proponent will avoid all nest sites, based on the buffer distances described above, during the remainder of the breeding season or while the nest is occupied by adults or young (occupation includes individuals or family groups that forage on or near the site following fledging). Construction may occur inside of the disturbance buffer during the breeding season if the nest is not disturbed and the project proponent develops an AMM plan that is approved by the Conservancy, CDFW, and USFWS prior to project construction, based on the following criteria:*

- *The Conservancy, CDFW, and USFWS approves the AMM plan provided by the project proponent.*
- *A qualified biologist monitors the owls for at least three days prior to construction to determine baseline nesting and foraging behavior (i.e., behavior without construction).*
- *The same qualified biologist monitors the owls during construction and finds no change in owl nesting and foraging behavior in response to construction activities.*

1 Occupancy of burrowing owl habitat during preconstruction surveys is confirmed at a site when at least one burrowing owl or sign (fresh whitewash, fresh pellets, feathers, or nest ornamentation) is observed at or near a burrow entrance.

- *If the qualified biologist identifies a change in owl nesting and foraging behavior as a result of construction activities, the qualified biologist will have the authority to stop all construction related activities within the non-disturbance buffers described above. The qualified biologist will report this information to the Conservancy, CDFW, and USFWS within 24 hours, and the Conservancy will require that these activities immediately cease within the non-disturbance buffer. Construction cannot resume within the buffer until the adults and juveniles from the occupied burrows have moved out of the project site, and the Conservancy, CDFW, and USFWS agree.*
- *If monitoring indicates that the nest is abandoned prior to the end of nesting season and the burrow is no longer in use by owls, the project proponent may remove the nondisturbance buffer, only with concurrence from CDFW and USFWS. If the burrow cannot be avoided by construction activity, the biologist will excavate and collapse the burrow in accordance with CDFW's 2012 guidelines to prevent reoccupation after receiving approval from the wildlife agencies.*

If evidence of western burrowing owl is detected outside the breeding season (September 1 to January 31), the project proponent will establish a non-disturbance buffer around occupied burrows, consistent with Table BIO-5, as determined by a qualified biologist. Construction activities within the disturbance buffer are allowed if the following criteria are met to prevent owls from abandoning important overwintering sites:

- *A qualified biologist monitors the owls for at least three days prior to construction to determine baseline foraging behavior (i.e., behavior without construction).*
- *The same qualified biologist monitors the owls during construction and finds no change in owl foraging behavior in response to construction activities.*
- *If there is any change in owl roosting and foraging behavior as a result of construction activities, these activities will cease within the buffer.*
- *If the owls are gone for at least one week, the project proponent may request approval from the Conservancy, CDFW, and USFWS for a qualified biologist to excavate and collapse usable burrows to prevent owls from reoccupying the site if the burrow cannot be avoided by construction activities. The qualified biologist will install one-way doors for a 48-hour period prior to collapsing any potentially occupied burrows. After all usable burrows are excavated, the buffer will be removed and construction may continue.*

Monitoring must continue as described above for the nonbreeding season as long as the burrow remains active.

A qualified biologist will monitor the site, consistent with the requirements described above, to ensure that buffers are enforced and owls are not disturbed. Passive relocation (i.e., exclusion) of owls has been used in the past in the Plan Area to remove and exclude owls from active burrows during the nonbreeding season (Trulio, 1995). Exclusion and burrow closure will not be conducted during the breeding season for any occupied burrow. If the Conservancy determines that passive relocation is necessary, the project proponent will develop a burrowing owl exclusion plan in consultation with CDFW biologists. The methods will be designed as described in the species monitoring guidelines (CDFW, 2012) and consistent with the most up-to-date checklist of passive relocation techniques.[2] *This may include the installation of one-way doors in*

[2] The Conservancy will maintain a checklist of passive relocation techniques. CDFW will approve the initial list, and the Conservancy will update as needed in coordination with CDFW.

burrow entrances by a qualified biologist during the nonbreeding season. These doors will be in place for 48 hours and monitored twice daily to ensure that the owls have left the burrow, after which time the biologist will collapse the burrow to prevent reoccupation. Burrows will be excavated using hand tools. During excavation, an escape route will be maintained at all times. This may include inserting an artificial structure, such as piping, into the burrow to prevent collapsing until the entire burrow can be excavated and it can be determined that no owls are trapped inside the burrow. The Conservancy may allow other methods of passive or active relocation, based on best available science, if approved by the wildlife agencies. Artificial burrows will be constructed prior to exclusion and will be created less than 300 feet from the existing burrows on lands that are protected as part of the reserve system.

Mitigation Measure BIO-3: Implement Yolo HCP/NCCP Avoidance and Minimization Measures 16: Minimize Take and Adverse Effects on Habitat of Swainson's Hawk and White-Tailed Kite.

The project proponent will retain a qualified biologist to conduct planning-level surveys and identify any nesting habitat present within 1,320 feet of the project footprint. Adjacent parcels under different land ownership will be surveyed only if access is granted or if the parcels are visible from authorized areas.

If a construction project cannot avoid potential nest trees (as determined by the qualified biologist) by 1,320 feet, the project proponent will retain a qualified biologist to conduct preconstruction surveys for active nests consistent, with guidelines provided by the Swanson's Hawk Technical Advisory Committee (2000), between March 15 and August 31, within 15 days prior to the beginning of the construction activity. The results of the survey will be submitted to the Conservancy and CDFW. If active nests are found during preconstruction surveys, a 1,320-foot initial temporary nest disturbance buffer shall be established. If project related activities within the temporary nest disturbance buffer are determined to be necessary during the nesting season, then the qualified biologist will monitor the nest and will, along with the project proponent, consult with CDFW to determine the best course of action necessary to avoid nest abandonment or take of individuals. Work may be allowed only to proceed within the temporary nest disturbance buffer if Swanson's hawk or white-tailed kite are not exhibiting agitated behavior, such as defensive flights at intruders, getting up from a brooding position, or flying off the nest, and only with the agreement of CDFW and USFWS. The designated on-site biologist/monitor shall be on-site daily while construction-related activities are taking place within the 1,320-foot buffer and shall have the authority to stop work if raptors are exhibiting agitated behavior. Up to 20 Swanson's hawk nest trees (documented nesting within the last 5 years) may be removed during the permit term, but they must be removed when not occupied by Swanson's hawks.

For covered activities that involve pruning or removal of a potential Swanson's hawk or white-tailed kite nest tree, the project proponent will conduct preconstruction surveys that are consistent with the guidelines provided by the Swanson's Hawk Technical Advisory Committee (2000). If active nests are found during preconstruction surveys, no tree pruning or removal of the nest tree will occur during the period between March 1 and August 30 within 1,320 feet of an active nest, unless a qualified biologist determines that the young have fledged and the nest is no longer active.

Mitigation Measure BIO-4: Conduct a Preconstruction Survey for other Nesting Migratory Birds and Raptors and Establish No-disturbance Buffers, if Necessary. *If construction (including equipment staging and tree removal) will occur during the breeding season for migratory birds and raptors (generally between February 15 and August 31), the City shall retain a qualified biologist to conduct a preconstruction nesting bird and raptor survey before the onset* *of construction activities. The preconstruction nesting bird and raptor surveys shall be conducted between February 1 and September 30 within suitable habitat at the project area. Surveys for migratory birds and raptor nests should extend 500 feet from the project area to ensure that nesting birds are not indirectly affected by construction noise. The survey shall be conducted no more than 14 days before the initiation of construction activities. If no active nests are detected during the survey, no additional mitigation is required and construction can proceed.*

If migratory birds or raptors are found to be nesting in or adjacent to the project area, a 500-foot no-disturbance buffer shall be established around raptor nests and a 250-foot buffer around non-raptor nests to avoid disturbance of the nest area and to avoid take. The buffer shall be maintained around the nest area until the end of the breeding season or until a qualified biologist determines that the young have fledged and are foraging on their own. The extent of these buffers shall be determined by the biologist (coordinating with the CDFW) and shall depend on the species identified, level of noise or construction disturbance, line of sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers.

Mitigation Measure BIO-5: Mitigate for Impacts to Protected Trees. *If the proposed project would remove protected trees, the City shall submit a tree removal permit application for the removal of protected trees, as defined by City Code 37.01.020. The application shall include proposed mitigation measures to protect retained trees and propose replacement measures to mitigate for the loss of tree resources (replacement measures may be determined in consultation with the City's Director of Community Services). Any trees planted within the Caltrans right-of-way will need to meet Caltrans standards.*

Mitigation Measure BIO-6: Obtain Coverage Under the Yolo HCP/NCCP. *As a condition of approval for the proposed project, the City of Davis shall apply for and obtain coverage under the Yolo HCP/NCCP for impacts to covered species.*

References

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Cultural Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
V. CULTURAL RESOURCES — Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource pursuant to §15064.5?	☐	☒	☐	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Disturb any human remains, including those interred outside of formal cemeteries?	☐	☒	☐	☐

Discussion

a–c) On behalf of Caltrans District 3 and the City of Davis, ESA cultural resources staff conducted a cultural resources investigation for the proposed project that included a review of records from the Northwest Information Center (NWIC) of the California Historical Resources Information System (April 24, 2018; File No. 17-2544), a review of the proposed project design plans and methods of construction, and a pedestrian survey of the project site by an ESA Registered Professional Archaeologist. The investigation was conducted in support of the proposed project's compliance with the requirements of Section 106 of the National Historic Preservation Act and CEQA (ESA, 2018).

The investigation determined that there are no previously recorded archaeological or architectural resources in the proposed project Area of Potential Effects (APE), which comprises the geographic area within which a project may directly or indirectly cause changes in the character or use of historical or archaeological resources.

The nearest known prehistoric archaeological site is CA-YOL-118, which includes the remains of a large sweathouse, features, midden, and human remains. The site is approximately 0.25 mile west of the APE and would not be affected by the proposed project. There are also two sites informally recorded as "possible sites" further to the north on the University of California Davis campus. These sites would also not be affected by the proposed project.

The Richards Boulevard Underpass, located immediately adjacent to the APE, was constructed in 1917 and has been recommended eligible for listing in the National Register of Historic Places and California Register of Historical Resources. It is one of the oldest surviving examples of I-beam bridge construction on a railroad grade separation. The underpass would not be affected by the proposed project.

The pedestrian archaeological survey consisted of walking the paved and unpaved portions of the APE in narrow (no greater than 10-meter-wide) transects, where feasible, to observe the existing conditions and identify cultural resources, if present. The narrowness of the APE along the roadways made the use of parallel transects unnecessary, so inspection for cultural materials on one transect was sufficient. All areas of the APE have been highly disturbed from construction of the existing overpass and roadways. Unpaved portions of the APE consisted of open, grassy areas between the on- and off-ramps. Non-native grasses covered much of the unpaved areas, and grasses were periodically scraped back to expose ground surface. Some small trees and shrubs were also present. All soils in the APE consisted of light or medium brown gravelly loam, consistent with artificially-deposited fill and/or landscaping. Modern trash was lightly scattered throughout the APE adjacent to the on- and off-ramps. No prehistoric or historic-era cultural materials or other evidence of past human use or occupation were identified in the APE.

Pursuant to Public Resources Code section 21080.3.1, the City of Davis consulted with California Native American tribes regarding the proposed project. Letters that described the proposed project, provided formal notification of the proposed project, and requested a written response within 30 days if consultation was desired were sent to the Ione Band of Miwok Indians, the Yoche Dehe Wintun Nation, and the Cortina Indian Rancheria of Wintun Indians on August 28, 2019. The City received one response. In a letter dated September 12, 2018, the Yoche Dehe Wintun Nation stated that the project site is within the aboriginal territory of the Yoche Dehe Wintun Nation and therefore the tribe has cultural interest and authority in the project area. The letter stated that the tribe is not aware of any known cultural resources near the project site and monitoring is not needed. The letter included a recommendation that pre-construction cultural resource sensitivity training should be provided by members of the Yoche Dehe Wintun Nation. Records of tribal consultation are included in **Appendix C** of this initial study.

The cultural resources investigation determined that the proposed project has no potential to affect above-ground historical resources and a low potential to affect archaeological or resources or human remains due to the environmental setting and previous extensive disturbance of the area. Nonetheless, because there is a possibility that project construction and excavation activities could unearth previously undiscovered or unrecorded prehistoric or historic archaeological resources or human remains, if they are present, the impact is considered to be potentially significant. Implementation of **Mitigation Measures CUL-1**, **CUL-2**, and **CUL-3** would ensure that impacts to archaeological resources or human remains would be **less than significant**.

Mitigation Measures

Mitigation Measure CUL-1: Conduct Pre-Construction Cultural Resources Sensitivity Training.

The City or its contractor shall coordinate with the Yoche Dehe Wintun Nation to provide pre-construction cultural sensitivity training for all construction personnel who will be involved in ground-disturbing construction activities.

Mitigation Measure CUL-2: Measures to Protect Subsurface Cultural Resources.

In the event that any prehistoric or historic-era subsurface archaeological features or deposits, including locally darkened soil ("midden"), that could conceal cultural deposits, are discovered during project construction, all ground-disturbing activity within 100 feet of the resources shall *be halted and a qualified professional archaeologist shall be retained to assess the significance of the find. If the find is determined to be significant by the qualified archaeologist (i.e., because it is determined to constitute either an historical resource or a unique archaeological resource), the archaeologist shall develop appropriate procedures to protect the integrity of the resource and ensure that no additional resources are affected. Procedures could include but would not necessarily be limited to preservation in place, archival research, subsurface testing, or contiguous block-unit excavation and data recovery.*

If the archaeologist determines that some or all of the affected property qualifies as a Native American Cultural Place, including a Native American sanctified cemetery, place of worship, religious or ceremonial site, or sacred shrine (Public Resources Code §5097.9) or a Native American historic, cultural, or sacred site, that is listed or may be eligible for listing in the California Register of Historical Resources pursuant to Public Resources Code §5024.1, including any historic or prehistoric ruins, any burial ground, any archaeological or historic site (Public Resources Code §5097.993), the archaeologist shall recommend to the City of Davis potentially feasible procedures that would preserve the integrity of the site or minimize impacts on it.

Mitigation Measure CUL-3: Measures to Protect Human Burials and Associated Features.

California law recognizes the need to protect Native American human burials, skeletal remains, and items associated with Native American burials from vandalism and inadvertent destruction. The procedures for the treatment of Native American human remains are contained in California Health and Safety Code Sections 7050.5 and 7052 and California Public Resources Code Section 5097. If human remains are discovered during any demolition/construction activities, potentially damaging ground-disturbing activities in the area of the remains shall be halted immediately, and the City of Davis shall notify the Yolo County coroner and the Native American Heritage Commission (NAHC) immediately, according to Section 5097.98 of the State Public Resources Code and Section 7050.5 of California's Health and Safety Code. If the remains are determined by the NAHC to be Native American, the guidelines of the NAHC shall be adhered to in the treatment and disposition of the remains. The City of Davis shall also retain a professional archaeologist with Native American burial experience to conduct a field investigation of the specific site and consult with the Most Likely Descendant (MLD), if any, identified by the NAHC. Following the coroner's and NAHC's findings, the archaeologist, and the NAHC-designated MLD shall determine the ultimate treatment and disposition of the remains and take appropriate steps to ensure that additional human interments are not disturbed. The responsibilities for acting upon notification of a discovery of Native American human remains are identified in California Public Resources Code Section 5097.94.

References

California Department of Transportation (Caltrans), 2018. Section 106 Compliance—Screened Undertaking for Richards Boulevard/Interstate-80 Interchange Improvements Project in the City of Davis, Yolo County (EA: 03-0H360; EFIS Project ID: 0315000148). Prepared by ESA for Caltrans District 3. August 9, 2018.

Energy

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
VI. ENERGY — Would the project:				
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?	☐	☐	☒	☐
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?	☐	☐	☐	☒

Discussion

a) The proposed project would require construction activities, including but not limited to asphalt and concrete removal, grubbing, cut-and-fill activities, and grading. Construction energy consumption would result primarily from transportation fuels (e.g., diesel and gasoline) used for haul trucks, heavy-duty construction equipment, and construction workers traveling to and from the project limits. Project construction would be performed by professional contractors and would not be anticipated to result in inefficient or unnecessary consumption of fuel resources. While construction may occur during nighttime hours, electricity consumption for construction lighting would not be anticipated to have an adverse impact on available electricity supplies and infrastructure. Therefore, no impacts on electricity supply and infrastructure associated with short-term construction activities would occur. Natural gas is not anticipated to be consumed in any substantial quantities during construction of the proposed project. Therefore, project impacts on energy and gas associated with construction activities would be **less than significant**.

Operation of the proposed project would not result in changes to the existing land use (e.g., transportation facility) within the project limits and is not anticipated to increase the demand for electricity or natural resources. Therefore, operational impacts on energy and gas would be **less than significant**.

b) The proposed project is a transportation project that would improve an existing interchange. The proposed project does not propose any new structures that would subject to the goals and policies of the City's General Plan specific to development and new construction of buildings. In addition, the proposed project would support regional and statewide efforts to improve transportation energy efficiency and reduce transportation energy consumption with respect to private automobiles. The proposed project would be consistent with and support the goals and benefits of SACOG's MTP/SCS, which seeks to maximize mobility and accessibility for all people and goods in the region. Therefore, the proposed project would not conflict with or obstruct a state or local plan for renewable energy or energy efficiency, and there would be **no impact**.

References

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Fehr & Peers, 2018. Transportation Analysis Report, Interstate 80 / Richards Boulevard Interchange. Prepared for City of Davis. June 2018.

Sacramento Area Council of Governments (SACOG), 2019. 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy, Adopted November 18, 2019. Available: https://www.sacog.org/2020-metropolitan-transportation-plansustainable-communities-strategy.

Geology and Soils

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
VII. GEOLOGY AND SOILS — Would the project:				
a) Directly or indirectly cause 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 known 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 or 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 direct or indirect risks to life or property?	☐	☒	☐	☐
e) 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?	☐	☐	☐	☒
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	☐	☒	☐	☐

Discussion

a.i) There are no faults mapped in the immediate vicinity of the project site. The nearest faults include the Late Quaternary age Vaca fault approximately 18 miles to the west-southwest and the Holcene-latest Pleistocene age Dunnigan Hills fault approximately 8.5 miles to the northwest. The project site is not located within an Alquist-Priolo earthquake fault zone (Crawford & Associates, 2018). There would be **no impact** related to rupture of a known earthquake fault.

a.ii) The project area is not located within an Alquist-Priolo earthquake fault zone and surface evidence of faulting has not been observed (Crawford & Associates, 2018). There would be **no impact** related to seismic ground shaking.

a.iii) Liquefaction can occur when saturated, loose- to medium-dense granular soils (generally within 50 feet of the surface), or specifically defined cohesive soils are subjected to ground shaking. Based on the medium-stiff to hard fine-grained silt/clay, medium-dense coarse to fine-grain sand, and groundwater conditions observed on the project site during the geotechnical investigation conducted for the proposed project, the potential for liquefaction is expected to be low (Crawford & Associates, 2018). In addition, all project-related work would be designed and constructed in accordance with the requirements of all applicable federal, state, and local safety regulations. Consequently, this impact would be **less than significant**.

a.iv) No significant erosion of the existing embankment fills, cut slopes, unlined drainage ditches, or swales in the project area were observed during the geotechnical investigation conducted for the proposed project (Crawford & Associates, 2018). In addition, all project-related work would be designed and constructed in accordance with the requirements of all applicable federal, state, and local safety regulations. Consequently, the likelihood of slope failure is low, and this impact would be **less than significant**.

b) Construction of the proposed project would involve grading and excavation activities that may result in short-term wind and water driven erosion of soils. The project's required compliance with the National Pollutant Discharge Elimination System (NPDES) permit, Storm Water Pollution Prevention Plan (SWPPP), and the City's grading permit would ensure that necessary erosion control measures are applied to the project site during preparation and construction activities. As a result, impacts associated with soil erosion would be **less than significant**.

c, d) The United States Department of Agriculture (USDA) Web Soil Survey shows the surface soils on the project site as Sycamore Silt Loam and Sycamore Silty Clay Loam Both units are underlain by Silt Loam. These soils are indicated to have generally moderate to high shrink-swell potential, low to moderate corrosion potential to concrete, moderate to high corrosion potential to steel, and low to moderate bearing capacity (Crawford & Associates, 2018). The geotechnical study prepared for the proposed project concluded that the site is adequately stable for the planned improvements provided that recommendations presented in the geotechnical study are followed, including retaining a Geotechnical Engineer of Record to review and provide comments on the civil plans and specifications prior to construction, and to monitor grading, foundation excavations (box culverts, retaining walls), wall backfill, and subgrade, aggregate based, and pavement placement and compaction. The proposed project would be designed and constructed in accordance with the requirements of all applicable federal, state, and local safety regulations (Crawford & Associates, 2018). Compliance with these regulations and implementation of **Mitigation Measure GEO-1** (see page 72) would ensure that potentially significant impacts related to soil stability would be **less than significant**.

e) The project does not propose the use or construction of septic tanks or alternative wastewater disposal systems. There would be **no impact**.

f) The project site been subject to substantial disturbance associated with construction of the existing interchange, and there is a low likelihood that paleontological resources or unique geological features would be encountered during construction of the proposed project. Despite this low likelihood, however, subsurface paleontological resources or unique geological features could be damaged by ground-disturbing activities associated with construction of the proposed project. Implementation of **Mitigation Measure GEO-2** would ensure that potentially significant impacts would be **less than significant**.

Mitigation Measures

Mitigation Measure GEO-1: Implement Recommendations Contained in the Site-Specific Geotechnical Report.

The City or its designated consultant shall retain a Geotechnical Engineer of Record to review and provide comments on the project plans and specifications prior to construction. The recommendations of the Geotechnical Engineer of Record shall be incorporated in the final design and construction of the project. Recommendations could include, but not be limited to, monitoring of grading, foundation excavations (box culverts, retaining walls), wall backfill, and subgrade, aggregate based, and pavement placement and compaction.

Mitigation Measure GEO-2: Measures to Protect Paleontological Resources.

In the event that any suspected paleontological resources (e.g., fossilized remains) or unique geological features are discovered during project construction, all ground-disturbing activity within 100 feet of the resources shall be halted and a qualified paleontologist shall be retained to assess the significance of the find. If the find is determined to be significant, the paleontologist shall develop appropriate procedures to protect the integrity of the resource and ensure that no additional resources are affected. Procedures could include but would not necessarily be limited to preservation in place, archival research, subsurface testing, or data recovery.

References

Crawford & Associates, Inc., 2018. Draft Geotechnical Design and Materials Report, I-80 Richards Interchange T.O. #10. Prepared for Mark Thomas. November 15, 2018.

Greenhouse Gas Emissions

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VIII. GREENHOUSE GAS EMISSIONS — Would the project:				
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?	☐	☐	☒	☐

Discussion

The term greenhouse gas (GHG) is used to describe atmospheric gases that absorb solar radiation and subsequently emit radiation in the thermal infrared region of the energy spectrum, trapping heat in the Earth's atmosphere. These gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and water vapor, among others. CO_2 is the most important GHG, so amounts of other gases are expressed relative to CO_2, using a metric called "carbon dioxide equivalent" (CO_2e). The global warming potential (GWP) of CO_2 is assigned a value of 1, and the warming potential of other gases is assessed as multiples of CO_2. For example, the 2007 International Panel on Climate Change (IPCC) *Fourth Assessment Report* calculates the GWP of CH_4 as 25 and the GWP of N_2O as 298, over a 100-year time horizon.[3] Generally, estimates of all GHGs are summed to obtain total emissions for a project or given time period, usually expressed in metric tons ($MTCO_2e$), or million metric tons ($MMTCO_2e$).[4]

Emissions of GHGs have the potential to adversely affect the environment because such emissions contribute, on a cumulative basis, to global climate change. Although the emissions of one single project will not cause global climate change, GHG emissions from multiple projects throughout the world could result in a cumulative impact with respect to global climate change.

Legislation and executive orders on the subject of climate change in California have established a statewide context for and a process for developing an enforceable statewide cap on GHG emissions. Given the nature of environmental consequences from GHGs and global climate change, CEQA requires that lead agencies consider evaluating the cumulative impacts of GHGs, even relatively small (on a global basis) additions.

The proposed project would generate direct and indirect GHG emissions that contribute to global warming and climate change impacts. Although the contribution from an individual project may be minor, the cumulative impact can be substantial. While YSAQMD, the local agency in charge

3 See Table 2.14 in IPCC Fourth Assessment Report: Climate Change 2007 (AR4): The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA. http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-chapter2.pdf.

4 See http://www.airquality.org/Businesses/CEQA-Land-Use-Planning/CEQA-Guidance-Tools.

of air quality considerations in Yolo County, has not established specific standard levels applicable to GHG emissions, CEQA still requires an evaluation of GHGs.

The California Global Warming Solution Act of 2006 (AB 32) was adopted establishing a state goal of reducing California's GHG emissions to 1990 levels by the year 2020. A subsequent Executive Order signed by the Governor establishes an additional target for State agencies of 80 percent below 1990 levels by 2050.

In June 2010, the City of Davis adopted a Climate Action and Adaptation Plan which included local reduction targets for greenhouse gas emissions. The targets are based on a range that uses the State targets as a minimum goal and identifies deeper reductions as the desired outcome. For example, the 2020 target reduction ranged from the State target of 1990 GHG emission levels to the desired target of 28 percent below 1990 levels. The 2050 emission targets ranged from the State target of 80 percent below 1990 levels to the desired outcome of being carbon neutral.

Recently, GHG and climate change impacts have been a major focus of federal and state regulatory agencies. One of the main strategies in the Climate Action Program (CAP) to reduce GHG emissions is to make California's transportation system more efficient. The highest levels of CO_2 come from mobile sources, such as automobiles, and occur at stop-and-go speeds (zero to 25 mph) and speeds over 55 mph. The most severe CO_2 emissions occur from zero to 25 mph. The intent of a highway design project is to relieve traffic congestion by enhancing operations and improving travel times, thus reducing GHG emissions, particularly CO_2.

Many studies show that an increase in traffic volume is related to higher overall CO_2 emissions. Traffic volumes are expected to increase under future conditions; however, operation of the project would increase traffic speed and flow and decrease congestion. With these improvements, CO_2 emissions are expected to decrease from the vehicles utilizing the roadway.

a) Implementation of the proposed project would result in short-term construction and long-term operational GHG emissions. GHG emissions generated by the proposed project would predominantly be in the form of CO_2. While emissions of other GHGs such as methane (CH_4) and nitrous oxide (N_2O) are important with respect to global climate change, the emission levels of these GHGs for the sources associated with project activities are nominal compared with CO_2 emissions, even considering their higher global warming potential. Therefore, all GHG emissions for are reported as CO_2.

   Construction-related emissions would result from mobile-source exhaust from worker commute trips, haul truck trips, and equipment used on site (e.g., pavers, lifts). Long-term operational emissions would be associated with vehicular trips within the proposed project corridor.

   As previously discussed in the *Air Quality* section of this initial study, construction emissions were estimated for the proposed project using default equipment inventories provided in RCEM, project construction scheduling information provided by the City and emissions factors from the EMFAC 2014 and OFFROAD models. GHG emissions generated from construction-related activities for the proposed project are presented below in **Table GHG-1**. As shown in Table GHG-1, construction of the proposed project would result in a total of 126 $MTCO_2e$ per year. As previously stated, given the enormity of GHG emissions worldwide, the contributions of one project, such as the proposed project, are negligible.

TABLE GHG-1
SUMMARY OF PROJECT CONSTRUCTION GHG EMISSIONS

Construction Activity	CO_2e (MT/phase)
Clearing/Grubbing	21
Grading/Excavation	3091
Drainage/Utilities	626
Paving	53
Total (tons/project)	3,792
Amortized Construction Emissions b	126

NOTES:
Totals may not add up exactly due to rounding in the modeling calculations.
For the purposes of the analysis, construction emissions were amortized over 30 years in accordance with industry standards.
CO_2e = carbon dioxide equivalent; MT = metric ton
SOURCE: ESA, 2019.

GHG emissions for baseline (existing) and future with project conditions was estimated utilizing Caltrans' CT-EMFAC, results of the emissions analysis are provided in **Table GHG-2**. The results of the GHG emission analysis show that future CO_2 emissions with the proposed project will decrease from baseline (existing) conditions. Operation of the proposed project would improve air quality throughout the Basin and would result in a **less-than-significant impact**.

TABLE GHG-2
SUMMARY OF NET INCREASE IN GHG EMISSIONS ASSOCIATED WITH THE PROPOSED PROJECT

Proposed Project	CO_2 Emissions (MT/Year)
Existing/Baseline [2016]	130,025
Open to Traffic [2022]	
With Project	123,427
Net Change in Emissions (With Project minus Baseline)	(6,598)
20-Year Horizon/Design-Year [2042]	
With Project	125,774
Net Change in Emissions (With Project minus Baseline)	(4,251)

NOTES:
CO_2 emissions derived from CT-EMFAC were adjusted based on CARB's off-model adjustment factors for CO_2.
CO_2 = carbon dioxide; MT = metric ton
SOURCE: ESA, 2021.

b) The proposed project is located in the City of Davis within the County of Yolo and is included in the Sacramento Area Council of Governments (SACOG) 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy (MTP/SCS). The current 2020 MTP/SCS was adopted in November 2019.

In order to support attainment of air quality standards, the MTP/SCS must be analyzed as an overall package via technical modeling to verify that its implementation would meet federal air quality requirements. In addition, the MTP/SCS must achieve regional greenhouse gas emissions reduction targets set by the CARB. The MTP/SCS must demonstrate a reduction in GHG emissions via technical modeling of the forecasted land use pattern and supporting transportation network designed to serve the regional transportation needs.

As discussed under item a) above, the total GHG emissions associated with the proposed project would not be considered substantial. Additionally, the proposed project is included in SACOG's 2020 MTP/SCS, which demonstrates a reduction in GHG emissions via technical modeling of the forecasted land use pattern and supporting transportation network designed to serve the regional transportation needs. For these reasons, the proposed project would not conflict with the reduction goals established by AB 32. As a result, this impact would be **less than significant**.

References

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Sacramento Area Council of Governments (SACOG), 2019. 2020 Metropolitan Transportation Plan/Sustainable Communities Strategy, Adopted November 18, 2019. Available: https://www.sacog.org/2020-metropolitan-transportation-plansustainable-communities-strategy.

Hazards and Hazardous Materials

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
IX. HAZARDS AND HAZARDOUS MATERIALS — Would the project:				
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 or excessive noise for people residing or working in the project area?	☐	☐	☐	☒
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires?	☐	☐	☐	☒

Discussion

a) Construction activities associated with the proposed project would involve the transport and use of limited quantities of fuels, lubricants, oils, solvents, and other potentially hazardous materials at the project site for the purposes of construction and equipment maintenance. The accidental release of hazardous materials due to the improper transport and handling of the common hazardous materials associated with the construction of the proposed could potentially occur. However, the transport, storage, and use of hazardous materials is regulated through various federal, state, and local laws and policies, enforced by an array of departments at local, municipal, and state levels. The use of hazardous materials associated with construction activities for their intended purposes in compliance with these regulations would therefore not represent a significant risk to public health or the environment, and this impact would be **less than significant**.

Operation of the completed interchange project would not result in material changes or increases related to the transport, storage, use, and/or disposal hazardous materials. Operation of the completed interchange project would occur in compliance with existing hazardous materials regulations, and operational impacts related to the transport, use or disposal of hazardous materials would be **less than significant**.

b) Crawford & Associates, Inc. prepared a Draft Initial Site Assessment (ISA) for the proposed project (Crawford & Associates, 2018). The purpose of the ISA was to identify and provide a preliminary assessment of the potential impacts of known or potential Recognized Environmental Conditions (RECs)[5] within the project area that may influence design and construction of the project. Crawford & Associates performed the following tasks for preparation of the ISA.

- Reviewed geologic and groundwater conditions;
- Initiated a request with GeoSearch to search federal, state, and local regulatory agency databases to determine whether areas of environmental concern exist on or near the project site. Search distances ranged between ⅛ and one mile from the project site, depending on the database;
- Reviewed available information to assess past and present activities conducted within the project study area and assessed the potential for hazardous materials impact;
- Reviewed historical aerial photographic coverage and topographic map coverage of the project site and vicinity for indications of potential sources of contamination;
- Reviewed the State of California’s GeoTracker and EnviroStor websites for sites in the project vicinity;
- Conducted limited reconnaissance of the project site and vicinity on February 15, 2018; and
- Contracted with National Analytical Laboratory, Inc. (NAL) to perform a survey of the I-80 bridge for the presence of asbestos containing construction material (ACCM) and lead-containing material (LCM).

Based on the records reviewed and the site reconnaissance performed for the ISA, Crawford & Associates made the following observations:

- The database records search did not identify any Recognized Environmental Conditions (RECs) or historical RECs (HRECs) that have potentially impacted shallow soil within the project site.
- A former service station in the vicinity of the eastern end of the I-80 off-ramp (HREC) was identified from review of aerial photographs.

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5 The term recognized environmental condition (REC) means the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimis conditions that generally do not present a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. Conditions determined to be de minimis are not recognized environmental conditions.

- A REC was identified with respect to potential for petroleum hydrocarbons and volatile organic compounds (VOCs) in groundwater beneath the overpass structure, where proposed construction activities may encounter groundwater.
- Site reconnaissance identified a concrete box culvert that could potentially contain asbestos and subgrade transformers that may be impacted by the northward expansion of the I-80 bridge.
- Site reconnaissance identified guardrails and traffic signs mounted on treated wood posts at the I-80 bridge, on the Richards Boulevard overpass, at the westbound I-80 on and off-ramps for Richards Boulevard, and the Olive Drive off-ramp.
- Shallow soil along the proposed alignment of the new westbound I-80 on- and off-ramps has been tested for aerially deposited lead (ADL). ADL is reported below concentrations that require additional testing or special handling; this soil may be reused without restriction. Soil adjacent to Richards Boulevard between Olive Drive and the railroad underpass, and in the vicinity of the Olive Drive exit, has the potential for ADL impact.
- A REC was identified with respect to asbestos-containing construction material (ACCM) in the Putah Creek box culvert.
- A REC was identified with respect to lead-containing material (LCM) on the westbound I-80 bridge.

Based on the public records, historical aerial photographs, and historical aerial photographs reviewed for this project, and the site reconnaissance performed on February 15, 2018, Crawford & Associates made the following recommendations:

- Fog line and lane striping material on Richards Boulevard, the Olive Drive off-ramp, the eastbound I-80 off-ramp, and the I-80 bridge should be evaluated for heavy metals (if they will be impacted by proposed construction activities, and the material will not be recycled).
- Groundwater upgradient of the overpass has been impacted by petroleum hydrocarbons and VOCs, which may have migrated beneath the overpass. If future construction activities include advancing borings (i.e., either by means of cast-in-drilled-holes or predrilling holes to assist driven piles) into groundwater, testing of extracted saturated soil and groundwater should be performed to minimize worker exposure and to properly classify the extracted material for disposal.
- Treated wood waste (TWW) will need to be handled and disposed of in accordance with alternative management standards (AMS) protocol.
- Soil adjacent to the Olive Drive exit and adjacent to Richards Boulevard between Olive Drive and the railroad underpass should be tested for the presence of ADL at concentrations in excess of the hazardous waste threshold if soil in these areas would be disturbed by proposed work.

Based on the findings of the ISA, without implementation of appropriate measures, construction of the proposed project could 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. Hazardous materials associated with the project site and vicinity identified in the ISA include, but are not limited to, contaminated groundwater, treated wood waste, asbestos-containing materials, aerially deposited lead, and lead-containing material, and heavy metals in paint and thermoplastic materials used for traffic striping. Consequently, impacts related to exposure or release of hazardous materials during project construction are potentially significant.

Implementation of **Mitigation Measures HAZ-1**, **HAZ-2**, and **HAZ-3** (see page 81) would ensure there would not be 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 and reduce the potentially significant impact to a **less-than-significant** level.

The project site is not located within one-quarter mile of an existing or proposed school. As discussed in item a) above, the transport, storage, and use of hazardous materials is regulated through various federal, state, and local laws and policies, enforced by an array of departments at local, municipal, and state levels. The use of hazardous materials associated with construction activities for their intended purposes in compliance with these regulations would therefore not represent a significant risk to public health or the environment, including school sites and attending students. This impact would **be less than significant**.

d) The ISA prepared for the proposed project included an extensive database records search for the project site and properties within a one-mile radius of the project site (Crawford & Associates, 2018). Search distances ranged between ⅛ and one mile from the project site, depending on the database. The ISA concluded that the project site was not identified in any of the databases searched, and the project site is not located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 (i.e., Cortese List). There would be **no impact** related to this significance criterion.

e) The Sacramento International Airport is located approximately 12 miles to the northeast of the project site, the Yolo County Airport is located approximately 7 miles to the northwest of the project site, and the University Airport is located approximately 2.5 miles west of the project site. The proposed project is not located within the airport influence areas of any airport. There would be **no impact** related to this significance criterion.

f) The proposed project would relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. Emergency access through the intersections would improve from conditions prior to the modifications.

A Transportation Management Plan (TMP) would be developed for use during project construction. The TMP would utilize strategies described in the *California Manual of Traffic Control Devices* and Caltrans *Transportation Management Plan Guidelines*. The TMP would direct the process and procedures for dissemination of information to the public and motorists, provide guidance for implementation of incident management, describe construction strategies for traffic handling and guiding traffic through work zones, address traffic demand management during construction, and describe and direct the implementation of alternate routes or detours. Implementation of the TMP would ensure that impacts related to emergency access during construction of the proposed project would be **less than significant**.

g) The project site comprises an existing interchange and adjacent roadways and structures in an urban environment in the City of Davis. There are no wildlands within or adjacent to the project site. Construction and operation of the proposed project would not expose people or structures, either directly or indirectly, to a significant risk of loss, injury, or death involving wildland fires. There would be **no impact** related to this significance criterion.

Mitigation Measures

Mitigation Measure HAZ-1: Safe Removal and Proper Disposal of Hazardous Materials.

The City shall ensure, through the enforcement of contractual obligations, that work plans address procedures for the safe testing, removal, and proper disposal of hazardous materials that could be encountered and released with implementation of the project, including, but not limited to, treated wood waste, asbestos-containing materials, aerially deposited lead, and lead-containing material, and heavy metals in paint and thermoplastic materials used for traffic striping, Hazardous materials shall be tested, handled, and disposed of in accordance with appropriate federal, state, and local regulations.

Mitigation Measure HAZ-2: Contamination of Soil and/or Groundwater.

During construction activities for the proposed project, if contaminated soil and/or groundwater are encountered or suspected contamination is encountered, work shall be stopped in the suspected area of contamination and the type and extent of the contamination be identified. If necessary, a remediation plan shall be implemented in conjunction with continued construction of the proposed project.

Mitigation Measure HAZ-3: Prepare and Implement a Health and Safety Plan (HASP).

The City shall ensure preparation and implement a Health and Safety Plan (HASP) that describes appropriate procedures to follow in the event that contaminated soil or groundwater or other hazardous materials or conditions are encountered during construction activities. Any unknown substances shall be tested, handled and disposed of in accordance with appropriate federal, state and local regulations.

References

Crawford & Associates, Inc., 2018. Draft Initial Site Assessment, I-80 Richards Interchange T.O. #10. Prepared for Mark Thomas. August 21, 2018.

Hydrology and Water Quality

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
X. HYDROLOGY AND WATER QUALITY — Would the project:				
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality?	☐	☐	☒	☐
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i) result in substantial erosion or siltation on- or off-site;	☐	☐	☒	☐
ii) substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or offsite;	☐	☐	☒	☐
iii) 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; or	☐	☐	☒	☐
iv) impede or redirect flood flows?	☐	☐	☒	☐
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?	☐	☐	☐	☒
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?	☐	☐	☒	☐

Environmental Setting

The project site is located within the City of Davis, within a largely developed area in the southeastern portion of the City. The area has a generally flat or nearly flat topography, although there is an incline along Richards Boulevard to cross over the interstate. In the greater vicinity of the project site, the City lies on a relatively flat alluvial plain. Land uses that surround the project site include commercial, industrial, light industrial, residential, and agriculture.

The project site is located within what is known as the Great Valley geomorphic province. The geology of the Great Valley geomorphic province is classified by thick Jurassic through Holocene-aged sedimentary deposits. The majority of Davis consists of alluvial sediments from the Putah Creek Plain below which are metamorphic and igneous rocks. Soils in the area generally have a high proportion of silt and clay and as a result are only moderately or slowly permeable, which hinders drainage and groundwater recharge (USDA, 2018).

The proposed project is located within the Yolo Subbasin of the Sacramento Valley Groundwater Basin (Subbasin 5-021.67) of the Sacramento Valley aquifer system (CDWR, 2004). Aquifers in this area generally consist of younger alluvium, older alluvium, and the Tehama Formation which can cumulatively range from a few hundred up to 3,000 feet. Groundwater in the subbasin is a sodium magnesium, calcium magnesium, or magnesium bicarbonate type. The geologic structure impedes subsurface groundwater flow from west to east. Subsurface groundwater outflow sometimes occurs from the Yolo subbasin into the Solano subbasin to the south. Subsurface outflow and inflow may also occur beneath the Sacramento River to the east with the South and North American subbasins. Subsurface groundwater inflow may occur from the west out of the Capay Valley Basin (CDWR, 2004).

Groundwater levels in the subbasin are impacted by periods of drought due to increased groundwater pumping and less surface water recharge, but recover quickly in high precipitation years. Long term trends for the subbasin do not indicate any significant declines except for localized depressions in areas including the City of Davis. The closest well for which groundwater level data were available was located just west of the study area, just south of Richards Boulevard (well number 08N02E15G004M), which indicated that groundwater levels are generally between 40 and 60 feet below ground surface (CDWR, 2018).

The project site and its immediate vicinity is mostly level. Drainage from Richards Boulevard is directed along curbside gutters into various catch basins. Runoff collected in the catch basins is presumably directed towards Putah Creek to the south of the site which is approximately 500 feet away. The Putah Creek watershed is approximately 225,301 acres and bounded by Putah Creek to the south and Cache Creek to the north.

The Federal Emergency Management Agency (FEMA), through its Flood Insurance Rate Maps (FIRMs), documents and delineates the occurrence of floodplains and flood hazard areas in populated areas of the US. In the Project vicinity, FEMA has delineated both the 100-year (i.e., 1 percent annual chance of return) and the 500-year (0.2 percent annual chance of return) floodplain areas. Based on a review of current FEMA maps, the project site is located within Zone X, area of minimal flood potential, and not within any 100- or 500-year flood zone (FEMA, 2018).

No potentially jurisdictional waters of the U.S. or state were identified within the project site during the biological investigation for the proposed project. The north fork of Putah Creek formerly flowed under Interstate 80 within the project area. The north fork of Putah Creek was diverted to the south fork in 1948 to prevent flooding in the City of Davis. The remnant channel is still visible within the project site but no longer carries water. This remnant channel does not exhibit an ordinary high water mark or show any evidence of flowing water. This remnant channel does not meet the criteria as a jurisdictional water of the U.S. or state (Caltrans, 2019).

Putah Creek is the primary natural drainage that flows south of the project site. Putah Creek ultimately discharges to the Sacramento River. Beneficial uses have not been specifically identified for Putah Creek. However, beneficial uses for the Sacramento River have been identified by the Central Valley RWQCB and include, municipal and domestic supply, irrigation and stock watering, process, power, contact recreation, other non-contact recreation, warm freshwater habitat, cold freshwater habitat, and wildlife habitat (SWRCB, 2017).

Discussion

a) Project construction would involve removal of existing roadway improvements, widening existing roadways, and other roadway improvements such as creating a separation barrier for a multi-use pathway. During the construction process, these activities would require the use of heavy equipment on-site, including but not limited to grading equipment, excavators, bulldozers, semi-trucks, and paving equipment. Existing drainages would be filled, and re-excavated in their proposed locations. Existing culverts would be removed and, as warranted, re-excavated to support installation of the updated culverts. These activities would disturb existing surface vegetation, as well as surface sediments at the project site. This loosening of surficial soils could result, in the event of a storm, in increased erosion from the project site, as well as an increase in sedimentation downstream. Drainage potential to Putah Creek is enhanced during periods of high to very high stormflows. As a result, construction of the proposed project could result in increased sediment loads downstream. Increased sediment load in either of these areas could meaningfully impact water quality, resulting in water quality degradation.

In addition to sediment, the use of heavy machinery on site would increase potential for construction related water quality pollution during storm events. Construction related oils, greases, paint, fuels, and other potential construction-period water quality pollutants could become entrained in stormwater, resulting in degraded water quality downstream.

Construction of the proposed project would be performed in compliance with the state National Pollutant Discharge Elimination System (NPDES) General Construction Permit and any subsequent General Permit in effect at the time of project construction. The applicable permits authorize stormwater and authorized non-stormwater discharges from City and Caltrans construction activities and would be required prior to commencement of the construction phase of the project. As part of this permit requirement, a Stormwater Pollution Prevention Plan (SWPPP) that follows the City requirements and guidance in the current version of the Caltrans Stormwater Pollution Prevention Plan would be prepared prior to construction consistent with the requirements of the Regional Water Quality Control Board (RWQCB). The SWPPP would incorporate all applicable best management practices (BMPs) to ensure that adequate measures are taken during construction to minimize water quality impacts.

Operation of the proposed project would result in accumulation of oil, grease, and other chemicals used by motor vehicles that may be released during first rains and have the potential to degrade water quality. Operation of the proposed project would require compliance with the City of Davis stormwater program, which operates under a municipal separate storm sewer system (MS4) NPDES permit from the Central Valley RWQCB. This permit requires the City to enforce a post-construction stormwater management program for new development and redevelopment. The City's Stormwater Management Plan includes control measures to improve the quality and reduce the quantity of stormwater runoff to protect receiving waters.

Compliance with the above regulatory requirements would ensure that the project construction and operational impacts to water quality would be **less than significant**.

b) Project construction activities would include clearing vegetation, grading, excavation, placing embankment, drainage, and paving roadway surfaces. Project construction activities would not interfere with groundwater recharge. The completed project would result in a minor net increase (approximately 0.15 acre) in impervious surface in the project area and would not be anticipated to substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin. The impact would be **less than significant**.

c) The completed project would result in a minor net increase (approximately 0.15 acre) in impervious surface in the project area and would not substantially alter the existing drainage pattern of the site or area or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite. The proposed project would be designed and operated in compliance with the City of Davis stormwater program, which operates under a MS4 NPDES permit from the Central Valley RWQCB. This permit requires the City to enforce a post-construction stormwater management program for new development and redevelopment. The City's Stormwater Management Plan includes control measures to improve the quality and reduce the quantity of stormwater runoff to protect receiving waters. Compliance with the City's stormwater program would ensure that the proposed project would 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 impact would be **less than significant**.

d) The project site is located within Zone X, area of minimal flood potential, and not within any 100- or 500-year flood zone (FEMA, 2018). Tsunamis are large waves created by earthquakes, undersea landslides, or volcanic eruptions. Low-lying coastal areas such as tidal flats, marshes, and former bay margins that have been artificially filled are susceptible to inundation. The California Department of Conservation prepares tsunami inundation maps for coastal areas and all populated areas at risk to tsunami within the state based on the maximum tsunami threat for that area, and no areas of Yolo County are at risk from tsunami (California Department of Conservation, 2009). Additionally, the project site is distant from any large water bodies that could create seiche waves and is located in level topography where the risk of mudflow is minimal. Consequently, there would be **no impact** related to risk of release of pollutants due to project inundation by flood, tsunami, or seiche.

e) As discussed in items a) and c) above, the proposed project would be constructed and operated in compliance with applicable regulations and permit requirements pertaining to water quality, including the requirements of the NPDES General Construction Permit and the City's Stormwater Management Plan. As discussed in item b) above, construction and operation of the proposed project would not impede sustainable groundwater management of the within the Yolo Subbasin of the Sacramento Valley Groundwater Basin. Consequently, the proposed project would not conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan. The impact would be **less than significant**.

References

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State Water Resources Control Board (SWRCB), 2017. Final 2014/2016 California Integrated Report (Clean Water Act Section 303(d) List/305(b) Report. Available: https://www.waterboards.ca.gov/water_issues/programs/tmdl/2014_16state_ir_reports/category5_report.shtml. Accessed June 28, 2018.

U.S. Department of Agriculture (USDA), Department of Conservation, 2018. Web Soil Survey, Sacramento County. Available: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm. Accessed June 27, 2018.

Land Use and Planning

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XI. LAND USE AND PLANNING — Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒

Discussion

a) The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. The project would not install any additional barriers to movement between various segments of the community or physically divide an established community. There would be **no impact** related to this significance criterion.

b) The project is located within the City of Davis. The City of Davis General Plan and Gateway/Olive Drive Specific Plan together provide the land use designations for the project area (City of Davis, 2007 and 2018). The land southeast of I-80 is designated as Business Park and General Commercial. This area contains multiple retail establishments, including fast food and casual sit-down restaurants, a gas station, auto part store, several hotels, and UC Davis Extension buildings. To the northwest of I-80, the land is mainly designated as Commercial Service, with fast food restaurants, a coffee shop, a gas station, hotel, and other businesses. A small portion of the area (north of the westbound off-ramp) is designated as East Olive Mixed Use and includes apartments, including Cesar Chavez Plaza Permanent Supportive Housing. The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. The proposed project is consistent with and would not conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. There would be **no impact** related to this significance criterion.

References

City of Davis, 2007. City of Davis General Plan. Available: https://www.cityofdavis.org/city-hall/community-development-and-sustainability/planning-and-zoning/general-plan.

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Mineral Resources

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XII. MINERAL RESOURCES — Would the project:				
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?	☐	☐	☐	☒

Discussion

a, b) The proposed project would not use or extract any mineral or energy resources and would not restrict access to known mineral resource areas. The proposed project would not conflict with energy conservation plans, use non-renewable resources in a wasteful manner, or result in the loss of availability of a known mineral resource. There would be **no impact**.

Noise

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XIII. NOISE — Would the project result in:				
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☒	☐
c) For a project located within the vicinity of a private airstrip or 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?	☐	☐	☐	☒

Discussion

a) Noise associated with the proposed project would include noise during demolition and construction and traffic noise after operations commence. Noise associated with construction activities for the proposed project would be temporary and operational noise would be similar to existing noise levels within the project area.

Construction

During construction of the project, noise from construction activities may intermittently dominate the noise environment in the immediate area of construction. Construction activities under the proposed project would include but not be limited to demolition, grubbing/land clearing, grading/excavation, paving, and pile driving for new pedestrian structures.

Table NOISE-1 summarizes noise levels produced by construction equipment that is commonly used on roadway construction projects. Construction equipment is expected to generate noise levels ranging from 70 to 90 decibels (dB)[6] at a distance of 50 feet, and noise produced by construction equipment would be reduced over distance at a rate of about 6 dB per doubling of distance.

Noise sensitive land uses may include residential uses, schools, hospitals, nursing homes, religious institutions, libraries, and similar uses. The areas within and immediately adjacent to the project limits are predominantly developed and generally consist of multi-family residences, commercial/retail uses, hotels, and a school extension associated with UC Davis.

6 A sound's loudness is measured in decibels (dB). Normal conversation is about 60 dB, a lawn mower is about 90 dB, and a loud rock concert is about 120 dB.

TABLE NOISE-1
CONSTRUCTION EQUIPMENT NOISE LEVELS

Equipment	Noise Level (dB at 50 feet)
Bulldozers	82
Heavy Trucks	81
Backhoe	78
Pneumatic Tools	85
Concrete Pump	81
Loader	79
Roller	80
Compressor	78
Crane	81
Drill Rig	79
Paver	77
Hoe Ram	90

SOURCE: FHWA, 2006.

Compliance with construction hours specified by the City would be required. Section 24.02.020 (Noise Limits) of the City's Municipal code allows construction between the hours of 7:00 a.m. and 7:00 p.m. on Mondays through Fridays, and between the hours of 8:00 a.m. and 8:00 p.m. on Saturdays and Sundays, if they meet at least one of the following noise limitations:

1. No individual piece of equipment shall produce a noise level exceeding eighty-three dBA[7] at a distance of twenty-five feet. If the device is housed within a structure on the property, the measurement shall be made outside the structure at a distance as close to twenty feet from the equipment as possible.
2. The noise level at any point outside of the property plane of the project shall not exceed eighty-six dBA.
3. The provisions of subdivisions (1) and (2) of this subsection shall not be applicable to impact tools and equipment; provided, that such impact tools and equipment shall have intake and exhaust mufflers recommended by manufacturers thereof and approved by the director of public works as best accomplishing maximum noise attenuation, and that pavement breakers and jackhammers shall also be equipped with acoustically attenuating shields or shrouds recommended by the manufacturers thereof and approved by the director of public works as best accomplishing maximum noise attenuation. In the absence of manufacturer's recommendations, the director of public works may prescribe such means of accomplishing maximum noise attenuation as he or she may determine to be in the public interest.

[7] A-weighted decibels, abbreviated dBA, or dBa, or dB(a), are an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-weighted system, the decibel values of sounds at low frequencies are reduced, compared with unweighted decibels, in which no correction is made for audio frequency.

4. Construction projects located more than two hundred feet from existing homes may request a special use permit to begin work at 6:00 a.m. on weekdays from June 15 until September 1. No percussion type tools (such as ramsets or jackhammers) can be used before 7:00 a.m. The permit shall be revoked if any noise complaint is received by the police department.
5. No individual powered blower shall produce a noise level exceeding seventy dBA measured at a distance of fifty feet.
6. No powered blower shall be operated within one hundred feet radius of another powered blower simultaneously.
7. On single-family residential property, the seventy dBA at fifty feet restriction shall not apply if operated for less than ten minutes per occurrence.

To minimize construction noise impacts on sensitive land uses adjacent to the project limits, construction noise is regulated by Caltrans Standard Specification Section 14-8.02, "Noise Control," and also by Standard Special Provisions (SSP) S5 310, which states the following:

- Do not exceed 86 dBA Lmax[8] at 50 feet from the job site activities from 9:00 p.m. to 6:00 a.m.
- Equip an internal combustion engine with the manufacturer-recommended muffler. Do not operate an internal combustion engine on the job site without the appropriate muffler.

Adherence to the City and Caltrans requirements for construction would ensure that the proposed project's short-term construction noise impacts would be **less than significant**.

Operation

As previously stated, permanent operational noise would be generated from vehicular traffic utilizing the new interchange. The City does not have specific noise requirements for transportation noise within the City limits. However, under CEQA, the baseline (existing) noise level is used as a comparison to the anticipated project noise level. The assessment of project noise impacts entails identifying the physical area and setting where the potential noise impact could occur and then determining how substantial and perceptible any noise increase would be in the given area. With respect to the community noise assessment, changes in noise levels of less than 3 dBA are generally not discernable to most people, while changes greater than 5 dBA are readily noticeable and would be considered a significant increase.

On behalf of Caltrans District 3 and the City of Davis, ESA staff conducted a noise study for the proposed project that included identifying existing ambient noise levels within the proposed project limits and calculating future noise levels with the proposed project. The analysis was conducted in accordance to Caltrans guidance and requirements (Caltrans, 2019).

[8] Lmax is the maximum sound level during a measurement period or a noise event.

Traffic noise levels were predicted using the Federal Highway Administration (FHWA) Traffic Noise Model Version 2.5. Key inputs to the traffic noise model were the locations of roadways, existing sound walls, ground type, and receptors. Three-dimensional representations of these inputs were developed using computer-aided design drawings, aerials, and topographic contours from the project design plans.

Traffic noise was evaluated under existing conditions future design year (2042) conditions with the project. Loudest-hour traffic volumes, vehicle classification percentages, and traffic speeds under existing (2016) and design year (2042) were used as input into the traffic noise model. The highest average traffic volumes on I-80 and Richards Boulevard are predicted to occur during the evening; therefore, evening peak-hour traffic volumes were used in the model.

Existing and future predicted noise levels were computed for a total of 423 noise sensitive land use receivers, including residential communities to the northeast of the interchange. Existing noise levels ranged from 39 to 74 dBA Equivalent Sound Level (Leq)[9] The noise modeling results indicated that predicted traffic noise levels for the future 2042 with-project conditions would range from 40 to 70 dBA Leq. The results show that the proposed project would increase the noise levels at some receiver locations by a maximum of 2 dB. Therefore, the traffic noise volumes associated with the proposed project would not exceed the 3 dB threshold (Caltrans, 2019). In addition, reconstruction of the interchange would shift traffic farther away from a number of noise-sensitive land uses within in the project area, which would result in a decrease in noise levels in the future with project conditions in comparison to the existing conditions. Consequently, operational noise impacts would be **less than significant**.

b) The project would include demolition, grubbing/land clearing, grading/excavation, paving, and pile driving for new pedestrian structures. Construction would be conducted in accordance with City and Caltrans requirements. Construction vibration would not be anticipated to occur beyond the construction site and would cease to occur once project construction is completed. Consequently, the proposed project would not be anticipated to generate excessive ground-borne vibration or ground-borne noise levels, and the impact would be **less than significant**.

c) The Sacramento International Airport is located approximately 12 miles to the northeast of the project site, the Yolo County Airport is located approximately 7 miles to the northwest of the project site, and the University Airport is located approximately 2.5 miles west of the project site. The proposed project is not located within the airport influence areas of any airport. There would be **no impact** related to this significance criterion.

9 Equivalent Sound Level (Leq) represents an average of the sound energy occurring over a specified period. In effect, Leq is the steady-state sound level containing the same acoustical energy as the time-varying sound that actually occurs during the same period. The 1-hour A-weighted equivalent sound level (Leq[h]) is the energy average of A-weighted sound levels occurring during a 1-hour period, and is the basis for noise abatement criteria (NAC) used by Caltrans and FHWA.

References

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Population and Housing

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

Discussion

a) The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. The project would involve the improvement of an existing interchange and would not in itself induce growth above that which is planned from development in the area. There would be **no impact** related to this significance criterion.

b) The proposed project would not involve the removal or relocation of any housing. There would be **no impact** related to this significance criterion.

Public Services

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XV. PUBLIC SERVICES —				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental 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 following public services:				
i) Fire protection?	☐	☐	☒	☐
ii) Police protection?	☐	☐	☒	☐
iii) Schools?	☐	☐	☐	☒
iv) Parks?	☐	☐	☐	☒
v) Other public facilities?	☐	☐	☐	☒

Discussion

a.i) The proposed project does not include a residential or commercial component that would increase human presence in the area. The project would not result in an increased demand for fire protection service or reduce response times. Traffic controls would be in place during construction and the dates and times of construction would be provided to the City Fire Department to avoid impacts to emergency. This impact would be **less than significant**.

a.ii) The proposed project does not include a residential or commercial component that would increase human presence in the area. The project would not result in an increased demand for police protection service or reduce response times. Traffic controls would be in place during construction and the dates and times of construction would be provided to the City Police Department to avoid impacts to emergency. This impact would be **less than significant**.

a.iii) The proposed project would not directly result in an increased demand for schools. There would be **no impact** related to this significance criterion.

a.iv) The proposed project would not directly result in an increased demand for parks. There would be **no impact** related to this significance criterion.

a.v) The proposed project would not require additional public facilities for construction of the proposed project or for maintenance of the interchange and roadway improvements. There would be **no impact** related to this significance criterion.

Recreation

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVI. RECREATION —				
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?	☐	☐	☐	☒

Discussion

a) The nearest parks to the project are Central Park about three-quarters of a mile northwest of the interchange, Toad Hollow Dog Park about a mile northeast of the interchange, Playfields Park and Walnut Park, both a mile east and south of the interchange. The nearest recreational facilities to the site include the Putah Creek bike path, just west of the interchange. The proposed project does not include a residential or commercial component that would increase human presence and 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. There would be **no impact** related to this significance criterion.

b) The project would include construction of a shared-use path along the west side of Richards Boulevard replacing the existing sidewalk, and serving both bicyclists and pedestrians. The project would also widen the existing Class II bicycle lanes along Richards Boulevard between Olive Drive and Research Park Drive to a minimum of 7 feet. The physical effects of construction and operation of these City transportation facilities are evaluated in this initial study. The project does not include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment. There would be **no impact** related to this significance criterion.

Transportation

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XVII. TRANSPORTATION — Would the project:				
a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?	☐	☐	☐	☒
b) Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?	☐	☐	☐	☒
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☒	☐
d) Result in inadequate emergency access?	☐	☐	☒	☐

Transportation Analysis

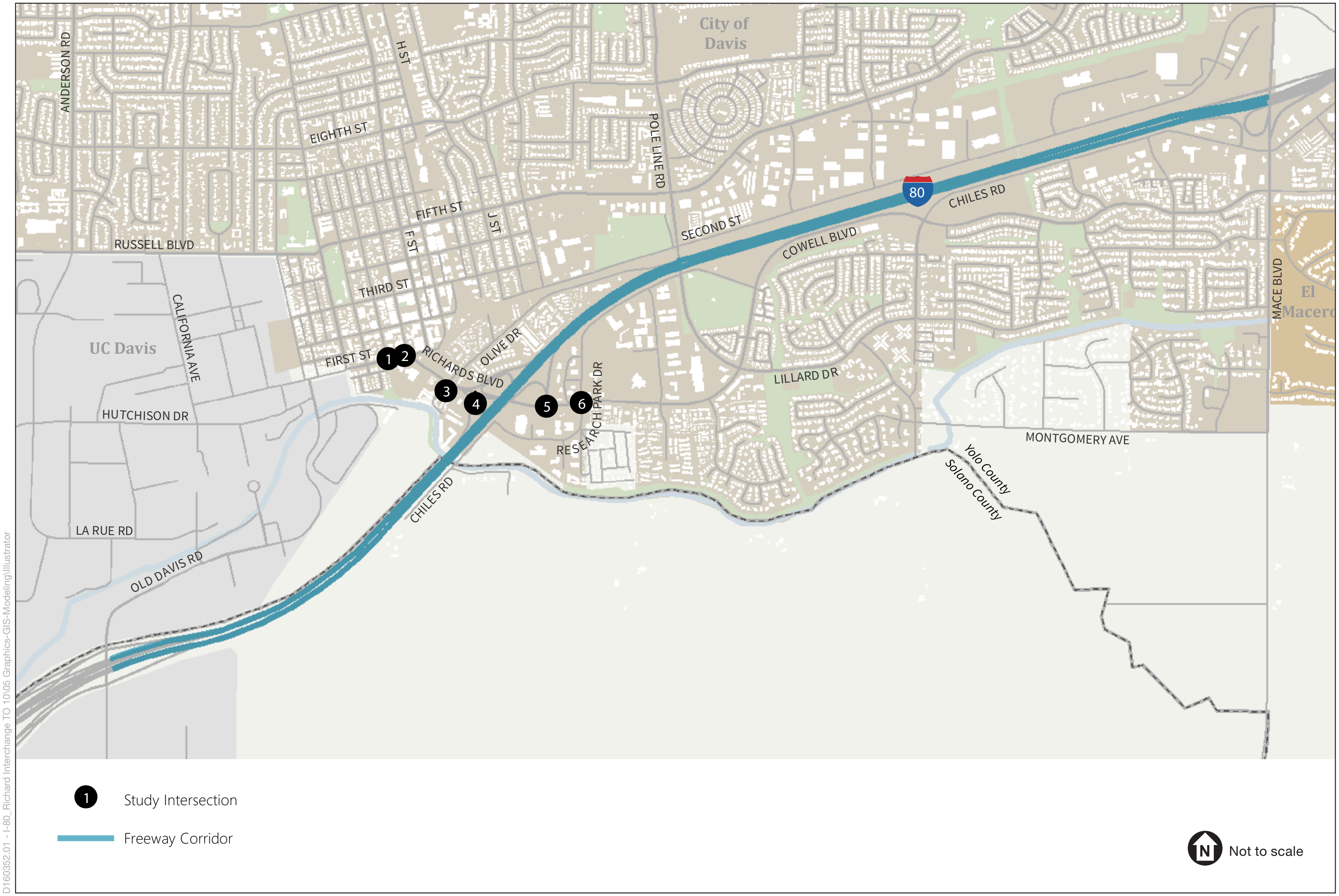
A transportation analysis report was prepared to analyze the effects of the proposed project on the transportation network, including roadways, intersections, transit systems, and bicycle and pedestrian facilities (Fehr & Peers, 2018). The transportation analysis report analyzed the transportation effects of the Build Alternative (i.e., the proposed project) and the No Build Alternative. The No Build Alternative would maintain the current roadway configuration with the exception of planned future improvements to the Richards Boulevard/Olive Drive intersection, including restriping of approaches to extend bicycle lanes and addition of separate eastbound right turn to serve traffic from planned development east of Richards Boulevard. The transportation analysis report is included as **Appendix D** and is summarized below.

Transportation Analysis Study Area

The transportation analysis study area is divided into a local street network and a freeway network. The local street network extends from First Street/D Street in downtown Davis along First Street and Richards Boulevard to Research Park Drive/Richards Boulevard/Cowell Boulevard in south Davis. The freeway network extends along I-80 from Old Davis Road to Mace Boulevard. **Figure 12** shows the intersections and freeway segments in the study area.

Study Intersections

1. First Street/D Street
2. First Street/E Street/Richards Boulevard
3. Olive Drive/Richards Boulevard
4. I-80 Westbound Ramps/Richards Boulevard
5. I-80 Eastbound Ramps/Richards Boulevard
6. Research Park Drive/Richards Boulevard/Cowell Boulevard



SOURCE: Fehr & Peers, 2018

Interstate 80/Richards Boulevard Interchange Improvements Project

Figure 12
Transportation Analysis Study Area

ESA

Freeway Study Segments

Eastbound I-80

1. West of Old Davis Road On-ramp
2. Old Davis Road On-ramp
3. Old Davis Road to 1st Lane Drop
4. 1st Lane Drop to 2nd Lane Drop
5. Richards Boulevard Off-ramp
6. Richards Boulevard Off to On-ramp
7. Richards Boulevard On-ramp
8. Richards Boulevard to Chiles Road
9. Chiles Road Off-ramp
10. East of Chiles Road Off-ramp

Westbound I-80

11. East of Mace Boulevard On-ramp
12. Mace Boulevard to Lane Drop
13. Lane Drop to Olive Drive
14. Olive Drive Off-ramp
15. Olive Drive to Richards Boulevard
16. Richards Boulevard Northbound Off-ramp
17. Richards Boulevard Northbound Off to On-ramp
18. Richards Boulevard Northbound On-ramp to Southbound Off-ramp
19. Richards Boulevard Southbound Off to On-ramp
20. Richards Boulevard to Old Davis Road
21. Old Davis Road Off-ramp
22. West of Old Davis Road

Evaluation Criteria

The intersection and freeway segment evaluation criteria used in the transportation analysis report were based on the policies of the City of Davis and Caltrans, both of which use level of service (LOS) as a metric for describing the operations of the segments and intersections of a roadway network. As described in the City of Davis General Plan Transportation Element, LOS is a semi-quantitative description of an intersection's operation, ranging from LOS A (indicating free flow traffic conditions with little or no delay) to LOS F (representing oversaturated conditions with traffic flows exceeding design capacity, resulting in long queues and delays). LOS at roadway segments can be qualified by several methodologies. A daily LOS is a generalized approach where the volume-to-capacity based on a theoretical daily roadway capacity is based on the number of lanes and capacity class. Roadway congestion is generally represented by an alphabetic level of service A through F. Level F is indicative of a roadway that has exceeded its theoretical maximum capacity, and therefore fully congested (City of Davis, 2013).

City of Davis

The City of Davis General Plan Transportation Element identifies LOS E as the minimum acceptable LOS for intersections during peak hours although LOS F is acceptable for the "Core Area and Richards Boulevard/Olive Drive area." For the proposed project, a significant impact occurs when (1) an intersection worsens from LOS E or better under the No Build Alternative to LOS F or (2) intersection delay increases for an intersection operating at LOS F under the No Build Alternative.

Caltrans

The *Interstate 80 Transportation Concept Report* (Caltrans, 2017) identifies LOS E as the concept LOS for urban areas in Caltrans District 3. For the proposed project, a significant impact occurs when (1) a freeway segment worsens from LOS E or better under the No Build Alternative to LOS F or (2) freeway segment density increases for a segment operating at LOS F under the No Build Alternative.

Data Collection

To identify existing traffic conditions in the study area, intersection and freeway traffic counts were collected from 7:00 to 9:00 a.m. and 4:00 to 6:00 p.m. The peak period counts included heavy vehicles, bicycles, and pedestrians. The intersection turning movement counts were collected in May 2016 on a typical midweek day. Freeway mainline volumes were obtained from the Caltrans Performance Measurement System (PeMS). The data were averaged across weekdays in October 2016. Freeway ramp volumes for the Richards Boulevard and Old Davis Road interchanges come from intersection counts taken in October 2016. The Olive Drive off-ramp was counted in May 2016. For the Mace Boulevard/Chiles Road ramps, data collected in May 2014 was used. For the ramps, the peak hour volumes were determined using the mainline peak hour.

Travel Demand Forecasting

Base Year Model Development

The City of Davis travel demand forecasting model was used to prepare the traffic volumes for future conditions. A base year model validation was performed to determine how well the model replicates existing traffic volumes.

Cumulative Year Model Development

Similar to the base year model, the cumulative year land use and roadway network inputs were reviewed. In addition to the roadway network adjustments identified for the base year model validation, the UC Davis land use growth was adjusted to the latest projections in the Long Range Development Plan (LRDP).

The cumulative year model includes build-out of the city's General Plan under 2035 conditions plus the following proposed projects.

- Aggie Research Campus – located north of I-80 and east of Mace Boulevard that would include 1.5 million square feet of research and development, 884,000 square feet of manufacturing, 160,000 square feet of hotel, and 100,000 square feet of retail and restaurant uses
- Davis Hotel and Conference Center – located west of Richards Boulevard between Olive Drive and I-80 that would replace the 43-room University Inn & Suites Hotel and Caffe Italia restaurant with a 132-room Embassy Suites hotel, a restaurant, and a 14,900 square-foot conference center
- Nishi/West Olive Drive Development – located in the triangle formed by I-80, the Union Pacific Railroad, and Putah Creek with vehicle connections to Olive Drive and the UC Davis campus that would include 650 residential units, 325,000 square feet of research and development/office, and 20,000 square feet of retail uses
- Lincoln40 Apartments – located on Olive Drive east of Richards Boulevard that would include 130 apartments oriented to students attending UC Davis
- Sterling Apartments – located on Fifth Street east of Pole Line Road that would include 198 apartments oriented to students attending UC Davis

The Aggie Research Campus has been approved, but is on hold, and the Davis Hotel and Conference Center was not approved by voters in an election. However, the properties are likely to be developed in some fashion by cumulative conditions. For the transportation analysis, the previously proposed projects were assumed although the actual development may be smaller in scope.

In addition, the forecasted growth was increased to account for growth between the cumulative model year of 2035 and the project design year of 2042. The design year represents an estimation of the future traffic demand and volume expected on the facility. For most locations, the growth rate from 2035 to 2042 was assumed to continue at the same rate predicted by the model from 2016 to 2035, which results in about 37 percent additional growth for the seven years from 2035 to 2042. However, land uses along Olive Drive are assumed to be built out by 2035 conditions, so the additional growth from 2035 to 2042 was reduced from 37 to 10 percent. The construction year (2022) volumes were prepared using linear interpolation, which assumed a constant rate of traffic growth between existing and cumulative year (2035) conditions.

Bicycle and pedestrian volumes were assumed to grow proportionally to the land use growth in the study area. In the project vicinity, land use grows by about 17 percent between the base year and cumulative year models. Extrapolating this growth from the cumulative year of 2035 to the design year of 2042 conditions, increases the total growth to about 23 percent. This value was rounded up to 25 percent and used to generate the design year bicycle and pedestrian volumes. Additionally, the minimum bicycle turning movement volume was set to 2 bicycles per hour, and the bicycle volumes were balanced through the study intersections.

Transportation Analysis Results and Findings

The findings of the transportation analysis report are summarized below. The complete transportation analysis report is included as **Appendix D**.

Intersections and Freeway Segments

The study locations that operate or would operate over capacity (LOS F) are summarized below by alternative.

Existing Conditions

- Intersections
  - I-80 Westbound Ramps/Richards Boulevard (AM)
- Freeway Segments
  - I-80 Eastbound, Old Davis Road to Mace Boulevard (PM)

No Build Alternative, Construction Year Conditions

- Intersections
  - Olive Drive/Richards Boulevard (AM)
  - I-80 Westbound Ramps/Richards Boulevard (AM)
  - I-80 Eastbound Ramps/Richards Boulevard (PM)
- Freeway Segments
  - I-80 Eastbound, Old Davis Road to Mace Boulevard (PM)

Build Alternative, Construction Year Conditions

- Freeway Segments
  - I-80 Eastbound, Old Davis Road to Mace Boulevard (PM)

No Build Alternative, Design Year Conditions

- Intersections
  - First Street/D Street (AM)
  - First Street/E Street/Richards Boulevard (AM)
  - Olive Drive/Richards Boulevard (AM and PM)
  - I-80 Westbound Ramps/Richards Boulevard (AM)
  - I-80 Eastbound Ramps/Richards Boulevard (AM and PM)
  - Research Park Drive/Richards Boulevard/Cowell Boulevard (AM and PM)

As discussed above, the intersection and freeway segment evaluation criteria used in the transportation analysis report were based on policies of the City of Davis and Caltrans. Under these criteria, a significant impact occurs where (1) the LOS threshold is exceeded and (2) the conditions are worse in Build Alternative than the No Build Alternative. Based on these evaluation criteria, the transportation analysis report determined that the proposed project would not result in impacts to intersections or freeway segments, and, consequently, no mitigations were necessary.

Roadway Safety

Using the forecasted daily volume, predicted collisions were calculated for design year conditions under the project alternatives. Under the No Build Alternative, the current five ramps in the westbound direction at Olive Drive and Richards Boulevard would be expected to have 5.7 collisions per year, with 2.2 fatality and injury-related collisions (see Table 18, Freeway Ramp Collision Rate – Construction Year Conditions, in Appendix D of this Initial Study). No Build Alternative Build Alternative. Under the proposed project, the westbound ramps would be reduced from 5 to 2, and the ramp roadways would be reconfigured to have curves that are less sharp (that is, a higher radius). The expected total collision rate would be 2.1 collisions per year, with 1.0 fatality and injury-related collisions. The transportation analysis report determined that, under the proposed project, the expected total collision rate would be reduced by 63 percent of the No Build Alternative rate, and the fatality and injury-related rate would be reduced by about 55 percent.

Bicycle System

The proposed project would provide a grade-separated two-way path for bicycles and pedestrians on the west side of the interchange. The path would function as an extension of the existing path on the west side of Richards Boulevard between First Street and Olive Drive that travels through a tunnel under the Union Pacific Railroad. South of Olive Drive, the path would run adjacent to Richards Boulevard. Approaching the interchange, the path would diverge from the roadway and then travel under the westbound on-ramp. Then, the path would loop around and travel over the path and adjacent to the westbound on-ramp to reach the freeway overcrossing. The path would continue adjacent to, but barrier-separated from, Richards Boulevard south to the Research Park Drive intersection. The existing Class II (on-street) bicycle lanes would be maintained on Richards Boulevard. The transportation analysis report determined that the reconstructed intersection at the I-80 Westbound Ramps would have slower speed turns than the existing configuration, which would provide a safer environment for on-street bicyclists.

Pedestrian System

The proposed project would replace the sidewalk and crosswalks on the west side of the interchange with the grade-separated pathway for bicycles and pedestrians described in the previous section. At the loop on the pathway, stairs would be provided so that pedestrians can travel a shorter route.

At the Olive Drive and Research Park Drive intersections, crosswalks would be provided on all legs. At Olive Drive, the wider approaches would result in longer crossing distances on three of the four approaches. Longer crossing distance increases pedestrian exposure and therefore reduces pedestrian safety. The median bus stop on the northbound approach would be moved to the shoulder of the northbound departure. The transportation analysis report determined that pedestrians traveling to the bus stop would have less exposure to conflicting vehicles.

At Research Park Drive, the west leg (Richards Boulevard) would be reconstructed to provide an additional eastbound lane. However, the southwest corner would be rebuilt with a smaller radius such that the crosswalks on the west and south legs would be shorter than under existing conditions. The transportation analysis report determined that the shorter crossing distance would reduce pedestrian exposure and therefore improve pedestrian safety.

Transit System

The proposed project would relocate the Unitrans bus stop on northbound Richards Boulevard at Olive Drive from a near side to a far side location. This would move the boarding area from a median between two lanes of traffic to the roadway shoulder thereby improving the waiting experience for passengers. The far side location also would allow buses to more easily reenter the roadway compared to the near side location that requires buses to merge into traffic in the intersection. The transportation analysis report determined that the improvement in intersection operations with the proposed project would also improve bus operations and travel time.

Performance Measures

To estimate the area-wide effect of the proposed project and the closure of the westbound off-ramp to Olive Drive, the design year (2042) performance measures of vehicle miles of travel (VMT), vehicle hours of travel (VHT), and vehicle hours of delay (VHD) were estimated using the cumulative year forecasting model. To capture the potential changes, performance was measured over the entire model area, which is the City of Davis. Under design year conditions, the same number of trips were assigned to the two different roadway alternatives.

The transportation analysis report determined that the proposed project would provide a small reduction in VMT by shifting trips originating in the City of Davis to shorter local routes with the closure of the Olive Drive westbound off-ramp. Network-wide delay would also be reduced by shifting trips from lower-speed Olive Drive to higher-speed I-80 and Richards Boulevard.

The transportation analysis report determined that the proposed project would provide more capacity along Richards Boulevard from Olive Drive to Research Park Drive. Intersections that would be over capacity under the No Build Alternative would operate with LOS E or better conditions.

The transportation analysis report determined that the reconfiguration of the westbound ramps at Richards Boulevard from a cloverleaf to a diamond design would remove the loop on-ramp and off-ramp, which have higher collision rates than slip or diagonal designs.

Even though the volume will be higher on the combined ramps, especially on the off-ramp with the closure of the Olive Drive off-ramp, the transportation analysis report determined that the combined westbound ramp collision rate for the proposed project is expected to be less than half the rate of the No Build Alternative under design year conditions.

Given the advantages in network efficiency, intersection operations, and freeway ramp safety, the transportation analysis report recommended the proposed project over the No Build Alternative to provide the best traffic operations and safety.

