Interstate 80 / U.S. Highway 50 Managed Lanes

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Concept of Operations

[DRAFT]

Prepared for:

Caltrans

YoloTD Yolo Transportation District

SACOG

Prepared by:

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Revision History

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0	11/17/2023	First Draft for YoloTD Review	Jef Nazareno
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Acronyms

AB	Assembly Bill
ADT	Average Daily Traffic
AVI	Automated Vehicle Identification
BOS	Back Office System
BRT	Bus Rapid Transit
Caltrans	California Department of Transportation
CA MUTCD	California Manual on Uniform Traffic Control Devices
CARTA	Capital Area Regional Tolling Authority
CAV	Clean Air Vehicle
CCR	California Code of Regulations
CCTV	Closed Circuit Television
CEQA	California Environmental Quality Act
CHP	California Highway Patrol
CMAQ	Congestion Mitigation and Air Quality
CMS	Changeable Message Sign
ConOps	Concept of Operations
CR	County Road
CSC	Customer Service Center
CTC	California Transportation Commission
CTOC	California Toll Operators Committee
CVC	California Vehicle Code
DC	Direct Connector
DMV	Department of Motor Vehicles
DPR	Draft Project Report
EB	Eastbound
EDCTC	El Dorado County Transportation Commission
ETC	Electronic Toll Collection
FHWA	Federal Highway Administration
FSP	Freeway Service Patrol
GGBHTD	Golden Gate Bridge Highway & Transportation District
GP	General Purpose
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
HOT	High Occupancy Toll
HOT2	High Occupancy Toll policy that requires 2 occupants to receive toll discount
HOT3	High Occupancy Toll policy that requires at least 3 occupants to receive toll discount
HOV	High Occupancy Vehicle

HOV2	High Occupancy Vehicle with 2 or more people in vehicle
HOV3+	High Occupancy Vehicle with 3 or more people in vehicle
HVAC	Heating, Ventilation, and Air Conditioning
I-80	Interstate 80
IBTTA	International Bridge, Tunnel & Turnpike Association
IMP	Incident Management Plan
INFRA	Infrastructure for Rebuilding America
ISO	International Standards Organization
ITS	Intelligent Transportation Systems
IVR	Interactive Voice Response
JPA	Joint Powers Authority
LA	Los Angeles
LED	Light Emitting Diode
LOS	Level of Service
LPR	License Plate Recognition
MPH	Miles per Hour
MTC	Metropolitan Transportation Commission
MUTCD	Manual of Uniform Traffic Control Devices
NCST	National Center for Sustainable Transportation
NGOs	Non-Governmental Organizations
NIOP	National Interoperability
ODS	Occupancy Detection Station
ORT	Open Road Tolling
P&R	Park and Ride
PA&ED	Project Approval and Environmental Documents
PCTPA	Placer County Transportation Planning Agency
PM	Post Mile
PMT	Personal Miles Traveled
PoDI	Projects of Division Interest
PS&E	Plan, Specification and Estimate
RFID	Radio Frequency Identification
RHMA-G	Rubberized Hot Mix Asphalt - Gap Graded
RHMA-O	Rubberized Hot Mix Asphalt - Open Graded
RIP	Regional Improvement Program
ROW	Right-of-Way
SACSIM	Sacramento Region Activity Based Travel Simulation Model
SACOG	Sacramento Area Council of Governments
SEMP	Systems Engineering Management Plan
SHC	Streets and Highway Code

SHS	State Highway System
SOV	Single Occupant Vehicle
SR	State Route
STA	Sacramento Transportation Authority
STAA	Surface Transportation Assistance Act
STIP	State Transportation Improvement Program
T&R	Traffic and Revenue
TAP	Transit Access Pass
TAR	Transportation Analysis Report
TCA	Transportation Corridor Agencies
TCEP	Trade Corridor Enhancement Program
TMC	Traffic Management Center
TMS	Traffic Monitoring System
TOD	Time of Day
TSI	Toll System Integrator
U.S.C.	United States Codes
UC	University of California
VES	Violation Enforcement Systems
VLAN	Virtual Local Access Network
VRF	Virtual Routing and Forwarding
VHD	Vehicle Hours Delayed
VHT	Vehicle Hours Traveled
VMT	Vehicle Miles Traveled
VPH	Vehicles per Hour
VTMS	Variable Toll Message Sign
WB	Westbound
YoloTD	Yolo Transportation District

1 EXECUTIVE SUMMARY

Yolo 80 Managed Lanes Project (the "Project") in Yolo County, California is a jointly sponsored project by Yolo Transportation District (YoloTD), California Department of Transportation (Caltrans) District 3 and Sacramento Area Council of Governments (SACOG). The Project was introduced to address current and future levels of travel demand and improve projected congested traffic operations on Interstate 80 (I-80) corridor. It will support reliable transport of goods and service through the region. The improvements would include the construction of a new priced-managed lane, referred to as express lanes.

The project is programmed in the State Transportation Improvement Program (STIP), Regional Surface Transportation Program, Congestion Management and Air Quality (CMAQ) Improvement Program, and Federal INFRA Grant Program). It is being proposed to be adopted by California Transportation Commission (CTC) Trade Corridor Enhancement Program (TCEP).

This report incorporates ongoing work being completed for the Project Approval and Environmental Document (PA&ED) phase of the Project. The PA&ED studies have identified design and operations alternatives and are evaluating the options relative to perceived user safety, convenience, and cost to identify a preferred alternative.

2 INTRODUCTION

2.1 Purpose and Intended Audience

The Concept of Operations (ConOps) is a living document that serves as the framework for the design, implementation, and operations of the Project. The purpose of this report is to provide additional information on facility design, operational policies, technical requirements, enforcement and incident management, institutional roles and responsibilities, and performance monitoring. Key design and operations support elements, such as ingress and egress locations, electronic toll collection implementation requirements, traffic data collection, pricing model, customer service and account management, enforcement options and supporting equipment, required system equipment, maintenance provisions and marketing concepts are all discussed in this document. The recommended design and operational features documented in this ConOps were developed through a collaborative process with key stakeholders including Federal Highway Administration (FHWA), California Highway Patrol (CHP), Sacramento Transportation Authority (STA), El Dorado County Transportation Commission (EDCTC) and Placer County Transportation Planning Agency (PCTPA).

The ConOps is one of the initial steps in the Systems Engineering Framework process established by FHWA, shown in Figure 1. This framework ensures that the Project will be built and operated consistent with the established policies and system requirements.

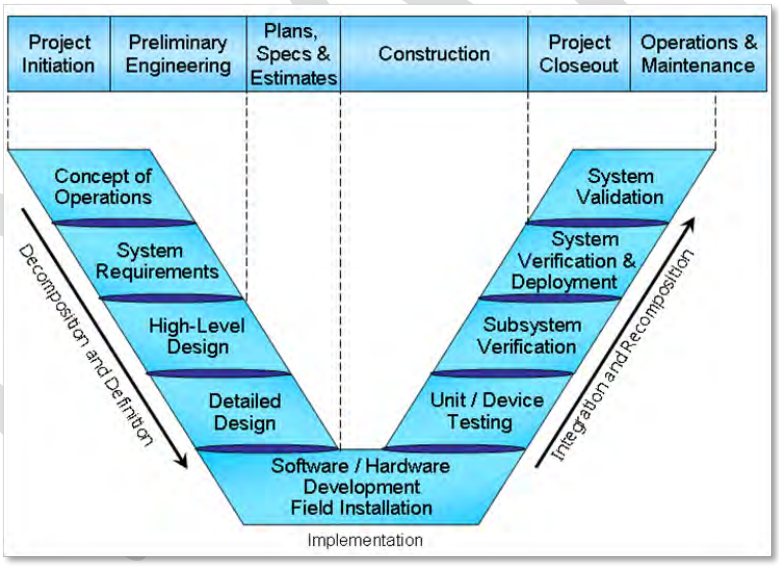

Figure 1: FHWA System Engineering Framework

2.1 Project Background

I-80 is a critical link to regional and interregional traffic as the only freeway connection between the San Francisco Bay Area and the Sacramento Metropolitan region. The route also links the Bay Area with recreational destinations in the Sierra Nevada and Northern California via US 50 to Interstate (I-5) north.

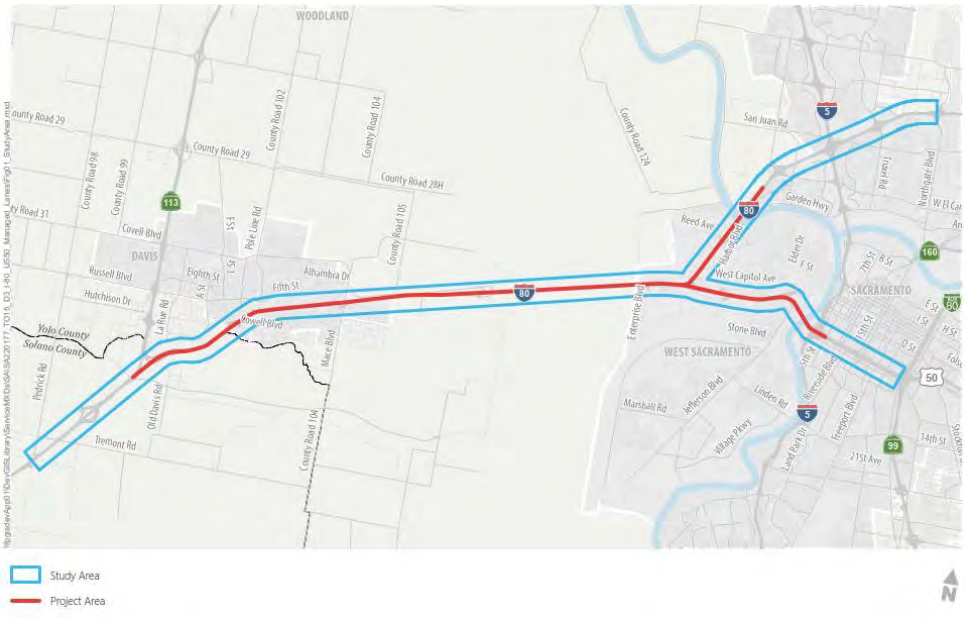

Figure 2: Yolo 80 Managed Lanes Project Area

In Solano County within the project limits, I-80 varies from three to four eastbound and westbound lanes with a standard outside shoulder, separated by a 20- to 35-foot-wide paved and/or unpaved center median with a guardrail or concrete barrier. In Yolo County within the project limits, I-80 is a six-lane freeway with three lanes in the eastbound and westbound directions. I-80 has variable 10- to 15-foot-wide outside shoulders in each direction. The corridor travels through the cities of Davis and West Sacramento. County Road (CR) 32A/Chiles Road is located north of I-80 and east of the Mace Boulevard interchange and acts as a frontage road to the Yolo Bypass where I-80 becomes a causeway.

In Sacramento County within the project limits, I-80 is a six-lane freeway with three eastbound and three westbound lanes separated by a variable 35- to 60-foot paved center median with concrete and/or guardrail center median barriers. Travel lanes are roughly 12 feet wide, and each direction of travel has variable 10- to 15-foot-wide paved outside shoulders.

Within the project limits, US 50 is a six-lane to eight-lane freeway. Auxiliary lanes exist in both directions between I-80 and Harbor Boulevard, Jefferson Boulevard and I-5, I-5 and 15th Street/16th Street, and 15th Street/16th Street and SR 51/SR 99.

Primary providers of bus and rail transit include Amtrak, Fairfield/Suisun Transit, Solano Express Bus, Yolobus, Unitrans, Sacramento Regional Transit, and Greyhound Bus. Bicycle (bike lane on the north side of the Causeway) and pedestrian accessibility are provided via the surrounding arterial network.