Discussion

a) As discussed above, a transportation analysis report was prepared to analyze the effects of the proposed project on the transportation network, including roadways, intersections, transit systems, and bicycle and pedestrian facilities (**Appendix D**). The evaluation criteria used in the transportation analysis report were based on the applicable transportation policies of the City of Davis and Caltrans. Based on these evaluation criteria, the transportation analysis report determined that the proposed project would not result in significant impacts to intersections or freeway segments; would improve safety for motorists, pedestrians and bicyclists; would improve bus operations and travel time. Consequently, the proposed project would not conflict with a program plan, ordinance, or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities. The transportation analysis report determined that the proposed project would improve network efficiency, intersection operations, and freeway ramp safety. There would be **no impact** related to this significance criterion.

b) CEQA Guidelines section 15064.3, *Determining the Significance of Transportation Impacts*, describes specific considerations for evaluating a project's transportation impacts and states that, generally, vehicle miles traveled (VMT), which refers to the amount and distance of automobile travel attributable to a project, is the most appropriate measure of transportation impacts. Section 15064.3, subdivision (b) (2) states that transportation projects that reduce, or have no impact on, vehicle miles traveled should be presumed to cause a less than significant transportation impact. As discussed above, the transportation analysis report determined that the proposed project would provide a small reduction in VMT by shifting trips originating in the City of Davis to shorter local routes with the closure of the Olive Drive westbound off-ramp. Consequently, the proposed project would not conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b). There would be **no impact** related to this significance criterion.

c) The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. Under the proposed project, the westbound ramps would be reduced from 5 to 2, and the ramp roadways would be reconfigured to have curves that are less sharp (that is, a higher radius). The transportation analysis report determined that, under the proposed project, the expected total collision rate would be reduced by 63 percent of the No Build Alternative rate, and the fatality and injury-related rate would be reduced by about 55 percent.

The proposed project would provide a grade-separated two-way path for bicycles and pedestrians on the west side of the interchange. The transportation analysis report determined that the reconstructed intersection at the I-80 westbound ramps would have slower speed turns than the existing configuration, which would provide a safer environment for on-street bicyclists.

At the Olive Drive and Research Park Drive intersections, crosswalks would be provided on all legs. At Olive Drive, the wider approaches would result in longer crossing distances on three of the four approaches.

At Research Park Drive, the west leg (Richards Boulevard) would be reconstructed to provide an additional eastbound lane. However, the southwest corner would be rebuilt with a smaller radius such that the crosswalks on the west and south legs would be shorter than under existing conditions. The transportation analysis report determined that the shorter crossing distance would reduce pedestrian exposure and therefore improve pedestrian safety.

As described above, the proposed project includes numerous improvements that would improve operational safety and reduce conflicts between bicyclists, pedestrians, and vehicles. While the wider approaches at the Olive Drive intersection would result in longer crosswalk distances on three of the four approaches, the facilities would meet all applicable design requirements related to safety. The proposed project would not substantially increase hazards due to a geometric design feature or incompatible uses, and the impact would be **less than significant**.

d) The proposed project would relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. Emergency access through the intersections would improve from conditions prior to the modifications.

A Transportation Management Plan (TMP) would be developed for use during project construction. The TMP would utilize strategies described in the *California Manual of Traffic Control Devices* and Caltrans *Transportation Management Plan Guidelines*. The TMP would direct the process and procedures for dissemination of information to the public and motorists, provide guidance for implementation of incident management, describe construction strategies for traffic handling and guiding traffic through work zones, address traffic demand management during construction, and describe and direct the implementation of alternate routes or detours. Implementation of the TMP would ensure that impacts related to emergency access during construction of the proposed project would be **less than significant**.

References

California Department of Transportation (Caltrans), 2017. Interstate 80 Transportation Concept Report. July 2017.

City of Davis, 2013. City of Davis General Plan Transportation Element. December 2013.

Fehr & Peers, 2018. Transportation Analysis Report, Interstate 80/Richards Boulevard Interchange. Prepared for City of Davis. June 2018.

Tribal Cultural Resources

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XVIII. TRIBAL CULTURAL RESOURCES —				
a) Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
i) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources. Code Section 5020.1(k), or	☐	☒	☐	☐
ii) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.	☐	☒	☐	☐

Discussion

a) A tribal cultural resource is defined in the Public Resources Code section 21074 and includes the following:

- Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American Tribe that are either of the following: included or determined to be eligible for inclusion in the California Register of Historical Resources or included in a local register of historical resources as defined in subdivision (k) of Section 5020.1;
- A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Section 5024.1. In applying the criteria set forth in subdivision (c) of Section 5024.1 for the purpose of this paragraph, the lead agency shall consider the significance of the resources to a California American tribe;
- A cultural landscape that meets the criteria of subdivision (a) is a tribal cultural resource to the extent that the landscape is geographically defined in terms of the size and scope of the landscape;
- A historical resource described in Section 21084.1, a unique archaeological resource as defined in subdivision (g) of Section 21083.2, or a "non-unique archaeological resource" as defined in subdivision (h) of Section 21083.2 may also be a tribal resource if it conforms with the criteria of subdivision (a).

As discussed in the *Cultural Resources* section of this initial study, the cultural resources investigation conducted for the proposed project determined that there are no previously recorded archaeological or tribal cultural resources in the proposed project Area of

Potential Effects (APE), and no evidence of archaeological or tribal cultural resources were encountered during the pedestrian archaeological survey of the APE.

Pursuant to Public Resources Code section 21080.3.1, the City of Davis consulted with California Native American tribes regarding the proposed project. Letters that described the proposed project, provided formal notification of the proposed project, and requested a written response within 30 days if consultation was desired were sent to the Ione Band of Miwok Indians, the Yoche Dehe Wintun Nation, and the Cortina Indian Rancheria of Wintun Indians on August 28, 2019. The City received one response. In a letter dated September 12, 2018, the Yoche Dehe Wintun Nation stated that the project site is within the aboriginal territory of the Yoche Dehe Wintun Nation and therefore the tribe has cultural interest and authority in the project area. The letter stated that the tribe is not aware of any known cultural resources near the project site and monitoring is not needed. The letter included a recommendation that pre-construction cultural resource sensitivity training should be provided by members of the Yoche Dehe Wintun Nation. Records of tribal consultation are included in **Appendix C** of this initial study.

As discussed in the *Cultural Resources* section of this initial study, the cultural resources investigation determined that the proposed project has a low potential to affect archaeological or resources or human remains due to the environmental setting and previous extensive disturbance of the area. Nonetheless, because there is a possibility that project construction and excavation activities could unearth previously undiscovered or unrecorded archaeological resources or human remains, if they are present, impacts to tribal cultural resources are considered to be potentially significant. Implementation of **Mitigation Measures CUL-1**, **CUL-2**, and **CUL-3** included in the *Cultural Resources* section of this initial study would ensure that impacts to tribal cultural resource would be **less than significant**.

Utilities and Service Systems

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XIX. UTILITIES AND SERVICE SYSTEMS — Would the project:				
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or storm water drainage, electric power, natural gas, or telecommunications facilities, the construction or relocation of which could cause significant environmental effects?	☐	☐	☒	☐
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?	☐	☐	☒	☐
c) 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?	☐	☐	☒	☐
d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?	☐	☐	☒	☐
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?	☐	☐	☒	☐

Discussion

a) The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. Operation of the proposed project would not produce additional wastewater and it would not require or generate a demand for either water or wastewater service that would require or result in the relocation or construction of new or expanded water or wastewater facilities. Onsite drainage improvements would improve existing stormwater drainage and would not require relocation or construction of new or expanded offsite conveyance or treatment facilities. Water and electric power consumed for project construction activities would not result in demand levels that would require relocation or construction of new or expanded offsite facilities. The impact would be **less than significant**.

b) As an interchange modification project, no increase in demand for water would occur as a result of the completed project. Water use for project construction activities, such as dust control, would not be anticipated to have any adverse impact on available supplies. The impact would be **less than significant**.

c) The proposed project does not include any uses that would generate wastewater. The impact would be **less than significant**.

d) Solid waste generated by the project would be limited to demolition and construction debris, including asphalt and concrete. Disposal would occur at permitted landfills. The impact would be **less than significant**.

e) Solid waste disposal of demolition and construction materials, including the disposal of any hazardous wastes that may be encountered, would occur in accordance with federal, state and local regulations. The impact would be **less than significant**.

Wildfire

Issues (and Supporting Information Sources):	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
XX. WILDFIRE — If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to, pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?	☐	☐	☐	☒
c) Require the installation or maintenance of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?	☐	☐	☐	☒
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?	☐	☐	☐	☒

Discussion

a–d) State Responsibility Areas are recognized by the Board of Forestry and Fire Protection as areas where Cal Fire is the primary emergency response agency responsible for fire suppression and prevention. The project site comprises an existing interchange and adjacent roadways and structures in an urban environment in the City of Davis. The project site is not located in or near state responsibility areas or lands classified as very high fire hazard severity zones (California State Board of Forestry and Fire Protection, 2019). There would be **no impact** under these significance criteria.

References

California State Board of Forestry and Fire Protection, 2019. State Responsibility Area Viewer. Available: https://bof.fire.ca.gov/projects-and-programs/state-responsibility-area-viewer/. Accessed September 24, 2019.

Mandatory Findings of Significance

Issues (and Supporting Information Sources):	*Potentially Significant Impact*	*Less Than Significant with Mitigation Incorporated*	*Less Than Significant Impact*	*No Impact*
XXI. MANDATORY FINDINGS OF SIGNIFICANCE —				
a) Does the project have the potential to substantially 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, substantially 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) As discussed in this initial study, there are no historical resources within or adjacent to the project site, and **Mitigation Measures CUL-1**, **CUL-2**, and **CUL-3** included in this initial study would ensure that unanticipated impacts to subsurface archaeological resources, human remains, or tribal cultural resources would be less than significant. Similarly, **Mitigation Measures BIO-1 through BIO-6** included in this initial study would ensure that potential impacts to special-status wildlife species and habitat would be less than significant. Consequently, impacts related to degradation of the quality of the environment, reduction of species or habitat, and elimination of important examples of the major periods of California history or prehistory would be **less than significant with mitigation incorporated**.

b) The proposed project in conjunction with other development within the City of Davis could incrementally contribute to cumulative impacts in the area. However, the project's incremental contribution towards cumulative impacts would not be considered significant. Therefore, the proposed project would not have any impacts that would be cumulatively considerable, and impacts would be **less than significant**.

c) The proposed project would reconstruct and reconfigure the I-80/Richards Boulevard interchange and make other related improvements to relieve existing congestion and reduce conflicts between bicyclists, pedestrians, and vehicles. Substantial adverse effects on human beings are not anticipated with implementation of the proposed project. During construction activities, the project could result in temporary noise increases and rerouting of traffic. However, the proposed project would be designed and constructed in accordance with all applicable standards and codes to ensure adequate safety is provided for the future residents of the proposed project. Therefore, impacts related to environmental effects that could cause adverse effects on human beings would be **less than significant**.

Appendix A
Interagency Consultation

Joza Burnam

From: Shengyi Gao <SGao@sacog.org>
Sent: Monday, September 10, 2018 1:55 PM
To: Alexander Fong; Dave Johnston; David Yang; Douglas Coleman; Heather Phillips ; Janice Lam Snyder; Jason Lee; Jerry Barton; John Ungvarsky; Jose Luis Caceres; Joseph Vaughn; Karina O'Connor; Ken Born; Lucas Sanchez; Mark Loutzenhiser; Matt Jones; Mcneel-Caird; Paul Philley; Renee DeVere-Oki; Rodney Tavitas; Shalanda Christian; Sharon Tang; Sondra Spaethe; Wright Molly; Yu-Shuo Chang
Cc: clark.peri@dot.ca.gov; Joza Burnam
Subject: RE: POAQC: City of Davis & Caltrans Richards Blvd Project (YOL17140), Due 9/6

Hi all,
The Project Level Conformity Group has determined that the City of Davis and Caltrans Richards Blvd Project (YOL17140) is Not a Project of Air Quality Concern (POAQC).
EPA concurred on 09/06/2018 and FHWA concurred on 09/10/2018.

Thanks to you all!

Shengyi Gao
Sacramento Area Council of Governments
916.340.6239

From: Shengyi Gao
Sent: Friday, August 24, 2018 10:15 AM
To: Alexander Fong <alexander.fong@dot.ca.gov>; Dave Johnston <dave.johnston@edcgov.us>; David Yang <DYang@airquality.org>; Douglas Coleman <douglas.coleman@dot.ca.gov>; Heather Phillips <Heather.Phillips@arb.ca.gov>; Janice Lam Snyder <JLam@airquality.org>; Jason Lee <jason.lee@dot.ca.gov>; Jerry Barton <jbarton@edctc.org>; John Ungvarsky <Ungvarsky.John@epa.gov>; Jose Luis Caceres <JCaceres@sacog.org>; Joseph Vaughn <Joseph.Vaughn@dot.gov>; Karina O'Connor <oconnor.karina@epa.gov>; Ken Born <kenneth.born@dot.gov>; Lucas Sanchez <lucas.sanchez@dot.ca.gov>; Mark Loutzenhiser <mloutzenhiser@airquality.org>; Matt Jones <mjones@ysaqmd.org>; Mcneel-Caird <lmcneel-caird@pctpa.net>; Paul Philley <pphilley@airquality.org>; Renee DeVere-Oki <RDeVere-Oki@sacog.org>; Rodney Tavitas <rodney.tavitas@dot.ca.gov>; Shalanda Christian <shalanda_christian@dot.ca.gov>; Sharon Tang <sharon.tang@dot.ca.gov>; Sondra Spaethe <sspaethe@fraqmd.org>; Wright Molly <mwright@airquality.org>; Yu-Shuo Chang <YChang@placer.ca.gov>
Cc: 'clark.peri@dot.ca.gov' <clark.peri@dot.ca.gov>; 'Joza Burnam' <jmburnam@esassoc.com>
Subject: POAQC: City of Davis & Caltrans Richards Blvd Project (YOL17140), Due 9/6

Project Level Conformity Group,

Attached for interagency review is the City of Davis and Caltrans Richards Blvd Project (YOL17140) **.** As part of project level conformity under NEPA, it requires a determination of whether it is a project of air quality concern.

Please confirm that you concur that this is NOT a Project of Air Quality Concern (POAQC). Please email questions and comments by 5 p.m., Thursday, September 6.

This project falls under the 23 USC 327 (formerly 6005) federal process. As such, it requires written concurrence by EPA (Karina O'Conner) and FHWA (Joseph Vaughn). Please remember to use "reply all," to make comments to the group. Otherwise, you may also contact the sponsor directly:

Clark Peri
Caltrans
Tel: 916.274.0538
Email: clark.peri@dot.ca.gov

Appendix B
Species Lists

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
Phone: (916) 414-6600 Fax: (916) 414-6713

In Reply Refer To: January 19, 2022
Consultation Code: 08ESMF00-2019-SLI-1525
Event Code: 08ESMF00-2022-E-02613
Project Name: 03-0H360 Richards Blvd Interchange Improvements

Subject: Updated list of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, under the jurisdiction of the U.S. Fish and Wildlife Service (Service) that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the Service under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

Please follow the link below to see if your proposed project has the potential to affect other species or their habitats under the jurisdiction of the National Marine Fisheries Service:

http://www.nwr.noaa.gov/protected_species/species_list/species_lists.html

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Sacramento Fish And Wildlife Office
Federal Building
2800 Cottage Way, Room W-2605
Sacramento, CA 95825-1846
(916) 414-6600

Project Summary

Consultation Code: 08ESMF00-2019-SLI-1525
Event Code: Some(08ESMF00-2022-E-02613)
Project Name: 03-0H360 Richards Blvd Interchange Improvements
Project Type: TRANSPORTATION
Project Description: Change the westbound on- and off-ramps from a full cloverleaf configuration into a tight diamond configuration at the Richards Blvd Interchange.
Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.54205604437582,-121.73271990776217,14z

Counties: Solano and Yolo counties, California

Endangered Species Act Species

There is a total of 10 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

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1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Western Snowy Plover *Charadrius nivosus nivosus* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8035	Threatened

Reptiles

NAME	STATUS
Giant Garter Snake *Thamnophis gigas* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/4482	Threatened

Amphibians

NAME	STATUS
California Red-legged Frog *Rana draytonii* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2891	Threatened
California Tiger Salamander *Ambystoma californiense* Population: U.S.A. (Central CA DPS) There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2076	Threatened

Fishes

NAME	STATUS
Delta Smelt *Hypomesus transpacificus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/321	Threatened

Insects

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate
Valley Elderberry Longhorn Beetle *Desmocerus californicus dimorphus* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7850	Threatened

Crustaceans

NAME	STATUS
Conservancy Fairy Shrimp *Branchinecta conservatio* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8246	Endangered
Vernal Pool Fairy Shrimp *Branchinecta lynchi* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/498	Threatened
Vernal Pool Tadpole Shrimp *Lepidurus packardi* There is **final** critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/2246	Endangered

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Duffy, Shawn@DOT

From: NMFS SpeciesList - NOAA Service Account <nmfs.wcrca.specieslist@noaa.gov>
Sent: Wednesday, January 19, 2022 6:09 PM
To: Duffy, Shawn@DOT
Subject: Federal ESA - - NOAA Fisheries Species List Re: 03-0H360 Richards Blvd Interchange

EXTERNAL EMAIL. Links/attachments may not be safe.

Please retain a copy of each email request that you send to NOAA at nmfs.wcrca.specieslist@noaa.gov as proof of your official Endangered Species Act SPECIES LIST. The email you send to NOAA should include the following information: your first and last name; email address; phone number; federal agency name (or delegated state agency such as Caltrans); mailing address; project title; brief description of the project; and a copy of a list of threatened or endangered species identified within specified geographic areas derived from the NOAA Fisheries, West Coast Region, California Species List Tool. You may only receive this instruction once per week. If you have questions, contact your local NOAA Fisheries liaison.

Duffy, Shawn@DOT

From: Duffy, Shawn@DOT
Sent: Wednesday, January 19, 2022 6:08 PM
To: nmfs.wcrca.specieslist@noaa.gov
Subject: Re: 03-0H360 Richards Blvd Interchange

Quad Name **Davis**
Quad Number **38121-E6**

ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) - **X**
SRWR Chinook Salmon ESU (E) - **X**
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) -
SCCC Steelhead DPS (T) -
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) - **X**
Eulachon (T) -
sDPS Green Sturgeon (T) - **X**

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat -
SRWR Chinook Salmon Critical Habitat -
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat -
SCCC Steelhead Critical Habitat -
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat -
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat - **X**

ESA Marine Invertebrates

Range Black Abalone (E) -

Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -
Olive Ridley Sea Turtle (T/E) -
Leatherback Sea Turtle (E) -
North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -
Fin Whale (E) -
Humpback Whale (E) -
Southern Resident Killer Whale (E) -
North Pacific Right Whale (E) -
Sei Whale (E) -
Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -
Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -
Chinook Salmon EFH - **X**
Groundfish EFH -
Coastal Pelagics EFH -
Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds
See list at left and consult the NMFS Long Beach office 562-980-4000

MMPA Cetaceans -
MMPA Pinnipeds -

Quad Name **Sacramento West**

Quad Number **38121-E5**

ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) - **X**
SRWR Chinook Salmon ESU (E) - **X**
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) -
SCCC Steelhead DPS (T) -
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) - **X**
Eulachon (T) -
sDPS Green Sturgeon (T) - **X**

ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat - **X**
SRWR Chinook Salmon Critical Habitat - **X**
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat -
SCCC Steelhead Critical Habitat -
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat - **X**
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat - **X**

ESA Marine Invertebrates

Range Black Abalone (E) -
Range White Abalone (E) -

ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

ESA Sea Turtles

East Pacific Green Sea Turtle (T) -
Olive Ridley Sea Turtle (T/E) -
Leatherback Sea Turtle (E) -
North Pacific Loggerhead Sea Turtle (E) -

ESA Whales

Blue Whale (E) -
Fin Whale (E) -
Humpback Whale (E) -
Southern Resident Killer Whale (E) -
North Pacific Right Whale (E) -
Sei Whale (E) -
Sperm Whale (E) -

ESA Pinnipeds

Guadalupe Fur Seal (T) -
Steller Sea Lion Critical Habitat -

Essential Fish Habitat

Coho EFH -
Chinook Salmon EFH - **X**
Groundfish EFH - **X**
Coastal Pelagics EFH -
Highly Migratory Species EFH -

MMPA Species (See list at left)

ESA and MMPA Cetaceans/Pinnipeds

See list at left and consult the NMFS Long Beach office
562-980-4000

MMPA Cetaceans -
MMPA Pinnipeds -

Shawn Duffy
Department of Transportation
North Region, Environmental Planning

Associate Environmental Planner/NS
Biologist
530-812-4313
Monday – Thursday, Fridays off

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad IS (Davis (3812156) OR Woodland (3812167) OR Grays Bend (3812166) OR Taylor Monument (3812165) OR Sacramento West (3812155) OR Clarksburg (3812145) OR Saxon (3812146) OR Dixon (3812147) OR Merritt (3812157))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	Threatened	G1G2	S1S2	SSC
Ambystoma californiense pop. 1 California tiger salamander - central California DPS	AAAAA01181	Threatened	Threatened	G2G3	S3	WL
Ammodramus savannarum grasshopper sparrow	ABPBXA0020	None	None	G5	S3	SSC
Antrozous pallidus pallid bat	AMACC10010	None	None	G4	S3	SSC
Archoplites interruptus Sacramento perch	AFCQB07010	None	None	G2G3	S1	SSC
Ardea alba great egret	ABNGA04040	None	None	G5	S4	
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Astragalus tener var. ferrisiae Ferris' milk-vetch	PDFAB0F8R3	None	None	G2T1	S1	1B.1
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T1	S1	1B.2
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Atriplex cordulata var. cordulata heartscale	PDCHE040B0	None	None	G3T2	S2	1B.2
Atriplex depressa brittlescale	PDCHE042L0	None	None	G2	S2	1B.2
Bombus crotchii Crotch bumble bee	IIHYM24480	None	None	G3G4	S1S2	
Bombus occidentalis western bumble bee	IIHYM24250	None	None	G2G3	S1	
Branchinecta conservatio Conservancy fairy shrimp	ICBRA03010	Endangered	None	G2	S2	
Branchinecta lynchi vernal pool fairy shrimp	ICBRA03030	Threatened	None	G3	S3	
Branchinecta mesovallensis midvalley fairy shrimp	ICBRA03150	None	None	G2	S2S3	
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Carex comosa bristly sedge	PMCYP032Y0	None	None	G5	S2	2B.1
Centromadia parryi ssp. parryi pappose tarplant	PDAST4R0P2	None	None	G3T2	S2	1B.2
Charadrius montanus mountain plover	ABNNB03100	None	None	G3	S2S3	SSC
Charadrius nivosus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2	SSC
Chloropyron palmatum palmate-bracted bird's-beak	PDSCR0J0J0	Endangered	Endangered	G1	S1	1B.1
Cicindela hirticollis abrupta Sacramento Valley tiger beetle	IICOL02106	None	None	G5TH	SH	
Circus hudsonius northern harrier	ABNKC11011	None	None	G5	S3	SSC
Coccyzus americanus occidentalis western yellow-billed cuckoo	ABNRB02022	Threatened	Endangered	G5T2T3	S1	
Desmocerus californicus dimorphus valley elderberry longhorn beetle	IICOL48011	Threatened	None	G3T2	S3	
Egretta thula snowy egret	ABNGA06030	None	None	G5	S4	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Elderberry Savanna Elderberry Savanna	CTT63440CA	None	None	G2	S2.1	
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eryngium jepsonii Jepson's coyote-thistle	PDAPI0Z130	None	None	G2	S2	1B.2
Extriplex joaquinana San Joaquin spearscale	PDCHE041F3	None	None	G2	S2	1B.2
Falco columbarius merlin	ABNKD06030	None	None	G5	S3S4	WL
Fritillaria pluriflora adobe-lily	PMLIL0V0F0	None	None	G2G3	S2S3	1B.2
Gonidea angulata western ridged mussel	IMBIV19010	None	None	G3	S1S2	
Great Valley Cottonwood Riparian Forest Great Valley Cottonwood Riparian Forest	CTT61410CA	None	None	G2	S2.1	
Hibiscus lasiocarpos var. occidentalis woolly rose-mallow	PDMAL0H0R3	None	None	G5T3	S3	1B.2
Hypomesus transpacificus Delta smelt	AFCHB01040	Threatened	Endangered	G1	S1	

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G3G4	S3S4	
Lasiurus cinereus hoary bat	AMACC05030	None	None	G3G4	S4	
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Lepidium latipes var. heckardii Heckard's pepper-grass	PDBRA1M0K1	None	None	G4T1	S1	1B.2
Lepidurus packardi vernal pool tadpole shrimp	ICBRA10010	Endangered	None	G4	S3S4	
Lilaeopsis masonii Mason's lilaeopsis	PDAPI19030	None	Rare	G2	S2	1B.1
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Melospiza melodia song sparrow ("Modesto" population)	ABPBXA3010	None	None	G5	S3?	SSC
Myrmosula pacifica Antioch multilid wasp	IIHYM15010	None	None	GH	SH	
Navarretia leucocephala ssp. bakeri Baker's navarretia	PDPLM0C0E1	None	None	G4T2	S2	1B.1
Neostapfia colusana Colusa grass	PMPOA4C010	Threatened	Endangered	G1	S1	1B.1
Nycticorax nycticorax black-crowned night heron	ABNGA11010	None	None	G5	S4	
Oncorhynchus mykiss irideus pop. 11 steelhead - Central Valley DPS	AFCHA0209K	Threatened	None	G5T2Q	S2	
Oncorhynchus tshawytscha pop. 11 chinook salmon - Central Valley spring-run ESU	AFCHA0205L	Threatened	Threatened	G5T1T2Q	S2	
Oncorhynchus tshawytscha pop. 7 chinook salmon - Sacramento River winter-run ESU	AFCHA0205B	Endangered	Endangered	G5T1Q	S1	
Plagiobothrys hystriculus bearded popcornflower	PDBOR0V0H0	None	None	G2	S2	1B.1
Plegadis chihi white-faced ibis	ABNGE02020	None	None	G5	S3S4	WL
Pogonichthys macrolepidotus Sacramento splittail	AFCJB34020	None	None	GNR	S3	SSC
Progne subis purple martin	ABPAU01010	None	None	G5	S3	SSC
Puccinellia simplex California alkali grass	PMPOA53110	None	None	G3	S2	1B.2
Sidalcea keckii Keck's checkerbloom	PDMAL110D0	Endangered	None	G2	S2	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Spea hammondii western spadefoot	AAABF02020	None	None	G2G3	S3	SSC
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	
Symphyotrichum lentum Suisun Marsh aster	PDASTE8470	None	None	G2	S2	1B.2
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Thamnophis gigas giant gartersnake	ARADB36150	Threatened	Threatened	G2	S2	
Trifolium hydrophilum saline clover	PDFAB400R5	None	None	G2	S2	1B.2
Tuctoria mucronata Crampton's tuctoria or Solano grass	PMPOA6N020	Endangered	Endangered	G1	S1	1B.1
Valley Oak Woodland Valley Oak Woodland	CTT71130CA	None	None	G3	S2.1	
Vireo bellii pusillus least Bell's vireo	ABPBW01114	Endangered	Endangered	G5T2	S2	
Xanthocephalus xanthocephalus yellow-headed blackbird	ABPBXB3010	None	None	G5	S3	SSC

Record Count: 70

CALIFORNIA NATIVE PLANT SOCIETY

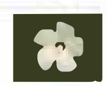
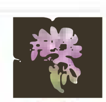
Inventory of Rare and Endangered Plants of California

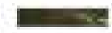
Search Results

28 matches found. Click on scientific name for details

Search Criteria: 9-Quad include [3812155:3812165:3812145:3812147:3812167:3812157:3812166:3812156:3812146]

▲ SCIENTIFIC NAME	COMMON NAME	FAMILY	LIFEFORM	BLOOMING PERIOD	FED LIST	STATE LIST	GLOBAL RANK	STATE RANK	CA RARE PLANT RANK	PHOTO
Astragalus pauperculus	depauperate milk-vetch	Fabaceae	annual herb	Mar-Jun	None	None	G4	S4	4.3	 ©2012 Tim Kellison
Astragalus tener var. ferrisiae	Ferris' milk-vetch	Fabaceae	annual herb	Apr-May	None	None	G2T1	S1	1B.1	No Photo Available
Astragalus tener var. tener	alkali milk-vetch	Fabaceae	annual herb	Mar-Jun	None	None	G2T1	S1	1B.2	No Photo Available
Atriplex cordulata var. cordulata	heartscale	Chenopodiaceae	annual herb	Apr-Oct	None	None	G3T2	S2	1B.2	 © 1994 Robert E. Preston, Ph.D.
Atriplex depressa	brittlescale	Chenopodiaceae	annual herb	Apr-Oct	None	None	G2	S2	1B.2	 © 2009 Zoya Akulova
Carex comosa	bristly sedge	Cyperaceae	perennial rhizomatous herb	May-Sep	None	None	G5	S2	2B.1	 Dean Wm. Taylor 1997
Centromadia parryi ssp. parryi	pappose tarplant	Asteraceae	annual herb	May-Nov	None	None	G3T2	S2	1B.2	No Photo

										Available
Centromadia parryi ssp. rudis	Parry's rough tarplant	Asteraceae	annual herb	May-Oct	None	None	G3T3	S3	4.2	No Photo Available
Chloropyron palmatum	palmate-bracted bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	May-Oct	FE	CE	G1	S1	1B.1	No Photo Available
Eryngium jepsonii	Jepson's coyote-thistle	Apiaceae	perennial herb	Apr-Aug	None	None	G2	S2	1B.2	No Photo Available
Extriplex joaquinana	San Joaquin spearscale	Chenopodiaceae	annual herb	Apr-Oct	None	None	G2	S2	1B.2	No Photo Available
Fritillaria agrestis	stinkbells	Liliaceae	perennial bulbiferous herb	Mar-Jun	None	None	G3	S3	4.2	 © 2016 Aaron Schusteff
Fritillaria pluriflora	adobe-lily	Liliaceae	perennial bulbiferous herb	Feb-Apr	None	None	G2G3	S2S3	1B.2	 © 2015 Steve Matson
Hesperevax caulescens	hogwallow starfish	Asteraceae	annual herb	Mar-Jun	None	None	G3	S3	4.2	 © 2017 John Doyen
Hibiscus lasiocarpos var. occidentalis	woolly rose-mallow	Malvaceae	perennial rhizomatous herb (emergent)	Jun-Sep	None	None	G5T3	S3	1B.2	 © 2020 Steven Perry
Lepidium latipes var. heckardii	Heckard's pepper-grass	Brassicaceae	annual herb	Mar-May	None	None	G4T1	S1	1B.2	 2018 Jennifer Buck
Lessingia hololeuca	woolly-headed lessingia	Asteraceae	annual herb	Jun-Oct	None	None	G2G3	S2S3	3	

										 © 2015 Aaron Schusteff
Lilaeopsis masonii	Mason's lilaeopsis	Apiaceae	perennial rhizomatous herb	Apr-Nov	None	CR	G2	S2	1B.1	No Photo Available
Myosurus minimus ssp. apus	little mousetail	Ranunculaceae	annual herb	Mar-Jun	None	None	G5T2Q	S2	3.1	No Photo Available
Navarretia cotulifolia	cotula navarretia	Polemoniaceae	annual herb	May-Jun	None	None	G4	S4	4.2	No Photo Available
Navarretia leucocephala ssp. bakeri	Baker's navarretia	Polemoniaceae	annual herb	Apr-Jul	None	None	G4T2	S2	1B.1	No Photo Available
Neostapfia colusana	Colusa grass	Poaceae	annual herb	May-Aug	FT	CE	G1	S1	1B.1	No Photo Available
Plagiobothrys hystriculus	bearded popcornflower	Boraginaceae	annual herb	Apr-May	None	None	G2	S2	1B.1	No Photo Available
Puccinellia simplex	California alkali grass	Poaceae	annual herb	Mar-May	None	None	G3	S2	1B.2	No Photo Available
Sidalcea keckii	Keck's checkerbloom	Malvaceae	annual herb	Apr-May(Jun)	FE	None	G2	S2	1B.1	No Photo Available
Symphyotrichum lentum	Suisun Marsh aster	Asteraceae	perennial rhizomatous herb	(Apr)May-Nov	None	None	G2	S2	1B.2	No Photo Available
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	Apr-Jun	None	None	G2	S2	1B.2	No Photo Available
Tuctoria mucronata	Crampton's tuctoria or Solano grass	Poaceae	annual herb	Apr-Aug	FE	CE	G1	S1	1B.1	No Photo Available

Showing 1 to 28 of 28 entries

Suggested Citation:
California Native Plant Society, Rare Plant Program. 2022. Inventory of Rare and Endangered Plants of California (online edition, v9-01 1.0). Website https://www.rareplants.cnps.org [accessed 20 January 2022].

Appendix C
Tribal Consultation Letters

COMMUNITY DEVELOPMENT DEPARTMENT

23 Russell Boulevard – Davis, California 95616
530/757-5610 – FAX: 530/757-5660 – TDD: 530/757-5666

Davis
California

August 28, 2018

Cultural Committee
Ione Band of Miwok Indians
PO Box 699
9252 Bush St, Suite 2
Plymouth, CA 95669

Re: Formal Notification of I-80/Richards Boulevard Interchange Improvements Project

In response to your request for formal notification of projects for which the City of Davis will prepare a negative declaration, mitigated negative declaration, or environmental impact report pursuant to Public Resources Code section 21080.3.1(b), this letter serves as formal notification of the City's consideration of the I-80/Richards Boulevard Interchange Improvements Project (Project).

Accordingly, as required by Public Resources Code section 21080.3.1(d), this letter provides a brief description of the Project and its location.

The Project would reconfigure the westbound I-80 ramps from a full cloverleaf (Type L-10) to a tight diamond (Type L-1) by consolidating the two off-ramps of the I-80/Richards Boulevard interchange into a single diagonal off-ramp; and the two on-ramps into a single diagonal on-ramp. The resulting westbound I-80 ramp terminal intersection would include signals optimized for the design year traffic forecast. The westbound I-80 on-ramp would require widening of I-80 over the existing bike and pedestrian tunnel.

The eastbound I-80 ramp intersection would remain as a cloverleaf (Type L-8). Project improvements include widening the eastbound off-ramp to include a right-turn lane and two left-turn lanes. Outside the State access control limits, Richards Boulevard would be widened to provide two southbound through movements at the Research Park Drive/Richards Boulevard intersection.

The Project would modify the Olive Drive/Richards Boulevard intersection providing the width, lane geometry, and right-of-way necessary for future developments on Olive Drive. The existing nearside bus stop on Richards Boulevard near Olive Drive would be relocated to the north of the Olive Drive/Richards Boulevard intersection. Along eastbound Richards Boulevard, improvements would connect the mixed-use paths; include a left-turn lane, a through lane, and a combination through-right lane on the intersection entrance; and include two through lanes on the eastbound intersection egress.

Between the Olive Drive/Richards Boulevard intersection and the westbound I-80 ramp terminal intersection, improvements would include widening Richards Boulevard and installing a raised median to restrict left turn movements.

The Project would include construction of a shared-use path along the west side of Richards Boulevard replacing the existing sidewalk, and serving both bicyclists and pedestrians. The shared-use path would connect to the existing path south of Olive Drive, diverge from Richards Boulevard to pass under the westbound I-80 on-ramp, then loop up to connect with the Richards Boulevard overcrossing. After passing over the existing structure, the shared-use path would terminate at the Research Park Drive/Richards Boulevard intersection. The Project would widen the existing Class II bicycle lanes along Richards Boulevard between Olive Drive and Research Park Drive to a minimum of 7 feet. A map identifying the Project is attached to this letter.

Environmental Science Associates (ESA) cultural resources staff conducted a records search for the Project at the Northwest Information Center (NWIC) of the California Historical Resources Information System (April 24, 2018; File No. 17-2544). The results indicate that there are no previously recorded archaeological or architectural resources in the project Area of Potential Effects (APE). The nearest known prehistoric archaeological site is approximately 0.25 mile west of the APE and would not be affected by the proposed project. There are also two sites informally recorded as "possible sites" further to the north on the University of California Davis campus. These sites would also not be affected by the proposed project.

An ESA Registered Professional Archaeologist completed a surface survey of the APE on August 8, 2018. The survey consisted of walking the paved and unpaved portions of the APE in narrow (no greater than 10-meter-wide) transects, where feasible, to observe the existing conditions and identify cultural resources, if present. No prehistoric or historic-era cultural materials or other evidence of past human use or occupation were identified in the APE. The APE has a low archaeological sensitivity due to the environmental setting and previous extensive disturbance of the area.

Pursuant to Public Resources Code section 21080.3.1 (b) and (d), the Ione Band of Miwok Indians now has 30 days to inform the City, in writing, of its request to consult with the City on the Project. Such a request must provide the name of the Tribe's designated lead contact person and should be directed to lead agency contact information Katherine Hess, Community Development Administrator, at (530)757-5652 or khess@cityofdavis.org.

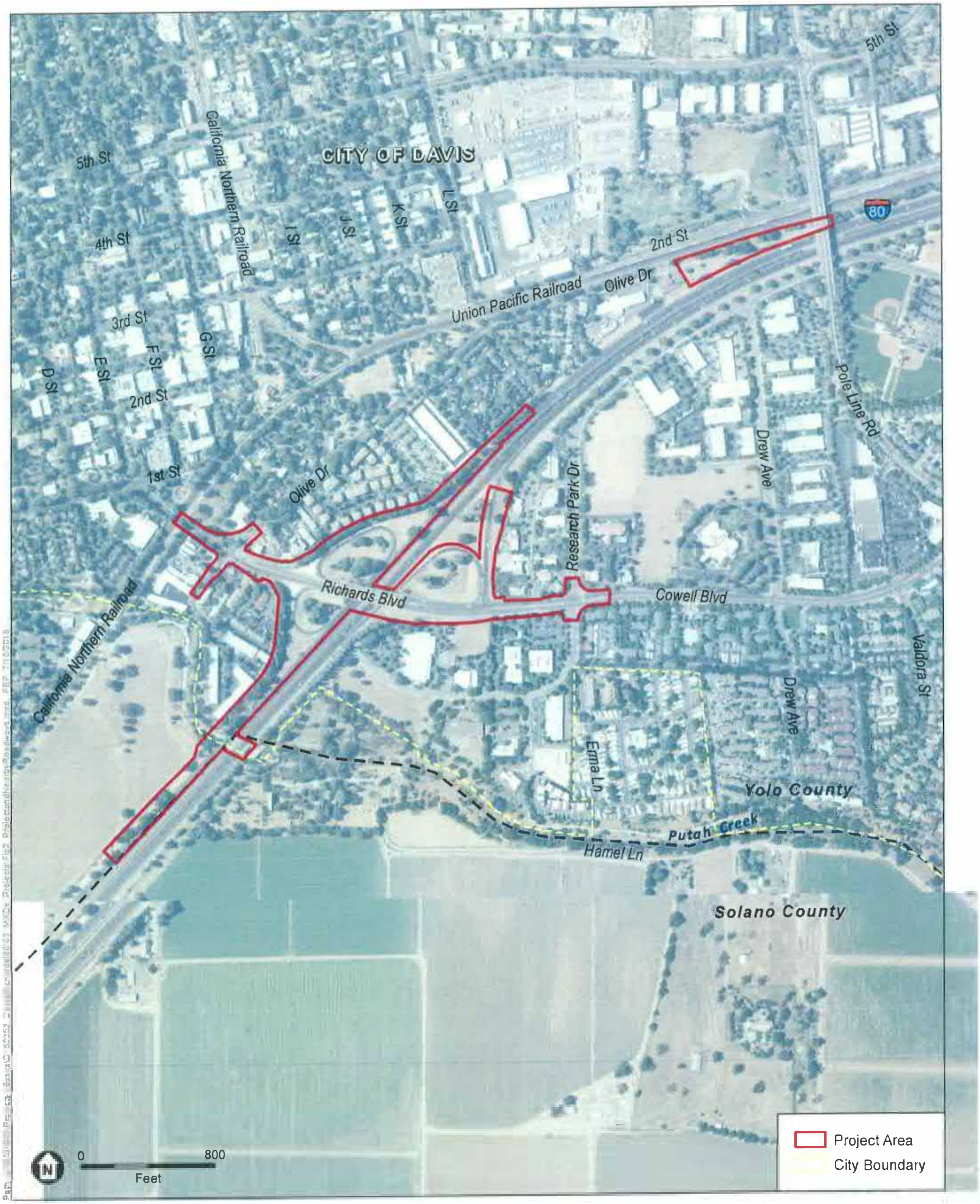
Please do not hesitate to contact me with any questions or concerns regarding the above.

Sincerely,

Katherine Hess

Katherine Hess, AICP
Community Development Administrator

Attachment: Project Map



SOURCE: USDA, 2016; ESA, 2018

I-80/Richards Interchange Project

Figure 1

Project Map

ESA

COMMUNITY DEVELOPMENT DEPARTMENT

23 Russell Boulevard – Davis, California 95616
530/757-5610 – FAX: 530/757-5660 – TDD: 530/757-5666

Davis
California

August 28, 2018

Laverne Bill, Cultural Resources Department Manager
Yocha Dehe Wintun Nation
PO Box 18
Brooks, CA 95606

Re: Formal Notification of I-80/Richards Boulevard Interchange Improvements Project

Dear Mr. Bill:

This letter serves as formal notification of the City's consideration of the I-80/Richards Boulevard Interchange Improvements Project (Project).

Accordingly, as required by Public Resources Code section 21080.3.1(d), this letter provides a brief description of the Project and its location.

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Pursuant to Public Resources Code section 21080.3.1 (b) and (d), the Yocha Dehe Wintun Nation now has 30 days to inform the City, in writing, of its request to consult with the City on the Project. Such a request must provide the name of the Tribe's designated lead contact person and should be directed to lead agency contact information Katherine Hess, Community Development Administrator, at (530)757-5652 or khess@cityofdavis.org.

Please do not hesitate to contact me with any questions or concerns regarding the above.

Sincerely,

Katherine Hess

Katherine Hess, AICP
Community Development Administrator

Attachment: Project Map

COMMUNITY DEVELOPMENT DEPARTMENT

23 Russell Boulevard – Davis, California 95616
530/757-5610 – FAX: 530/757-5660 – TDD: 530/757-5666

Davis California

August 28, 2018

Cortina Indian Rancheria of Wintun Indians
Charlie Wright, Chairperson
P.O. Box 1630
Williams, CA 95987

Re: Formal Notification of I-80/Richards Boulevard Interchange Improvements Project

Dear Mr. Wright:

This letter serves as formal notification of the City's consideration of the I-80/Richards Boulevard Interchange Improvements Project (Project).

Accordingly, as required by Public Resources Code section 21080.3.1(d), this letter provides a brief description of the Project and its location.

The Project would reconfigure the westbound I-80 ramps from a full cloverleaf (Type L-10) to a tight diamond (Type L-1) by consolidating the two off-ramps of the I-80/Richards Boulevard interchange into a single diagonal off-ramp; and the two on-ramps into a single diagonal on-ramp. The resulting westbound I-80 ramp terminal intersection would include signals optimized for the design year traffic forecast. The westbound I-80 on-ramp would require widening of I-80 over the existing bike and pedestrian tunnel.

The eastbound I-80 ramp intersection would remain as a cloverleaf (Type L-8). Project improvements include widening the eastbound off-ramp to include a right-turn lane and two left-turn lanes. Outside the State access control limits, Richards Boulevard would be widened to provide two southbound through movements at the Research Park Drive/Richards Boulevard intersection.

The Project would modify the Olive Drive/Richards Boulevard intersection providing the width, lane geometry, and right-of-way necessary for future developments on Olive Drive. The existing nearside bus stop on Richards Boulevard near Olive Drive would be relocated to the north of the Olive Drive/Richards Boulevard intersection. Along eastbound Richards Boulevard, improvements would connect the mixed-use paths; include a left-turn lane, a through lane, and a combination through-right lane on the intersection entrance; and include two through lanes on the eastbound intersection egress.

Between the Olive Drive/Richards Boulevard intersection and the westbound I-80 ramp terminal intersection, improvements would include widening Richards Boulevard and installing a raised median to restrict left turn movements.

The Project would include construction of a shared-use path along the west side of Richards Boulevard replacing the existing sidewalk, and serving both bicyclists and pedestrians. The shared-use path would connect to the existing path south of Olive Drive, diverge from Richards Boulevard to pass under the westbound I-80 on-ramp, then loop up to connect with the Richards Boulevard overcrossing. After passing over the existing structure, the shared-use path would terminate at the Research Park Drive/Richards Boulevard intersection. The Project would widen the existing Class II bicycle lanes along Richards Boulevard between Olive Drive and Research Park Drive to a minimum of 7 feet. A map identifying the Project is attached to this letter.

Environmental Science Associates (ESA) cultural resources staff conducted a records search for the Project at the Northwest Information Center (NWIC) of the California Historical Resources Information System (April 24, 2018; File No. 17-2544). The results indicate that there are no previously recorded archaeological or architectural resources in the project Area of Potential Effects (APE). The nearest known prehistoric archaeological site is approximately 0.25 mile west of the APE and would not be affected by the proposed project. There are also two sites informally recorded as "possible sites" further to the north on the University of California Davis campus. These sites would also not be affected by the proposed project.

An ESA Registered Professional Archaeologist completed a surface survey of the APE on August 8, 2018. The survey consisted of walking the paved and unpaved portions of the APE in narrow (no greater than 10-meter-wide) transects, where feasible, to observe the existing conditions and identify cultural resources, if present. No prehistoric or historic-era cultural materials or other evidence of past human use or occupation were identified in the APE. The APE has a low archaeological sensitivity due to the environmental setting and previous extensive disturbance of the area.

Pursuant to Public Resources Code section 21080.3.1 (b) and (d), the Cortina Indian Rancheria of Wintun Indians now has 30 days to inform the City, in writing, of its request to consult with the City on the Project. Such a request must provide the name of the Tribe's designated lead contact person and should be directed to lead agency contact information Katherine Hess, Community Development Administrator, at (530)757-5652 or khess@cityofdavis.org.

Please do not hesitate to contact me with any questions or concerns regarding the above.

Sincerely,

Katherine Hess

Katherine Hess, AICP
Community Development Administrator

Attachment: Project Map

YOCHA DEHE
CULTURAL RESOURCES

September 12, 2018

City of Davis - Community Development
Attn: Katherine Hess, Administrator
23 Russell Boulevard
Davis, CA 95616

RE: I-80 Richards Boulevard Interchange Improvements Project

Dear Ms. Hess:

Thank you for your project notification letter dated, August 28, 2018, regarding cultural information on or near the proposed I-80 Richards Boulevard Interchange Improvements Project, Davis, Yolo County. We appreciate your effort to contact us and wish to respond.

The Cultural Resources Department has reviewed the project and concluded that it is within the aboriginal territories of the Yocha Dehe Wintun Nation. Therefore, we have a cultural interest and authority in the proposed project area.

Based on the information provided, Yocha Dehe Wintun Nation is not aware of any known cultural resources near this project site and a cultural monitor is not needed. However, we recommend cultural sensitivity training for any pre-project personnel. Please contact one of the individuals listed below to schedule the cultural sensitivity training, prior to the start of the project.

Lawrence Longee, Tribal Monitor
Yocha Dehe Wintun Nation
Office: (530) 605-6655
Email: llongee@yochadehe-nsn.gov

Robert Geary, Tribal Monitor
Yocha Dehe Wintun Nation
Office: (530) 215-6180
Email: rgeary@yochadehe-nsn.gov

Please refer to identification number YD – 09062018-01 in correspondence concerning this project.

Thank you for providing us the opportunity to comment.

Sincerely,

Leland Kinter
Tribal Historic Preservation Officer

Appendix D
Traffic Study

Interstate 80 / Richards Boulevard Interchange

Transportation Analysis Report

Prepared for:
City of Davis

June 2018

FEHR PEERS

RS17-3574

Transportation Analysis Report

Interstate 80 / Richards Boulevard Interchange

03-YOL-80-PM 0.0/0.5, 04-SOL-80 PM 44.5/44.7

EA 03-0H360
Project ID 0315000148

June 2018

Prepared By: David Stanek, PE Date: 6/1/18

Phone Number 916-329-7332
Firm Name Fehr & Peers
Location Sacramento, CA

Planning
Approved By: ______________________ Date: __________

Name ______________________
Title ______________________
Phone Number ______________________
Office Name ______________________
District/Region ______________________

Traffic Operations
Approved By: ______________________ Date: __________

Name ______________________
Title ______________________
Phone Number ______________________
Office Name ______________________
District/Region ______________________

Transportation Analysis Report

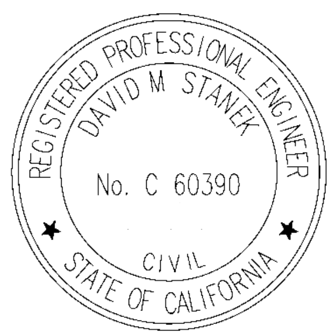
Interstate 80 / Richards Boulevard Interchange

03-YOL-80-PM 0.0/0.5, 04-SOL-80 PM 44.5/44.7

EA 03-0H360
Project ID 0315000148

June 2018

This report was prepared under my direction and responsible charge. I attest to the technical information contained herein and have judged the qualification of any technical specialists providing engineering data upon which recommendations, conclusions, and decisions are based.



David Stanek

6/1/18

David Stanek, P.E. — Date
Registered Professional Civil Engineer
Fehr & Peers

RS17-3574

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Chapter 1. Introduction

This transportation analysis report was prepared for the Interstate 80 (I-80) / Richards Boulevard Interchange project. The report contains the results and findings of the transportation operations analyses, while the detailed analysis calculations are compiled in a separately bound appendix.

1.1 Report Purpose

The purpose of this report is to analyze project design alternatives and their effects on the transportation network. The report focuses on a comparison of alternatives that are each designed to improve current and future traffic operations for intersections and roadways in City of Davis. Portions of the analysis results will also be used to comply with environmental impact analysis requirements for the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA).

1.2 Project Description

The project proposes to reconstruct the westbound ramps at the I-80/Richards Boulevard interchange by converting from a cloverleaf (Type L-12) to a tight diamond (Type L-1) configuration, construct a grade-separated bicycle and pedestrian path along the west side of Richards Boulevard, and close the isolated westbound off-ramp to Olive Drive. The elements of the interchange reconstruction and associated intersection widening are listed below.

- Install a traffic signal at the new westbound ramp terminal intersection
- Install a ramp meter signal on the new westbound on-ramp with two metered lanes and an HOV bypass lane
- At Richards Boulevard/Olive Drive, widen the northbound approach to provide a second left-turn lane, the southbound approach to provide a second through lane, and the east leg to provide two receiving lanes and eastbound left, through, and right lanes (one each)
- At Richards Boulevard/I-80 Eastbound Ramps, widen the eastbound off-ramp approach to provide a second left-turn lane
- At Richards Boulevard/Cowell Boulevard/Research Park Drive, widen southbound Richards Boulevard to provide a second through lane

1.3 Project Alternatives

Figure 1 shows an initial design layout for the Build Alternative at the I-80/Richards Boulevard interchange. The No Build Alternative would maintain the current roadway configuration with the following exceptions at the Richards Boulevard/Olive Drive intersection.

- Under future year conditions, the westbound approach will be re-striped so that the bicycle lane extends to the intersection under a separate project.
- Under design year conditions, the eastbound approach is assumed to be restriped to provide bike lanes in both directions. and a separate eastbound right turn lane is assumed to be added to serve traffic from planned development east of Richards Boulevard.

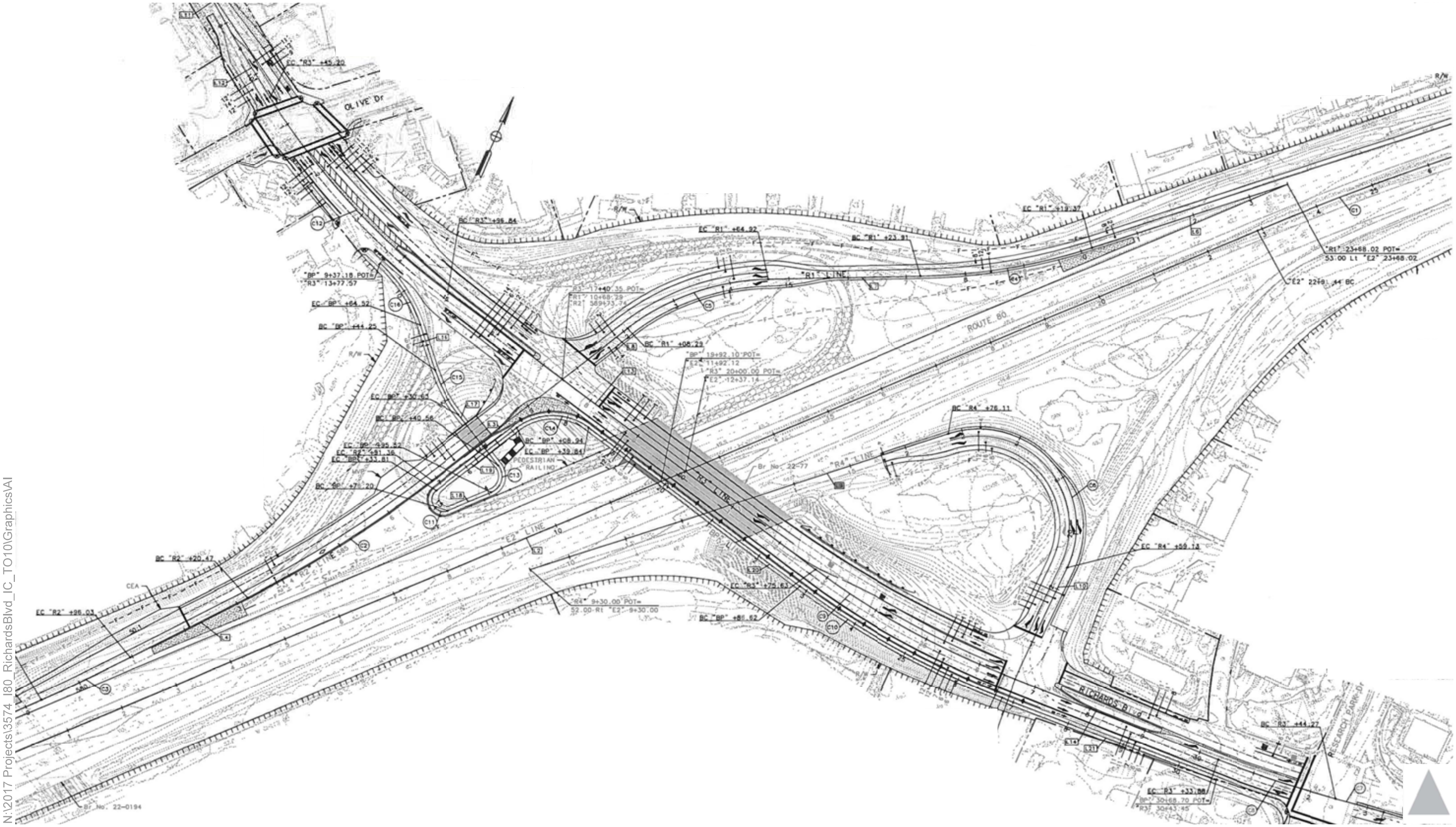

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Figure 1

Build Alternative

Chapter 2. **Analysis Methodology**

This chapter describes the study area and the methods used to analyze the transportation facilities.

2.1 Study Area

The transportation analysis study area is divided into a local street network and a freeway network. The local street network extends from First Street/D Street in downtown Davis along First Street and Richards Boulevard to Research Park Drive/Richards Boulevard/Cowell Boulevard in south Davis. The freeway network extends along I-80 from Old Davis Road to Mace Boulevard. Figure 2 shows the intersections, and freeway segments in the study area.

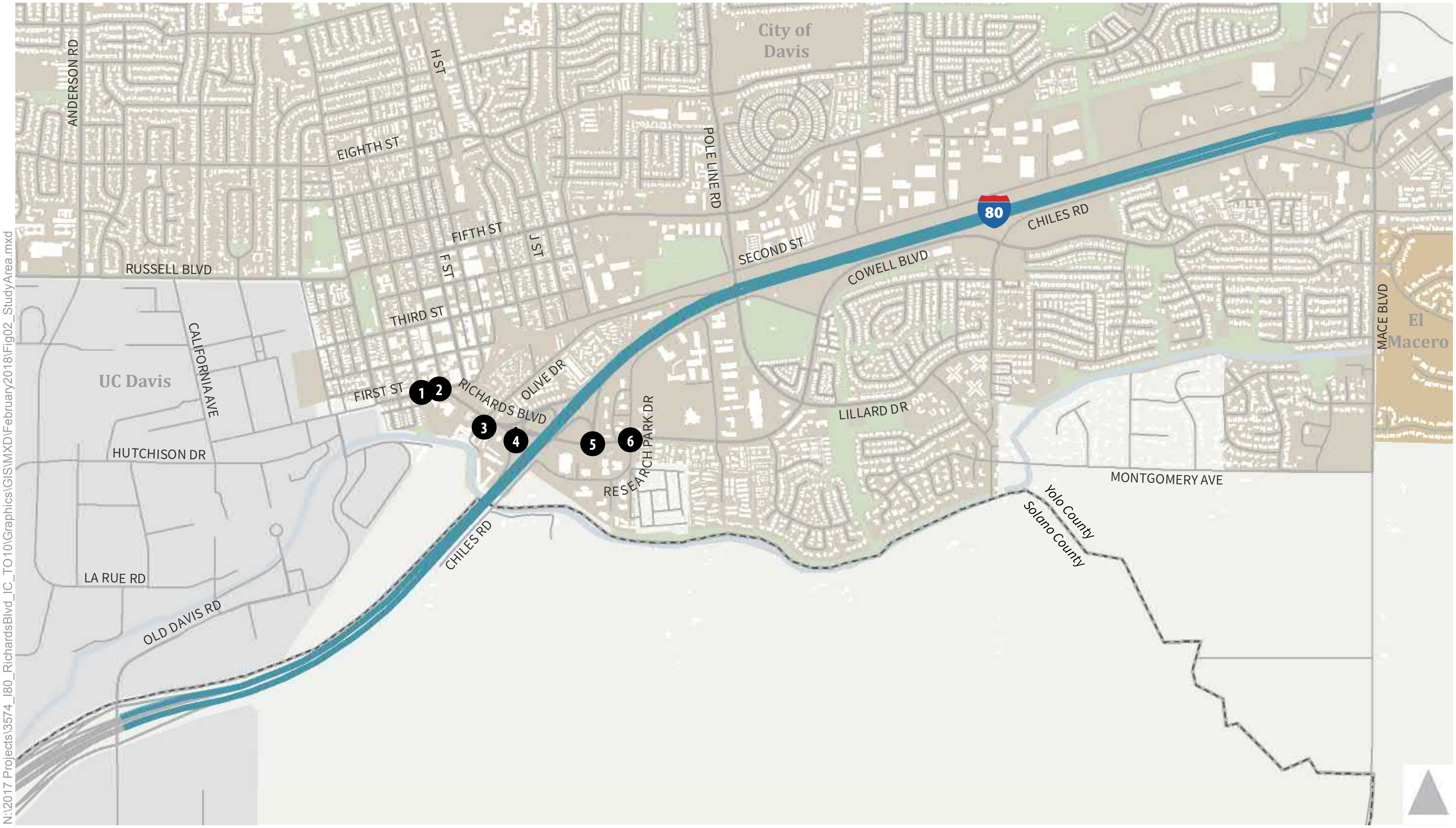
The study intersections are listed below.

1. First Street/D Street
2. First Street/E Street/Richards Boulevard
3. Olive Drive/Richards Boulevard
4. I-80 Westbound Ramps/Richards Boulevard
5. I-80 Eastbound Ramps/Richards Boulevard
6. Research Park Drive/Richards Boulevard/Cowell Boulevard

The freeway study segments are listed below.

<u>Eastbound I-80</u>

1. West of Old Davis Road On-ramp
2. Old Davis Road On-ramp
3. Old Davis Road to 1st Lane Drop
4. 1st Lane Drop to 2nd Lane Drop
5. Richards Boulevard Off-ramp
6. Richards Boulevard Off to On-ramp
7. Richards Boulevard On-ramp
8. Richards Boulevard to Chiles Road
9. Chiles Road Off-ramp
10. East of Chiles Road Off-ramp



1 Study Intersection

Freeway Corridor

Figure 2

Study Area

Westbound I-80

11. East of Mace Boulevard On-ramp
12. Mace Boulevard to Lane Drop
13. Lane Drop to Olive Drive
14. Olive Drive Off-ramp
15. Olive Drive to Richards Boulevard
16. Richards Boulevard Northbound Off-ramp
17. Richards Boulevard Northbound Off to On-ramp
18. Richards Boulevard Northbound On-ramp to Southbound Off-ramp
19. Richards Boulevard Southbound Off to On-ramp
20. Richards Boulevard to Old Davis Road
21. Old Davis Road Off-ramp
22. West of Old Davis Road

No new study intersections are added with the Build Alternative or under future analysis years. The freeway segments are modified in the westbound direction with the Build Alternative. The planned HOV lanes on I-80 also modify the freeway study segments under design year conditions.

2.2 Data Collection

The intersection and freeway traffic counts were collected from 7:00 to 9:00 AM and 4:00 to 6:00 PM. The peak period counts included heavy vehicles, bicycles, and pedestrians. The intersection turning movement counts were collected in May 2016 on a typical midweek day.

The morning peak hour occurred from 8:00 to 9:00 AM, and the evening peak hour occurred from 5:00 to 6:00 PM. The network-wide peak hour factors were 0.92 and 0.94 during the morning and evening peak hours. The average network heavy vehicle percentages were 3 and 1 percent during the morning and evening peak hours, respectively. Figure 3 shows the peak hour vehicle turning movement volumes and lane configurations for the study intersections. Figure 4 shows the peak hour bicycle and pedestrian volumes.

Signal timing plans were obtained from the signal controllers under a previous project that developed optimized signal timings. New signal timings were implemented in January 2017 after the counts were collected, so the previous signal timing plans will be used for the existing conditions analysis. Existing traffic conditions, including peak hour vehicle queuing, were also observed under the previous project.

Existing lane configurations, turn pocket lengths, and intersection spacing were taken from Bing Maps. The lane configurations were confirmed in the field concurrent with the collection of posted speeds, bus stop locations, and parking restrictions. The intersection and roadway configuration for the Build Alternative was provided via the draft geometric approval drawing. The proposed project has a design exception for corner sight distance at the Richards Boulevard/I-80 Westbound Ramps intersection. The operations analysis model includes a 1-second all-red time for the signal phases to offset the reduced corner sight distance.

Freeway mainline volumes were obtained from the Caltrans Performance Measurement System (PeMS). The data were averaged across weekdays in October 2016. Table 1 lists the peak hours and peak hour factors by direction. The AM and PM peak hour heavy vehicle percentages were assumed to be the same as the daily percentage of 9 percent as reported in the Caltrans Annual Average Daily Truck Traffic publication (http://www.dot.ca.gov/trafficops/census/docs/2015_aadt_truck.pdf).

Table 1: Freeway Mainline Volume Data

Direction	AM Peak Hour			PM Peak Hour		
	Peak Hour	Peak Hour Factor	Heavy Vehicle Percentage	Peak Hour	Peak Hour Factor	Heavy Vehicle Percentage
Eastbound I-80	7:15 to 8:15	0.95	9%	4:00 to 5:00	0.96	9%
Westbound I-80	8:00 to 9:00	0.98	9%	4:15 to 5:15	0.99	9%

Source: Caltrans PeMS (October 2016), Caltrans Annual Average Daily Truck Traffic (2015)

Freeway ramp volumes for the Richards Boulevard and Old Davis Road interchanges come from intersection counts taken in October 2016. The Olive Drive off-ramp was counted in May 2016. For the Mace Boulevard/Chiles Road ramps, data collected in May 2014 was used. For the ramps, the peak hour volumes were determined using the mainline peak hour. The freeway mainline and ramp volumes for the AM and PM peak hours are shown in Figure 5.

2.3 Travel Demand Forecasting

2.3.1 Base Year Model Development

The City of Davis travel demand forecasting model was used to prepare the traffic volumes for future conditions. A base year model validation was performed to determine how well the model replicates existing traffic volumes. We reviewed base year model land uses, roadway network, link properties (speed, functional classification, etc.), and model traffic analysis zone (TAZ) centroid connections in the study area. Based on the review, land uses, network connections, and link speed and capacity were adjusted (see appendix for a list of model changes).

The model validation process involved running the model, checking the results against existing traffic volumes, and then adjusting input parameters in an iterative manner. This static sub-area validation method was performed on roadways near or parallel to the I-80/Richards Boulevard interchange.

The sub-area validation results were compared to the following validation thresholds discussed in 2017 California Regional Transportation Plan Guidelines (CTC, January 2017):

- The two-way sum of the volumes on all roadway links for which counts are available should be within 10 percent of the counts.

- At least 75 percent of the roadway links for which counts are available should be within the maximum desirable deviation, which ranges from approximately 14 to 68 percent depending on total volume (the larger the volume, the less deviation is permitted).
- The percent root mean square error (RMSE[1]) should not exceed 40 percent.
- The correlation coefficient[2] between the actual ground counts and the estimated traffic volumes should be greater than 88 percent.

Table 2 presents the results of the base year forecast model validation. See the appendix for detailed results.

- Mainline model volumes compare well to I-80 mainline count volumes in the peak directions: the westbound direction under AM peak hour and in the eastbound direction under PM peak hour.
- The overall model was improved; however, a few links could not be validated within the Caltrans standard deviation. This includes the I-80 Westbound off-ramp to southbound Richards Boulevard in the AM peak hour, the I-80 Eastbound on-ramp at Old Davis Road in the PM peak hour, and the I-80 Westbound off-ramp at Olive Drive in the PM peak hour.
- The model is overly sensitive to the balance of traffic between I-80 eastbound off ramp at Olive Drive and at Richards Boulevard with only minor changes in speed.
- The model generally overestimates traffic on study intersections in downtown Davis, especially during the AM peak hour.

Table 2: Base Year Forecast Model Validation

Validation Statistic	Acceptance Criterion[1]	Model Result	
		AM Peak Hour	PM Peak Hour
Model/Count Ratio	-	1.03	0.97
Percent of Links within Caltrans Standard Deviations	> 75%	83%	87%
Percent RMSE	≤ 30%	24%	25%
Correlation Coefficient	> 0.88	0.99	0.99

Note: 1. *2017 California Regional Transportation Plan Guidelines* (CTC, January 2017)
Source: Fehr & Peers, 2018

A dynamic validation test was also performed to evaluate the model's sensitivity to changes in the roadway network. Pole Line Road at the I-80 overcrossing was increased to 4 lanes between Fifth Street and Cowell

[1] RMSE is a statistical measure for how close the estimated value is to the observed data, regardless of positive or negative direction.

[2] Correlation coefficient is a variable that determines the degree to which two variables are associated. The value varies between -1 (-100%) and 1 (100%). A value closer to 1 suggests, in general, the model estimates are in line with observed data.

Boulevard. The overall screen line of volumes at Richards Boulevard, Pole Line Road, and Mace Boulevard over I-80 increased by 3 percent in the AM peak hour and 5 percent in the PM peak hour. Volumes appropriately shifted from Richards Boulevard and Mace Boulevard to Pole Line Road with the increase in capacity.

2.3.2 Cumulative Year Model Development

Similar to the base year model, the cumulative year land use and roadway network inputs were reviewed. In addition to the roadway network adjustments identified for the base year model validation, the UC Davis land use growth was adjusted to the latest projections in the Long Range Development Plan (LRDP).

As directed by Caltrans staff, the planned I-80 HOV lanes were assumed to extend through the study area. This was accounted for by adding the capacity of the HOV lane (assumed to be 900 vehicles per hour) to the capacity of the three mainline travel lanes (an additional 300 vehicles per hour per lane).

The cumulative year model includes build-out of the city's general plan under 2035 conditions plus the following proposed projects.

- Mace Ranch Innovation Center – located north of I-80 and east of Mace Boulevard that would include 1.51 million square feet of research and development/office, 884,000 square feet of manufacturing, 150,000 square feet of hotel/conference center, and 100,000 square feet of retail land uses
- Davis Hotel and Conference Center – located west of Richards Boulevard between Olive Drive and I-80 that would replace the 43-room University Inn & Suites Hotel and Caffe Italia restaurant with a 132-room Embassy Suites hotel, a restaurant, and a 14,900 square-foot conference center
- Nishi/West Olive Drive Development – located in the triangle formed by I-80, the Union Pacific Railroad, and Putah Creek with vehicle connections to Olive Drive and the UC Davis campus that would include 650 residential units, 325,000 square feet of research and development/office, and 20,000 square feet of retail uses
- Lincoln40 Apartments – located on Olive Drive east of Richards Boulevard that would include 130 apartments oriented to students attending UC Davis
- Sterling Apartments – located on Fifth Street east of Pole Line Road that would include 198 apartments oriented to students attending UC Davis

The Mace Ranch Innovation Center and Nishi/West Olive Drive projects have not been approved. The first is on hold and the second was not approved by the voters in an election. However, the properties are likely to be developed in some fashion by cumulative conditions. For this analysis, the previously proposed projects were assumed although the actual development may be smaller in scope.

Forecasting future traffic volumes is inherently uncertain. In addition to the assumptions for land use and roadway network changes, the following limitations are noted below.

- The effect of transportation network companies (such as Uber or Lyft) on trip making patterns is not included in the model.
- The effect of internet shopping on passenger or freight travel is not included.

2.3.3 Analysis Year Forecasts

To account for model error, the cumulative year model volumes for the freeway and ramps were adjusted using a process known as the "difference method," which adjusts model output volume forecasts based on incremental growth from existing conditions using the following formula:

Forecast Volume = Existing Traffic Count +
(Cumulative Year Raw Model Volume – Base Year Raw Model Volume)

In addition, the forecasted growth was increased to account for growth between the cumulative model year of 2035 and the project design year of 2042. For most locations, the growth rate from 2035 to 2042 was assumed to continue at the same rate predicted by the model from 2016 to 2035, which results in about 37 percent additional growth for the seven years from 2035 to 2042. However, land uses along Olive Drive are assumed to be built out by 2035 conditions, so the additional growth from 2035 to 2042 was reduced from 37 to 10 percent. The construction year (2022) volumes were prepared using linear interpolation, which assumed a constant rate of traffic growth between existing and cumulative year (2035) conditions.

For the intersection forecasts, the difference method was applied using trip tables. An origin-destination trip table was estimated from the existing conditions peak hour counts using the base year model trip table as a seed matrix. Then, subarea trip tables were extracted from the base year and cumulative year models. The difference between the model matrices, factored to extrapolate to design year conditions, was added to the existing conditions matrix to generate the design year trip table, which was then assigned to the project area network. For the freeway forecasts, the difference method was applied to the link counts.

As part of the forecasting process, all peak hour volumes were rounded to the nearest ten vehicles per hour to acknowledge that these volumes are estimated projections. In general, decreases in turning movement volumes greater than 10 vehicles per hour were not allowed between existing and design year conditions with the following exception. During the PM peak hour, the eastbound through at First Street/D Street, eastbound right turn at First Street/E Street/Richards Boulevard, and southbound through at Olive Drive/Richards Boulevard were allowed to decrease due to the new connection to UC Davis via Olive Drive and the Nishi/West Olive development. Additionally, volumes were balanced through the study area.

Bicycle and pedestrian volumes were assumed to grow proportionally to the land use growth in the study area. In the project vicinity, land use grows by about 17 percent between the base year and cumulative year models. Extrapolating this growth from the cumulative year of 2035 to the design year of 2042 conditions, increases the total growth to about 23 percent. This value was rounded up to 25 percent and used to generate the design year bicycle and pedestrian volumes. Additionally, the minimum bicycle turning movement volume was set to 2 bicycles per hour, and the bicycle volumes were balanced through the study intersections.

The traffic volumes for the Build Alternative will be the same as the No Build Alternative except for reassigning traffic based on the new roadway configuration. For example, the reconfiguration of the westbound ramps from four to two at the I-80/Richards Boulevard interchange will shift the loop off-ramp volumes to become off-ramp left-turn movements at the new signalized intersection. The closure of the Olive Drive westbound off-ramp will shift the traffic to the westbound off-ramp to northbound Richards Boulevard. The distribution of the Olive Drive off-ramp traffic destinations were determined using a select-link model run so that the volumes were assigned to the appropriate turning movements at the study intersections.

Under design year conditions, turning volumes at the Richards Boulevard/Cowell Boulevard/Research Park Drive intersection were adjusted based on preliminary intersection operations. The initial forecasted volume for the left turn from Richards Boulevard to Research Park Drive would have resulted in queues exceeding the storage length. Drivers could easily avoid this queue by continuing through onto Cowell Boulevard to make a left turn midblock or at Drew Avenue. As a result, 50 vph was shifted during the AM peak hour, and 150 vph was shifted during the PM peak hour from the left turn to the through movement. Similarly, 100 vph was shifted during the PM peak hour from the right turn from Research Park Drive to Richards Boulevard to the through movement from Cowell Boulevard to Richards Boulevard.

2.4 Traffic Operations Analysis

2.4.1 Intersections

The study intersections were analyzed using the performance measures of intersection delay and level of service (LOS). LOS is a qualitative measure of traffic operating conditions that assigns a letter rating, from A (the best) to F (the worst). These ratings represent the perspective of drivers and are an indication of the comfort and convenience associated with driving. The descriptions of letter ratings and the delay thresholds for signalized and unsignalized intersections are provided in Table 3. For unsignalized intersections with some movements uncontrolled, the intersection LOS is determined by the controlled movement with the highest delay.

Intersection operations were analyzed under AM and PM peak period conditions (7:00 to 9:00 AM and 4:00 to 6:00 PM) using the Vissim (Version 9) microsimulation software. Traffic simulation analysis allows for the direct modeling of vehicle, bicycle, and pedestrian interactions, delays due to queues that block turn pockets or adjacent lanes, bus routes and stops, and congestion that either constrains vehicles from reaching downstream intersections or causes queues that create additional delay at upstream intersections. The Vissim software was applied consistent with the methodology presented in the *Highway Capacity Manual, 6th Edition* (Transportation Research Board, 2016). The analysis results are an average of ten model runs using different random seed values. Intersection delay and LOS are based on the Vissim results, and the average maximum queue lengths from Vissim are reported.

Table 3: Intersection LOS Thresholds

LOS	Description	Delay[1]	
		Signalized	Unsignalized
A	Operations with very low delay occurring with favorable progression and/or short cycle length.	$\leq$ 10	$\leq$ 10
B	Operations with low delay occurring with good progression and/or short cycle lengths.	> 10 to 20	>10 to 15
C	Operations with average delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures begin to appear.	> 20 to 35	>15 to 25
D	Operations with longer delays due to a combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop and individual cycle failures are noticeable.	> 35 to 55	>25 to 35
E	Operations with high delay values indicating poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55 to 80	>35 to 50
F	Operation with delays unacceptable to most drivers occurring due to over saturation, poor progression, or very long cycle lengths.	> 80 or v/c > 1[2]	>50 or v/c > 1[2]

Notes: 1. Delay is reported in seconds per vehicle.
2. Volume-to-capacity ratio is greater than 1 (demand exceeds capacity).
Source: *Highway Capacity Manual* (Transportation Research Board, 2010)

The following key assumptions were included in the intersection operations analysis.

- The truck percentages collected during the May 2016 counts were used for to develop a network-wide value. The existing values were used for all future analysis years.
- For existing conditions, bicycle and pedestrian volumes are based on observed data. For future conditions, the minimum conflicting bicycle volume was set to 2 bicycles per hour, and the minimum pedestrian volume was 5 pedestrians per hour.
- Input volumes for vehicles, bicycles and pedestrians are based on the 15-minute flow rates collected during the traffic counts. Although traffic volumes change between analysis years, the arrival distribution of volumes across the peak period is assumed to stay the same as existing conditions for the one-hour seeding period. For the one-hour analysis period, the input volumes were adjusted to have a peak hour factor of 0.92 for the AM peak hour and 0.95 for the PM peak hour under future years. The 15-minute interval in the peak hour with the highest flow rate was kept the same for all analysis scenarios.

2.4.2 Simulation Model Development

Development of the street network and traffic volumes that comprise the Vissim models required the input of geometric, traffic control and traffic flow data, each of which is described in this section. An overview of the micro-simulation model development process is described below.

Roadway geometric data (traffic lanes, turn pockets, bus lanes, bus stop locations, etc.) were gathered using aerial photographs and field observations. Lane configurations were initially taken from aerial photographs and were then confirmed or revised based on field observations.

City staff provided signal timing plans for the traffic signals in the study area. The signal timing settings include vehicle and pedestrian signal phases. The posted speed limits for streets in the study area were collected during field observations. Maximum vehicle speeds in the model are consistent with posted speed limits, although random speed variability is assigned to each vehicle, causing them to drive above or below the speed limit, to mimic prevailing driver behavior.

For each peak period, the analysis period is two hours with a 15-minute seeding period. The volume inputs vary each 15 minutes based on the traffic counts. The peak hour was determined based on the highest consecutive four 15-minute interval period based on the overall network volume. The routing decisions for the two-hour analysis period are based on the peak hour volumes. That is, the travel patterns during the peak hour are assumed to be the same for the two-hour peak period. When developing the peak hour volumes, the volumes were balanced between intersections to reduce unexpected changes in through volumes between adjacent intersections. Where balancing was performed, the volumes were balanced to the higher volume to provide for a conservative analysis.

The pedestrian and bicycle volumes were directly modeled through use of pedestrian crossing counts and bicycle turning movement counts taken at the same time as the intersection vehicle turning movement counts. Bicycle peak hour volumes were also balanced through the network.

The Vissim models were validated to existing conditions using criteria suggested by the Federal Highway Administration (FHWA) and additional criteria developed by Fehr & Peers. A number of iterations were required to successively adjust the default Vissim parameters for driver behavior until the model was validated to observed conditions.

Because micro-simulation models like Vissim rely on the random arrival of vehicles, multiple runs are needed to provide a reasonable level of statistical accuracy and validity. The models are run up to twenty times (each using a different random seed number). Starting with the first ten runs, runs that are clear outliers are reviewed to determine if coding errors are present. If no obvious error is found, the run is discarded and replaced with a subsequent run. This process is repeated until ten acceptable runs remain. The final results are based on an average of the ten acceptable runs.

2.4.2.1 Model Calibration

During calibration of a microsimulation model, individual components are adjusted to match collected and field-observed data. Calibration of a model is necessary to ensure that the model provides a visually accurate depiction of the field-observed condition and that model outputs can be trusted to inform the best possible analysis.

Adjustments to the Vissim models focus on the model components related to driver behavior including yielding right-of-way at intersections, driver performance such as aggressiveness, vehicle fleet mix, and vehicle performance. In particular, roadway links with bicycles traveling in the regular traffic lane have been adjusted so that bikes can be overtaken on the left if the lane is wide enough to provide acceptable clearance.

2.4.2.2 Model Validation

During validation, the VISSIM model output is compared against field data to determine if the output is within acceptable levels. FHWA (Traffic Analysis Toolbox Volume III – Guidelines for Applying Traffic Microsimulation Modeling Software, 2003) suggests the following validation criteria:

- Link volumes for more than 85 percent of cases meet the following criteria:
    - For volumes less than 700 vph, within 100 vph
    - For volumes between 700 and 2,700 vph, within 15 percent
    - For volumes greater than 2,700 vph, within 400 vph
- Link volumes for more than 85 percent of cases have a GEH statistic less than 5 (a measure of how well the model replicates actual conditions)
- Sum of link volumes within 5 percent
- Sum of link volumes have a GEH statistic less than 4
- Signals create visually acceptable queuing and agree with observed conditions

Fehr & Peers has developed the following additional validation criterion, which has a narrower tolerance for intersection volumes (which are aggregated link volumes) than the criteria suggested by FHWA.