Within the Sacramento region, I-80 serves local and commute traffic, traffic to and from the Bay Area, recreational traffic to and from the Lake Tahoe Basin, and is a primary corridor for goods movement. Within the corridor, the Yolo Bypass Wildlife Area and floodplain limits east–west linkages, funneling many modes and forms of transportation into the narrow I-80 corridor between the cities of Davis and West Sacramento.

I-80 provides direct linkages between agricultural and manufacturing industries in the Central Valley, the Bay Area, and major ports (e.g., Oakland, Richmond, Stockton, West Sacramento). Freight trucks travel through and throughout the region 24 hours a day, seven days a week, transporting large quantities of goods, with demand increasing over time.

The segment of I-80 within the project limits is a primary access route to the Sacramento International Airport and other large distribution centers like Amazon, Target, Walmart, and Walgreens.

2.2 Project History

The project has obtained funding under the STIP Regional Improvement Program (RIP), CMAQ, FHWA, and other competitive funding sources. The project has obtained SACOG funding for PA&ED support costs and Federal Highway Administration (FHWA) Infrastructure for Rebuilding America (INFRA) grant funding for a portion of the project Plan, Specification and Estimate (PS&E), Right of Way and Construction phases. Other competitive funding sources, such as TCEP, are being sought to supplement the PS&E and construction phases.

2.3 Goals and Objectives

The purpose of the proposed project is to:

- Ease congestion and improve overall freight and person throughput[1].
- Improve freeway operation on the mainline, ramps, and at system interchanges.
- Support reliable transport of goods and service through the region.
- Improve modality[2] and travel time reliability.
- Provide expedited traveler information and monitoring systems.

This will be accomplished through the addition of managed lanes on I-80 and US 50 by a combination of median and shoulder reconstruction, lane conversion, and restriping.

The proposed project is needed for the following reasons:

- Recurring congestion during morning and afternoon peak periods exceeds current design capacity limiting freight and person throughput.
- Operational inefficiencies lead to the formation of bottlenecks due to short weaving and merging areas and lane drops.
- Inefficient movement of goods and services impedes regional and interstate economic sustainability.
- The corridor users rely heavily on single-occupancy vehicles with limited multimodal options such as transit, carpool, bicycle, and pedestrian facilities, resulting in unreliable travel times.
- Lack of real-time traveler information and coordinated traffic communication systems impede timely response to roadway incidents resulting in secondary collisions and increased non-recurring congestion.

[1] Throughput is the number of people moving efficiently through a region.

[2] Modality is the variety in modes of transportation. This includes access and multiple options for the movement of people and goods. Examples include access to transit, carpool, bicycle, and pedestrian facilities.

3 EXISTING CONDITIONS

3.1 Interstate 80 and US Highway 50 Corridor

I-80 is a transcontinental highway that extends from San Francisco, CA to New York, NY. In the study area, I-80 serves commuter, freight, and recreational traffic between the San Francisco Bay Area and the Sacramento metropolitan area and provides one of two all-weather connections across the Yolo Bypass. I-80 is a six-lane freeway in most of the study area with an eight-lane portion from Kidwell Road to Old Davis Road in Solano County. System interchanges exist at SR 113, US 50, and I-5. Auxiliary lanes exist in both directions between Kidwell Road and SR 113, Enterprise Boulevard/West Capitol Avenue and US 50, West El Camino Avenue and I-5, I-5 and Truxel Road, and Truxel Road and Northgate Boulevard.

US 50 is a transcontinental highway that extends from I-80 in West Sacramento to Ocean City, MD. In the study area, US 50 serves commuter, freight, and recreational traffic between Yolo and Sacramento counties. US 50 is a six-lane to eight-lane freeway in the study area. Auxiliary lanes exist in both directions between I-80 and Harbor Boulevard, Jefferson Boulevard and I-5, I-5 and 15th Street/16th Street, and 15th Street/16th Street and SR 51/SR 99. An eastbound auxiliary lane is provided from Harbor Boulevard to Jefferson Boulevard/Tower Bridge Gateway.

As documented throughout this section, the existing configuration and operation of the I-80/US 50 Project corridor results in inefficiency and recurring congestion. Several segments along the I-80 Project corridor currently operate with a Level-of-Service (LOS) of F during peak hours, which is characterized as oversaturated heavily congested conditions. The TAR (May 2023) includes more specific details.

3.1.1 Existing Bottlenecks Assessment

The bottleneck analysis is provided in the Interstate 80/US Highway 50 Managed Lanes Transportation Analysis Report (TAR, May 2023). The Highway Capacity Manual (HCM) procedure for freeway analysis was conducted for the AM (7-8 AM) and PM (4-5 PM) peak hours using the existing year (2019) traffic volumes. The observed eastbound AM peak hour bottlenecks are on I-80 at Mace Boulevard and on US 50 between I-5 and 15th Street. The observed westbound AM peak hour bottlenecks are on US 50 between SR 51 and 16th Street, on I-80 at the West Capitol Avenue westbound on-ramp, and on I-80 at the I-5 off-ramp.

The Highway Capacity Software (HCS) analysis identified the following locations with LOS F conditions under existing (2019 pre-COVID) conditions during the AM peak hour.

- I-80 eastbound from Mace Boulevard off-ramp to Mace Boulevard northbound on-ramp
- US 50 westbound from SR 99 on-ramp to 16th Street
- US 50 westbound from 15th Street to I-5
- I-80 westbound from West Capitol Avenue eastbound on-ramp to westbound on-ramp

The HCS analysis identified the following locations with LOS F conditions during the PM peak hour.

- I-80 eastbound from Mace Boulevard off to on-ramp to Mace Boulevard northbound on-ramp
- I-80 eastbound from County Road 32B off to on-ramp to County Road 32B on-ramp
- I-80 eastbound from I-5 southbound on-ramp to Truxel Road
- US 50 eastbound from Jefferson Boulevard on-ramp to South River Road on-ramp
- US 50 eastbound from 11th Street on-ramp to SR 51/SR 99
- US 50 westbound from SR 99 on-ramp to 16th Street
- US 50 westbound from 15th Street to I-5
- US 50 westbound at Jefferson Boulevard off-ramp
- US 50 westbound at West Capitol Avenue westbound on-ramp

The speed contour plots were created for the peak period using microsimulation software (VISSIM) calibrated to 2019 conditions. The model speed contour plots for the freeway segments by direction and peak period are presented in Figures Figure 3 through Figure 10. These charts show the average link speed in 15-minute intervals during the peak periods. The bottlenecks shown in the figures are described below.

Figure 3 and Figure 4 show the speed contour plots for the AM and PM peak periods for the eastbound corridor from I-80 at Pedrick Road to US 50 at SR 51/SR 99. During the AM peak period, two bottlenecks occur in the eastbound direction: one on I-80 at Mace Boulevard and the other on US 50 in downtown Sacramento. The congestion at Mace Boulevard lasts from about 7:30 to 8:00 AM and is limited to the interchange itself. The downtown bottleneck is in the weaving section between I-5 and 15th Street. Congested conditions last from about 7:30 to 9:00 AM and extend back through the Harbor Boulevard interchange.

During the PM peak period, the eastbound I-80/US 50 corridor direction has several bottlenecks. The upstream bottleneck at Mace Boulevard lasts the entire peak period and results in congested speeds that extend back to Old Davis Road. The horizontal curve and the Mace Boulevard on-ramps traffic together create the bottleneck, which has a maximum throughput of about 4,800 vph and lasts from 2:30 to 6:30 PM. Like Mace Boulevard, the secondary bottleneck at County Road 32B forms due to the on-ramp volume although a ramp meter on the on-ramp works to reduce this impact. The bottleneck is also affected by the vertical curve at the beginning of the Yolo Causeway. The maximum throughput is about 5,320 vph, and congestion lasts from about 3:30 to 6:30 PM. On US 50, the I-5 off-ramp and the weaving section between 16th Street and SR 51/SR 99 are bottlenecks. The first lasts from 3:15 to 6:00 PM, and the second from 3:00 to 7:00 PM. Both the SR 51 and SR 99 freeways also have downstream bottlenecks that can affect operations on US 50.

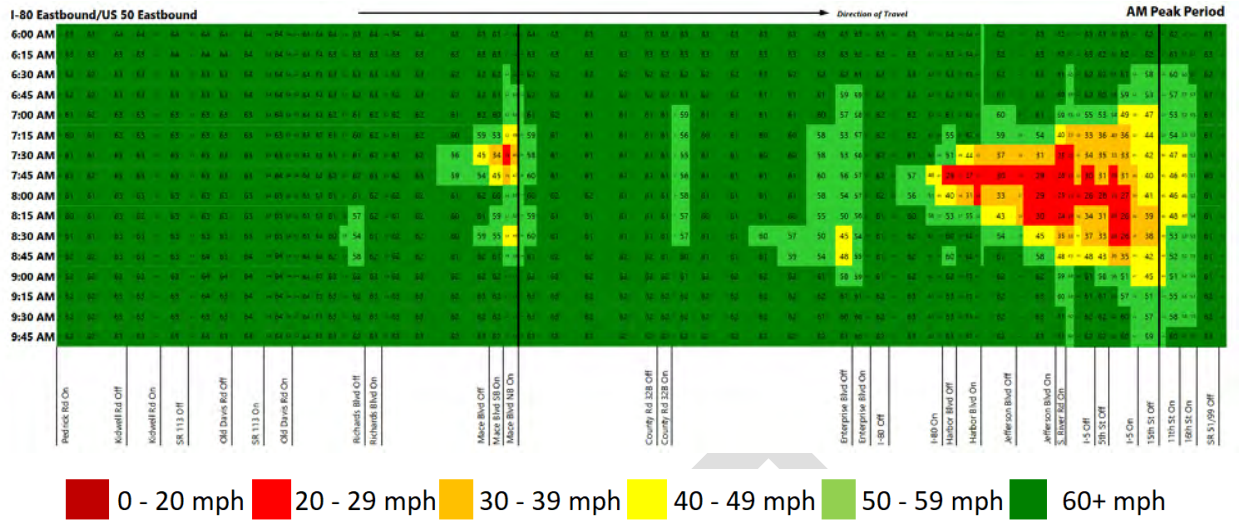

Figure 3: AM Peak Period EB Speed from I-80 at Pedrick Road to US 50 at SR 51/SR 99 – Existing Conditions

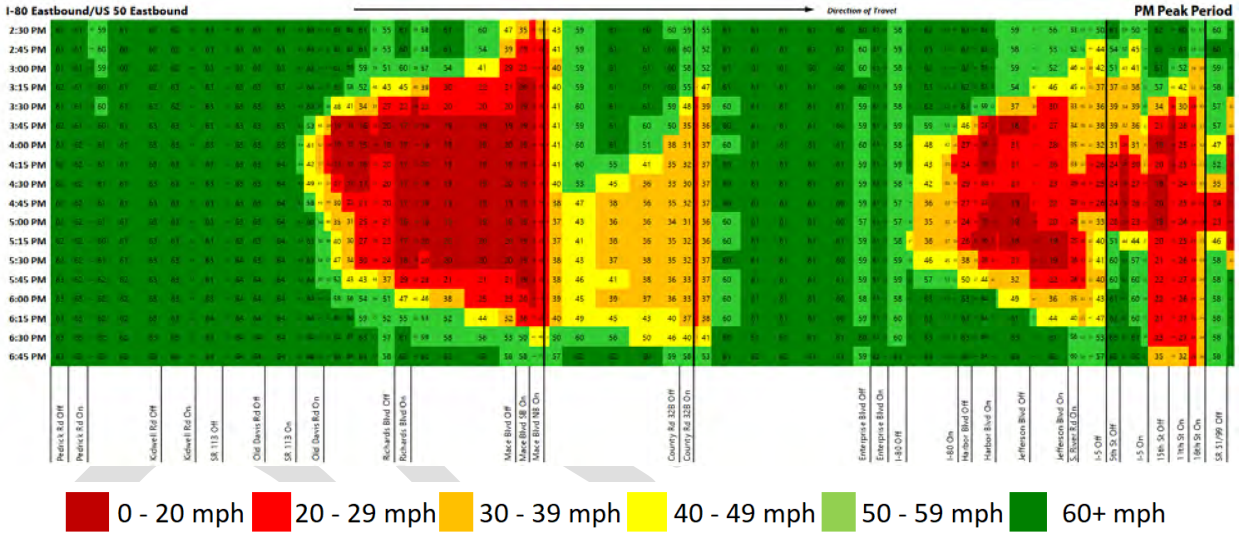

Figure 4: PM Peak Period EB Speed from I-80 at Pedrick Road to US 50 at SR 51/SR 99 – Existing Conditions

Figure 5 and Figure 6 show the speed contour plots for the AM and PM peak periods for eastbound I-80 from US 50 to Northgate Boulevard. During the AM peak period, eastbound I-80 from US 50 to Northgate Boulevard is not congested. However, two bottlenecks exist during the PM peak period. The Reed Avenue on-ramp serves as a bottleneck due to the on-ramp volume combined with the grade and reduced clear zone at the Bryte Bend Bridge. Congested conditions last from about 4:15 to 6:15 PM and extend back to US 50. Freeway capacity downstream of the Reed Avenue on-ramp is about 5,100 vph. The I-5 to Truxel Road weaving section is also a bottleneck due to the heavy I-5 on-ramp volume entering the freeway. Congestion lasts from about 3:45 to 5:45 PM. Downstream of the study area, a bottleneck exists at the Steelhead Creek Bridge just east of the Northgate Boulevard interchange that causes congestion to extend upstream of the Northgate Boulevard off-ramp.

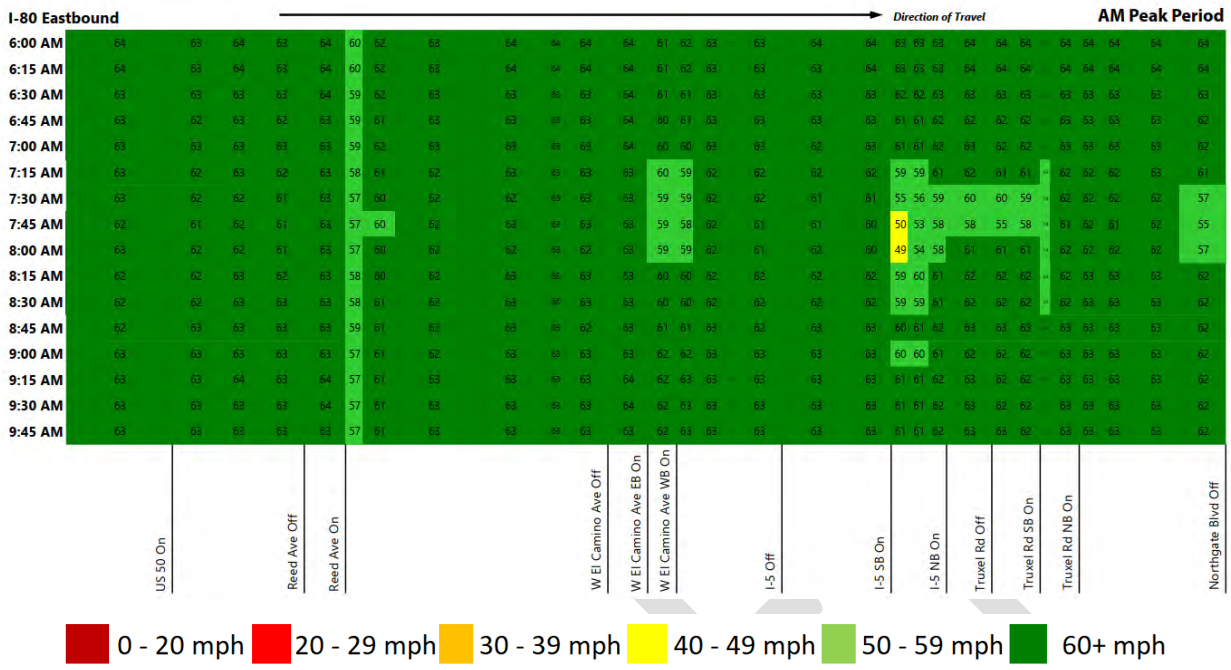

Figure 5: AM Peak Period EB from I-80 at US 50 to Northgate Blvd – Existing Conditions

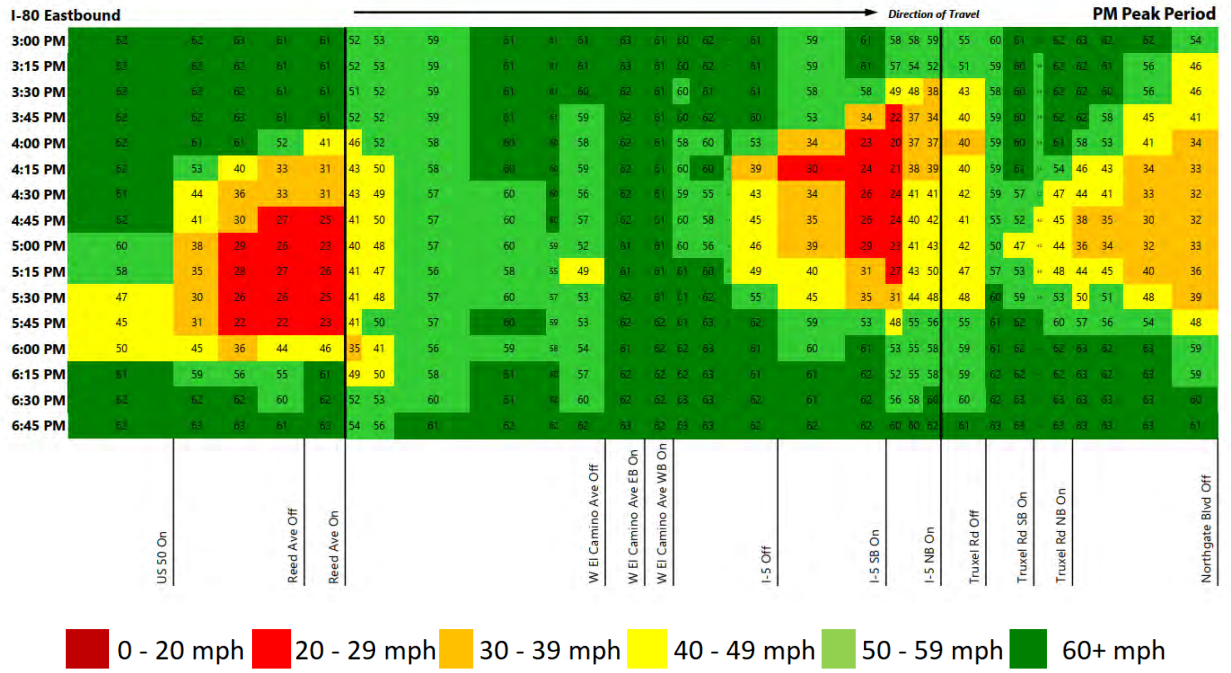

Figure 6: PM Peak Period EB from I-80 at US 50 to Northgate Blvd – Existing Conditions

Figure 7 and Figure 8 show the speed contour plots for the AM and PM peak periods for the westbound corridor from US 50 at SR 51/SR 99 to I-80 at Pedrick Road. During the AM peak period, the weaving section between the SR 51 on-ramp and the 16th Street off-ramp is a bottleneck from 7:00 to past 9:00 AM. Congestion also occurs at the downstream weaving

segment between 15th Street and I-5. At the downstream bottleneck at the Yolo Causeway, congestion begins at 6:30 AM and lasts beyond the end of the analysis period at 10:00 AM. Congestion extends from West Capitol Avenue upstream through the I-80 interchange. The maximum throughput on the Yolo Causeway is about 5,600 vph. During the PM peak period, the downtown section of US 50 has overlapping bottlenecks at SR 51 to 16th Street and the I-5 off-ramp. The downstream Jefferson Boulevard off-ramp is also a bottleneck, with a shorter duration of about an hour compared to the three hours of congestion downtown. The lane drop at Jefferson Boulevard requires the I-5 on-ramp traffic to merge over. Additionally, the off-ramp demand volume is greater than 1,500 vph, which suggests that two off-ramp lanes are needed. Like the AM peak period, the Yolo Causeway is also a bottleneck, but the congestion is less severe, only about two-and-a-half hours in duration. The bottleneck throughput is about 4,700 vph.

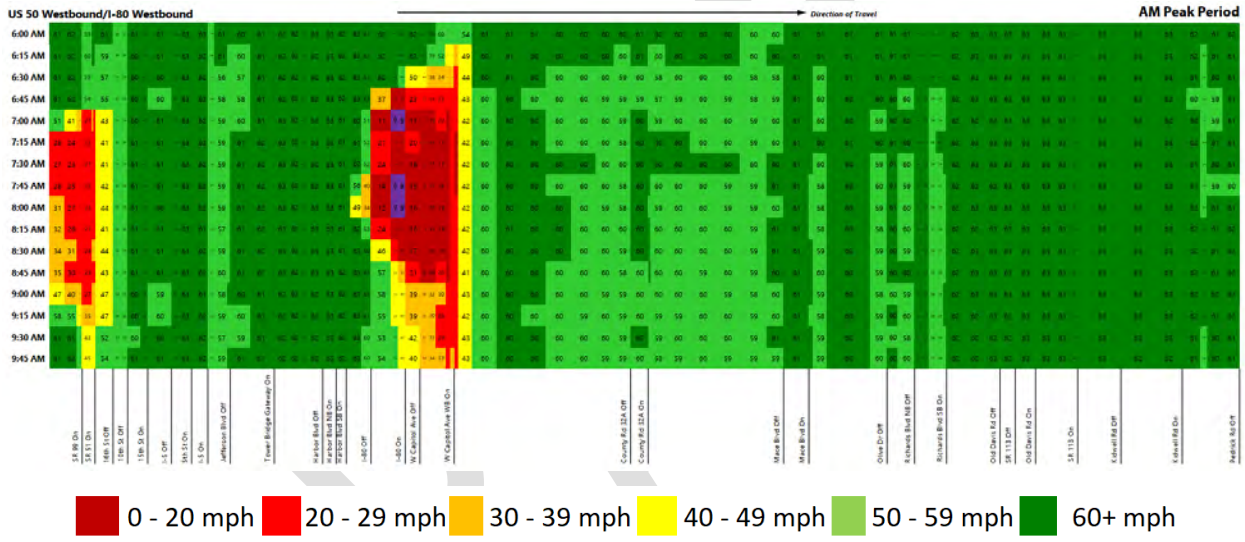

Figure 7: AM Peak Hour WB Speed from US 50 at SR 51/SR 99 to I-80 at Pedrick Rd – Existing Conditions