- Peak-hour volumes for more than 85 percent of intersections within 5 percent of traffic counts

Table 4: Validation Criteria Thresholds Comparison shows how the results for the existing conditions Vissim models compare to the validation criteria thresholds. The results reflect the average of 10 micro-simulation model runs.

As noted above, the Vissim analysis used a 15-minute seeding interval followed by a 2-hour modeling period corresponding to the 2-hour peak period. Measures of effectiveness (network throughput, intersection delay, queue length, etc.) were recorded for the 60-minute period corresponding to the peak hour.

2.4.3 Freeway Segments

Freeway operations were analyzed under AM and PM peak hour conditions according to the methodology presented in the *Highway Capacity Manual, 6th Edition* (Transportation Research Board, 2016). As with intersections, LOS is used to describe the operating condition of freeway segments. Table 5 lists the descriptions of the letter ratings and thresholds for each category.

Table 4: Validation Criteria Thresholds Comparison

Criteria	Criteria Threshold	Target for % Met	Peak Hour	% Met / Value	Pass/Fail
Link Volumes					
< 700 vph	± 100 vph	> 85%	AM PM	100% 100%	Pass Pass
700 to 2,700 vph	±15%				
> 2,700 vph	± 400 vph				
GEH statistic	< 5.0	> 85%	AM PM	100% 100%	Pass Pass
Sum of Link Volumes					
Sum of all links	±5%	-	AM PM	-0.4% -1.7%	Pass Pass
GEH statistic	< 4.0	-	AM PM	0.5 2.3	Pass Pass
Aggregated Volumes					
Intersections	±5%	> 85%	AM PM	100% 100%	Pass Pass
Visual Inspection					
Queuing	match observations		AM PM	- -	Pass Pass

Source: FHWA, 2003 and Fehr & Peers, 2018

The HCM method for freeway capacity analysis has the following limitations that may apply in one or more analysis scenario.

- The methodology does not account for the influence of a downstream bottleneck that causes queuing to extend into the study area.
- The methodology does not account for the influence of an upstream bottleneck that constrains traffic demand from reaching the study area.

- The capacity-enhancing effects of ramp metering and intelligent transportation system features (for example, electronic dynamic message signs) are not captured.
- The effect of the posted speed limit and enforcement practices on actual vehicle speed is not modeled.
- The effect of a ramp HOV (high-occupancy vehicle) lane on merge segment capacity is not captured.
- The effect of a mainline HOV lane on freeway segment capacity is not modeled directly.

Table 5: Freeway LOS Thresholds

LOS	Description	Density[1]	
		Basic	Merge, Diverge and Weave
A	Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver.	< 11	< 10
B	Free-flow speeds are maintained. The ability to maneuver with the traffic stream is only slightly restricted.	> 11 to 18	> 10 to 20
C	Flow with speeds at or near free-flow speeds. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver.	> 18 to 26	> 20 to 28
D	Speeds decline slightly with increasing flows. Freedom to maneuver with the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort.	> 26 to 35	> 28 to 35
E	Operation at capacity. There are virtually no usable gaps within the traffic stream, leaving little room to maneuver. Any disruption can be expected to produce a breakdown with queuing.	> 35 to 45	> 35 to 43
F	Represents a breakdown in flow.	> 45 or v/c > 1[2]	> 43[3] or v/c > 1[2]

Notes: 1. Density is reported in vehicles per lane per mile.
2. Volume-to-capacity ratio is greater than 1 (demand exceeds capacity).
3. Threshold of 43 vehicles per lane per mile applies to weave segments only. Merge and diverge segments do not have a density threshold for LOS F.

Source: *Highway Capacity Manual* (Transportation Research Board, 2016)

To address the last limitation, the mainline HOV lane volume and lane will be removed from the segment analysis to estimate operations in the general purpose lanes under design year conditions. The HOV percentage was assumed to be 14 percent under both peak hours based on forecasted volumes for I-80 between Davis and West Sacramento from the cumulative year SACMET regional traffic demand model.

For weave segments, capacity is also analyzed according the Leisch Method as described in the *Highway Design Manual* (Caltrans, 2012) Section 504.7.

The freeway mainline peak hour factors and heavy vehicle percentages are provided in Table 1. For ramps, the peak hour factor and heavy vehicle percentage come from the appropriate ramp terminal intersection count. These values were used for all future analysis years with the following exception. The minimum value of 0.92 peak hour factor and 3 percent heavy vehicles was applied.

The lane configuration for the ramp meter proposed for the new westbound on-ramp was evaluated according to the arrival distribution and practical metering rates as described in the *Ramp Meter Design Manual* (Caltrans, 2016). The HOV percentage for on-ramp traffic was assumed to be 15 percent.

2.5 Evaluation Criteria

The intersection and freeway segment evaluation criteria were based on policies of the respective jurisdictions.

The *City of Davis General Plan* (December 2013) identifies LOS E as the minimum acceptable LOS for intersections during peak hours although LOS F is acceptable for the "Core Area and Richards Boulevard/Olive Drive area." For this project, a project impact for the Build Alternative occurs when (1) an intersection worsens from LOS E or better under the No Build Alternative to LOS F or (2) intersection delay increases for an intersection operating at LOS F under the No Build Alternative.

The *Interstate 80 Transportation Concept Report* (July 2017) identifies LOS E as the concept LOS for urban areas in Caltrans District 3. For this project, a project impact for the Build Alternative occurs when (1) a freeway segment worsens from LOS E or better under the No Build Alternative to LOS F or (2) freeway segment density increases for a segment operating at LOS F under the No Build Alternative.

2.6 Safety Analysis

The *Highway Safety Manual* (American Association of State Highway and Transportation Officials, 2010) methodology was used to predict the expected number of collisions for the westbound I-80 freeway ramps at Richards Boulevard and Olive Drive. The methodology uses daily volume, roadway geometry, and other characteristics to predict collisions for a given roadway. The collision history is also a model input that can improve the statistical reliability of the prediction. Although this methodology estimates collisions, it does not ensure or imply that the actual number of collisions will match the predicted value.

The Enhanced Interchange Safety Analysis Tool spreadsheet (Texas Transportation Institute, 2013) was used to estimate collisions to apply the *Highway Safety Manual* methodology.

Chapter 3. Existing Conditions

The existing conditions chapter presents the operations and safety of the roadway system. The operations analysis is a detailed evaluation of individual facilities with separate discussions for intersections and freeway segments. Crash history for roadways adjacent and parallel to the proposed project are presented. The existing transit, bicycle, and pedestrian systems are also discussed.

3.1 Study Facilities

The roadway study area extends along the First Street/Richards Boulevard corridor from D Street in the north to Research Park Drive in the south and along I-80 from Old Davis Road in the west to Mace Boulevard in the east. The study locations are in Yolo and Solano Counties and the City of Davis. The major roadways are described below.

- Richards Boulevard is a north-south arterial that extends from First Street/E Street in downtown Davis under the Union Pacific Railroad and over I-80 to Research Park Drive/Cowell Boulevard in south Davis. The roadway is one of three crossings of the railroad and the freeway in the City of Davis.
- First Street is an east-west arterial that runs from A Street at the University of California at Davis (UC Davis) campus to G Street and serves as the southernmost street in downtown Davis.
- Olive Drive is an east-west collector street that provides access to parcels located in the triangle formed by the Union Pacific Railroad on the north, I-80 on the south, and Putah Creek on the west. Land uses in this area include highway commercial, light industrial, and residential (student) apartment complexes.
- Cowell Boulevard is an east-west arterial serving south Davis that runs from Richards Boulevard/Research Park Drive to the El Macero neighborhood east of Mace Boulevard.
- Old Davis Road is a north-south roadway that serves as the south entrance to UC Davis and the main access point from I-80.
- Mace Boulevard is a north-south roadway that serves east and south Davis. It is the easternmost of three crossings of the railroads and has one of two I-80 interchanges in the City of Davis.
- I-80 is an east-west freeway that traverses the United States from San Francisco to New York. In the study area, the freeway has three lanes in each direction and serves regional traffic between the Sacramento metropolitan area and the Bay Area.

Five of the six study intersections are signalized and operate as a coordinated corridor during the AM and PM peak periods. The cycle length was 120 seconds during both peak hours when the traffic counts and field observations were conducted in October 2016. The unsignalized intersection at the I-80 Westbound Ramps is uncontrolled; that is, turning vehicles either have free movements or must merge (westbound I-80 to southbound Richards Boulevard) or weave (westbound I-80 to northbound Richards Boulevard) with conflicting vehicles.

Marked, on-street parallel parking is provided on westbound First Street. Parking is restricted to 90 minutes for vehicles without a residential permit. On-street parking is also allowed on the north legs of the D and E Street intersections at First Street. Elsewhere in the study area, on-street parking is prohibited. The effect of on-street parking on traffic operations was not directly modeled in Vissim.

The I-80/Richards Boulevard interchange has a loop off-ramp and slip on-ramp in the eastbound direction and a full cloverleaf configuration in the westbound direction. West of the interchange, the freeway widens out approaching the Old Davis Road and State Route 113 interchanges. The next interchange to the east is at Mace Boulevard. Further west is the three-mile long causeway at the Yolo Bypass.

The causeway is a bottleneck in the westbound direction that constrains traffic demand from reaching the Richards Boulevard interchange during both peak periods. The measured peak hour factors for the westbound mainline freeway (0.98 and 0.99) are close to 1.0 due to this upstream constraint. If the bottleneck were removed, the westbound peak hour volumes would be higher than measured.

In the eastbound direction, the causeway is a bottleneck during the PM peak hour only. Congestion from this bottleneck has grown in recent years until the queue regularly extends through the Richards Boulevard interchange during the PM peak period. If this bottleneck were removed, the congested, stop-and-go conditions observed for the eastbound freeway at Richards Boulevard would be improved, and the observed PM peak hour freeway volume would increase.

Due to the congested conditions, the freeway count measured at Richards Boulevard via PeMS does not reflect the actual demand volume. To estimate the eastbound PM peak hour demand, the additional congested length during the PM peak hour was assumed to extend upstream to the Union Pacific Railroad Overhead, a distance of about 1.1 miles. Assuming three lanes of queued vehicles and 50 feet per vehicle, the unserved volume during the PM peak hour was estimated as 350 vehicles. This additional volume was added to the mainline volume for the eastbound PM peak hour freeway capacity analysis.

Figure 3 shows the peak hour vehicle turning movement volumes, traffic control, and lane configurations for the study intersections. Figure 4 shows the intersection peak hour bicycle and pedestrian volumes. The freeway mainline and ramp peak hour volumes are shown in Figure 5.

3.2 Intersection Operations

Intersection operations were analyzed for existing (2016) conditions under AM and PM peak hour conditions using the Vissim software. Table 6 shows the intersection LOS and average delay under existing conditions.

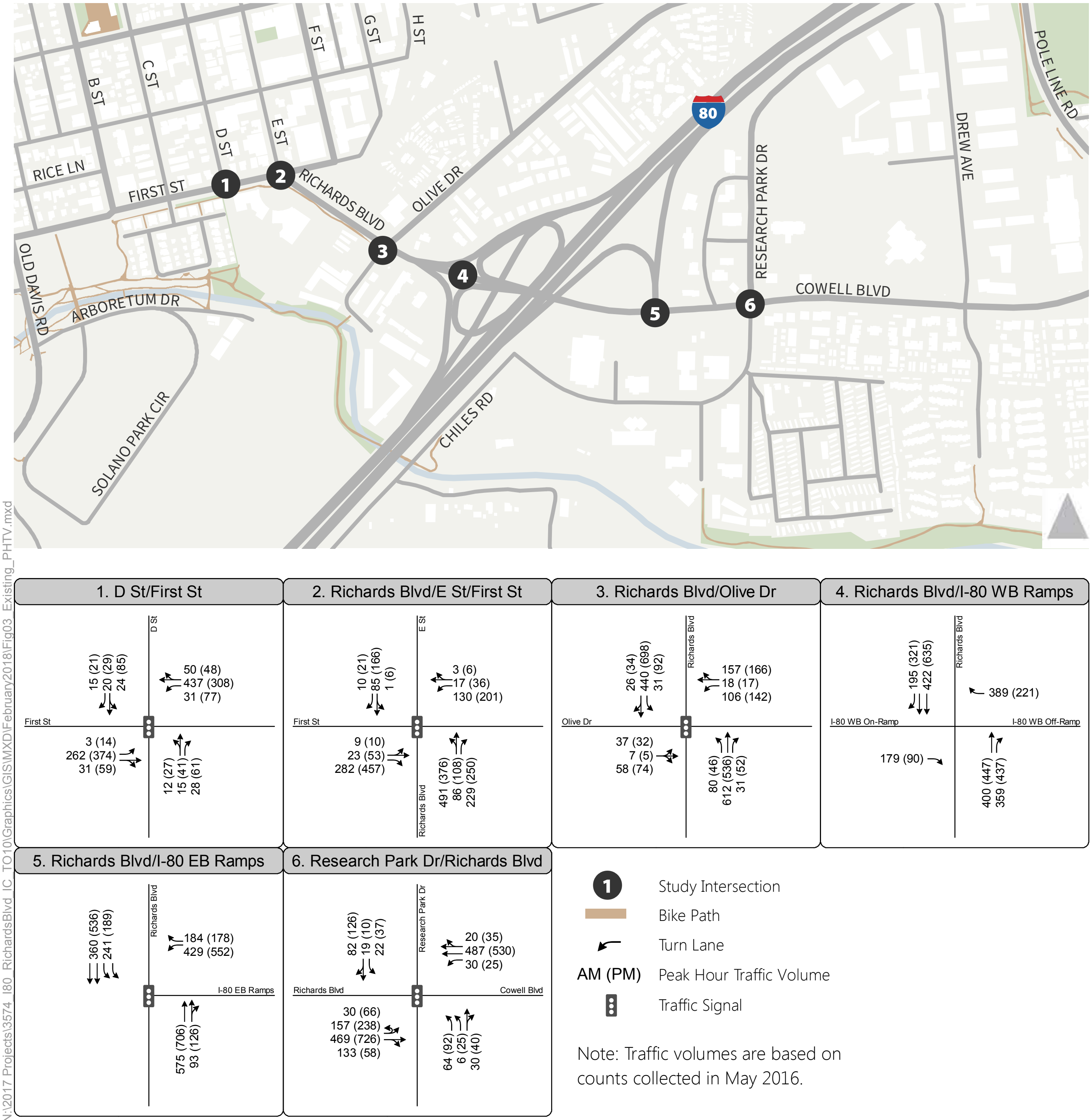


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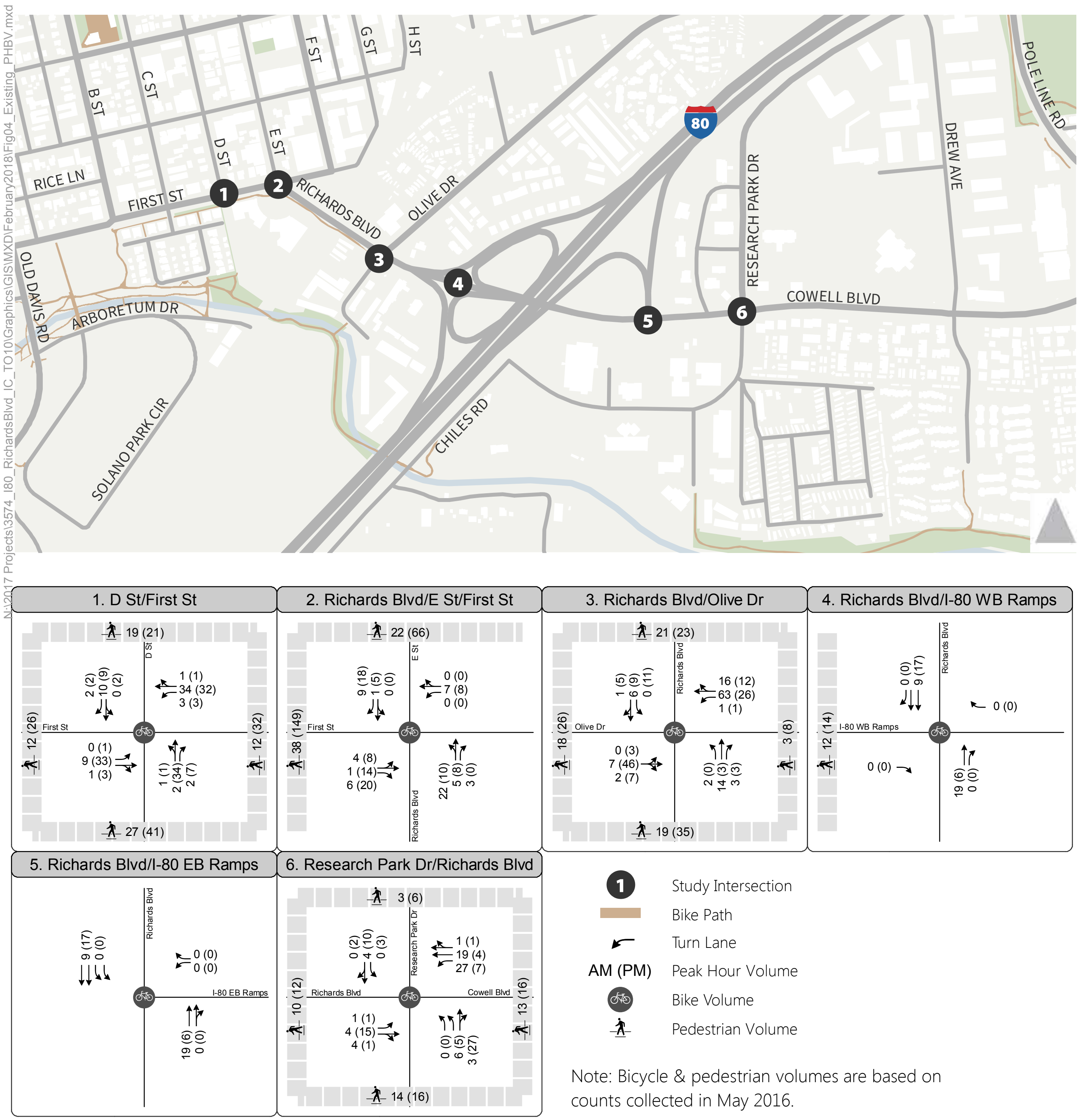
Figure 3

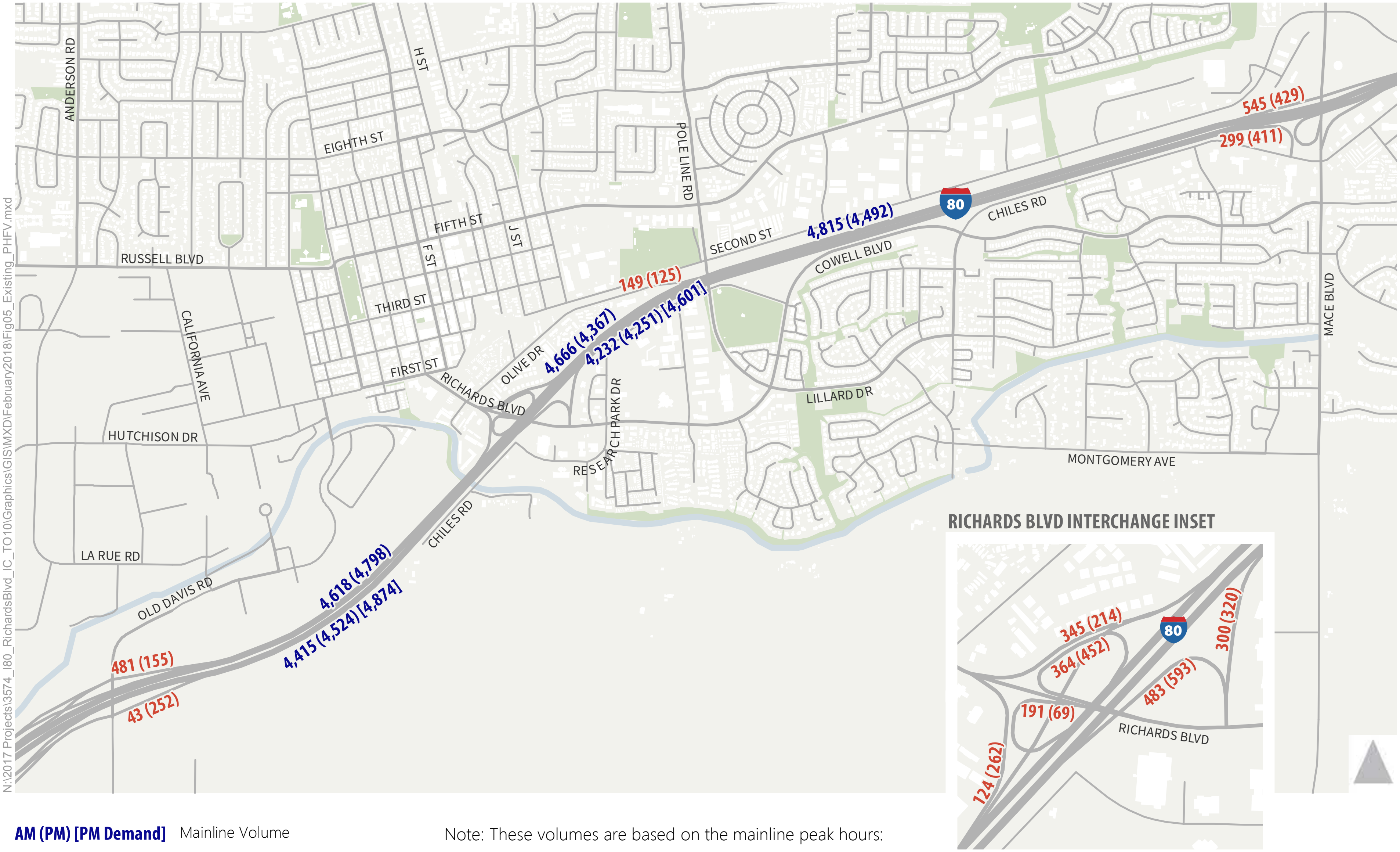
Vehicle Volume, Traffic Control, and Lane Configurations - Existing Conditions



Note: Bicycle & pedestrian volumes are based on counts collected in May 2016.

Figure 4

Bicycle and Pedestrian Volume - Existing Conditions



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AM (PM) [PM Demand] Mainline Volume

AM (PM) Ramp Volume

Note: The traffic volumes are based on counts collected in October 2016.

Note: These volumes are based on the mainline peak hours:

	AM	PM
I-80 EB	7:15 - 8:15 am	4:00 - 5:00 pm
I-80 WB	8:00 - 9:00 am	4:15 - 5:15 pm

Figure 5

Freeway Volume - Existing Conditions

Table 6: Intersection Operations – Existing Conditions

Intersection	Control	LOS / Delay[1]	
		AM	PM
1. First St/D St	Signal	B / 13	D / 43
2. First St/E St/Richards Blvd	Signal	C / 29	D / 41
3. Olive Dr/Richards Blvd	Signal	E / 69	E / 64
4. I-80 Westbound Ramps/Richards Blvd	Side Street Yield	**F / 51** (WB RT)	A / 1 (WB RT)
5. I-80 Eastbound Ramps/Richards Blvd	Signal	D / 37	E / 62
6. Research Park Dr/Richards Blvd/Cowell Blvd	Signal	D / 35	C / 29

Notes: Bold and underline font indicate LOS F conditions: that is, volume exceeds capacity. For the side street yield intersection, the highest controlled movement delay is reported with the movement listed in parentheses. Vehicle delay includes delay for bicycles traveling in regular lanes but excludes delay for bicycles traveling in bicycle-only lanes.
1. Delay is reported in seconds per vehicle.
Source: Fehr & Peers, 2018

During the AM peak hour, the First Street intersections have LOS C or better conditions, but Olive Drive/Richards Boulevard operates at LOS E with high delays on the northbound and westbound approaches. The southern intersections at the I-80 Eastbound Ramps and Research Park Drive have LOS D conditions. The LOS F on the westbound right turn on the I-80 off-ramp is caused by traffic queuing back from the downstream Olive Drive intersection. During the PM peak hour, the First Street intersections have LOS D conditions, and the Olive Drive/Richards Boulevard and I-80 Eastbound Ramps/Richards Boulevard intersections have the highest delays (similar to the AM peak hour) with LOS E conditions.

Table 7 reports the average maximum queue length under existing conditions from the Vissim models. During the AM peak hour, field observations showed long queues on the westbound and northbound approaches at Olive Drive/Richards Boulevard. The bottleneck at the First Street/E Street intersection backs up along Richards Boulevard and extends onto the I-80 overcrossing and the westbound I-80 off-ramp. This is reflected in the 625-foot queue on northbound Richards Boulevard at Olive Drive and the 250-foot queue on the westbound off-ramp to northbound Richards Boulevard. During the PM peak hour, queues extend to the upstream intersection on all approaches at the First Street/E Street/Richards Boulevard intersection. At the I-80 Eastbound Ramps, the queue on the off-ramp approach can extend back to the Richards Boulevard overcrossing.

It should be noted that the signal timing plans for the study area were updated in February 2017. The signal timing changes reduced the cycle length for most study intersections resulting in improved operations. In particular, the cycle length at the I-80 Eastbound Ramps/Richards Boulevard intersection was reduced from 120 to 60 seconds, which resulted in shorter off-ramp queues. As a result, the existing conditions operations results reported above no longer reflect current conditions.

Table 7: Average Maximum Queue Length – Existing Conditions

Intersection	Approach	Storage Length	Queue Length	
			AM Peak Hour	PM Peak Hour
1. First St / D St	Eastbound	250	150	**475**
2. First St / E St / Richards Blvd	Northbound	625	**775**	**650**
	Eastbound	225	200	**300**
	Westbound	225	175	**275**
3. Olive Dr / Richards Blvd	Northbound	300	**625**	**425**
	Southbound	625	400	500
	Westbound	>1,500	475	575
4. I-80 Westbound Ramps / Richards Blvd	Eastbound	530	25	25
	Westbound	1,470	250	25
5. I-80 Eastbound Ramps / Richards Blvd	Northbound	445	325	275
	Southbound	1,010	175	175
	Westbound	1,625	650	1,150
6. Research Park Dr / Richards Blvd / Cowell Blvd	Eastbound	445	425	**500**

Note: The storage length and average maximum queue length is reported in feet.
Source: Fehr & Peers, 2018

3.3 Freeway Operations

Freeway operations were analyzed for existing (2016) conditions under AM and PM peak hour conditions using the HCM analysis method. Tables 8 and 9 present freeway operations under existing conditions for I-80 between Old Davis Road and Mace Boulevard for the eastbound and westbound directions, respectively.

During the AM peak hour, both eastbound and westbound freeway study segments would have LOS D or better conditions. The eastbound off-ramp at Richards Boulevard and the westbound off-ramps at Olive Drive and northbound Richards Boulevard have the highest densities (and LOS D conditions).

During the PM peak hour, the HCM analysis showed similar conditions with LOS D or better conditions in both directions. The eastbound PM peak hour conditions are actually congested as shown in Exhibit 1. Slow speeds are shown on eastbound I-80 starting from the Old Davis Road on-ramp and extending to the east. Given the observed congested conditions, the eastbound I-80 study segments are reported as having LOS F conditions in Table 8.

Table 8: Eastbound Freeway Operations – Existing Conditions

Segment	Facility Type	LOS / Density	
		AM	PM
West of Old Davis Rd On-ramp	Basic	B / 14	F[2]
Old Davis Road On-ramp	Basic[1]	B / 12	F[2]
Old Davis Road to 1st Lane Drop	Basic	B / 14	F[2]
1st Lane Drop to 2nd Lane Drop	Basic	B / 18	F[2]
Richards Blvd Off-ramp	Diverge	D / 31	F[2]
Richards Blvd Off-ramp to On-ramp	Basic	C / 22	F[2]
Richards Blvd On-ramp	Merge	C / 26	F[2]
Richards Blvd to Chiles Rd	Basic	C / 24	F[2]
Chiles Rd Off-ramp	Diverge	B / 15	F[2]
East of Chiles Rd Off-ramp	Basic	C / 22	F[2]

Notes: Density is reported in passenger car equivalents per lane per mile.
1. Since the acceleration lane is greater than 1,500 feet, the location is classified as a basic segment according to the HCM.
2. HCM analysis indicates LOS C/D conditions in the study area. However, actual conditions are LOS F due to a downstream bottleneck at the Yolo Causeway, which causes congestion that extends through the study area.

Source: Fehr & Peers, 2018

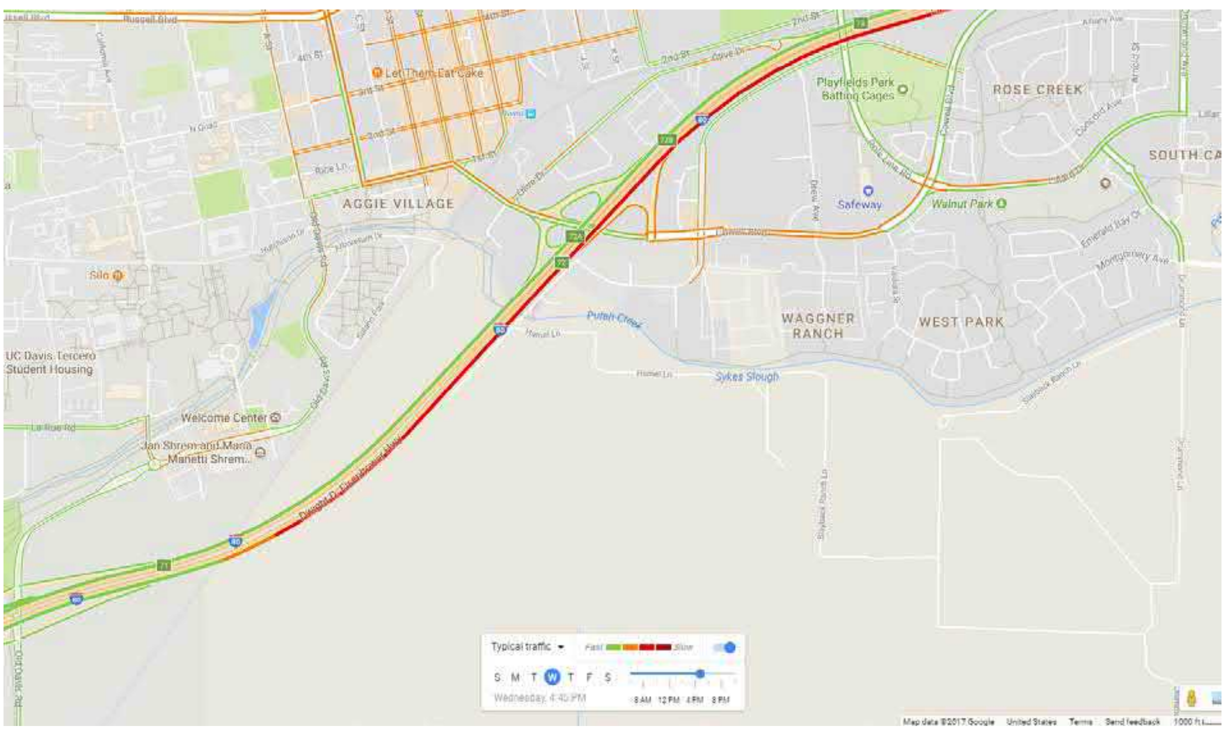

Exhibit 1 – Google Maps Typical Traffic Conditions for Wednesday at 4:45 PM

Table 9: Westbound Freeway Operations – Existing Conditions

Segment	Facility Type	LOS / Density	
		AM	PM
East of Mace Blvd On-ramp	Basic	C / 23	C / 21
Mace Blvd to Lane Drop	Basic[1]	C / 19	B / 18
Lane Drop to Olive Dr	Basic	D / 27	C / 24
Olive Dr Off-ramp	Diverge	D / 32	D / 30
Olive Dr to Richards Blvd	Basic	C / 26	C / 24
Richards Blvd NB Off-ramp	Diverge	D / 32	D / 30
Richards Blvd NB Off-ramp to On-ramp	Basic	C / 24	C / 22
Richards Blvd NB On-ramp to SB Off-ramp	Weave[2]	C / 23 (C)	C / 23 (C)
Richards Blvd SB Off-ramp to On-ramp	Basic	C / 25	C / 25
Richards Blvd to Old Davis Rd	Basic	C / 18	C / 19
Old Davis Rd Off-ramp	Diverge	C / 25	C / 24
West of Old Davis Rd Off-ramp	Basic	B / 13	B / 15

Notes: Density is reported in passenger car equivalents per lane per mile.
1. Since the acceleration lane is greater than 1,500 feet, the location is classified as a basic segment according to the HCM.
2. For the weave segment, the LOS from the Leisch Method is also reported in parentheses.

Source: Fehr & Peers, 2018

3.4 Roadway Safety

The California Highway Patrol's Statewide Integrated Traffic Records System (SWITRS) was queried to find crashes on Richards Boulevard in the City of Davis. Table 10 lists the crashes by type on Richards Boulevard at or near Olive Drive and Research Park Drive/Cowell Boulevard (collisions at the I-80 ramp terminal intersections are reported in Table 11). The crashes occurred between January 1, 2012 and December 31, 2014. This three-year period was chosen to match the most recent three-year period available from Caltrans' Traffic Accident Surveillance and Analysis System (TASAS) for the freeway and ramp facilities.

More collisions occurred at or near the Olive Drive intersection, 14, compared to the Research Park Drive intersection, 2. The most common collision type was a rear-end collision (43 percent), which is consistent with the observed congested conditions. The next most common type are bicycle-related collisions (29 percent). Of the 16 reported crashes, a majority (9) were injury-related, but none were fatality-related.

Table 10: Collision History – Richards Boulevard

Collision Type	Intersection	
	Olive Dr	Research Park Dr
Broadside	0	0
Head On	1	0
Hit Object	2	1
Overturn	0	0
Pedestrian/Bicycle	4	1
Rear End	6	0
Sideswipe	1	0
Fatality	0	0
Injury	8	1
Total	14	2

Note: Collisions occurred from January 2012 through December 2014.
Source: SWITRS, 2017

Table 11 shows reported collisions for the I-80 freeway mainline from Old Davis Road to Mace Boulevard from the TASAS database for January 2012 through December 2014. For this three-year period, 262 collisions occurred with one fatality. On an overall basis, the collision rate is lower than the statewide collision rate for similar facilities. However, the pattern is different when separated by direction. About three-quarters of the collisions occurred in the eastbound direction. This is consistent with the congested conditions observed during the weekday PM peak hour. In the eastbound direction, the actual collision rate for fatality and injury-related collisions and total collisions exceeds the statewide average collision rate.

Table 11 also shows the collision rate for the freeway ramps at Richards Boulevard and Olive Drive including the ramp terminal intersections. The collision rate for most ramps was below the statewide average rate. No collisions were reported in the three-year period for the westbound on-ramp from southbound Richards Boulevard and the westbound off-ramp to Olive Drive. However, two ramps have collision rates that exceed the statewide average. The collision rate for the westbound off-ramp to southbound Richards Boulevard is about double the statewide average for fatality and injury-related collisions and total collisions. The fatality and injury-related collision rate for the eastbound on-ramp from Richards Boulevard is about 50 percent higher than the statewide average. The most common collision types were rear end (5) and hit object (5), each 36 percent of the 14 total ramp collisions.

Using the *Highway Safety Manual* (AASHTO, 2010), the number of collisions were predicted for existing (2016) conditions for the freeway ramps that will be modified by the project. For all ramps, no fatality and injury collisions were recorded in the most recent three-year period although the analysis predicts an average of 1.6 such collisions per year. Similarly, the actual property damage only rate is lower than the predicted rate for most ramps. Overall, the observed total collision rate was 2.0 compared with the predicted rate of 4.0 collisions per year.

Table 11: I-80 Collision History

Facility	Total Collisions	Total Fatalities	Actual Collision Rate[1]			Average Collision Rate[1]		
			F	F&I	Total	F	F&I	Total
Mainline	262	1	0.002	0.18	0.51	0.005	0.24	0.75
Eastbound Mainline	197	1	0.004	**0.27**	**0.77**	0.005	0.24	0.75
Westbound Mainline	65	0	0.000	0.08	0.25	0.005	0.24	0.75
WB On from SB Richards Blvd	0	0	0.000	0.00	0.00	0.003	0.18	0.57
WB Off to SB Richards Blvd	3	0	0.000	**0.65**	**1.96**	0.003	0.30	1.06
EB Off to Richards Blvd	5	0	0.000	0.29	0.74	0.004	0.33	1.00
WB On from NB Richards Blvd	2	0	0.000	0.00	0.42	0.002	0.21	0.73
WB Off to NB Richards Blvd	1	0	0.000	0.00	0.26	0.004	0.24	0.75
EB On from Richards Blvd	3	0	0.000	**0.34**	0.51	0.002	0.22	0.63
WB Off to Olive Dr	0	0	0.000	0.00	0.00	0.004	0.24	0.75

Note: 1. The collision rate is in collisions per million vehicle-miles. "F" refers to the fatality collision rate, and "F&I" refers to the fatality and injury collision rate.
Source: Caltrans TASAS Table B, January 2012 to December 2014

Table 12: Freeway Ramp Collision Rate – Existing Conditions

Location	Fatality and Injury		Property Damage Only		Total	
	Observed	Predicted	Observed	Predicted	Observed	Predicted
WB On from SB Richards Blvd	0	0.271	0	0.311	0	0.582
WB Off to SB Richards Blvd	0	0.437	1.000	0.663	1.000	1.100
WB On from NB Richards Blvd	0	0.467	0.667	0.958	0.667	1.425
WB Off to NB Richards Blvd	0	0.341	0.333	0.442	0.333	0.784
WB Off to Olive Dr	0	0.052	0	0.053	0	0.106
Total	0	1.568	2.0	2.427	2.0	3.997

Note: Values are in collisions per year.
Source: Caltrans TASAS Table B, January 2012 to December 2014, and Fehr & Peers, 2018

3.5 Multimodal Facilities

3.5.1 Transit System

Two transit agencies serve the study area. Unitrans, operated by UC Davis, provides weekday bus service on M (hourly) and W (twice per hour) lines that travels both directions between along First Street west of Richards Boulevard, Richards Boulevard, and Cowell Boulevard east of Research Park Drive.

Yolobus has three express routes in the study area. Route 43R is an express route between downtown Sacramento and UC Davis that has one bus westbound during the AM peak hour and one bus eastbound during the PM peak hour. Route 44 has three eastbound AM and three westbound PM buses that travel along First Street and Richards Boulevard. Route 242 is an express route between Woodland and Davis with one northbound AM bus and one southbound PM bus. It travels the same path as Route 44 but in the opposite direction.

3.5.2 Bicycle System

The existing bicycle facilities are listed below.

- Along First Street, a buffered bicycle lane is provided in the eastbound direction. The westbound lane has sharrow markings indicating that vehicles and bicycles share the travel lane. A shared-use path (bicycles and pedestrians) exists on the south side of First Street that continues along the west side of Richards Boulevard to Olive Drive.
- Class II (on-street) bicycle lanes are provided on Olive Drive east of Richards Boulevard, on Richards Boulevard south of Olive Drive, and on all legs of the Research Park Drive/Richards Boulevard/Cowell Boulevard intersection.
- Importantly, the Putah Creek bicycle trail parallels Richards Boulevard to the west and provides a grade separated crossing on I-80. Connections to the trail exist at the south end of D Street, the west end of Olive Drive, and Chiles Road, which connects to the south end of Research Park Drive.

During the AM peak hour, intersection bicycle volume was highest at Richards Boulevard/Olive Drive (115), with the majority (63) heading west on Olive Drive towards the Putah Creek trail and the UC Davis campus. During the PM peak hour, the First Street/D Street and Richards Boulevard/Olive Drive intersections had about the same total bicycle volume: 128 and 126, respectively. At First Street/D Street, the northbound, eastbound and westbound through volume were all between 32 and 34 bicycles per hour. At Richards Boulevard/Olive Drive, the peak direction was eastbound through away from the UC Davis campus. The bicycle volume using the Richards Boulevard overcrossing was 28 during the AM peak hour and 23 during the PM peak hour.

3.5.3 Pedestrian System

In the study area, crosswalks are provided on all four approaches at First Street/D Street, Richards Boulevard/Olive Drive, and Research Park Drive/Richards Boulevard/Cowell Boulevard. At First Street/E Street/Richards Boulevard, pedestrians are allowed to cross only the west and north legs. At I-80 Westbound Ramps/Richards Boulevard, no marked crossings are provided, but a pedestrian path with sidewalks and curb ramps exists on the west side of the intersection. No pedestrian crossings are provided at I-80 Eastbound Ramps/Richards Boulevard.

Pedestrians are accommodated on a shared-use path (bicycles and pedestrians) on the west side of Richards Boulevard between First Street and Olive Drive. A sidewalk is provided on the west side of Richards Boulevard through the interchange. Sidewalks are provided on the east side of Richards Boulevard only south of Olive Drive and north of Research Park Drive along the frontage of gas stations.

The highest total crosswalk volume during the AM peak hour occurred at First Street/D Street (70) although Richards Boulevard/Olive Drive (61) and First Street/E Street/Richards Boulevard (60) also have substantial pedestrian volume. During the PM peak hour, 215 pedestrians were observed using the First Street/E Street/Richards Boulevard crosswalks. First Street/D Street (120) and Richards Boulevard/Olive Drive (92) also had substantial PM peak hour pedestrian volumes. During the peak hours, 12 (AM) and 14 (PM) pedestrians traveled across the Richards Boulevard overcrossing.

3.5.4 Freight System

The I-80/Richards Boulevard interchange provides access for trucks to retail and commercial businesses along Richards Boulevard, Olive Drive, and Research Park Drive. However, the Richards Boulevard underpass at the Union Pacific Railroad has a low clearance of 13.5 feet, which restricts some trucks from reaching downtown Davis from the interchange. As noted above, heavy vehicle percentages at the study intersections are relatively low at 3 and 1 percent during the AM and PM peak hours.

I-80 is an important route for freight traffic. It is part of the National Highway Freight Network and included in the Primary Highway Freight System established by USDOT in December 2015, which includes approximately 41,518 miles across the nation. I-80 is on the Strategic Highway Network (STRAHNET), National Truck Network, the Interregional Road System, the Extra Legal Load Network (ELLN), and is a Surface Transportation Assistance Act (STAA) route. I-80 also connects the Bay Area and Sacramento metropolitan areas, the two largest economic and population centers in Northern California.

Chapter 4. Travel Demand Forecasts

This chapter presents the construction and design year forecasts.

4.1 Construction Year Forecasts

Figures 6 and 7 show the study intersection peak hour volumes for construction year (2022) conditions under the No Build and Build Alternatives, respectively. These volumes represent traffic demand volumes that may not be fully accommodated during the peak hour due to bottlenecks outside the study area. The figures also show the assumed intersection traffic control and lane configurations.

The traffic volumes for the Build Alternative (Figure 7) are the same as the No Build Alternative (Figure 6) except for reassigning traffic based on the new roadway configuration. At the I-80/Richards Boulevard interchange, the reconfiguration of the westbound ramps from four to two would shift the loop ramp volumes (both loop on-ramp and loop off-ramp) to become left-turn movements at the new signalized intersection. The closure of the Olive Drive westbound off-ramp would shift traffic to the westbound off-ramp to northbound Richards Boulevard. The distribution of the Olive Drive off-ramp traffic destinations were determined using a select-link model run so that the volumes could be assigned to the appropriate turning movements at the study intersections.

Compared to existing conditions, the construction year volumes for the No Build Alternative show an increase of about 200 vehicles per hour during the peak hours for Richards Boulevard between I-80 and Olive Drive. This is a growth of 14 (PM) to 17 (AM) percent over existing volumes. With the closure of the Olive Drive off-ramp in the Build Alternative, the volume change would increase to about 570 vehicles per hour during the AM peak hour and 270 vehicles per hour during the PM peak hour.

Figure 8 shows the bicycle and pedestrian volumes for construction year conditions. Similar to the vehicle volumes, the bicycle and pedestrian volumes are estimated by linear interpolation of the existing and design year volumes. The bicycle and pedestrian connections are the same for the project alternatives, so the forecasted volumes are also the same.

Figure 9 shows the freeway volumes for construction year conditions. The difference between the project alternatives is shown for westbound I-80 at Olive Drive and Richards Boulevard. On westbound I-80 east of Olive Drive, traffic volume would grow by about 300 vehicles per hour during the peak hours, a 6 (AM) to 8 (PM) percent growth over existing volumes.

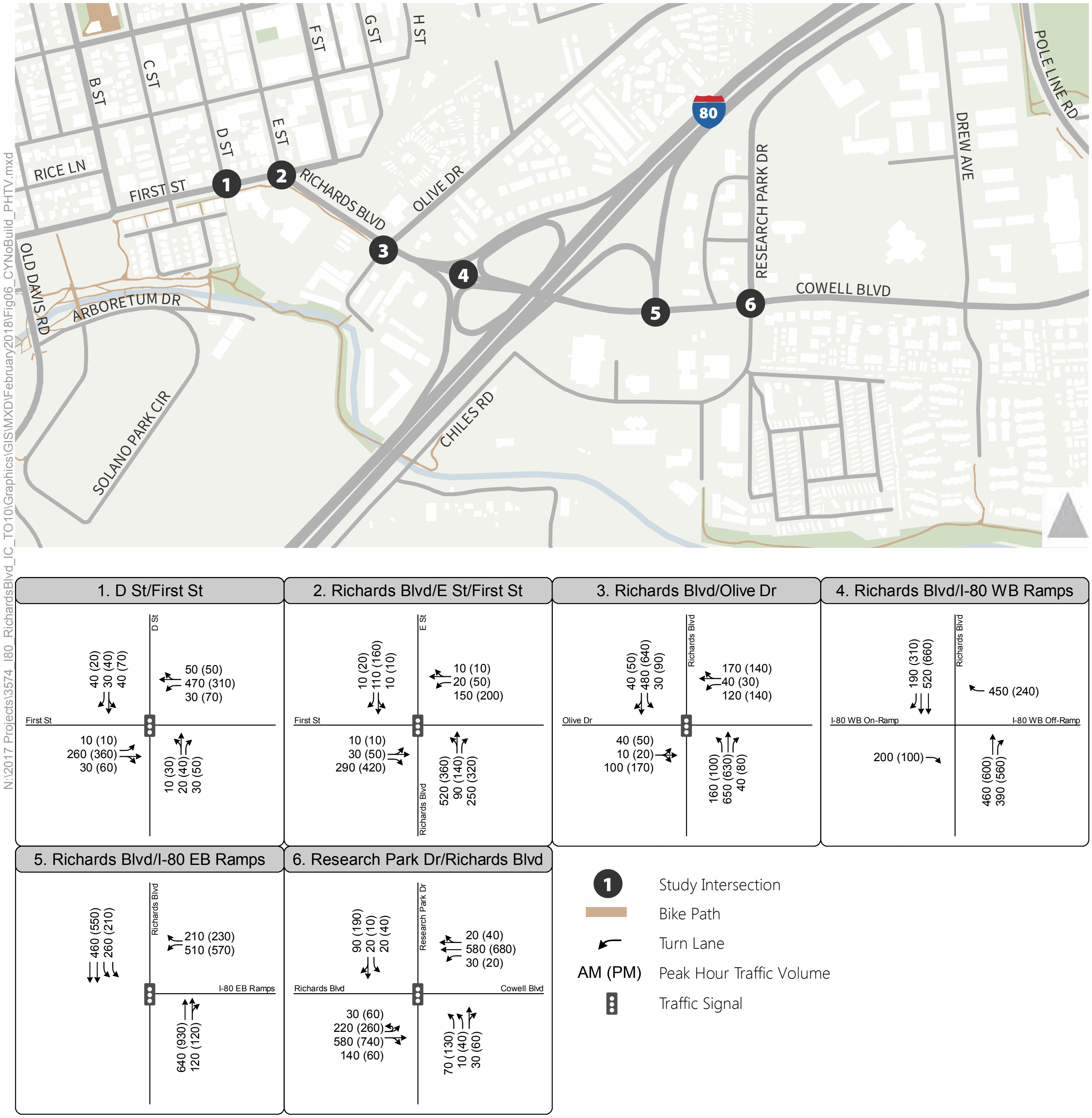

Figure 6

Vehicle Volume, Traffic Control, and Lane Configurations - Construction Year Conditions No Build Alternative

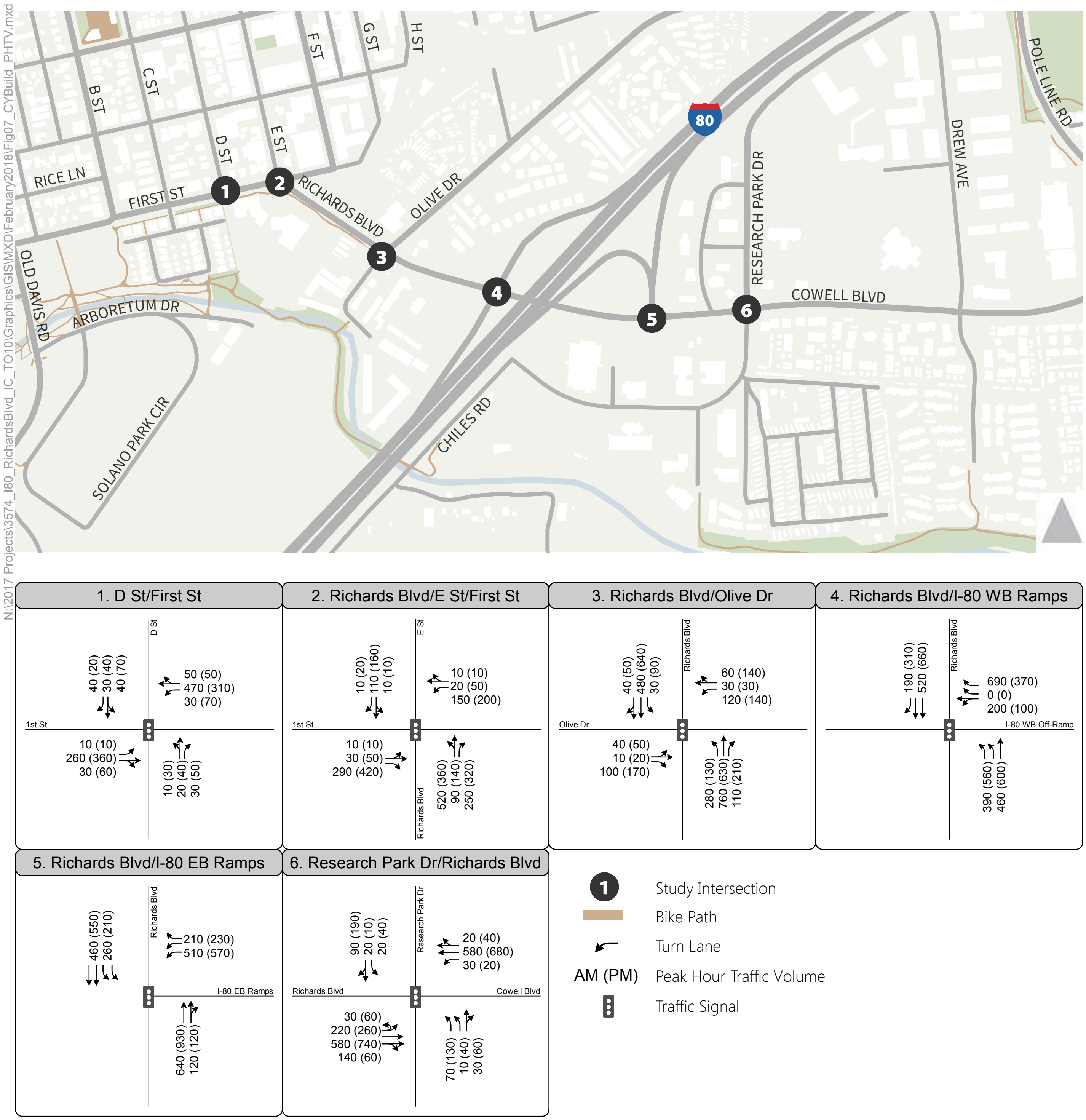

Figure 7

Vehicle Volume, Traffic Control, and Lane Configurations - Construction Year Conditions Build Alternative

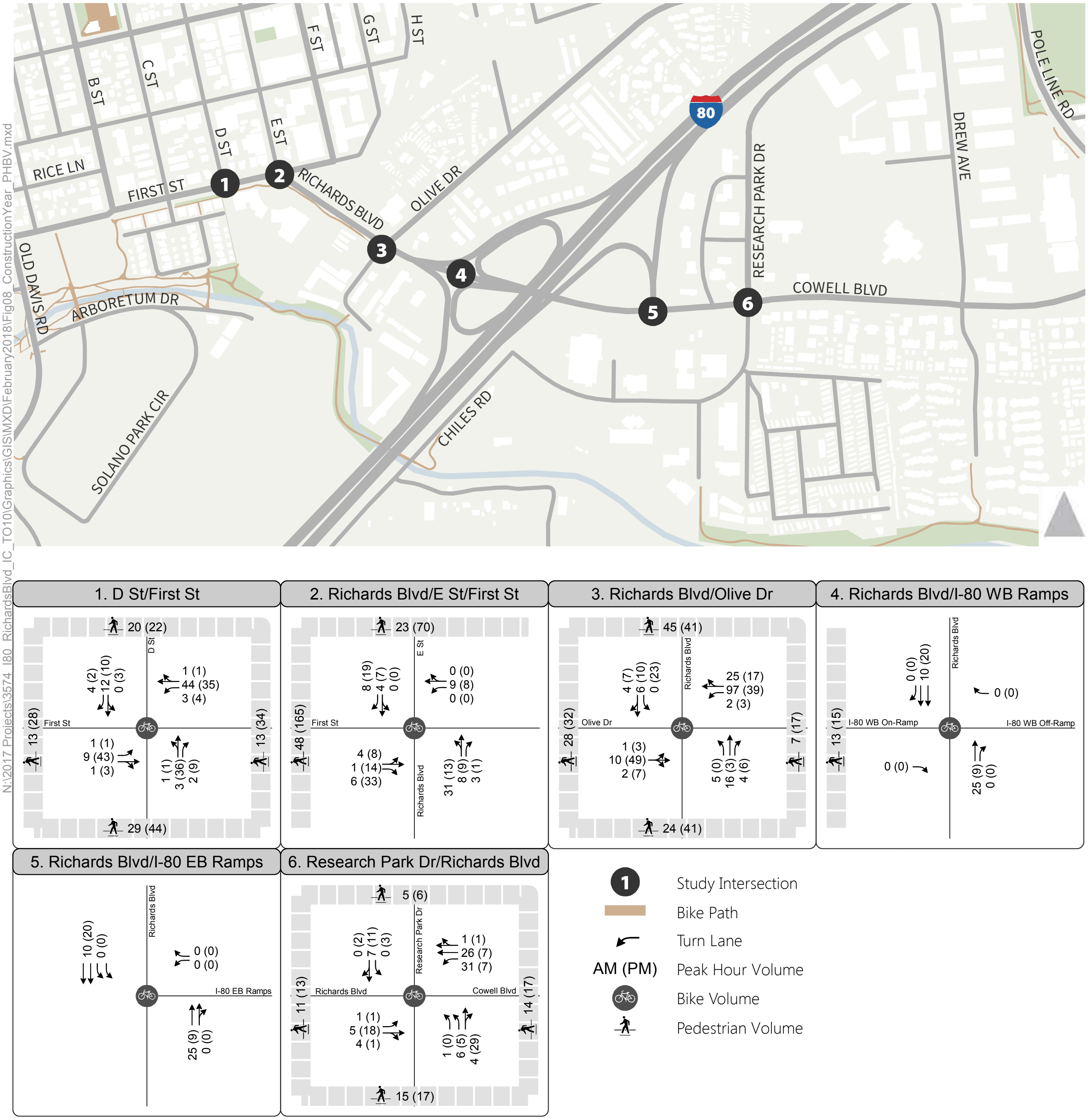

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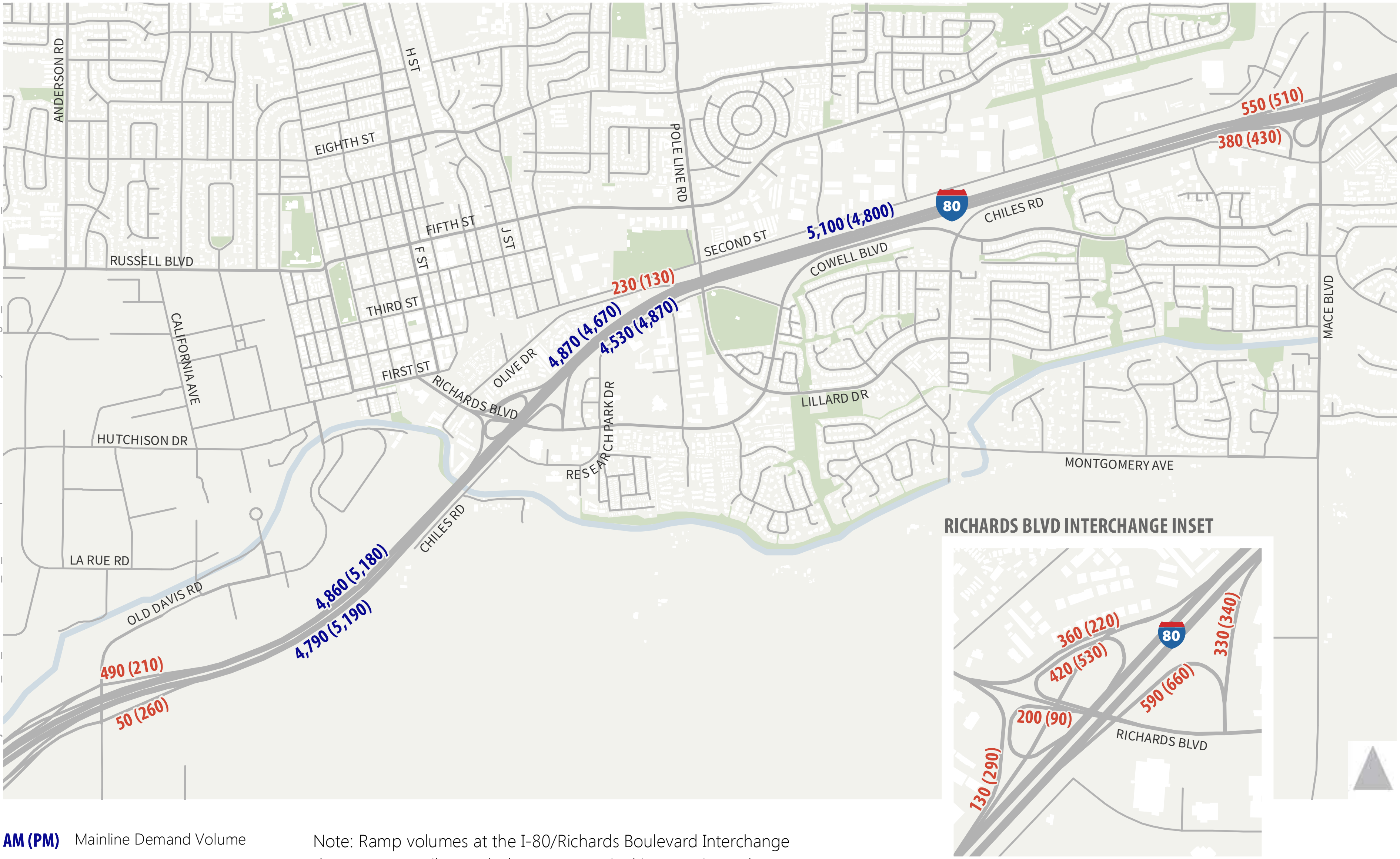
Figure 8

Bicycle and Pedestrian Volume - Construction Year Conditions



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AM (PM) Mainline Demand Volume

AM (PM) Ramp Demand Volume

Note: Ramp volumes at the I-80/Richards Boulevard Interchange do not necessarily match the ramp terminal intersection volumes due to differing peak hours.

Figure 9

Freeway Volume -
Construction Year Conditions

4.2 Design Year Forecasts

Figures 10 and 11 show the study intersection peak hour volumes for design year (2042) conditions under the No Build and Build Alternatives, respectively. These volumes represent traffic demand volumes that may not be fully accommodated during the peak hour due to bottlenecks outside the study area. The figures also show the assumed intersection traffic control and lane configurations. For the Olive Drive/Richards Boulevard intersection, additional widening on the west leg was assumed to serve the traffic generated from the Nishi and Hotel Conference Center projects.

The traffic volumes for the Build Alternative (Figure 11) are the same as the No Build Alternative (Figure 10) except for reassigning traffic based on the new roadway configuration. At the I-80/Richards Boulevard interchange, the reconfiguration of the westbound ramps from four to two would shift the loop ramp volumes (both loop on-ramp and loop off-ramp) to become left-turn movements at the new signalized intersection. The closure of the Olive Drive westbound off-ramp would shift traffic to the westbound off-ramp to northbound Richards Boulevard. The distribution of the Olive Drive off-ramp traffic destinations were determined using a select-link model run so that the volumes could be assigned to the appropriate turning movements at the study intersections.

Compared to existing conditions, the design year volumes for the No Build Alternative show an increase of about 800 vehicles per hour during the peak hours for Richards Boulevard between I-80 and Olive Drive. This is a growth of 52 (PM) to 62 (AM) percent over existing volumes. With the closure of the Olive Drive off-ramp in the Build Alternative, the volume change would increase to about 1,100 vehicles per hour during the AM peak hour and 940 vehicles per hour during the PM peak hour.

Figure 12 shows the bicycle and pedestrian volumes for design year conditions. Similar to the vehicle volumes, the bicycle and pedestrian volumes are estimated by linear interpolation of the existing and design year volumes. The bicycle and pedestrian connections are the same for the project alternatives, so the forecasted volumes are also the same.

Figure 13 shows the freeway volumes for design year conditions. The difference between the project alternatives is shown for westbound I-80 at Olive Drive and Richards Boulevard. On westbound I-80 east of Olive Drive, traffic volume would grow by about 1,500 vehicles per hour during the peak hours, a 30 (AM) to 33 (PM) percent growth over existing volumes.

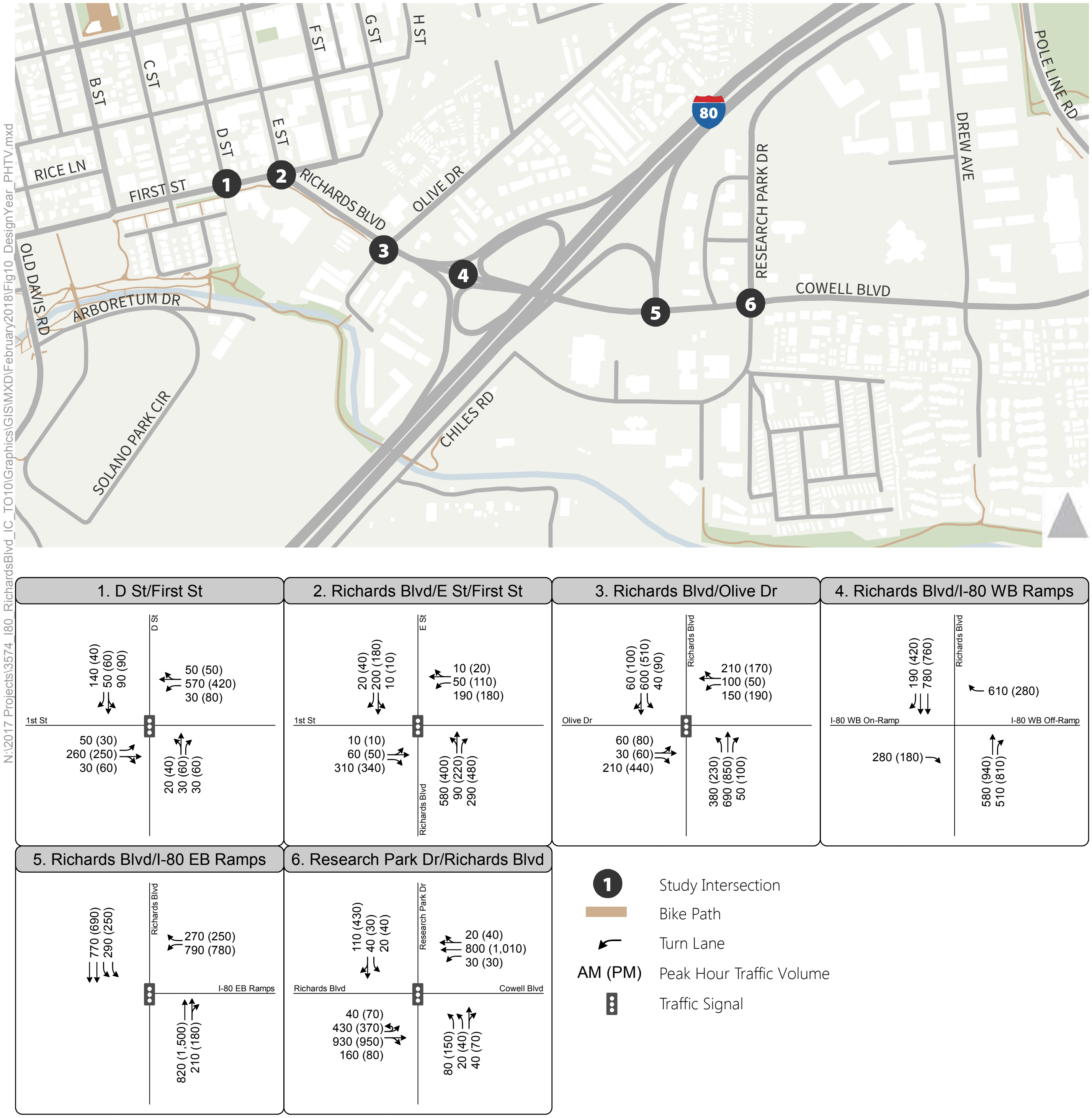

Figure 10

Vehicle Volume, Traffic Control, and Lane Configurations - Design Year Conditions No Build Alternative

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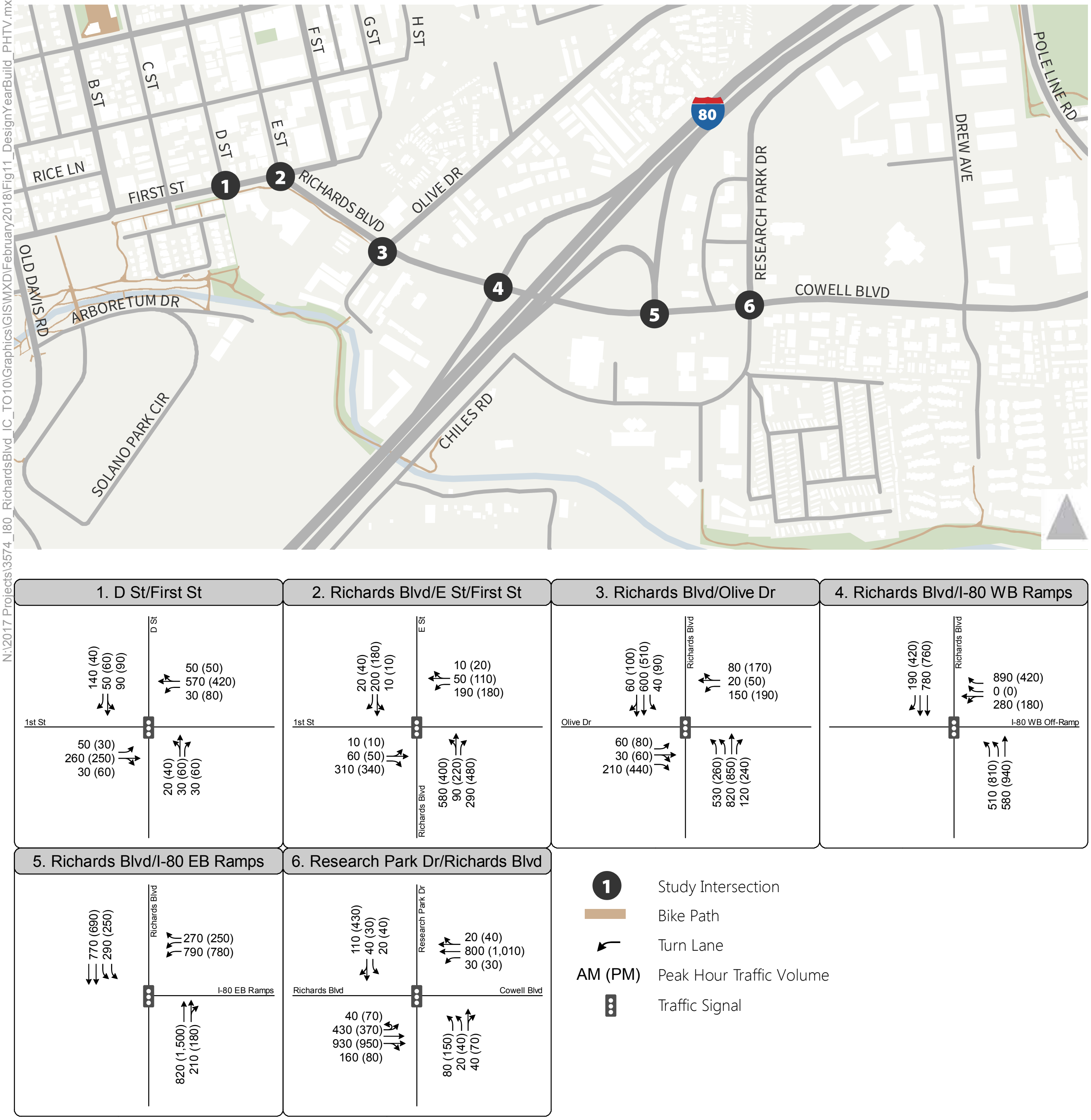
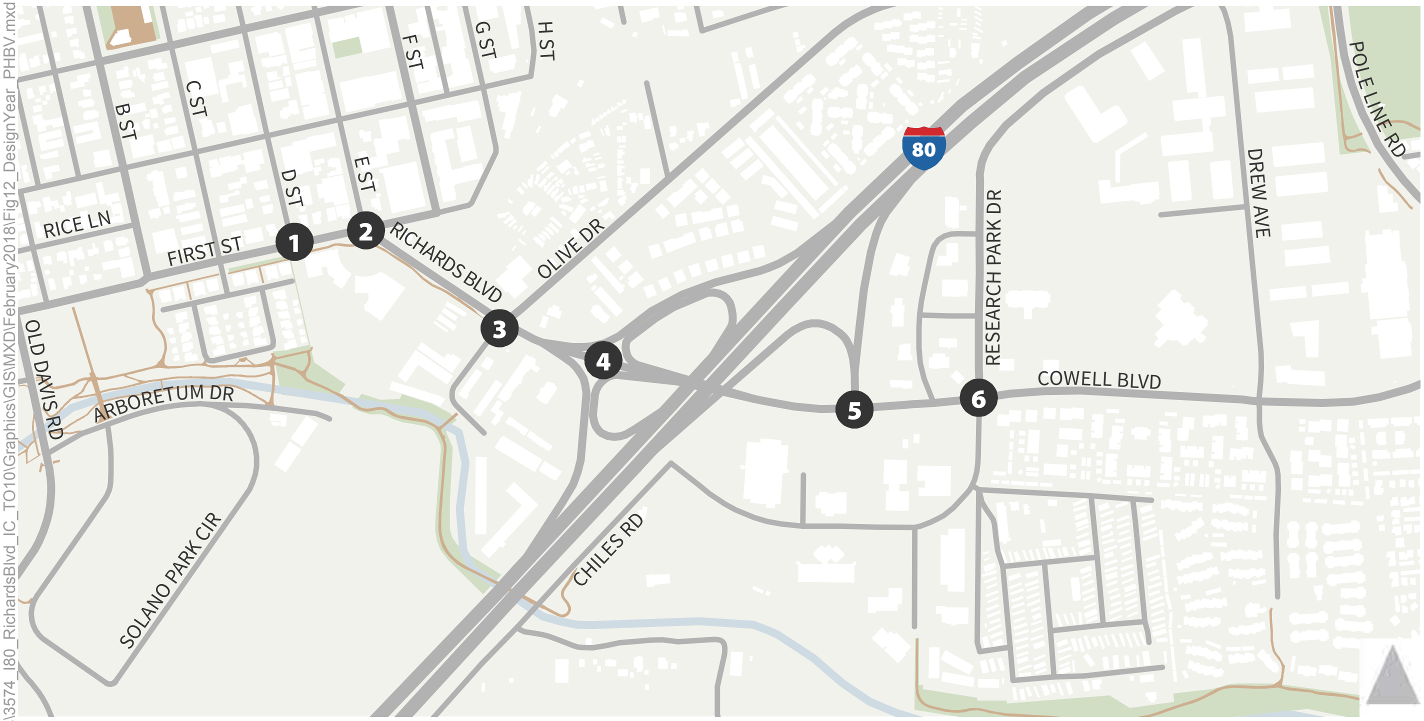


Figure 11

Vehicle Volume, Traffic Control, and Lane Configurations - Design Year Conditions Build Alternative



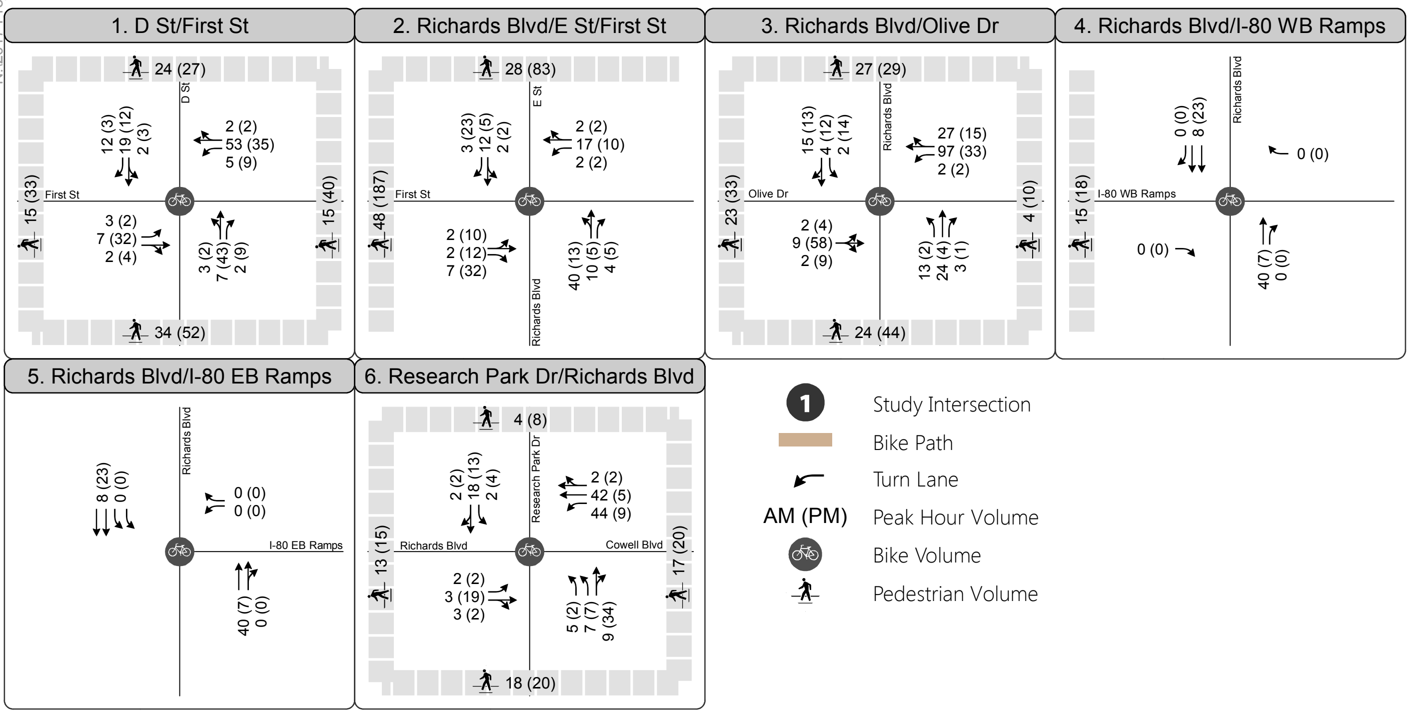
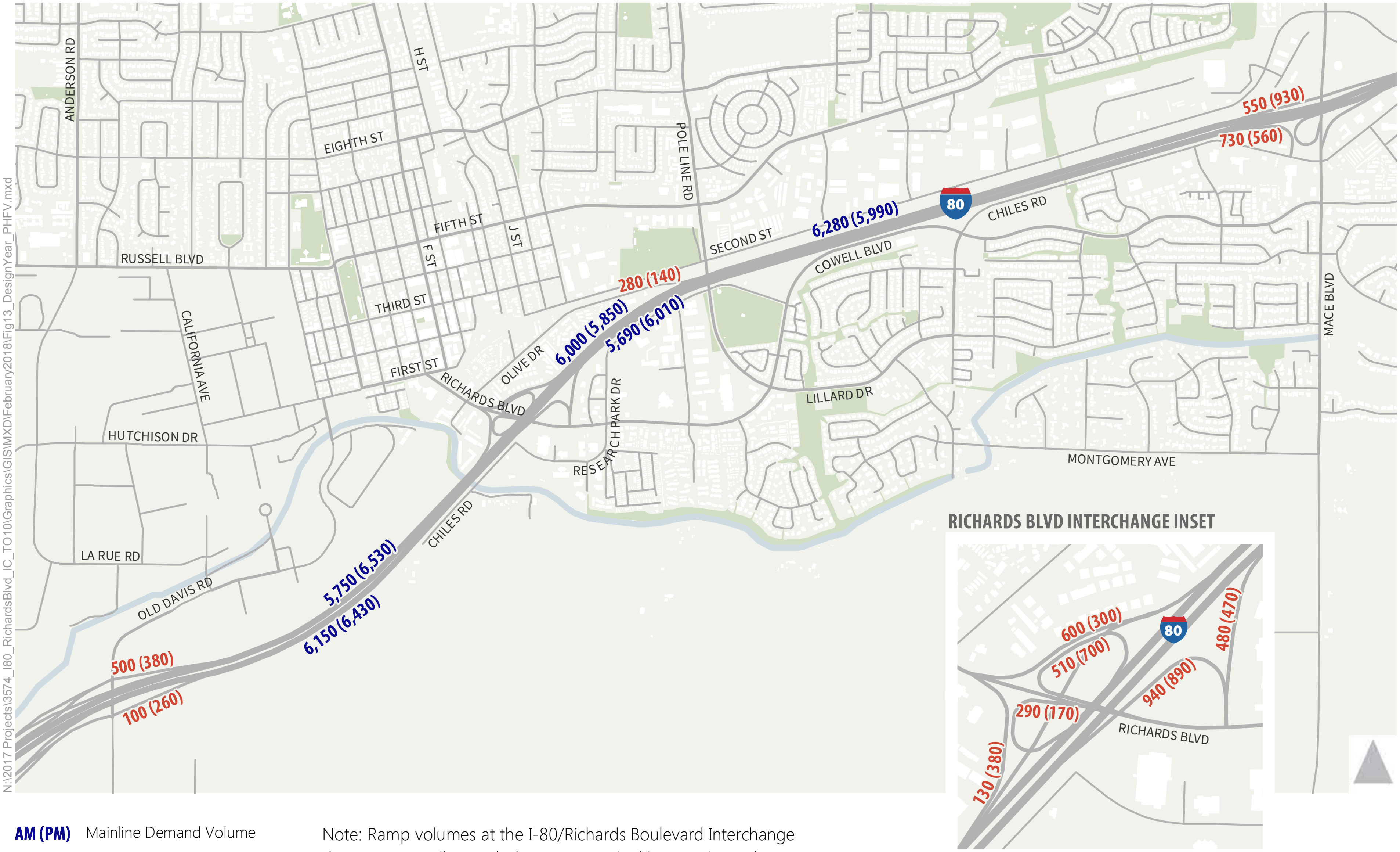


Figure 12

Bicycle and Pedestrian Volume - Design Year Conditions



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AM (PM) Mainline Demand Volume

AM (PM) Ramp Demand Volume

Note: Ramp volumes at the I-80/Richards Boulevard Interchange do not necessarily match the ramp terminal intersection volumes due to differing peak hours.

Figure 13

Freeway Volume - Design Year Conditions

4.3 Design Year Performance Measures

To estimate the area-wide effect of the reconstruction of the I-80/Richards Boulevard interchange and the closure of the westbound off-ramp to Olive Drive, the design year performance measures of vehicle miles of travel (VMT), vehicle hours of travel (VHT), and vehicle hours of delay (VHD) were estimated using the cumulative year forecasting model. To capture the potential changes, performance was measured over the entire model area, which is the City of Davis. Under design year conditions, the same number of trips were assigned to the two different roadway alternatives.

Table 13 shows the local area-wide performance measures (see the appendix for VMT by 5-mph speed bin).

Table 13: Area-wide Performance Measures

Statistic	Existing	Design Year Conditions		Change from No Build
		No Build	Build Alternative	
Vehicle Miles of Travel (VMT)	2,360,828	2,980,219	2,979,159	-1,060 (-0.04%)
Vehicle Hours of Travel (VHT)	69,583	101,513	101,451	-62 (-0.06%)
Vehicle Hours of Delay (VHD)	7,148	21,965	21,911	-54 (-0.25%)

Source: Fehr & Peers, 2018

Compared to existing conditions, the No Build Alternative under design year conditions would have 26 percent more VMT, 46 percent more VHT, and 207 percent more VHD. Compared to the No Build Alternative, the Build Alternative would have a lower VMT by about 1,060 vehicle-miles, or 0.04 percent. Although closing the Olive Drive off-ramp would increase trip lengths from westbound I-80 to the east Olive Drive area, trips originating in the City of Davis and destined to east Olive Drive would shift from using the freeway to shorter local street routes, which would result in an overall VMT decrease.

The change in VHT and VHD would both be marginal with the project: 0.06 percent fewer vehicle-hours of travel and 0.25 percent vehicle-hours of delay. The travel time would be improved by shifting regional trips destined to east Olive Drive from the lower-speed Olive Drive via the westbound off-ramp closure to the higher speed I-80 and Richards Boulevard. This improvement would be offset by the local trips using lower speed local streets to access east Olive Drive.

Chapter 5. Construction Year Conditions

This chapter presents the operations and safety analysis under construction year (2022) conditions.

5.1 Intersection Operations

Intersection operations were analyzed for construction year (2022) conditions during the AM and PM peak hours. Table 14 shows the intersection LOS and average delay for the AM and PM peak hours (see the appendix for detailed analysis results).

Table 14: Intersection Operations – Construction Year Conditions

Intersection	Control	No Build Alternative		Build Alternative	
		AM	PM	AM	PM
1. First St/D St	Signal	B / 15	C / 29	B / 13	D / 36
2. First St/E St/Richards Blvd	Signal	C / 31	C / 34	B / 18	C / 26
3. Olive Dr/Richards Blvd	Signal	**<u>F / 93</u>**	E / 65	D / 38	D / 52
4. I-80 Westbound Ramps/Richards Blvd	Side Street Yield/ Signal[1]	**<u>F / 121</u>** (NB TH)	A / 9 (NB TH)	C / 35	C / 23
5. I-80 Eastbound Ramps/Richards Blvd	Signal	D / 40	**<u>F / 109</u>**	C / 26	C / 24
6. Research Park Dr/Richards Blvd/Cowell Blvd	Signal	D / 47	D / 42	C / 27	C / 30

Notes: Bold and underline font indicate LOS F conditions: that is, volume exceeds capacity. For the side street yield intersection, the highest controlled movement delay is reported with the movement listed in parentheses. Vehicle delay includes delay for bicycles traveling in regular lanes but excludes delay for bicycles traveling in bicycle-only lanes. Delay is reported in seconds per vehicle.
1. The intersection would have signal control under the Build Alternative
Source: Fehr & Peers, 2018

Under the No Build Alternative, the higher forecasted volumes at Richards Boulevard/Olive Drive would worsen operations from LOS E to F during the AM peak hour for construction year conditions. The northbound queue at the intersection would extend through the I-80 Westbound Ramps intersection resulting in higher delay for the westbound to northbound off-ramp approach than under existing conditions. The other study intersections would continue to operate with the same LOS as under existing conditions.

During the PM peak hour, increasing volume on the eastbound off-ramp would result in worse operations with LOS E degrading to LOS F at the I-80 Eastbound Ramps intersection. Similarly, the Research Park Drive intersection operations would worsen from LOS D to E, and the other study intersections would operate the same or better than under existing conditions.

Under the Build Alternative, additional capacity at the Richards Boulevard/Olive Drive intersection would reduce vehicle delay compared to the No Build Alternative. Operations would improve from LOS F to D during the AM peak hour and LOS E to D during the PM peak hour. The reconstructed and signalized I-80 Westbound Ramps intersection would operate with LOS C conditions during both peak hours. The addition of a second left-turn lane on the eastbound off-ramp would improve the I-80 Eastbound Ramps intersection from LOS F to C during the PM peak hour. All study intersections would have LOS D or better operations under the Build Alternative.

Table 15 presents the average maximum queue length for selected approaches to the study intersection under the Build Alternative (see the appendix for detailed analysis results). During the AM peak hour, the queues would be less than the storage length except for northbound Richards Boulevard at Olive Drive. The constraint would be the single lane for northbound through vehicles. Despite this, the upstream I-80 Westbound Ramps intersection would operate acceptably, and the westbound off-ramp queue would be contained on the ramp.

Table 15: Average Maximum Queue Length – Construction Year Conditions

Intersection	Approach	Storage Length	Queue Length	
			AM Peak Hour	PM Peak Hour
1. First St / D St	Eastbound	250	150	**<u>400</u>**
2. First St / E St / Richards Blvd	Northbound	625	425	250
	Eastbound	225	200	**<u>275</u>**
	Westbound	225	175	**<u>250</u>**
3. Olive Dr / Richards Blvd	Northbound	525	**<u>550</u>**	475
	Southbound	625	475	**<u>700</u>**
	Westbound	>1,500	50	275
4. I-80 Westbound Ramps / Richards Blvd	Northbound	815	450	300
	Southbound	500	200	150
	Westbound	1,250	575	275
5. I-80 Eastbound Ramps / Richards Blvd	Northbound	440	275	300
	Southbound	850	175	225
	Westbound	1,270	250	300
6. Research Park Dr / Richards Blvd / Cowell Blvd	Eastbound	440	325	375

Notes: Bold and underline font indicate a queue length that is greater than the storage length. The storage length and average maximum queue length is reported in feet.
Source: Fehr & Peers, 2018

During the PM peak hour, the average maximum queue would exceed the storage on southbound Richards Boulevard at Olive Drive. The queue would extend upstream and affect other approaches to the First Street intersections. These queues reflect the high traffic demand from downtown Davis to I-80 and south Davis. As during the AM peak hour, the freeway off-ramp queues (300 feet or less) would be contained on the off-ramps.

5.2 Freeway Operations

Freeway operations were analyzed for construction year (2022) conditions under AM and PM peak hour conditions. Table 16 and Table 17 show the freeway LOS and density for the study segments (see the appendix for detailed analysis results).

Although density would increase with the increasing volumes compared to existing conditions, freeway segments would operate at LOS D or better under the No Build Alternative. The eastbound freeway segments are listed as LOS F during the PM peak hour since no improvements are planned to occur at the Yolo Bypass bottleneck by construction year conditions.

Table 16: Eastbound Freeway Operations – Construction Year Conditions

Segment	Facility Type	No Build Alternative		Build Alternative	
		AM	PM	AM	PM
West of Old Davis Rd On-ramp	Basic	B / 15	F[2]	Same as No Build Alternative	
Old Davis Road On-ramp	Basic[1]	B / 13	F[2]		
Old Davis Road to 1st Lane Drop	Basic	B / 16	F[2]		
1st Lane Drop to 2nd Lane Drop	Basic	C / 20	F[2]		
Richards Blvd Off-ramp	Diverge	D / 33	F[2]		
Richards Blvd Off-ramp to On-ramp	Basic	C / 24	F[2]		
Richards Blvd On-ramp	Merge	C / 27	F[2]		
Richards Blvd to Chiles Rd	Basic	C / 26	F[2]		
Chiles Rd Off-ramp	Diverge	B / 16	F[2]		
East of Chiles Rd Off-ramp	Basic	C / 23	F[2]		

Notes: Density is reported in passenger car equivalents per lane per mile.
1. Since the acceleration lane is greater than 1,500 feet, the location is classified as a basic segment according to the HCM.
2. HCM analysis indicates LOS C/D conditions in the study area. However, actual conditions are likely to be LOS F since no improvements are planned by the construction year at the downstream bottleneck at the Yolo Causeway, which causes congestion that extends through the study area under existing conditions.

Source: Fehr & Peers, 2018

For the Build Alternative, the eastbound freeway configuration and volumes would be the same as the No Build Alternative since no improvements to eastbound I-80 are included in the proposed project. In the westbound direction, the closure of the Olive Drive off-ramp and consolidation of ramps at Richards

Boulevard provide different configurations and volumes. Near Olive Drive, the Build Alternative would provide a lower density due to the ramp removal. The combined Richards Boulevard off-ramp would have a higher density due to the higher exiting volume compared to existing conditions. Operations between the on and off-ramps would be the same or better under the No Build Alternative since the weaving section would be removed. Similar to the combined off-ramp, the combined on-ramp would have higher densities. Despite these changes, no freeway segments would have project impacts under construction year conditions.

Table 17: Westbound Freeway Operations – Construction Year Conditions

Segment	Facility Type	No Build Alternative		Build Alternative	
		AM	PM	AM	PM
East of Mace Blvd On-ramp	Basic	C / 25	C / 23	C / 25	C / 23
Mace Blvd to Lane Drop	Basic	C / 20	C / 19	C / 20	C / 18
Lane Drop to Olive Dr	Basic	D / 29	D / 26	D / 29	D / 26
Olive Dr Off-ramp	Diverge	D / 33	D / 32		
Olive Dr to Richards Blvd	Basic	D / 28	C / 26		
Richards Blvd NB Off-ramp	Diverge	D / 33	D / 31	D / 34	D / 32
Richards Blvd NB Off-ramp to On-ramp	Basic	C / 25	C / 24	C / 26	C / 23
Richards Blvd NB On-ramp to SB Off-ramp	Weave[1]	C / 25 (D)	C / 25 (D)		
Richards Blvd SB Off-ramp to On-ramp	Basic	D / 26	D / 27		
Richards Blvd to Old Davis Rd	Basic	C / 19	C / 21	C / 21	D / 30
Old Davis Rd Off-ramp	Diverge	C / 24	C / 25	C / 24	C / 22
West of Old Davis Rd	Basic	B / 14	B / 16	B / 15	B / 15

Notes: Density is reported in passenger car equivalents per lane per mile.
1. For the weave segment, the LOS from the Leisch Method is also reported in parentheses.
Source: Fehr & Peers, 2018

5.3 Roadway Safety

Using the forecasted daily volume, predicted collisions were calculated for construction year conditions under the project alternatives as shown in Table 18 (see the appendix for detailed analysis results). Under the No Build Alternative, the current five ramps in the westbound direction at Olive Drive and Richards Boulevard would be expected to have 4.3 collisions per year, with 1.7 fatality and injury-related collisions. With the Build Alternative, the number of westbound ramps is reduced from 5 to 2, and the ramp roadways are reconfigured to have less sharp curves (a higher radius). The expected total collision rate would be 1.6

collisions per year, with 0.8 fatality and injury-related collisions. Under the Build Alternative, the expected total collision rate would be less than one-third of the No Build Alternative rate, and the fatality and injury-related rate would be less than one-half.

Table 18: Freeway Ramp Collision Rate – Construction Year Conditions

Location	No Build Alternative			Build Alternative		
	F+I	PDO	Total	F+I	PDO	Total
WB On from SB Richards Blvd	0.293	0.338	0.631	0.422	0.411	0.833
WB Off to SB Richards Blvd	0.459	0.695	1.155	-	-	-
WB On from NB Richards Blvd	0.522	1.072	1.593	-	-	-
WB Off to NB Richards Blvd	0.355	0.460	0.815	0.347	0.398	0.745
WB Off to Olive Dr	0.072	0.073	0.145	-	-	-
Total	1.701	2.638	4.339	0.769	0.809	1.578

Note: Values are in collisions per year.
Source: Fehr & Peers, 2018

Chapter 6. Design Year Conditions

This chapter presents the operations and safety analysis of the roadway system under design year (2042) conditions and an assessment of multimodal systems affected by the proposed project.

6.1 Intersection Operations

Intersection operations were analyzed for design year (2042) conditions during the AM and PM peak hours. Table 19 shows the intersection LOS and average delay for the AM and PM peak hours (see the appendix for detailed analysis results).

Table 19: Intersection Operations – Design Year Conditions

Intersection	Control	No Build Alternative		Build Alternative	
		AM	PM	AM	PM
1. First St/D St	Signal	**F / 224**	D / 41	C / 27	D / 36
2. First St/E St/Richards Blvd	Signal	**F / 123**	C / 32	C / 28	C / 27
3. Olive Dr/Richards Blvd	Signal	**F / 142**	**F / 183**	D / 44	D / 44
4. I-80 Westbound Ramps/Richards Blvd	Side Street Yield/ Signal[1]	**F / 267** (WB RT)	A / 3 (WB RT)	D / 42	D / 39
5. I-80 Eastbound Ramps/Richards Blvd	Signal	**F / 182**	**F / 131**	C / 30	D / 53
6. Research Park Dr/Richards Blvd/Cowell Blvd	Signal	**F / 122**	**F / 101**	D / 48	E / 78

Notes: Bold and underline font indicate LOS F conditions: that is, volume exceeds capacity. For the side street yield intersection, the highest controlled movement delay is reported with the movement listed in parentheses. Vehicle delay includes delay for bicycles traveling in regular lanes but excludes delay for bicycles traveling in bicycle-only lanes. Delay is reported in seconds per vehicle.
1. The intersection would have signal control under the Build Alternative.

Source: Fehr & Peers, 2018

Under the No Build Alternative, the design year forecasts would not be accommodated during the AM peak hour. All study intersections would have LOS F conditions. Bottlenecks at the Olive Drive and I-80 Eastbound Ramps intersections would extend into the adjacent intersections resulting in poor operations overall. During the PM peak hour, the corridor bottlenecks would also result in LOS F conditions at Olive Drive, I-80 Eastbound Ramps, and Research Park Drive. The First Street intersections would have lower overall delays compared to the AM peak hour due to upstream congestion that constrains demand volume from reaching the intersection.

The Build Alternative would reduce intersection delay and improve operations to LOS D or better during the AM peak hour. Average delay at the Olive Drive and I-80 Eastbound Ramps intersection would be less than under existing conditions.

During the PM peak hour, all study intersections would operate acceptably at LOS E or better. Operations on the north side of the interchange would be similar to the AM peak hour with LOS D or better conditions. The Research Park Drive intersection would have the worst overall operations at LOS E with two approaches at LOS F: southbound Research Park Drive and westbound Cowell Boulevard. These approaches would have high demand volumes heading towards I-80. Intersection efficiency could be improved by prohibiting the U-turn movement on the Richards Boulevard approach. The U-turning traffic could be re-routed to northbound Research Park Drive to access the highway commercial properties adjacent to the interchange.

Table 20: Average Maximum Queue Length – Design Year Conditions

Intersection	Approach	Storage Length	Queue Length	
			AM Peak Hour	PM Peak Hour
1. First St / D St	Eastbound	250	200	**<u>275</u>**
2. First St / E St / Richards Blvd	Northbound	625	400	250
	Eastbound	225	**<u>275</u>**	**<u>300</u>**
	Westbound	225	**<u>250</u>**	**<u>250</u>**
3. Olive Dr / Richards Blvd	Northbound	525	**<u>600</u>**	**<u>675</u>**
	Southbound	625	**<u>675</u>**	625
	Westbound	>1,500	100	200
4. I-80 Westbound Ramps / Richards Blvd	Northbound	815	575	675
	Southbound	500	300	325
	Westbound	1,250	600	275
5. I-80 Eastbound Ramps / Richards Blvd	Northbound	440	300	400
	Southbound	850	225	225
	Westbound	1,270	500	775
6. Research Park Dr / Richards Blvd / Cowell Blvd	Eastbound	440	**<u>475</u>**	**<u>450</u>**

Notes: Bold and underline font indicate a queue length that is greater than the storage length. The storage length and average maximum queue length is reported in feet.
Source: Fehr & Peers, 2018

Table 20 presents the average maximum queue length for selected approaches to the study intersection under the Build Alternative (see the appendix for detailed analysis results). The off-ramp queues would be contained on the ramps during both peak hours. The results show three areas with queues that exceed the storage length.

- At Richards Boulevard/Olive Drive, queues on the southbound approach extend to First Street during both peak hours. This queuing would extend upstream on the eastbound and westbound approaches to the First Street/E Street intersection.
- Also, the northbound approach at Richards Boulevard/Olive Drive would extend back to the I-80 Westbound Ramps during both peak hours. However, this queue would not cause upstream queuing issues.
- The third location is the eastbound approach at Research Park Drive (southbound Richards Boulevard), which would have a queue that extends into the upstream intersection. Although the queue would cause additional delay at the upstream intersection, the queues would be contained.

6.2 Freeway Operations

Freeway operations were analyzed for design year (2042) conditions under AM and PM peak hour conditions. Table 21 and Table 22 show the freeway LOS and density for the study segments (see the appendix for detailed analysis results).

Table 21: Eastbound Freeway Operations – Design Year Conditions

Segment	Facility Type	No Build Alternative		Build Alternative	
		AM	PM	AM	AM
West of Old Davis Rd On-ramp	Basic	C / 22	C / 21[2]		
Old Davis Road On-ramp	Basic[1]	B / 17	B / 17[2]		
Old Davis Road to Lane Drop	Basic	C / 22	B / 22[2]		
Lane Drop to Richards Blvd	Basic	D / 33	D / 33[2]		
Richards Blvd Off-ramp	Diverge	E / 36	E / 36[2]	Same as No Build Alternative	
Richards Blvd Off-ramp to On-ramp	Basic	C / 26	D / 26[2]		
Richards Blvd On-ramp	Merge	D / 30	D / 31[2]		
Richards Blvd to Chiles Rd	Basic	D / 29	D / 29[2]		
Chiles Rd Off-ramp	Diverge	B / 18	B / 19[2]		
East of Chiles Rd Off-ramp	Basic	C / 24	C / 26[2]		

Note: Density is reported in passenger car equivalents per lane per mile.
1. Since the acceleration lane is greater than 1,500 feet, the location is classified as a basic segment according to the HCM.
2. Actual design year conditions may be worse if planned improvements (HOV lane, ramp metering, and other active traffic management strategies) are unable to prevent downstream congestion from extending into the study area.

Source: Fehr & Peers, 2018

With the increased volumes, some freeway segments that operated at LOS D under construction year conditions worsen to LOS E. Since I-80 is assumed to be widened to provide HOV lanes at the Yolo Bypass bottleneck, the eastbound freeway segments no longer listed as LOS F during the PM peak hour. However, congested conditions may still occur under design year conditions if the planned improvements are unable to prevent downstream congestion from extending into the study area.

In the westbound direction, the Richards Boulevard off-ramp segment would have the highest density and would be the only segment with LOS E conditions. In the westbound direction, all segments would have LOS D or better conditions for the No Build Alternative. For the Build Alternative, the consolidation of the westbound off-ramps results in LOS E conditions at Richards Boulevard during the AM peak hour. Despite this, no freeway segments would have project impacts under design year conditions since LOS E is considered acceptable.

Table 22: Westbound Freeway Operations – Design Year Conditions

Segment	Facility Type	No Build Alternative		Build Alternative	
		AM	PM	AM	PM
East of Mace Blvd On-ramp	Basic	D / 28	C / 23	D / 28	C / 23
Mace Blvd to Lane Drop	Basic	C / 22	C / 21	C / 22	C / 21
Lane Drop to Olive Dr	Basic	D / 32	D / 29	D / 32	D / 29
Olive Dr Off-ramp	Diverge	D / 35	D / 33		
Olive Dr to Richards Blvd	Basic	D / 30	D / 28		
Richards Blvd NB Off-ramp	Diverge	D / 34	D / 33	E / 36	D / 34
Richards Blvd NB Off-ramp to On-ramp	Basic	C / 26	D / 26	C / 24	C / 25
Richards Blvd NB On-ramp to SB Off-ramp	Weave[1]	C / 26 (D)	C / 28 (D)		
Richards Blvd SB Off-ramp to On-ramp	Basic	D / 27	D / 30		
Richards Blvd SB On-ramp	Merge	D / 29	D / 33	D / 31	E / 35
Richards Blvd to Old Davis Rd	Basic	D / 28	D / 33	D / 28	D / 33
Old Davis Rd Off-ramp	Diverge	D / 33	C / 28	D / 33	C / 28
West of Old Davis Rd Off-ramp	Basic	B / 18	C / 21	B / 18	C / 21

Notes: Density is reported in passenger car equivalents per lane per mile.
1. For the weave segment, the LOS from the Leisch Method is also reported in parentheses.
Source: Fehr & Peers, 2018

6.3 Roadway Safety

Using the forecasted daily volume, predicted collisions were calculated for design year conditions under the project alternatives as shown in Table 23 (see the appendix for detailed analysis results). Under the No Build Alternative, the current five ramps in the westbound direction at Olive Drive and Richards Boulevard would be expected to have 5.7 collisions per year, with 2.2 fatality and injury-related collisions. With the Build Alternative, the westbound ramps are reduced from 5 to 2 and the ramp roadways are reconfigured to have curves that are less sharp (that is, a higher radius). The expected total collision rate would be 2.1 collisions per year, with 1.0 fatality and injury-related collisions. Under the Build Alternative, the expected total collision rate would be reduced by 63 percent of the No Build Alternative rate, and the fatality and injury-related rate would be reduced by about 55 percent.

Table 23: Freeway Ramp Collision Rate – Design Year Conditions

Location	No Build Alternative			Build Alternative		
	F+I	PDO	Total	F+I	PDO	Total
WB On from SB Richards Blvd	0.357	0.416	0.773	0.557	0.548	1.105
WB Off to SB Richards Blvd	0.585	0.878	1.463	-	-	-
WB On from NB Richards Blvd	0.696	1.421	2.117	-	-	-
WB Off to NB Richards Blvd	0.510	0.659	1.169	0.456	0.524	0.980
WB Off to Olive Dr	0.082	0.084	0.166	-	-	-
Total	2.230	3.458	5.688	1.013	1.072	2.085

Note: Values are in collisions per year.
Source: Fehr & Peers, 2018

6.4 Ramp Meter Storage

The Build Alternative includes the construction of a ramp meter signal on the proposed diagonal westbound on-ramp. An HOV preferential lane is required at ramp meter locations according to the *Ramp Meter Design Manual* (Caltrans 2016). To confirm that two general purpose lanes would provide adequate storage, the expected arrival rate and practical discharge rate were compared under design year (2042) conditions. The arrival rate was based on the arrival rate as counted in May 2016. The HOV percentage was assumed to 15 percent.

Table 24 shows the maximum metering rates and corresponding maximum queues for one and two general purpose lanes. The storage length was measured at 630 feet from the stop bar to the end of the HOV lane using the draft geometric approval drawing. With one lane for storage at the ramp meter, the AM peak period demand volume under design year conditions could be stored on the ramp. However, the PM peak period demand would exceed the available storage at the maximum practical metering rate of 900 vehicles per hour per lane. As a result, two general purpose lanes would be needed to serve the design year peak period demand.

Table 24: Ramp Meter Storage Analysis – Design Year Conditions

Configuration	Storage Length	Maximum Metering Rate		Maximum Queue	
		AM	PM	AM	PM
1 general purpose lane and 1 HOV lane	630 ft	575 vph	900 vph	606 ft	**<u>3,261 ft</u>**
2 general purpose lanes and 1 HOV lane	630 ft (each lane)	540 vph	990 vph	566 ft	618 ft

Note: Bold and underline font indicate that the queue would not be contained on the ramp. The maximum practical metering rate is 900 vehicles per hour (vph) per lane.
Source: Fehr & Peers, 2018

The *Ramp Meter Design Manual* also states that the "minimum storage length should be designed based on seven percent (7%) of the peak hour demand for the design year" for new or reconstructed on-ramps. Seven percent of the peak hour design year volume (1,080 vph during the PM peak hour) is 76 vehicles. Assuming 30 feet per vehicle, 15 percent HOV volume, and two storage lanes, the required storage length general purpose would be about 965 feet. As noted in Table 24, the proposed ramp storage is 630 feet, which is 335 feet short.

As noted in the manual, additional storage capacity can be provided on the local street. At the ramp terminal intersection, the right-turn pocket length is 150 feet (one lane), and the left-turn pocket length is 400 feet (two lanes). Under peak hour conditions, the northbound left turn volume onto the ramp is about twice the southbound right turn volume (810 versus 420 vehicles per hour). The additional needed 335 feet for two lanes of storage can then be allocated one-third to the right turn pocket (112 feet of two-lane storage or about 225 feet of one-lane storage) and two-thirds to the left turn pocket (about 225 feet). The northbound left turn pocket would have sufficient storage, but the southbound right turn pocket would need to be lengthened by about 75 feet to meet the 7 percent storage requirement.

6.5 Multimodal Facilities

6.5.1 Transit System

The Build Alternative will relocate the Unitrans bus stop on northbound Richards Boulevard at Olive Drive from a near side to a far side location. This will move the boarding area from a median between two lanes of traffic to the roadway shoulder thereby improving the waiting experience for passengers. The far side location also would allow buses to more easily reenter the roadway compared to the near side location that requires buses to merge into traffic in the intersection.

The improvement in intersection operations with the Build Alternative will also improve bus operations and travel time.

6.5.2 Bicycle System

The Build Alternative will provide a grade-separated two-way path for bicycles and pedestrians on the west side of the interchange. The path will function as an extension of the existing path on the west side of Richards Boulevard between First Street and Olive Drive that travels through a tunnel under the Union Pacific Railroad. South of Olive Drive, the path will run adjacent to Richards Boulevard. Approaching the interchange, the path will diverge from the roadway and then travel under the westbound on-ramp. Then, the path will loop around and travel over the path and adjacent to the westbound on-ramp to reach the freeway overcrossing. The path will continue adjacent to, but barrier-separated from, Richards Boulevard south to the Research Park Drive intersection.

The existing Class II (on-street) bicycle lanes will be maintained on Richards Boulevard. The reconstructed intersection at the I-80 Westbound Ramps will have slower speed turns than the existing configuration, which will provide a safer environment for on-street bicyclists.

6.5.3 Pedestrian System

The Build Alternative will replace the sidewalk and crosswalks on the west side of the interchange with the grade-separated pathway for bicycles and pedestrians described in the previous section. At the loop on the pathway, stairs will be provided so that pedestrians can travel a shorter route.

At the Olive Drive and Research Park Drive intersections, crosswalks would be provided on all legs. At Olive Drive, the wider approaches would result in longer crossing distances on three of the four approaches. Longer crossing distance increases pedestrian exposure and therefore reduces pedestrian safety. As noted above, the median bus stop on the northbound approach would be moved to the shoulder of the northbound departure. Pedestrians traveling to the bus stop would have less exposure to conflicting vehicles.

At Research Park Drive, the west leg (Richards Boulevard) would be reconstructed to provide an additional eastbound lane. However, the southwest corner would be rebuilt with a smaller radius such that the crosswalks on the west and south legs would be shorter than under existing conditions. The shorter crossing distance would reduce pedestrian exposure and therefore improve pedestrian safety.

6.5.4 Freight System

As noted above, the intersection curb returns would be reconstructed with a smaller radius at some study intersections. However, all turning movements will be designed to accommodate a California legal 65-foot design vehicle so that heavy vehicles can safely travel through the study area.

Chapter 7. Summary and Conclusions

7.1 Deficiencies

The study locations that operate or would operate over capacity (LOS F) are summarized below by alternative.

<u>Existing Conditions</u>

- Intersections
  - I-80 Westbound Ramps/Richards Boulevard (AM)
- Freeway Segments
  - I-80 Eastbound, Old Davis Road to Mace Boulevard (PM)

<u>No Build Alternative, Construction Year Conditions</u>

- Intersections
  - Olive Drive/Richards Boulevard (AM)
  - I-80 Westbound Ramps/Richards Boulevard (AM)
  - I-80 Eastbound Ramps/Richards Boulevard (PM)
- Freeway Segments
  - I-80 Eastbound, Old Davis Road to Mace Boulevard (PM)

<u>Build Alternative, Construction Year Conditions</u>

- Freeway Segments
  - I-80 Eastbound, Old Davis Road to Mace Boulevard (PM)

<u>No Build Alternative, Design Year Conditions</u>

- Intersections
  - First Street/D Street (AM)
  - First Street/E Street/Richards Boulevard (AM)
  - Olive Drive/Richards Boulevard (AM and PM)
  - I-80 Westbound Ramps/Richards Boulevard (AM)

- I-80 Eastbound Ramps/Richards Boulevard (AM and PM)
- Research Park Drive/Richards Boulevard/Cowell Boulevard (AM and PM)

7.2 Project Impacts

A project impact occurs where (1) the LOS threshold is exceeded and (2) the conditions are worse in Build Alternative than the No Build Alternative. The LOS thresholds are provided in Section 2.5.

The proposed project does not have impacts to intersections or freeway segments.

7.3 Potential Mitigation Measures

Since the proposed project does not have impacts, no mitigation measures were identified.

7.4 Design Designation

Table 25 shows the traffic data needed for the design designation for project roadways per the *Highway Design Manual* (Caltrans, 2012). The existing daily volume for I-80 comes from the traffic volumes published by Caltrans (http://www.dot.ca.gov/trafficops/census/). The existing daily volume estimate for Richards Boulevard uses the ratio of daily volume to peak hour volume for the segment of Richards Boulevard between First Street and Olive Drive. The future year volumes are based on the Build Alternative and use the existing ratio of daily to peak hour volume to estimate daily volume.

Table 25: Traffic Data for Design Designation

		I-80 east of Olive Dr		Richards Blvd at I-80	
Scenario	Year	Annual ADT	Peak Hour	Annual ADT	Peak Hour
Existing	2016	133,600	8,898	23,950	1,609
Construction Year	2022	144,350	9,620	27,920	1,890
Design Year	2042	180,180	12,000	41,160	2,800

Source: Fehr & Peers, 2018

Table 26 provides the traffic index for roadway pavement design according the *Highway Design Manual* (see the appendix for detailed calculations). For I-80, the distribution of trucks based on the number of axles come from a truck classification count collected at Richards Boulevard in 2000 as shown in the 2015 Daily Truck Traffic (http://www.dot.ca.gov/trafficops/census/docs/2015_aadt_truck.pdf).

Table 26: Traffic Index

Parameter	Roadway	
	I-80	Richards Boulevard
Directional Split (%)	50%	50%
Trucks (%)	9%	2%
10-Year Traffic Index	13.5/11.5 (Outside/Inside)	10.0
20-Year Traffic Index	14.5/12.5 (Outside/Inside)	10.0

Source: Fehr & Peers, 2018

7.5 Alternative Comparison

Table 27 compares the alternatives based on the design year performance measures reported above. The performance measures are the network-wide VMT (vehicle miles of travel) and VHD (vehicle hours of delay); intersection operations deficiencies; and expected collisions.

Table 27: Alternative Comparison Summary – Design Year Conditions

Category	No Build Alternative	Build Alternative	Difference
Vehicle Miles of Travel (VMT)	2,980,219	2,979,159	-1,060 (-0.04%)
Vehicle Hours of Delay (VHD)	21,965	21,911	-54 (-0.25%)
Intersection Operations Deficiencies	9 of 12	0	-9
Expected Total Collisions on Westbound Ramps	5.7 per year	2.1 per year	-3.6 per year

Source: Fehr & Peers, 2018

The Build Alternative would provide a small reduction in VMT by shifting trips originating in the City of Davis to shorter local routes with the closure of the Olive Drive westbound off-ramp. Network-wide delay would also be reduced by shifting trips from lower-speed Olive Drive to higher-speed I-80 and Richards Boulevard.

The Build Alternative would provide more capacity along Richards Boulevard from Olive Drive to Research Park Drive. Intersections that would be over capacity under the No Build Alternative would operate with LOS E or better conditions.

The reconfiguration of the westbound ramps at Richards Boulevard from a cloverleaf to a diamond design will remove the loop on-ramp and off-ramp, which have higher collision rates than slip or diagonal rates.

Even though the volume will be higher on the combined ramps, especially on the off-ramp with the closure of the Olive Drive off-ramp, the combined westbound ramp collision rate for the Build Alternative is expected to be less than half the rate of the No Build Alternative under design year conditions.

Given the advantages in network efficiency, intersection operations, and freeway ramp safety, the Build Alternative is recommended to provide the best traffic operations and safety.

Chapter 8. **References**

The references cited in the Transportation Analysis Report are listed below.

- 2017 California Regional Transportation Plan Guidelines (CTC, January 2017)
- Caltrans Traffic Census Program, http://www.dot.ca.gov/trafficops/census/, accessed October 2017
- Caltrans Performance Measurement System (PeMS), http://pems.dot.ca.gov/, accessed October 2017.
- City of Davis General Plan (City of Davis, December 2013)
- Enhanced Interchange Safety Analysis Tool: User Manual. Texas Transportation Institute, Texas A&M University, College Station, Texas, July 2013.
- Highway Capacity Manual, 6th Edition (Transportation Research Board, 2016)
- Highway Design Manual (Caltrans, 2012)
- Highway Safety Manual (American Association of State Highway and Transportation Officials, 2010)
- Interstate 80 Transportation Concept Report (Caltrans, July 2017)
- Ramp Meter Design Manual (Caltrans, 2016)
- Statewide Integrated Taffic Records System (SWITRS), California Highway Patrol, http://iswitrs.chp.ca.gov, accessed December 2017
- Traffic Accident Surveillance and Analysis System (TASAS), Caltrans, accessed November 2017
- Traffic Analysis Toolbox Volume III – Guidelines for Applying Traffic Microsimulation Modeling Software (FHWA, 2003)

Interstate 80 / Richards Boulevard Interchange

Transportation Analysis Report

APPENDIX

Prepared for:
City of Davis

June 2018

RS17-3574

FEHR PEERS

Table of Contents

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-004 D St & 1st St
Date : 5/18/2016

Unshifted Count = All Vehicles & Uturns

	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	1	2	1	0	4	9	48	9	0	66	0	1	5	0	6	0	37	0	0	37	113	0
7:15	5	0	0	0	5	3	66	9	0	78	2	2	3	0	7	0	35	5	0	40	130	0
7:30	5	1	1	0	7	4	80	5	0	89	0	1	4	0	5	0	51	5	0	56	157	0
7:45	6	5	3	0	14	6	120	8	0	134	2	1	2	0	5	0	60	3	0	63	216	0
Total	17	8	5	0	30	22	314	31	0	367	4	5	14	0	23	0	183	13	0	196	616	0
8:00	3	4	4	0	11	10	109	12	0	131	6	1	3	0	10	0	68	7	0	75	227	0
8:15	7	6	4	0	17	5	95	9	0	109	0	4	10	0	14	1	65	7	0	73	213	0
8:30	6	5	2	0	13	10	116	11	0	137	6	1	7	0	14	2	62	6	0	70	234	0
8:45	8	5	5	0	18	6	114	18	0	138	0	9	8	0	17	0	67	11	0	78	251	0
Total	24	20	15	0	59	31	434	50	0	515	12	15	28	0	55	3	262	31	0	296	925	0
11:30	17	16	5	0	38	19	70	14	0	103	5	6	17	0	28	3	68	17	0	88	257	0
11:45	14	14	4	0	32	26	72	15	0	113	5	5	8	0	18	6	66	18	0	90	253	0
12:00	18	7	7	0	32	18	86	13	0	117	9	7	17	0	33	0	86	13	0	99	281	0
12:15	13	3	7	0	23	12	77	17	0	106	10	13	18	0	41	5	100	15	0	120	290	0
Total	62	40	23	0	125	75	305	59	0	439	29	31	60	0	120	14	320	63	0	397	1081	0
12:30	11	6	8	0	25	27	70	22	0	119	9	11	22	0	42	2	56	13	0	71	257	0
12:45	12	6	4	0	22	27	79	16	0	122	17	8	21	0	46	3	81	13	0	97	287	0
13:00	18	6	9	0	33	25	63	20	0	108	10	10	23	0	43	8	84	14	0	106	290	0
13:15	18	6	10	0	34	17	83	16	0	116	10	16	25	0	51	5	78	13	0	96	297	0
Total	59	24	31	0	114	96	295	74	0	465	46	45	91	0	182	18	299	53	0	370	1131	0
16:00	15	12	11	0	38	20	76	8	0	104	8	7	14	0	29	4	107	6	0	117	288	0
16:15	14	4	4	0	22	20	65	17	0	102	8	7	8	0	23	6	116	12	0	134	281	0
16:30	14	7	6	0	27	27	59	11	0	97	6	9	11	0	26	6	107	12	0	125	275	0
16:45	14	10	1	0	25	14	80	17	0	111	10	5	14	0	29	3	105	15	0	123	288	0
Total	57	33	22	0	112	81	280	53	0	414	32	28	47	0	107	19	435	45	0	499	1132	0
17:00	29	7	6	0	42	20	63	11	0	94	4	9	9	0	22	3	88	11	0	102	260	0
17:15	23	7	4	0	34	19	80	8	0	107	7	8	19	0	34	3	105	17	0	125	300	0
17:30	16	7	6	0	29	16	75	12	0	103	6	10	17	0	33	4	80	14	0	98	263	0
17:45	17	8	5	0	30	22	90	17	0	129	10	14	16	0	40	4	101	17	0	122	321	0
Total	85	29	21	0	135	77	308	48	0	433	27	41	61	0	129	14	374	59	0	447	1144	0
Grand Total	304	154	117	0	575	382	1936	315	0	2633	150	165	301	0	616	68	1873	264	0	2205	6029	0
Apprch %	52.9%	26.8%	20.3%	0.0%		14.5%	73.5%	12.0%	0.0%		24.4%	26.8%	48.9%	0.0%		3.1%	84.9%	12.0%	0.0%			
Total %	5.0%	2.6%	1.9%	0.0%	9.5%	6.3%	32.1%	5.2%	0.0%	43.7%	2.5%	2.7%	5.0%	0.0%	10.2%	1.1%	31.1%	4.4%	0.0%	36.6%	100.0%	

AM PEAK HOUR	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	3	4	4	0	11	10	109	12	0	131	6	1	3	0	10	0	68	7	0	75	227
8:15	7	6	4	0	17	5	95	9	0	109	0	4	10	0	14	1	65	7	0	73	213
8:30	6	5	2	0	13	10	116	11	0	137	6	1	7	0	14	2	62	6	0	70	234
8:45	8	5	5	0	18	6	114	18	0	138	0	9	8	0	17	0	67	11	0	78	251
Total Volume	24	20	15	0	59	31	434	50	0	515	12	15	28	0	55	3	262	31	0	296	925
% App Total	40.7%	33.9%	25.4%	0.0%		6.0%	84.3%	9.7%	0.0%		21.8%	27.3%	50.9%	0.0%		1.0%	88.5%	10.5%	0.0%		
PHF	.750	.833	.750	.000	.819	.775	.935	.694	.000	.933	.500	.417	.700	.000	.809	.375	.963	.705	.000	.949	.921

NOON PEAK	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	11	6	8	0	25	27	70	22	0	119	9	11	22	0	42	2	56	13	0	71	257
12:45	12	6	4	0	22	27	79	16	0	122	17	8	21	0	46	3	81	13	0	97	287
13:00	18	6	9	0	33	25	63	20	0	108	10	10	23	0	43	8	84	14	0	106	290
13:15	18	6	10	0	34	17	83	16	0	116	10	16	25	0	51	5	78	13	0	96	297
Total Volume	59	24	31	0	114	96	295	74	0	465	46	45	91	0	182	18	299	53	0	370	1131
% App Total	51.8%	21.1%	27.2%	0.0%		20.6%	63.4%	15.9%	0.0%		25.3%	24.7%	50.0%	0.0%		4.9%	80.8%	14.3%	0.0%		
PHF	.819	1.000	.775	.000	.838	.889	.889	.841	.000	.953	.676	.703	.910	.000	.892	.563	.890	.946	.000	.873	.952

PM PEAK HOUR	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	29	7	6	0	42	20	63	11	0	94	4	9	9	0	22	3	88	11	0	102	260
17:15	23	7	4	0	34	19	80	8	0	107	7	8	19	0	34	3	105	17	0	125	300
17:30	16	7	6	0	29	16	75	12	0	103	6	10	17	0	33	4	80	14	0	98	263
17:45	17	8	5	0	30	22	90	17	0	129	10	14	16	0	40	4	101	17	0	122	321
Total Volume	85	29	21	0	135	77	308	48	0	433	27	41	61	0	129	14	374	59	0	447	1144
% App Total	63.0%	21.5%	15.6%	0.0%		17.8%	71.1%	11.1%	0.0%		20.9%	31.8%	47.3%	0.0%		3.1%	83.7%	13.2%	0.0%		
PHF	.733	.906	.875	.000	.804	.875	.856	.706	.000	.839	.675	.732	.803	.000	.806	.875	.890	.868	.000	.894	.891

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-004 D St & 1st St
Date : 5/18/2016

Bank 1 Count = Bikes & Peds

	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	1	4	1	0	2	0	2	2	0	1	1	2	2	0	0	0	0	0	5	8
7:15	0	0	0	1	0	0	3	0	0	3	0	0	0	1	0	0	0	0	3	0	3	5
7:30	0	3	0	7	3	1	3	0	1	4	0	0	0	2	0	0	2	0	1	2	9	11
7:45	0	5	2	1	7	0	5	0	1	5	0	1	0	3	1	0	0	0	4	0	13	9
Total	0	8	3	13	11	1	13	0	4	14	0	2	1	8	3	0	2	0	8	2	30	33
8:00	0	4	0	2	4	0	3	0	4	3	1	0	0	4	1	0	2	0	1	2	10	11
8:15	0	1	0	3	1	1	2	0	3	3	0	1	0	5	1	0	0	1	0	1	6	11
8:30	0	2	1	5	3	2	3	0	1	5	0	0	1	4	1	0	0	0	0	0	9	10
8:45	0	3	1	9	4	0	19	1	4	20	0	1	1	14	2	0	2	0	11	2	28	38
Total	0	10	2	19	12	3	27	1	12	31	1	2	2	27	5	0	4	1	12	5	53	70
11:30	0	3	0	3	3	3	7	0	7	10	1	0	1	6	2	0	4	0	7	4	19	23
11:45	0	1	0	7	1	1	6	0	9	7	0	4	1	15	5	0	6	1	2	7	20	33
12:00	0	3	1	9	4	0	12	1	11	13	2	2	0	14	4	2	8	1	8	11	32	42
12:15	0	2	3	7	5	0	1	3	4	4	0	6	1	23	7	0	5	1	4	6	22	38
Total	0	9	4	26	13	4	26	4	31	34	3	12	3	58	18	2	23	3	21	28	93	136
12:30	0	1	0	7	1	0	3	1	7	4	0	5	0	17	5	0	6	2	8	8	18	39
12:45	0	2	1	3	3	0	6	0	11	6	0	2	0	14	2	2	2	0	6	4	15	34
13:00	0	5	0	11	5	1	8	0	15	9	1	7	0	12	8	0	8	0	6	8	30	44
13:15	0	1	0	7	1	2	4	0	9	6	1	2	0	14	3	0	7	0	4	7	17	34
Total	0	9	1	28	10	3	21	1	42	25	2	16	0	57	18	2	23	2	24	27	80	151
16:00	0	1	0	3	1	1	3	0	3	4	1	4	1	4	6	0	10	0	2	10	21	12
16:15	0	2	0	5	2	0	4	0	3	4	1	3	2	4	6	0	8	0	3	8	20	15
16:30	0	4	1	12	5	0	4	0	5	4	1	5	1	7	7	0	2	0	4	2	18	28
16:45	0	0	0	17	0	0	8	1	12	9	5	5	0	11	10	1	6	2	1	9	28	41
Total	0	7	1	37	8	1	19	1	23	21	8	17	4	26	29	1	26	2	10	29	87	96
17:00	0	1	2	7	3	2	6	0	3	8	0	11	3	3	14	1	15	1	2	17	42	15
17:15	0	4	0	2	4	1	3	0	13	4	1	9	2	14	12	0	5	0	2	5	25	31
17:30	1	2	0	5	3	0	8	1	5	9	0	9	1	12	10	0	5	1	6	6	28	28
17:45	1	2	0	7	3	0	7	0	11	7	0	5	1	12	6	0	8	1	16	9	25	46
Total	2	9	2	21	13	3	24	1	32	28	1	34	7	41	42	1	33	3	26	37	120	120
Grand Total	2	52	13	144	67	15	130	8	144	153	15	83	17	217	115	6	111	11	101	128	463	606
Apprch %	3.0%	77.6%	19.4%			9.8%	85.0%	5.2%			13.0%	72.2%	14.8%			4.7%	86.7%	8.6%				
Total %	0.4%	11.2%	2.8%		14.5%	3.2%	28.1%	1.7%		33.0%	3.2%	17.9%	3.7%		24.8%	1.3%	24.0%	2.4%		27.6%	100.0%	

AM PEAK HOUR	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	4	0	2	4	0	3	0	4	3	1	0	0	4	1	0	2	0	1	2	10
8:15	0	1	0	3	1	1	2	0	3	3	0	1	0	5	1	0	0	1	0	1	6
8:30	0	2	1	5	3	2	3	0	1	5	0	0	1	4	1	0	0	0	0	0	9
8:45	0	3	1	9	4	0	19	1	4	20	0	1	1	14	2	0	2	0	11	2	28
Total Volume	0	10	2	19	12	3	27	1	12	31	1	2	2	27	5	0	4	1	12	5	53
% App Total	0.0%	83.3%	16.7%			9.7%	87.1%	3.2%			20.0%	40.0%	40.0%			0.0%	80.0%	20.0%			
PHF	.000	.625	.500		.750	.375	.355	.250		.388	.250	.500	.500		.625	.000	.500	.250		.625	.473

NOON PEAK	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	1	0	7	1	0	3	1	7	4	0	5	0	17	5	0	6	2	8	8	18
12:45	0	2	1	3	3	0	6	0	11	6	0	2	0	14	2	2	2	0	6	4	15
13:00	0	5	0	11	5	1	8	0	15	9	1	7	0	12	8	0	8	0	6	8	30
13:15	0	1	0	7	1	2	4	0	9	6	1	2	0	14	3	0	7	0	4	7	17
Total Volume	0	9	1	28	10	3	21	1	42	25	2	16	0	57	18	2	23	2	24	27	80
% App Total	0.0%	90.0%	10.0%			12.0%	84.0%	4.0%			11.1%	88.9%	0.0%			7.4%	85.2%	7.4%			
PHF	.000	.450	.250		.500	.375	.656	.250		.694	.500	.571	.000		.563	.250	.719	.250		.844	.667

PM PEAK HOUR	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	1	2	7	3	2	6	0	3	8	0	11	3	3	14	1	15	1	2	17	42
17:15	0	4	0	2	4	1	3	0	13	4	1	9	2	14	12	0	5	0	2	5	25
17:30	1	2	0	5	3	0	8	1	5	9	0	9	1	12	10	0	5	1	6	6	28
17:45	1	2	0	7	3	0	7	0	11	7	0	5	1	12	6	0	8	1	16	9	25
Total Volume	2	9	2	21	13	3	24	1	32	28	1	34	7	41	42	1	33	3	26	37	120
% App Total	15.4%	69.2%	15.4%			10.7%	85.7%	3.6%			2.4%	81.0%	16.7%			2.7%	89.2%	8.1%			
PHF	.500	.563	.250		.813	.375	.750	.250		.778	.250	.773	.583		.750	.250	.550	.750		.544	.714

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-004 D St & 1st St
Date : 5/18/2016

Bank 2 Count = Heavy Trucks

	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	0	0	0	0	2	0	0	2	0	0	1	0	1	0	2	0	0	2	5	0
7:15	1	0	0	0	1	1	3	0	0	4	0	0	0	0	0	0	4	0	0	4	9	0
7:30	0	1	0	0	1	0	4	0	0	4	0	0	1	0	1	0	3	0	0	3	9	0
7:45	0	0	0	0	0	1	3	0	0	4	0	1	1	0	2	0	0	0	0	0	6	0
Total	1	1	0	0	2	2	12	0	0	14	0	1	3	0	4	0	9	0	0	9	29	0
8:00	1	0	0	0	1	1	3	0	0	4	1	0	0	0	1	0	3	0	0	3	9	0
8:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	4	0	0	4	7	0
8:30	1	0	0	0	1	1	4	0	0	5	0	0	0	0	0	0	2	0	0	2	8	0
8:45	1	0	0	0	1	0	2	2	0	4	0	0	0	0	0	0	0	0	0	0	5	0
Total	3	0	0	0	3	2	12	2	0	16	1	0	0	0	1	0	9	0	0	9	29	0
11:30	0	0	0	0	0	0	4	1	0	5	0	1	0	0	1	0	4	1	0	5	11	0
11:45	1	0	0	0	1	0	2	0	0	2	0	2	0	0	2	0	0	0	0	0	5	0
12:00	1	0	1	0	2	0	2	0	0	2	0	0	1	0	1	0	4	0	0	4	9	0
12:15	0	0	0	0	0	0	3	2	0	5	1	0	0	0	1	0	2	1	0	3	9	0
Total	2	0	1	0	3	0	11	3	0	14	1	3	1	0	5	0	10	2	0	12	34	0
12:30	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5	0
12:45	0	0	0	0	0	1	6	0	0	7	0	0	0	0	0	0	2	0	0	2	9	0
13:00	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	1	3	0	0	4	7	0
13:15	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	3	1	0	4	10	0
Total	0	0	0	0	0	1	16	0	0	17	1	0	0	0	1	1	11	1	0	13	31	0
16:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3	0
16:15	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	6	0	0	6	9	0
16:30	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4	0
16:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4	0
Total	0	0	0	0	0	0	8	1	0	9	0	0	0	0	0	0	11	0	0	11	20	0
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0
17:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	8	0
17:30	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	2	0	0	2	5	0
17:45	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5	0
Total	0	0	0	0	0	0	9	1	0	10	0	0	0	0	0	0	9	0	0	9	19	0
Grand Total	6	1	1	0	8	5	68	7	0	80	3	4	4	0	11	1	59	3	0	63	162	0
Apprch %	75.0%	12.5%	12.5%			6.3%	85.0%	8.8%			27.3%	36.4%	36.4%			1.6%	93.7%	4.8%				
Total %	3.7%	0.6%	0.6%		4.9%	3.1%	42.0%	4.3%		49.4%	1.9%	2.5%	2.5%		6.8%	0.6%	36.4%	1.9%		38.9%	100.0%	

AM PEAK HOUR	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	1	0	0	0	1	1	3	0	0	4	1	0	0	0	1	0	3	0	0	3	9
8:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	4	0	0	4	7
8:30	1	0	0	0	1	1	4	0	0	5	0	0	0	0	0	0	2	0	0	2	8
8:45	1	0	0	0	1	0	2	2	0	4	0	0	0	0	0	0	0	0	0	0	5
Total Volume	3	0	0	0	3	2	12	2	0	16	1	0	0	0	1	0	9	0	0	9	29
% App Total	100.0%	0.0%	0.0%			12.5%	75.0%	12.5%			100.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.750	.000	.000		.750	.500	.750	.250		.800	.250	.000	.000		.250	.000	.563	.000		.563	.806

NOON PEAK	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5
12:45	0	0	0	0	0	1	6	0	0	7	0	0	0	0	0	0	2	0	0	2	9
13:00	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	1	3	0	0	4	7
13:15	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	3	1	0	4	10
Total Volume	0	0	0	0	0	1	16	0	0	17	1	0	0	0	1	1	11	1	0	13	31
% App Total	0.0%	0.0%	0.0%			5.9%	94.1%	0.0%			100.0%	0.0%	0.0%			7.7%	84.6%	7.7%			
PHF	.000	.000	.000		.000	.250	.667	.000		.607	.250	.000	.000		.250	.250	.917	.250		.813	.775

PM PEAK HOUR	D St Southbound					1st St Westbound					D St Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
17:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	8
17:30	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	2	0	0	2	5
17:45	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5
Total Volume	0	0	0	0	0	0	9	1	0	10	0	0	0	0	0	0	9	0	0	9	19
% App Total	0.0%	0.0%	0.0%			0.0%	90.0%	10.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.563	.250		.625	.000	.000	.000		.000	.000	.450	.000		.450	.594

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-005 E St/Richards Blvd & 1st St
Date : 5/18/2016

Unshifted Count = All Vehicles & Uturns

	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	0	15	1	0	16	33	4	0	0	37	62	15	41	0	118	1	4	37	0	42	213	0
7:15	0	26	2	0	28	29	2	2	0	33	74	18	33	0	125	0	1	44	0	45	231	0
7:30	0	24	3	0	27	28	1	0	0	29	94	14	40	0	148	0	0	61	0	61	265	0
7:45	0	24	2	0	26	27	6	0	0	33	118	20	56	0	194	0	2	62	0	64	317	0
Total	0	89	8	0	97	117	13	2	0	132	348	67	170	0	585	1	7	204	0	212	1026	0
8:00	0	24	5	0	29	27	3	1	0	31	121	13	57	0	191	2	2	64	0	68	319	0
8:15	1	18	1	0	20	35	1	1	0	37	111	28	53	0	192	2	10	75	0	87	336	0
8:30	0	19	3	0	22	38	5	1	0	44	129	18	52	0	199	2	7	65	0	74	339	0
8:45	0	23	1	0	24	30	8	0	0	38	130	27	67	0	224	3	2	78	0	83	369	0
Total	1	84	10	0	95	130	17	3	0	150	491	86	229	0	806	9	21	282	0	312	1363	0
11:30	3	21	8	0	32	38	11	6	0	55	90	25	58	0	173	4	9	88	0	101	361	0
11:45	3	30	10	0	43	47	6	1	0	54	93	26	55	0	174	4	7	78	0	89	360	0
12:00	2	32	8	0	42	45	16	1	0	62	85	28	65	0	178	2	15	99	0	116	398	0
12:15	2	26	7	0	35	39	11	4	0	54	91	18	44	0	153	5	14	115	0	134	376	0
Total	10	109	33	0	152	169	44	12	0	225	359	97	222	0	678	15	45	380	0	440	1495	0
12:30	1	38	9	0	48	41	9	4	0	54	95	19	58	0	172	2	12	69	0	83	357	0
12:45	5	30	8	0	43	53	12	3	0	68	100	27	41	0	168	4	9	102	0	115	394	0
13:00	1	31	11	0	43	70	9	4	0	83	91	25	51	0	167	1	6	116	0	123	416	0
13:15	0	40	5	0	45	62	12	1	0	75	96	29	57	0	182	3	8	113	0	124	426	0
Total	7	139	33	0	179	226	42	12	0	280	382	100	207	0	689	10	35	400	0	445	1593	0
16:00	1	41	2	0	44	45	12	2	0	59	88	17	66	0	171	1	5	117	0	123	397	0
16:15	1	31	10	0	42	58	11	2	0	71	80	24	51	0	155	4	13	119	0	136	404	0
16:30	0	34	7	0	41	42	5	1	0	48	90	24	69	0	183	7	12	127	0	146	418	0
16:45	1	39	3	0	43	38	17	3	0	58	96	26	59	0	181	2	14	112	0	128	410	0
Total	3	145	22	0	170	183	45	8	0	236	354	91	245	0	690	14	44	475	0	533	1629	0
17:00	0	45	3	0	48	55	11	1	0	67	75	20	58	0	153	3	12	116	0	131	399	0
17:15	3	41	4	0	48	50	7	0	0	57	94	29	68	0	191	1	11	127	0	139	435	0
17:30	1	42	5	0	48	53	10	2	0	65	89	19	65	0	173	3	13	101	0	117	403	0
17:45	2	36	9	0	47	43	8	3	0	54	112	22	59	0	193	3	15	113	0	131	425	0
Total	6	164	21	0	191	201	36	6	0	243	370	90	250	0	710	10	51	457	0	518	1662	0
Grand Total	27	730	127	0	884	1026	197	43	0	1266	2304	531	1323	0	4158	59	203	2198	0	2460	8768	0
Apprch %	3.1%	82.6%	14.4%	0.0%		81.0%	15.6%	3.4%	0.0%		55.4%	12.8%	31.8%	0.0%		2.4%	8.3%	89.3%	0.0%			
Total %	0.3%	8.3%	1.4%	0.0%	10.1%	11.7%	2.2%	0.5%	0.0%	14.4%	26.3%	6.1%	15.1%	0.0%	47.4%	0.7%	2.3%	25.1%	0.0%	28.1%	100.0%	

AM PEAK HOUR	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	24	5	0	29	27	3	1	0	31	121	13	57	0	191	2	2	64	0	68	319
8:15	1	18	1	0	20	35	1	1	0	37	111	28	53	0	192	2	10	75	0	87	336
8:30	0	19	3	0	22	38	5	1	0	44	129	18	52	0	199	2	7	65	0	74	339
8:45	0	23	1	0	24	30	8	0	0	38	130	27	67	0	224	3	2	78	0	83	369
Total Volume	1	84	10	0	95	130	17	3	0	150	491	86	229	0	806	9	21	282	0	312	1363
% App Total	1.1%	88.4%	10.5%	0.0%		86.7%	11.3%	2.0%	0.0%		60.9%	10.7%	28.4%	0.0%		2.9%	6.7%	90.4%	0.0%		
PHF	.250	.875	.500	.000	.819	.855	.531	.750	.000	.852	.944	.768	.854	.000	.900	.750	.525	.904	.000	.897	.923

NOON PEAK	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	1	38	9	0	48	41	9	4	0	54	95	19	58	0	172	2	12	69	0	83	357
12:45	5	30	8	0	43	53	12	3	0	68	100	27	41	0	168	4	9	102	0	115	394
13:00	1	31	11	0	43	70	9	4	0	83	91	25	51	0	167	1	6	116	0	123	416
13:15	0	40	5	0	45	62	12	1	0	75	96	29	57	0	182	3	8	113	0	124	426
Total Volume	7	139	33	0	179	226	42	12	0	280	382	100	207	0	689	10	35	400	0	445	1593
% App Total	3.9%	77.7%	18.4%	0.0%		80.7%	15.0%	4.3%	0.0%		55.4%	14.5%	30.0%	0.0%		2.2%	7.9%	89.9%	0.0%		
PHF	.350	.869	.750	.000	.932	.807	.875	.750	.000	.843	.955	.862	.892	.000	.946	.625	.729	.862	.000	.897	.935

PM PEAK HOUR	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 16:30 to 17:30																					
Peak Hour For Entire Intersection Begins at 16:30																					
16:30	0	34	7	0	41	42	5	1	0	48	90	24	69	0	183	7	12	127	0	146	418
16:45	1	39	3	0	43	38	17	3	0	58	96	26	59	0	181	2	14	112	0	128	410
17:00	0	45	3	0	48	55	11	1	0	67	75	20	58	0	153	3	12	116	0	131	399
17:15	3	41	4	0	48	50	7	0	0	57	94	29	68	0	191	1	11	127	0	139	435
Total Volume	4	159	17	0	180	185	40	5	0	230	355	99	254	0	708	13	49	482	0	544	1662
% App Total	2.2%	88.3%	9.4%	0.0%		80.4%	17.4%	2.2%	0.0%		50.1%	14.0%	35.9%	0.0%		2.4%	9.0%	88.6%	0.0%		
PHF	.333	.883	.607	.000	.938	.841	.588	.417	.000	.858	.924	.853	.920	.000	.927	.464	.875	.949	.000	.932	.955

ALL TRAFFIC DATA

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 16-7381-005 E St/Richards Blvd & 1st St
Date : 5/18/2016

Bank 1 Count = Bikes & Peds

	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	1	1	6	2	0	0	0	0	0	0	0	0	0	0	1	0	0	3	1	3	9
7:15	0	0	3	2	3	0	1	0	0	1	2	0	0	0	2	0	0	0	5	0	6	7
7:30	0	0	4	5	4	0	0	0	0	0	2	0	0	0	2	0	0	3	12	3	9	17
7:45	0	0	2	5	2	0	3	1	0	4	1	0	1	0	2	0	0	0	12	0	8	17
Total	0	1	10	18	11	0	4	1	0	5	5	0	1	0	6	1	0	3	32	4	26	50
8:00	0	1	2	4	3	0	0	0	0	0	2	0	0	0	2	0	0	2	11	2	7	15
8:15	0	0	3	8	3	0	1	0	0	1	2	0	1	0	3	0	0	0	10	0	7	18
8:30	0	0	1	6	1	0	2	0	0	2	5	0	2	0	7	2	0	2	10	4	14	16
8:45	0	0	3	4	3	0	4	0	0	4	13	0	0	0	13	2	1	2	7	5	25	11
Total	0	1	9	22	10	0	7	0	0	7	22	0	3	0	25	4	1	6	38	11	53	60
11:30	0	0	4	10	4	0	1	0	0	1	6	1	1	0	8	4	1	0	16	5	18	26
11:45	0	0	4	9	4	1	0	0	0	1	2	0	0	0	2	3	2	6	33	11	18	42
12:00	0	0	4	10	4	1	2	0	0	3	1	0	0	0	1	4	0	5	36	9	17	46
12:15	0	0	4	3	4	0	1	0	0	1	3	0	0	0	3	0	2	6	32	8	16	35
Total	0	0	16	32	16	2	4	0	0	6	12	1	1	0	14	11	5	17	117	33	69	149
12:30	0	2	0	5	2	1	0	0	0	1	3	0	0	0	3	0	1	3	31	4	10	36
12:45	0	0	1	7	1	0	3	0	0	3	1	0	0	0	1	0	0	5	38	5	10	45
13:00	0	0	3	6	3	0	3	0	0	3	4	1	1	0	6	2	1	3	45	6	18	51
13:15	0	0	4	10	4	0	3	1	0	4	4	0	0	0	4	2	1	5	31	8	20	41
Total	0	2	8	28	10	1	9	1	0	11	12	1	1	0	14	4	3	16	145	23	58	173
16:00	0	0	3	8	3	0	1	0	0	1	4	0	1	0	5	6	2	2	24	10	19	32
16:15	0	0	4	9	4	1	1	0	0	2	1	0	1	0	2	2	3	5	21	10	18	30
16:30	0	0	7	11	7	0	0	1	0	1	2	0	1	0	3	2	4	6	21	12	23	32
16:45	0	0	4	15	4	0	3	0	0	3	3	0	0	1	3	7	1	4	18	12	22	34
Total	0	0	18	43	18	1	5	1	0	7	10	0	3	1	13	17	10	17	84	44	82	128
17:00	0	4	2	13	6	0	2	0	0	2	5	4	0	0	9	0	3	7	35	10	27	48
17:15	0	0	5	16	5	0	1	0	0	1	2	0	0	0	2	5	2	7	21	14	22	37
17:30	0	0	8	15	8	0	3	0	0	3	0	0	0	0	0	1	0	5	57	6	17	72
17:45	0	0	3	22	3	0	2	0	0	2	3	0	0	1	3	2	0	1	36	3	11	59
Total	0	4	18	66	22	0	8	0	0	8	10	4	0	1	14	8	5	20	149	33	77	216
Grand Total	0	8	79	209	87	4	37	3	0	44	71	6	9	2	86	45	24	79	565	148	365	776
Apprch %	0.0%	9.2%	90.8%			9.1%	84.1%	6.8%			82.6%	7.0%	10.5%			30.4%	16.2%	53.4%				
Total %	0.0%	2.2%	21.6%		23.8%	1.1%	10.1%	0.8%		12.1%	19.5%	1.6%	2.5%		23.6%	12.3%	6.6%	21.6%		40.5%	100.0%	

AM PEAK HOUR	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	1	2	4	3	0	0	0	0	0	2	0	0	0	2	0	0	2	11	2	7
8:15	0	0	3	8	3	0	1	0	0	1	2	0	1	0	3	0	0	0	10	0	7
8:30	0	0	1	6	1	0	2	0	0	2	5	0	2	0	7	2	0	2	10	4	14
8:45	0	0	3	4	3	0	4	0	0	4	13	0	0	0	13	2	1	2	7	5	25
Total Volume	0	1	9	22	10	0	7	0	0	7	22	0	3	0	25	4	1	6	38	11	53
% App Total	0.0%	10.0%	90.0%			0.0%	100.0%	0.0%			88.0%	0.0%	12.0%			36.4%	9.1%	54.5%			
PHF	.000	.250	.750		.833	.000	.438	.000		.438	.423	.000	.375		.481	.500	.250	.750		.550	.530

NOON PEAK	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	2	0	5	2	1	0	0	0	1	3	0	0	0	3	0	1	3	31	4	10
12:45	0	0	1	7	1	0	3	0	0	3	1	0	0	0	1	0	0	5	38	5	10
13:00	0	0	3	6	3	0	3	0	0	3	4	1	1	0	6	2	1	3	45	6	18
13:15	0	0	4	10	4	0	3	1	0	4	4	0	0	0	4	2	1	5	31	8	20
Total Volume	0	2	8	28	10	1	9	1	0	11	12	1	1	0	14	4	3	16	145	23	58
% App Total	0.0%	20.0%	80.0%			9.1%	81.8%	9.1%			85.7%	7.1%	7.1%			17.4%	13.0%	69.6%			
PHF	.000	.250	.500		.625	.250	.750	.250		.688	.750	.250	.250		.583	.500	.750	.800		.719	.725

PM PEAK HOUR	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 16:30 to 17:30																					
Peak Hour For Entire Intersection Begins at 16:30																					
16:30	0	0	7	11	7	0	0	1	0	1	2	0	1	0	3	2	4	6	21	12	23
16:45	0	0	4	15	4	0	3	0	0	3	3	0	0	1	3	7	1	4	18	12	22
17:00	0	4	2	13	6	0	2	0	0	2	5	4	0	0	9	0	3	7	35	10	27
17:15	0	0	5	16	5	0	1	0	0	1	2	0	0	0	2	5	2	7	21	14	22
Total Volume	0	4	18	55	22	0	6	1	0	7	12	4	1	1	17	14	10	24	95	48	94
% App Total	0.0%	18.2%	81.8%			0.0%	85.7%	14.3%			70.6%	23.5%	5.9%			29.2%	20.8%	50.0%			
PHF	.000	.250	.643		.786	.000	.500	.250		.583	.600	.250	.250		.472	.500	.625	.857		.857	.870

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-005 E St/Richards Blvd & 1st St
Date : 5/18/2016

Bank 2 Count = Heavy Trucks

	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	0	0	0	1	0	0	0	1	2	0	3	0	5	0	0	3	0	3	9	0
7:15	0	3	0	0	3	1	0	0	0	1	4	1	0	0	5	0	0	4	0	4	13	0
7:30	0	1	1	0	2	0	0	0	0	0	3	0	0	0	3	0	0	5	0	5	10	0
7:45	0	1	0	0	1	0	0	0	0	0	4	0	1	0	5	0	0	1	0	1	7	0
Total	0	5	1	0	6	2	0	0	0	2	13	1	4	0	18	0	0	13	0	13	39	0
8:00	0	0	1	0	1	1	0	0	0	1	3	1	3	0	7	0	0	4	0	4	13	0
8:15	0	1	0	0	1	0	0	0	0	0	3	0	0	0	3	0	0	4	0	4	8	0
8:30	0	0	0	0	0	1	0	0	0	1	5	0	0	0	5	0	0	3	0	3	9	0
8:45	0	1	0	0	1	0	0	0	0	0	4	0	0	0	4	0	0	1	0	1	6	0
Total	0	2	1	0	3	2	0	0	0	2	15	1	3	0	19	0	0	12	0	12	36	0
11:30	0	0	0	0	0	1	0	3	0	4	5	0	0	0	5	0	0	4	0	4	13	0
11:45	0	1	0	0	1	1	0	0	0	1	3	0	1	0	4	0	0	1	0	1	7	0
12:00	0	2	0	0	2	0	0	0	0	0	1	0	2	0	3	1	0	5	0	6	11	0
12:15	0	1	1	0	2	0	0	0	0	0	4	0	1	0	5	0	0	2	0	2	9	0
Total	0	4	1	0	5	2	0	3	0	5	13	0	4	0	17	1	0	12	0	13	40	0
12:30	0	1	0	0	1	0	0	1	0	1	3	0	0	0	3	0	0	3	0	3	8	0
12:45	0	2	0	0	2	0	0	1	0	1	6	0	0	0	6	0	0	2	0	2	11	0
13:00	0	1	0	0	1	0	0	0	0	0	2	0	0	0	2	0	0	2	0	2	5	0
13:15	0	1	0	0	1	0	0	0	0	0	6	0	0	0	6	0	0	4	0	4	11	0
Total	0	5	0	0	5	0	0	2	0	2	17	0	0	0	17	0	0	11	0	11	35	0
16:00	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	0	0	2	0	2	4	0
16:15	0	0	0	0	0	1	0	0	0	1	3	0	0	0	3	0	0	5	0	5	9	0
16:30	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	3	0	3	5	0
16:45	0	0	0	0	0	2	0	0	0	2	4	0	0	0	4	0	0	1	0	1	7	0
Total	0	0	0	0	0	3	0	0	0	3	10	0	1	0	11	0	0	11	0	11	25	0
17:00	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2	0
17:15	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	5	0	5	8	0
17:30	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	2	0	2	5	0
17:45	0	1	0	0	1	0	0	0	0	0	4	0	0	0	4	0	0	1	0	1	6	0
Total	0	2	0	0	2	0	0	0	0	0	10	0	0	0	10	0	0	9	0	9	21	0
Grand Total	0	18	3	0	21	9	0	5	0	14	78	2	12	0	92	1	0	68	0	69	196	0
Apprch %	0.0%	85.7%	14.3%			64.3%	0.0%	35.7%			84.8%	2.2%	13.0%			1.4%	0.0%	98.6%				
Total %	0.0%	9.2%	1.5%		10.7%	4.6%	0.0%	2.6%		7.1%	39.8%	1.0%	6.1%		46.9%	0.5%	0.0%	34.7%		35.2%	100.0%	

AM PEAK HOUR	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	0	1	0	1	1	0	0	0	1	3	1	3	0	7	0	0	4	0	4	13
8:15	0	1	0	0	1	0	0	0	0	0	3	0	0	0	3	0	0	4	0	4	8
8:30	0	0	0	0	0	1	0	0	0	1	5	0	0	0	5	0	0	3	0	3	9
8:45	0	1	0	0	1	0	0	0	0	0	4	0	0	0	4	0	0	1	0	1	6
Total Volume	0	2	1	0	3	2	0	0	0	2	15	1	3	0	19	0	0	12	0	12	36
% App Total	0.0%	66.7%	33.3%			100.0%	0.0%	0.0%			78.9%	5.3%	15.8%			0.0%	0.0%	100.0%			
PHF	.000	.500	.250		.750	.500	.000	.000		.500	.750	.250	.250		.679	.000	.000	.750		.750	.692

NOON PEAK	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	1	0	0	1	0	0	1	0	1	3	0	0	0	3	0	0	3	0	3	8
12:45	0	2	0	0	2	0	0	1	0	1	6	0	0	0	6	0	0	2	0	2	11
13:00	0	1	0	0	1	0	0	0	0	0	2	0	0	0	2	0	0	2	0	2	5
13:15	0	1	0	0	1	0	0	0	0	0	6	0	0	0	6	0	0	4	0	4	11
Total Volume	0	5	0	0	5	0	0	2	0	2	17	0	0	0	17	0	0	11	0	11	35
% App Total	0.0%	100.0%	0.0%			0.0%	0.0%	100.0%			100.0%	0.0%	0.0%			0.0%	0.0%	100.0%			
PHF	.000	.625	.000		.625	.000	.000	.500		.500	.708	.000	.000		.708	.000	.000	.688		.688	.795

PM PEAK HOUR	E St/Richards Blvd Southbound					1st St Westbound					E St/Richards Blvd Northbound					1st St Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 16:30 to 17:30																					
Peak Hour For Entire Intersection Begins at 16:30																					
16:30	0	0	0	0	0	0	0	0	0	0	2	0	0	0	2	0	0	3	0	3	5
16:45	0	0	0	0	0	2	0	0	0	2	4	0	0	0	4	0	0	1	0	1	7
17:00	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	2
17:15	0	0	0	0	0	0	0	0	0	0	3	0	0	0	3	0	0	5	0	5	8
Total Volume	0	1	0	0	1	2	0	0	0	2	9	0	0	0	9	0	0	10	0	10	22
% App Total	0.0%	100.0%	0.0%			100.0%	0.0%	0.0%			100.0%	0.0%	0.0%			0.0%	0.0%	100.0%			
PHF	.000	.250	.000		.250	.250	.000	.000		.250	.563	.000	.000		.563	.000	.000	.500		.500	.688

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-006 Olive Dr & Richards Blvd
Date : 5/18/2016

Unshifted Count = All Vehicles & Uturns

	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	17	5	16	0	38	9	105	5	0	119	1	1	8	0	10	2	79	4	0	85	252	0
7:15	19	10	17	0	46	17	101	11	0	129	2	1	10	0	13	3	93	4	0	100	288	0
7:30	12	5	29	0	46	12	131	9	0	152	3	1	16	0	20	6	98	8	0	112	330	0
7:45	32	7	41	0	80	16	152	8	0	176	6	1	10	0	17	4	105	4	0	113	386	0
Total	80	27	103	0	210	54	489	33	0	576	12	4	44	0	60	15	375	20	0	410	1256	0
8:00	20	4	26	0	50	21	161	5	0	187	10	2	9	0	21	5	104	7	0	116	374	0
8:15	29	2	36	0	67	23	138	9	0	170	7	1	16	0	24	9	111	6	0	126	387	0
8:30	21	9	47	0	77	14	150	6	0	170	10	2	21	0	33	6	113	7	0	126	406	0
8:45	36	3	48	0	87	22	155	11	0	188	10	2	12	0	24	11	112	6	0	129	428	0
Total	106	18	157	0	281	80	604	31	0	715	37	7	58	0	102	31	440	26	0	497	1595	0
11:30	23	4	33	0	60	15	137	13	0	165	11	1	10	0	22	23	116	5	2	146	393	2
11:45	44	7	40	0	91	16	125	11	0	152	6	2	18	0	26	11	128	12	0	151	420	0
12:00	40	4	32	0	76	18	131	13	0	162	6	2	15	0	23	14	144	12	0	170	431	0
12:15	37	5	35	0	77	16	126	18	0	160	7	3	15	0	25	21	164	6	0	191	453	0
Total	144	20	140	0	304	65	519	55	0	639	30	8	58	0	96	69	552	35	2	658	1697	2
12:30	39	7	39	0	85	11	130	9	0	150	10	3	12	0	25	13	117	6	1	137	397	1
12:45	37	6	39	0	82	14	107	18	0	139	11	2	15	0	28	14	171	8	0	193	442	0
13:00	41	10	28	0	79	22	141	18	0	181	12	3	18	0	33	16	185	9	0	210	503	0
13:15	42	11	47	0	100	10	113	10	0	133	7	2	19	0	28	21	195	7	0	223	484	0
Total	159	34	153	0	346	57	491	55	0	603	40	10	64	0	114	64	668	30	1	763	1826	1
16:00	32	2	32	0	66	18	129	16	0	163	12	1	17	0	30	18	161	12	0	191	450	0
16:15	38	2	35	0	75	12	118	19	0	149	13	0	20	1	34	20	183	8	0	211	469	1
16:30	40	4	35	0	79	10	138	14	0	162	8	2	17	0	27	17	174	10	0	201	469	0
16:45	26	1	34	0	61	6	125	14	0	145	10	2	11	0	23	16	169	12	0	197	426	0
Total	136	9	136	0	281	46	510	63	0	619	43	5	65	1	114	71	687	42	0	800	1814	1
17:00	40	6	47	0	93	11	120	14	0	145	11	2	21	0	34	24	178	7	0	209	481	0
17:15	34	3	44	0	81	5	123	16	0	144	8	0	6	0	14	21	193	10	0	224	463	0
17:30	37	4	35	0	76	18	136	11	0	165	9	1	25	0	35	21	163	11	0	195	471	0
17:45	31	4	39	0	74	12	157	11	0	180	4	2	22	0	28	25	164	6	1	196	478	1
Total	142	17	165	0	324	46	536	52	0	634	32	5	74	0	111	91	698	34	1	824	1893	1
Grand Total	767	125	854	0	1746	348	3149	289	0	3786	194	39	363	1	597	341	3420	187	4	3952	10081	5
Apprch %	43.9%	7.2%	48.9%	0.0%		9.2%	83.2%	7.6%	0.0%		32.5%	6.5%	60.8%	0.2%		8.6%	86.5%	4.7%	0.1%			
Total %	7.6%	1.2%	8.5%	0.0%	17.3%	3.5%	31.2%	2.9%	0.0%	37.6%	1.9%	0.4%	3.6%	0.0%	5.9%	3.4%	33.9%	1.9%	0.0%	39.2%	100.0%	

AM PEAK HOUR	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	20	4	26	0	50	21	161	5	0	187	10	2	9	0	21	5	104	7	0	116	374
8:15	29	2	36	0	67	23	138	9	0	170	7	1	16	0	24	9	111	6	0	126	387
8:30	21	9	47	0	77	14	150	6	0	170	10	2	21	0	33	6	113	7	0	126	406
8:45	36	3	48	0	87	22	155	11	0	188	10	2	12	0	24	11	112	6	0	129	428
Total Volume	106	18	157	0	281	80	604	31	0	715	37	7	58	0	102	31	440	26	0	497	1595
% App Total	37.7%	6.4%	55.9%	0.0%		11.2%	84.5%	4.3%	0.0%		36.3%	6.9%	56.9%	0.0%		6.2%	88.5%	5.2%	0.0%		
PHF	.736	.500	.818	.000	.807	.870	.938	.705	.000	.951	.925	.875	.690	.000	.773	.705	.973	.929	.000	.963	.932