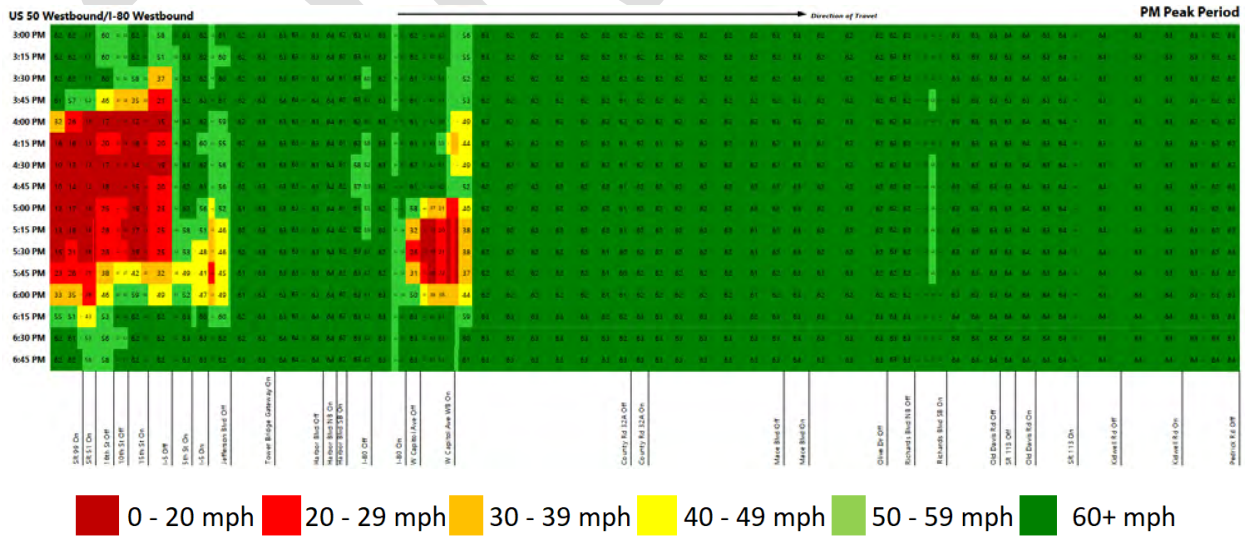

Figure 8: PM WB Speed from US 50 at SR 51/SR 99 to I-80 at Pedrick Rd – Existing Conditions

Figure 9 and Figure 10 show the speed contour plots for the AM and PM peak periods for westbound I-80 from Northgate Boulevard to US 50. During the AM peak period, a bottleneck exists on southbound I-5 that extends onto the connector ramp from westbound I-80, which then causes congested conditions on westbound I-80 for about an hour. Congestion also extends from the Yolo Causeway bottleneck onto eastbound I-80 back to Reed Avenue. During the PM peak period, this freeway section is mostly uncongested. The only slow speeds occur near US 50 when congestion from the Yolo Causeway bottleneck extends back.

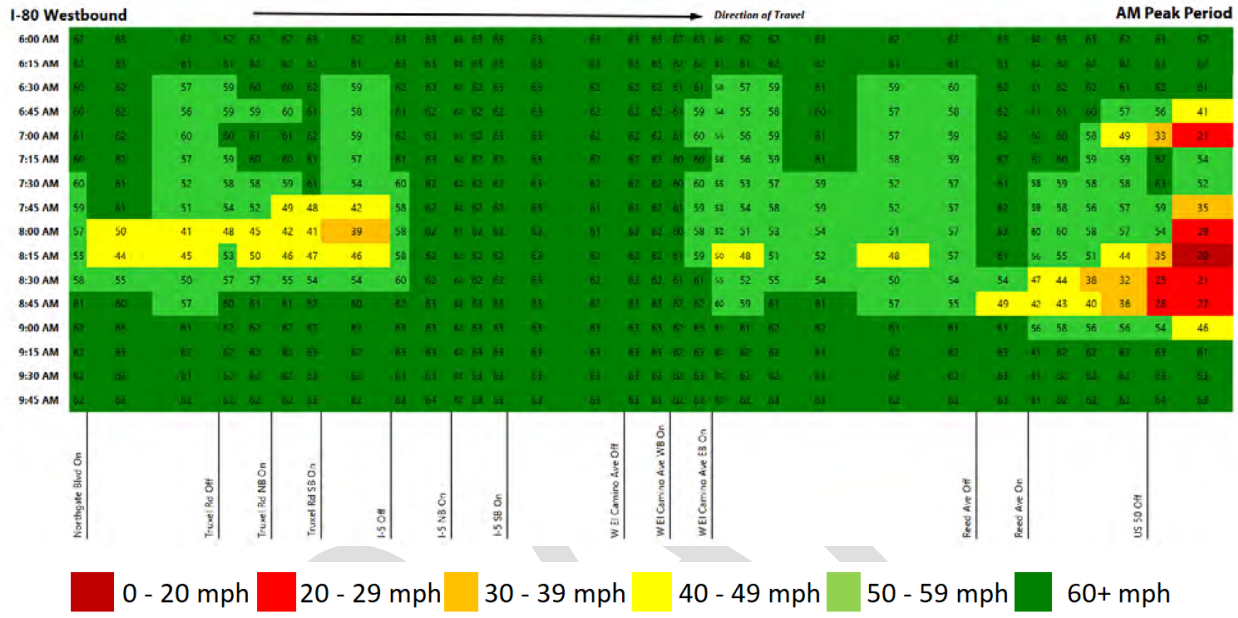

Figure 9: AM Peak Hour WB Speed from I-80 at Northgate Boulevard to US 50 – Existing Conditions

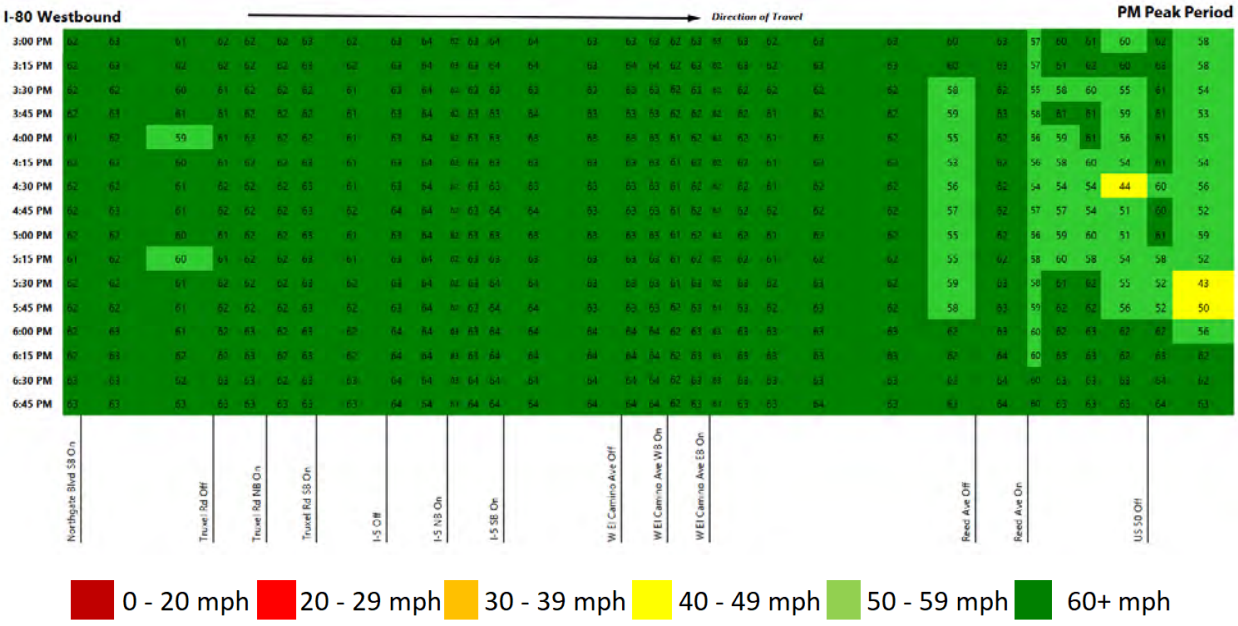

Figure 10: PM Peak Hour WB Speed from I-80 at Northgate Boulevard to US 50 – Existing Conditions

Bottlenecks are also active on weekends. On Saturdays, eastbound I-80 is congested at the Pedrick Road on-ramp with speeds below 50 mph from 1:15 to 3:45 PM. The main bottlenecks occur at Mace Boulevard and County Road 32B like on weekdays during the PM peak period. Congested speeds start at about 1:00 PM and last until 8:15 PM. On Sundays in October 2019, eastbound I-80 did not have bottlenecks. Westbound I-80 had similar congested areas on both Saturdays and Sundays. The two bottlenecks are the Yolo Causeway and the lane drop downstream of Kidwell Road. On Saturdays, the Yolo Causeway bottleneck starts before 10:00 AM and lasts until 6:00 PM. On Sundays, congestion occurs during two periods – from about 11:00 AM to 5:30 PM and from 6:00 to 7:30 PM. The duration of the Kidwell Road bottleneck is about the same for both weekend days – 12:00 to 6:00 PM.

3.2 I-80/US 50 Corridor General Purpose Lanes

Peak hour travel times (in minutes) from the operations model are reported in Table 1. The table includes the free flow travel time at the posted speed of 65 mph.

During the AM peak hour, congested conditions affect eastbound travel times the most for eastbound US 50 from I-80 to SR 51/SR 99, which has an average travel time 46 percent greater, an additional 2.3 minutes, than the uncongested travel time. For westbound travel times, I-80 from US 50 to Kidwell Road has an average travel time about 40 percent greater, an additional 4.8 minutes, than the uncongested travel time.

During the PM peak hour, average eastbound travel time is 88 percent greater than free flow for I-80 from Kidwell Road to US 50, about 10.7 additional minutes, and 142 percent greater for US 50 from I-80 to SR 51/SR 99, about 7.1 additional minutes. Westbound travel time is worst for US 50 from SR 51 to I-80 where the congested travel time is 85 percent greater than free flow, about 3.5 additional minutes.

Path	Free Flow	AM Peak Hour	PM Peak Hour
I-80 Eastbound: Kidwell Rd Off-ramp to US 50 Off-ramp	12.2	13.1	22.9
US 50 Eastbound: I-80 to SR 51/SR 99 Off-ramp	5.0	7.3	12.1
I-80 Eastbound: US 50 Off-ramp to Truxel Rd Off-ramp	5.2	5.5	7.5
US 50/I-80 Westbound: I-80 EB Off-ramp to Kidwell Rd Off-ramp	12.2	17.0	12.9
US 50 Westbound: SR 51 On-ramp to I-80 Off-ramp	4.1	4.5	7.6
I-80 Westbound: Truxel Rd SB On-ramp to US 50	5.3	5.8	5.3

Notes: Travel time is reported in minutes. Free Flow is the travel time at the posted speed of 65 mph. The peak hours are 7:00 to 8:00 AM and 4:00 to 5:00 PM.

Table 1: Travel Times - Existing Conditions

Table 2 and Table 3 show the peak hour (7:00 to 8:00 AM and 4:00 to 5:00 PM) LOS and average density at selected eastbound and westbound ramp junctions and mainline sections under existing conditions.

For the eastbound direction, AM peak hour LOS F congested conditions occur on US 50 from the I-80 on-ramp in West Sacramento to the I-5 on-ramp in Sacramento. LOS F also occurs on I-80 at Mace Boulevard, but the segments on either side of the interchange operate at LOS D or

better. During the PM peak hour, LOS F conditions exist on I-80 from Old Davis Road to County Road 32B in Davis, on US 50 from Harbor Boulevard to the I-5 off-ramp, and on US 50 from the I-5 on-ramp past the SR 51/SR 99 off-ramp. LOS F also occurs on I-80 between US 50 and Reed Avenue, at I-5, and from Truxel Road to east of Northgate Boulevard.