NOON PEAK	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	39	7	39	0	85	11	130	9	0	150	10	3	12	0	25	13	117	6	1	137	397
12:45	37	6	39	0	82	14	107	18	0	139	11	2	15	0	28	14	171	8	0	193	442
13:00	41	10	28	0	79	22	141	18	0	181	12	3	18	0	33	16	185	9	0	210	503
13:15	42	11	47	0	100	10	113	10	0	133	7	2	19	0	28	21	195	7	0	223	484
Total Volume	159	34	153	0	346	57	491	55	0	603	40	10	64	0	114	64	668	30	1	763	1826
% App Total	46.0%	9.8%	44.2%	0.0%		9.5%	81.4%	9.1%	0.0%		35.1%	8.8%	56.1%	0.0%		8.4%	87.5%	3.9%	0.1%		
PHF	.946	.773	.814	.000	.865	.648	.871	.764	.000	.833	.833	.833	.842	.000	.864	.762	.856	.833	.250	.855	.908

PM PEAK HOUR	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	40	6	47	0	93	11	120	14	0	145	11	2	21	0	34	24	178	7	0	209	481
17:15	34	3	44	0	81	5	123	16	0	144	8	0	6	0	14	21	193	10	0	224	463
17:30	37	4	35	0	76	18	136	11	0	165	9	1	25	0	35	21	163	11	0	195	471
17:45	31	4	39	0	74	12	157	11	0	180	4	2	22	0	28	25	164	6	1	196	478
Total Volume	142	17	165	0	324	46	536	52	0	634	32	5	74	0	111	91	698	34	1	824	1893
% App Total	43.8%	5.2%	50.9%	0.0%		7.3%	84.5%	8.2%	0.0%		28.8%	4.5%	66.7%	0.0%		11.0%	84.7%	4.1%	0.1%		
PHF	.888	.708	.878	.000	.871	.639	.854	.813	.000	.881	.727	.625	.740	.000	.793	.910	.904	.773	.250	.920	.984

ALL TRAFFIC DATA

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 16-7381-006 Olive Dr & Richards Blvd
Date : 5/18/2016

Bank 1 Count = Bikes & Peds

	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	4	1	0	5	0	1	0	2	1	0	0	0	0	0	0	0	0	2	0	6	4
7:15	0	7	1	0	8	0	1	1	2	2	0	3	0	0	3	2	0	0	1	2	15	3
7:30	0	9	0	0	9	0	0	0	7	0	0	2	3	1	5	0	2	0	3	2	16	11
7:45	0	18	2	0	20	0	2	0	2	2	0	0	0	6	0	0	0	0	1	0	22	9
Total	0	38	4	0	42	0	4	1	13	5	0	5	3	7	8	2	2	0	7	4	59	27
8:00	0	6	1	0	7	0	2	0	5	2	0	2	0	3	2	0	2	0	4	2	13	12
8:15	0	7	3	1	10	0	0	0	8	0	0	1	1	4	2	0	0	1	2	1	13	15
8:30	1	10	7	1	18	1	1	3	2	5	0	2	1	7	3	0	2	0	4	2	28	14
8:45	0	40	5	1	45	1	6	0	4	7	0	2	0	4	2	0	1	0	11	1	55	20
Total	1	63	16	3	80	2	9	3	19	14	0	7	2	18	9	0	5	1	21	6	109	61
11:30	0	11	6	0	17	0	0	0	4	0	1	5	1	2	7	4	0	0	1	4	28	7
11:45	0	28	2	1	30	0	2	0	15	2	0	19	2	1	21	0	0	2	5	2	55	22
12:00	0	15	4	2	19	1	0	0	6	1	0	12	0	6	12	3	3	0	2	6	38	16
12:15	0	4	2	0	6	1	2	0	8	3	0	3	0	6	3	2	1	1	1	4	16	15
Total	0	58	14	3	72	2	4	0	33	6	1	39	3	15	43	9	4	3	9	16	137	60
12:30	1	2	0	0	3	0	0	0	5	0	0	4	0	6	4	3	0	1	4	4	11	15
12:45	0	13	0	1	13	0	0	0	2	0	0	5	0	3	5	2	0	0	8	2	20	14
13:00	0	12	2	1	14	1	2	0	4	3	0	11	0	5	11	1	1	2	3	4	32	13
13:15	0	7	1	0	8	0	3	0	8	3	0	8	0	5	8	1	1	1	7	3	22	20
Total	1	34	3	2	38	1	5	0	19	6	0	28	0	19	28	7	2	4	22	13	85	62
16:00	0	5	0	2	5	0	1	0	9	1	0	25	0	7	25	2	2	0	1	4	35	19
16:15	0	4	0	0	4	0	1	0	13	1	0	12	1	8	13	1	2	0	1	3	21	22
16:30	1	1	4	0	6	0	1	0	6	1	2	12	1	3	15	0	0	2	1	2	24	10
16:45	0	10	4	0	14	0	4	0	7	4	2	12	0	9	14	3	1	2	3	6	38	19
Total	1	20	8	2	29	0	7	0	35	7	4	61	2	27	67	6	5	4	6	15	118	70
17:00	1	9	4	5	14	0	1	0	9	1	1	15	1	4	17	2	2	2	6	6	38	24
17:15	0	3	2	0	5	0	1	0	16	1	0	11	2	6	13	4	4	1	2	9	28	24
17:30	0	5	2	1	7	0	0	0	8	0	1	12	0	3	13	2	1	1	11	4	24	23
17:45	0	9	4	2	13	0	1	0	2	1	1	8	0	13	9	3	2	1	4	6	29	21
Total	1	26	12	8	39	0	3	0	35	3	3	46	3	26	52	11	9	5	23	25	119	92
Grand Total	4	239	57	18	300	5	32	4	154	41	8	186	13	112	207	35	27	17	88	79	627	372
Apprch %	1.3%	79.7%	19.0%			12.2%	78.0%	9.8%			3.9%	89.9%	6.3%			44.3%	34.2%	21.5%				
Total %	0.6%	38.1%	9.1%		47.8%	0.8%	5.1%	0.6%		6.5%	1.3%	29.7%	2.1%		33.0%	5.6%	4.3%	2.7%		12.6%	100.0%	

AM PEAK HOUR	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	6	1	0	7	0	2	0	5	2	0	2	0	3	2	0	2	0	4	2	13
8:15	0	7	3	1	10	0	0	0	8	0	0	1	1	4	2	0	0	1	2	1	13
8:30	1	10	7	1	18	1	1	3	2	5	0	2	1	7	3	0	2	0	4	2	28
8:45	0	40	5	1	45	1	6	0	4	7	0	2	0	4	2	0	1	0	11	1	55
Total Volume	1	63	16	3	80	2	9	3	19	14	0	7	2	18	9	0	5	1	21	6	109
% App Total	1.3%	78.8%	20.0%			14.3%	64.3%	21.4%			0.0%	77.8%	22.2%			0.0%	83.3%	16.7%			
PHF	.250	.394	.571		.444	.500	.375	.250		.500	.000	.875	.500		.750	.000	.625	.250		.750	.495

NOON PEAK	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	1	2	0	0	3	0	0	0	5	0	0	4	0	6	4	3	0	1	4	4	11
12:45	0	13	0	1	13	0	0	0	2	0	0	5	0	3	5	2	0	0	8	2	20
13:00	0	12	2	1	14	1	2	0	4	3	0	11	0	5	11	1	1	2	3	4	32
13:15	0	7	1	0	8	0	3	0	8	3	0	8	0	5	8	1	1	1	7	3	22
Total Volume	1	34	3	2	38	1	5	0	19	6	0	28	0	19	28	7	2	4	22	13	85
% App Total	2.6%	89.5%	7.9%			16.7%	83.3%	0.0%			0.0%	100.0%	0.0%			53.8%	15.4%	30.8%			
PHF	.250	.654	.375		.679	.250	.417	.000		.500	.000	.636	.000		.636	.583	.500	.500		.813	.664

PM PEAK HOUR	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	1	9	4	5	14	0	1	0	9	1	1	15	1	4	17	2	2	2	6	6	38
17:15	0	3	2	0	5	0	1	0	16	1	0	11	2	6	13	4	4	1	2	9	28
17:30	0	5	2	1	7	0	0	0	8	0	1	12	0	3	13	2	1	1	11	4	24
17:45	0	9	4	2	13	0	1	0	2	1	1	8	0	13	9	3	2	1	4	6	29
Total Volume	1	26	12	8	39	0	3	0	35	3	3	46	3	26	52	11	9	5	23	25	119
% App Total	2.6%	66.7%	30.8%			0.0%	100.0%	0.0%			5.8%	88.5%	5.8%			44.0%	36.0%	20.0%			
PHF	.250	.722	.750		.696	.000	.750	.000		.750	.750	.767	.375		.765	.688	.563	.625		.694	.783

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-006 Olive Dr & Richards Blvd
Date : 5/18/2016

Bank 2 Count = Heavy Trucks

	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	4	0	0	4	11	0
7:15	0	1	0	0	1	0	4	0	0	4	0	0	1	0	1	0	8	0	0	8	14	0
7:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	6	0	0	6	9	0
7:45	3	0	3	0	6	0	3	0	0	3	0	0	0	0	0	1	0	0	0	1	10	0
Total	4	1	3	0	8	0	16	0	0	16	0	0	1	0	1	1	18	0	0	19	44	0
8:00	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	6	0	0	6	13	0
8:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	8	0
8:30	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	2	1	0	3	10	0
8:45	1	0	0	0	1	0	3	1	0	4	0	1	0	0	1	1	2	0	0	3	9	0
Total	3	0	0	0	3	0	18	1	0	19	0	1	0	0	1	1	15	1	0	17	40	0
11:30	0	0	1	0	1	0	5	0	0	5	0	0	0	0	0	0	4	0	0	4	10	0
11:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	1	0	4	7	0
12:00	2	0	2	0	4	0	1	0	0	1	0	0	0	0	0	1	6	0	0	7	12	0
12:15	1	0	0	0	1	0	5	1	0	6	0	0	1	0	1	0	3	0	0	3	11	0
Total	3	0	3	0	6	0	14	1	0	15	0	0	1	0	1	1	16	1	0	18	40	0
12:30	0	1	1	0	2	0	2	0	0	2	0	0	0	0	0	0	4	0	0	4	8	0
12:45	0	0	0	0	0	0	4	0	0	4	1	0	0	0	1	0	4	0	0	4	9	0
13:00	0	0	1	0	1	0	2	1	0	3	0	0	0	0	0	0	3	0	0	3	7	0
13:15	0	0	0	0	0	0	6	1	0	7	0	0	0	0	0	0	5	0	0	5	12	0
Total	0	1	2	0	3	0	14	2	0	16	1	0	0	0	1	0	16	0	0	16	36	0
16:00	0	0	0	0	0	0	2	1	0	3	0	0	1	0	1	0	2	0	0	2	6	0
16:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	6	0	0	6	9	0
16:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6	0
16:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	1	0	3	6	0
Total	0	0	0	0	0	0	11	1	0	12	0	0	1	0	1	0	13	1	0	14	27	0
17:00	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	2	0	0	2	4	0
17:15	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	9	0
17:30	0	0	0	0	0	1	4	0	0	5	0	0	1	0	1	0	2	0	0	2	8	0
17:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5	0
Total	1	0	0	0	1	2	10	0	0	12	0	0	2	0	2	0	11	0	0	11	26	0
Grand Total	11	2	8	0	21	2	83	5	0	90	1	1	5	0	7	3	89	3	0	95	213	0
Apprch %	52.4%	9.5%	38.1%			2.2%	92.2%	5.6%			14.3%	14.3%	71.4%			3.2%	93.7%	3.2%				
Total %	5.2%	0.9%	3.8%		9.9%	0.9%	39.0%	2.3%		42.3%	0.5%	0.5%	2.3%		3.3%	1.4%	41.8%	1.4%		44.6%	100.0%	

AM PEAK HOUR	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	6	0	0	6	13
8:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	8
8:30	1	0	0	0	1	0	6	0	0	6	0	0	0	0	0	0	2	1	0	3	10
8:45	1	0	0	0	1	0	3	1	0	4	0	1	0	0	1	1	2	0	0	3	9
Total Volume	3	0	0	0	3	0	18	1	0	19	0	1	0	0	1	1	15	1	0	17	40
% App Total	100.0%	0.0%	0.0%			0.0%	94.7%	5.3%			0.0%	100.0%	0.0%			5.9%	88.2%	5.9%			
PHF	.750	.000	.000		.750	.000	.750	.250		.792	.000	.250	.000		.250	.250	.625	.250		.708	.769

NOON PEAK	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	1	1	0	2	0	2	0	0	2	0	0	0	0	0	0	4	0	0	4	8
12:45	0	0	0	0	0	0	4	0	0	4	1	0	0	0	1	0	4	0	0	4	9
13:00	0	0	1	0	1	0	2	1	0	3	0	0	0	0	0	0	3	0	0	3	7
13:15	0	0	0	0	0	0	6	1	0	7	0	0	0	0	0	0	5	0	0	5	12
Total Volume	0	1	2	0	3	0	14	2	0	16	1	0	0	0	1	0	16	0	0	16	36
% App Total	0.0%	33.3%	66.7%			0.0%	87.5%	12.5%			100.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.250	.500		.375	.000	.583	.500		.571	.250	.000	.000		.250	.000	.800	.000		.800	.750

PM PEAK HOUR	Olive Dr Southbound					Richards Blvd Westbound					Olive Dr Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	1	0	0	0	1	0	0	1	0	1	0	2	0	0	2	4
17:15	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	9
17:30	0	0	0	0	0	1	4	0	0	5	0	0	1	0	1	0	2	0	0	2	8
17:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5
Total Volume	1	0	0	0	1	2	10	0	0	12	0	0	2	0	2	0	11	0	0	11	26
% App Total	100.0%	0.0%	0.0%			16.7%	83.3%	0.0%			0.0%	0.0%	100.0%			0.0%	100.0%	0.0%			
PHF	.250	.000	.000		.250	.500	.625	.000		.600	.000	.000	.500		.500	.000	.550	.000		.550	.722

ALL TRAFFIC DATA

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 16-7381-007 I-80 WB Ramps & Richards Blvd
Date : 5/18/2016

Unshifted Count = All Vehicles & Uturns

	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	0	0	75	0	75	0	53	50	0	103	0	0	25	0	25	0	71	31	0	102	305	0
7:15	0	0	75	0	75	0	60	67	0	127	0	0	25	0	25	0	77	57	0	134	361	0
7:30	0	0	99	0	99	0	64	97	0	161	0	0	43	0	43	0	69	62	0	131	434	0
7:45	0	0	96	0	96	0	111	126	0	237	0	0	34	0	34	0	94	42	0	136	503	0
Total	0	0	345	0	345	0	288	340	0	628	0	0	127	0	127	0	311	192	0	503	1603	0
8:00	0	0	117	0	117	0	87	91	0	178	0	0	50	0	50	0	92	39	0	131	476	0
8:15	0	0	101	0	101	0	79	85	0	164	0	0	53	0	53	0	116	45	0	161	479	0
8:30	0	0	75	0	75	0	129	100	0	229	0	0	43	0	43	0	102	61	0	163	510	0
8:45	0	0	96	0	96	0	105	83	0	188	0	0	33	0	33	0	112	50	0	162	479	0
Total	0	0	389	0	389	0	400	359	0	759	0	0	179	0	179	0	422	195	0	617	1944	0
11:30	0	0	66	0	66	0	121	68	0	189	0	0	20	0	20	0	100	41	0	141	416	0
11:45	0	0	83	0	83	0	104	97	0	201	0	0	21	0	21	0	121	61	0	182	487	0
12:00	0	0	47	0	47	0	123	72	0	195	0	0	15	0	15	0	145	66	1	212	469	1
12:15	0	0	45	0	45	0	130	66	0	196	0	0	25	0	25	0	142	71	0	213	479	0
Total	0	0	241	0	241	0	478	303	0	781	0	0	81	0	81	0	508	239	1	748	1851	1
12:30	0	0	57	0	57	0	102	68	0	170	0	0	24	0	24	0	115	59	0	174	425	0
12:45	0	0	70	0	70	0	105	79	0	184	0	0	17	0	17	0	166	65	0	231	502	0
13:00	0	0	57	0	57	0	129	74	0	203	0	0	25	0	25	0	176	78	0	254	539	0
13:15	0	0	51	0	51	0	90	63	0	153	0	0	34	0	34	0	182	91	0	273	511	0
Total	0	0	235	0	235	0	426	284	0	710	0	0	100	0	100	0	639	293	0	932	1977	0
16:00	0	0	58	0	58	0	115	89	0	204	0	0	19	0	19	0	133	74	0	207	488	0
16:15	0	0	48	0	48	0	115	82	0	197	0	0	17	0	17	0	169	68	0	237	499	0
16:30	0	0	67	0	67	0	111	103	0	214	0	0	25	0	25	0	157	74	1	232	538	1
16:45	0	0	58	0	58	0	102	94	0	196	0	0	19	0	19	0	144	68	0	212	485	0
Total	0	0	231	0	231	0	443	368	0	811	0	0	80	0	80	0	603	284	1	888	2010	1
17:00	0	0	53	0	53	0	102	163	0	265	0	0	27	0	27	0	161	90	0	251	596	0
17:15	0	0	51	0	51	0	110	95	0	205	0	0	18	0	18	0	179	72	0	251	525	0
17:30	0	0	59	0	59	0	110	100	0	210	0	0	16	0	16	0	141	80	0	221	506	0
17:45	0	0	58	0	58	0	125	80	0	205	0	0	29	0	29	0	155	78	0	233	525	0
Total	0	0	221	0	221	0	447	438	0	885	0	0	90	0	90	0	636	320	0	956	2152	0
Grand Total	0	0	1662	0	1662	0	2482	2092	0	4574	0	0	657	0	657	0	3119	1523	2	4644	11537	2
Apprch %	0.0%	0.0%	100.0%	0.0%		0.0%	54.3%	45.7%	0.0%		0.0%	0.0%	100.0%	0.0%		0.0%	67.2%	32.8%	0.0%			
Total %	0.0%	0.0%	14.4%	0.0%	14.4%	0.0%	21.5%	18.1%	0.0%	39.6%	0.0%	0.0%	5.7%	0.0%	5.7%	0.0%	27.0%	13.2%	0.0%	40.3%	100.0%	

AM PEAK HOUR	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 07:45 to 08:45																					
Peak Hour For Entire Intersection Begins at 07:45																					
7:45	0	0	96	0	96	0	111	126	0	237	0	0	34	0	34	0	94	42	0	136	503
8:00	0	0	117	0	117	0	87	91	0	178	0	0	50	0	50	0	92	39	0	131	476
8:15	0	0	101	0	101	0	79	85	0	164	0	0	53	0	53	0	116	45	0	161	479
8:30	0	0	75	0	75	0	129	100	0	229	0	0	43	0	43	0	102	61	0	163	510
Total Volume	0	0	389	0	389	0	406	402	0	808	0	0	180	0	180	0	404	187	0	591	1968
% App Total	0.0%	0.0%	100.0%	0.0%		0.0%	50.2%	49.8%	0.0%		0.0%	0.0%	100.0%	0.0%		0.0%	68.4%	31.6%	0.0%		
PHF	.000	.000	.831	.000	.831	.000	.787	.798	.000	.852	.000	.000	.849	.000	.849	.000	.871	.766	.000	.906	.965

NOON PEAK	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	0	57	0	57	0	102	68	0	170	0	0	24	0	24	0	115	59	0	174	425
12:45	0	0	70	0	70	0	105	79	0	184	0	0	17	0	17	0	166	65	0	231	502
13:00	0	0	57	0	57	0	129	74	0	203	0	0	25	0	25	0	176	78	0	254	539
13:15	0	0	51	0	51	0	90	63	0	153	0	0	34	0	34	0	182	91	0	273	511
Total Volume	0	0	235	0	235	0	426	284	0	710	0	0	100	0	100	0	639	293	0	932	1977
% App Total	0.0%	0.0%	100.0%	0.0%		0.0%	60.0%	40.0%	0.0%		0.0%	0.0%	100.0%	0.0%		0.0%	68.6%	31.4%	0.0%		
PHF	.000	.000	.839	.000	.839	.000	.826	.899	.000	.874	.000	.000	.735	.000	.735	.000	.878	.805	.000	.853	.917

PM PEAK HOUR	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	53	0	53	0	102	163	0	265	0	0	27	0	27	0	161	90	0	251	596
17:15	0	0	51	0	51	0	110	95	0	205	0	0	18	0	18	0	179	72	0	251	525
17:30	0	0	59	0	59	0	110	100	0	210	0	0	16	0	16	0	141	80	0	221	506
17:45	0	0	58	0	58	0	125	80	0	205	0	0	29	0	29	0	155	78	0	233	525
Total Volume	0	0	221	0	221	0	447	438	0	885	0	0	90	0	90	0	636	320	0	956	2152
% App Total	0.0%	0.0%	100.0%	0.0%		0.0%	50.5%	49.5%	0.0%		0.0%	0.0%	100.0%	0.0%		0.0%	66.5%	33.5%	0.0%		
PHF	.000	.000	.936	.000	.936	.000	.894	.672	.000	.835	.000	.000	.776	.000	.776	.000	.888	.889	.000	.952	.903

ALL TRAFFIC DATA

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 16-7381-007 I-80 WB Ramps & Richards Blvd
Date : 5/18/2016

Bank 1 Count = Bikes & Peds

	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
7:15	0	0	0	0	0	0	3	0	0	3	0	0	0	1	0	0	0	0	0	0	3	1
7:30	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	5	0	0	5	9	0
7:45	0	0	0	0	0	0	3	0	0	3	0	0	0	2	0	0	1	0	0	1	4	2
Total	0	0	0	0	0	0	11	0	0	11	0	0	0	3	0	0	6	0	0	6	17	3
8:00	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	0	3	0	0	3	4	2
8:15	0	0	0	0	0	0	2	0	0	2	0	0	0	2	0	0	0	0	0	0	2	2
8:30	0	0	0	0	0	0	5	0	0	5	0	0	0	5	0	0	3	0	0	3	8	5
8:45	0	0	0	0	0	0	11	0	0	11	0	0	0	3	0	0	2	0	0	2	13	3
Total	0	0	0	0	0	0	19	0	0	19	0	0	0	12	0	0	8	0	0	8	27	12
11:30	0	0	0	0	0	0	2	0	0	2	0	0	0	1	0	0	0	0	0	0	2	1
11:45	0	0	0	0	0	0	3	0	0	3	0	0	0	2	0	0	2	0	0	2	5	2
12:00	0	0	0	0	0	0	2	0	0	2	0	0	0	2	0	0	3	0	0	3	5	2
12:15	0	0	0	0	0	0	2	0	0	2	0	0	0	5	0	0	2	0	0	2	4	5
Total	0	0	0	0	0	0	9	0	0	9	0	0	0	10	0	0	7	0	0	7	16	10
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	2	2	1
12:45	0	0	0	0	0	0	4	0	0	4	0	0	0	5	0	0	1	0	0	1	5	5
13:00	0	0	0	0	0	0	2	0	0	2	0	0	0	3	0	0	2	0	0	2	4	3
13:15	0	0	0	0	0	0	2	0	0	2	0	0	0	4	0	0	3	0	0	3	5	4
Total	0	0	0	0	0	0	8	0	0	8	0	0	0	13	0	0	8	0	0	8	16	13
16:00	0	0	0	0	0	0	1	0	0	1	0	0	0	3	0	0	3	0	0	3	4	3
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	4	4	1
16:30	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	0	1	0	0	1	2	2
16:45	0	0	0	0	0	0	1	0	0	1	0	0	0	4	0	0	3	0	0	3	4	4
Total	0	0	0	0	0	0	3	0	0	3	0	0	0	10	0	0	11	0	0	11	14	10
17:00	0	0	0	0	0	0	3	0	0	3	0	0	0	2	0	0	3	0	0	3	6	2
17:15	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	0	7	0	0	7	8	2
17:30	0	0	0	0	0	0	1	0	0	1	0	0	0	7	0	0	3	0	0	3	4	7
17:45	0	0	0	0	0	0	1	0	0	1	0	0	0	3	0	0	2	0	0	2	3	3
Total	0	0	0	0	0	0	6	0	0	6	0	0	0	14	0	0	15	0	0	15	21	14
Grand Total	0	0	0	0	0	0	56	0	0	56	0	0	0	62	0	0	55	0	0	55	111	62
Apprch %	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%				
Total %	0.0%	0.0%	0.0%		0.0%	0.0%	50.5%	0.0%		50.5%	0.0%	0.0%	0.0%		0.0%	0.0%	49.5%	0.0%		49.5%	100.0%	

AM PEAK HOUR	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 07:45 to 08:45																					
Peak Hour For Entire Intersection Begins at 07:45																					
7:45	0	0	0	0	0	0	3	0	0	3	0	0	0	2	0	0	1	0	0	1	4
8:00	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	0	3	0	0	3	4
8:15	0	0	0	0	0	0	2	0	0	2	0	0	0	2	0	0	0	0	0	0	2
8:30	0	0	0	0	0	0	5	0	0	5	0	0	0	5	0	0	3	0	0	3	8
Total Volume	0	0	0	0	0	0	11	0	0	11	0	0	0	11	0	0	7	0	0	7	18
% App Total	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.550	.000		.550	.000	.000	.000		.000	.000	.583	.000		.583	.563

NOON PEAK	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	2	2
12:45	0	0	0	0	0	0	4	0	0	4	0	0	0	5	0	0	1	0	0	1	5
13:00	0	0	0	0	0	0	2	0	0	2	0	0	0	3	0	0	2	0	0	2	4
13:15	0	0	0	0	0	0	2	0	0	2	0	0	0	4	0	0	3	0	0	3	5
Total Volume	0	0	0	0	0	0	8	0	0	8	0	0	0	13	0	0	8	0	0	8	16
% App Total	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.500	.000		.500	.000	.000	.000		.000	.000	.667	.000		.667	.800

PM PEAK HOUR	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	0	3	0	0	3	0	0	0	2	0	0	3	0	0	3	6
17:15	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	0	7	0	0	7	8
17:30	0	0	0	0	0	0	1	0	0	1	0	0	0	7	0	0	3	0	0	3	4
17:45	0	0	0	0	0	0	1	0	0	1	0	0	0	3	0	0	2	0	0	2	3
Total Volume	0	0	0	0	0	0	6	0	0	6	0	0	0	14	0	0	15	0	0	15	21
% App Total	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.500	.000		.500	.000	.000	.000		.000	.000	.536	.000		.536	.656

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-007 I-80 WB Ramps & Richards Blvd
Date : 5/18/2016

Bank 2 Count = Heavy Trucks

	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	3	0	3	0	3	1	0	4	0	0	0	0	0	0	3	2	0	5	12	0
7:15	0	0	1	0	1	0	2	1	0	3	0	0	1	0	1	0	7	2	0	9	14	0
7:30	0	0	1	0	1	0	2	1	0	3	0	0	1	0	1	0	3	1	0	4	9	0
7:45	0	0	3	0	3	0	3	0	0	3	0	0	1	0	1	0	3	2	0	5	12	0
Total	0	0	8	0	8	0	10	3	0	13	0	0	3	0	3	0	16	7	0	23	47	0
8:00	0	0	1	0	1	0	3	1	0	4	0	0	1	0	1	0	6	1	0	7	13	0
8:15	0	0	1	0	1	0	3	2	0	5	0	0	2	0	2	0	3	1	0	4	12	0
8:30	0	0	1	0	1	0	5	1	0	6	0	0	0	0	0	0	2	1	0	3	10	0
8:45	0	0	2	0	2	0	2	5	0	7	0	0	4	0	4	0	3	1	0	4	17	0
Total	0	0	5	0	5	0	13	9	0	22	0	0	7	0	7	0	14	4	0	18	52	0
11:30	0	0	0	0	0	0	5	4	0	9	0	0	0	0	0	0	4	1	0	5	14	0
11:45	0	0	1	0	1	0	2	2	0	4	0	0	0	0	0	0	3	0	0	3	8	0
12:00	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	5	3	0	8	11	0
12:15	0	0	1	0	1	0	6	2	0	8	0	0	0	0	0	0	4	0	0	4	13	0
Total	0	0	2	0	2	0	15	9	0	24	0	0	0	0	0	0	16	4	0	20	46	0
12:30	0	0	1	0	1	0	1	3	0	4	0	0	0	0	0	0	3	1	0	4	9	0
12:45	0	0	1	0	1	0	3	2	0	5	0	0	0	0	0	0	3	0	0	3	9	0
13:00	0	0	0	0	0	0	2	1	0	3	0	0	1	0	1	0	3	1	0	4	8	0
13:15	0	0	1	0	1	0	6	0	0	6	0	0	0	0	0	0	4	1	0	5	12	0
Total	0	0	3	0	3	0	12	6	0	18	0	0	1	0	1	0	13	3	0	16	38	0
16:00	0	0	1	0	1	0	2	1	0	3	0	0	2	0	2	0	3	0	0	3	9	0
16:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	5	1	0	6	9	0
16:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6	0
16:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	1	0	2	5	0
Total	0	0	1	0	1	0	11	1	0	12	0	0	2	0	2	0	12	2	0	14	29	0
17:00	0	0	0	0	0	0	2	0	0	2	0	0	1	0	1	0	2	1	0	3	6	0
17:15	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	5	2	0	7	9	0
17:30	0	0	1	0	1	0	4	0	0	4	0	0	1	0	1	0	2	0	0	2	8	0
17:45	0	0	0	0	0	0	3	0	0	3	0	0	2	0	2	0	1	2	0	3	8	0
Total	0	0	2	0	2	0	10	0	0	10	0	0	4	0	4	0	10	5	0	15	31	0
Grand Total	0	0	21	0	21	0	71	28	0	99	0	0	17	0	17	0	81	25	0	106	243	0
Apprch %	0.0%	0.0%	100.0%			0.0%	71.7%	28.3%			0.0%	0.0%	100.0%			0.0%	76.4%	23.6%				
Total %	0.0%	0.0%	8.6%		8.6%	0.0%	29.2%	11.5%		40.7%	0.0%	0.0%	7.0%		7.0%	0.0%	33.3%	10.3%		43.6%	100.0%	

AM PEAK HOUR	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 07:45 to 08:45																					
Peak Hour For Entire Intersection Begins at 07:45																					
7:45	0	0	3	0	3	0	3	0	0	3	0	0	1	0	1	0	3	2	0	5	12
8:00	0	0	1	0	1	0	3	1	0	4	0	0	1	0	1	0	6	1	0	7	13
8:15	0	0	1	0	1	0	3	2	0	5	0	0	2	0	2	0	3	1	0	4	12
8:30	0	0	1	0	1	0	5	1	0	6	0	0	0	0	0	0	2	1	0	3	10
Total Volume	0	0	6	0	6	0	14	4	0	18	0	0	4	0	4	0	14	5	0	19	47
% App Total	0.0%	0.0%	100.0%			0.0%	77.8%	22.2%			0.0%	0.0%	100.0%			0.0%	73.7%	26.3%			
PHF	.000	.000	.500		.500	.000	.700	.500		.750	.000	.000	.500		.500	.000	.583	.625		.679	.904

NOON PEAK	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	0	1	0	1	0	1	3	0	4	0	0	0	0	0	0	3	1	0	4	9
12:45	0	0	1	0	1	0	3	2	0	5	0	0	0	0	0	0	3	0	0	3	9
13:00	0	0	0	0	0	0	2	1	0	3	0	0	1	0	1	0	3	1	0	4	8
13:15	0	0	1	0	1	0	6	0	0	6	0	0	0	0	0	0	4	1	0	5	12
Total Volume	0	0	3	0	3	0	12	6	0	18	0	0	1	0	1	0	13	3	0	16	38
% App Total	0.0%	0.0%	100.0%			0.0%	66.7%	33.3%			0.0%	0.0%	100.0%			0.0%	81.3%	18.8%			
PHF	.000	.000	.750		.750	.000	.500	.500		.750	.000	.000	.250		.250	.000	.813	.750		.800	.792

PM PEAK HOUR	I-80 WB Ramps Southbound					Richards Blvd Westbound					I-80 WB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	0	2	0	0	2	0	0	1	0	1	0	2	1	0	3	6
17:15	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	5	2	0	7	9
17:30	0	0	1	0	1	0	4	0	0	4	0	0	1	0	1	0	2	0	0	2	8
17:45	0	0	0	0	0	0	3	0	0	3	0	0	2	0	2	0	1	2	0	3	8
Total Volume	0	0	2	0	2	0	10	0	0	10	0	0	4	0	4	0	10	5	0	15	31
% App Total	0.0%	0.0%	100.0%			0.0%	100.0%	0.0%			0.0%	0.0%	100.0%			0.0%	66.7%	33.3%			
PHF	.000	.000	.500		.500	.000	.625	.000		.625	.000	.000	.500		.500	.000	.500	.625		.536	.861

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-008 I-80 EB Ramps & Richards Blvd
Date : 5/18/2016

Unshifted Count = All Vehicles & Uturns

	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	37	0	25	0	62	0	79	28	0	107	0	0	0	0	0	53	42	0	0	95	264	0
7:15	61	0	35	0	96	0	85	25	0	110	0	0	0	0	0	57	35	0	0	92	298	0
7:30	56	0	37	0	93	0	132	24	0	156	0	0	0	0	0	54	67	0	0	121	370	0
7:45	93	0	58	0	151	0	183	23	0	206	0	0	0	0	0	62	62	0	0	124	481	0
Total	247	0	155	0	402	0	479	100	0	579	0	0	0	0	0	226	206	0	0	432	1413	0
8:00	120	0	51	0	171	0	112	27	0	139	0	0	0	0	0	56	88	0	0	144	454	0
8:15	99	0	38	0	137	0	121	22	0	143	0	0	0	0	0	59	105	0	0	164	444	0
8:30	100	0	51	0	151	0	187	20	0	207	0	0	0	0	0	56	96	0	0	152	510	0
8:45	110	0	44	0	154	0	144	24	0	168	0	0	0	0	0	70	73	0	0	143	465	0
Total	429	0	184	0	613	0	564	93	0	657	0	0	0	0	0	241	362	0	0	603	1873	0
11:30	65	0	48	0	113	0	135	32	0	167	0	0	0	0	0	42	71	0	0	113	393	0
11:45	70	0	42	0	112	0	178	27	0	205	0	0	0	0	0	61	85	0	0	146	463	0
12:00	84	0	56	0	140	0	125	33	0	158	0	0	0	0	0	63	93	0	0	156	454	0
12:15	62	0	41	0	103	0	152	35	0	187	0	0	0	0	0	78	95	0	0	173	463	0
Total	281	0	187	0	468	0	590	127	0	717	0	0	0	0	0	244	344	0	0	588	1773	0
12:30	71	0	39	0	110	0	125	33	0	158	0	0	0	0	0	46	89	0	0	135	403	0
12:45	70	0	50	0	120	0	149	29	0	178	0	0	0	0	0	68	115	0	0	183	481	0
13:00	86	0	56	0	142	0	130	33	0	163	0	0	0	0	0	87	104	0	0	191	496	0
13:15	76	0	36	0	112	0	143	35	0	178	0	0	0	0	0	92	127	0	0	219	509	0
Total	303	0	181	0	484	0	547	130	0	677	0	0	0	0	0	293	435	0	0	728	1889	0
16:00	117	0	48	0	165	0	156	40	0	196	0	0	0	0	0	59	98	0	0	157	518	0
16:15	119	0	54	0	173	0	140	18	0	158	0	0	0	0	0	52	129	0	0	181	512	0
16:30	118	0	42	0	160	0	171	22	0	193	0	0	0	0	0	56	130	0	0	186	539	0
16:45	134	0	37	0	171	0	174	25	0	199	0	0	0	0	0	40	116	0	0	156	526	0
Total	488	0	181	0	669	0	641	105	0	746	0	0	0	0	0	207	473	0	0	680	2095	0
17:00	123	0	52	0	175	0	200	44	0	244	0	0	0	0	0	36	142	0	0	178	597	0
17:15	139	0	39	0	178	0	174	36	0	210	0	0	0	0	0	60	138	0	1	199	587	1
17:30	146	0	40	0	186	0	169	29	0	198	0	0	0	0	0	31	117	0	0	148	532	0
17:45	144	0	47	0	191	0	172	17	0	189	0	0	0	0	0	62	133	0	0	195	575	0
Total	552	0	178	0	730	0	715	126	0	841	0	0	0	0	0	189	530	0	1	720	2291	1
Grand Total	2300	0	1066	0	3366	0	3536	681	0	4217	0	0	0	0	0	1400	2350	0	1	3751	11334	1
Apprch %	68.3%	0.0%	31.7%	0.0%		0.0%	83.9%	16.1%	0.0%		0.0%	0.0%	0.0%	0.0%		37.3%	62.6%	0.0%	0.0%			
Total %	20.3%	0.0%	9.4%	0.0%	29.7%	0.0%	31.2%	6.0%	0.0%	37.2%	0.0%	0.0%	0.0%	0.0%	0.0%	12.4%	20.7%	0.0%	0.0%	33.1%	100.0%	

AM PEAK HOUR	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 07:45 to 08:45																					
Peak Hour For Entire Intersection Begins at 07:45																					
7:45	93	0	58	0	151	0	183	23	0	206	0	0	0	0	0	62	62	0	0	124	481
8:00	120	0	51	0	171	0	112	27	0	139	0	0	0	0	0	56	88	0	0	144	454
8:15	99	0	38	0	137	0	121	22	0	143	0	0	0	0	0	59	105	0	0	164	444
8:30	100	0	51	0	151	0	187	20	0	207	0	0	0	0	0	56	96	0	0	152	510
Total Volume	412	0	198	0	610	0	603	92	0	695	0	0	0	0	0	233	351	0	0	584	1889
% App Total	67.5%	0.0%	32.5%	0.0%		0.0%	86.8%	13.2%	0.0%		0.0%	0.0%	0.0%	0.0%		39.9%	60.1%	0.0%	0.0%		
PHF	.858	.000	.853	.000	.892	.000	.806	.852	.000	.839	.000	.000	.000	.000	.000	.940	.836	.000	.000	.890	.926

NOON PEAK	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	71	0	39	0	110	0	125	33	0	158	0	0	0	0	0	46	89	0	0	135	403
12:45	70	0	50	0	120	0	149	29	0	178	0	0	0	0	0	68	115	0	0	183	481
13:00	86	0	56	0	142	0	130	33	0	163	0	0	0	0	0	87	104	0	0	191	496
13:15	76	0	36	0	112	0	143	35	0	178	0	0	0	0	0	92	127	0	0	219	509
Total Volume	303	0	181	0	484	0	547	130	0	677	0	0	0	0	0	293	435	0	0	728	1889
% App Total	62.6%	0.0%	37.4%	0.0%		0.0%	80.8%	19.2%	0.0%		0.0%	0.0%	0.0%	0.0%		40.2%	59.8%	0.0%	0.0%		
PHF	.881	.000	.808	.000	.852	.000	.918	.929	.000	.951	.000	.000	.000	.000	.000	.796	.856	.000	.000	.831	.928

PM PEAK HOUR	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	123	0	52	0	175	0	200	44	0	244	0	0	0	0	0	36	142	0	0	178	597
17:15	139	0	39	0	178	0	174	36	0	210	0	0	0	0	0	60	138	0	1	199	587
17:30	146	0	40	0	186	0	169	29	0	198	0	0	0	0	0	31	117	0	0	148	532
17:45	144	0	47	0	191	0	172	17	0	189	0	0	0	0	0	62	133	0	0	195	575
Total Volume	552	0	178	0	730	0	715	126	0	841	0	0	0	0	0	189	530	0	1	720	2291
% App Total	75.6%	0.0%	24.4%	0.0%		0.0%	85.0%	15.0%	0.0%		0.0%	0.0%	0.0%	0.0%		26.3%	73.6%	0.0%	0.1%		
PHF	.945	.000	.856	.000	.955	.000	.894	.716	.000	.862	.000	.000	.000	.000	.000	.762	.933	.000	.250	.905	.959

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-008 I-80 EB Ramps & Richards Blvd
Date : 5/18/2016

Bank 1 Count = Bikes & Peds

	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
7:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0
7:30	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	5	0	0	5	9	0
7:45	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5	0
Total	0	0	0	0	0	0	12	0	0	12	0	0	0	0	0	0	6	0	0	6	18	0
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3	0
8:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0
8:30	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	3	0	0	3	7	0
8:45	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	0	1	0	0	1	12	0
Total	0	0	0	0	0	0	18	0	0	18	0	0	0	0	0	0	7	0	0	7	25	0
11:30	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	2	0
11:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5	0
12:00	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5	0
12:15	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4	0
Total	0	0	0	0	0	0	9	0	0	9	0	0	0	0	0	0	7	0	0	7	16	0
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2	0
12:45	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5	0
13:00	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4	0
13:15	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4	0
Total	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	0	7	0	0	7	15	0
16:00	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	3	0	0	3	5	0
16:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3	0
16:30	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3	0
16:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	1	0	0	1	4	0
Total	0	0	0	0	0	0	6	0	0	6	0	0	0	0	0	0	9	0	0	9	15	0
17:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	5	0	0	5	6	0
17:15	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	7	0	0	7	8	0
17:30	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	4	0
17:45	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4	0
Total	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	17	0	0	17	22	0
Grand Total	0	0	0	0	0	0	58	0	0	58	0	0	0	0	0	0	53	0	0	53	111	0
Apprch %	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%				
Total %	0.0%	0.0%	0.0%		0.0%	0.0%	52.3%	0.0%		52.3%	0.0%	0.0%	0.0%		0.0%	0.0%	47.7%	0.0%		47.7%	100.0%	

AM PEAK HOUR	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 07:45 to 08:45																					
Peak Hour For Entire Intersection Begins at 07:45																					
7:45	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5
8:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	3
8:15	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	3
8:30	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	3	0	0	3	7
Total Volume	0	0	0	0	0	0	11	0	0	11	0	0	0	0	0	0	7	0	0	7	18
% App Total	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.688	.000		.688	.000	.000	.000		.000	.000	.583	.000		.583	.643

NOON PEAK	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	2
12:45	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	5
13:00	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4
13:15	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4
Total Volume	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	0	7	0	0	7	15
% App Total	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.500	.000		.500	.000	.000	.000		.000	.000	.875	.000		.875	.750

PM PEAK HOUR	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	5	0	0	5	6
17:15	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	7	0	0	7	8
17:30	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	3	0	0	3	4
17:45	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	2	0	0	2	4
Total Volume	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	17	0	0	17	22
% App Total	0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			0.0%	100.0%	0.0%			
PHF	.000	.000	.000		.000	.000	.625	.000		.625	.000	.000	.000		.000	.000	.607	.000		.607	.688

ALL TRAFFIC DATA

(916) 771-8700

orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-008 I-80 EB Ramps & Richards Blvd
Date : 5/18/2016

Bank 2 Count = Heavy Trucks

	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	1	0	2	0	3	0	2	1	0	3	0	0	0	0	0	1	2	0	0	3	9	0
7:15	2	0	1	0	3	0	2	0	0	2	0	0	0	0	0	4	4	0	0	8	13	0
7:30	1	0	0	0	1	0	3	1	0	4	0	0	0	0	0	0	4	0	0	4	9	0
7:45	3	0	1	0	4	0	3	0	0	3	0	0	0	0	0	1	3	0	0	4	11	0
Total	7	0	4	0	11	0	10	2	0	12	0	0	0	0	0	6	13	0	0	19	42	0
8:00	1	0	0	0	1	0	3	1	0	4	0	0	0	0	0	2	5	0	0	7	12	0
8:15	1	0	0	0	1	0	5	0	0	5	0	0	0	0	0	1	4	0	0	5	11	0
8:30	1	0	1	0	2	0	6	0	0	6	0	0	0	0	0	0	1	0	0	1	9	0
8:45	1	0	1	0	2	0	5	0	0	5	0	0	0	0	0	1	7	0	0	8	15	0
Total	4	0	2	0	6	0	19	1	0	20	0	0	0	0	0	4	17	0	0	21	47	0
11:30	0	0	2	0	2	0	5	1	0	6	0	0	0	0	0	1	3	0	0	4	12	0
11:45	1	0	0	0	1	0	4	1	0	5	0	0	0	0	0	2	1	0	0	3	9	0
12:00	3	0	1	0	4	0	2	0	0	2	0	0	0	0	0	0	5	0	0	5	11	0
12:15	1	0	2	0	3	0	6	0	0	6	0	0	0	0	0	1	3	0	0	4	13	0
Total	5	0	5	0	10	0	17	2	0	19	0	0	0	0	0	4	12	0	0	16	45	0
12:30	1	0	0	0	1	0	4	1	0	5	0	0	0	0	0	1	2	0	0	3	9	0
12:45	2	0	0	0	2	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	10	0
13:00	4	0	1	0	5	0	2	1	0	3	0	0	0	0	0	1	3	0	0	4	12	0
13:15	0	0	1	0	1	0	5	0	0	5	0	0	0	0	0	0	4	0	0	4	10	0
Total	7	0	2	0	9	0	16	2	0	18	0	0	0	0	0	2	12	0	0	14	41	0
16:00	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	2	3	0	0	5	9	0
16:15	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	0	5	0	0	5	9	0
16:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6	0
16:45	3	0	0	0	3	0	4	0	0	4	0	0	0	0	0	0	1	0	0	1	8	0
Total	5	0	0	0	5	0	13	0	0	13	0	0	0	0	0	2	12	0	0	14	32	0
17:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2	0
17:15	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	5	0	0	7	8	0
17:30	2	0	0	0	2	0	4	0	0	4	0	0	0	0	0	0	3	0	0	3	9	0
17:45	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	2	1	0	0	3	7	0
Total	3	0	0	0	3	0	9	0	0	9	0	0	0	0	0	4	10	0	0	14	26	0
Grand Total	31	0	13	0	44	0	84	7	0	91	0	0	0	0	0	22	76	0	0	98	233	0
Apprch %	70.5%	0.0%	29.5%			0.0%	92.3%	7.7%			0.0%	0.0%	0.0%			22.4%	77.6%	0.0%				
Total %	13.3%	0.0%	5.6%		18.9%	0.0%	36.1%	3.0%		39.1%	0.0%	0.0%	0.0%		0.0%	9.4%	32.6%	0.0%		42.1%	100.0%	

AM PEAK HOUR	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 07:45 to 08:45																					
Peak Hour For Entire Intersection Begins at 07:45																					
7:45	3	0	1	0	4	0	3	0	0	3	0	0	0	0	0	1	3	0	0	4	11
8:00	1	0	0	0	1	0	3	1	0	4	0	0	0	0	0	2	5	0	0	7	12
8:15	1	0	0	0	1	0	5	0	0	5	0	0	0	0	0	1	4	0	0	5	11
8:30	1	0	1	0	2	0	6	0	0	6	0	0	0	0	0	0	1	0	0	1	9
Total Volume	6	0	2	0	8	0	17	1	0	18	0	0	0	0	0	4	13	0	0	17	43
% App Total	75.0%	0.0%	25.0%			0.0%	94.4%	5.6%			0.0%	0.0%	0.0%			23.5%	76.5%	0.0%			
PHF	.500	.000	.500		.500	.000	.708	.250		.750	.000	.000	.000		.000	.500	.650	.000		.607	.896

NOON PEAK	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	1	0	0	0	1	0	4	1	0	5	0	0	0	0	0	1	2	0	0	3	9
12:45	2	0	0	0	2	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	10
13:00	4	0	1	0	5	0	2	1	0	3	0	0	0	0	0	1	3	0	0	4	12
13:15	0	0	1	0	1	0	5	0	0	5	0	0	0	0	0	0	4	0	0	4	10
Total Volume	7	0	2	0	9	0	16	2	0	18	0	0	0	0	0	2	12	0	0	14	41
% App Total	77.8%	0.0%	22.2%			0.0%	88.9%	11.1%			0.0%	0.0%	0.0%			14.3%	85.7%	0.0%			
PHF	.438	.000	.500		.450	.000	.800	.500		.900	.000	.000	.000		.000	.500	.750	.000		.875	.854

PM PEAK HOUR	I-80 EB Ramps Southbound					Richards Blvd Westbound					I-80 EB Ramps Northbound					Richards Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	2
17:15	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	5	0	0	7	8
17:30	2	0	0	0	2	0	4	0	0	4	0	0	0	0	0	0	3	0	0	3	9
17:45	1	0	0	0	1	0	3	0	0	3	0	0	0	0	0	2	1	0	0	3	7
Total Volume	3	0	0	0	3	0	9	0	0	9	0	0	0	0	0	4	10	0	0	14	26
% App Total	100.0%	0.0%	0.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			28.6%	71.4%	0.0%			
PHF	.375	.000	.000		.375	.000	.563	.000		.563	.000	.000	.000		.000	.500	.500	.000		.500	.722

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-009 Research Park Dr & Richards Blvd/Cowell Blvd
Date : 5/18/2016

Unshifted Count = All Vehicles & Uturns

	Research Park Dr					Richards Blvd/Cowell Blvd					Research Park Dr					Richards Blvd/Cowell Blvd						
	Southbound					Westbound					Northbound					Eastbound						
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total	Uturns Total
7:00	1	1	12	0	14	1	85	2	0	88	3	1	4	0	8	15	50	13	5	83	193	5
7:15	7	5	17	0	29	4	79	3	0	86	10	2	3	0	15	21	46	16	9	92	222	9
7:30	0	0	24	0	24	3	116	2	0	121	11	3	3	0	17	26	71	27	7	131	293	7
7:45	3	2	32	0	37	5	136	2	0	143	22	0	2	0	24	27	92	28	7	154	358	7
Total	11	8	85	0	104	13	416	9	0	438	46	6	12	0	64	89	259	84	28	460	1066	28
8:00	8	3	25	0	36	6	89	4	0	99	23	1	6	0	30	49	120	30	7	206	371	7
8:15	1	6	17	0	24	9	98	3	0	110	15	1	14	0	30	45	111	32	6	194	358	6
8:30	6	5	25	0	36	9	167	10	0	186	15	3	6	0	24	41	123	32	10	206	452	10
8:45	7	5	15	0	27	6	133	3	0	142	11	1	4	0	16	22	103	39	7	171	356	7
Total	22	19	82	0	123	30	487	20	0	537	64	6	30	0	100	157	457	133	30	777	1537	30
11:30	7	9	16	0	32	3	117	9	0	129	21	3	6	0	30	31	88	13	7	139	330	7
11:45	14	1	29	0	44	3	128	13	0	144	19	2	11	0	32	23	101	9	12	145	365	12
12:00	12	3	17	0	32	5	124	11	0	140	13	8	4	0	25	21	127	17	11	176	373	11
12:15	11	3	15	0	29	7	139	7	0	153	13	4	8	0	25	36	96	18	11	161	368	11
Total	44	16	77	0	137	18	508	40	0	566	66	17	29	0	112	111	412	57	41	621	1436	41
12:30	9	7	19	0	35	4	114	8	0	126	15	1	6	0	22	31	97	12	12	152	335	12
12:45	12	7	23	0	42	6	128	8	0	142	14	0	5	0	19	26	133	16	16	191	394	16
13:00	14	6	18	0	38	8	124	5	0	137	10	1	3	0	14	36	110	24	14	184	373	14
13:15	13	6	29	0	48	5	114	6	0	125	17	1	9	0	27	30	150	16	8	204	404	8
Total	48	26	89	0	163	23	480	27	0	530	56	3	23	0	82	123	490	68	50	731	1506	50
16:00	8	3	29	0	40	9	112	3	0	124	26	6	8	1	41	50	142	12	12	216	421	13
16:15	7	1	24	0	32	3	101	9	0	113	20	7	10	0	37	38	194	15	12	259	441	12
16:30	7	3	29	0	39	4	123	8	0	135	26	5	5	0	36	49	156	15	14	234	444	14
16:45	9	4	31	0	44	2	128	9	0	139	20	8	12	0	40	72	162	14	8	256	479	8
Total	31	11	113	0	155	18	464	29	0	511	92	26	35	1	154	209	654	56	46	965	1785	47
17:00	5	2	46	0	53	5	136	9	0	150	38	3	16	0	57	64	164	16	16	260	520	16
17:15	13	3	29	0	45	7	144	9	0	160	11	8	11	0	30	67	189	17	17	290	525	17
17:30	7	3	29	0	39	5	115	11	0	131	26	10	8	0	44	49	169	18	15	251	465	15
17:45	12	2	22	0	36	8	135	6	0	149	17	4	5	0	26	58	197	7	18	280	491	18
Total	37	10	126	0	173	25	530	35	0	590	92	25	40	0	157	238	719	58	66	1081	2001	66
Grand Total	193	90	572	0	855	127	2885	160	0	3172	416	83	169	1	669	927	2991	456	261	4635	9331	262
Apprch %	22.6%	10.5%	66.9%	0.0%		4.0%	91.0%	5.0%	0.0%		62.2%	12.4%	25.3%	0.1%		20.0%	64.5%	9.8%	5.6%			
Total %	2.1%	1.0%	6.1%	0.0%	9.2%	1.4%	30.9%	1.7%	0.0%	34.0%	4.5%	0.9%	1.8%	0.0%	7.2%	9.9%	32.1%	4.9%	2.8%	49.7%	100.0%	

AM PEAK HOUR	Research Park Dr					Richards Blvd/Cowell Blvd					Research Park Dr					Richards Blvd/Cowell Blvd					
	Southbound					Westbound					Northbound					Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	8	3	25	0	36	6	89	4	0	99	23	1	6	0	30	49	120	30	7	206	371
8:15	1	6	17	0	24	9	98	3	0	110	15	1	14	0	30	45	111	32	6	194	358
8:30	6	5	25	0	36	9	167	10	0	186	15	3	6	0	24	41	123	32	10	206	452
8:45	7	5	15	0	27	6	133	3	0	142	11	1	4	0	16	22	103	39	7	171	356
Total Volume	22	19	82	0	123	30	487	20	0	537	64	6	30	0	100	157	457	133	30	777	1537
% App Total	17.9%	15.4%	66.7%	0.0%		5.6%	90.7%	3.7%	0.0%		64.0%	6.0%	30.0%	0.0%		20.2%	58.8%	17.1%	3.9%		
PHF	.688	.792	.820	.000	.854	.833	.729	.500	.000	.722	.696	.500	.536	.000	.833	.801	.929	.853	.750	.943	.850

NOON PEAK	Research Park Dr					Richards Blvd/Cowell Blvd					Research Park Dr					Richards Blvd/Cowell Blvd					
	Southbound					Westbound					Northbound					Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	9	7	19	0	35	4	114	8	0	126	15	1	6	0	22	31	97	12	12	152	335
12:45	12	7	23	0	42	6	128	8	0	142	14	0	5	0	19	26	133	16	16	191	394
13:00	14	6	18	0	38	8	124	5	0	137	10	1	3	0	14	36	110	24	14	184	373
13:15	13	6	29	0	48	5	114	6	0	125	17	1	9	0	27	30	150	16	8	204	404
Total Volume	48	26	89	0	163	23	480	27	0	530	56	3	23	0	82	123	490	68	50	731	1506
% App Total	29.4%	16.0%	54.6%	0.0%		4.3%	90.6%	5.1%	0.0%		68.3%	3.7%	28.0%	0.0%		16.8%	67.0%	9.3%	6.8%		
PHF	.857	.929	.767	.000	.849	.719	.938	.844	.000	.933	.824	.750	.639	.000	.759	.854	.817	.708	.781	.896	.932

PM PEAK HOUR	Research Park Dr					Richards Blvd/Cowell Blvd					Research Park Dr					Richards Blvd/Cowell Blvd					
	Southbound					Westbound					Northbound					Eastbound					
START TIME	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	LEFT	THRU	RIGHT	UTURNS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	5	2	46	0	53	5	136	9	0	150	38	3	16	0	57	64	164	16	16	260	520
17:15	13	3	29	0	45	7	144	9	0	160	11	8	11	0	30	67	189	17	17	290	525
17:30	7	3	29	0	39	5	115	11	0	131	26	10	8	0	44	49	169	18	15	251	465
17:45	12	2	22	0	36	8	135	6	0	149	17	4	5	0	26	58	197	7	18	280	491
Total Volume	37	10	126	0	173	25	530	35	0	590	92	25	40	0	157	238	719	58	66	1081	2001
% App Total	21.4%	5.8%	72.8%	0.0%		4.2%	89.8%	5.9%	0.0%		58.6%	15.9%	25.5%	0.0%		22.0%	66.5%	5.4%	6.1%		
PHF	.712	.833	.685	.000	.816	.781	.920	.795	.000	.922	.605	.625	.625	.000	.689	.888	.912	.806	.917	.932	.953

ALL TRAFFIC DATA

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

(916) 771-8700
orders@atdtraffic.com

File Name : 16-7381-009 Research Park Dr & Richards Blvd/Cowell Blvd
Date : 5/18/2016

Bank 1 Count = Bikes & Peds

	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	0	0	0	4	0	0	3	4	1	0	2	1	3	0	0	0	0	0	7	4
7:15	0	0	0	1	0	1	2	0	4	3	0	0	0	0	0	0	0	0	0	0	3	5
7:30	0	1	0	0	1	3	5	1	3	9	0	1	0	0	1	0	2	2	1	4	15	4
7:45	0	2	0	2	2	5	3	0	5	8	0	1	2	2	3	0	0	0	3	0	13	12
Total	0	3	0	3	3	13	10	1	15	24	1	2	4	3	7	0	2	2	4	4	38	25
8:00	0	3	0	0	3	1	0	0	1	1	0	1	2	3	3	0	1	3	3	4	11	7
8:15	0	0	0	0	0	5	3	0	4	8	0	2	1	2	3	0	0	0	2	0	11	8
8:30	0	1	0	0	1	9	4	1	7	14	0	1	0	7	1	1	1	0	3	2	18	17
8:45	0	0	0	3	0	12	11	0	1	23	0	2	0	2	2	0	1	1	2	2	27	8
Total	0	4	0	3	4	27	18	1	13	46	0	6	3	14	9	1	3	4	10	8	67	40
11:30	0	1	0	2	1	3	3	0	7	6	0	0	0	3	0	0	0	0	0	0	7	12
11:45	0	0	0	1	0	0	3	0	5	3	0	0	2	5	2	1	0	0	2	1	6	13
12:00	0	1	0	5	1	4	2	0	4	6	0	3	4	2	7	0	4	0	3	4	18	14
12:15	0	0	1	1	1	1	1	0	3	2	0	0	1	2	1	0	1	0	4	1	5	10
Total	0	2	1	9	3	8	9	0	19	17	0	3	7	12	10	1	5	0	9	6	36	49
12:30	0	1	0	3	1	5	0	0	7	5	0	0	1	3	1	0	2	1	2	3	10	15
12:45	0	1	0	0	1	4	3	0	3	7	1	0	0	4	1	0	1	0	5	1	10	12
13:00	0	0	0	5	0	2	2	0	2	4	0	3	6	0	9	0	1	1	10	2	15	17
13:15	0	1	0	1	1	1	1	0	3	2	0	1	1	7	2	0	2	0	2	2	7	13
Total	0	3	0	9	3	12	6	0	15	18	1	4	8	14	13	0	6	2	19	8	42	57
16:00	0	0	0	0	0	1	2	0	4	3	0	1	6	3	7	0	2	1	2	3	13	9
16:15	0	2	0	1	2	0	0	0	1	0	0	2	7	5	9	0	1	1	3	2	13	10
16:30	0	1	0	2	1	0	1	0	2	1	0	0	5	1	5	1	0	1	5	2	9	10
16:45	0	0	0	2	0	2	3	0	7	5	0	1	6	6	7	0	0	0	5	0	12	20
Total	0	3	0	5	3	3	6	0	14	9	0	4	24	15	28	1	3	3	15	7	47	49
17:00	0	2	0	0	2	2	1	0	8	3	0	1	10	6	11	0	5	0	2	5	21	16
17:15	2	4	0	2	6	1	1	0	2	2	0	1	7	2	8	0	6	0	2	6	22	8
17:30	1	1	0	4	2	0	0	0	4	0	0	1	2	2	3	0	1	0	6	1	6	16
17:45	0	3	0	0	3	4	2	1	2	7	0	2	8	6	10	1	3	1	2	5	25	10
Total	3	10	0	6	13	7	4	1	16	12	0	5	27	16	32	1	15	1	12	17	74	50
Grand Total	3	25	1	35	29	70	53	3	92	126	2	24	73	74	99	4	34	12	69	50	304	270
Apprch %	10.3%	86.2%	3.4%			55.6%	42.1%	2.4%			2.0%	24.2%	73.7%			8.0%	68.0%	24.0%				
Total %	1.0%	8.2%	0.3%		9.5%	23.0%	17.4%	1.0%		41.4%	0.7%	7.9%	24.0%		32.6%	1.3%	11.2%	3.9%		16.4%	100.0%	

AM PEAK HOUR	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	3	0	0	3	1	0	0	1	1	0	1	2	3	3	0	1	3	3	4	11
8:15	0	0	0	0	0	5	3	0	4	8	0	2	1	2	3	0	0	0	2	0	11
8:30	0	1	0	0	1	9	4	1	7	14	0	1	0	7	1	1	1	0	3	2	18
8:45	0	0	0	3	0	12	11	0	1	23	0	2	0	2	2	0	1	1	2	2	27
Total Volume	0	4	0	3	4	27	18	1	13	46	0	6	3	14	9	1	3	4	10	8	67
% App Total	0.0%	100.0%	0.0%			58.7%	39.1%	2.2%			0.0%	66.7%	33.3%			12.5%	37.5%	50.0%			
PHF	.000	.333	.000		.333	.563	.409	.250		.500	.000	.750	.375		.750	.250	.750	.333		.500	.620

NOON PEAK	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	1	0	3	1	5	0	0	7	5	0	0	1	3	1	0	2	1	2	3	10
12:45	0	1	0	0	1	4	3	0	3	7	1	0	0	4	1	0	1	0	5	1	10
13:00	0	0	0	5	0	2	2	0	2	4	0	3	6	0	9	0	1	1	10	2	15
13:15	0	1	0	1	1	1	1	0	3	2	0	1	1	7	2	0	2	0	2	2	7
Total Volume	0	3	0	9	3	12	6	0	15	18	1	4	8	14	13	0	6	2	19	8	42
% App Total	0.0%	100.0%	0.0%			66.7%	33.3%	0.0%			7.7%	30.8%	61.5%			0.0%	75.0%	25.0%			
PHF	.000	.750	.000		.750	.600	.500	.000		.643	.250	.333	.333		.361	.000	.750	.500		.667	.700

PM PEAK HOUR	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	2	0	0	2	2	1	0	8	3	0	1	10	6	11	0	5	0	2	5	21
17:15	2	4	0	2	6	1	1	0	2	2	0	1	7	2	8	0	6	0	2	6	22
17:30	1	1	0	4	2	0	0	0	4	0	0	1	2	2	3	0	1	0	6	1	6
17:45	0	3	0	0	3	4	2	1	2	7	0	2	8	6	10	1	3	1	2	5	25
Total Volume	3	10	0	6	13	7	4	1	16	12	0	5	27	16	32	1	15	1	12	17	74
% App Total	23.1%	76.9%	0.0%			58.3%	33.3%	8.3%			0.0%	15.6%	84.4%			5.9%	88.2%	5.9%			
PHF	.375	.625	.000		.542	.438	.500	.250		.429	.000	.625	.675		.727	.250	.625	.250		.708	.740

ALL TRAFFIC DATA

(916) 771-8700
orders@atdtraffic.com

City of Davis
All Vehicles & Uturns On Unshifted
Bikes & Peds On Bank 1
Heavy Trucks On Bank 2

File Name : 16-7381-009 Research Park Dr & Richards Blvd/Cowell Blvd
Date : 5/18/2016

Bank 2 Count = Heavy Trucks

	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound						
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total	Peds Total
7:00	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	3	6	0
7:15	0	0	0	0	0	0	1	1	0	2	1	0	0	0	1	1	4	1	0	6	9	0
7:30	0	0	0	0	0	0	5	0	0	5	0	0	1	0	1	2	2	1	0	5	11	0
7:45	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	1	4	1	0	6	8	0
Total	0	0	0	0	0	0	10	1	0	11	2	0	1	0	3	4	13	3	0	20	34	0
8:00	0	0	1	0	1	0	2	0	0	2	1	0	0	0	1	1	3	2	0	6	10	0
8:15	1	0	0	0	1	0	4	0	0	4	1	0	0	0	1	2	2	0	0	4	10	0
8:30	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	8	0
8:45	0	0	0	0	0	0	2	0	0	2	3	0	0	0	3	1	3	3	0	7	12	0
Total	1	0	1	0	2	0	13	0	0	13	5	0	0	0	5	4	11	5	0	20	40	0
11:30	2	0	1	0	3	0	2	0	0	2	3	0	0	0	3	1	2	0	0	3	11	0
11:45	0	0	1	0	1	0	3	0	0	3	1	0	0	0	1	0	2	1	0	3	8	0
12:00	0	1	0	0	1	0	4	1	0	5	0	0	0	0	0	0	7	0	0	7	13	0
12:15	0	0	1	0	1	0	3	0	0	3	1	0	0	0	1	1	2	1	0	4	9	0
Total	2	1	3	0	6	0	12	1	0	13	5	0	0	0	5	2	13	2	0	17	41	0
12:30	0	1	0	0	1	0	3	0	0	3	1	0	0	0	1	0	4	0	0	4	9	0
12:45	0	0	2	0	2	1	2	0	0	3	1	0	2	0	3	1	1	2	0	4	12	0
13:00	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	3	2	2	0	7	9	0
13:15	0	1	2	0	3	0	2	0	0	2	1	0	0	0	1	0	4	0	0	4	10	0
Total	0	2	4	0	6	1	8	0	0	9	4	0	2	0	6	4	11	4	0	19	40	0
16:00	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	1	2	0	0	3	5	0
16:15	0	0	1	0	1	0	2	0	0	2	0	0	0	0	0	3	4	0	0	7	10	0
16:30	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	0	2	1	0	3	7	0
16:45	0	0	0	0	0	0	2	0	0	2	1	0	0	0	1	2	1	0	0	3	6	0
Total	0	0	2	0	2	0	9	0	0	9	1	0	0	0	1	6	9	1	0	16	28	0
17:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3	0
17:15	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	5	0	0	5	7	0
17:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	1	4	0	0	5	8	0
17:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5	0
Total	0	0	1	0	1	0	8	0	0	8	0	0	0	0	0	1	13	0	0	14	23	0
Grand Total	3	3	11	0	17	1	60	2	0	63	17	0	3	0	20	21	70	15	0	106	206	0
Apprch %	17.6%	17.6%	64.7%			1.6%	95.2%	3.2%			85.0%	0.0%	15.0%			19.8%	66.0%	14.2%				
Total %	1.5%	1.5%	5.3%		8.3%	0.5%	29.1%	1.0%		30.6%	8.3%	0.0%	1.5%		9.7%	10.2%	34.0%	7.3%		51.5%	100.0%	

AM PEAK HOUR	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 08:00 to 09:00																					
Peak Hour For Entire Intersection Begins at 08:00																					
8:00	0	0	1	0	1	0	2	0	0	2	1	0	0	0	1	1	3	2	0	6	10
8:15	1	0	0	0	1	0	4	0	0	4	1	0	0	0	1	2	2	0	0	4	10
8:30	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	3	0	0	3	8
8:45	0	0	0	0	0	0	2	0	0	2	3	0	0	0	3	1	3	3	0	7	12
Total Volume	1	0	1	0	2	0	13	0	0	13	5	0	0	0	5	4	11	5	0	20	40
% App Total	50.0%	0.0%	50.0%			0.0%	100.0%	0.0%			100.0%	0.0%	0.0%			20.0%	55.0%	25.0%			
PHF	.250	.000	.250		.500	.000	.650	.000		.650	.417	.000	.000		.417	.500	.917	.417		.714	.833

NOON PEAK	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 12:30 to 13:30																					
Peak Hour For Entire Intersection Begins at 12:30																					
12:30	0	1	0	0	1	0	3	0	0	3	1	0	0	0	1	0	4	0	0	4	9
12:45	0	0	2	0	2	1	2	0	0	3	1	0	2	0	3	1	1	2	0	4	12
13:00	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	3	2	2	0	7	9
13:15	0	1	2	0	3	0	2	0	0	2	1	0	0	0	1	0	4	0	0	4	10
Total Volume	0	2	4	0	6	1	8	0	0	9	4	0	2	0	6	4	11	4	0	19	40
% App Total	0.0%	33.3%	66.7%			11.1%	88.9%	0.0%			66.7%	0.0%	33.3%			21.1%	57.9%	21.1%			
PHF	.000	.500	.500		.500	.250	.667	.000		.750	1.000	.000	.250		.500	.333	.688	.500		.679	.833

PM PEAK HOUR	Research Park Dr Southbound					Richards Blvd/Cowell Blvd Westbound					Research Park Dr Northbound					Richards Blvd/Cowell Blvd Eastbound					
START TIME	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	LEFT	THRU	RIGHT	PEDS	APP.TOTAL	Total
Peak Hour Analysis From 17:00 to 18:00																					
Peak Hour For Entire Intersection Begins at 17:00																					
17:00	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	2	0	0	2	3
17:15	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	5	0	0	5	7
17:30	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	1	4	0	0	5	8
17:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	2	0	0	2	5
Total Volume	0	0	1	0	1	0	8	0	0	8	0	0	0	0	0	1	13	0	0	14	23
% App Total	0.0%	0.0%	100.0%			0.0%	100.0%	0.0%			0.0%	0.0%	0.0%			7.1%	92.9%	0.0%			
PHF	.000	.000	.250		.250	.000	.667	.000		.667	.000	.000	.000		.000	.250	.650	.000		.700	.719

Richards Blvd / I-80 Interchange
AM Peak Hour Model Validation

			Directional Volumes				Two-Way Total Validation							
Segment ID	Roadway	Segment	Count AB Vol	Count BA Vol	Model AB Vol	Model BA Vol	Count Two-Way	Model Two Way	Model / Count Two-Way	Percent Deviation Two-Way	Max % Deviation Two-Way	Within Deviation Two-Way	Model - Count Two-Way	Difference Squared Two-Way
1	I-80	West of Richards Blvd	4,415	4,618	4,005	3,682	9,033	7,687	0.85	0.149	0.138	Low	-1,346	1,812,408
2	I-80	East of Richards Blvd	4,232	4,666	4,284	4,423	8,898	8,707	0.98	0.021	0.139	Acceptable	-191	36,572
3	I-80 WB Richards Blvd	Slip Off-Ramp	0	389	868	0	389	868	2.23	1.230	0.520	High	479	229,061
4	I-80 WB Richards Blvd	Loop On-Ramp	359	0	336	0	359	336	0.94	0.063	0.575	Acceptable	-23	513
5	I-80 WB Richards Blvd	Loop Off-Ramp	179	0	173	0	179	173	0.97	0.032	0.630	Acceptable	-6	32
6	I-80 WB Richards Blvd	Slip On-Ramp	0	195	287	0	195	287	1.47	0.471	0.630	Acceptable	92	8,418
7	I-80 EB Richards Blvd	Off-Ramp	0	613	533	0	613	533	0.87	0.131	0.475	Acceptable	-80	6,407
8	I-80 EB Richards Blvd	On-Ramp	334	0	1,135	0	334	1,135	3.40	2.399	0.575	High	801	641,857
9	First St	west of D St	296	464	218	235	760	453	0.60	0.404	0.410	Acceptable	-307	94,477
10	First St	between D St and E St	314	518	508	489	832	997	1.20	0.198	0.410	Acceptable	165	27,146
11	First St	east of E St	253	150	378	423	403	801	1.99	0.987	0.520	High	398	158,077
12	D St	north of First St	68	59	222	277	127	498	3.92	2.925	0.630	High	371	137,964
13	D St	south of First St	55	82	0	0	137	0	0.00	1.000	0.630	Low	-137	18,769
14	E St	north of First St	98	96	424	416	194	840	4.33	3.331	0.630	High	646	417,553
15	Richards Blvd	between First St / E St and Olive Dr	806	497	1,232	1,215	1,303	2,447	1.88	0.878	0.325	High	1,144	1,308,296
16	Richards Blvd	between Olive Dr and In-n-Out / Caffe Italia	723	604	1,412	1,461	1,327	2,874	2.17	1.166	0.325	High	1,547	2,392,797
17	Richards Blvd	between In-n-Out / Caffe Italia and I-80 WB Ramps	789	617	1,412	1,461	1,406	2,874	2.04	1.044	0.313	High	1,468	2,154,633
18	Richards Blvd	between I-80 WB Ramps and I-80 EB Ramps	759	601	1,348	881	1,360	2,229	1.64	0.639	0.325	High	869	755,455
19	Richards Blvd	between I-80 Ramps and KFC	668	789	758	894	1,457	1,652	1.13	0.134	0.313	Acceptable	195	37,950
20	Richards Blvd	between KFC and Research Park Dr	789	663	758	773	1,452	1,531	1.05	0.055	0.313	Acceptable	79	6,284
21	Richards Blvd	east of Research Park Dr	521	537	473	594	1,058	1,067	1.01	0.009	0.359	Acceptable	9	89
22	Olive Dr	east of Richards Blvd	69	281	188	330	350	518	1.48	0.481	0.575	Acceptable	168	28,363
23	Olive Dr	west of Richards Blvd	102	124	294	184	226	477	2.11	1.112	0.630	High	251	63,143
24	Research Park Dr	north of Richards Blvd	183	123	211	135	306	346	1.13	0.132	0.575	Acceptable	40	1,638
25	Research Park Dr	south of Richards Blvd	100	182	198	168	282	366	1.30	0.299	0.575	Acceptable	84	7,110
26	I-80 WB Mace Blvd	On-Ramp	0	545	549	0	545	549	1.01	0.007	0.475	Acceptable	4	13
27	I-80 EB Chiles Rd	Off-Ramp	0	299	533	0	299	533	1.78	0.782	0.575	High	234	54,735
28	I-80 WB Olive Dr	Off-Ramp	0	149	179	0	149	179	1.20	0.201	0.630	Acceptable	30	895
29	I-80 WB Old Davis Rd	Off-Ramp	0	481	399	0	481	399	0.83	0.170	0.520	Acceptable	-82	6,663
30	I-80 EB Old Davis Rd	On-Ramp	43	0	307	0	43	307	7.15	6.146	0.683	High	264	69,846
							33,824	39,697	**Total**					

30	**Total Count**
16	**Links Within Deviation**
14	**Links Outside Deviation**
1.17	**Model/Count Ratio**
53%	**Percent Within Caltrans Maximum Deviation (>75%)**
51%	**Percent Root Mean Square Error (<30%)**
0.97	**Correlation Coefficient (>0.88)**

Notes:

Study segments 1,2, and 26-30 have mainline-based peak hour counts from (which is 7:15-8:15 am for EB and 8:00-9:00 am for WB)

Study segments 3-25 are have intersection-based peak hour counts from May 2016 (which is 8:00-9:00 am)

Richards Blvd / I-80 Interchange
PM Peak Hour Model Validation

			Directional Volumes				Two-Way Total Validation							
Segment ID	**Roadway**	**Segment**	**Count AB Vol**	**Count BA Vol**	**Model AB Vol**	**Model BA Vol**	**Count Two-Way**	**Model Two Way**	**Model / Count Two-Way**	**Percent Deviation Two-Way**	**Max % Deviation Two-Way**	**Within Deviation Two-Way**	**Model - Count Two-Way**	**Difference Squared Two-Way**
1	I-80	West of Richards Blvd	4,874	4,798	4,767	3,682	9,672	8,449	0.87	0.126	0.137	Acceptable	-1,223	1,496,286
2	I-80	East of Richards Blvd	4,601	4,367	4,924	4,423	8,968	9,347	1.04	0.042	0.139	Acceptable	379	143,461
3	I-80 WB Richards Blvd	Slip Off-Ramp	0	221	817	0	221	817	3.70	2.698	0.630	High	596	355,613
4	I-80 WB Richards Blvd	Loop On-Ramp	437	0	513	0	437	513	1.17	0.175	0.520	Acceptable	76	5,823
5	I-80 WB Richards Blvd	Loop Off-Ramp	90	0	235	0	90	235	2.61	1.613	0.683	High	145	21,067
6	I-80 WB Richards Blvd	Slip On-Ramp	0	321	398	0	321	398	1.24	0.241	0.575	Acceptable	77	5,976
7	I-80 EB Richards Blvd	Off-Ramp	0	730	667	0	730	667	0.91	0.087	0.440	Acceptable	-63	4,010
8	I-80 EB Richards Blvd	On-Ramp	315	0	1,257	0	315	1,257	3.99	2.991	0.575	High	942	887,908
9	First St	west of D St	447	356	418	235	803	653	0.81	0.186	0.410	Acceptable	-150	22,385
10	First St	between D St and E St	520	433	732	489	953	1,221	1.28	0.281	0.380	Acceptable	268	71,620
11	First St	east of E St	309	243	587	423	552	1,009	1.83	0.828	0.475	High	457	209,101
12	D St	north of First St	103	135	350	277	238	627	2.63	1.633	0.630	High	389	151,096
13	D St	south of First St	129	165	0	0	294	0	0.00	1.000	0.575	Low	-294	86,436
14	E St	north of First St	124	193	337	416	317	753	2.38	1.375	0.575	High	436	190,058
15	Richards Blvd	between First St / E St and Olive Dr	734	824	1,474	1,215	1,558	2,689	1.73	0.726	0.303	High	1,131	1,279,479
16	Richards Blvd	between Olive Dr and In-n-Out / Caffe Italia	634	914	1,545	1,461	1,548	3,007	1.94	0.942	0.303	High	1,459	2,127,844
17	Richards Blvd	between In-n-Out / Caffe Italia and I-80 WB Ramps	668	956	1,545	1,461	1,624	3,007	1.85	0.851	0.303	High	1,383	1,911,895
18	Richards Blvd	between I-80 WB Ramps and I-80 EB Ramps	884	725	1,728	881	1,609	2,609	1.62	0.622	0.303	High	1,000	1,000,543
19	Richards Blvd	between I-80 Ramps and KFC	832	1,088	1,217	894	1,920	2,111	1.10	0.099	0.280	Acceptable	191	36,374
20	Richards Blvd	between KFC and Research Park Dr	1,088	814	1,217	773	1,902	1,990	1.05	0.046	0.280	Acceptable	88	7,776
21	Richards Blvd	east of Research Park Dr	803	590	822	594	1,393	1,416	1.02	0.017	0.313	Acceptable	23	534
22	Olive Dr	east of Richards Blvd	149	325	302	330	474	632	1.33	0.333	0.520	Acceptable	158	24,881
23	Olive Dr	west of Richards Blvd	111	97	387	184	208	571	2.75	1.746	0.630	High	363	131,876
24	Research Park Dr	north of Richards Blvd	298	173	340	135	471	475	1.01	0.009	0.520	Acceptable	4	19
25	Research Park Dr	south of Richards Blvd	157	93	317	168	250	485	1.94	0.941	0.575	High	235	55,343
26	I-80 WB Mace Blvd	On-Ramp	0	429	874	0	429	874	2.04	1.036	0.520	High	445	197,690
27	I-80 EB Chiles Rd	Off-Ramp	0	411	667	0	411	667	1.62	0.622	0.520	High	256	65,372
28	I-80 WB Olive Dr	Off-Ramp	0	125	198	0	125	198	1.58	0.580	0.630	Acceptable	73	5,260
29	I-80 WB Old Davis Rd	Off-Ramp	0	155	338	0	155	338	2.18	1.184	0.630	High	183	33,653
30	I-80 EB Old Davis Rd	On-Ramp	252	0	417	0	252	417	1.65	0.654	0.575	High	165	27,129

37,708	44,939	**Total**
30		**Total Count**
13		**Links Within Deviation**
17		**Links Outside Deviation**
1.19		**Model/Count Ratio**
43%		**Percent Within Caltrans Maximum Deviation (>75%)**
47%		**Percent Root Mean Square Error (<30%)**
0.97		**Correlation Coefficient (>0.88)**

Notes:
Study segments 1,2, and 26-30 have mainline-based peak hour counts from (which is 4:00-5:00 pm for EB and 4:15-5:15 pm for WB)
Study segments 3-25 are have intersection-based peak hour counts from May 2016 (which is 4:45-5:45 pm)

I-80 / Richards Blvd PDT
VISSIM Calibration
Existing AM Peak Hour

			Measured Volumes	Modeled Conditions				Link Flow Criteria		Link GEH Criteria	
			Demand	Served Volume	Difference			Measure	Meets	Target	Meets
ID	Link	Direction	Volume (vph)	(vph)	vph	%	GEH		Target?		Target?
19	D St S. of 1st St	NB	55	54.7	-0.3	-0.5%	0.0	+/- 100 vph	Yes	< 5	Yes
20	D St S. of 1st St	SB	82	76.3	-5.7	-7.0%	0.6	+/- 100 vph	Yes	< 5	Yes
21	D St between 1st St and 2nd St	NB	68	59.3	-8.7	-12.8%	1.1	+/- 100 vph	Yes	< 5	Yes
22	D St between 2nd St and 1st St	SB	59	58.8	-0.2	-0.3%	0.0	+/- 100 vph	Yes	< 5	Yes
23	1st St between C St and D St	EB	296	301.5	5.5	1.9%	0.3	+/- 100 vph	Yes	< 5	Yes
24	1st St between D St and C St	WB	464	465.6	1.6	0.3%	0.1	+/- 100 vph	Yes	< 5	Yes
25	1st St between D St and E St / Richards Blvd	EB	314	319.7	5.7	1.8%	0.3	+/- 100 vph	Yes	< 5	Yes
26	1st St between E St / Richards Blvd and D St	WB	518	507.4	-10.6	-2.0%	0.5	+/- 100 vph	Yes	< 5	Yes
27	Richards Blvd between Olive Dr and 1st St	NB	806	785.9	-20.1	-2.5%	0.7	+/- 400 vph	Yes	< 5	Yes
28	Richards Blvd between 1st St and Olive Dr	SB	497	502.1	5.1	1.0%	0.2	+/- 100 vph	Yes	< 5	Yes
29	E St between 1st St and 2nd St	NB	98	101.2	3.2	3.3%	0.3	+/- 100 vph	Yes	< 5	Yes
30	E St between 2nd St and 1st St	SB	96	95.3	-0.7	-0.7%	0.1	+/- 100 vph	Yes	< 5	Yes
31	1st St between E St / Richards Blvd and F St	EB	253	238.5	-14.5	-5.7%	0.9	+/- 100 vph	Yes	< 5	Yes
32	1st St between F St and E St / Richards Blvd	WB	150	148.6	-1.4	-0.9%	0.1	+/- 100 vph	Yes	< 5	Yes
33	Richards Blvd between Hotel and Olive Dr	NB	723	714.6	-8.4	-1.2%	0.3	+/- 400 vph	Yes	< 5	Yes
34	Richards Blvd between Olive Dr and Hotel	SB	604	607.2	3.2	0.5%	0.1	+/- 100 vph	Yes	< 5	Yes
35	Olive Dr west of Richards Blvd	EB	102	101.6	-0.4	-0.4%	0.0	+/- 100 vph	Yes	< 5	Yes
36	Olive Dr west of Richards Blvd	WB	124	121.9	-2.1	-1.7%	0.2	+/- 100 vph	Yes	< 5	Yes
37	Olive Dr between Richards Blvd and Dwy	EB	69	69.2	0.2	0.3%	0.0	+/- 100 vph	Yes	< 5	Yes
38	Olive Dr between Dwy and Richards Blvd	WB	281	268.6	-12.4	-4.4%	0.7	+/- 100 vph	Yes	< 5	Yes
39	Richards Blvd between Olive Dr and I-80 WB Ramps	SB	617	617.5	0.5	0.1%	0.0	+/- 100 vph	Yes	< 5	Yes
40	Richards Blvd between I-80 WB Ramps and Olive Dr	NB	789	778.6	-10.4	-1.3%	0.4	+/- 400 vph	Yes	< 5	Yes
41	I-80 WB Off-Ramp to Richards Blvd NB	WB	389	380.2	-8.8	-2.3%	0.4	+/- 100 vph	Yes	< 5	Yes
42	I-80 WB On-Ramp from Richards Blvd NB	EB	359	357.5	-1.5	-0.4%	0.1	+/- 100 vph	Yes	< 5	Yes
43	I-80 WB Off-Ramp to Richards Blvd SB	EB	179	178.5	-0.5	-0.3%	0.0	+/- 100 vph	Yes	< 5	Yes
44	I-80 WB On-Ramp to Richards Blvd SB	WB	195	189.8	-5.2	-2.7%	0.4	+/- 100 vph	Yes	< 5	Yes
45	Richards Blvd from I-80 WB Ramps to I-80 EB Ramps	SB	601	606.2	5.2	0.9%	0.2	+/- 100 vph	Yes	< 5	Yes
46	Richards Blvd from I-80 EB Ramps to I-80 WB Ramps	NB	759	755.9	-3.1	-0.4%	0.1	+/- 400 vph	Yes	< 5	Yes
47	I-80 EB Off-Ramp to Richards Blvd	WB	613	611.9	-1.1	-0.2%	0.0	+/- 100 vph	Yes	< 5	Yes
48	I-80 EB On-Ramp from Richards Blvd	EB	334	338	4	1.2%	0.2	+/- 100 vph	Yes	< 5	Yes
49	Richards Blvd from I-80 EB Ramps to KFC	SB	789	793.1	4.1	0.5%	0.1	+/- 400 vph	Yes	< 5	Yes
50	Richards Blvd from KFC to I-80 EB Ramps	NB	668	672.9	4.9	0.7%	0.2	+/- 100 vph	Yes	< 5	Yes
51	Richards Blvd from KFC to Research Park Dr	EB	789	790.8	1.8	0.2%	0.1	+/- 400 vph	Yes	< 5	Yes
52	Richards Blvd from Research Park Dr to KFC	WB	663	667.8	4.8	0.7%	0.2	+/- 100 vph	Yes	< 5	Yes
53	Cowell Blvd from Research Park Dr to Drew Ave	EB	521	522.1	1.1	0.2%	0.0	+/- 100 vph	Yes	< 5	Yes
54	Cowell Blvd from Drew Ave to Research Park Dr	WB	537	543.2	6.2	1.2%	0.3	+/- 100 vph	Yes	< 5	Yes
55	Research Park Dr from Richards Blvd / Cowell Blvd to Drew Av	NB	183	186.6	3.6	2.0%	0.3	+/- 100 vph	Yes	< 5	Yes
56	Research Park Dr from Drew Ave to Richards Blvd / Cowell Blv	SB	123	123.1	0.1	0.1%	0.0	+/- 100 vph	Yes	< 5	Yes
57	Research Park Dr from to Richards Blvd / Cowell Blvd	NB	100	99.9	-0.1	-0.1%	0.0	+/- 100 vph	Yes	< 5	Yes
58	Research Park Dr from Richards Blvd / Cowell Blvd to	SB	182	180.5	-1.5	-0.8%	0.1	+/- 100 vph	Yes	< 5	Yes
	Total		15049	14992.1	-56.9	-0.4%	0.5	+/- 5%	Yes	<4	Yes

All Link Flows			
Link Flow Criteria		Link GEH Criteria	
Measure	% Cases	Measure	% Cases
> 85%	100%	> 85%	100%
Met Target		**Met Target**	

I-80 / Richards Blvd PDT
VISSIM Calibration
Existing PM Peak Hour

			Measured Volumes	Modeled Conditions				Link Flow Criteria		Link GEH Criteria	
			Demand	Served Volume	Difference			Measure	Meets	Target	Meets
ID	Link	Direction	Volume (vph)	(vph)	vph	%	GEH		Target?		Target?
19	D St S. of 1st St	NB	129	129	0	0.0%	0.0	+/- 100 vph	Yes	< 5	Yes
20	D St S. of 1st St	SB	165	163	-2	-1.2%	0.2	+/- 100 vph	Yes	< 5	Yes
21	D St between 1st St and 2nd St	NB	103	104.9	1.9	1.8%	0.2	+/- 100 vph	Yes	< 5	Yes
22	D St between 2nd St and 1st St	SB	135	134.4	-0.6	-0.4%	0.1	+/- 100 vph	Yes	< 5	Yes
23	1st St between C St and D St	EB	447	449.7	2.7	0.6%	0.1	+/- 100 vph	Yes	< 5	Yes
24	1st St between D St and C St	WB	356	351.1	-4.9	-1.4%	0.3	+/- 100 vph	Yes	< 5	Yes
25	1st St between D St and E St / Richards Blvd	EB	520	530.5	10.5	2.0%	0.5	+/- 100 vph	Yes	< 5	Yes
26	1st St between E St / Richards Blvd and D St	WB	433	431.1	-1.9	-0.4%	0.1	+/- 100 vph	Yes	< 5	Yes
27	Richards Blvd between Olive Dr and 1st St	NB	734	728.6	-5.4	-0.7%	0.2	+/- 400 vph	Yes	< 5	Yes
28	Richards Blvd between 1st St and Olive Dr	SB	824	823.2	-0.8	-0.1%	0.0	+/- 400 vph	Yes	< 5	Yes
29	E St between 1st St and 2nd St	NB	124	125.4	1.4	1.1%	0.1	+/- 100 vph	Yes	< 5	Yes
30	E St between 2nd St and 1st St	SB	193	188.1	-4.9	-2.5%	0.4	+/- 100 vph	Yes	< 5	Yes
31	1st St between E St / Richards Blvd and F St	EB	309	302.5	-6.5	-2.1%	0.4	+/- 100 vph	Yes	< 5	Yes
32	1st St between F St and E St / Richards Blvd	WB	243	238.8	-4.2	-1.7%	0.3	+/- 100 vph	Yes	< 5	Yes
33	Richards Blvd between Hotel and Olive Dr	NB	634	621.5	-12.5	-2.0%	0.5	+/- 100 vph	Yes	< 5	Yes
34	Richards Blvd between Olive Dr and Hotel	SB	914	904.2	-9.8	-1.1%	0.3	+/- 400 vph	Yes	< 5	Yes
35	Olive Dr west of Richards Blvd	EB	111	111.2	0.2	0.2%	0.0	+/- 100 vph	Yes	< 5	Yes
36	Olive Dr west of Richards Blvd	WB	97	95	-2	-2.1%	0.2	+/- 100 vph	Yes	< 5	Yes
37	Olive Dr between Richards Blvd and Dwy	EB	149	148.3	-0.7	-0.5%	0.1	+/- 100 vph	Yes	< 5	Yes
38	Olive Dr between Dwy and Richards Blvd	WB	325	316.2	-8.8	-2.7%	0.5	+/- 100 vph	Yes	< 5	Yes
39	Richards Blvd between Olive Dr and I-80 WB Ramps	SB	956	929.3	-26.7	-2.8%	0.9	+/- 400 vph	Yes	< 5	Yes
40	Richards Blvd between I-80 WB Ramps and Olive Dr	NB	668	656.5	-11.5	-1.7%	0.4	+/- 100 vph	Yes	< 5	Yes
41	I-80 WB Off-Ramp to Richards Blvd NB	WB	221	217.9	-3.1	-1.4%	0.2	+/- 100 vph	Yes	< 5	Yes
42	I-80 WB On-Ramp from Richards Blvd NB	EB	437	413.6	-23.4	-5.4%	1.1	+/- 100 vph	Yes	< 5	Yes
43	I-80 WB Off-Ramp to Richards Blvd SB	EB	90	89.5	-0.5	-0.6%	0.1	+/- 100 vph	Yes	< 5	Yes
44	I-80 WB On-Ramp to Richards Blvd SB	WB	321	307.2	-13.8	-4.3%	0.8	+/- 100 vph	Yes	< 5	Yes
45	Richards Blvd from I-80 WB Ramps to I-80 EB Ramps	SB	725	711.6	-13.4	-1.8%	0.5	+/- 400 vph	Yes	< 5	Yes
46	Richards Blvd from I-80 EB Ramps to I-80 WB Ramps	NB	884	852.2	-31.8	-3.6%	1.1	+/- 400 vph	Yes	< 5	Yes
47	I-80 EB Off-Ramp to Richards Blvd	WB	730	702.1	-27.9	-3.8%	1.0	+/- 400 vph	Yes	< 5	Yes
48	I-80 EB On-Ramp from Richards Blvd	EB	315	306.5	-8.5	-2.7%	0.5	+/- 100 vph	Yes	< 5	Yes
49	Richards Blvd from I-80 EB Ramps to KFC	SB	1088	1052	-36	-3.3%	1.1	+/- 400 vph	Yes	< 5	Yes
50	Richards Blvd from KFC to I-80 EB Ramps	NB	832	802.3	-29.7	-3.6%	1.0	+/- 400 vph	Yes	< 5	Yes
51	Richards Blvd from KFC to Research Park Dr	EB	1088	1056.6	-31.4	-2.9%	1.0	+/- 400 vph	Yes	< 5	Yes
52	Richards Blvd from Research Park Dr to KFC	WB	814	819.1	5.1	0.6%	0.2	+/- 400 vph	Yes	< 5	Yes
53	Cowell Blvd from Research Park Dr to Drew Ave	EB	803	794.3	-8.7	-1.1%	0.3	+/- 400 vph	Yes	< 5	Yes
54	Cowell Blvd from Drew Ave to Research Park Dr	WB	590	602.1	12.1	2.1%	0.5	+/- 100 vph	Yes	< 5	Yes
55	Research Park Dr from Richards Blvd / Cowell Blvd to Drew Av	NB	298	288.7	-9.3	-3.1%	0.5	+/- 100 vph	Yes	< 5	Yes
56	Research Park Dr from Drew Ave to Richards Blvd / Cowell Bl	SB	173	173.5	0.5	0.3%	0.0	+/- 100 vph	Yes	< 5	Yes
57	Research Park Dr from to Richards Blvd / Cowell Blvd	NB	157	157.7	0.7	0.4%	0.1	+/- 100 vph	Yes	< 5	Yes
58	Research Park Dr from Richards Blvd / Cowell Blvd to	SB	93	87.8	-5.2	-5.6%	0.5	+/- 100 vph	Yes	< 5	Yes
	Total		18228	17917.2	-310.8	-1.7%	2.3	+/- 5%	Yes	<4	Yes

All Link Flows			
Link Flow Criteria		Link GEH Criteria	
Measure	% Cases	Measure	% Cases
> 85%	100%	> 85%	100%
Met Target		**Met Target**	

Vissim Post-Processor
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I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
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Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	12	11	93.3%	2.7	7	15	0.2	51.2	27.6	4.5	84.5	D
	Through	15	14	94.7%	1.9	12	17	0.2	52.1	29.6	28.7	90.5	D
	Right Turn	28	29	104.6%	2.9	25	33	0.2	5.9	0.6	3.6	7.4	A
	Subtotal	55	55	99.5%	0.7	54	56	0.0	30.4	14.0	15.7	47.5	C
SB	Left Turn	24	23	95.4%	2.6	20	28	0.2	51.0	17.4	28.5	86.9	D
	Through	20	20	98.0%	2.5	16	24	0.1	55.4	10.2	29.7	65.8	E
	Right Turn	15	16	108.7%	2.5	13	21	0.3	16.0	11.1	6.7	41.3	B
	Subtotal	59	59	99.7%	0.4	58	59	0.0	45.5	9.6	24.1	68.5	D
EB	Left Turn	3	3	90.0%	1.4	0	5	0.2	33.7	40.6	0.0	126.2	C
	Through	262	269	102.7%	7.1	258	280	0.4	10.5	2.9	8.7	14.4	B
	Right Turn	31	30	96.1%	5.9	21	40	0.2	11.5	10.0	2.7	32.1	B
	Subtotal	296	302	101.9%	2.1	297	305	0.3	11.0	3.4	8.9	15.1	B
WB	Left Turn	31	27	86.8%	5.3	17	32	0.8	68.5	9.8	48.4	87.7	E
	Through	437	438	100.3%	13.1	417	456	0.1	2.6	1.5	0.5	5.1	A
	Right Turn	50	42	84.8%	7.4	30	53	1.1	2.4	1.9	0.6	6.2	A
	Subtotal	518	507	98.0%	16.6	486	526	0.5	6.9	2.1	2.9	8.8	A
Total		928	922	99.4%	17.6	898	942	0.2	12.7	2.5	8.3	15.7	B

Vissim Post-Processor
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Existing Conditions (May 2016)
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Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	491	482	98.1%	14.5	461	501	0.4	29.6	2.9	25.5	34.1	C
	Through	86	89	102.9%	12.6	70	108	0.3	29.0	6.6	11.5	35.9	C
	Right Turn	229	216	94.3%	16.5	184	248	0.9	15.1	3.7	9.3	20.9	B
	Subtotal	806	786	97.5%	16.7	750	811	0.7	25.6	2.9	19.2	28.0	C
SB	Left Turn	1	1	100.0%	1.1	0	3	0.0	11.9	33.2	0.0	105.7	B
	Through	85	84	99.1%	4.3	76	90	0.1	44.0	9.5	26.9	55.7	D
	Right Turn	10	10	101.0%	2.9	6	17	0.0	12.4	7.7	0.0	24.0	B
	Subtotal	96	95	99.3%	1.5	93	98	0.1	40.2	9.3	24.8	52.9	D
EB	Left Turn	9	9	104.4%	3.4	4	14	0.1	67.7	32.5	12.2	116.1	E
	Through	23	22	93.9%	4.8	14	31	0.3	75.5	29.9	41.2	139.5	E
	Right Turn	282	289	102.4%	9.6	277	305	0.4	11.9	2.1	8.7	16.2	B
	Subtotal	314	320	101.8%	8.6	308	332	0.3	17.2	3.3	12.1	21.2	B
WB	Left Turn	130	129	99.4%	2.5	126	134	0.1	61.7	11.3	42.4	86.5	E
	Through	17	16	94.7%	1.9	13	19	0.2	42.0	12.7	23.5	60.2	D
	Right Turn	3	3	110.0%	1.6	1	6	0.2	20.5	28.5	0.0	74.9	C
	Subtotal	150	149	99.1%	1.0	147	150	0.1	59.0	10.7	39.2	81.3	E
Total		1,366	1,350	98.8%	17.1	1,318	1,367	0.4	28.8	2.2	24.1	32.5	C

Vissim Post-Processor
Average Results from 10 Runs
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I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
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Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	80	81	100.6%	10.3	66	97	0.1	138.1	44.3	81.4	242.7	F
	Through	612	604	98.7%	17.7	571	625	0.3	94.8	33.2	39.4	154.7	F
	Right Turn	31	30	96.8%	4.0	23	34	0.2	34.0	18.1	10.5	71.0	C
	Subtotal	723	715	98.8%	26.3	668	752	0.3	97.2	30.8	43.6	150.8	F
SB	Left Turn	31	31	100.6%	6.6	20	38	0.0	38.3	19.0	11.4	74.1	D
	Through	440	447	101.5%	9.7	426	460	0.3	13.1	3.2	8.2	17.0	B
	Right Turn	26	24	91.2%	4.8	18	32	0.5	12.7	6.9	4.4	28.4	B
	Subtotal	497	501	100.9%	10.9	487	521	0.2	14.5	3.0	10.4	18.0	B
EB	Left Turn	37	36	96.8%	3.0	32	40	0.2	42.2	15.1	18.2	68.2	D
	Through	7	8	114.3%	2.0	5	11	0.4	28.6	17.7	0.0	49.7	C
	Right Turn	58	58	99.7%	2.3	55	62	0.0	17.6	9.5	6.9	33.8	B
	Subtotal	102	102	99.6%	1.6	99	104	0.0	28.0	10.9	13.0	44.4	C
WB	Left Turn	106	103	97.1%	7.1	88	110	0.3	86.9	33.1	42.0	134.2	F
	Through	18	18	98.3%	4.1	13	24	0.1	144.6	71.8	52.3	298.5	F
	Right Turn	157	148	94.3%	7.5	134	157	0.7	138.9	58.3	53.4	242.6	F
	Subtotal	281	269	95.6%	7.5	256	279	0.7	118.9	47.2	48.3	195.3	F
Total		1,603	1,586	99.0%	29.6	1,528	1,617	0.4	69.2	12.6	52.6	94.9	E

Vissim Post-Processor
Average Results from 10 Runs
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I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
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Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	64	62	96.4%	6.5	51	75	0.3	18.4	16.9	2.7	55.2	C
	Through	336	337	100.2%	18.1	302	361	0.0	38.6	21.6	8.1	76.0	E
	Right Turn	359	358	99.6%	11.1	337	374	0.1	2.9	0.8	1.7	4.4	A
	Subtotal	759	756	99.6%	15.4	729	775	0.1	19.0	10.6	5.2	37.9	C
SB	Left Turn												
	Through	422	428	101.4%	15.1	403	450	0.3	1.3	0.4	0.7	2.1	A
	Right Turn	195	190	97.3%	10.6	175	210	0.4	4.4	0.7	3.1	5.2	A
	Subtotal	617	618	100.1%	15.0	587	633	0.0	2.2	0.4	1.5	2.9	A
EB	Left Turn												
	Through												
	Right Turn	179	179	99.7%	1.3	177	181	0.0	0.8	0.2	0.6	1.1	A
	Subtotal	179	179	99.7%	1.3	177	181	0.0	0.8	0.2	0.6	1.1	A
WB	Left Turn												
	Through												
	Right Turn	389	380	97.7%	5.9	371	388	0.4	51.3	38.6	8.6	126.2	F
	Subtotal	389	380	97.7%	5.9	371	388	0.4	51.3	38.6	8.6	126.2	F
Total		1,944	1,932	99.4%	24.3	1,900	1,970	0.3	18.0	10.2	4.7	39.2	C

Vissim Post-Processor
Average Results from 10 Runs
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Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn												
	Through	575	580	100.8%	17.0	561	609	0.2	26.4	3.0	22.8	33.4	C
	Right Turn	93	93	100.2%	9.8	77	108	0.0	17.4	6.4	9.5	28.4	B
	Subtotal	668	673	100.7%	13.8	648	692	0.2	25.2	2.9	21.0	31.1	C
SB	Left Turn	241	245	101.6%	11.9	226	264	0.2	54.1	5.4	43.1	60.4	D
	Through	360	362	100.5%	11.1	346	383	0.1	14.1	2.3	11.8	17.3	B
	Right Turn												
	Subtotal	601	607	100.9%	13.7	581	626	0.2	30.2	2.5	25.3	34.6	C
EB	Left Turn												
	Through												
	Right Turn												
	Subtotal												
WB	Left Turn	429	431	100.5%	14.4	402	451	0.1	60.7	14.1	44.9	92.8	E
	Through												
	Right Turn	184	181	98.2%	9.2	170	199	0.3	30.5	13.0	15.7	59.7	C
	Subtotal	613	612	99.8%	7.7	601	628	0.0	51.7	14.0	36.1	82.8	D
Total		1,882	1,891	100.5%	20.7	1,859	1,920	0.2	36.5	5.4	29.6	48.8	D

Vissim Post-Processor
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Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	64	63	98.6%	6.6	51	72	0.1	53.7	11.4	39.4	75.6	D
	Through	6	6	98.3%	2.9	2	10	0.0	36.7	23.1	0.0	73.3	D
	Right Turn	30	31	103.0%	6.4	24	44	0.2	10.9	4.2	6.8	18.0	B
	Subtotal	100	100	99.9%	1.7	97	102	0.0	42.1	7.9	32.4	56.5	D
SB	Left Turn	22	26	116.8%	3.9	20	32	0.8	57.5	14.3	37.2	75.1	E
	Through	19	18	96.8%	3.4	14	23	0.1	36.7	16.6	1.1	57.5	D
	Right Turn	82	79	96.3%	3.6	72	84	0.3	11.1	5.7	4.3	21.8	B
	Subtotal	123	123	100.1%	3.2	116	127	0.0	26.0	7.0	15.3	36.8	C
EB	Left Turn	187	191	102.0%	7.0	178	201	0.3	49.7	6.2	38.0	57.5	D
	Through	469	466	99.3%	19.1	427	492	0.2	31.4	5.0	22.7	37.9	C
	Right Turn	133	135	101.2%	9.6	119	148	0.1	27.2	6.1	14.8	34.3	C
	Subtotal	789	791	100.2%	18.8	758	826	0.1	35.1	4.4	27.4	42.6	D
WB	Left Turn	30	28	91.7%	5.7	19	36	0.5	76.8	17.8	53.5	107.9	E
	Through	487	495	101.6%	8.3	478	505	0.4	35.2	11.7	22.4	58.8	D
	Right Turn	20	21	103.5%	4.6	12	27	0.2	13.8	10.9	3.2	34.9	B
	Subtotal	537	543	101.2%	2.7	537	547	0.3	36.6	11.4	24.3	59.0	D
Total		1,549	1,557	100.5%	21.0	1,519	1,593	0.2	35.3	5.9	26.5	45.5	D

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Existing Conditions (May 2016)
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Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	27	26	96.7%	5.4	19	33	0.2	20.8	6.3	11.6	30.1	C
	Through	41	40	97.3%	5.6	33	51	0.2	24.4	6.4	17.2	33.7	C
	Right Turn	61	63	103.3%	5.7	54	73	0.3	15.2	6.9	6.2	29.7	B
	Subtotal	129	129	100.0%	1.9	124	130	0.0	19.1	5.0	10.6	30.1	B
SB	Left Turn	85	86	100.6%	7.2	68	94	0.1	43.6	18.8	23.8	88.9	D
	Through	29	28	97.6%	5.4	21	38	0.1	44.3	17.1	16.6	87.1	D
	Right Turn	21	21	98.1%	2.6	18	25	0.1	15.7	11.7	3.3	37.1	B
	Subtotal	135	134	99.6%	2.4	129	137	0.1	40.1	17.2	18.5	84.0	D
EB	Left Turn	14	14	100.7%	3.8	9	21	0.0	91.1	35.8	45.6	172.9	F
	Through	374	377	100.7%	14.7	356	398	0.1	75.9	27.3	27.6	120.1	E
	Right Turn	59	59	99.8%	7.8	48	70	0.0	69.7	24.1	22.2	109.2	E
	Subtotal	447	450	100.6%	12.9	423	467	0.1	75.5	26.8	27.7	117.6	E
WB	Left Turn	77	76	98.4%	7.6	67	90	0.1	38.1	8.4	24.0	52.5	D
	Through	308	304	98.8%	18.4	270	335	0.2	12.0	3.8	8.2	17.7	B
	Right Turn	48	51	106.0%	8.8	35	65	0.4	7.9	2.7	4.8	13.4	A
	Subtotal	433	431	99.6%	23.6	383	471	0.1	16.2	5.1	11.9	24.6	B
Total		1,144	1,144	100.0%	27.0	1,111	1,201	0.0	43.3	11.9	19.4	63.5	D

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Existing Conditions (May 2016)
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Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	376	379	100.7%	22.9	328	416	0.1	29.6	4.9	23.4	37.8	C
	Through	108	109	101.2%	7.8	96	118	0.1	26.0	5.6	18.0	35.6	C
	Right Turn	250	241	96.2%	16.7	212	258	0.6	10.4	2.3	6.6	14.4	B
	Subtotal	734	729	99.3%	35.7	636	765	0.2	22.8	4.4	17.8	30.2	C
SB	Left Turn	6	6	106.7%	1.4	5	9	0.2	58.2	37.6	0.0	106.1	E
	Through	166	160	96.4%	6.7	146	169	0.5	59.3	5.5	53.4	70.6	E
	Right Turn	21	22	102.9%	6.3	14	35	0.1	32.6	30.1	5.4	101.6	C
	Subtotal	193	188	97.5%	2.0	186	191	0.4	56.2	5.3	49.0	66.4	E
EB	Left Turn	10	11	106.0%	2.9	7	15	0.2	91.7	44.6	0.0	179.0	F
	Through	53	56	104.7%	8.1	42	69	0.3	103.2	15.7	76.2	123.0	F
	Right Turn	457	464	101.6%	19.7	426	490	0.3	14.1	1.7	11.9	17.3	B
	Subtotal	520	531	102.0%	19.8	488	551	0.5	26.3	4.1	17.4	31.5	C
WB	Left Turn	201	199	98.9%	5.5	192	209	0.2	121.6	35.7	72.2	195.2	F
	Through	36	35	96.1%	5.5	25	42	0.2	88.1	29.4	57.5	153.2	F
	Right Turn	6	6	91.7%	1.8	3	8	0.2	25.3	42.9	0.0	135.6	C
	Subtotal	243	239	98.3%	4.5	234	250	0.3	115.2	34.0	71.0	188.2	F
Total		1,690	1,686	99.8%	33.8	1,614	1,731	0.1	41.0	5.1	35.5	52.8	D

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
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Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	46	43	93.3%	5.6	37	55	0.5	71.7	14.7	39.2	90.5	E
	Through	536	530	98.9%	31.6	443	552	0.3	26.5	6.8	19.1	43.3	C
	Right Turn	52	49	93.5%	9.2	31	58	0.5	8.8	3.5	4.5	14.7	A
	Subtotal	634	622	98.0%	30.1	543	652	0.5	28.4	7.0	19.4	44.7	C
SB	Left Turn	92	96	104.6%	9.2	75	107	0.4	43.6	6.0	34.3	52.8	D
	Through	698	692	99.1%	15.2	664	719	0.2	12.9	1.7	8.1	15.2	B
	Right Turn	34	35	101.5%	4.0	26	40	0.1	12.6	4.7	4.9	18.4	B
	Subtotal	824	823	99.8%	17.5	788	845	0.1	16.4	2.0	10.8	19.7	B
EB	Left Turn	32	32	99.7%	5.4	20	38	0.0	86.6	39.4	22.4	160.8	F
	Through	5	4	70.0%	2.8	0	8	0.7	25.3	33.6	0.0	92.5	C
	Right Turn	74	76	102.4%	7.0	68	91	0.2	49.6	22.7	13.3	94.2	D
	Subtotal	111	111	100.2%	1.4	108	113	0.0	60.7	27.0	17.6	106.9	E
WB	Left Turn	142	137	96.2%	7.8	119	146	0.5	285.3	105.2	70.0	473.9	F
	Through	17	18	103.5%	3.5	11	22	0.1	217.3	83.0	73.9	401.4	F
	Right Turn	166	162	97.6%	12.2	143	186	0.3	195.0	77.4	45.3	367.7	F
	Subtotal	325	316	97.3%	7.4	303	325	0.5	239.6	87.3	60.7	426.3	F
Total		1,894	1,871	98.8%	27.1	1,818	1,906	0.5	64.1	17.9	28.1	103.0	E

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
PM Peak Hour

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	29	28	97.9%	3.8	22	34	0.1	4.7	3.0	0.4	12.5	A
	Through	418	410	98.1%	18.4	368	429	0.4	6.9	2.0	2.4	11.0	A
	Right Turn	437	414	94.6%	19.4	382	455	1.1	2.9	0.6	1.5	4.0	A
	Subtotal	884	852	96.4%	27.4	803	893	1.1	4.8	1.1	2.3	7.1	A
SB	Left Turn												
	Through	635	622	98.0%	14.8	595	651	0.5	2.4	0.7	1.0	4.3	A
	Right Turn	321	307	95.7%	15.4	283	330	0.8	5.6	1.1	3.9	7.1	A
	Subtotal	956	929	97.2%	21.6	896	973	0.9	3.5	0.8	2.1	5.2	A
EB	Left Turn												
	Through												
	Right Turn	90	90	99.4%	0.8	88	91	0.1	0.7	0.2	0.6	1.1	A
	Subtotal	90	90	99.4%	0.8	88	91	0.1	0.7	0.2	0.6	1.1	A
WB	Left Turn												
	Through												
	Right Turn	221	218	98.6%	9.2	192	223	0.2	0.8	0.2	0.6	1.2	A
	Subtotal	221	218	98.6%	9.2	192	223	0.2	0.8	0.2	0.6	1.2	A
Total		2,151	2,089	97.1%	27.9	2,057	2,145	1.3	3.7	0.6	2.5	4.8	A

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Total Delay (sec/veh) Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn												
	Through	706	686	97.2%	15.9	665	715	0.8	17.0	2.9	12.0	21.5	B
	Right Turn	126	116	92.4%	7.7	109	129	0.9	12.7	4.2	7.3	18.9	B
	Subtotal	832	802	96.4%	14.8	785	827	1.0	16.3	2.7	11.8	19.4	B
SB	Left Turn	189	190	100.6%	13.8	170	208	0.1	67.4	5.7	58.1	77.7	E
	Through	536	520	97.0%	10.4	502	535	0.7	9.8	1.6	7.3	12.3	A
	Right Turn												
	Subtotal	725	710	98.0%	11.8	687	730	0.6	24.0	2.9	18.4	28.0	C
EB	Left Turn												
	Through												
	Right Turn												
	Subtotal												
WB	Left Turn	552	532	96.4%	12.7	514	549	0.9	154.9	23.1	110.2	182.7	F
	Through												
	Right Turn	178	170	95.6%	12.0	145	187	0.6	121.4	22.3	79.1	156.4	F
	Subtotal	730	702	96.2%	10.4	685	718	1.0	146.7	23.0	101.4	176.5	F
Total		2,287	2,215	96.8%	17.0	2,193	2,254	1.5	62.1	6.6	49.2	68.7	E

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

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Existing Conditions (May 2016)
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Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)						Total Delay (sec/veh)				
			Average	Percent	Std. Dev.	Minimum	Maximum	GEH	Average	Std. Dev.	Minimum	Maximum	LOS
NB	Left Turn	92	92	100.0%	6.6	81	99	0.0	50.8	13.1	36.4	63.3	D
	Through	25	24	94.8%	4.6	17	32	0.3	39.4	16.6	13.6	57.3	D
	Right Turn	40	42	105.0%	5.5	36	54	0.3	12.6	7.1	7.4	30.8	B
	Subtotal	157	158	100.4%	1.3	156	161	0.1	40.5	8.5	29.0	51.9	D
SB	Left Turn	37	36	98.4%	5.5	27	45	0.1	57.9	14.2	26.6	83.2	E
	Through	10	10	104.0%	2.8	7	16	0.1	44.7	36.7	0.0	123.9	D
	Right Turn	126	127	100.6%	4.5	122	133	0.1	10.5	4.0	5.3	19.3	B
	Subtotal	173	174	100.3%	2.6	170	179	0.0	21.9	5.7	10.1	34.5	C
EB	Left Turn	304	287	94.5%	21.6	250	317	1.0	52.3	5.6	44.5	60.7	D
	Through	726	716	98.6%	19.0	685	752	0.4	16.9	6.1	7.3	27.3	B
	Right Turn	58	53	91.9%	5.5	43	61	0.6	12.5	7.9	1.3	28.1	B
	Subtotal	1,088	1,057	97.1%	16.1	1,018	1,076	1.0	27.0	5.5	20.3	35.1	C
WB	Left Turn	25	24	96.4%	4.7	17	32	0.2	66.2	19.5	49.7	100.8	E
	Through	530	543	102.4%	13.2	525	565	0.6	32.2	6.0	19.3	43.4	C
	Right Turn	35	35	100.3%	5.7	29	44	0.0	11.5	5.9	2.8	26.8	B
	Subtotal	590	602	102.1%	10.2	584	615	0.5	32.2	5.8	20.2	43.1	C
Total		2,008	1,990	99.1%	19.8	1,946	2,021	0.4	29.1	4.4	22.5	34.3	C

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	100	7	1	5	9	50	10	37	67	NO
	Through	100	7	1	5	9	50	10	37	67	NO
	Right Turn	400	1	0	0	1	33	7	23	43	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	12	1	11	14	70	13	46	94	NO
	Through	400	12	1	11	14	70	13	46	94	NO
	Right Turn	400	0	0	0	0	37	15	22	64	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	80	1	1	0	2	12	7	0	25	NO
	Through	560	8	2	7	13	133	27	91	168	NO
	Right Turn	560	10	2	8	15	142	27	101	178	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	100	10	2	6	13	55	13	31	76	NO
	Through	240	4	3	0	7	109	63	30	239	NO
	Right Turn	240	4	3	0	7	109	67	16	241	NO
	Second Right										

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	640	303	47	209	364	774	2	773	779	MAX
	Through	640	303	47	209	364	774	2	773	779	MAX
	Right Turn	180	0	0	0	0	3	4	0	8	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	400	22	4	18	29	114	19	89	148	NO
	Right Turn	400	0	0	0	1	23	8	14	43	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	100	13	2	10	16	68	19	39	101	NO
	Through	220	13	2	10	16	68	19	39	101	NO
	Right Turn	200	22	1	20	24	195	24	166	242	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	220	44	6	36	55	165	21	135	197	NO
	Through	240	44	6	36	55	165	21	135	197	NO
	Right Turn	240	44	6	36	55	165	21	135	197	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

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Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	75	39	35	169	310	117	115	548	MAX
	Through	1,540	152	63	78	263	603	100	489	801	NO
	Right Turn	160	0	0	0	0	6	4	0	13	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	640	6	2	3	9	51	14	30	82	NO
	Through	640	41	13	20	59	395	98	247	557	NO
	Right Turn	640	39	13	18	57	393	98	245	555	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	600	14	4	9	22	101	24	72	142	NO
	Through	600	14	4	9	22	101	24	72	142	NO
	Right Turn	600	13	4	7	21	104	24	77	144	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	200	32	12	23	63	159	55	120	279	NO
	Through	4,000	133	39	64	197	453	86	295	586	NO
	Right Turn	4,000	136	38	67	200	456	86	298	589	NO
	Second Right										

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	200	1	1	0	3	100	47	25	163	NO
	Right Turn	120	1	1	0	3	100	47	25	163	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	1,280	2	1	1	4	128	11	114	151	NO
	Right Turn	1,800	1	1	1	3	142	22	97	181	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn	560	0	0	0	0	9	6	0	18	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn	1,500	56	44	9	123	240	90	161	425	NO
	Second Right										

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	500	55	4	51	63	308	29	269	364	NO
	Right Turn	500	42	4	38	50	280	29	241	336	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	360	48	3	44	52	159	18	130	187	NO
	Through	1,300	12	1	10	14	121	13	100	137	NO
	Right Turn										
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	160	174	25	131	214	636	78	550	818	AVG
	Through										
	Right Turn	1,260	8	1	7	10	96	17	66	121	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
AM Peak Hour

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	100	16	2	14	19	72	13	52	94	NO
	Through	620	2	1	0	4	37	17	15	72	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	120	8	2	5	12	53	17	29	89	NO
	Through	3,940	8	3	4	14	96	24	68	145	NO
	Right Turn										
	Second Right										
EB	U Turn	440	107	14	87	124	406	38	337	464	NO
	Second Left										
	Left Turn	440	107	14	87	124	406	38	337	464	NO
	Through	440	107	14	87	124	406	38	337	464	NO
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	80	10	11	3	41	196	122	84	502	MAX
	Through	180	10	11	3	41	196	122	84	502	MAX
	Right Turn										
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
PM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	8	1	6	11	71	9	59	89	NO
	Through	100	8	1	6	11	71	9	59	89	NO
	Right Turn	400	2	1	1	4	41	7	31	53	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	23	6	18	34	134	39	89	233	NO
	Through	400	23	6	18	34	134	39	89	233	NO
	Right Turn	400	4	3	0	11	105	48	61	236	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	80	8	13	2	43	65	66	24	231	NO
	Through	560	158	44	61	210	457	95	306	638	NO
	Right Turn	560	164	45	65	217	466	95	316	647	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	100	15	3	9	20	96	22	72	148	NO
	Through	240	18	5	11	26	259	54	141	322	MAX
	Right Turn	240	17	5	10	25	262	54	143	324	MAX
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
PM Peak Hour

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	640	119	15	106	148	635	52	548	728	NO
	Through	640	119	15	106	148	635	52	548	728	NO
	Right Turn	180	0	0	0	1	32	11	22	51	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	400	57	6	47	66	237	21	204	275	NO
	Right Turn	400	1	0	0	1	26	5	18	37	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	100	51	11	36	68	232	47	140	291	MAX
	Through	220	51	11	36	68	232	47	140	291	MAX
	Right Turn	200	47	3	44	52	284	12	269	306	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	220	152	43	91	239	361	57	258	438	MAX
	Through	240	152	43	91	239	361	57	258	438	MAX
	Right Turn	240	152	43	91	239	361	57	258	438	MAX
	Second Right										

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	14	3	10	19	83	30	52	137	NO
	Through	1,540	36	42	19	155	407	174	282	893	NO
	Right Turn	160	0	0	0	0	20	15	7	57	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	640	22	5	16	31	185	76	93	308	NO
	Through	640	54	9	43	74	482	55	406	557	NO
	Right Turn	640	53	9	41	73	480	55	404	555	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	600	33	10	18	51	160	24	117	198	NO
	Through	600	33	10	18	51	160	24	117	198	NO
	Right Turn	600	34	10	21	51	162	24	120	200	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	200	315	197	58	690	574	273	184	1,004	AVG
	Through	4,000	243	106	108	459	511	173	291	766	NO
	Right Turn	4,000	246	106	111	462	514	173	293	769	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
PM Peak Hour

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	200	5	9	1	30	130	88	47	337	NO
	Right Turn	120	5	9	1	30	130	88	47	337	MAX
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	1,280	7	3	4	11	202	47	139	290	NO
	Right Turn	1,800	5	2	2	9	200	39	158	262	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn	560	0	0	0	0	6	7	0	18	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn	1,500	0	0	0	0	0	0	0	0	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
PM Peak Hour

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	500	35	3	31	41	266	29	215	326	NO
	Right Turn	500	24	3	21	30	238	29	187	298	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	360	44	3	38	48	124	8	113	136	NO
	Through	1,300	13	2	11	16	155	33	113	203	NO
	Right Turn										
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	160	607	151	418	944	1,134	118	929	1,291	AVG
	Through										
	Right Turn	1,260	10	5	6	23	126	88	76	371	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Existing Conditions (May 2016)
PM Peak Hour

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	22	3	17	26	88	21	66	129	NO
	Through	620	7	2	4	10	71	13	52	89	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	120	11	3	6	14	66	16	45	85	NO
	Through	3,940	6	2	3	9	87	21	61	121	NO
	Right Turn										
	Second Right										
EB	U Turn	440	121	11	100	137	485	70	392	564	MAX
	Second Left										
	Left Turn	440	121	11	100	137	485	70	392	564	MAX
	Through	440	121	11	100	137	485	70	392	564	MAX
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	80	7	2	4	12	187	36	127	228	MAX
	Through	180	7	2	4	12	187	36	127	228	MAX
	Right Turn										
	Second Right										

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	West of Old Davis Rd
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,372	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,003	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.42	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.2	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,372	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,003	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.42	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.2	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	6	ln	Average Speed, S	70.5	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	12.0	pcphpl
Flow Rate, vp	844	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.35				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	5	2	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,372	43	vph
Peak Hour Factor, PHF	0.95	0.90	
Total Trucks	9.0%	0.5%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.995	
Flow Rate, v_p	5,016	48	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,016	12,000	pcph	0.42
Exiting General Purpose Lanes	5,064	14,400	pcph	0.35
On Ramp	48	4,200	pcph	0.01

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd to Lane Drop 1
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	820	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,415	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,013	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.42	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Lane Drop 1 to Lane Drop 2
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,480	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,415	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,266	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.53	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	17.9	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,240	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,415	483	vph
Peak Hour Factor, PHF	0.95	0.88	
Total Trucks	9.0%	3.3%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.968	
Flow Rate, v_p	5,066	567	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		2,740	ft
Volume on Adjacent Ramp		348	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	447	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.607	
Flow Rate in Lanes 1 and 2, v_{12}	3,299	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,066	7,200	pcph	0.70
Exiting General Purpose Lanes	4,499	7,200	pcph	0.62
Off Ramp	567	1,900	pcph	0.30
Ramp Influence Area	3,299	4,400	pcph	0.75

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	31.3	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.609	
Average Speed in Ramp Influence Area, S_R	53.3	mph
Average Flow in Outer Lanes, v_{OA}	1,767	pcphpl
Average Speed in Outer Lanes, S_O	74.8	mph
Average Speed for Segment, S	59.2	mph
Density across All Lanes, D	28.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off to On
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	3,932	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,504	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.63	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.7	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	3,932	300	vph
Peak Hour Factor, PHF	0.95	0.88	
Total Trucks	9.0%	1.7%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.983	
Flow Rate, v_p	4,511	347	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,740		ft
Volume on Adjacent Ramp	567		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,213	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.592	
Flow Rate in Lanes 1 and 2, v_{12}	2,669	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,511	7,200	pcph	0.63
Exiting General Purpose Lanes	4,858	7,200	pcph	0.67
On Ramp	347	2,100	pcph	0.17
Ramp Influence Area	3,015	4,600	pcph	0.66

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	25.8	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.356	
Average Speed in Ramp Influence Area, S_R	60.3	mph
Average Flow in Outer Lanes, v_{OA}	1,843	pcphpl
Average Speed in Outer Lanes, S_O	65.6	mph
Average Speed for Segment, S	62.2	mph
Density across All Lanes, D	26.9	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd to Chiles Rd
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	5,710	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,232	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,619	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.6	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,500	1,500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,232	299	vph
Peak Hour Factor, PHF	0.95	0.78	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,856	395	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.450	
Flow Rate in Lanes 1 and 2, v_{12}	2,775	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,856	7,200	pcph	0.67
Exiting General Purpose Lanes	4,461	7,200	pcph	0.62
Off Ramp	395	3,800	pcph	0.10
Ramp Influence Area	2,775	4,400	pcph	0.63

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	14.6	pcpmpl
Level of Service, LOS	B	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.594	
Average Speed in Ramp Influence Area, S_R	53.7	mph
Average Flow in Outer Lanes, v_{OA}	2,081	pcphpl
Average Speed in Outer Lanes, S_O	73.5	mph
Average Speed for Segment, S	60.7	mph
Density across All Lanes, D	28.5	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off to Mace Rd On
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,000	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	3,933	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,504	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.63	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.6	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	West of Old Davis Rd
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,622	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,018	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.42	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,622	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,018	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.42	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	6	ln	Average Speed, S	70.5	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	12.8	pcphpl
Flow Rate, vp	903	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.38				

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	5	2	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,622	252	vph
Peak Hour Factor, PHF	0.99	0.77	
Total Trucks	9.0%	0.5%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.995	
Flow Rate, v_p	5,089	329	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,089	12,000	pcph	0.42
Exiting General Purpose Lanes	5,418	14,400	pcph	0.38
On Ramp	329	4,200	pcph	0.08

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd to Lane Drop 1
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	820	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,874	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,073	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.45	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.2	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Lane Drop 1 to Lane Drop 2
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,480	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,874	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,342	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.56	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	19.0	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,240	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,874	593	vph
Peak Hour Factor, PHF	0.99	0.86	
Total Trucks	9.0%	2.4%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.977	
Flow Rate, v_p	5,366	706	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		2,740	ft
Volume on Adjacent Ramp		389	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	542	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.593	
Flow Rate in Lanes 1 and 2, v_{12}	3,471	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,366	7,200	pcph	0.75
Exiting General Purpose Lanes	4,660	7,200	pcph	0.65
Off Ramp	706	1,900	pcph	0.37
Ramp Influence Area	3,471	4,400	pcph	0.79

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	32.8	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.622	
Average Speed in Ramp Influence Area, S_R	52.9	mph
Average Flow in Outer Lanes, v_{OA}	1,895	pcphpl
Average Speed in Outer Lanes, S_O	74.3	mph
Average Speed for Segment, S	58.9	mph
Density across All Lanes, D	30.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off to On
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,281	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,571	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.65	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.9	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,281	320	vph
Peak Hour Factor, PHF	0.99	0.84	
Total Trucks	9.0%	2.2%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.978	
Flow Rate, v_p	4,713	389	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,740		ft
Volume on Adjacent Ramp	706		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,265	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.592	
Flow Rate in Lanes 1 and 2, v_{12}	2,788	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,713	7,200	pcph	0.65
Exiting General Purpose Lanes	5,103	7,200	pcph	0.71
On Ramp	389	2,100	pcph	0.19
Ramp Influence Area	3,177	4,600	pcph	0.69

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	27.0	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.370	
Average Speed in Ramp Influence Area, S_R	59.9	mph
Average Flow in Outer Lanes, v_{OA}	1,925	pcphpl
Average Speed in Outer Lanes, S_O	65.3	mph
Average Speed for Segment, S	61.9	mph
Density across All Lanes, D	28.4	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd to Chiles Rd
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	5,710	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,601	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,689	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.70	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.9	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,500	1,500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,601	411	vph
Peak Hour Factor, PHF	0.99	0.76	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,066	557	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.450	
Flow Rate in Lanes 1 and 2, v_{12}	2,895	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,066	7,200	pcph	0.70
Exiting General Purpose Lanes	4,509	7,200	pcph	0.63
Off Ramp	557	3,800	pcph	0.15
Ramp Influence Area	2,895	4,400	pcph	0.66

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	15.6	pcpmpl
Level of Service, LOS	B	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.608	
Average Speed in Ramp Influence Area, S_R	53.3	mph
Average Flow in Outer Lanes, v_{OA}	2,171	pcphpl
Average Speed in Outer Lanes, S_O	73.2	mph
Average Speed for Segment, S	60.3	mph
Density across All Lanes, D	30.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off to Mace Rd On
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,000	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,190	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,538	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.64	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.2	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,270	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,583	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.0	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Existing Conditions
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,270	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,583	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.1	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.9	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.8	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	19.1	pcphpl
Flow Rate, vp	1,351	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.56				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,270	545	vph
Peak Hour Factor, PHF	0.98	0.86	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,749	653	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,749	7,200	pcph	0.66
Exiting General Purpose Lanes	5,402	9,600	pcph	0.56
On Ramp	653	4,200	pcph	0.16

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Olive Dr
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	4,780	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,815	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,785	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.74	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	35	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,815	149	vph
Peak Hour Factor, PHF	0.98	0.81	
Total Trucks	9.0%	0.7%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.993	
Flow Rate, v_p	5,355	185	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		Off	
Distance to Adjacent Ramp		2,390	ft
Volume on Adjacent Ramp		400	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	440	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.618	
Flow Rate in Lanes 1 and 2, v_{12}	3,378	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,355	7,200	pcph	0.74
Exiting General Purpose Lanes	5,170	7,200	pcph	0.72
Off Ramp	185	2,000	pcph	0.09
Ramp Influence Area	3,378	4,400	pcph	0.77

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	32.0	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.445	
Average Speed in Ramp Influence Area, S_R	57.8	mph
Average Flow in Outer Lanes, v_{OA}	1,977	pcphpl
Average Speed in Outer Lanes, S_O	73.5	mph
Average Speed for Segment, S	62.7	mph
Density across All Lanes, D	29.2	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr to Richards Blvd
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	890	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,666	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,730	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.72	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.9	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,666	345	vph
Peak Hour Factor, PHF	0.98	0.87	
Total Trucks	9.0%	0.9%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.991	
Flow Rate, v_p	5,190	400	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,390		ft
Volume on Adjacent Ramp	185		pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,158	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.612	
Flow Rate in Lanes 1 and 2, v_{12}	3,331	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,190	7,200	pcph	0.72
Exiting General Purpose Lanes	4,790	7,200	pcph	0.67
Off Ramp	400	2,100	pcph	0.19
Ramp Influence Area	3,331	4,400	pcph	0.76

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	31.5	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.334	
Average Speed in Ramp Influence Area, S_R	60.7	mph
Average Flow in Outer Lanes, v_{OA}	1,859	pcphpl
Average Speed in Outer Lanes, S_O	73.5	mph
Average Speed for Segment, S	64.7	mph
Density across All Lanes, D	27.2	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off to On
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	430	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,321	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,602	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.5	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Existing Conditions
Time period	AM Peak Hour

Geometric Data

Segment Type	Freeway	
Weaving Configuration	One-sided	
Number of Lanes, N	4	ln
Weaving Segment Length, L_S	500	ft
Interchange Density, ID	0.8	int/mi
Number of Manuever Lanes, N_{WL}	2.0	ln
On Ramp to Freeway Lane Changes, LC_{RF}	1	
Freeway to Off Ramp Lane Changes, LC_{FR}	1	
On Ramp to Off Ramp Lane Changes, LC_{RR}	0	

Adjustment Factors

Driver Population	Familiar
Weather Type	Non-severe
Incident Type	No incident
Capacity Adjustment Factor, CAF	
Demand Adjustment Factor, DAF	

Volume Data

	Frwy to Frwy	On to Frwy	Frwy to Off	Frwy to Off	
Volume, V	4,130	364	191	0	vph
Peak-hour factor, PHF	0.98	0.78	0.72	0.95	
Total Trucks	9.0%	2.2%	0.5%	3.0%	
Terrain Type	Level	Level	Level	Level	
Grade					
Length					mi
SUT/TT Mix					
Passenger Car Equivalent, E_T	2.0	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.978	0.995	0.971	
Demand Adjustment Factor, DAF	1.00	1.00	1.00	1.00	
Flow Rate, v_p	4,594	477	267	0	pcph

Weaving Flow Rate, vW	744	Total Flow Rate, v	5,337
Non-Weaving Flow Rate, vNW	4,594	Volume Ratio, VR	0.139

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Existing Conditions
Time period	AM Peak Hour

Capacity

Maximum Weaving Length, L_{MAX}	3,925	ft
Weaving Length Check	OK	
Freeway Maximum Capacity, c_{IFL}	2,400	pchpl
Density-Based Capacity, c_{IWL}	9,338	pchpl
Demand Flow-Based Capacity, c_{IW}	15,966	pch
Weaving Segment Capacity, c_W	15,966	vph
Adjusted Weaving Area Capacity, c_{wa}	15,966	vph
Volume-to-Capacity Ratio, v/c	0.31	

Speed and Density

Minimum Lane Change Rate, LC_{MIN}	744	lc/h
Weaving Lane Change Rate, LC_W	763	lc/h
Non-weaving Vehicle Index, I_{NW}	191	
Non-weaving Lane Change Rate, LC_{NW}	447	lc/h
Total Lane Change Rate, LC_{ALL}	1,210	lc/h
Weaving Intensity Factor, W	0.454	
Average Weaving Speed, S_W	52.9	mph
Average Non-Weaving Speed, S_{NW}	58.3	mph
Average Speed, S	57.5	mph
Density, D	23.2	pcpmpl
Level of Service, LOS	C	

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,806	7,200	pcph	0.67
Exiting General Purpose Lanes	5,016	7,200	pcph	0.70
On Ramp	477	1,900	pcph	0.25
Off Ramp	267	1,900	pcph	0.14

Leisch Method for Weaving Analysis

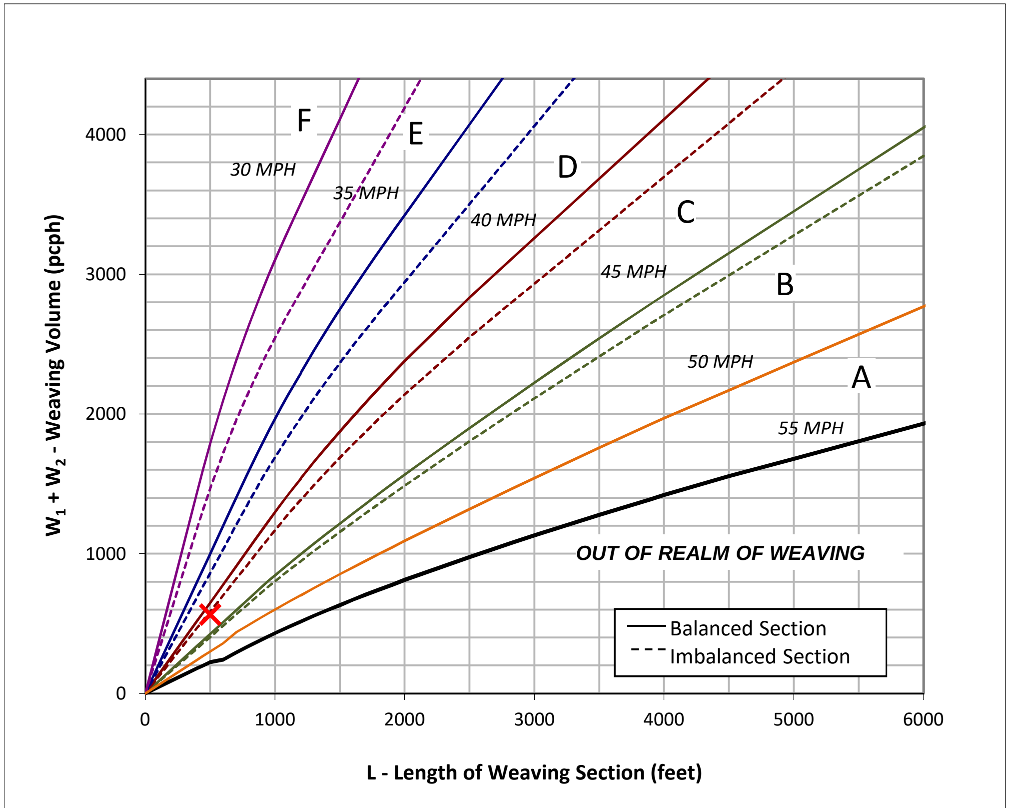
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	500

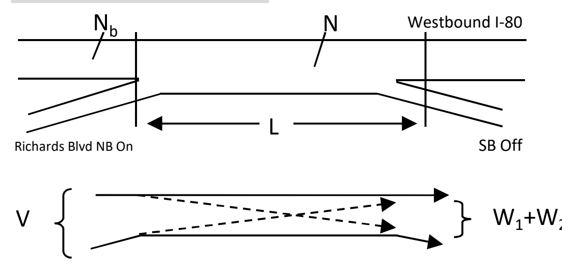
Project Information

Project	I-80/Richards Blvd Interchange
Scenario	Existing Conditions
Freeway	Westbound I-80
On-ramp	Richards Blvd NB On
Off-ramp	SB Off

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,685	Volume (vph)*	364	Volume (vph)*	191
Truck Percentage	8.1%	Truck Percentage	2.2%	Truck Percentage	0.5%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,066	Volume (pcph)	372	Volume (pcph)	192



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?

   40 MPH and **45 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) 40.6
4. Weaving Intensity Factor (k) 2.48
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,337

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

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB Off to On
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	210	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,494	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,666	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.69	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.7	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Existing Conditions
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	3,770	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.4	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,494	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,666	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.69	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.4	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.6	pcpmpl
Total Ramp Density Adjustment	5.0	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.3	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	18.4	pcphpl
Flow Rate, vp	1,290	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.54				

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Existing Conditions
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,618	481	vph
Peak Hour Factor, PHF	0.98	0.83	
Total Trucks	9.0%	1.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.990	
Flow Rate, v_p	5,136	585	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Existing Conditions
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,570	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,136	9,600	pcph	0.54
Exiting General Purpose Lanes	4,551	12,000	pcph	0.38
Off Ramp	585	2,100	pcph	0.28
Ramp Influence Area	2,570	4,400	pcph	0.58

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	25.0	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.351	
Average Speed in Ramp Influence Area, S_R	60.2	mph
Average Flow in Outer Lanes, v_{OA}	1,283	pcphpl
Average Speed in Outer Lanes, S_O	75.7	mph
Average Speed for Segment, S	67.1	mph
Density across All Lanes, D	19.1	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Existing Conditions
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,137	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	920	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.38	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	13.1	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,063	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,491	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.62	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.4	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Existing Conditions
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,063	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,491	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.62	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.3	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	71.2	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	17.7	pcphpl
Flow Rate, vp	1,260	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.52				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,063	429	vph
Peak Hour Factor, PHF	0.99	0.78	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,473	567	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,473	7,200	pcph	0.62
Exiting General Purpose Lanes	5,040	9,600	pcph	0.52
On Ramp	567	4,200	pcph	0.13

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Olive Dr
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	4,780	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,492	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,649	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.69	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.1	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	35	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,492	125	vph
Peak Hour Factor, PHF	0.99	0.84	
Total Trucks	9.0%	0.8%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.992	
Flow Rate, v_p	4,946	150	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		Off	
Distance to Adjacent Ramp		2,390	ft
Volume on Adjacent Ramp		255	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	273	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.629	
Flow Rate in Lanes 1 and 2, v_{12}	3,169	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,946	7,200	pcph	0.69
Exiting General Purpose Lanes	4,796	7,200	pcph	0.67
Off Ramp	150	2,000	pcph	0.08
Ramp Influence Area	3,169	4,400	pcph	0.72

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	30.2	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.442	
Average Speed in Ramp Influence Area, S_R	57.9	mph
Average Flow in Outer Lanes, v_{OA}	1,777	pcphpl
Average Speed in Outer Lanes, S_O	74.3	mph
Average Speed for Segment, S	62.9	mph
Density across All Lanes, D	26.7	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr to Richards Blvd
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	890	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,367	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,603	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.5	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,367	214	vph
Peak Hour Factor, PHF	0.99	0.85	
Total Trucks	9.0%	1.4%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.986	
Flow Rate, v_p	4,808	255	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,390		ft
Volume on Adjacent Ramp	150		pcph

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	925	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.628	
Flow Rate in Lanes 1 and 2, v_{12}	3,115	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,808	7,200	pcph	0.67
Exiting General Purpose Lanes	4,553	7,200	pcph	0.63
Off Ramp	255	2,100	pcph	0.12
Ramp Influence Area	3,115	4,400	pcph	0.71

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	29.7	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.321	
Average Speed in Ramp Influence Area, S_R	61.0	mph
Average Flow in Outer Lanes, v_{OA}	1,693	pcphpl
Average Speed in Outer Lanes, S_O	74.1	mph
Average Speed for Segment, S	65.1	mph
Density across All Lanes, D	25.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off to On
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	430	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,153	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,524	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.64	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.1	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Existing Conditions
Time period	PM Peak Hour

Geometric Data

Segment Type	Freeway	
Weaving Configuration	One-sided	
Number of Lanes, N	4	ln
Weaving Segment Length, L_S	500	ft
Interchange Density, ID	0.8	int/mi
Number of Manuever Lanes, N_{WL}	2.0	ln
On Ramp to Freeway Lane Changes, LC_{RF}	1	
Freeway to Off Ramp Lane Changes, LC_{FR}	1	
On Ramp to Off Ramp Lane Changes, LC_{RR}	0	

Adjustment Factors

Driver Population	Familiar
Weather Type	Non-severe
Incident Type	No incident
Capacity Adjustment Factor, CAF	
Demand Adjustment Factor, DAF	

Volume Data

	Frwy to Frwy	On to Frwy	Frwy to Off	Frwy to Off	
Volume, V	4,084	452	69	0	vph
Peak-hour factor, PHF	0.99	0.74	0.78	0.95	
Total Trucks	9.0%	1.8%	0.5%	3.0%	
Terrain Type	Level	Level	Level	Level	
Grade					
Length					mi
SUT/TT Mix					
Passenger Car Equivalent, E_T	2.0	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.982	0.995	0.971	
Demand Adjustment Factor, DAF	1.00	1.00	1.00	1.00	
Flow Rate, v_p	4,497	622	89	0	pcph

Weaving Flow Rate, vW	711	Total Flow Rate, v	5,207
Non-Weaving Flow Rate, vNW	4,497	Volume Ratio, VR	0.136

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Existing Conditions
Time period	PM Peak Hour

Capacity

Maximum Weaving Length, L_{MAX}	3,897	ft
Weaving Length Check	OK	
Freeway Maximum Capacity, c_{IFL}	2,400	pchpl
Density-Based Capacity, c_{IWL}	9,340	pchpl
Demand Flow-Based Capacity, c_{IW}	16,292	pch
Weaving Segment Capacity, c_W	16,292	vph
Adjusted Weaving Area Capacity, c_{wa}	16,292	vph
Volume-to-Capacity Ratio, v/c	0.30	

Speed and Density

Minimum Lane Change Rate, LC_{MIN}	711	lc/h
Weaving Lane Change Rate, LC_W	730	lc/h
Non-weaving Vehicle Index, I_{NW}	187	
Non-weaving Lane Change Rate, LC_{NW}	427	lc/h
Total Lane Change Rate, LC_{ALL}	1,157	lc/h
Weaving Intensity Factor, W	0.438	
Average Weaving Speed, S_W	53.3	mph
Average Non-Weaving Speed, S_{NW}	58.7	mph
Average Speed, S	57.9	mph
Density, D	22.5	pcpmpl
Level of Service, LOS	C	

Capacity Checks

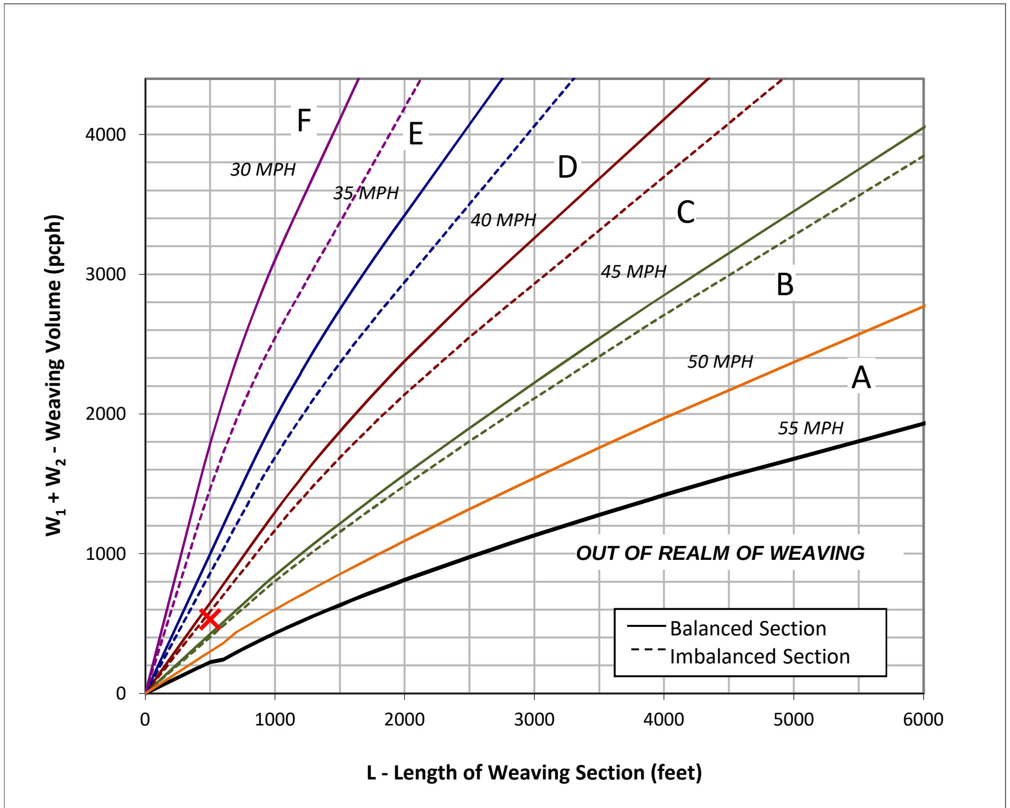
	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,572	7,200	pcph	0.64
Exiting General Purpose Lanes	5,105	7,200	pcph	0.71
On Ramp	622	1,900	pcph	0.33
Off Ramp	89	1,900	pcph	0.05

Leisch Method for Weaving Analysis

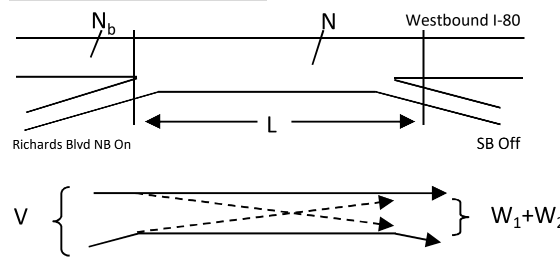
Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	500

Project Information	
Project	I-80/Richards Blvd Interchange
Scenario	Existing Conditions
Freeway	Westbound I-80
On-ramp	Richards Blvd NB On
Off-ramp	SB Off

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,605	Volume (vph)*	452	Volume (vph)*	69
Truck Percentage	8.2%	Truck Percentage	1.8%	Truck Percentage	0.5%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	4,981	Volume (pcph)	460	Volume (pcph)	69



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?