Freeway Segment	Facility Type	LOS/Density[1]	
		AM Peak Hour	PM Peak Hour
I-80 EB: Old Davis Rd to Richards Blvd	Basic	C / 26	**F / 66**
I-80 EB: Richards Blvd to Mace Blvd	Basic	C / 26	**F / 66**
I-80 EB: Mace Blvd SB On-ramp	Merge	**F / 49**	**F / 73**
I-80 EB: Mace Blvd to County Rd 32B	Basic	D / 28	E / 40
I-80 EB: County Rd 32B On-ramp	Merge	D / 30	**F / 52**
I-80 EB: County Rd 32B to Enterprise Blvd	Basic	D / 31	D / 29
I-80 EB: Enterprise Blvd to US 50	Weave	B / 16	B / 17
US 50 EB: I-80 to Harbor Blvd	Weave	**F / 49**	**F / 66**
US 50 EB: Harbor Blvd to Jefferson Blvd	Weave	**F / 44**	**F / 58**
US 50 EB: Jefferson Blvd On-ramp	Basic	**F / 60**	**F / 51**
US 50 EB: I-5 to 15th St	Weave	E / 38	**F / 56**
I-80 EB: US 50 to Reed Ave	Basic	C / 18	**F / 62**
I-80 EB: W El Camino Ave to I-5	Basic	B / 16	D / 28
I-80 EB: I-5 SB On-ramp	Merge	D / 32	**F / 73**
I-80 EB: I-5 to Truxel Rd	Weave	D / 31	E / 41
I-80 EB: Truxel Rd to Northgate Blvd	Basic	D / 28	**F / 57**

Notes: Bold and underline font indicate LOS F conditions. The peak hours are 7:00 to 8:00 AM and 4:00 to 5:00 PM.
1. Density is reported in vehicles per lane per mile.

Table 2: Selected Eastbound Freeway Operations

For the westbound direction, AM peak hour LOS F congested conditions occur on from the I-80/US 50 interchange through the West Capitol Avenue interchange. During the PM peak hour, LOS F conditions exist on US 50 from east of SR 51/SR 99 to the 15th Street on-ramp. The Yolo Causeway bottleneck forms after the peak hour, so LOS F conditions occur after 5:00 PM at this location.

Freeway Segment	Facility Type	LOS/Density[1]	
		AM Peak Hour	PM Peak Hour
US 50 WB: SR 51 to 16th St	Weave	E / 39	**F / 87**
US 50 WB: 15th St to I-5	Weave	B / 20	**F / 45**
US 50 WB: I-5 On-ramp	Merge	C / 24	C / 27
US 50 WB: Jefferson Blvd to Harbor Blvd	Basic	C / 20	B / 18
US 50 WB: I-80 Off-ramp	Diverge	C / 23	B / 15
I-80 WB: US 50 to W Capitol Ave	Weave	**F / 73**	B / 15
I-80 WB: W Capitol Ave WB On-ramp	Merge	**F / 51**	D / 33
I-80 WB: County Rd 32A to Mace Blvd	Basic	D / 31	C / 24
I-80 WB: Mace Blvd to Olive Dr	Basic	D / 29	C / 20
I-80 WB: Richards Blvd to Old Davis Rd	Basic	C / 21	B / 16
I-80 WB: Old Davis Rd On-ramp to SR 113 On-ramp	Basic	B / 18	B / 13
I-80 WB: Truxel Rd to I-5	Weave	D / 35	B / 20
I-80 WB: I-5 to W El Camino Ave	Weave	C / 21	B / 17
I-80 WB: W El Camino Ave to Reed Ave	Basic	E / 35	C / 25
I-80 WB: Reed Ave to US 50	Basic	C / 27	D / 28

Notes: Bold and underline font indicate LOS F conditions. The peak hours are 7:00 to 8:00 AM and 4:00 to 5:00 PM.
1. Density is reported in vehicles per lane per mile.

Table 3: Selected Westbound Freeway Operations

4 PROJECT ALTERNATIVES

The Project will consider multiple improvement alternatives for the I-80 corridor, including implementation of new high occupancy vehicle (HOV) lanes, high occupancy toll (HOT) lanes, transit only lanes, and conversion of an existing general purpose lane to an HOV lane.

"No-Build" Alternative 1 would maintain existing conditions and no work would be conducted to relieve current traffic congestion to improve traffic flow. Build Alternatives 2a, 3a, 4a, 5a, and 6a propose the same geometric footprint, but would incorporate different managed lane types. Build Alternatives 2b, 3b, 4b, 5b, and 6b propose the same geometric footprint and managed lane types as Build Alternatives 2a, 3a, 4a, 5a, and 6a, but include an I-80 managed lane direct connector (to provide a direct connection of the managed lane by flying over US-50 at the I-80/US-50 Interchange). Build Alternatives 7a and 7b would not construct new lanes but would repurpose the existing number 1 lane instead; however, Build Alternative 7b would include the I-80 managed lane direct connector. Note that for priced managed lane alternatives, all transit vehicles will be toll-exempt.

Section 7 provides detailed comparisons among the alternatives regarding the traffic performance forecasts, and mostly focuses on Alternative 1 and 2a through 7a.

- **No-Build Alternative 1:** Maintain existing conditions.
- **Build Alternative 2a:** Add a high-occupancy vehicle lane in each direction for use by vehicles with two or more occupants (HOV 2+).
- **Build Alternative 2b:** Add a high-occupancy vehicle lane in each direction for use by vehicles with two or more occupants (HOV 2+) and build an I-80 managed lane direct connector.
- **Build Alternative 3a**: Add a high-occupancy toll lane in each direction for free use by vehicles with two or more occupants (HOT 2+). Single-occupied vehicles would pay a fee for lane usage.
- **Build Alternative 3b**: Add a high-occupancy toll lane in each direction for free use by vehicles with two or more occupants (HOT 2+) and build an I-80 managed lane direct connector. Single-occupied vehicles would pay a fee for lane usage.
- **Build Alternative 4a:** Add a high-occupancy toll lane in each direction for free use by vehicles with three or more occupants (HOT 3+). Vehicles with less than three riders would pay a fee for lane usage.
- **Build Alternative 4b:** Add a high-occupancy toll lane in each direction for free use by vehicles with three or more riders (HOT 3+) and build an I-80 managed lane direct connector. Vehicles with less than three occupants would pay a fee for lane usage.
- **Build Alternative 5a:** Add an express lane in each direction (i.e., everyone would pay a fee to use the lane, regardless of the number of riders).
- **Build Alternative 5b:** Add an express lane in each direction (i.e., everyone would pay a fee to use the lane, regardless of number of occupants) and build an I-80 managed lane direct connector.

- **Build Alternative 6a:** Add a transit-only lane in each direction.
- **Build Alternative 6b:** Add a transit-only lane in each direction and build an I-80 managed lane direct connector.
- **Build Alternative 7a:** Repurpose the current number one general-purpose lane for use by vehicles with two or more riders (HOV 2+); no new lanes would be constructed.
- **Build Alternative 7b:** Repurpose the current number one general-purpose lane for use by vehicles with two or more riders (HOV 2+); no new lanes would be constructed. Build an I-80 managed lane direct connector.

It should be noted that since an alternative has not yet been selected, we use results from analysis of Alternative 4a which provides significant operational benefits. Alternative 4b would provide more mobility benefits.

Note that since an alternative has not yet been selected, we use results from analysis of Alternative 4A which provides significant operational benefits. Alternative 4B would provide more mobility benefits, particularly in the westbound AM Peak period.

The Alternatives naming convention defined above from the Draft Project Report (in November 2023) is slightly different to the Transportation Analysis Report (May 2023). **Error! Reference source not found.** provides the connection between the Alternatives from DPR and TAR. The TAR alternatives are discussed in the TRAFFIC PERFORMANCE FORECASTS section.

5 FACILITY DESIGN

This section provides an overview of the proposed Yolo 80 Managed Lane facility design assumptions and highlights geometric and signing standards that will be applied to the Project design for each build alternatives. The design concept discussed in this section is based on the preliminary engineering performed for the project as part of the PA&ED phase and confirmed through stakeholder reviews as part of the ConOps process. Further changes and refinements are anticipated to be made later in project development during the final design phase. The concepts provided in this chapter do not represent final design decisions. Instead, they are intended to guide final design decisions to promote clarity and consistency for users and stakeholders.

The facility design section focuses on the tolled managed lane alternatives, which will be implemented in multiple phases, culminating in the construction of the Yolo 80 Managed Lanes direct connector. This section's purpose is to delineate the Project facility design for its initial phase of construction, which includes reduced project limits and excludes the construction of a direct connector. As the design plans for future phases of the Project become more finalized, this document will be updated to reflect proposed final facility design features. See Table 4 below for project limits of initial design as compared to final design.

Table 4: Initial vs Final Design Project Limits

Phase	Project Limits	Centerline miles	Lane Miles
Initial Design	Sol-80 PM 42.7 – 44.7 Yol-80 PM 0.0 - 9.5 Yol-50 PM 0.0 – 0.17	8.5 miles	17 miles
Final Design	Sol-80 PM 40.7 – 44.7 Yol-80 PM 0.0 – 11.72 Sac-80 PM 0.0 – 1.36 Yol-50 PM 0.0 – 3.12 Sac-50 PM 0.0 – 0.617	17 miles	34 miles

Note: Project scope in Solano County is limited to advanced warning signs for managed lane.

5.1 The Causeway

The Yolo Causeway is a 3.2-mile elevated structure that currently consists of 3 lanes in each direction. The Project proposes to restripe the existing roadway footprint to maintain three general purpose lanes and add one managed lane in each direction on the Causeway. Since the Project does not propose widening of the Yolo Causeway structure, this limits the ability to

introduce separation treatments, access configuration options, and toll system equipment. Implementing toll points on the causeway would introduce structural, environmental, and safety challenges and may not be feasible.

Figure 11 shows existing and proposed typical cross section of the I-80 Yolo Causeway. With the addition of a new managed lane in each direction on the Yolo Causeway, the existing general purpose lanes will likely be reduced to a non-standard width of 11 feet and the inside shoulder will be reduced from 10 feet to the minimum two foot width at some locations, however the outside shoulder will have a standard ten foot width.

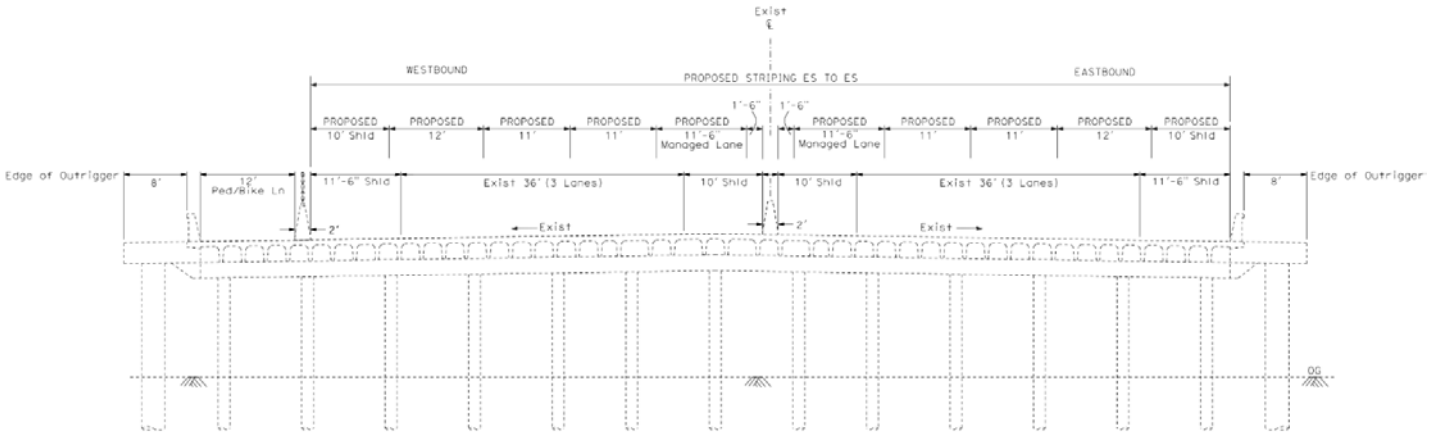

Figure 11: Cross Section of Yolo Causeway

Separation treatment on the Causeway was a particular focus of attention for the Project design team. Restricted access on the causeway is preferred, as it would discourage drivers from entering the managed lanes in a corridor segment without toll equipment. However, even with a reduction in lane width to non-standard 11 feet, the only lane separation treatment that the Causeway can accommodate is a single 8-inch white stripe for separation between managed lane and general purpose lanes. The causeway will have a continuous access designated by a broken 8 inch white line with retroreflective markers, as shown in Figure 12 – Detail 42 from CA MUTCD.