   40 MPH and **45 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) 41.5
4. Weaving Intensity Factor (k) 3.15
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,283
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

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB Off to On
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	210	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,536	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,665	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.69	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.7	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Existing Conditions
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	3,770	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.4	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,536	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,665	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.69	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.4	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.6	pcpmpl
Total Ramp Density Adjustment	5.0	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.2	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	18.8	pcphpl
Flow Rate, vp	1,321	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.55				

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Existing Conditions
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,798	155	vph
Peak Hour Factor, PHF	0.99	0.90	
Total Trucks	9.0%	1.9%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.981	
Flow Rate, v_p	5,283	175	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Existing Conditions
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,402	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,283	9,600	pcph	0.55
Exiting General Purpose Lanes	5,107	12,000	pcph	0.43
Off Ramp	175	2,100	pcph	0.08
Ramp Influence Area	2,402	4,400	pcph	0.55

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	23.6	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.314	
Average Speed in Ramp Influence Area, S_R	61.2	mph
Average Flow in Outer Lanes, v_{OA}	1,440	pcphpl
Average Speed in Outer Lanes, S_O	75.1	mph
Average Speed for Segment, S	68.1	mph
Density across All Lanes, D	19.4	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Existing Conditions
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,643	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,022	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.43	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.6	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	B	

Output Summary

General Information					
Project description:	I-80/Richards Blvd Interchange - Existing Conditions				
Analyst:	DS	Date:	1/20/2018	Area type:	Urban
First year of analysis:	2016				
Last year of analysis:	2016				

Crash Data Description				
Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2012
	Project-level crash data available?	No	Last year of crash data:	2014
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility	Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:	4.0	0.0	0.1	0.6	0.8	2.4
Estimated average crash freq. during Study Period, crashes/yr:	4.0	0.0	0.1	0.6	0.8	2.4

Crashes by Facility Component	Nbr. Sites	Total	K	A	B	C	PDO
Freeway segments, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	5	4.0	0.0	0.1	0.6	0.8	2.4
Crossroad ramp terminals, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0

Crashes for Entire Facility by Year	Year	Total	K	A	B	C	PDO
Estimated number of crashes during the Study Period, crashes:	2016	4.0	0.0	0.1	0.6	0.8	2.4
	2017						
	2018						
	2019						
	2020						
	2021						
	2022						
	2023						
	2024						
	2025						
	2026						
	2027						
	2028						
	2029						
	2030						
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
	2038						
	2039						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	K	A	B	C	PDO
Multiple vehicle	Head-on crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Rear-end crashes:	0.2	0.0	0.0	0.0	0.1	0.1
	Sideswipe crashes:	0.1	0.0	0.0	0.0	0.0	0.1
	Other multiple-vehicle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Total multiple-vehicle crashes:	0.3	0.0	0.0	0.1	0.1	0.2
Single vehicle	Crashes with animal:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:	2.9	0.0	0.1	0.4	0.5	1.9
	Crashes with other object:	0.1	0.0	0.0	0.0	0.0	0.1
	Crashes with parked vehicle:	0.0	0.0	0.0	0.0	0.0	0.0
	Other single-vehicle crashes	0.6	0.0	0.0	0.1	0.2	0.3
	Total single-vehicle crashes:	3.7	0.0	0.1	0.6	0.7	2.3
Total crashes:		4.0	0.0	0.1	0.6	0.8	2.4

Speed Bin	Davis Model Wide Performance Measures - Existing Conditions		
	Congested Speed		Vehicle Miles of Travel (VMT)
1	>0	<=5	2,431
2	>5	<=10	40,862
3	>10	<=15	40,752
4	>15	<=20	74,656
5	>20	<=25	284,651
6	>25	<=30	152,480
7	>30	<=35	181,912
8	>35	<=40	71,359
9	>40	<=45	922,020
10	>45	<=50	435,359
11	>50	<=55	8,716
12	>55	<=60	145,630
13	>60	<=65	0
14	>65	<=70	0
15	>70	<=75	0
16	>75		0
Total			**2,360,828**

Speed Bin	Davis Model Wide Performance Measures - Cumulative No Build Conditions		
	Congested Speed		Vehicle Miles of Travel (VMT)
1	>0	<=5	21,666
2	>5	<=10	88,051
3	>10	<=15	75,900
4	>15	<=20	79,555
5	>20	<=25	419,018
6	>25	<=30	173,661
7	>30	<=35	157,139
8	>35	<=40	991,544
9	>40	<=45	330,834
10	>45	<=50	460,922
11	>50	<=55	11,078
12	>55	<=60	170,851
13	>60	<=65	0
14	>65	<=70	0
15	>70	<=75	0
16	>75		0
Total			**2,980,219**

Speed Bin	Davis Model Wide Performance Measures - Cumulative Build Conditions		
	Congested Speed		Vehicle Miles of Travel (VMT)
1	>0	<=5	17,036
2	>5	<=10	86,330
3	>10	<=15	77,488
4	>15	<=20	87,251
5	>20	<=25	408,957
6	>25	<=30	189,145
7	>30	<=35	156,430
8	>35	<=40	991,490
9	>40	<=45	312,856
10	>45	<=50	478,222
11	>50	<=55	11,179
12	>55	<=60	171,314
13	>60	<=65	0
14	>65	<=70	0
15	>70	<=75	0
16	>75		0
Total			**2,987,698**

Vissim Post-Processor **I-80 / Richards Blvd Interchange**
Average Results from 10 Runs **Construction Year No Build Conditions**
Volume and Delay by Movement **AM Peak Hour**

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	10	10	98.0%	30.0	23.5	C
	Through	20	17	85.5%	50.9	13.1	D
	Right Turn	30	31	102.0%	7.0	3.3	A
	Subtotal	60	58	95.8%	25.8	6.8	C
SB	Left Turn	40	39	98.5%	55.4	15.4	E
	Through	30	27	91.3%	57.8	12.1	E
	Right Turn	40	41	103.0%	17.6	6.3	B
	Subtotal	110	108	98.2%	40.9	9.4	D
EB	Left Turn	10	8	81.0%	58.7	28.4	E
	Through	260	273	104.8%	12.2	2.0	B
	Right Turn	30	27	89.0%	9.8	6.1	A
	Subtotal	300	307	102.5%	13.3	2.3	B
WB	Left Turn	30	26	86.3%	54.5	7.3	D
	Through	470	463	98.4%	7.0	2.1	A
	Right Turn	50	48	95.0%	5.3	5.1	A
	Subtotal	550	536	97.5%	9.8	2.5	A
Total		1,020	1,009	98.9%	15.8	2.2	B

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	520	505	97.2%	22.7	3.3	C
	Through	90	83	92.6%	26.0	5.1	C
	Right Turn	250	238	95.1%	11.6	1.6	B
	Subtotal	860	826	96.1%	19.6	2.5	B
SB	Left Turn	10	9	87.0%	68.1	31.4	E
	Through	110	110	100.0%	48.6	10.4	D
	Right Turn	10	10	95.0%	18.8	23.2	B
	Subtotal	130	128	98.6%	47.2	8.7	D
EB	Left Turn	10	11	105.0%	59.7	33.6	E
	Through	30	29	97.7%	56.1	18.3	E
	Right Turn	290	302	104.0%	12.7	2.6	B
	Subtotal	330	341	103.4%	18.8	3.8	B
WB	Left Turn	150	146	97.1%	80.6	15.2	F
	Through	20	20	101.5%	64.4	21.1	E
	Right Turn	10	11	114.0%	38.6	28.2	D
	Subtotal	180	177	98.5%	76.9	13.7	E
Total		1,500	1,473	98.2%	29.5	3.1	C

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Construction Year No Build Conditions
AM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	160	154	96.5%	206.6	87.1	F
	Through	650	628	96.6%	170.8	89.8	F
	Right Turn	40	39	96.5%	133.8	87.4	F
	Subtotal	850	821	96.6%	176.2	88.8	F
SB	Left Turn	30	29	97.7%	62.3	9.7	E
	Through	480	483	100.6%	18.3	2.7	B
	Right Turn	40	41	103.3%	16.4	5.6	B
	Subtotal	550	554	100.7%	20.2	2.6	C
EB	Left Turn	40	38	94.8%	47.9	17.5	D
	Through	10	10	104.0%	44.8	16.5	D
	Right Turn	100	99	98.6%	28.4	9.7	C
	Subtotal	150	147	97.9%	36.2	7.9	D
WB	Left Turn	120	121	100.8%	58.9	20.9	E
	Through	40	40	100.8%	76.0	25.7	E
	Right Turn	170	162	95.2%	70.4	22.2	E
	Subtotal	330	323	97.9%	66.6	18.8	E
Total		1,880	1,845	98.1%	97.8	37.0	F

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph)		Total Delay (sec/veh)		
			Average	Percent	Average	Std. Dev.	LOS
NB	Left Turn	60	57	95.2%	113.4	90.2	F
	Through	400	400	99.9%	131.2	86.8	F
	Right Turn	390	376	96.4%	13.2	23.7	B
	Subtotal	850	833	97.9%	79.7	60.2	F
SB	Left Turn						
	Through	520	521	100.1%	1.5	0.2	A
	Right Turn	190	189	99.3%	5.2	0.9	A
	Subtotal	710	709	99.9%	2.5	0.3	A
EB	Left Turn						
	Through						
	Right Turn	200	197	98.4%	1.0	0.2	A
	Subtotal	200	197	98.4%	1.0	0.2	A
WB	Left Turn						
	Through						
	Right Turn	450	426	94.6%	162.3	87.4	F
	Subtotal	450	426	94.6%	162.3	87.4	F
Total		2,210	2,164	97.9%	62.0	33.3	F

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Construction Year No Build Conditions
AM Peak Hour

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	640	638	99.7%	25.4	4.0	C
	Right Turn	120	115	95.8%	20.4	4.6	C
	Subtotal	760	753	99.1%	24.7	3.9	C
SB	Left Turn	260	259	99.5%	59.7	7.0	E
	Through	460	458	99.6%	32.0	8.6	C
	Right Turn						
	Subtotal	720	717	99.6%	42.0	6.4	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	510	508	99.6%	63.8	26.8	E
	Through						
	Right Turn	210	206	97.9%	33.5	20.0	C
	Subtotal	720	714	99.1%	55.0	25.3	D
Total		2,200	2,183	99.2%	39.8	10.5	D

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	70	68	97.3%	55.3	7.3	E
	Through	10	10	100.0%	35.3	22.8	D
	Right Turn	30	30	99.3%	11.2	9.7	B
	Subtotal	110	108	98.1%	42.1	7.3	D
SB	Left Turn	20	24	120.5%	49.6	15.6	D
	Through	20	19	94.0%	43.2	12.9	D
	Right Turn	90	86	95.6%	13.8	5.0	B
	Subtotal	130	129	99.2%	25.1	6.1	C
EB	Left Turn	250	252	100.7%	53.4	10.3	D
	Through	580	572	98.6%	40.3	7.8	D
	Right Turn	140	142	101.1%	29.6	7.1	C
	Subtotal	970	965	99.5%	42.2	6.0	D
WB	Left Turn	30	31	103.3%	78.4	14.0	E
	Through	580	586	101.1%	53.0	16.3	D
	Right Turn	20	21	103.5%	26.4	18.4	C
	Subtotal	630	638	101.3%	53.4	15.8	D
Total		1,840	1,840	100.0%	44.8	8.5	D

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Construction Year No Build Conditions
PM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	30	30	100.7%	47.2	15.5	D
	Through	40	40	99.5%	58.9	14.0	E
	Right Turn	50	50	100.0%	16.3	4.3	B
	Subtotal	120	120	100.0%	39.5	7.9	D
SB	Left Turn	70	69	98.1%	61.9	13.2	E
	Through	40	40	100.5%	56.0	13.5	E
	Right Turn	20	20	98.0%	12.9	5.1	B
	Subtotal	130	129	98.8%	53.0	8.4	D
EB	Left Turn	10	10	95.0%	88.4	24.3	F
	Through	360	369	102.5%	33.4	6.2	C
	Right Turn	60	56	92.7%	29.3	7.8	C
	Subtotal	430	434	101.0%	34.3	6.1	C
WB	Left Turn	70	68	97.0%	58.3	5.6	E
	Through	310	316	101.9%	7.5	1.4	A
	Right Turn	50	50	100.2%	2.7	1.6	A
	Subtotal	430	434	100.9%	14.9	2.5	B
Total		1,110	1,117	100.6%	29.4	2.7	C

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	360	363	100.9%	14.1	4.8	B
	Through	140	131	93.7%	18.6	6.8	B
	Right Turn	320	305	95.4%	8.1	2.5	A
	Subtotal	820	800	97.5%	12.5	3.8	B
SB	Left Turn	10	8	80.0%	36.7	35.5	D
	Through	160	158	98.9%	52.6	6.2	D
	Right Turn	20	21	103.0%	21.3	10.5	C
	Subtotal	190	187	98.3%	48.2	5.5	D
EB	Left Turn	10	10	95.0%	58.7	44.6	E
	Through	50	55	110.2%	73.0	15.5	E
	Right Turn	420	425	101.1%	12.5	3.6	B
	Subtotal	480	489	101.9%	19.9	6.3	B
WB	Left Turn	200	197	98.7%	109.7	37.6	F
	Through	50	50	100.0%	70.0	23.4	E
	Right Turn	10	10	100.0%	36.2	32.1	D
	Subtotal	260	257	99.0%	99.6	35.9	F
Total		1,750	1,733	99.0%	31.8	6.3	C

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Construction Year No Build Conditions
PM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	100	96	95.6%	92.5	26.0	F
	Through	630	616	97.8%	38.6	16.8	D
	Right Turn	80	77	95.9%	19.1	13.7	B
	Subtotal	810	788	97.3%	43.4	17.8	D
SB	Left Turn	90	90	100.1%	53.1	10.9	D
	Through	640	642	100.3%	23.3	5.8	C
	Right Turn	50	48	96.2%	22.5	6.4	C
	Subtotal	780	780	100.1%	26.9	6.5	C
EB	Left Turn	50	49	97.8%	305.7	132.6	F
	Through	20	21	103.0%	304.6	131.6	F
	Right Turn	170	171	100.6%	291.0	136.6	F
	Subtotal	240	241	100.3%	294.9	135.2	F
WB	Left Turn	140	139	99.1%	96.6	59.4	F
	Through	30	30	98.7%	46.8	17.7	D
	Right Turn	140	137	97.9%	32.4	19.0	C
	Subtotal	310	305	98.5%	65.7	44.7	E
Total		2,140	2,115	98.8%	68.3	18.8	E

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	30	30	98.3%	9.6	9.6	A
	Through	570	552	96.8%	12.8	11.0	B
	Right Turn	560	555	99.1%	3.5	0.7	A
	Subtotal	1,160	1,136	97.9%	8.3	5.5	A
SB	Left Turn						
	Through	660	658	99.7%	1.8	0.3	A
	Right Turn	310	313	101.0%	4.7	0.8	A
	Subtotal	970	971	100.1%	2.7	0.4	A
EB	Left Turn						
	Through						
	Right Turn	100	98	97.8%	0.9	0.3	A
	Subtotal	100	98	97.8%	0.9	0.3	A
WB	Left Turn						
	Through						
	Right Turn	240	241	100.5%	2.5	2.8	A
	Subtotal	240	241	100.5%	2.5	2.8	A
Total		2,470	2,446	99.0%	5.1	2.7	A

Vissim Post-Processor | **I-80 / Richards Blvd Interchange**
Average Results from 10 Runs | **Construction Year No Build Conditions**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 5 | **Richards Blvd/I-80 EB Ramps** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	930	932	100.2%	16.5	3.0	B
	Right Turn	120	118	98.0%	10.6	2.9	B
	Subtotal	1,050	1,050	100.0%	15.8	2.8	B
SB	Left Turn	210	219	104.2%	50.6	3.4	D
	Through	550	536	97.5%	21.8	3.3	C
	Right Turn						
	Subtotal	760	755	99.3%	29.8	2.1	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	570	522	91.5%	327.7	52.1	F
	Through						
	Right Turn	230	206	89.7%	291.6	46.7	F
	Subtotal	800	728	91.0%	317.6	50.1	F
Total		2,610	2,533	97.0%	106.2	12.2	F

Intersection 6 | **Research Park Dr/Richards Blvd-Cowell Blvd** | **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	130	130	100.0%	54.1	7.3	D
	Through	40	37	92.8%	31.3	7.8	C
	Right Turn	60	61	102.0%	14.4	5.1	B
	Subtotal	230	228	99.3%	39.4	4.9	D
SB	Left Turn	40	38	94.5%	57.6	12.9	E
	Through	10	10	99.0%	26.5	23.8	C
	Right Turn	190	192	100.9%	10.3	4.4	B
	Subtotal	240	239	99.8%	17.3	4.2	B
EB	Left Turn	320	299	93.4%	58.9	5.7	E
	Through	740	696	94.1%	24.4	4.3	C
	Right Turn	60	57	94.7%	19.1	10.7	B
	Subtotal	1,120	1,052	93.9%	33.9	3.1	C
WB	Left Turn	20	21	104.0%	78.3	23.8	E
	Through	680	682	100.3%	53.8	17.4	D
	Right Turn	40	41	102.0%	26.5	28.7	C
	Subtotal	740	744	100.5%	53.3	18.0	D
Total		2,330	2,263	97.1%	39.3	6.7	D

Vissim Post-Processor | **I-80 / Richards Blvd Interchange**
Average Results from 10 Runs | **Construction Year Build Conditions**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	10	9	94.0%	34.0	29.1	C
	Through	20	19	96.0%	45.9	20.3	D
	Right Turn	30	29	96.7%	5.2	1.8	A
	Subtotal	60	58	96.0%	27.7	10.2	C
SB	Left Turn	40	41	101.5%	60.3	9.0	E
	Through	30	28	94.7%	55.8	13.8	E
	Right Turn	40	38	93.8%	18.3	10.0	B
	Subtotal	110	107	96.8%	43.3	7.2	D
EB	Left Turn	10	10	96.0%	50.2	29.7	D
	Through	260	266	102.2%	12.2	2.3	B
	Right Turn	30	30	99.0%	7.7	3.6	A
	Subtotal	300	305	101.6%	13.3	2.4	B
WB	Left Turn	30	27	89.3%	71.4	6.7	E
	Through	470	482	102.6%	1.2	0.4	A
	Right Turn	50	50	99.0%	1.5	0.8	A
	Subtotal	550	559	101.6%	5.5	2.1	A
Total		1,020	1,028	100.8%	12.8	1.8	B

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	520	527	101.4%	9.6	2.1	A
	Through	90	92	102.2%	12.7	7.1	B
	Right Turn	250	254	101.8%	3.0	1.0	A
	Subtotal	860	874	101.6%	8.0	2.1	A
SB	Left Turn	10	9	89.0%	56.6	17.5	E
	Through	110	108	97.7%	46.5	8.1	D
	Right Turn	10	12	119.0%	26.2	25.2	C
	Subtotal	130	128	98.7%	45.2	7.6	D
EB	Left Turn	10	9	88.0%	63.6	34.4	E
	Through	30	30	98.3%	67.5	14.3	E
	Right Turn	290	296	102.0%	11.0	1.6	B
	Subtotal	330	334	101.2%	18.6	2.4	B
WB	Left Turn	150	148	98.5%	51.0	6.8	D
	Through	20	20	100.5%	55.5	12.9	E
	Right Turn	10	9	90.0%	18.7	16.6	B
	Subtotal	180	177	98.3%	49.7	7.5	D
Total		1,500	1,513	100.8%	18.3	2.2	B

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
AM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	280	280	99.8%	78.1	11.0	E
	Through	760	765	100.7%	25.4	3.0	C
	Right Turn	110	97	87.9%	6.1	2.2	A
	Subtotal	1,150	1,142	99.3%	36.4	4.5	D
SB	Left Turn	30	29	97.3%	69.2	17.8	E
	Through	480	481	100.2%	35.1	6.2	D
	Right Turn	40	38	95.5%	32.4	7.9	C
	Subtotal	550	549	99.7%	36.5	6.1	D
EB	Left Turn	40	41	102.3%	52.0	9.7	D
	Through	10	9	91.0%	41.4	28.9	D
	Right Turn	100	97	97.4%	12.6	3.8	B
	Subtotal	150	147	98.3%	26.7	5.5	C
WB	Left Turn	120	117	97.8%	48.0	7.5	D
	Through	30	25	84.0%	78.6	21.5	E
	Right Turn	60	67	111.0%	72.9	19.8	E
	Subtotal	210	209	99.6%	59.1	11.6	E
Total		2,060	2,047	99.3%	38.3	3.9	D

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	390	393	100.6%	50.7	2.7	D
	Through	460	463	100.6%	36.3	3.5	D
	Right Turn						
	Subtotal	850	855	100.6%	42.8	2.9	D
SB	Left Turn						
	Through	520	516	99.2%	12.8	3.2	B
	Right Turn	190	188	98.7%	6.8	1.8	A
	Subtotal	710	704	99.1%	11.2	2.4	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	200	199	99.5%	51.6	6.9	D
	Through						
	Right Turn	690	685	99.3%	42.6	15.1	D
	Subtotal	890	884	99.3%	44.9	11.8	D
Total		2,450	2,443	99.7%	34.9	3.8	C

Intersection 5 **I-80 EB Ramps/Richards Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	640	644	100.6%	12.7	4.4	B
	Right Turn	120	121	100.9%	12.6	3.3	B
	Subtotal	760	765	100.7%	12.7	4.2	B
SB	Left Turn	260	256	98.5%	77.5	6.5	E
	Through	460	459	99.7%	12.5	2.0	B
	Right Turn						
	Subtotal	720	715	99.3%	35.9	3.9	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	510	510	100.0%	36.3	5.2	D
	Through						
	Right Turn	210	208	99.0%	9.3	1.4	A
	Subtotal	720	718	99.7%	28.6	3.6	C
Total		2,200	2,198	99.9%	25.5	2.0	C

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	70	69	98.9%	53.0	7.4	D
	Through	10	9	86.0%	38.4	26.4	D
	Right Turn	30	30	99.0%	6.4	4.3	A
	Subtotal	110	108	97.7%	38.9	3.8	D
SB	Left Turn	20	18	88.5%	55.3	22.8	E
	Through	20	19	96.0%	46.1	18.5	D
	Right Turn	90	93	103.0%	13.4	5.4	B
	Subtotal	130	130	99.7%	23.0	5.6	C
EB	Left Turn	250	248	99.3%	51.2	13.2	D
	Through	580	581	100.2%	15.8	3.0	B
	Right Turn	140	137	97.6%	7.8	3.4	A
	Subtotal	970	966	99.6%	23.9	4.9	C
WB	Left Turn	30	28	94.0%	55.2	11.4	E
	Through	580	589	101.5%	30.0	5.2	C
	Right Turn	20	18	88.0%	9.6	5.6	A
	Subtotal	630	635	100.7%	30.6	4.4	C
Total		1,840	1,838	99.9%	27.2	3.1	C

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	30	30	100.7%	54.0	14.3	D
	Through	40	38	95.3%	56.7	18.1	E
	Right Turn	50	49	98.8%	21.1	5.2	C
	Subtotal	120	118	98.1%	42.5	10.1	D
SB	Left Turn	70	68	97.3%	72.0	19.0	E
	Through	40	42	105.0%	65.4	13.4	E
	Right Turn	20	19	95.0%	25.0	10.9	C
	Subtotal	130	129	99.3%	63.1	16.3	E
EB	Left Turn	10	11	109.0%	67.1	24.0	E
	Through	360	368	102.1%	48.2	28.5	D
	Right Turn	60	57	94.5%	40.2	24.5	D
	Subtotal	430	435	101.2%	47.5	27.1	D
WB	Left Turn	70	71	101.1%	54.9	4.7	D
	Through	310	316	101.8%	6.9	0.8	A
	Right Turn	50	48	95.2%	3.2	1.7	A
	Subtotal	430	434	100.9%	15.1	1.9	B
Total		1,110	1,116	100.5%	36.2	11.3	D

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	360	361	100.3%	9.3	2.8	A
	Through	140	135	96.7%	7.9	3.5	A
	Right Turn	320	313	97.7%	3.5	0.8	A
	Subtotal	820	809	98.7%	6.7	1.9	A
SB	Left Turn	10	10	102.0%	65.0	29.7	E
	Through	160	156	97.8%	57.1	15.7	E
	Right Turn	20	20	98.0%	40.1	14.3	D
	Subtotal	190	186	98.0%	56.4	15.5	E
EB	Left Turn	10	10	100.0%	80.7	22.0	F
	Through	50	54	107.6%	79.9	16.9	E
	Right Turn	420	421	100.3%	21.2	8.9	C
	Subtotal	480	485	101.0%	29.1	8.0	C
WB	Left Turn	200	194	97.0%	53.0	6.3	D
	Through	50	53	106.8%	46.3	10.1	D
	Right Turn	10	9	92.0%	23.1	15.1	C
	Subtotal	260	257	98.7%	50.5	4.4	D
Total		1,750	1,737	99.2%	25.6	3.7	C

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
PM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	130	183	140.7%	77.5	6.4	E
	Through	630	621	98.5%	25.6	3.0	C
	Right Turn	210	207	98.6%	5.2	0.9	A
	Subtotal	970	1,011	104.2%	30.2	2.8	C
SB	Left Turn	90	91	101.6%	70.0	10.4	E
	Through	640	634	99.0%	39.5	12.9	D
	Right Turn	50	48	96.2%	43.3	13.1	D
	Subtotal	780	773	99.1%	43.8	12.2	D
EB	Left Turn	50	49	97.2%	66.5	17.0	E
	Through	20	20	102.0%	66.7	28.4	E
	Right Turn	170	170	99.7%	34.3	8.2	C
	Subtotal	240	239	99.4%	42.6	10.9	D
WB	Left Turn	140	137	97.9%	97.2	60.5	F
	Through	30	28	92.7%	168.5	84.6	F
	Right Turn	140	141	100.5%	161.0	81.3	F
	Subtotal	310	306	98.5%	133.7	70.5	F
Total		2,300	2,328	101.2%	52.2	14.7	D

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	560	521	93.1%	60.3	3.1	E
	Through	600	643	107.1%	5.7	1.8	A
	Right Turn						
	Subtotal	1,160	1,164	100.3%	31.8	1.7	C
SB	Left Turn						
	Through	660	664	100.5%	9.5	1.6	A
	Right Turn	310	294	94.7%	7.4	1.2	A
	Subtotal	970	957	98.7%	8.9	1.3	A
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	100	99	98.7%	47.7	7.5	D
	Through						
	Right Turn	370	368	99.5%	20.9	4.5	C
	Subtotal	470	467	99.3%	26.9	3.8	C
Total		2,600	2,588	99.5%	22.5	1.0	C

Vissim Post-Processor | **I-80 / Richards Blvd Interchange**
Average Results from 10 Runs | **Construction Year Build Conditions**
Volume and Delay by Movement | **PM Peak Hour**

Intersection 5 — **I-80 EB Ramps/Richards Blvd** — **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	930	949	102.0%	12.2	1.3	B
	Right Turn	120	107	89.1%	9.1	2.1	A
	Subtotal	1,050	1,056	100.6%	11.9	1.2	B
SB	Left Turn	210	214	101.8%	67.0	4.2	E
	Through	550	547	99.5%	13.7	2.3	B
	Right Turn						
	Subtotal	760	761	100.1%	30.4	2.9	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	570	569	99.8%	41.9	3.3	D
	Through						
	Right Turn	230	224	97.5%	11.3	2.9	B
	Subtotal	800	793	99.1%	32.8	2.4	C
Total		2,610	2,610	100.0%	23.8	0.9	C

Intersection 6 — **Research Park Dr/Richards Blvd-Cowell Blvd** — **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	130	128	98.2%	51.2	5.7	D
	Through	40	40	101.0%	37.0	13.8	D
	Right Turn	60	59	98.8%	13.1	7.2	B
	Subtotal	230	227	98.8%	39.1	4.3	D
SB	Left Turn	40	44	109.8%	54.0	11.8	D
	Through	10	11	108.0%	38.7	20.9	D
	Right Turn	190	186	98.1%	13.8	4.7	B
	Subtotal	240	241	100.5%	22.2	4.9	C
EB	Left Turn	320	302	94.5%	54.2	5.3	D
	Through	740	749	101.2%	11.0	4.0	B
	Right Turn	60	58	96.3%	6.0	3.8	A
	Subtotal	1,120	1,109	99.0%	22.7	2.8	C
WB	Left Turn	20	18	90.0%	59.2	8.3	E
	Through	680	692	101.8%	40.4	5.9	D
	Right Turn	40	34	85.8%	22.3	12.2	C
	Subtotal	740	744	100.6%	40.1	5.7	D
Total		2,330	2,322	99.6%	29.9	1.8	C

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
AM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	8	2	5	12	48	9	41	71	NO
	Through	100	8	2	5	12	48	9	41	71	NO
	Right Turn	400	1	0	0	1	32	6	24	42	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	22	3	18	28	129	23	101	179	NO
	Through	400	22	3	18	28	129	23	101	179	NO
	Right Turn	400	2	1	1	5	92	32	57	159	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	3	1	1	5	24	6	15	34	NO
	Through	250	8	2	6	12	127	19	100	163	NO
	Right Turn	250	9	2	6	13	130	19	103	166	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	100	0	0	0	0	4	5	0	14	NO
	Through	225	0	0	0	0	4	5	0	14	NO
	Right Turn	225	0	0	0	0	4	5	0	14	NO
	Second Right										

Vissim Post-Processor | **I-80 / Richards Blvd Interchange**
Average Results from 10 Runs | **Construction Year Build Conditions**
Queue Length | **AM Peak Hour**

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	625	34	7	20	42	411	116	181	539	NO
	Through	625	34	7	20	42	411	116	181	539	NO
	Right Turn	180	0	0	0	0	12	11	0	31	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	31	4	26	40	142	20	118	173	NO
	Through	400	31	4	26	40	142	20	118	173	NO
	Right Turn	400	5	2	1	8	85	31	41	141	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	100	16	3	12	22	73	11	58	93	NO
	Through	225	16	3	12	22	73	11	58	93	NO
	Right Turn	225	21	3	16	28	193	29	140	235	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	225	40	4	33	47	172	18	146	205	NO
	Through	225	40	4	33	47	172	18	146	205	NO
	Right Turn	225	40	4	33	47	172	18	146	205	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
AM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	175	125	10	113	143	524	48	408	580	MAX
	Through	600	116	11	96	137	541	35	464	578	NO
	Right Turn	275	0	0	0	0	20	9	7	39	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	625	9	2	5	12	56	10	46	81	NO
	Through	625	81	14	66	112	475	44	419	546	NO
	Right Turn	625	78	14	63	110	473	44	417	545	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	250	15	3	11	21	119	25	75	159	NO
	Through	600	15	3	11	21	119	25	75	159	NO
	Right Turn	250	5	2	2	9	99	31	50	149	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	200	1	1	0	2	36	19	6	69	NO
	Through	1,500	1	1	0	2	36	19	6	69	NO
	Right Turn	1,500	1	1	0	2	36	19	6	69	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
AM Peak Hour

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	475	59	2	56	62	217	10	202	235	NO
	Through	825	105	7	95	118	431	41	365	486	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	600	20	2	15	24	199	31	161	263	NO
	Right Turn	225	0	0	0	1	32	18	8	58	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	450	56	5	46	62	229	29	196	283	NO
	Through										
	Right Turn	1,225	138	25	100	171	554	106	386	710	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
AM Peak Hour

Intersection 5 **I-80 EB Ramps/Richards Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	450	22	5	17	30	270	39	228	350	NO
	Right Turn	450	16	4	12	23	246	39	203	325	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	350	67	6	57	73	152	20	129	185	NO
	Through	600	16	2	15	20	139	11	127	162	NO
	Right Turn										
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	175	61	3	58	66	245	18	209	273	MAX
	Through										
	Right Turn	1,625	9	1	8	12	99	18	75	135	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
AM Peak Hour

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	17	2	15	20	74	10	65	98	NO
	Through	625	2	1	1	3	39	12	22	60	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	125	4	1	3	5	40	6	30	47	NO
	Through	1,500	8	2	4	13	91	21	68	131	NO
	Right Turn										
	Second Right										
EB	U Turn	450	82	8	67	99	310	72	228	436	NO
	Second Left										
	Left Turn	450	82	8	67	99	310	72	228	436	NO
	Through	450	40	4	35	47	269	19	239	296	NO
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	75	0	0	0	1	23	23	0	73	NO
	Through	1,125	0	0	0	1	30	22	0	77	NO
	Right Turn										
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
PM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	21	4	17	28	119	32	84	175	MAX
	Through	100	21	4	17	28	119	32	84	175	MAX
	Right Turn	400	2	0	1	2	47	12	25	62	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	36	5	29	47	157	17	126	190	NO
	Through	400	36	5	29	47	157	17	126	190	NO
	Right Turn	400	5	3	2	10	124	29	82	162	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	4	2	2	8	45	42	23	162	NO
	Through	250	82	47	44	207	381	62	297	498	MAX
	Right Turn	250	83	48	45	209	384	62	300	501	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	100	2	3	0	8	26	31	0	109	NO
	Through	225	2	3	0	8	26	31	0	109	NO
	Right Turn	225	2	3	0	8	26	31	0	109	NO
	Second Right										

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	625	21	5	17	32	247	140	141	617	NO
	Through	625	21	5	17	32	247	140	141	617	NO
	Right Turn	180	1	0	0	1	39	20	18	86	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	47	4	39	55	197	25	171	249	NO
	Through	400	47	4	39	55	197	25	171	249	NO
	Right Turn	400	13	6	5	25	148	39	90	220	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	100	36	6	27	45	184	64	102	297	MAX
	Through	225	36	6	27	45	184	64	102	297	NO
	Right Turn	225	48	15	27	79	268	26	211	303	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	225	59	8	43	69	227	30	189	298	MAX
	Through	225	59	8	43	69	227	30	189	298	MAX
	Right Turn	225	59	8	43	69	227	30	189	298	MAX
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
PM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	175	84	9	75	102	270	54	210	353	MAX
	Through	600	93	7	85	108	469	14	449	493	NO
	Right Turn	275	1	0	1	2	51	11	43	76	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	625	43	21	21	78	300	130	134	534	NO
	Through	625	194	39	135	257	684	32	639	752	MAX
	Right Turn	625	192	39	133	255	683	32	638	751	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	250	40	7	24	50	248	37	193	295	NO
	Through	600	40	7	24	50	248	37	193	295	NO
	Right Turn	250	25	8	15	36	249	43	182	297	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	200	64	65	3	169	260	136	89	457	MAX
	Through	1,500	64	65	3	169	260	136	89	457	NO
	Right Turn	1,500	64	65	3	169	260	136	89	457	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
PM Peak Hour

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	475	92	7	80	102	278	31	248	348	NO
	Through	825	8	2	5	11	174	34	117	214	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	600	23	2	20	26	137	20	100	162	NO
	Right Turn	225	1	0	0	1	41	16	15	67	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	450	28	2	24	32	140	23	112	198	NO
	Through										
	Right Turn	1,225	46	7	39	60	256	40	190	318	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
PM Peak Hour

Intersection 5 **I-80 EB Ramps/Richards Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn										
	Through	450	36	5	26	42	282	40	209	327	NO
	Right Turn	450	25	4	16	30	257	40	185	302	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	350	52	4	48	58	144	15	121	169	NO
	Through	600	26	2	23	28	208	27	158	250	NO
	Right Turn										
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	175	74	4	70	80	294	40	254	368	MAX
	Through										
	Right Turn	1,625	13	2	10	16	115	18	80	137	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Construction Year Build Conditions
PM Peak Hour

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	29	3	23	34	100	11	81	119	NO
	Through	625	12	3	8	16	108	25	81	158	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	125	13	3	8	19	71	10	54	91	NO
	Through	1,500	9	2	7	13	129	31	95	193	NO
	Right Turn										
	Second Right										
EB	U Turn	450	103	12	91	127	351	60	287	472	NO
	Second Left										
	Left Turn	450	103	12	91	127	351	60	287	472	NO
	Through	450	29	8	18	44	222	28	173	262	NO
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	75	1	1	0	3	43	29	13	95	NO
	Through	1,125	1	1	0	3	46	30	15	101	NO
	Right Turn										
	Second Right										

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	West of Old Davis Rd
Alternative	Construction Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,740	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,088	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.45	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,740	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,088	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.45	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	6	ln	Average Speed, S	70.5	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	13.0	pcphpl
Flow Rate, vp	916	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.38				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	5	2	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,740	50	vph
Peak Hour Factor, PHF	0.95	0.90	
Total Trucks	9.0%	0.5%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.995	
Flow Rate, v_p	5,439	56	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,439	12,000	pcph	0.45
Exiting General Purpose Lanes	5,494	14,400	pcph	0.38
On Ramp	56	4,200	pcph	0.01

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd to Lane Drop 1
Alternative	Construction Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	820	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,790	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,099	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.46	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.6	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Lane Drop 1 to Lane Drop 2
Alternative	Construction Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,480	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,790	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,374	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.57	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	19.5	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,240	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,790	590	vph
Peak Hour Factor, PHF	0.95	0.88	
Total Trucks	9.0%	3.3%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.968	
Flow Rate, v_p	5,496	693	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		2,740	ft
Volume on Adjacent Ramp		381	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	531	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.591	
Flow Rate in Lanes 1 and 2, v_{12}	3,530	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,496	7,200	pcph	0.76
Exiting General Purpose Lanes	4,803	7,200	pcph	0.67
Off Ramp	693	1,900	pcph	0.36
Ramp Influence Area	3,530	4,400	pcph	0.80

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	33.3	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.620	
Average Speed in Ramp Influence Area, S_R	53.0	mph
Average Flow in Outer Lanes, v_{OA}	1,966	pcphpl
Average Speed in Outer Lanes, S_O	74.0	mph
Average Speed for Segment, S	59.0	mph
Density across All Lanes, D	31.6	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off to On
Alternative	Construction Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,200	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,606	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.5	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,200	330	vph
Peak Hour Factor, PHF	0.95	0.88	
Total Trucks	9.0%	1.7%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.983	
Flow Rate, v_p	4,819	381	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,740		ft
Volume on Adjacent Ramp	693		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,286	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.592	
Flow Rate in Lanes 1 and 2, v_{12}	2,850	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,819	7,200	pcph	0.67
Exiting General Purpose Lanes	5,200	7,200	pcph	0.72
On Ramp	381	2,100	pcph	0.18
Ramp Influence Area	3,232	4,600	pcph	0.70

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	27.4	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.375	
Average Speed in Ramp Influence Area, S_R	59.8	mph
Average Flow in Outer Lanes, v_{OA}	1,969	pcphpl
Average Speed in Outer Lanes, S_O	65.2	mph
Average Speed for Segment, S	61.7	mph
Density across All Lanes, D	29.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd to Chiles Rd
Alternative	Construction Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	5,710	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,530	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,733	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.72	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.8	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,500	1,500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,530	380	vph
Peak Hour Factor, PHF	0.95	0.78	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,198	502	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Construction Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.450	
Flow Rate in Lanes 1 and 2, v_{12}	2,970	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,198	7,200	pcph	0.72
Exiting General Purpose Lanes	4,696	7,200	pcph	0.65
Off Ramp	502	3,800	pcph	0.13
Ramp Influence Area	2,970	4,400	pcph	0.68

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	16.3	pcpmpl
Level of Service, LOS	B	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.603	
Average Speed in Ramp Influence Area, S_R	53.5	mph
Average Flow in Outer Lanes, v_{OA}	2,228	pcphpl
Average Speed in Outer Lanes, S_O	73.0	mph
Average Speed for Segment, S	60.4	mph
Density across All Lanes, D	30.7	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off to Mace Rd On
Alternative	Construction Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,000	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,150	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,587	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.1	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	West of Old Davis Rd
Alternative	Construction Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,930	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,086	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.45	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,930	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,086	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.45	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.4	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	6	ln	Average Speed, S	70.5	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	13.6	pcphpl
Flow Rate, vp	961	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.40				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	5	2	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,930	260	vph
Peak Hour Factor, PHF	0.99	0.77	
Total Trucks	9.0%	0.5%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.995	
Flow Rate, v_p	5,428	339	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,428	12,000	pcph	0.45
Exiting General Purpose Lanes	5,767	14,400	pcph	0.40
On Ramp	339	4,200	pcph	0.08

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd to Lane Drop 1
Alternative	Construction Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	820	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	5,190	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,143	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.48	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	16.2	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Lane Drop 1 to Lane Drop 2
Alternative	Construction Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,480	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,190	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,429	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.60	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.1	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	20.4	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,240	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,190	660	vph
Peak Hour Factor, PHF	0.99	0.86	
Total Trucks	9.0%	2.4%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.977	
Flow Rate, v_p	5,714	786	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		2,740	ft
Volume on Adjacent Ramp		414	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	611	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.581	
Flow Rate in Lanes 1 and 2, v_{12}	3,649	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,714	7,200	pcph	0.79
Exiting General Purpose Lanes	4,928	7,200	pcph	0.68
Off Ramp	786	1,900	pcph	0.41
Ramp Influence Area	3,649	4,400	pcph	0.83

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	34.3	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.629	
Average Speed in Ramp Influence Area, S_R	52.7	mph
Average Flow in Outer Lanes, v_{OA}	2,065	pcphpl
Average Speed in Outer Lanes, S_O	73.6	mph
Average Speed for Segment, S	58.7	mph
Density across All Lanes, D	33.1	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off to On
Alternative	Construction Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,530	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,663	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.69	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.5	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,530	340	vph
Peak Hour Factor, PHF	0.99	0.84	
Total Trucks	9.0%	2.2%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.978	
Flow Rate, v_p	4,988	414	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,740		ft
Volume on Adjacent Ramp	786		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,329	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.592	
Flow Rate in Lanes 1 and 2, v_{12}	2,950	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,988	7,200	pcph	0.69
Exiting General Purpose Lanes	5,401	7,200	pcph	0.75
On Ramp	414	2,100	pcph	0.20
Ramp Influence Area	3,364	4,600	pcph	0.73

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	28.5	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.389	
Average Speed in Ramp Influence Area, S_R	59.4	mph
Average Flow in Outer Lanes, v_{OA}	2,037	pcphpl
Average Speed in Outer Lanes, S_O	64.9	mph
Average Speed for Segment, S	61.4	mph
Density across All Lanes, D	30.3	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd to Chiles Rd
Alternative	Construction Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	5,710	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,870	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,787	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.74	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.9	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,500	1,500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,870	430	vph
Peak Hour Factor, PHF	0.99	0.76	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,362	583	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Construction Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.450	
Flow Rate in Lanes 1 and 2, v_{12}	3,064	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,362	7,200	pcph	0.74
Exiting General Purpose Lanes	4,779	7,200	pcph	0.66
Off Ramp	583	3,800	pcph	0.15
Ramp Influence Area	3,064	4,400	pcph	0.70

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	17.1	pcpmpl
Level of Service, LOS	B	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.610	
Average Speed in Ramp Influence Area, S_R	53.2	mph
Average Flow in Outer Lanes, v_{OA}	2,298	pcphpl
Average Speed in Outer Lanes, S_O	72.7	mph
Average Speed for Segment, S	60.1	mph
Density across All Lanes, D	31.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off to Mace Rd On
Alternative	Construction Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,000	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,440	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,629	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.68	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.8	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Construction Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,550	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,687	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.70	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.9	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,550	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,687	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.70	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.5	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	20.1	pcphpl
Flow Rate, vp	1,419	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.59				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,550	550	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,061	616	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,061	7,200	pcph	0.70
Exiting General Purpose Lanes	5,676	9,600	pcph	0.59
On Ramp	616	4,200	pcph	0.15

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Olive Dr
Alternative	Construction Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	4,780	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,100	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,891	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.79	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	29.1	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	35	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,100	230	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,672	258	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		Off	
Distance to Adjacent Ramp		2,390	ft
Volume on Adjacent Ramp		403	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	461	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.606	
Flow Rate in Lanes 1 and 2, v_{12}	3,541	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,672	7,200	pcph	0.79
Exiting General Purpose Lanes	5,415	7,200	pcph	0.75
Off Ramp	258	2,000	pcph	0.13
Ramp Influence Area	3,541	4,400	pcph	0.80

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	33.4	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.451	
Average Speed in Ramp Influence Area, S_R	58.1	mph
Average Flow in Outer Lanes, v_{OA}	2,132	pcphpl
Average Speed in Outer Lanes, S_O	73.8	mph
Average Speed for Segment, S	63.1	mph
Density across All Lanes, D	30.9	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr to Richards Blvd
Alternative	Construction Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	890	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,870	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,806	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.75	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.5	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,870	360	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,417	403	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,390		ft
Volume on Adjacent Ramp	258		pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,561	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.606	
Flow Rate in Lanes 1 and 2, v_{12}	3,442	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,417	7,200	pcph	0.75
Exiting General Purpose Lanes	5,014	7,200	pcph	0.70
Off Ramp	403	2,100	pcph	0.19
Ramp Influence Area	3,442	4,400	pcph	0.78

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	32.5	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.334	
Average Speed in Ramp Influence Area, S_R	60.7	mph
Average Flow in Outer Lanes, v_{OA}	1,975	pcphpl
Average Speed in Outer Lanes, S_O	73.0	mph
Average Speed for Segment, S	64.7	mph
Density across All Lanes, D	28.6	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off to On
Alternative	Construction Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	430	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,510	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,672	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.70	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.8	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Construction Year No Build
Time period	AM Peak Hour

Geometric Data

Segment Type	Freeway	
Weaving Configuration	One-sided	
Number of Lanes, N	4	ln
Weaving Segment Length, L_S	500	ft
Interchange Density, ID	0.8	int/mi
Number of Manuever Lanes, N_{WL}	2.0	ln
On Ramp to Freeway Lane Changes, LC_{RF}	1	
Freeway to Off Ramp Lane Changes, LC_{FR}	1	
On Ramp to Off Ramp Lane Changes, LC_{RR}	0	

Adjustment Factors

Driver Population	Familiar
Weather Type	Non-severe
Incident Type	No incident
Capacity Adjustment Factor, CAF	
Demand Adjustment Factor, DAF	

Volume Data

	Frwy to Frwy	On to Frwy	Frwy to Off	Frwy to Off	
Volume, V	4,310	420	200	0	vph
Peak-hour factor, PHF	0.98	0.78	0.72	0.95	
Total Trucks	9.0%	2.2%	0.5%	3.0%	
Terrain Type	Level	Level	Level	Level	
Grade					
Length					mi
SUT/TT Mix					
Passenger Car Equivalent, E_T	2.0	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.978	0.995	0.971	
Demand Adjustment Factor, DAF	1.00	1.00	1.00	1.00	
Flow Rate, v_p	4,794	550	279	0	pcph

Weaving Flow Rate, vW	829	Total Flow Rate, v	5,623
Non-Weaving Flow Rate, vNW	4,794	Volume Ratio, VR	0.148

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Construction Year No Build
Time period	AM Peak Hour

Capacity

Maximum Weaving Length, L_{MAX}	4,007	ft
Weaving Length Check	OK	
Freeway Maximum Capacity, c_{IFL}	2,400	pchpl
Density-Based Capacity, c_{IWL}	9,332	pchpl
Demand Flow-Based Capacity, c_{IW}	15,087	pch
Weaving Segment Capacity, c_W	15,087	vph
Adjusted Weaving Area Capacity, c_{wa}	15,087	vph
Volume-to-Capacity Ratio, v/c	0.35	

Speed and Density

Minimum Lane Change Rate, LC_{MIN}	829	lc/h
Weaving Lane Change Rate, LC_W	849	lc/h
Non-weaving Vehicle Index, I_{NW}	200	
Non-weaving Lane Change Rate, LC_{NW}	488	lc/h
Total Lane Change Rate, LC_{ALL}	1,337	lc/h
Weaving Intensity Factor, W	0.491	
Average Weaving Speed, S_W	51.9	mph
Average Non-Weaving Speed, S_{NW}	57.3	mph
Average Speed, S	56.5	mph
Density, D	24.9	pcpmpl
Level of Service, LOS	C	

Capacity Checks

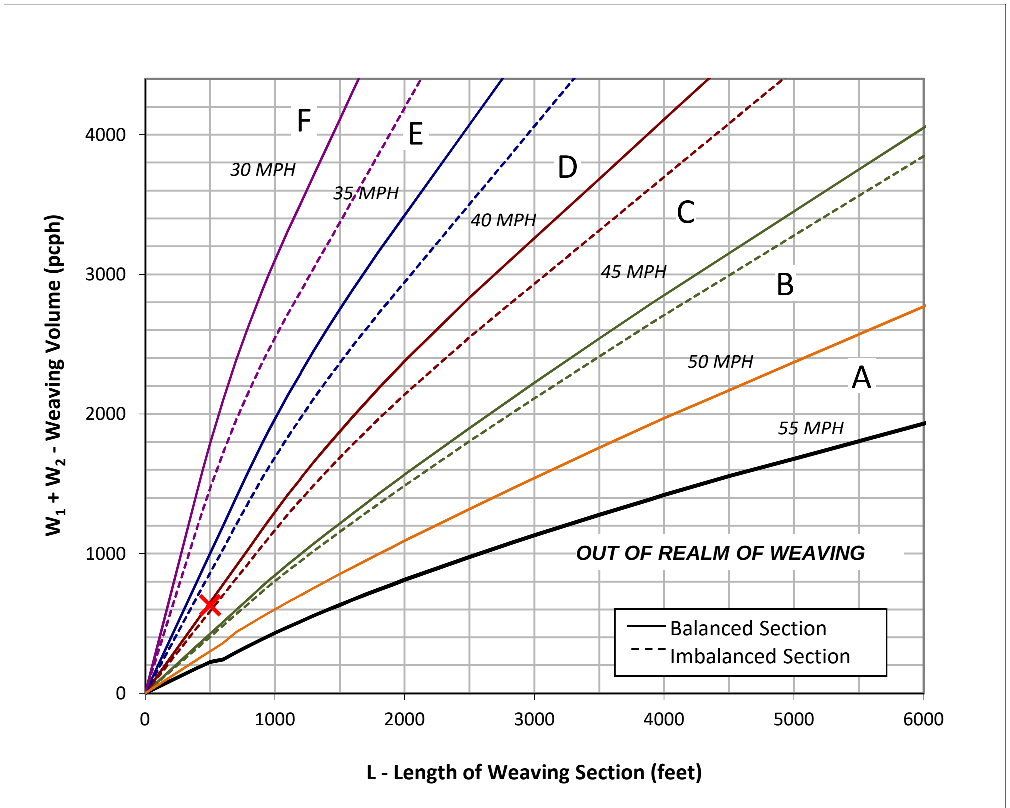
	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,016	7,200	pcph	0.70
Exiting General Purpose Lanes	5,263	7,200	pcph	0.73
On Ramp	470	1,900	pcph	0.25
Off Ramp	224	1,900	pcph	0.12

Leisch Method for Weaving Analysis

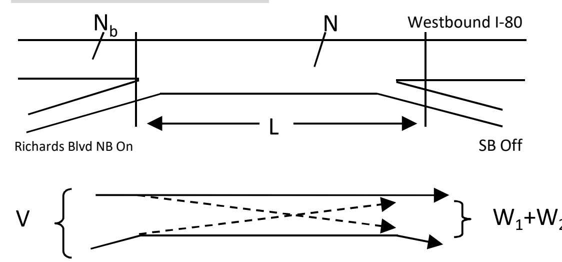
Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	500

Project Information	
Project	I-80/Richards Blvd Interchange
Scenario	Construction Year No Build
Freeway	Westbound I-80
On-ramp	Richards Blvd NB On
Off-ramp	SB Off

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,930	Volume (vph)*	420	Volume (vph)*	200
Truck Percentage	8.1%	Truck Percentage	2.2%	Truck Percentage	0.5%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,328	Volume (pcph)	429	Volume (pcph)	201



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?

   35 MPH and **40 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) — 39.2
4. Weaving Intensity Factor (k) — 2.57
5. Service Volume (SV, pcph)

   SV = (1/N)*[V + (k - 1)*min(W_1, W_2)] — 1,411
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

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB Off to On
Alternative	Construction Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	210	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,730	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,754	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.73	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.4	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	3,770	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.4	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,730	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,315	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.55	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.4	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	18.7	pcpmpl
Total Ramp Density Adjustment	5.0	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.1	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	19.3	pcphpl
Flow Rate, vp	1,352	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.56				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	70.4	45	mph
Segment Length, L / Acceleration Length, LA	3,770	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,730	130	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,261	146	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,261	9,600	pcph	0.55
Exiting General Purpose Lanes	5,406	9,600	pcph	0.56
On Ramp	146	2,100	pcph	0.07

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	5	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,860	490	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,406	549	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Construction Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,431	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,406	12,000	pcph	0.45
Exiting General Purpose Lanes	4,857	12,000	pcph	0.40
Off Ramp	549	2,100	pcph	0.26
Ramp Influence Area	2,431	4,400	pcph	0.55

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	23.8	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.347	
Average Speed in Ramp Influence Area, S_R	60.3	mph
Average Flow in Outer Lanes, v_{OA}	992	pcphpl
Average Speed in Outer Lanes, S_O	76.8	mph
Average Speed for Segment, S	68.4	mph
Density across All Lanes, D	16.1	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Construction Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,370	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	972	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.41	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	13.9	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Construction Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,290	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,574	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.8	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,290	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,574	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.7	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.9	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	18.7	pcphpl
Flow Rate, vp	1,324	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.55				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,290	510	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,723	571	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,723	7,200	pcph	0.66
Exiting General Purpose Lanes	5,294	9,600	pcph	0.55
On Ramp	571	4,200	pcph	0.14

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Olive Dr
Alternative	Construction Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	4,780	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,800	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,762	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.73	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.3	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	35	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,800	130	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,285	146	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		Off	
Distance to Adjacent Ramp		2,390	ft
Volume on Adjacent Ramp		246	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	266	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.621	
Flow Rate in Lanes 1 and 2, v_{12}	3,338	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,285	7,200	pcph	0.73
Exiting General Purpose Lanes	5,139	7,200	pcph	0.71
Off Ramp	146	2,000	pcph	0.07
Ramp Influence Area	3,338	4,400	pcph	0.76

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	31.6	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.441	
Average Speed in Ramp Influence Area, S_R	58.4	mph
Average Flow in Outer Lanes, v_{OA}	1,947	pcphpl
Average Speed in Outer Lanes, S_O	74.5	mph
Average Speed for Segment, S	63.4	mph
Density across All Lanes, D	28.5	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr to Richards Blvd
Alternative	Construction Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	890	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,670	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,714	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.71	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.6	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,670	220	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,142	246	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,390		ft
Volume on Adjacent Ramp	146		pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	853	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.620	
Flow Rate in Lanes 1 and 2, v_{12}	3,282	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,142	7,200	pcph	0.71
Exiting General Purpose Lanes	4,895	7,200	pcph	0.68
Off Ramp	246	2,100	pcph	0.12
Ramp Influence Area	3,282	4,400	pcph	0.75

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	31.1	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.320	
Average Speed in Ramp Influence Area, S_R	61.1	mph
Average Flow in Outer Lanes, v_{OA}	1,860	pcphpl
Average Speed in Outer Lanes, S_O	73.5	mph
Average Speed for Segment, S	65.0	mph
Density across All Lanes, D	26.9	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off to On
Alternative	Construction Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	430	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,450	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,633	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.68	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.1	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Construction Year No Build
Time period	PM Peak Hour

Geometric Data

Segment Type	Freeway	
Weaving Configuration	One-sided	
Number of Lanes, N	4	ln
Weaving Segment Length, L_S	500	ft
Interchange Density, ID	0.8	int/mi
Number of Manuever Lanes, N_{WL}	2.0	ln
On Ramp to Freeway Lane Changes, LC_{RF}	1	
Freeway to Off Ramp Lane Changes, LC_{FR}	1	
On Ramp to Off Ramp Lane Changes, LC_{RR}	0	

Adjustment Factors

Driver Population	Familiar
Weather Type	Non-severe
Incident Type	No incident
Capacity Adjustment Factor, CAF	
Demand Adjustment Factor, DAF	

Volume Data

	Frwy to Frwy	On to Frwy	Frwy to Off	Frwy to Off	
Volume, V	4,360	530	90	0	vph
Peak-hour factor, PHF	0.99	0.74	0.78	0.95	
Total Trucks	9.0%	1.8%	0.5%	3.0%	
Terrain Type	Level	Level	Level	Level	
Grade					
Length					mi
SUT/TT Mix					
Passenger Car Equivalent, E_T	2.0	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.982	0.995	0.971	
Demand Adjustment Factor, DAF	1.00	1.00	1.00	1.00	
Flow Rate, v_p	4,800	729	116	0	pcph

Weaving Flow Rate, vW	845	Total Flow Rate, v	5,645
Non-Weaving Flow Rate, vNW	4,800	Volume Ratio, VR	0.150

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Construction Year No Build
Time period	PM Peak Hour

Capacity

Maximum Weaving Length, L_{MAX}	4,028	ft
Weaving Length Check	OK	
Freeway Maximum Capacity, c_{IFL}	2,400	pchpl
Density-Based Capacity, c_{IWL}	9,330	pchpl
Demand Flow-Based Capacity, c_{IW}	14,869	pch
Weaving Segment Capacity, c_W	14,869	vph
Adjusted Weaving Area Capacity, c_{wa}	14,869	vph
Volume-to-Capacity Ratio, v/c	0.35	

Speed and Density

Minimum Lane Change Rate, LC_{MIN}	845	lc/h
Weaving Lane Change Rate, LC_W	865	lc/h
Non-weaving Vehicle Index, I_{NW}	200	
Non-weaving Lane Change Rate, LC_{NW}	489	lc/h
Total Lane Change Rate, LC_{ALL}	1,354	lc/h
Weaving Intensity Factor, W	0.496	
Average Weaving Speed, S_W	51.8	mph
Average Non-Weaving Speed, S_{NW}	57.2	mph
Average Speed, S	56.3	mph
Density, D	25.1	pcpmpl
Level of Service, LOS	C	

Capacity Checks

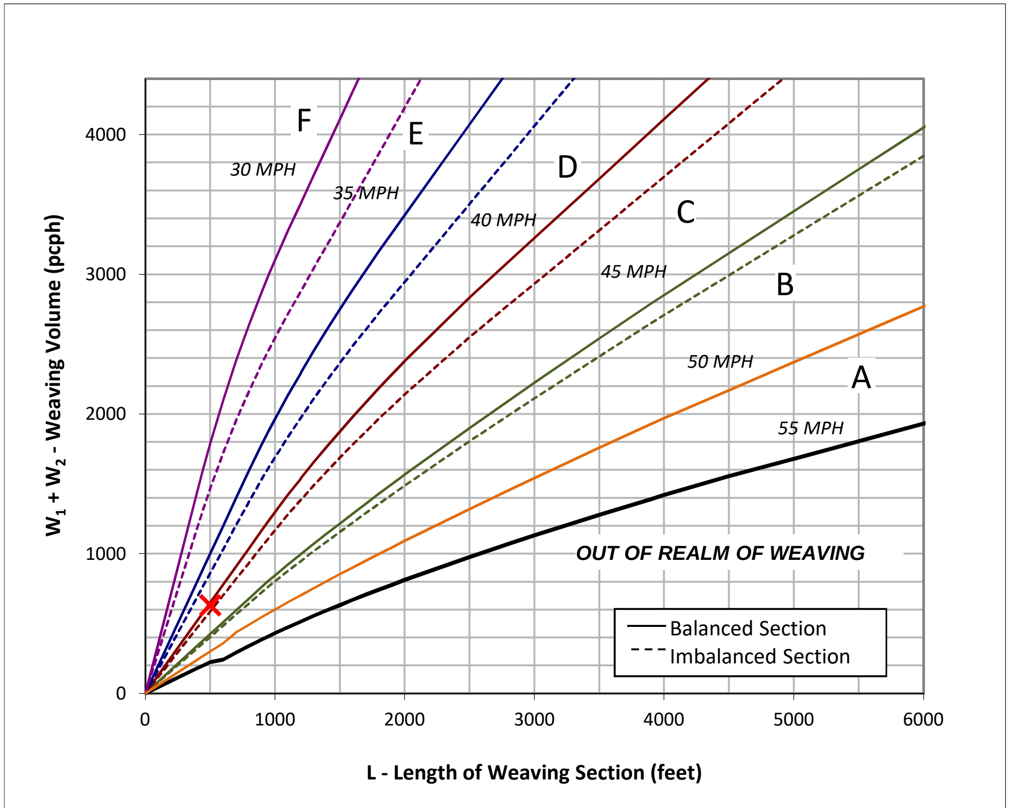
	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,899	7,200	pcph	0.68
Exiting General Purpose Lanes	5,392	7,200	pcph	0.75
On Ramp	593	1,900	pcph	0.31
Off Ramp	101	1,900	pcph	0.05

Leisch Method for Weaving Analysis

Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	500

Project Information	
Project	I-80/Richards Blvd Interchange
Scenario	Construction Year No Build
Freeway	Westbound I-80
On-ramp	Richards Blvd NB On
Off-ramp	SB Off

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	4,980	Volume (vph)*	530	Volume (vph)*	90
Truck Percentage	8.1%	Truck Percentage	1.8%	Truck Percentage	0.5%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,382	Volume (pcph)	540	Volume (pcph)	90

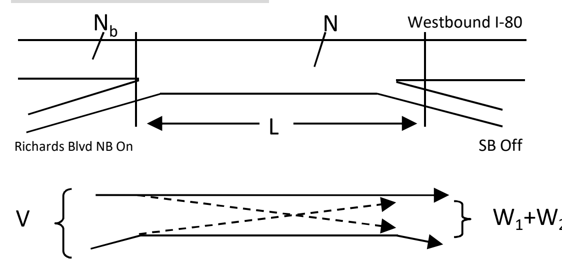


The LOS in the chart above refers to the capacity of weaving traffic only; through and ramp to ramp traffic is not included.

* 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?

   40 MPH and **45 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) 38.8
4. Weaving Intensity Factor (k) 3.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,391
6. Level of Service (LOS) D

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB Off to On
Alternative	Construction Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	210	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,890	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,795	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.75	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.2	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	3,770	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.4	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,890	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,795	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.75	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.4	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.1	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.1	pcpmpl
Total Ramp Density Adjustment	5.0	mph	Level of Service, LOS	D	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	69.8	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	20.5	pcphpl
Flow Rate, vp	1,427	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.59				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.4	45	mph
Segment Length, L / Acceleration Length, LA	3,770	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,890	290	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,384	325	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,384	7,200	pcph	0.75
Exiting General Purpose Lanes	5,709	9,600	pcph	0.59
On Ramp	325	2,100	pcph	0.15

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,180	210	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,703	235	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Construction Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,619	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,703	9,600	pcph	0.59
Exiting General Purpose Lanes	5,468	12,000	pcph	0.46
Off Ramp	235	2,100	pcph	0.11
Ramp Influence Area	2,619	4,400	pcph	0.60

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	25.4	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.319	
Average Speed in Ramp Influence Area, S_R	61.1	mph
Average Flow in Outer Lanes, v_{OA}	1,542	pcphpl
Average Speed in Outer Lanes, S_O	74.7	mph
Average Speed for Segment, S	67.8	mph
Density across All Lanes, D	21.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Construction Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,970	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,094	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.46	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.6	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Construction Year Build
Time Period	AM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.00	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.2	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,550	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,687	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.70	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.2	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.7	pcpmpl
Total Ramp Density Adjustment	3.2	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year Build
Time Period	AM Peak Period

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,550	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,687	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.70	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.6	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	71.5	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	19.9	pcphpl
Flow Rate, vp	1,419	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.59				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year Build
Time Period	AM Peak Period

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,550	550	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,061	616	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year Build
Time Period	AM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,061	7,200	pcph	0.70
Exiting General Purpose Lanes	5,676	9,600	pcph	0.59
On Ramp	616	4,200	pcph	0.15

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Richards Blvd
Alternative	Construction Year Build
Time Period	AM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	7,170	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,100	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,891	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.79	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	28.9	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year Build
Time Period	AM Peak Period

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,100	430	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,672	481	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year Build
Time Period	AM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.596	
Flow Rate in Lanes 1 and 2, v_{12}	3,575	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,672	7,200	pcph	0.79
Exiting General Purpose Lanes	5,191	7,200	pcph	0.72
Off Ramp	481	2,100	pcph	0.23
Ramp Influence Area	3,575	4,400	pcph	0.81

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	33.7	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.341	
Average Speed in Ramp Influence Area, S_R	62.2	mph
Average Flow in Outer Lanes, v_{OA}	2,097	pcphpl
Average Speed in Outer Lanes, S_O	75.4	mph
Average Speed for Segment, S	66.5	mph
Density across All Lanes, D	29.2	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off to On
Alternative	Construction Year Build
Time Period	AM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,140	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,670	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,731	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.72	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.7	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year Build
Time Period	AM Peak Period

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	3,770	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,670	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,299	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.54	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	71.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	18.3	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.2	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	20.7	pcphpl
Flow Rate, vp	1,452	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.61				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year Build
Time Period	AM Peak Period

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	3,770	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,670	550	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,194	616	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year Build
Time Period	AM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,194	9,600	pcph	0.54
Exiting General Purpose Lanes	5,810	9,600	pcph	0.61
On Ramp	616	2,100	pcph	0.29

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Davis Off
Alternative	Construction Year Build
Time Period	AM Peak Period

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	5	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,220	481	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,806	539	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Davis Off
Alternative	Construction Year Build
Time Period	AM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,455	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,806	12,000	pcph	0.48
Exiting General Purpose Lanes	5,267	12,000	pcph	0.44
Off Ramp	539	2,100	pcph	0.26
Ramp Influence Area	2,455	4,400	pcph	0.56

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	24.0	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.346	
Average Speed in Ramp Influence Area, S_R	61.1	mph
Average Flow in Outer Lanes, v_{OA}	1,117	pcphpl
Average Speed in Outer Lanes, S_O	77.8	mph
Average Speed for Segment, S	69.7	mph
Density across All Lanes, D	16.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Construction Year Build
Time Period	AM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,739	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,054	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.44	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	71.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	14.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Construction Year Build
Time Period	PM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.00	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.2	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,290	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,574	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.2	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.6	pcpmpl
Total Ramp Density Adjustment	3.2	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year Build
Time Period	PM Peak Period

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,290	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,574	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.66	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.5	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	72.1	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	18.4	pcphpl
Flow Rate, vp	1,324	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.55				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year Build
Time Period	PM Peak Period

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,290	510	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,723	571	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Construction Year Build
Time Period	PM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,723	7,200	pcph	0.66
Exiting General Purpose Lanes	5,294	9,600	pcph	0.55
On Ramp	571	4,200	pcph	0.14

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Richards Blvd
Alternative	Construction Year Build
Time Period	PM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	7,170	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,800	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,762	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.73	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.1	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	D	

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year Build
Time Period	PM Peak Period

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,800	440	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,285	493	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Construction Year Build
Time Period	PM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.605	
Flow Rate in Lanes 1 and 2, v_{12}	3,393	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,285	7,200	pcph	0.73
Exiting General Purpose Lanes	4,792	7,200	pcph	0.67
Off Ramp	493	2,100	pcph	0.23
Ramp Influence Area	3,393	4,400	pcph	0.77

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	32.1	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.342	
Average Speed in Ramp Influence Area, S_R	62.2	mph
Average Flow in Outer Lanes, v_{OA}	1,892	pcphpl
Average Speed in Outer Lanes, S_O	76.2	mph
Average Speed for Segment, S	66.6	mph
Density across All Lanes, D	27.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off to On
Alternative	Construction Year Build
Time Period	PM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,140	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,360	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,600	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.2	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year Build
Time Period	PM Peak Period

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	3,770	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,360	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,200	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.50	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	71.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	16.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	B	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	3	ln	Average Speed, S	64.7	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	29.5	pcphpl
Flow Rate, vp	1,906	pcphpl	Level of Service, LOS	D	
Volume-to-Capacity Ratio, v/c	0.79				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year Build
Time Period	PM Peak Period

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	3,770	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,360	820	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,800	918	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Construction Year Build
Time Period	PM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,800	9,600	pcph	0.50
Exiting General Purpose Lanes	5,718	7,200	pcph	0.79
On Ramp	918	2,100	pcph	0.44

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Davis Off
Alternative	Construction Year Build
Time Period	PM Peak Period

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	5	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,180	210	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,703	235	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Davis Off
Alternative	Construction Year Build
Time Period	PM Peak Period

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,246	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,703	12,000	pcph	0.48
Exiting General Purpose Lanes	5,468	12,000	pcph	0.46
Off Ramp	235	2,100	pcph	0.11
Ramp Influence Area	2,246	4,400	pcph	0.51

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	22.2	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.319	
Average Speed in Ramp Influence Area, S_R	61.9	mph
Average Flow in Outer Lanes, v_{OA}	1,152	pcphpl
Average Speed in Outer Lanes, S_O	77.6	mph
Average Speed for Segment, S	70.6	mph
Density across All Lanes, D	16.1	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Construction Year Build
Time Period	PM Peak Period

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	5	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,970	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,094	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.46	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	71.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	15.3	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	B	

Output Summary

General Information

Project description:	I-80/Richards Blvd Interchange - Construction Year Conditions No Build Alternative				
Analyst:	DS	Date:	1/20/2018	Area type:	Urban
First year of analysis:	2022				
Last year of analysis:	2022				

Crash Data Description

Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2012
	Project-level crash data available?	No	Last year of crash data:	2014
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility		**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:		4.3	0.0	0.1	0.7	0.8	2.6
Estimated average crash freq. during Study Period, crashes/yr:		4.3	0.0	0.1	0.7	0.8	2.6
Crashes by Facility Component	**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	5	4.3	0.0	0.1	0.7	0.8	2.6
Crossroad ramp terminals, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Crashes for Entire Facility by Year	**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during the Study Period, crashes:	2022	4.3	0.0	0.1	0.7	0.8	2.6
	2023						
	2024						
	2025						
	2026						
	2027						
	2028						
	2029						
	2030						
	2031						
	2032						
	2033						
	2034						
	2035						
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						
	2043						
	2044						
	2045						

Distribution of Crashes for Entire Facility

Crash Type	**Crash Type Category**	**Estimated Number of Crashes During the Study Period**					
		Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Rear-end crashes:	0.2	0.0	0.0	0.0	0.1	0.1
	Sideswipe crashes:	0.1	0.0	0.0	0.0	0.0	0.1
	Other multiple-vehicle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Total multiple-vehicle crashes:	0.3	0.0	0.0	0.1	0.1	0.2
Single vehicle	Crashes with animal:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:	3.2	0.0	0.1	0.4	0.5	2.1
	Crashes with other object:	0.1	0.0	0.0	0.0	0.0	0.1
	Crashes with parked vehicle:	0.0	0.0	0.0	0.0	0.0	0.0
	Other single-vehicle crashes	0.7	0.0	0.0	0.2	0.2	0.3
	Total single-vehicle crashes:	4.0	0.0	0.1	0.6	0.8	2.5
	Total crashes:	4.3	0.0	0.1	0.7	0.8	2.6

Output Summary								
General Information								
Project description:	I-80/Richards Blvd Interchange - Construction Year Conditions Build Alternative							
Analyst:	DS	Date:	1/20/2018		Area type:		Urban	
First year of analysis:	2022							
Last year of analysis:	2022							
Crash Data Description								
Freeway segments	Segment crash data available?			No	First year of crash data:			
	Project-level crash data available?			No	Last year of crash data:			
Ramp segments	Segment crash data available?			No	First year of crash data:			
	Project-level crash data available?			No	Last year of crash data:			
Ramp terminals	Segment crash data available?			No	First year of crash data:			
	Project-level crash data available?			No	Last year of crash data:			
Estimated Crash Statistics								
Crashes for Entire Facility			**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during Study Period, crashes:			1.6	0.0	0.1	0.3	0.4	0.8
Estimated average crash freq. during Study Period, crashes/yr:			1.6	0.0	0.1	0.3	0.4	0.8
Crashes by Facility Component		**Nbr. Sites**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Freeway segments, crashes:		0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:		2	1.6	0.0	0.1	0.3	0.4	0.8
Crossroad ramp terminals, crashes:		0	0.0	0.0	0.0	0.0	0.0	0.0
Crashes for Entire Facility by Year		**Year**	**Total**	**K**	**A**	**B**	**C**	**PDO**
Estimated number of crashes during the Study Period, crashes:		2022	1.6	0.0	0.1	0.3	0.4	0.8
		2023						
		2024						
		2025						
		2026						
		2027						
		2028						
		2029						
		2030						
		2031						
		2032						
		2033						
		2034						
		2035						
		2036						
		2037						
		2038						
		2039						
		2040						
		2041						
		2042						
		2043						
		2044						
		2045						
Distribution of Crashes for Entire Facility								
Crash Type	**Crash Type Category**		**Estimated Number of Crashes During the Study Period**					
			Total	**K**	**A**	**B**	**C**	**PDO**
Multiple vehicle	Head-on crashes:		0.0	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:		0.0	0.0	0.0	0.0	0.0	0.0
	Rear-end crashes:		0.2	0.0	0.0	0.0	0.0	0.1
	Sideswipe crashes:		0.1	0.0	0.0	0.0	0.0	0.0
	Other multiple-vehicle crashes:		0.0	0.0	0.0	0.0	0.0	0.0
	Total multiple-vehicle crashes:		0.2	0.0	0.0	0.0	0.0	0.1
Single vehicle	Crashes with animal:		0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:		1.0	0.0	0.0	0.2	0.2	0.6
	Crashes with other object:		0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with parked vehicle:		0.0	0.0	0.0	0.0	0.0	0.0
	Other single-vehicle crashes		0.3	0.0	0.0	0.1	0.1	0.1
	Total single-vehicle crashes:		1.3	0.0	0.1	0.3	0.3	0.7
Total crashes:			1.6	0.0	0.1	0.3	0.4	0.8

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	20	14	68.0%	335.9	372.5	F
	Through	30	25	84.3%	357.6	370.8	F
	Right Turn	30	21	70.0%	1012.4	406.9	F
	Subtotal	80	60	74.9%	694.7	472.2	F
SB	Left Turn	90	8	9.1%	2155.4	1615.7	F
	Through	50	5	10.8%	1886.2	1738.5	F
	Right Turn	140	16	11.5%	2059.8	1587.3	F
	Subtotal	280	30	10.6%	2126.1	1610.9	F
EB	Left Turn	50	34	68.0%	327.2	41.9	F
	Through	260	175	67.4%	413.6	87.9	F
	Right Turn	30	19	64.3%	339.5	69.4	F
	Subtotal	340	229	67.2%	395.6	83.0	F
WB	Left Turn	30	25	84.3%	76.8	9.8	E
	Through	570	521	91.4%	1.9	0.9	A
	Right Turn	50	41	82.8%	1.2	0.4	A
	Subtotal	650	588	90.4%	5.4	1.7	A
Total		1,350	906	67.1%	234.3	136.8	F

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	580	517	89.2%	20.4	3.7	C
	Through	90	72	79.6%	25.7	5.8	C
	Right Turn	290	250	86.2%	8.3	2.9	A
	Subtotal	960	839	87.4%	17.4	3.7	B
SB	Left Turn	10	8	80.0%	440.4	255.8	F
	Through	200	178	89.1%	562.5	103.4	F
	Right Turn	20	18	90.5%	443.6	182.4	F
	Subtotal	230	204	88.8%	556.9	102.7	F
EB	Left Turn	10	7	67.0%	78.9	53.6	E
	Through	60	42	70.3%	100.1	25.4	F
	Right Turn	310	156	50.2%	157.5	24.9	F
	Subtotal	380	205	53.8%	143.7	16.9	F
WB	Left Turn	190	185	97.4%	145.4	29.1	F
	Through	50	52	103.4%	95.3	16.8	F
	Right Turn	10	11	108.0%	82.5	35.0	F
	Subtotal	250	248	99.0%	133.1	23.9	F
Total		1,820	1,495	82.2%	125.1	12.6	F

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	380	331	87.1%	85.8	15.5	F
	Through	690	613	88.9%	68.9	12.1	E
	Right Turn	50	37	73.2%	46.9	13.1	D
	Subtotal	1,120	981	87.6%	74.1	12.9	E
SB	Left Turn	40	26	66.0%	110.3	18.2	F
	Through	600	452	75.4%	88.7	3.3	F
	Right Turn	60	41	68.0%	82.6	7.5	F
	Subtotal	700	520	74.2%	89.4	3.7	F
EB	Left Turn	60	59	98.3%	57.9	13.0	E
	Through	30	30	100.3%	56.4	16.3	E
	Right Turn	210	206	98.1%	21.0	5.7	C
	Subtotal	300	295	98.4%	30.8	6.9	C
WB	Left Turn	150	118	78.6%	484.4	37.7	F
	Through	100	81	80.7%	566.4	53.3	F
	Right Turn	210	166	79.1%	544.0	49.7	F
	Subtotal	460	365	79.3%	530.2	45.9	F
Total		2,580	2,161	83.7%	141.6	9.1	F

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	70	60	85.1%	27.9	11.6	D
	Through	550	417	75.9%	42.7	11.4	E
	Right Turn	510	415	81.3%	3.1	1.2	A
	Subtotal	1,130	891	78.9%	24.1	6.7	C
SB	Left Turn						
	Through	780	643	82.5%	16.1	14.9	C
	Right Turn	190	150	79.0%	2.1	1.1	A
	Subtotal	970	794	81.8%	13.6	12.3	B
EB	Left Turn						
	Through						
	Right Turn	280	271	96.6%	92.0	122.1	F
	Subtotal	280	271	96.6%	92.0	122.1	F
WB	Left Turn						
	Through						
	Right Turn	610	567	92.9%	266.1	117.8	F
	Subtotal	610	567	92.9%	266.1	117.8	F
Total		2,990	2,522	84.4%	83.9	35.6	F

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	820	676	82.4%	30.4	1.9	C
	Right Turn	210	167	79.4%	28.6	1.9	C
	Subtotal	1,030	843	81.8%	30.1	1.7	C
SB	Left Turn	290	232	80.1%	134.8	53.3	F
	Through	770	636	82.5%	281.1	100.6	F
	Right Turn						
	Subtotal	1,060	868	81.9%	241.7	87.2	F
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	790	639	80.8%	262.3	26.7	F
	Through						
	Right Turn	270	215	79.5%	240.2	24.7	F
	Subtotal	1,060	853	80.5%	257.0	26.5	F
Total		3,150	2,564	81.4%	181.8	31.0	F

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	80	81	100.6%	50.0	8.3	D
	Through	20	18	89.5%	38.1	15.5	D
	Right Turn	40	42	105.3%	13.3	8.2	B
	Subtotal	140	141	100.4%	37.6	5.1	D
SB	Left Turn	20	18	88.5%	57.1	17.9	E
	Through	40	40	100.3%	39.4	10.7	D
	Right Turn	110	112	101.6%	19.6	4.4	B
	Subtotal	170	170	99.8%	28.3	2.9	C
EB	Left Turn	420	341	81.1%	90.8	11.6	F
	Through	980	791	80.7%	50.5	5.4	D
	Right Turn	160	136	85.0%	46.3	8.7	D
	Subtotal	1,560	1,267	81.2%	60.8	5.0	E
WB	Left Turn	30	24	81.3%	337.0	27.4	F
	Through	800	613	76.6%	295.9	17.9	F
	Right Turn	20	15	72.5%	227.7	82.4	F
	Subtotal	850	651	76.6%	296.1	17.7	F
Total		2,720	2,229	81.9%	122.7	5.3	F

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Design Year No Build Conditions
PM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	40	40	98.8%	49.8	10.4	D
	Through	60	58	96.3%	50.7	13.1	D
	Right Turn	60	61	102.0%	26.4	15.3	C
	Subtotal	160	159	99.1%	39.6	9.7	D
SB	Left Turn	90	87	96.8%	120.4	69.2	F
	Through	60	59	97.8%	117.4	73.7	F
	Right Turn	40	41	102.5%	69.9	61.3	E
	Subtotal	190	187	98.3%	110.1	69.0	F
EB	Left Turn	30	32	106.0%	89.3	16.4	F
	Through	250	257	102.9%	41.2	18.7	D
	Right Turn	60	56	92.7%	36.3	13.4	D
	Subtotal	340	345	101.4%	44.6	16.5	D
WB	Left Turn	80	70	86.9%	72.2	6.6	E
	Through	420	389	92.6%	3.7	1.7	A
	Right Turn	50	41	81.6%	2.3	1.5	A
	Subtotal	550	499	90.8%	13.0	2.3	B
Total		1,240	1,189	95.9%	41.3	14.4	D

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	400	353	88.2%	13.1	3.0	B
	Through	220	180	81.6%	13.1	3.0	B
	Right Turn	480	394	82.1%	5.3	1.0	A
	Subtotal	1,100	926	84.2%	9.8	1.9	A
SB	Left Turn	10	10	102.0%	59.4	33.3	E
	Through	180	176	98.0%	63.5	9.2	E
	Right Turn	40	39	96.3%	34.0	9.5	C
	Subtotal	230	225	97.9%	59.4	9.0	E
EB	Left Turn	10	10	103.0%	46.5	33.2	D
	Through	50	53	105.2%	58.7	9.2	E
	Right Turn	340	342	100.7%	20.2	7.4	C
	Subtotal	400	405	101.3%	25.9	6.6	C
WB	Left Turn	180	180	100.2%	95.2	34.1	F
	Through	110	108	98.1%	67.8	16.8	E
	Right Turn	20	21	106.5%	67.0	22.4	E
	Subtotal	310	310	99.9%	84.4	27.5	F
Total		2,040	1,866	91.5%	31.8	5.1	C

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Design Year No Build Conditions
PM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	230	187	81.1%	75.2	14.5	E
	Through	850	697	81.9%	44.6	13.0	D
	Right Turn	100	65	65.4%	25.9	12.1	C
	Subtotal	1,180	948	80.4%	49.6	12.7	D
SB	Left Turn	90	94	104.4%	71.3	8.6	E
	Through	510	498	97.6%	48.8	7.3	D
	Right Turn	100	105	105.2%	51.9	5.2	D
	Subtotal	700	697	99.5%	52.9	6.7	D
EB	Left Turn	80	71	88.4%	417.0	20.6	F
	Through	60	55	92.2%	423.1	25.9	F
	Right Turn	440	369	83.9%	492.4	24.7	F
	Subtotal	580	495	85.4%	472.9	21.3	F
WB	Left Turn	190	175	91.8%	399.4	176.6	F
	Through	50	44	88.2%	327.4	133.5	F
	Right Turn	170	158	93.2%	318.3	141.5	F
	Subtotal	410	377	92.0%	358.8	155.3	F
Total		2,870	2,517	87.7%	182.7	20.6	F

Intersection 4 **I-80 WB Ramps/Richards Blvd** **Uncontrolled**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	30	21	69.3%	24.1	26.4	C
	Through	910	672	73.9%	31.2	25.3	D
	Right Turn	810	621	76.7%	4.5	0.8	A
	Subtotal	1,750	1,314	75.1%	18.6	13.9	C
SB	Left Turn						
	Through	760	687	90.4%	0.8	0.2	A
	Right Turn	420	394	93.8%	2.1	0.3	A
	Subtotal	1,180	1,081	91.6%	1.3	0.2	A
EB	Left Turn						
	Through						
	Right Turn	180	179	99.4%	0.9	0.2	A
	Subtotal	180	179	99.4%	0.9	0.2	A
WB	Left Turn						
	Through						
	Right Turn	280	277	99.0%	3.4	2.3	A
	Subtotal	280	277	99.0%	3.4	2.3	A
Total		3,390	2,851	84.1%	9.6	6.5	A

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	1,500	1,177	78.5%	32.7	11.5	C
	Right Turn	180	129	71.8%	16.3	3.5	B
	Subtotal	1,680	1,306	77.8%	31.1	10.5	C
SB	Left Turn	250	224	89.4%	65.5	4.0	E
	Through	690	647	93.8%	25.3	3.9	C
	Right Turn						
	Subtotal	940	871	92.6%	35.5	3.6	D
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	780	442	56.6%	500.6	62.2	F
	Through						
	Right Turn	250	141	56.2%	443.8	50.8	F
	Subtotal	1,030	582	56.5%	487.2	59.9	F
Total		3,650	2,759	75.6%	131.2	9.1	F

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	150	148	98.7%	64.2	7.2	E
	Through	40	40	99.0%	41.4	14.3	D
	Right Turn	70	64	91.6%	16.5	5.8	B
	Subtotal	260	252	96.8%	50.3	5.9	D
SB	Left Turn	40	42	104.0%	99.2	43.1	F
	Through	30	32	105.0%	85.6	55.2	F
	Right Turn	330	323	97.8%	62.6	58.4	E
	Subtotal	400	396	99.0%	69.1	56.2	E
EB	Left Turn	290	221	76.1%	76.0	12.0	E
	Through	1,100	812	73.8%	26.5	6.2	C
	Right Turn	80	62	77.3%	18.3	8.1	B
	Subtotal	1,470	1,094	74.4%	35.4	7.9	D
WB	Left Turn	30	19	63.7%	261.7	15.4	F
	Through	1,110	766	69.0%	212.0	15.6	F
	Right Turn	40	28	69.0%	182.2	20.9	F
	Subtotal	1,180	813	68.9%	212.4	15.2	F
Total		3,310	2,554	77.2%	101.3	10.2	F

Vissim Post-Processor | **I-80 / Richards Blvd Interchange**
Average Results from 10 Runs | **Design Year Build Conditions**
Volume and Delay by Movement | **AM Peak Hour**

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	20	19	94.0%	48.3	22.1	D
	Through	30	27	91.3%	37.8	13.5	D
	Right Turn	30	31	102.0%	8.2	2.6	A
	Subtotal	80	77	96.0%	31.2	5.7	C
SB	Left Turn	90	87	97.1%	88.2	24.2	F
	Through	50	49	97.4%	77.9	26.1	E
	Right Turn	140	138	98.4%	64.8	18.5	E
	Subtotal	280	274	97.8%	75.0	22.2	E
EB	Left Turn	50	48	95.8%	66.5	11.7	E
	Through	260	263	101.3%	17.1	4.5	B
	Right Turn	30	31	102.0%	15.0	5.3	B
	Subtotal	340	342	100.6%	24.3	4.4	C
WB	Left Turn	30	24	79.7%	77.9	5.2	E
	Through	570	570	100.0%	2.0	0.5	A
	Right Turn	50	52	103.6%	1.2	0.4	A
	Subtotal	650	646	99.3%	5.3	1.5	A
Total		1,350	1,338	99.1%	26.3	6.1	C

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	580	575	99.1%	14.3	3.3	B
	Through	90	87	96.4%	15.9	5.7	B
	Right Turn	290	288	99.3%	2.9	1.1	A
	Subtotal	960	949	98.9%	11.1	2.7	B
SB	Left Turn	10	8	80.0%	37.8	24.3	D
	Through	200	200	100.2%	52.5	6.7	D
	Right Turn	20	19	92.5%	29.3	24.9	C
	Subtotal	230	227	98.6%	50.6	6.6	D
EB	Left Turn	10	10	100.0%	100.6	38.9	F
	Through	60	63	104.5%	106.0	20.4	F
	Right Turn	310	307	99.2%	11.9	3.2	B
	Subtotal	380	380	100.0%	29.6	5.5	C
WB	Left Turn	190	185	97.5%	76.0	24.1	E
	Through	50	53	105.0%	51.8	11.7	D
	Right Turn	10	10	100.0%	37.9	59.3	D
	Subtotal	250	248	99.1%	69.3	21.1	E
Total		1,820	1,804	99.1%	28.0	2.9	C

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	530	531	100.2%	50.9	3.3	D
	Through	820	811	98.9%	34.7	5.3	C
	Right Turn	120	120	100.2%	11.0	2.6	B
	Subtotal	1,470	1,462	99.5%	39.1	3.2	D
SB	Left Turn	40	38	94.8%	84.0	16.5	F
	Through	600	596	99.3%	54.2	11.5	D
	Right Turn	60	59	97.7%	49.6	8.7	D
	Subtotal	700	692	98.9%	55.3	11.1	E
EB	Left Turn	60	59	98.2%	54.8	10.5	D
	Through	30	31	104.7%	40.3	11.1	D
	Right Turn	210	205	97.8%	13.2	1.5	B
	Subtotal	300	296	98.5%	24.4	3.9	C
WB	Left Turn	150	148	98.7%	86.1	26.4	F
	Through	20	19	96.0%	44.5	17.2	D
	Right Turn	80	77	96.6%	49.5	11.9	D
	Subtotal	250	245	97.8%	72.1	17.8	E
Total		2,720	2,695	99.1%	44.8	4.2	D

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	Total Delay (sec/veh) LOS
NB	Left Turn	510	523	102.5%	61.3	1.4	E
	Through	580	586	101.0%	47.0	5.1	D
	Right Turn						
	Subtotal	1,090	1,109	101.7%	53.7	2.6	D
SB	Left Turn						
	Through	780	770	98.7%	12.8	1.7	B
	Right Turn	190	187	98.3%	5.6	0.8	A
	Subtotal	970	957	98.6%	11.4	1.4	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	280	282	100.8%	48.2	4.0	D
	Through						
	Right Turn	890	883	99.2%	44.2	16.6	D
	Subtotal	1,170	1,165	99.6%	45.2	13.1	D
Total		3,230	3,230	100.0%	38.3	4.7	D

Intersection 5 **I-80 EB Ramps/Richards Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	820	837	102.1%	31.6	6.9	C
	Right Turn	210	209	99.4%	28.3	6.6	C
	Subtotal	1,030	1,046	101.6%	30.9	6.6	C
SB	Left Turn	290	286	98.8%	18.7	2.6	B
	Through	770	764	99.2%	16.1	1.6	B
	Right Turn						
	Subtotal	1,060	1,050	99.0%	16.8	1.2	B
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	790	789	99.8%	48.5	10.0	D
	Through						
	Right Turn	270	266	98.6%	20.9	13.0	C
	Subtotal	1,060	1,055	99.5%	41.5	10.8	D
Total		3,150	3,151	100.0%	29.9	3.4	C

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	80	84	104.9%	49.9	7.2	D
	Through	20	20	100.5%	31.1	17.7	C
	Right Turn	40	36	91.0%	8.5	4.8	A
	Subtotal	140	140	100.3%	36.4	3.4	D
SB	Left Turn	20	21	107.0%	45.8	19.1	D
	Through	40	42	104.0%	39.2	8.1	D
	Right Turn	110	108	98.4%	25.5	5.1	C
	Subtotal	170	171	100.7%	32.1	3.8	C
EB	Left Turn	420	415	98.7%	41.0	10.6	D
	Through	980	976	99.6%	29.1	7.1	C
	Right Turn	160	162	101.3%	18.4	5.4	B
	Subtotal	1,560	1,553	99.6%	31.4	7.2	C
WB	Left Turn	30	29	95.3%	95.7	21.8	F
	Through	800	812	101.5%	77.6	19.8	E
	Right Turn	20	18	88.0%	71.1	39.1	E
	Subtotal	850	858	101.0%	78.3	19.8	E
Total		2,720	2,723	100.1%	47.2	9.0	D

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	40	40	100.0%	61.9	16.2	E
	Through	60	60	100.2%	62.5	11.3	E
	Right Turn	60	59	98.3%	22.9	5.3	C
	Subtotal	160	159	99.4%	47.5	9.8	D
SB	Left Turn	90	88	98.1%	81.2	33.2	F
	Through	60	59	99.0%	70.8	25.4	E
	Right Turn	40	39	98.5%	42.4	26.2	D
	Subtotal	190	187	98.5%	71.4	28.2	E
EB	Left Turn	30	31	102.7%	76.9	31.4	E
	Through	250	257	102.9%	39.6	19.0	D
	Right Turn	60	57	94.8%	32.5	14.7	C
	Subtotal	340	345	101.5%	41.9	19.0	D
WB	Left Turn	80	76	95.0%	71.8	8.0	E
	Through	420	403	96.0%	4.4	1.4	A
	Right Turn	50	45	89.8%	1.9	1.0	A
	Subtotal	550	524	95.3%	13.8	3.4	B
Total		1,240	1,216	98.0%	35.9	9.9	D

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	400	378	94.6%	11.7	1.3	B
	Through	220	207	93.9%	11.4	2.4	B
	Right Turn	480	464	96.7%	3.1	0.5	A
	Subtotal	1,100	1,049	95.4%	7.8	0.9	A
SB	Left Turn	10	10	95.0%	50.9	28.1	D
	Through	180	178	99.1%	62.0	12.7	E
	Right Turn	40	36	90.0%	44.9	18.6	D
	Subtotal	230	224	97.3%	59.4	12.4	E
EB	Left Turn	10	9	87.0%	93.1	55.0	F
	Through	50	49	97.4%	88.0	22.3	F
	Right Turn	340	347	102.1%	15.0	4.9	B
	Subtotal	400	404	101.1%	26.0	4.9	C
WB	Left Turn	180	179	99.4%	70.4	17.3	E
	Through	110	109	99.4%	54.3	8.5	D
	Right Turn	20	21	106.5%	39.8	12.8	D
	Subtotal	310	310	99.8%	63.1	12.0	E
Total		2,040	1,987	97.4%	27.0	3.6	C

Vissim Post-Processor — **I-80 / Richards Blvd Interchange**

Average Results from 10 Runs — **Design Year Build Conditions**

Volume and Delay by Movement — **PM Peak Hour**

Intersection 3 — **Richards Blvd/Olive Dr** — **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	260	248	95.3%	50.8	3.5	D
	Through	850	808	95.0%	40.4	8.2	D
	Right Turn	240	238	99.1%	13.2	4.6	B
	Subtotal	1,350	1,293	95.8%	37.4	5.7	D
SB	Left Turn	90	90	99.6%	79.8	21.2	E
	Through	510	507	99.3%	43.7	8.9	D
	Right Turn	100	107	106.5%	48.1	10.4	D
	Subtotal	700	703	100.4%	49.4	11.0	D
EB	Left Turn	80	78	97.5%	57.5	5.3	E
	Through	60	59	98.3%	53.7	10.4	D
	Right Turn	440	438	99.6%	18.2	2.7	B
	Subtotal	580	575	99.2%	27.7	2.1	C
WB	Left Turn	190	190	100.2%	86.6	36.5	F
	Through	50	48	95.8%	67.4	24.9	E
	Right Turn	170	164	96.5%	71.4	27.0	E
	Subtotal	410	402	98.1%	79.4	28.1	E
Total		3,040	2,974	97.8%	44.4	5.1	D

Intersection 4 — **Richards Blvd/I-80 WB Ramps** — **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	810	780	96.2%	62.7	2.3	E
	Through	940	887	94.3%	38.2	21.3	D
	Right Turn						
	Subtotal	1,750	1,666	95.2%	50.3	10.1	D
SB	Left Turn						
	Through	760	751	98.9%	27.3	2.2	C
	Right Turn	420	420	99.9%	18.7	3.2	B
	Subtotal	1,180	1,171	99.2%	24.3	2.1	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	180	173	96.1%	48.2	5.6	D
	Through						
	Right Turn	420	420	99.9%	28.8	5.4	C
	Subtotal	600	593	98.8%	34.6	3.9	C
Total		3,530	3,430	97.2%	38.7	5.4	D

Vissim Post-Processor
Average Results from 10 Runs
Volume and Delay by Movement

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn						
	Through	1,500	1,431	95.4%	19.8	6.9	B
	Right Turn	180	170	94.4%	15.4	7.5	B
	Subtotal	1,680	1,601	95.3%	19.4	6.9	B
SB	Left Turn	250	242	96.8%	49.1	8.7	D
	Through	690	685	99.2%	17.0	1.8	B
	Right Turn						
	Subtotal	940	927	98.6%	24.6	2.7	C
EB	Left Turn						
	Through						
	Right Turn						
	Subtotal						
WB	Left Turn	780	739	94.8%	149.9	94.4	F
	Through						
	Right Turn	250	242	96.7%	115.7	76.3	F
	Subtotal	1,030	981	95.2%	141.8	90.3	F
Total		3,650	3,508	96.1%	52.9	20.7	D

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Demand Volume (vph)	Served Volume (vph) Average	Served Volume (vph) Percent	Total Delay (sec/veh) Average	Total Delay (sec/veh) Std. Dev.	LOS
NB	Left Turn	150	145	96.7%	53.6	5.3	D
	Through	40	41	103.5%	28.6	10.6	C
	Right Turn	70	71	100.9%	13.3	6.4	B
	Subtotal	260	257	98.8%	36.9	8.1	D
SB	Left Turn	40	37	92.0%	131.5	102.3	F
	Through	30	28	94.7%	121.2	106.7	F
	Right Turn	330	329	99.7%	112.7	95.1	F
	Subtotal	400	394	98.5%	115.0	96.5	F
EB	Left Turn	290	274	94.6%	106.4	22.2	F
	Through	1,050	1,068	101.7%	22.5	3.6	C
	Right Turn	80	76	95.3%	18.4	7.3	B
	Subtotal	1,420	1,418	99.9%	38.7	5.5	D
WB	Left Turn	30	28	93.3%	158.2	16.2	F
	Through	1,110	1,048	94.4%	124.5	7.6	F
	Right Turn	40	39	96.3%	113.4	14.0	F
	Subtotal	1,180	1,115	94.5%	125.1	7.4	F
Total		3,260	3,184	97.7%	77.7	11.6	E

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
AM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	12	2	9	15	83	12	68	107	NO
	Through	100	12	2	9	15	83	12	68	107	NO
	Right Turn	400	1	1	0	2	31	5	24	37	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	93	21	65	124	388	65	314	525	NO
	Through	400	78	20	54	104	397	67	317	528	NO
	Right Turn	400	64	19	42	95	387	66	279	497	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	17	3	13	21	117	36	67	164	MAX
	Through	250	17	5	12	27	191	39	143	288	NO
	Right Turn	250	18	5	12	28	194	39	146	291	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	100	0	0	0	0	24	19	0	66	NO
	Through	225	0	0	0	0	24	19	0	66	NO
	Right Turn	225	0	0	0	0	24	19	0	66	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
AM Peak Hour

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	625	56	15	31	75	397	133	168	552	NO
	Through	625	56	15	31	75	397	133	168	552	NO
	Right Turn	180	0	0	0	0	23	10	11	42	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	64	4	58	69	258	25	211	296	NO
	Through	400	64	4	58	69	258	25	211	296	NO
	Right Turn	400	12	7	4	23	169	48	80	232	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	100	49	6	39	58	263	39	195	346	MAX
	Through	225	49	6	39	58	263	39	195	346	MAX
	Right Turn	225	23	2	20	26	203	19	167	231	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	225	74	17	50	98	242	56	186	338	MAX
	Through	225	74	17	50	98	242	56	186	338	MAX
	Right Turn	225	74	17	50	98	242	56	186	338	MAX
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
AM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	175	144	9	125	160	580	7	569	591	MAX
	Through	600	176	13	160	199	580	10	570	604	NO
	Right Turn	275	0	0	0	0	25	7	15	40	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	625	13	4	8	19	119	77	54	250	NO
	Through	625	188	25	157	218	675	51	598	749	MAX
	Right Turn	625	186	25	155	216	674	51	598	748	MAX
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	250	0	0	0	0	0	0	0	0	NO
	Through	600	0	0	0	0	0	0	0	0	NO
	Right Turn	250	0	0	0	0	0	0	0	0	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	200	5	6	0	14	77	61	25	215	NO
	Through	1,500	5	6	0	14	77	61	25	215	NO
	Right Turn	1,500	5	6	0	14	77	61	25	215	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
AM Peak Hour

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	475	102	5	94	113	301	17	268	319	NO
	Through	825	181	14	166	215	575	39	494	644	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	600	34	4	29	40	279	29	255	339	NO
	Right Turn	225	1	0	0	1	63	27	25	111	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	450	83	6	69	88	315	36	250	363	NO
	Through										
	Right Turn	1,225	167	56	74	240	577	191	341	824	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
AM Peak Hour

Intersection 5 **I-80 EB Ramps/Richards Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	450	95	22	71	144	286	77	199	471	NO
	Right Turn	450	78	22	54	126	261	77	175	447	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	350	15	2	12	18	126	15	103	155	NO
	Through	600	33	2	30	37	205	16	178	240	NO
	Right Turn										
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	175	130	20	102	161	492	126	315	805	MAX
	Through										
	Right Turn	1,625	20	7	12	32	169	79	95	347	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
AM Peak Hour

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	21	2	19	25	82	11	61	99	NO
	Through	625	4	1	2	6	53	16	23	75	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	125	6	2	4	9	48	10	30	65	NO
	Through	1,500	18	3	12	21	146	22	118	174	NO
	Right Turn										
	Second Right										
EB	U Turn	450	113	19	86	151	453	39	392	513	MAX
	Second Left										
	Left Turn	450	113	19	86	151	453	39	392	513	MAX
	Through	450	112	10	95	130	453	27	395	480	MAX
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	75	67	72	8	245	520	220	209	874	MAX
	Through	1,125	67	72	9	246	525	220	215	880	NO
	Right Turn										
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 1 **D St/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	30	5	21	35	144	18	118	171	MAX
	Through	100	30	5	21	35	144	18	118	171	MAX
	Right Turn	400	2	0	1	3	46	6	38	58	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	57	11	43	76	226	31	171	273	NO
	Through	400	40	10	28	60	229	32	173	278	NO
	Right Turn	400	24	10	13	44	218	41	140	278	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	75	15	5	10	29	122	38	67	182	MAX
	Through	250	42	12	31	74	270	44	232	388	MAX
	Right Turn	250	44	12	32	75	273	44	235	391	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	100	3	3	0	8	61	30	7	97	NO
	Through	225	3	3	0	8	61	30	7	97	NO
	Right Turn	225	3	3	0	8	61	30	7	97	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 2 **E St-Richards Blvd/First St** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds Storage?
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	
NB	U Turn										
	Second Left										
	Left Turn	625	31	4	26	36	250	77	173	395	NO
	Through	625	31	4	26	36	250	77	173	395	NO
	Right Turn	180	0	0	0	0	25	9	7	40	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	400	72	32	50	160	260	70	218	452	NO
	Through	400	72	32	50	160	260	70	218	452	NO
	Right Turn	400	32	30	18	115	236	59	186	389	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	100	43	5	35	49	287	41	228	363	MAX
	Through	225	43	5	35	49	287	41	228	363	MAX
	Right Turn	225	28	5	20	35	254	46	190	334	MAX
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	225	69	10	55	85	232	30	194	291	MAX
	Through	225	69	10	55	85	232	30	194	291	MAX
	Right Turn	225	69	10	55	85	232	30	194	291	MAX
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 3 **Richards Blvd/Olive Dr** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	175	49	5	42	57	191	111	118	439	MAX
	Through	600	214	31	179	266	656	6	640	661	MAX
	Right Turn	275	2	1	1	3	76	31	23	118	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	625	33	12	21	57	203	65	113	343	NO
	Through	625	140	27	102	174	615	71	524	714	NO
	Right Turn	625	138	27	101	173	614	71	523	713	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn	250	0	0	0	0	3	5	0	15	NO
	Through	600	0	0	0	0	3	5	0	15	NO
	Right Turn	250	0	0	0	0	3	5	0	15	NO
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	200	18	11	3	39	178	54	96	242	NO
	Through	1,500	18	11	3	39	178	54	96	242	NO
	Right Turn	1,500	18	11	3	39	178	54	96	242	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 4 **Richards Blvd/I-80 WB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Average Queue (ft) Std. Dev.	Average Queue (ft) Minimum	Average Queue (ft) Maximum	Maximum Queue (ft) Average	Maximum Queue (ft) Std. Dev.	Maximum Queue (ft) Minimum	Maximum Queue (ft) Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	475	151	7	139	162	378	16	356	401	NO
	Through	825	168	87	54	339	662	144	475	913	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn										
	Through	600	69	5	61	78	319	33	283	397	NO
	Right Turn	225	7	3	4	12	138	29	87	175	NO
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	450	51	4	45	57	199	18	168	226	NO
	Through										
	Right Turn	1,225	56	9	44	71	263	40	192	317	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 5 **Richards Blvd/I-80 EB Ramps** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft)				Maximum Queue (ft)				Exceeds
			Average	Std. Dev.	Minimum	Maximum	Average	Std. Dev.	Minimum	Maximum	Storage?
NB	U Turn										
	Second Left										
	Left Turn										
	Through	450	79	35	47	142	377	128	194	537	NO
	Right Turn	450	65	33	35	127	352	128	169	512	NO
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	350	39	3	32	42	153	19	128	195	NO
	Through	600	27	2	24	32	213	19	189	251	NO
	Right Turn										
	Second Right										
EB	U Turn										
	Second Left										
	Left Turn										
	Through										
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	175	328	240	158	903	774	349	433	1,464	AVG
	Through										
	Right Turn	1,625	185	217	32	680	556	311	292	1,141	NO
	Second Right										

Vissim Post-Processor
Average Results from 10 Runs
Queue Length

I-80 / Richards Blvd Interchange
Design Year Build Conditions
PM Peak Hour

Intersection 6 **Research Park Dr/Richards Blvd-Cowell Blvd** **Signal**

Direction	Movement	Storage (ft)	Average Queue (ft) Average	Std. Dev.	Minimum	Maximum	Maximum Queue (ft) Average	Std. Dev.	Minimum	Maximum	Exceeds Storage?
NB	U Turn										
	Second Left										
	Left Turn	100	33	2	29	37	107	12	96	136	MAX
	Through	625	10	1	8	12	93	15	76	123	NO
	Right Turn										
	Second Right										
SB	U Turn										
	Second Left										
	Left Turn	125	14	4	6	21	84	32	45	131	NO
	Through	1,500	204	125	104	521	498	198	323	966	NO
	Right Turn										
	Second Right										
EB	U Turn	450	174	28	142	227	436	54	300	486	NO
	Second Left										
	Left Turn	450	174	28	142	227	436	54	300	486	NO
	Through	450	59	5	50	67	337	51	267	422	NO
	Right Turn										
	Second Right										
WB	U Turn										
	Second Left										
	Left Turn	75	687	94	533	838	1,462	117	1,267	1,581	AVG
	Through	1,125	689	95	535	840	1,467	117	1,273	1,587	MAX
	Right Turn										
	Second Right										

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	West of Old Davis Rd
Alternative	Design Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,203	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,492	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.62	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.5	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	5,203	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,492	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.62	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.5	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	5	ln	Average Speed, S	70.4	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	17.3	pcphpl
Flow Rate, vp	1,216	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.51				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	4	2	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	5,203	100	vph
Peak Hour Factor, PHF	0.95	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,970	112	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,970	9,600	pcph	0.62
Exiting General Purpose Lanes	6,082	12,000	pcph	0.51
Entering Managed Lanes	909	1,723	pcph	0.53
On Ramp	112	4,200	pcph	0.03

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd to Lane Drop
Alternative	Design Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	820	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,289	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,517	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.63	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.9	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Lane Drop to Richards Blvd
Alternative	Design Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,220	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,289	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	2,023	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.84	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	62.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	32.5	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	25	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,289	940	vph
Peak Hour Factor, PHF	0.95	0.92	
Total Trucks	9.0%	3.3%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.968	
Flow Rate, v_p	6,068	1,055	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		1,780	ft
Volume on Adjacent Ramp		537	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	949	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.560	
Flow Rate in Lanes 1 and 2, v_{12}	3,861	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	6,068	7,200	pcph	0.84
Exiting General Purpose Lanes	5,013	7,200	pcph	0.70
Entering Managed Lanes	924	1,723	pcph	0.54
Off Ramp	1,055	1,900	pcph	0.56
Ramp Influence Area	3,861	4,400	pcph	0.88

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	36.1	pcpmpl
Level of Service, LOS	E	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.653	
Average Speed in Ramp Influence Area, S_R	51.9	mph
Average Flow in Outer Lanes, v_{OA}	2,207	pcphpl
Average Speed in Outer Lanes, S_O	72.6	mph
Average Speed for Segment, S	57.9	mph
Density across All Lanes, D	35.7	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off to On
Alternative	Design Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,481	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,714	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.71	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.5	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,481	480	vph
Peak Hour Factor, PHF	0.95	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,141	537	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	1,780		ft
Volume on Adjacent Ramp	1,055		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,389	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.592	
Flow Rate in Lanes 1 and 2, v_{12}	3,041	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,141	7,200	pcph	0.71
Exiting General Purpose Lanes	5,678	7,200	pcph	0.79
Entering Managed Lanes	783	1,723	pcph	0.45
On Ramp	537	2,100	pcph	0.26
Ramp Influence Area	3,578	4,600	pcph	0.78

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	30.1	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.416	
Average Speed in Ramp Influence Area, S_R	58.6	mph
Average Flow in Outer Lanes, v_{OA}	2,100	pcphpl
Average Speed in Outer Lanes, S_O	64.7	mph
Average Speed for Segment, S	60.7	mph
Density across All Lanes, D	32.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd to Chiles Rd
Alternative	Design Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	5,710	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,893	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,872	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.78	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.1	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	28.7	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,500	1,500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,893	730	vph
Peak Hour Factor, PHF	0.95	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,615	817	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Design Year
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.450	
Flow Rate in Lanes 1 and 2, v_{12}	3,208	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,615	7,200	pcph	0.78
Exiting General Purpose Lanes	4,797	7,200	pcph	0.67
Entering Managed Lanes	855	1,723	pcph	0.50
Off Ramp	817	3,800	pcph	0.22
Ramp Influence Area	3,208	4,400	pcph	0.73

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	18.3	pcpmpl
Level of Service, LOS	B	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.632	
Average Speed in Ramp Influence Area, S_R	52.6	mph
Average Flow in Outer Lanes, v_{OA}	2,406	pcphpl
Average Speed in Outer Lanes, S_O	72.3	mph
Average Speed for Segment, S	59.6	mph
Density across All Lanes, D	33.7	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off to Mace Rd On
Alternative	Design Year
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,000	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,266	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.95		Flow Rate, v_p	1,631	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.68	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.9	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	West of Old Davis Rd
Alternative	Design Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,306	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,461	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.61	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.0	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	5,306	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,461	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.61	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	21.0	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	5	ln	Average Speed, S	70.4	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	17.4	pcphpl
Flow Rate, vp	1,227	pcphpl	Level of Service, LOS	B	
Volume-to-Capacity Ratio, v/c	0.51				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	4	2	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	5,306	260	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,842	291	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd On Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,842	9,600	pcph	0.61
Exiting General Purpose Lanes	6,133	12,000	pcph	0.51
Entering Managed Lanes	927	1,723	pcph	0.54
On Ramp	291	4,200	pcph	0.07

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Old Davis Rd to Lane Drop
Alternative	Design Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	820	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,530	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,522	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.63	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.1	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.0	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Lane Drop to Richards Blvd
Alternative	Design Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,220	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,530	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	2,029	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.85	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	62.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	32.6	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	25	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,530	890	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	6,088	996	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		1,780	ft
Volume on Adjacent Ramp		526	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	896	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.562	
Flow Rate in Lanes 1 and 2, v_{12}	3,858	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	6,088	7,200	pcph	0.85
Exiting General Purpose Lanes	5,092	7,200	pcph	0.71
Entering Managed Lanes	967	1,723	pcph	0.56
Off Ramp	996	1,900	pcph	0.52
Ramp Influence Area	3,858	4,400	pcph	0.88

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	36.1	pcpmpl
Level of Service, LOS	E	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.648	
Average Speed in Ramp Influence Area, S_R	52.0	mph
Average Flow in Outer Lanes, v_{OA}	2,231	pcphpl
Average Speed in Outer Lanes, S_O	72.5	mph
Average Speed for Segment, S	58.0	mph
Density across All Lanes, D	35.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd Off to On
Alternative	Design Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,500	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.5	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,764	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,749	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.73	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.5	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.2	pcpmpl
Total Ramp Density Adjustment	4.9	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.5	45	mph
Segment Length, L / Acceleration Length, LA	1,500	500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,764	470	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,246	526	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	1,780		ft
Volume on Adjacent Ramp	996		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,409	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.592	
Flow Rate in Lanes 1 and 2, v_{12}	3,103	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,246	7,200	pcph	0.73
Exiting General Purpose Lanes	5,772	7,200	pcph	0.80
Entering Managed Lanes	833	1,723	pcph	0.48
On Ramp	526	2,100	pcph	0.25
Ramp Influence Area	3,629	4,600	pcph	0.79

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	30.5	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.423	
Average Speed in Ramp Influence Area, S_R	58.4	mph
Average Flow in Outer Lanes, v_{OA}	2,143	pcphpl
Average Speed in Outer Lanes, S_O	64.5	mph
Average Speed for Segment, S	60.6	mph
Density across All Lanes, D	32.7	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Richards Blvd to Chiles Rd
Alternative	Design Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	5,710	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,169	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,897	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.79	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	64.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	29.3	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	70.9	25	mph
Segment Length, L / Deceleration Length, LD	1,500	1,500	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,169	560	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,691	627	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off Ramp
Alternative	Design Year
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.450	
Flow Rate in Lanes 1 and 2, v_{12}	3,252	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,691	7,200	pcph	0.79
Exiting General Purpose Lanes	5,064	7,200	pcph	0.70
Entering Managed Lanes	903	1,723	pcph	0.52
Off Ramp	627	3,800	pcph	0.16
Ramp Influence Area	3,252	4,400	pcph	0.74

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	18.7	pcpmpl
Level of Service, LOS	B	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.614	
Average Speed in Ramp Influence Area, S_R	53.1	mph
Average Flow in Outer Lanes, v_{OA}	2,439	pcphpl
Average Speed in Outer Lanes, S_O	72.1	mph
Average Speed for Segment, S	59.9	mph
Density across All Lanes, D	33.9	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Eastbound I-80
Segment	Chiles Rd Off to Mace Rd On
Alternative	Design Year
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,000	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,687	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,720	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.72	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	67.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.5	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,928	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,827	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.76	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.8	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year No Build
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,928	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,827	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.76	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.7	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	69.7	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	21.9	pcphpl
Flow Rate, vp	1,524	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.64				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,928	550	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,481	616	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,481	7,200	pcph	0.76
Exiting General Purpose Lanes	6,097	9,600	pcph	0.64
Entering Managed Lanes	861	1,723	pcph	0.50
On Ramp	616	4,200	pcph	0.15

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Olive Dr
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	4,780	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,401	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	2,002	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.83	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	62.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	31.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	35	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,401	280	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	6,007	313	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		Off	
Distance to Adjacent Ramp		2,390	ft
Volume on Adjacent Ramp		672	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	798	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.595	
Flow Rate in Lanes 1 and 2, v_{12}	3,703	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	6,007	7,200	pcph	0.83
Exiting General Purpose Lanes	5,694	7,200	pcph	0.79
Entering Managed Lanes	944	1,723	pcph	0.55
Off Ramp	313	2,000	pcph	0.16
Ramp Influence Area	3,703	4,400	pcph	0.84

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	34.8	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.456	
Average Speed in Ramp Influence Area, S_R	57.9	mph
Average Flow in Outer Lanes, v_{OA}	2,304	pcphpl
Average Speed in Outer Lanes, S_O	73.1	mph
Average Speed for Segment, S	62.9	mph
Density across All Lanes, D	33.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr to Richards Blvd
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	890	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	5,160	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,913	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.80	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	64.1	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	29.8	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,160	600	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,739	672	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,390		ft
Volume on Adjacent Ramp	313		pcph

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	2,063	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.586	
Flow Rate in Lanes 1 and 2, v_{12}	3,639	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,739	7,200	pcph	0.80
Exiting General Purpose Lanes	5,067	7,200	pcph	0.70
Entering Managed Lanes	902	1,723	pcph	0.52
Off Ramp	672	2,100	pcph	0.32
Ramp Influence Area	3,639	4,400	pcph	0.83

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	34.2	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.358	
Average Speed in Ramp Influence Area, S_R	60.0	mph
Average Flow in Outer Lanes, v_{OA}	2,100	pcphpl
Average Speed in Outer Lanes, S_O	72.5	mph
Average Speed for Segment, S	64.0	mph
Density across All Lanes, D	30.6	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off to On
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	430	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,644	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,722	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.72	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	25.7	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

Leisch Method for Weaving Analysis

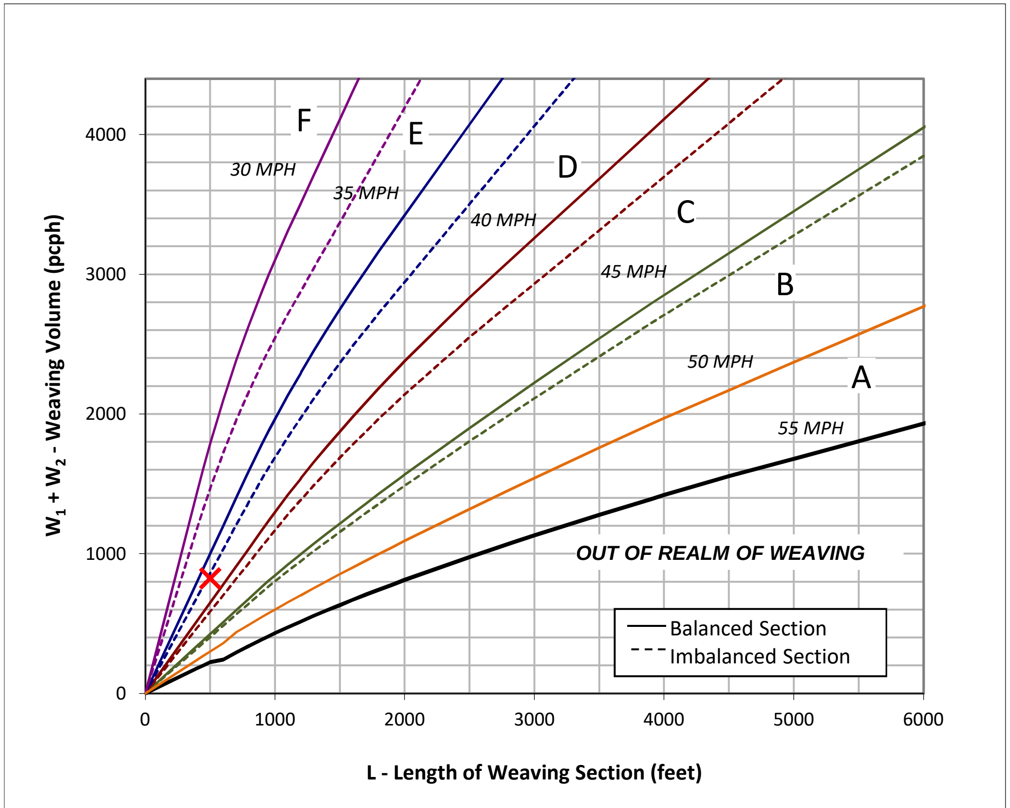
Data Input

Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	500

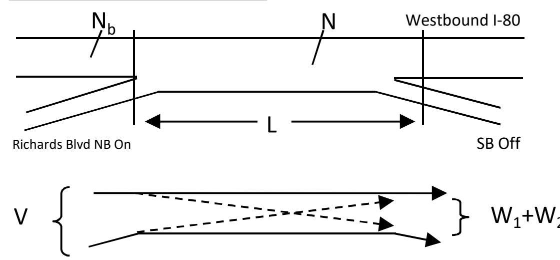
Project Information

Project	I-80/Richards Blvd Interchange
Scenario	Design Year No Build
Freeway	Westbound I-80
On-ramp	Richards Blvd NB On
Off-ramp	SB Off

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,154	Volume (vph)*	510	Volume (vph)*	290
Truck Percentage	8.1%	Truck Percentage	3.0%	Truck Percentage	3.0%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,570	Volume (pcph)	525	Volume (pcph)	299



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?

   35 MPH and **40 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) 35.7
4. Weaving Intensity Factor (k) 2.76
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,524
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

HCM 6th Edition: Freeway Ramp Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	Off Ramp	
Number of Lanes, N	3	1	1	
Free-Flow Speed, FFS	70.0	25	25	mph
Segment Length, L / Deceleration Length, LD	1,500	0	0	ft
Terrain Type	Level	Level	Level	
Percent Grade	-	-	-	
Grade Length	-	-	-	ft
Segment Type / Ramp Type	Freeway	Right	Right	

Adjustment Factors

	Freeway	On Ramp	Off Ramp
Driver Population	Familiar	Familiar	Familiar
Weather Type	Non-severe	Non-severe	Non-severe
Incident Type	No incident	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	Off Ramp	
Volume, V	4,644	510	290	vph
Peak Hour Factor, PHF	0.98	0.92	0.92	
Total Trucks	9.0%	3.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	0.971	
Flow Rate, v_p	5,165	571	325	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria			
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Ramp Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,165	7,200	pcph	0.72
Exiting General Purpose Lanes	5,412	7,200	pcph	0.75
Entering Managed Lanes	812	1,723	pcph	0.47
On Ramp	571	1,900	pcph	0.30
Off Ramp	325	1,900	pcph	0.17

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time period	AM Peak Hour

Geometric Data

Segment Type	Freeway	
Weaving Configuration	One-sided	
Number of Lanes, N	4	ln
Weaving Segment Length, L_S	500	ft
Interchange Density, ID	0.8	int/mi
Number of Manuever Lanes, N_{WL}	2.0	ln
On Ramp to Freeway Lane Changes, LC_{RF}	1	
Freeway to Off Ramp Lane Changes, LC_{FR}	1	
On Ramp to Off Ramp Lane Changes, LC_{RR}	0	

Adjustment Factors

Driver Population	Familiar
Weather Type	Non-severe
Incident Type	No incident
Capacity Adjustment Factor, CAF	1.00
Demand Adjustment Factor, DAF	1.00

Volume Data

	Frwy to Frwy	On to Frwy	Frwy to Off	Frwy to Off	
Volume, V	4,354	510	290	0	vph
Peak-hour factor, PHF	0.98	0.92	0.92	0.95	
Total Trucks	9.0%	3.0%	3.0%	3.0%	
Terrain Type	Level	Level	Level	Level	
Grade					
Length					mi
SUT/TT Mix					
Passenger Car Equivalent, E_T	2.0	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	0.971	0.971	
Demand Adjustment Factor, DAF	1.00	1.00	1.00	1.00	
Flow Rate, v_p	4,843	571	325	0	pcph

Weaving Flow Rate, vW	896	Total Flow Rate, v	5,738
Non-Weaving Flow Rate, vNW	4,843	Volume Ratio, VR	0.156

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time period	AM Peak Hour

Capacity

Maximum Weaving Length, L_{MAX}	4,092	ft
Weaving Length Check	OK	
Freeway Maximum Capacity, c_{IFL}	2,400	pchpl
Density-Based Capacity, c_{IWL}	9,325	pchpl
Demand Flow-Based Capacity, c_{IW}	14,235	pch
Weaving Segment Capacity, c_W	14,235	vph
Adjusted Weaving Area Capacity, c_{wa}	14,235	vph
Volume-to-Capacity Ratio, v/c	0.37	

Speed and Density

Minimum Lane Change Rate, LC_{MIN}	896	lc/h
Weaving Lane Change Rate, LC_W	915	lc/h
Non-weaving Vehicle Index, I_{NW}	202	
Non-weaving Lane Change Rate, LC_{NW}	498	lc/h
Total Lane Change Rate, LC_{ALL}	1,413	lc/h
Weaving Intensity Factor, W	0.513	
Average Weaving Speed, S_W	51.4	mph
Average Non-Weaving Speed, S_{NW}	56.7	mph
Average Speed, S	55.8	mph
Density, D	25.7	pcpmpl
Level of Service, LOS	C	

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,165	7,200	pcph	0.72
Exiting General Purpose Lanes	5,412	7,200	pcph	0.75
On Ramp	571	1,900	pcph	0.30
Off Ramp	325	1,900	pcph	0.17

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB Off to On
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	210	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,833	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,792	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.75	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.2	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB On Ramp
Alternative	Design Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.4	45	mph
Segment Length, L / Acceleration Length, LA	1,500	400	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,833	130	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,376	146	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB On Ramp
Alternative	Design Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.589	
Flow Rate in Lanes 1 and 2, v_{12}	3,165	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,376	7,200	pcph	0.75
Exiting General Purpose Lanes	5,521	7,200	pcph	0.77
Entering Managed Lanes	845	1,723	pcph	0.49
On Ramp	146	2,100	pcph	0.07
Ramp Influence Area	3,310	4,600	pcph	0.72

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	28.8	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.392	
Average Speed in Ramp Influence Area, S_R	59.3	mph
Average Flow in Outer Lanes, v_{OA}	2,211	pcphpl
Average Speed in Outer Lanes, S_O	64.3	mph
Average Speed for Segment, S	61.2	mph
Density across All Lanes, D	31.6	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,270	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.4	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,945	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,833	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.76	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.4	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	28.0	pcpmpl
Total Ramp Density Adjustment	5.0	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,945	500	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,500	560	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year No Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.597	
Flow Rate in Lanes 1 and 2, v_{12}	3,508	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,500	7,200	pcph	0.76
Exiting General Purpose Lanes	4,940	9,600	pcph	0.51
Entering Managed Lanes	864	1,723	pcph	0.50
Off Ramp	560	2,100	pcph	0.27
Ramp Influence Area	3,508	4,400	pcph	0.80

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	33.1	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.348	
Average Speed in Ramp Influence Area, S_R	60.3	mph
Average Flow in Outer Lanes, v_{OA}	1,992	pcphpl
Average Speed in Outer Lanes, S_O	73.0	mph
Average Speed for Segment, S	64.3	mph
Density across All Lanes, D	29.1	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Design Year No Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,515	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,255	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.52	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	17.9	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.50	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.9	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,352	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,597	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.9	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.7	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.2	pcpmpl
Total Ramp Density Adjustment	4.5	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd On Ramp
Alternative	Design Year No Build
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,352	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,597	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.1	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.2	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	20.8	pcphpl
Flow Rate, vp	1,458	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.61				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd On Ramp
Alternative	Design Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,352	930	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,791	1,041	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd On Ramp
Alternative	Design Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,791	7,200	pcph	0.67
Exiting General Purpose Lanes	5,832	9,600	pcph	0.61
Entering Managed Lanes	761	1,723	pcph	0.44
On Ramp	1,041	4,200	pcph	0.25

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Olive Dr
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	4,780	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,151	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,891	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.79	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	29.1	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	35	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,151	140	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,672	157	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		Off	
Distance to Adjacent Ramp		2,390	ft
Volume on Adjacent Ramp		336	pcph

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	369	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.611	
Flow Rate in Lanes 1 and 2, v_{12}	3,526	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,672	7,200	pcph	0.79
Exiting General Purpose Lanes	5,515	7,200	pcph	0.77
Entering Managed Lanes	900	1,723	pcph	0.52
Off Ramp	157	2,000	pcph	0.08
Ramp Influence Area	3,526	4,400	pcph	0.80

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	33.2	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.442	
Average Speed in Ramp Influence Area, S_R	58.3	mph
Average Flow in Outer Lanes, v_{OA}	2,145	pcphpl
Average Speed in Outer Lanes, S_O	73.7	mph
Average Speed for Segment, S	63.4	mph
Density across All Lanes, D	30.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Olive Dr to Richards Blvd
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	890	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,031	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,846	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.77	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	28.3	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,031	300	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,539	336	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	2,390		ft
Volume on Adjacent Ramp	157		pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	907	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.606	
Flow Rate in Lanes 1 and 2, v_{12}	3,489	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,539	7,200	pcph	0.77
Exiting General Purpose Lanes	5,203	7,200	pcph	0.72
Entering Managed Lanes	879	1,723	pcph	0.51
Off Ramp	336	2,100	pcph	0.16
Ramp Influence Area	3,489	4,400	pcph	0.79

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	32.9	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.328	
Average Speed in Ramp Influence Area, S_R	60.8	mph
Average Flow in Outer Lanes, v_{OA}	2,050	pcphpl
Average Speed in Outer Lanes, S_O	72.7	mph
Average Speed for Segment, S	64.8	mph
Density across All Lanes, D	29.3	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB Off to On
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	430	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,773	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,752	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.73	

General Purpose Lanes - Speed and Density

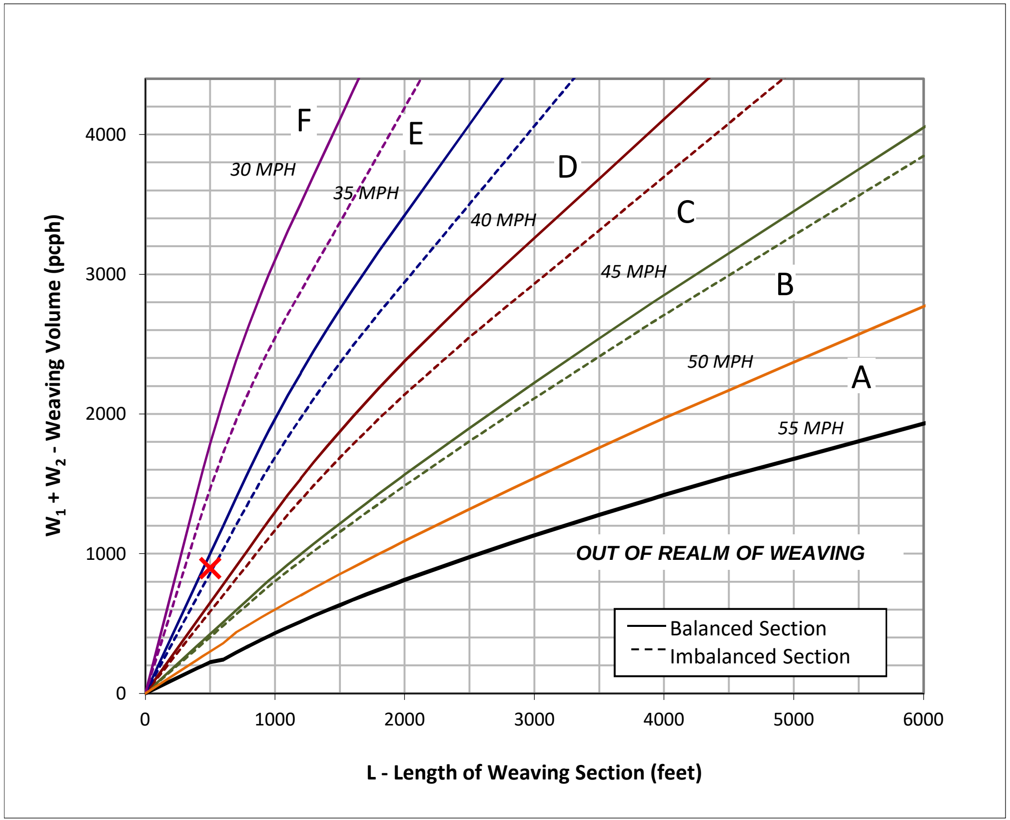
Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	26.3	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

Leisch Method for Weaving Analysis

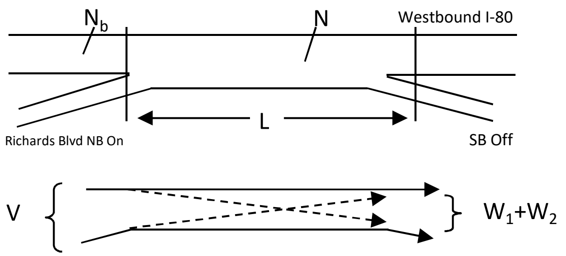
Data Input		
Number of Entering Mainline Lanes	N_b	3
Number of Lanes in Weaving Section	N	4
Length of Weaving Section (feet)	L	500

Project Information	
Project	I-80/Richards Blvd Interchange
Scenario	Design Year No Build
Freeway	Westbound I-80
On-ramp	Richards Blvd NB On
Off-ramp	SB Off

Total Weaving Section (V)		On-ramp to Mainline (W_1)		Mainline to Off-ramp (W_2)	
Volume (vph)*	5,473	Volume (vph)*	700	Volume (vph)*	170
Truck Percentage	8.0%	Truck Percentage	3.0%	Truck Percentage	3.0%
PCE for Trucks	2.0	PCE for Trucks	2.0	PCE for Trucks	2.0
Volume (pcph)	5,913	Volume (pcph)	721	Volume (pcph)	175



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?

   35 MPH and **40 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) 34.3
4. Weaving Intensity Factor (k) 3.00
5. Service Volume (SV, pcph)

   $SV = (1/N)*[V + (k - 1)*\min(W_1, W_2)]$ 1,566
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

HCM 6th Edition: Freeway Ramp Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	Off Ramp	
Number of Lanes, N	3	1	1	
Free-Flow Speed, FFS	70.0	25	25	mph
Segment Length, L / Deceleration Length, LD	1,500	0	0	ft
Terrain Type	Level	Level	Level	
Percent Grade	-	-	-	
Grade Length	-	-	-	ft
Segment Type / Ramp Type	Freeway	Right	Right	

Adjustment Factors

	Freeway	On Ramp	Off Ramp
Driver Population	Familiar	Familiar	Familiar
Weather Type	Non-severe	Non-severe	Non-severe
Incident Type	No incident	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	Off Ramp	
Volume, V	4,773	700	170	vph
Peak Hour Factor, PHF	0.99	0.92	0.92	
Total Trucks	9.0%	3.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	0.971	
Flow Rate, v_p	5,255	784	190	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria			
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Ramp Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,255	7,200	pcph	0.73
Exiting General Purpose Lanes	5,848	7,200	pcph	0.81
Entering Managed Lanes	834	1,723	pcph	0.48
On Ramp	784	1,900	pcph	0.41
Off Ramp	190	1,900	pcph	0.10

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time period	PM Peak Hour

Geometric Data

Segment Type	Freeway	
Weaving Configuration	One-sided	
Number of Lanes, N	4	ln
Weaving Segment Length, L_S	500	ft
Interchange Density, ID	0.8	int/mi
Number of Manuever Lanes, N_{WL}	2.0	ln
On Ramp to Freeway Lane Changes, LC_{RF}	1	
Freeway to Off Ramp Lane Changes, LC_{FR}	1	
On Ramp to Off Ramp Lane Changes, LC_{RR}	0	

Adjustment Factors

Driver Population	Familiar
Weather Type	Non-severe
Incident Type	No incident
Capacity Adjustment Factor, CAF	1.00
Demand Adjustment Factor, DAF	1.00

Volume Data

	Frwy to Frwy	On to Frwy	Frwy to Off	Frwy to Off	
Volume, V	4,603	700	170	0	vph
Peak-hour factor, PHF	0.99	0.92	0.92	0.95	
Total Trucks	9.0%	3.0%	3.0%	3.0%	
Terrain Type	Level	Level	Level	Level	
Grade					
Length					mi
SUT/TT Mix					
Passenger Car Equivalent, E_T	2.0	2.0	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	0.971	0.971	
Demand Adjustment Factor, DAF	1.00	1.00	1.00	1.00	
Flow Rate, v_p	5,068	784	190	0	pcph

Weaving Flow Rate, vW	974	Total Flow Rate, v	6,042
Non-Weaving Flow Rate, vNW	5,068	Volume Ratio, VR	0.161

HCM 6th Edition: Freeway Weaving Segment

Freeway Weave Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd NB On to SB Off
Alternative	Design Year No Build
Time period	PM Peak Hour

Capacity

Maximum Weaving Length, L_{MAX}	4,143	ft
Weaving Length Check	OK	
Freeway Maximum Capacity, c_{IFL}	2,400	pchpl
Density-Based Capacity, c_{IWL}	6,921	pchpl
Demand Flow-Based Capacity, c_{IW}	13,787	pch
Weaving Segment Capacity, c_W	13,787	vph
Adjusted Weaving Area Capacity, c_{wa}	13,787	vph
Volume-to-Capacity Ratio, v/c	0.41	

Speed and Density

Minimum Lane Change Rate, LC_{MIN}	974	lc/h
Weaving Lane Change Rate, LC_W	993	lc/h
Non-weaving Vehicle Index, I_{NW}	211	
Non-weaving Lane Change Rate, LC_{NW}	545	lc/h
Total Lane Change Rate, LC_{ALL}	1,538	lc/h
Weaving Intensity Factor, W	0.548	
Average Weaving Speed, S_W	50.5	mph
Average Non-Weaving Speed, S_{NW}	55.8	mph
Average Speed, S	54.9	mph
Density, D	27.5	pcpmpl
Level of Service, LOS	C	

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,255	7,200	pcph	0.73
Exiting General Purpose Lanes	5,848	7,200	pcph	0.81
On Ramp	784	1,900	pcph	0.41
Off Ramp	190	1,900	pcph	0.10

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB Off to On
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	210	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	5,229	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,919	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.80	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	64.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	30.0	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB On Ramp
Alternative	Design Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	70.4	45	mph
Segment Length, L / Acceleration Length, LA	1,500	400	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	5,229	380	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,757	425	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB On Ramp
Alternative	Design Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.589	
Flow Rate in Lanes 1 and 2, v_{12}	3,389	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,757	7,200	pcph	0.80
Exiting General Purpose Lanes	6,182	7,200	pcph	0.86
Entering Managed Lanes	914	1,723	pcph	0.53
On Ramp	425	2,100	pcph	0.20
Ramp Influence Area	3,815	4,600	pcph	0.83

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	32.6	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.462	
Average Speed in Ramp Influence Area, S_R	57.3	mph
Average Flow in Outer Lanes, v_{OA}	2,368	pcphpl
Average Speed in Outer Lanes, S_O	63.5	mph
Average Speed for Segment, S	59.5	mph
Density across All Lanes, D	35.9	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd SB On to Lane Add
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,270	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.67	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.4	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	5,556	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	2,039	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.85	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.4	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	62.0	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	32.9	pcpmpl
Total Ramp Density Adjustment	5.0	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	70.0	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,556	380	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	6,117	425	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year No Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,907	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	6,117	9,600	pcph	0.64
Exiting General Purpose Lanes	5,691	9,600	pcph	0.59
Entering Managed Lanes	971	1,723	pcph	0.56
Off Ramp	425	2,100	pcph	0.20
Ramp Influence Area	2,907	4,400	pcph	0.66

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	27.9	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.336	
Average Speed in Ramp Influence Area, S_R	60.6	mph
Average Flow in Outer Lanes, v_{OA}	1,605	pcphpl
Average Speed in Outer Lanes, S_O	74.5	mph
Average Speed for Segment, S	67.2	mph
Density across All Lanes, D	22.8	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Design Year No Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	70.0	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,229	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,439	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.60	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	70.0	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	20.7	pcpmpl
Total Ramp Density Adjustment	5.4	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Design Year Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.00	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.2	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,928	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,827	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.76	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.2	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.4	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.5	pcpmpl
Total Ramp Density Adjustment	3.2	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year Build
Time Period	AM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,928	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,827	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.76	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	66.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.4	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	D	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	70.6	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	21.6	pcphpl
Flow Rate, vp	1,524	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.64				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,928	550	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,481	616	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,481	7,200	pcph	0.76
Exiting General Purpose Lanes	6,097	9,600	pcph	0.64
Entering Managed Lanes	861	1,723	pcph	0.50
On Ramp	616	4,200	pcph	0.15

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Richards Blvd
Alternative	Design Year Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	7,170	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	5,401	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	2,002	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.83	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	63.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	31.6	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,401	1,170	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	6,007	1,310	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		3,640	ft
Volume on Adjacent Ramp		717	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	1,510	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.550	
Flow Rate in Lanes 1 and 2, v_{12}	3,891	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	6,007	7,200	pcph	0.83
Exiting General Purpose Lanes	4,697	7,200	pcph	0.65
Entering Managed Lanes	944	1,723	pcph	0.55
Off Ramp	1,310	2,100	pcph	0.62
Ramp Influence Area	3,891	4,400	pcph	0.88

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	36.4	pcpmpl
Level of Service, LOS	E	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.416	
Average Speed in Ramp Influence Area, S_R	59.9	mph
Average Flow in Outer Lanes, v_{OA}	2,116	pcphpl
Average Speed in Outer Lanes, S_O	75.3	mph
Average Speed for Segment, S	64.6	mph
Density across All Lanes, D	31.5	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off to On
Alternative	Design Year Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,140	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,395	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,629	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.68	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.6	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.7	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,500	400	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,395	640	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,888	717	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	3,640		ft
Volume on Adjacent Ramp	1,310		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,328	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.589	
Flow Rate in Lanes 1 and 2, v_{12}	2,877	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,888	7,200	pcph	0.68
Exiting General Purpose Lanes	5,604	7,200	pcph	0.78
Entering Managed Lanes	768	1,723	pcph	0.45
On Ramp	717	2,100	pcph	0.34
Ramp Influence Area	3,594	4,600	pcph	0.78

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	30.7	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.427	
Average Speed in Ramp Influence Area, S_R	58.8	mph
Average Flow in Outer Lanes, v_{OA}	2,010	pcphpl
Average Speed in Outer Lanes, S_O	65.9	mph
Average Speed for Segment, S	61.2	mph
Density across All Lanes, D	31.1	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Design Year Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,270	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,945	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,833	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.76	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.9	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	27.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year Build
Time Period	AM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	4,945	500	vph
Peak Hour Factor, PHF	0.98	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,500	560	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year Build
Time Period	AM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.597	
Flow Rate in Lanes 1 and 2, v_{12}	3,508	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,500	7,200	pcph	0.76
Exiting General Purpose Lanes	4,940	9,600	pcph	0.51
Entering Managed Lanes	864	1,723	pcph	0.50
Off Ramp	560	2,100	pcph	0.27
Ramp Influence Area	3,508	4,400	pcph	0.80

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	33.1	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.348	
Average Speed in Ramp Influence Area, S_R	61.1	mph
Average Flow in Outer Lanes, v_{OA}	1,992	pcphpl
Average Speed in Outer Lanes, S_O	74.4	mph
Average Speed for Segment, S	65.3	mph
Density across All Lanes, D	28.7	pcpmpl

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Design Year Build
Time Period	AM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,515	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.98		Flow Rate, v_p	1,255	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.52	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	71.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	17.6	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	B	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	East of Mace Blvd
Alternative	Design Year Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,590	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.00	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.2	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	4,352	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,597	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.2	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	23.0	pcpmpl
Total Ramp Density Adjustment	3.2	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year Build
Time Period	PM Peak Hour

Entering General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	1,850	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

Entering General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

Entering General Purpose Lanes - Demand and Capacity

Volume, V	4,352	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,597	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.67	

Entering General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	69.8	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	22.9	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	C	

Segment General Purpose Lanes - Capacity, Speed, and Density

General Purpose Lanes, N	4	ln	Average Speed, S	71.1	mph
Adjusted Capacity, cadj	2,400	pcphpl	Density, D	20.5	pcphpl
Flow Rate, vp	1,458	pcphpl	Level of Service, LOS	C	
Volume-to-Capacity Ratio, v/c	0.61				

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	2	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Acceleration Length, LA	1,850	0	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,352	930	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	4,791	1,041	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Mace Blvd to Lane Drop
Alternative	Design Year Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}		
Flow Rate in Lanes 1 and 2, v_{12}		pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	4,791	7,200	pcph	0.67
Exiting General Purpose Lanes	5,832	9,600	pcph	0.61
Entering Managed Lanes	761	1,723	pcph	0.44
On Ramp	1,041	4,200	pcph	0.25

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R		pcpmpl
Level of Service, LOS		

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF		
Speed Index, M_S or D_S		
Average Speed in Ramp Influence Area, S_R		mph
Average Flow in Outer Lanes, v_{OA}		pcphpl
Average Speed in Outer Lanes, S_O		mph
Average Speed for Segment, S		mph
Density across All Lanes, D		pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Drop to Richards Blvd
Alternative	Design Year Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	7,170	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,151	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,891	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.79	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	65.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	28.9	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	72.6	45	mph
Segment Length, L / Deceleration Length, LD	1,500	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,151	610	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,672	683	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	Yes	
Type of Adjacent Ramp		On	
Distance to Adjacent Ramp		3,700	ft
Volume on Adjacent Ramp		1,209	pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off Ramp
Alternative	Design Year Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}	1,688	ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.587	
Flow Rate in Lanes 1 and 2, v_{12}	3,610	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,672	7,200	pcph	0.79
Exiting General Purpose Lanes	4,989	7,200	pcph	0.69
Entering Managed Lanes	900	1,723	pcph	0.52
Off Ramp	683	2,100	pcph	0.33
Ramp Influence Area	3,610	4,400	pcph	0.82

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	34.0	pcpmpl
Level of Service, LOS	D	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.359	
Average Speed in Ramp Influence Area, S_R	61.6	mph
Average Flow in Outer Lanes, v_{OA}	2,061	pcphpl
Average Speed in Outer Lanes, S_O	75.6	mph
Average Speed for Segment, S	66.1	mph
Density across All Lanes, D	29.3	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd Off to On
Alternative	Design Year Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,200	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	0.83	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	72.6	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	4,627	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,698	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.71	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	72.6	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	68.5	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	24.8	pcpmpl
Total Ramp Density Adjustment	2.8	mph	Level of Service, LOS	C	

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	On Ramp	
Number of Lanes, N	3	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Acceleration Length, LA	1,500	400	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	On Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	On Ramp	
Volume, V	4,627	1,080	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	5,094	1,209	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	Yes	No	
Type of Adjacent Ramp	Off		
Distance to Adjacent Ramp	3,700		ft
Volume on Adjacent Ramp	683		pcph

HCM 6th Edition: Freeway Merge Segment

Freeway Merge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd On Ramp
Alternative	Design Year Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}	1,478	ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.589	
Flow Rate in Lanes 1 and 2, v_{12}	2,999	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	5,094	7,200	pcph	0.71
Exiting General Purpose Lanes	6,303	7,200	pcph	0.88
Entering Managed Lanes	809	1,723	pcph	0.47
On Ramp	1,209	2,100	pcph	0.58
Ramp Influence Area	4,208	4,600	pcph	0.91

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	35.3	pcpmpl
Level of Service, LOS	E	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.547	
Average Speed in Ramp Influence Area, S_R	55.3	mph
Average Flow in Outer Lanes, v_{OA}	2,095	pcphpl
Average Speed in Outer Lanes, S_O	65.6	mph
Average Speed for Segment, S	58.3	mph
Density across All Lanes, D	36.0	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Richards Blvd to Lane Add
Alternative	Design Year Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	3	ln	Terrain Type	Level	
Segment Length, L	2,270	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00	
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00	
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00	

General Purpose Lanes - Demand and Capacity

Volume, V	5,556	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	2,039	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.85	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	62.2	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	32.8	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	D	

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year Build
Time Period	PM Peak Hour

Geometric Data

	Freeway	Off Ramp	
Number of Lanes, N	4	1	
Free-Flow Speed, FFS	71.3	45	mph
Segment Length, L / Deceleration Length, LD	1,190	150	ft
Terrain Type	Level	Level	
Percent Grade	-	-	
Grade Length	-	-	ft
Segment Type / Ramp Type	Freeway	Right	

Adjustment Factors

	Freeway	Off Ramp
Driver Population	Familiar	Familiar
Weather Type	Non-severe	Non-severe
Incident Type	No incident	No incident
Capacity Adjustment Factor, CAF	1.00	1.00
Demand Adjustment Factor, DAF	1.00	1.00

Volume Data

Junction Components	Freeway	Off Ramp	
Volume, V	5,556	380	vph
Peak Hour Factor, PHF	0.99	0.92	
Total Trucks	9.0%	3.0%	
Single Unit/Tractor-Trailer Mix	-	-	
Passenger Car Equivalent, E_T	2.0	2.0	
Heavy Vehicle Adjustment, f_{HV}	0.917	0.971	
Flow Rate, v_p	6,117	425	pcph

Adjacent Ramp Data

	Upstream	Downstream	
Adjacent Ramp Meeting Criteria	No	No	
Type of Adjacent Ramp			
Distance to Adjacent Ramp			ft
Volume on Adjacent Ramp			pcph

HCM 6th Edition: Freeway Diverge Segment

Freeway Diverge Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	Lane Add to Old Davis Off
Alternative	Design Year Build
Time Period	PM Peak Hour

Estimation of Volume in Ramp Influence Area

Adjacent Upstream On-ramp Equilibrium Distance, L_{EQ}		ft
Adjacent Downstream On-ramp Equilibrium Distance, L_{EQ}		ft
Proportion of Freeway Vehicles in Lanes 1 and 2, P_{FM} or P_{FD}	0.436	
Flow Rate in Lanes 1 and 2, v_{12}	2,907	pcph

Capacity Checks

	Flow	Capacity		V/C Ratio
Entering General Purpose Lanes	6,117	9,600	pcph	0.64
Exiting General Purpose Lanes	5,691	9,600	pcph	0.59
Entering Managed Lanes	971	1,723	pcph	0.56
Off Ramp	425	2,100	pcph	0.20
Ramp Influence Area	2,907	4,400	pcph	0.66

Ramp Influence Area Density and Level of Service

Density in Ramp Influence Area, D_R	27.9	pcpmpl
Level of Service, LOS	C	

Segment Speed, Flow, and Density

Speed Adjustment Factor, SAF	1.00	
Speed Index, M_S or D_S	0.336	
Average Speed in Ramp Influence Area, S_R	61.5	mph
Average Flow in Outer Lanes, v_{OA}	1,605	pcphpl
Average Speed in Outer Lanes, S_O	75.9	mph
Average Speed for Segment, S	68.3	mph
Density across All Lanes, D	22.4	pcpmpl

HCM 6th Edition: Freeway Basic Segment

Freeway Basic Report

Project	I-80/Richards Blvd Interchange
Freeway	Westbound I-80
Segment	West of Old Davis Rd
Alternative	Design Year Build
Time Period	PM Peak Hour

General Purpose Lanes - Geometric Data

General Purpose Lanes, N	4	ln	Terrain Type	Level	
Segment Length, L	1,350	ft	Percent Grade	-	
Base Free Flow Speed, BFFS	75.4	mph	Grade Length	-	mi
Lane Width	12.0	ft	Total Ramp Density, TRD	1.33	ramps/mi
Right Side Lateral Clearance	6.0	ft	Free Flow Speed, FFS	71.3	mph

General Purpose Lanes - Adjustment Factors

Driver Population	Familiar	Speed Adjustment Factor, SAF	1.00
Weather Type	Non-severe	Capacity Adjustment Factor, CAF	1.00
Incident Type	No incident	Demand Adjustment Factor, DAF	1.00

General Purpose Lanes - Demand and Capacity

Volume, V	5,229	vph	Heavy Vehicle Adjustment Factor, f_{HV}	0.917	
Peak Hour Factor, PHF	0.99		Flow Rate, v_p	1,439	pcphpl
Total Trucks	9.0%		Capacity, c	2,400	pcphpl
Single Unit/Tractor-Trailer Mix	-		Adjusted Capacity, c_{adj}	2,400	pcphpl
Passenger Car Equivalent, E_T	2.0		Volume-to-Capacity Ratio, v/c	0.60	

General Purpose Lanes - Speed and Density

Measured or Base FFS	Base		Adjusted Free Flow Speed, FFS_{adj}	71.3	mph
Lane Width Adjustment, f_{LW}	0.0	mph	Average Speed, S	70.3	mph
Right Lateral Clearance Adjustment, f_{RLC}	0.0	mph	Density, D	20.5	pcpmpl
Total Ramp Density Adjustment	4.1	mph	Level of Service, LOS	C	

Output Summary

General Information

Project description:	I-80/Richards Blvd Interchange - Design Year Conditions No Build Alternative				
Analyst:	DS	Date:	1/20/2018	Area type:	Urban
First year of analysis:	2035				
Last year of analysis:	2035				

Crash Data Description

Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	Yes	First year of crash data:	2012
	Project-level crash data available?	No	Last year of crash data:	2014
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility	Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:	5.7	0.1	0.2	0.9	1.1	3.5
Estimated average crash freq. during Study Period, crashes/yr:	5.7	0.1	0.2	0.9	1.1	3.5

Crashes by Facility Component	Nbr. Sites	Total	K	A	B	C	PDO
Freeway segments, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	5	5.7	0.1	0.2	0.9	1.1	3.5
Crossroad ramp terminals, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0

Crashes for Entire Facility by Year	Year	Total	K	A	B	C	PDO
Estimated number of crashes during the Study Period, crashes:	2035	5.7	0.1	0.2	0.9	1.1	3.5
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						
	2043						
	2044						
	2045						
	2046						
	2047						
	2048						
	2049						
	2050						
	2051						
	2052						
	2053						
	2054						
	2055						
	2056						
	2057						
	2058						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	K	A	B	C	PDO
Multiple vehicle	Head-on crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Rear-end crashes:	0.3	0.0	0.0	0.1	0.1	0.2
	Sideswipe crashes:	0.1	0.0	0.0	0.0	0.0	0.1
	Other multiple-vehicle crashes:	0.1	0.0	0.0	0.0	0.0	0.0
	Total multiple-vehicle crashes:	0.5	0.0	0.0	0.1	0.1	0.3
Single vehicle	Crashes with animal:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:	4.1	0.0	0.1	0.6	0.7	2.7
	Crashes with other object:	0.1	0.0	0.0	0.0	0.0	0.1
	Crashes with parked vehicle:	0.1	0.0	0.0	0.0	0.0	0.0
	Other single-vehicle crashes	0.9	0.0	0.0	0.2	0.2	0.4
	Total single-vehicle crashes:	5.2	0.1	0.2	0.8	1.0	3.2
	Total crashes:	5.7	0.1	0.2	0.9	1.1	3.5

Output Summary

General Information

Project description:	I-80/Richards Blvd Interchange - Design Year Conditions Build Alternative				
Analyst:	DS	Date:	1/20/2018	Area type:	Urban
First year of analysis:	2035				
Last year of analysis:	2035				

Crash Data Description

Freeway segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp segments	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	
Ramp terminals	Segment crash data available?	No	First year of crash data:	
	Project-level crash data available?	No	Last year of crash data:	

Estimated Crash Statistics

Crashes for Entire Facility	Total	K	A	B	C	PDO
Estimated number of crashes during Study Period, crashes:	2.1	0.0	0.1	0.4	0.5	1.1
Estimated average crash freq. during Study Period, crashes/yr:	2.1	0.0	0.1	0.4	0.5	1.1

Crashes by Facility Component	Nbr. Sites	Total	K	A	B	C	PDO
Freeway segments, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0
Ramp segments, crashes:	2	2.1	0.0	0.1	0.4	0.5	1.1
Crossroad ramp terminals, crashes:	0	0.0	0.0	0.0	0.0	0.0	0.0

Crashes for Entire Facility by Year	Year	Total	K	A	B	C	PDO
Estimated number of crashes during the Study Period, crashes:	2035	2.1	0.0	0.1	0.4	0.5	1.1
	2036						
	2037						
	2038						
	2039						
	2040						
	2041						
	2042						
	2043						
	2044						
	2045						
	2046						
	2047						
	2048						
	2049						
	2050						
	2051						
	2052						
	2053						
	2054						
	2055						
	2056						
	2057						
	2058						

Distribution of Crashes for Entire Facility

Crash Type	Crash Type Category	Estimated Number of Crashes During the Study Period					
		Total	K	A	B	C	PDO
Multiple vehicle	Head-on crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Right-angle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Rear-end crashes:	0.2	0.0	0.0	0.0	0.1	0.1
	Sideswipe crashes:	0.1	0.0	0.0	0.0	0.0	0.1
	Other multiple-vehicle crashes:	0.0	0.0	0.0	0.0	0.0	0.0
	Total multiple-vehicle crashes:	0.4	0.0	0.0	0.1	0.1	0.2
Single vehicle	Crashes with animal:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with fixed object:	1.3	0.0	0.0	0.2	0.3	0.7
	Crashes with other object:	0.0	0.0	0.0	0.0	0.0	0.0
	Crashes with parked vehicle:	0.0	0.0	0.0	0.0	0.0	0.0
	Other single-vehicle crashes	0.3	0.0	0.0	0.1	0.1	0.1
	Total single-vehicle crashes:	1.7	0.0	0.1	0.3	0.4	0.8
	Total crashes:	2.1	0.0	0.1	0.4	0.5	1.1

RAMP METERING ANALYSIS

Project: I-80/Richards Blvd Interchange
Ramp: Westbound I-80 On-ramp
Scenario: Build Alternative Design Year Conditions

Configuration: 1 metered + 1 HOV
Peak Hour Volume: 640
Peak Period Volume: 1,250

HOV Bypass (%)	15%
Metered Volume (veh/hr)	544
Metering Rate (veh/hr)	575
Discharge Rate (veh/15 min)	144

Storage Length (ft)	630
Storage Lanes	1
Maximum Storage (veh)	21

Time Interval	Hourly Arrival Distribution	Estimated 15-Minute Volumes	Metered 15-Minute min flows	Excess Demand	Accum-ulated Vehicles	Total Delay (veh-hr)	Vehicles Delayed	Total Hourly Volume	Metered Hourly Volume
7:00-7:15	18%	115	98	0	0	0.00	0		
7:15-7:30	22%	141	120	0	0	0.00	0		
7:30-7:45	26%	168	143	0	0	0.00	0		
7:45-8:00	30%	189	161	17	17	4.23	161	613	521
8:00-8:15	19%	124	105	0	0	0.00	0	622	529
8:15-8:30	24%	153	130	0	0	0.00	0	634	539
8:30-8:45	30%	190	162	18	18	4.44	162	656	558
8:45-9:00	27%	172	146	2	20	5.05	146	639	543

Total Delay (veh-hr)	14
Total Vehicles Delayed (veh)	468
Average Delay (hr)	0.03
Average Delay (min)	1.76

Maximum Queue (veh)	20
Maximum Queue (ft)	606

Project: I-80/Richards Blvd Interchange
Ramp: Westbound I-80 On-ramp
Scenario: Build Alternative Design Year Conditions

Configuration: 1 metered + 1 HOV
Peak Hour Volume: 1,080
Peak Period Volume: 2,150

HOV Bypass (%)	15%
Metered Volume (veh/hr)	918
Metering Rate (veh/hr)	900
Discharge Rate (veh/15 min)	225

Storage Length (ft)	630
Storage Lanes	1
Maximum Storage (veh)	21

Time Interval	Hourly Arrival Distribution	Estimated 15-Minute Volumes	Metered 15-Minute min flows	Excess Demand	Accum-ulated Vehicles	Total Delay (veh-hr)	Vehicles Delayed	Total Hourly Volume	Metered Hourly Volume
4:00-4:15	23%	245	208	0	0	0.00	0		
4:15-4:30	24%	262	223	0	0	0.00	0		
4:30-4:45	22%	233	198	0	0	0.00	0		
4:45-5:00	24%	254	216	0	0	0.00	0	994	845
5:00-5:15	31%	331	281	56	56	14.09	281	1080	918
5:15-5:30	27%	292	248	23	80	19.89	248	1110	944
5:30-5:45	28%	299	254	29	109	27.18	254	1176	1000
5:45-3:00	21%	230	196	0	79	19.80	196	1152	979

Total Delay (veh-hr)	81
Total Vehicles Delayed (veh)	979
Average Delay (hr)	0.08
Average Delay (min)	4.96

Maximum Queue (veh)	109
Maximum Queue (ft)	3,261

RAMP METERING ANALYSIS

Project: I-80/Richards Blvd Interchange
Ramp: Westbound I-80 On-ramp
Scenario: Build Alternative Design Year Conditions

Configuration: 1 metered + 1 HOV
Peak Hour Volume: 640
Peak Period Volume: 1,250

HOV Bypass (%)	15%
Metered Volume (veh/hr)	544
Metering Rate (veh/hr)	540
Discharge Rate (veh/15 min)	135

Storage Length (ft)	630
Storage Lanes	2
Maximum Storage (veh)	42

Time Interval	Hourly Arrival Distribution	Estimated 15-Minute Volumes	Metered 15-Minute min flows	Excess Demand	Accum-ulated Vehicles	Total Delay (veh-hr)	Vehicles Delayed	Total Hourly Volume	Metered Hourly Volume
7:00-7:15	18%	115	98	0	0	0.00	0		
7:15-7:30	22%	141	120	0	0	0.00	0		
7:30-7:45	26%	168	143	8	8	1.95	143		
7:45-8:00	30%	189	161	26	33	8.36	161	613	521
8:00-8:15	19%	124	105	0	4	0.96	105	622	529
8:15-8:30	24%	153	130	0	0	0.00	0	634	539
8:30-8:45	30%	190	162	27	27	6.63	162	656	558
8:45-9:00	27%	172	146	11	38	9.43	146	639	543

Total Delay (veh-hr)	27
Total Vehicles Delayed (veh)	717
Average Delay (hr)	0.04
Average Delay (min)	2.29

Maximum Queue (veh)	38
Maximum Queue (ft)	566

Project: I-80/Richards Blvd Interchange
Ramp: Westbound I-80 On-ramp
Scenario: Build Alternative Design Year Conditions

Configuration: 1 metered + 1 HOV
Peak Hour Volume: 1,080
Peak Period Volume: 2,150

HOV Bypass (%)	15%
Metered Volume (veh/hr)	918
Metering Rate (veh/hr)	990
Discharge Rate (veh/15 min)	248

Storage Length (ft)	630
Storage Lanes	2
Maximum Storage (veh)	42

Time Interval	Hourly Arrival Distribution	Estimated 15-Minute Volumes	Metered 15-Minute min flows	Excess Demand	Accum-ulated Vehicles	Total Delay (veh-hr)	Vehicles Delayed	Total Hourly Volume	Metered Hourly Volume
4:00-4:15	23%	245	208	0	0	0.00	0		
4:15-4:30	24%	262	223	0	0	0.00	0		
4:30-4:45	22%	233	198	0	0	0.00	0		
4:45-5:00	24%	254	216	0	0	0.00	0	994	845
5:00-5:15	31%	331	281	34	34	8.46	281	1080	918
5:15-5:30	27%	292	248	1	35	8.64	248	1110	944
5:30-5:45	28%	299	254	7	41	10.30	254	1176	1000
5:45-3:00	21%	230	196	0	0	0.00	0	1152	979

Total Delay (veh-hr)	27
Total Vehicles Delayed (veh)	784
Average Delay (hr)	0.03
Average Delay (min)	2.10

Maximum Queue (veh)	41
Maximum Queue (ft)	618

Traffic Index for Pavement Design

Roadway:	I-80
Limits:	East of Olive Drive
Facility type:	Freeway or Expressway
Lanes in one direction:	3
Design life in years:	10

1.	Baseline one-way daily traffic volume	72,175	2022 Forecast
	Forecasted one-way daily traffic volume	90,090	2042 Forecast
2.	Baseline truck percentage	9.0%	Caltrans truck volumes, 2015
	Baseline one-way daily truck traffic volume	6,496	
3.	Forecasted truck percentage	9.0%	Caltrans truck volumes, 2015
	Forecasted one-way daily truck traffic volume	8,108	
4.	Expanded average daily truck traffic	7,302	

5. Distribution of truck traffic by axles — Caltrans truck volumes, 2015

Vehicle Type	Percentage	Outside Lanes Daily Trucks	Inside Lanes Daily Trucks
2 Axle	28.5%	1,666	417
3 Axle	7.6%	442	111
4 Axle	3.4%	201	50
5+ Axle	60.5%	3,532	883

6. Calculation of total ESAL (Equivalent Single-Axle Loads)

Vehicle Type	Constants for 10-Year ESAL	Outside Lanes 10-Year ESAL	Inside Lanes 10-Year ESAL
2 Axle	690	1,149,816	287,454
3 Axle	1,840	814,016	203,504
4 Axle	2,940	590,352	147,588
5+ Axle	6,890	24,335,480	6,083,870
TOTAL		26,889,664	6,722,416

7. Calculation of Traffic Index

	Outside Lanes	Inside Lanes
Raw Value	13.3	11.3
Final Value	13.5	11.5

Source: *Highway Design Manual* , Chapter 610 (Caltrans, 2012)

Traffic Index for Pavement Design

Roadway:	I-80
Limits:	East of Olive Drive
Facility type:	Freeway or Expressway
Lanes in one direction:	3
Design life in years:	20

1.	Baseline one-way daily traffic volume	72,175	2022 Forecast
	Forecasted one-way daily traffic volume	90,090	2042 Forecast
2.	Baseline truck percentage	9.0%	Caltrans truck volumes, 2015
	Baseline one-way daily truck traffic volume	6,496	
3.	Forecasted truck percentage	9.0%	Caltrans truck volumes, 2015
	Forecasted one-way daily truck traffic volume	8,108	
4.	Expanded average daily truck traffic	7,302	

5. Distribution of truck traffic by axles — Caltrans truck volumes, 2015

Vehicle Type	Percentage	Outside Lanes Daily Trucks	Inside Lanes Daily Trucks
2 Axle	28.5%	1,666	417
3 Axle	7.6%	442	111
4 Axle	3.4%	201	50
5+ Axle	60.5%	3,532	883

6. Calculation of total ESAL (Equivalent Single-Axle Loads)

Vehicle Type	Constants for 20-Year ESAL	Outside Lanes 20-Year ESAL	Inside Lanes 20-Year ESAL
2 Axle	1,380	2,299,632	574,908
3 Axle	3,680	1,628,032	407,008
4 Axle	5,880	1,180,704	295,176
5+ Axle	13,780	48,670,960	12,167,740
TOTAL		53,779,328	13,444,832

7. Calculation of Traffic Index

	Outside Lanes	Inside Lanes
Raw Value	14.5	12.3
Final Value	14.5	12.5

Source: *Highway Design Manual*, Chapter 610 (Caltrans, 2012)

Traffic Index for Pavement Design

Roadway:	Richards Boulevard
Limits:	I-80 Overcrossing
Facility type:	Conventional Highway
Lanes in one direction:	2
Design life in years:	10

1.	Baseline one-way daily traffic volume	13,960	2025 Forecast
	Forecasted one-way daily traffic volume	20,580	2045 Forecast
2.	Baseline truck percentage	2.0%	May 2016 peak hour traffic counts
	Baseline one-way daily truck traffic volume	279	
3.	Forecasted truck percentage	2.0%	May 2016 peak hour traffic counts
	Forecasted one-way daily truck traffic volume	412	
4.	Expanded average daily truck traffic	345	
5.	Distribution of truck traffic by axles		Estimated

Vehicle Type	Percentage	Daily Trucks
2 Axle	60.0%	207
3 Axle	10.0%	35
4 Axle	10.0%	35
5+ Axle	20.0%	69

6. Calculation of total ESAL (Equivalent Single-Axle Loads)

Vehicle Type	Constants for 10-Year ESAL	10-Year ESAL
2 Axle	690	142,830
3 Axle	1,840	64,400
4 Axle	2,940	102,900
5+ Axle	6,890	475,410
TOTAL		785,540

7. Calculation of Traffic Index

Raw Value	8.7
Final Value	10.0

Source: *Highway Design Manual*, Chapter 610 (Caltrans, 2012)

Traffic Index for Pavement Design

Roadway:	Richards Boulevard
Limits:	I-80 Overcrossing
Facility type:	Conventional Highway
Lanes in one direction:	2
Design life in years:	20

1.	Baseline one-way daily traffic volume	13,960	2025 Forecast	
	Forecasted one-way daily traffic volume	20,580	2045 Forecast	
2.	Baseline truck percentage	2.0%	May 2016 peak hour traffic counts	
	Baseline one-way daily truck traffic volume	279		
3.	Forecasted truck percentage	2.0%	May 2016 peak hour traffic counts	
	Forecasted one-way daily truck traffic volume	412		
4.	Expanded average daily truck traffic	345		
5.	Distribution of truck traffic by axles		Estimated	
		Vehicle Type	Percentage	Daily Trucks
		2 Axle	60.0%	207
		3 Axle	10.0%	35
		4 Axle	10.0%	35
		5+ Axle	20.0%	69
6.	Calculation of total ESAL (Equivalent Single-Axle Loads)			
			Constants for	
		Vehicle Type	20-Year ESAL	20-Year ESAL
		2 Axle	1,380	285,660
		3 Axle	3,680	128,800
		4 Axle	5,880	205,800
		5+ Axle	13,780	950,820
		TOTAL		1,571,080
7.	Calculation of Traffic Index			
		Raw Value	9.5	
		Final Value	10.0	

Source: *Highway Design Manual* , Chapter 610 (Caltrans, 2012)