5.2 Access Configuration

There are two types of access treatments for managed lanes:

1. **Continuous access design** – Access to/from the express lane is not restricted to designated locations. Instead, vehicles can enter and exit the express lane at any point. A broken single 8-inch white lane line separating the express lane from the general purpose lanes will designate unrestricted access. Continuous access design is assumed in the TAR (May 2023) throughout the project limits.

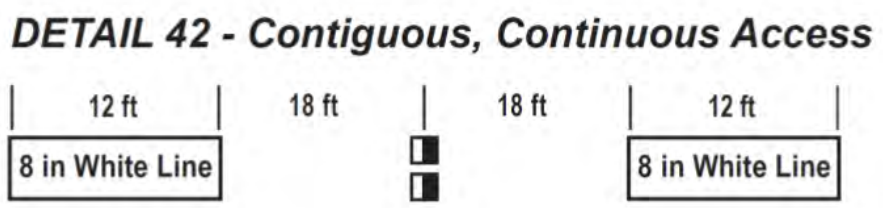

Figure 12: CA MUTCD 3A-113(CA) Detail 42 – Continuous Access

Figure 13: Detail 42 Example – I-880 Express Lanes

2. **Limited access design** – Access to/from the express lane is provided at designated locations, typically through at-grade access openings that can serve ingress, egress, or combined ingress and egress. Physical barriers or striping separates the express lane from the adjacent general purpose lanes between access locations. Typical striping for areas of restricted access is shown in Detail 44 and Detail 45 of the CA MUTCD – 8 inch solid white lines with retroreflective markers, as seen in Figure 14 and Figure 16 below.

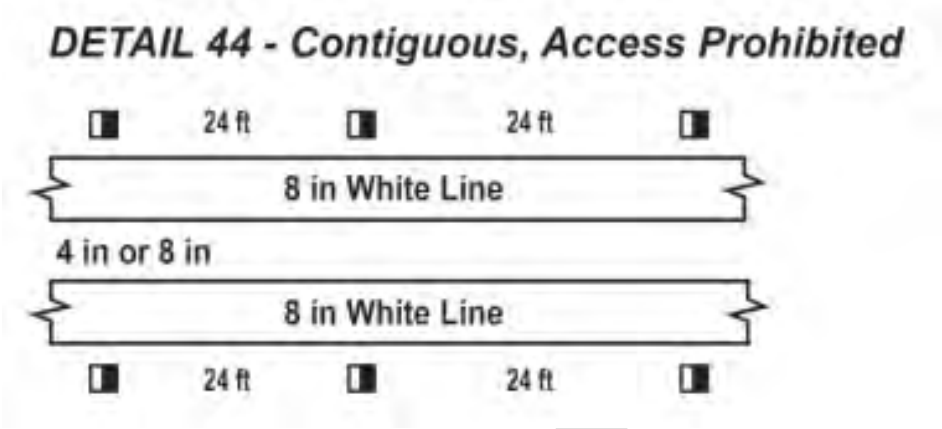

Figure 14: CA MUTCD 3A-113(CA) Detail 44 – Prohibited Access

Figure 15: Detail 44 Example - I-580 Express Lanes

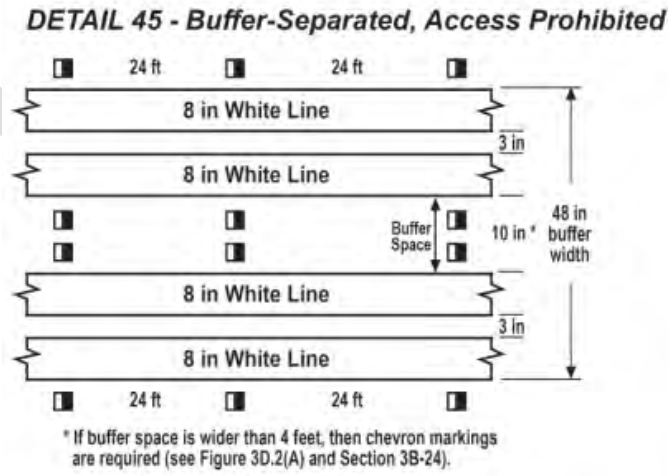

Figure 16: CA MUTCD 3A-113(CA) Detail 45 – Buffer Separated

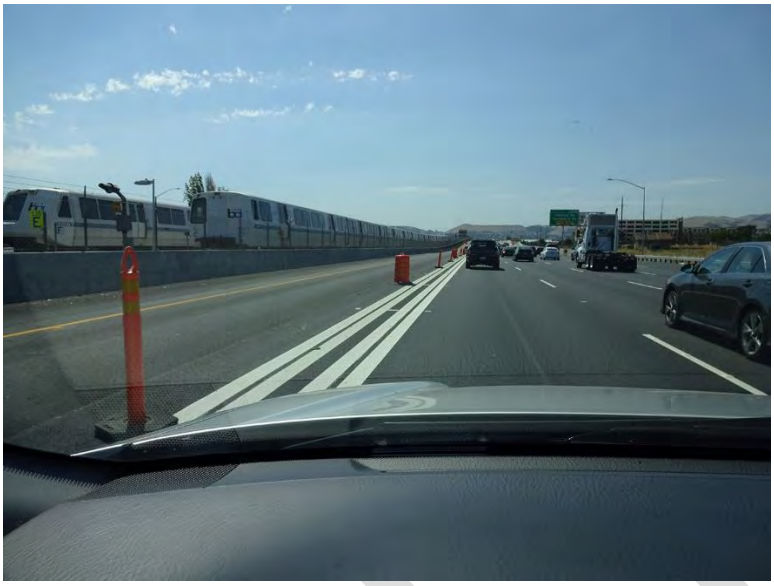

Figure 17: Detail 45 Example - I-580 Express Lanes

The Project team has identified that restricting access on the I-80 corridor will not result in operational benefits, and instead may worsen conditions due to reduced lane width. Implementing larger stretches of open access will limit the need to reduce lane widths and shoulder space. Thus, the access configuration of the Yolo Managed Lanes will be continuous access solution.

Continuous access solution provides the flexibility to implement access restrictions for future phases or areas that can be improved with buffer separation. Adding areas of access restriction to a continuous access facility is largely driven by traffic modeling and analysis to determine areas where access restrictions make sense and areas where unrestricted access is appropriate. Access restrictions are typically introduced around areas where there are recurring bottlenecks and heavy weaving. Sometimes access restrictions are implemented in the vicinity of major interchanges where there is heavy demand to enter or exit the freeway. This is done in a way that forces vehicles to exit the managed lane well in advance of a major interchange so weaving movements are spread out over a longer distance.

An example of a hybrid access facility is the I-880 Express Lanes in the Bay Area, which is a corridor that was converted from a continuous access HOV lane. For this corridor, traffic modeling showed that certain segments would perform better if access restrictions were introduced to prevent weaving into and out of the lane. Many of these restricted segments coincide with locations that experience recurring congestion and bottlenecks. Analysis also informed the design of the ingress and egress locations, resulting in some locations with a weave zone and others with a dedicated weave lane. The placement of access restrictions must consider an 800’ per lane weaving distance required to reach the express lane from a freeway on-ramp and to reach an off-ramp from the express lane. Transit lines, park and ride lots, and major destinations should also be considered when placing access restrictions.

5.2.1 Start of Managed Lanes

The addition of an express lane will serve as an ingress point at the beginning of the managed lanes. The start of the express lanes in the eastbound direction will be just west of Richards Boulevard on I-80 (PM YOL 0.10). In the east end of the Project, the start of the managed lanes will be located on US-50 upstream to the I-80/US-50 interchange (PM YOL 0.17). Since access will be unrestricted, people traveling from I-80 and US-50 will both be able to enter the express lanes at the start.

In the ultimate phase of the Project, the start of the eastbound I-80 managed lane will still begin just west of Richards Boulevard, the start of the westbound I-80 managed lane will begin just west of W El Camino Avenue and will require a transition zone to connect to the existing HOV2+ lane. On westbound US 50, the start of the managed lane will begin at the I-5 Interchange and there will also need to be a transition zone here to connect to the under construction HOV2+ lane.

5.2.2 End of Managed Lanes

At the eastbound direction, the managed lane will terminate by transitioning into an existing general purpose lane. The eastbound termini will be just east of the I-80/US-50 split on US-50 (PM YOL 0.12). The westbound termini will be a lane drop, providing enough taper length to merge into the general purpose lanes. The westbound termini will be located west of the Mace Boulevard off-ramp on I-80 (PM YOL 2.98).

In the ultimate build of the Project, in the eastbound I-80 direction, the lane will terminate just west of W El Camino Avenue and will feed into the existing HOV2+ lane; this will require a transition zone to allow vehicles to merge in and without to avoid violating occupancy requirements. In the eastbound US 50 direction, the lane will terminate at the I-5 interchange and will feed into the existing HOV2+ lane; this will also require a transition zone. In the westbound I-80 direction, the lane will end just west of Richards Boulevard; this will be completed by terminating the restriction and feeding into an existing general purpose lane.

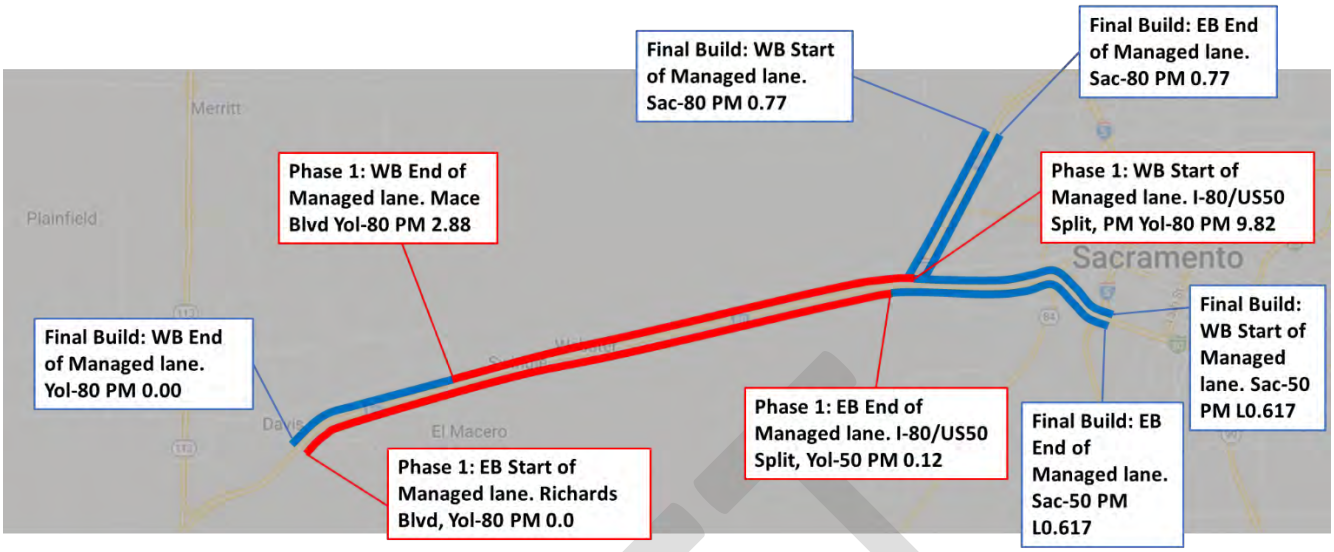

Figure 18: Start and End of Managed Lanes

5.2.3 Transit Access

Since the Project will be continuous access, existing and future transit routes will not be impacted and does not limit the option to enter or exit the express lanes.

5.3 Price Locking

Price locking ensures that toll-paying customers will be charged the rate displayed on the toll rate sign prior to entry into the Express Lane and is not subject to any price changes that may occur while traveling in the zone. Toll rate signs display up to two destinations, meaning customers are price locked in both destinations. The top destination will be end of the most immediate zone and the bottom destination will be the facility termini.

For example, customers who enter at the facility at Richards Boulevard going eastbound will be price locked for Mace Boulevard, E. Chiles Road, and US-50. This ensures that regardless of price changes during their trip, they will be charged the price they saw on the pricing sign before entering the toll lane.

5.4 Toll Zones

Yolo 80 Managed Lanes toll zones will be defined as the segments between major destinations or movements, such as off ramps. The proposed configuration for the first phase of the project includes three zones in the eastbound direction, and two zones in the westbound direction, as shown in Table 5 below. A single toll applied over the entire corridor will not be able to manage demand efficiently since traffic conditions will inevitably vary along the Express Lane corridor. The concept of zone pricing allows the toll system to respond to bottlenecks by increasing the toll rate in the zone while avoiding unnecessary price increases for other zones with available capacity.

Zone	Beginning	End	Length (mi)	Number of Toll Points
EB 1	Richards Blvd	Mace Blvd	2.2	2
EB 2	Mace Blvd	E. Chiles Rd	3.0	2
EB 3	E. Chiles Rd	US-50/I-80 Split	4.3	3
WB 1	US-50/I-80 Merge	E. Chiles Rd	4.0	3
WB 2	E. Chiles Rd	Mace Blvd	2.9	3

Table 5: Phase 1 Toll Zones

Figure 19 below shows the proposed toll zone map for phase 1 of the Project. The figure identifies the locations of the pricing signs associated with each zone and major destinations. The pricing signs in the first phase of the Project will include overlays for future destinations that will be included in the final phase. As funds become available to construct the entirety of the project limits, additional zones will be created and the zone map will be updated. Depending on the alternative, the expanded limits, and the direct connector will include tolling equipment and be treated as a new zone that can be priced separately to increase the ability to manage traffic demands.

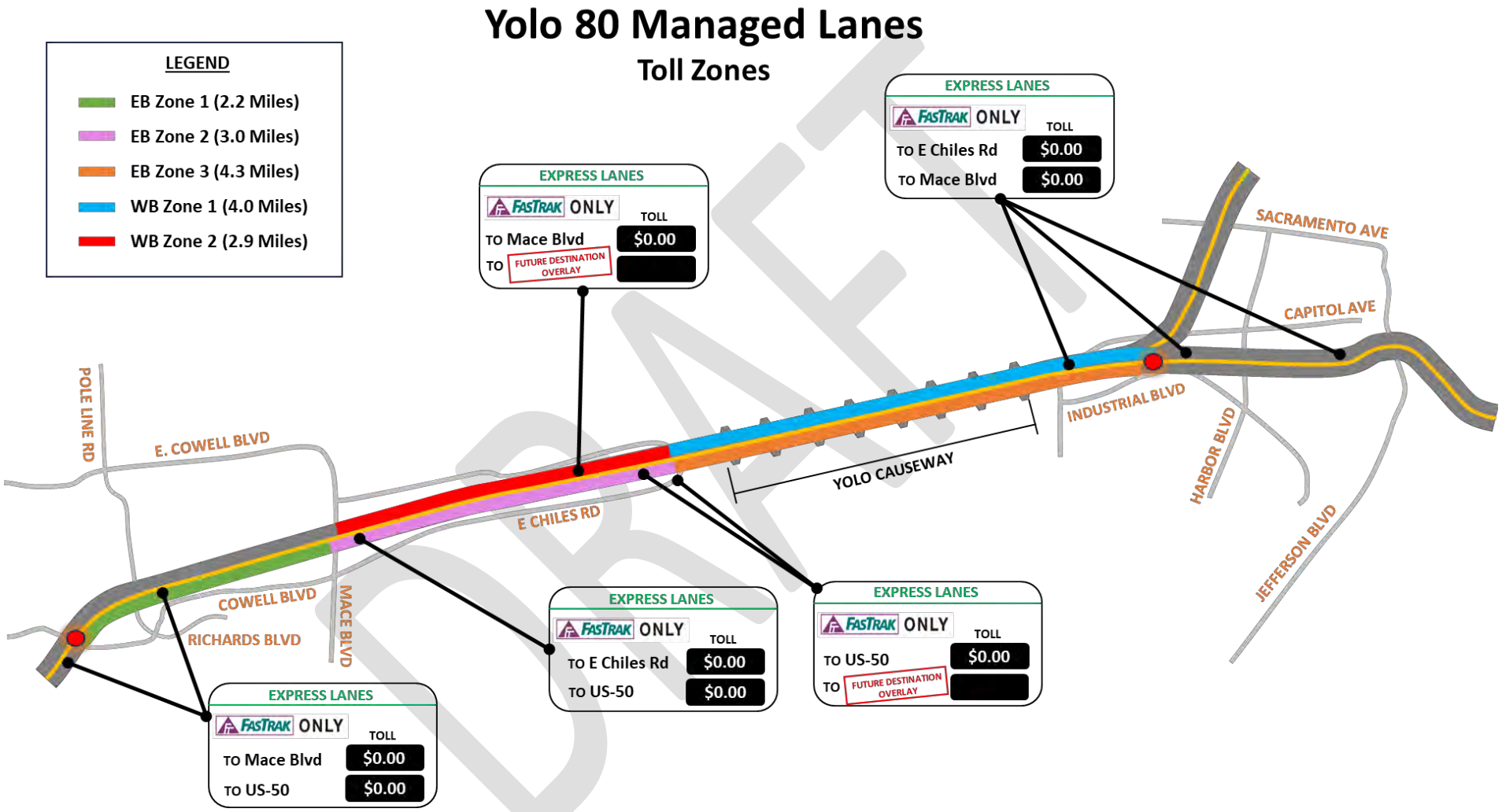

Figure 19: Phase 1 Toll Zone Map

5.5 Lane Separation

Different types of separations can have different impacts on operations and constructability, as well as maintenance, enforcement, and incident management. These factors, and the local context of the I-80 Project corridor, will ultimately determine which separation treatment is most appropriate. However, the project team has considered the pros and cons of each method of separation treatment to understand the impacts of potential design tradeoffs.

Although the Project team has identified that the facility will operate best with unrestricted, continuous access there may be locations where lane separation is introduced to improve traffic operations. In such cases, the following options are summarized below:

- **Painted Line or Buffer:** Multiple managed lane corridors, including the Metro I-10 and I-110 Express Lanes in Los Angeles use a painted buffer separation indicated by solid double white lines at a 2, 4 or 8 ft spacing. This option is the least expensive in terms of capital and maintenance costs and provides the greatest flexibility for operations and access to emergency vehicles. However, this option also has the lowest traffic reliability and performance due to friction with adjacent lanes, and potential turbulence from vehicles illegally crossing the painted lines. Enforcement resources are necessary to minimize buffer crossing violations.

Figure 20: Example - Facility with Painted Buffer

- **Channelizer or Delineator**: Express Lane facilities such as the SR-91 Express Lanes, I-95 in Miami, and I-10 in Houston employ traffic channelizers or delineators as a separation method, see Figure 21**Error! Reference source not found.**. Channelizers are placed at frequent intervals within a painted buffer area to create a perceived physical barrier to

prevent drivers from exiting or entering the Express Lanes at undesignated areas. This configuration reduces the risk of buffer crossings and associated revenue leakage, while also allowing emergency vehicle access. However, this option also has the highest ongoing maintenance cost. On the SR-91 facility, buffer crossings and vehicle strikes require 30 to 50 percent of channelizers to be replaced annually.

Figure 21: Example - Facility with Channelizers

- **Concrete Barrier or Grade Separated:** It should be noted that some managed lane projects use concrete barriers or grade separations to designate Express Lanes from general purpose lanes. This option is usually deployed only on reversible or contra-flow facilities. The I-25 Express Lanes in Denver are an example of this strategy. Operationally, this option allows for the highest speed differential from general purpose lanes, prevents buffer crossings and revenue leakage, and has relatively low maintenance costs. However, this option is also the most expensive due to capital and right-of-way costs. This option can also complicate incident management and allows little flexibility for future operational changes. See Figure 22 for an example of a barrier separated facility.

Figure 22: Example - Facility with Concrete Barrier

5.6 Signage

Overhead and median mounted signs are used to display guidance and regulatory information to drivers about the use of managed lanes. Signs are used to designate access locations, display eligibility requirements and hours of operation, and for express lanes, to display toll rates and toll tag account requirements. The 2014 edition of the California Manual on Uniform Traffic Control Devices (2014 CA MUTCD, Revision 7) provides specifications and guidance for the design and placement of managed lanes signs.

5.6.1 Start of Lane Signage

The CA MUTCD Express Lane requirements include the placement of prescriptive signing at the beginning and end of an Express Lane facility, as well as intermediate access locations. As drivers approach the Express Lanes, they will see a sequence of advanced overhead signs which include Changeable Message Signs (CMS), Pricing Signs, and Preferential Lane Entrance signs (CA MUTCD E8-2 and E8-3), beginning two miles before the entrance. The sequence of advanced signage will align with Figure 2G-21 from CA MUTCD, which designates example signing for the entrance to a priced managed lane. Examples of this signage are shown in Figure 23.

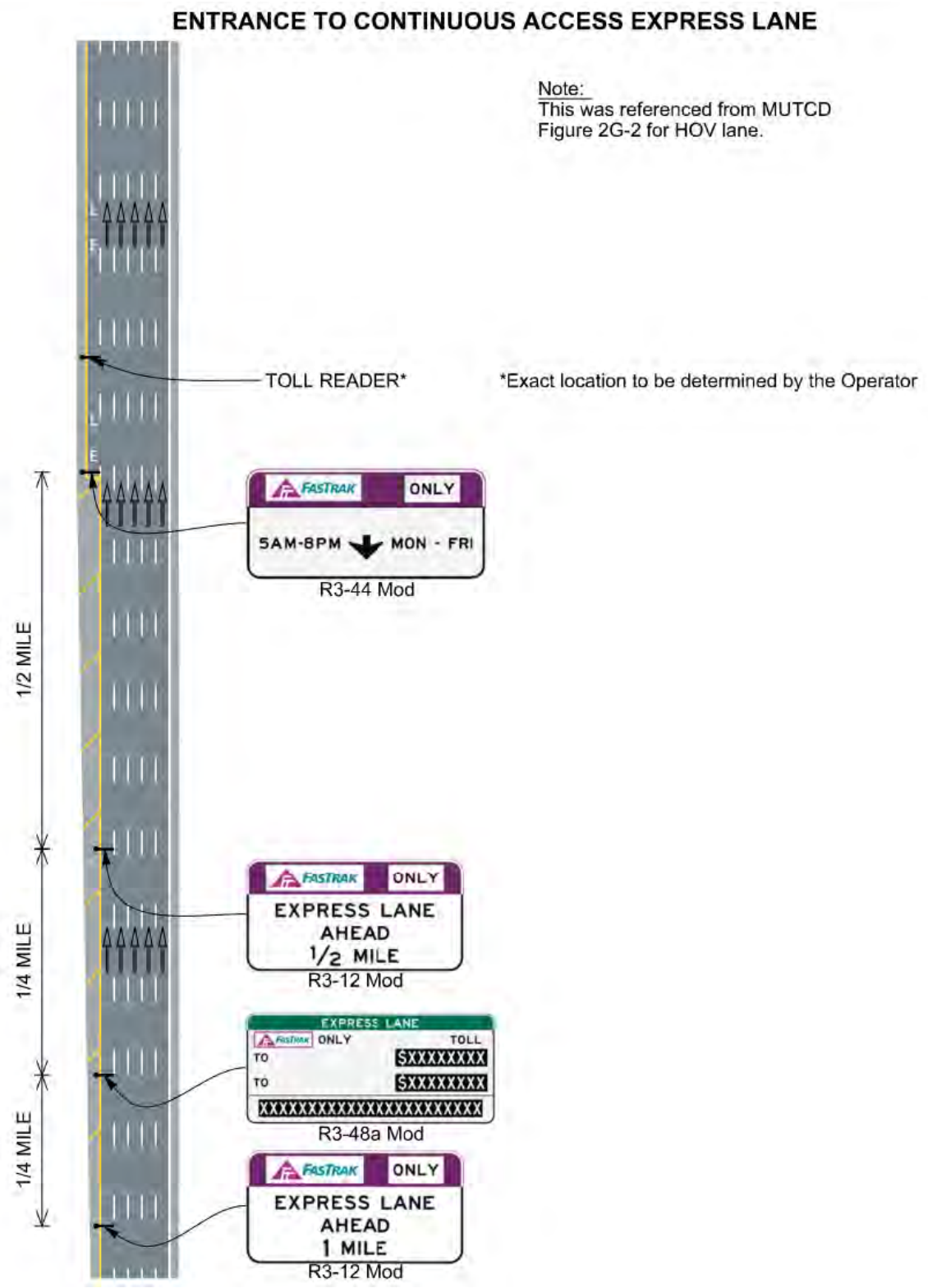

Figure 23: Example Start of Express Lane Signage

MUTCD provides recommended spacing between overhead signs upstream of the Express Lanes entrance. Signs will be placed in accordance with the recommended spacing with few exceptions:

- Placing sign panels on existing sign structure at nearby stationing, if possible
- Avoiding the placement of signs on overpasses or the causeway structure
- Ensuring proposed signs are spaced 800 feet from existing signs
- Placing signs upstream of bridges to avoid sight obstruction

5.6.2 Intermediate Signage

Along segments where there are few or no access restrictions, overhead and median mounted regulatory signs will be located at regular intervals to clearly designate the express lane and display the HOV eligibility requirement, hours of operation and the FasTrak® account requirement for all vehicles in the lane. These signs may need to allow for easy modifications if the HOV eligibility requirement or the hours of operation change in the future.

Occupancy requirement to receive toll discount will be displayed on median mounted signs with FasTrak branding, see Figure 24 below.

Figure 24: Example FasTrak Occupancy Requirement Sign

5.6.3 Pricing Signage

As required by CA MUTCD, pricing signs will be placed before each point of entry to the Express Lanes to inform drivers of the toll before they make their decision to either enter the Express Lanes or remain in GP lanes.

Overhead pricing signs are installed to display the toll rates to travel to downstream destinations. These signs are installed in advance of access points for limited access facilities, or

at regular intervals throughout the corridor for continuous access facilities. The CA MUTCD includes guidance for the types and number of destinations to be displayed on pricing signs. Current guidance suggests no more than two destinations be displayed, including the price to the end of the facility and an intermediate major destination. Exceptions have been made to allow more than two destinations, but it is preferable to keep the amount of information on Express Lane signs to a minimum to avoid driver confusion.

The pricing signs on the Yolo 80 Managed Lanes will consist of static panels with changeable message inserts for pricing. Example shown in Figure 25 below.

Figure 25: Example Pricing Sign - I-880 Express Lanes

5.6.4 End of Lane

A sequence of overhead signs beginning one-half mile upstream of the terminus of an express lane will be used in accordance with the CA MUTCD to indicate that the express lane is ending.

Figure 26 for example of advanced warning signs that will be installed.

Figure 26: Termini Signage

5.7 Roadway Improvements

The proposed addition of the Project will improve the pavement condition, support various mode options, increase the corridor reliability, and reduce travel times through the corridor. The Project Development Team recommends milling and crack sealing of the existing mainline pavement, and for specified ramp locations, all cracks sealed, and potholes repaired, and then a rubberized hot mix asphalt-open graded (RHMA-O) and rubberized hot mix asphalt-gap graded (RHMA-G) overlay on the existing travel lanes on Yolo 80 post mile (PM) 0.0/4.1.

Existing storm drain culverts needing repair will be slip-lined or replaced. The proposed inside widening and minor outside widening will require the existing storm drain facilities to be upgraded and supplemented.

Each of the Build alternatives includes the following corridor improvements:

- Placement of ramp meters and other ITS elements, such as changeable message signs (CMS) and closed-circuit television (CCTV)
- Structural modifications
- Bicycle/Pedestrian facility rehabilitation and extension
- New Mobility Hub on east side of Enterprise Blvd
- Roadside and overhead sign replacement

- Lighting upgrades
- Safety device improvements
- Striping and pavement marker replacement

6 TRANSIT CONSIDERATIONS

Managed lane design must also take into consideration the needs of existing and future transit service providers, as well as carpools and vanpools. If access restrictions are to be introduced, the ability of transit buses, carpools and vanpools to use the lanes should not be impeded. For freeway ramps utilized by buses, the distance between the ramp and the start or end of a managed lane access restriction should ideally accommodate the extra distance required by buses to merge across multiple lanes of traffic. Locations where there are high volumes of transit and carpool vehicle volumes accessing a managed lane, such as Mace Boulevard, may warrant consideration of direct access ramps that provide access between the managed lane and a local street.

6.1 Existing Park and Ride Lots

There are currently three Park and Ride (P&R) lots along the I-80 Project. At the east end, there are two Caltrans owned parking lots (170 spaces) on Enterprise Boulevard just off the I-80 exit, just east of the causeway. These P&R facilities are located near the bus stop that services bus line 42A and 42B. On the west end of the facility there is the Mace P&R lot (145 spaces), which is located near bus lines 42A, 42B and 43. See Figure 28 for map of these existing P&R facilities within project scope.

6.2 Existing Transit Routes

I-80 is the main connection between the City of Davis and the City of Sacramento and serves the following Yolobus lines (Figure 21):

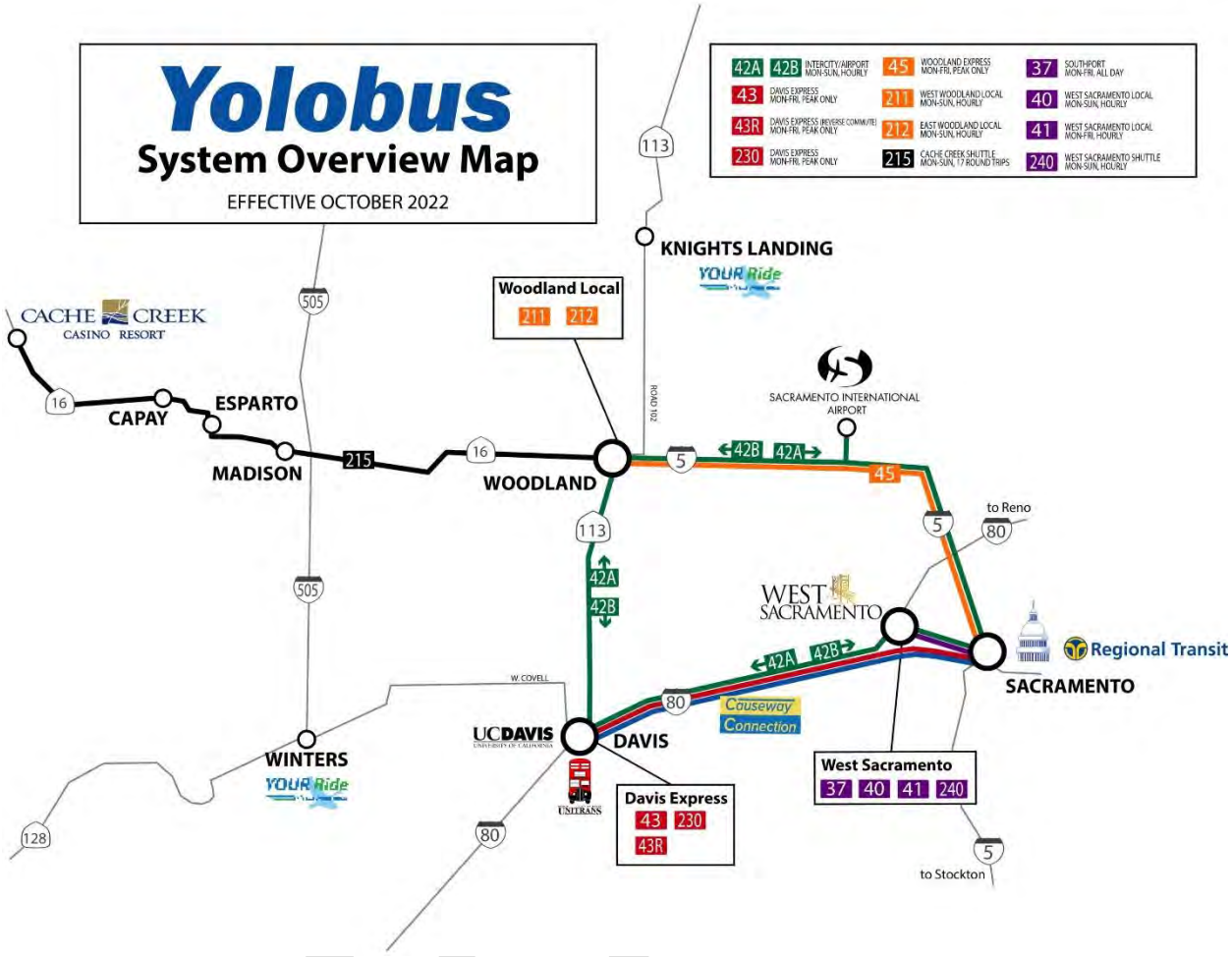

Figure 27 Yolobus System Overview Map

- **Route 42A/42B –** The intercity loop, which runs through Davis, West Sacramento, Downtown Sacramento, Sacramento International Airport, and Woodland. This is an hourly service that runs seven days a week with increased service during peak hour.
- **Route 43AM/43PM/43R –** Monday through Friday route that runs between central and east Davis to downtown Sacramento.
- **Route 138 (Causeway Connection)** - Zero emission bus service between Silo Terminal in Davis and the UC Davis Medical Center in Sacramento. Operations are managed by Yolobus and SacRT. Operations are hourly Monday through Friday.
- **Route 230AM/230PM –** Express bus that runs from West Davis to Downtown Sacramento, Monday through Friday.

6.3 Proposed Mobility Hub

The Project proposes the construction of a new Mobility Hub for all build alternatives to provide approximately 300 additional park and ride spaces to the I-80/Enterprise Blvd/West

Capital Ave Interchange, where existing park and ride spaces frequently fill. CARTA will continue to coordinate with local transit agencies, the City of West Sacramento, UC Davis, Sacramento Regional Transit, and Yolo County to increase the possibility of providing a bus stop and bus transfer station. The Mobility Hub preliminary scope includes a pedestrian drop-off area, electrical vehicle charging stations for buses and vehicles, bus stop shelter, bike lockers, trees, lighting, landscaping, and vegetated infiltration basins/planters. This Mobility Hub will provide an ideal location and opportunity for pedestrians, bicyclists and carpoolers to transfer onto various bus routes. The Mobility Hub construction will be part of a future construction phase of this project.

6.4 Proposed Transit Improvements

The Project Development Team (PDT) is discussing and coordinating these efforts with local partners invested in transit such as the City of West Sacramento, YoloTD, City of Davis, Yolo County, Yolo Bus, Sacramento Regional Transit District (SacRT), Amtrak Capitol Corridor (rail), Unitrans (UC Davis Bus service), and others. With the objective of reducing overall VMT, the project is looking to use revenue to integrate transit improvements in the region. Strategies may include dedicated lanes, transit signal priority, enhanced connectivity, bike and pedestrian integration, fare integration, accessibility improvements, community engagement and public awareness.

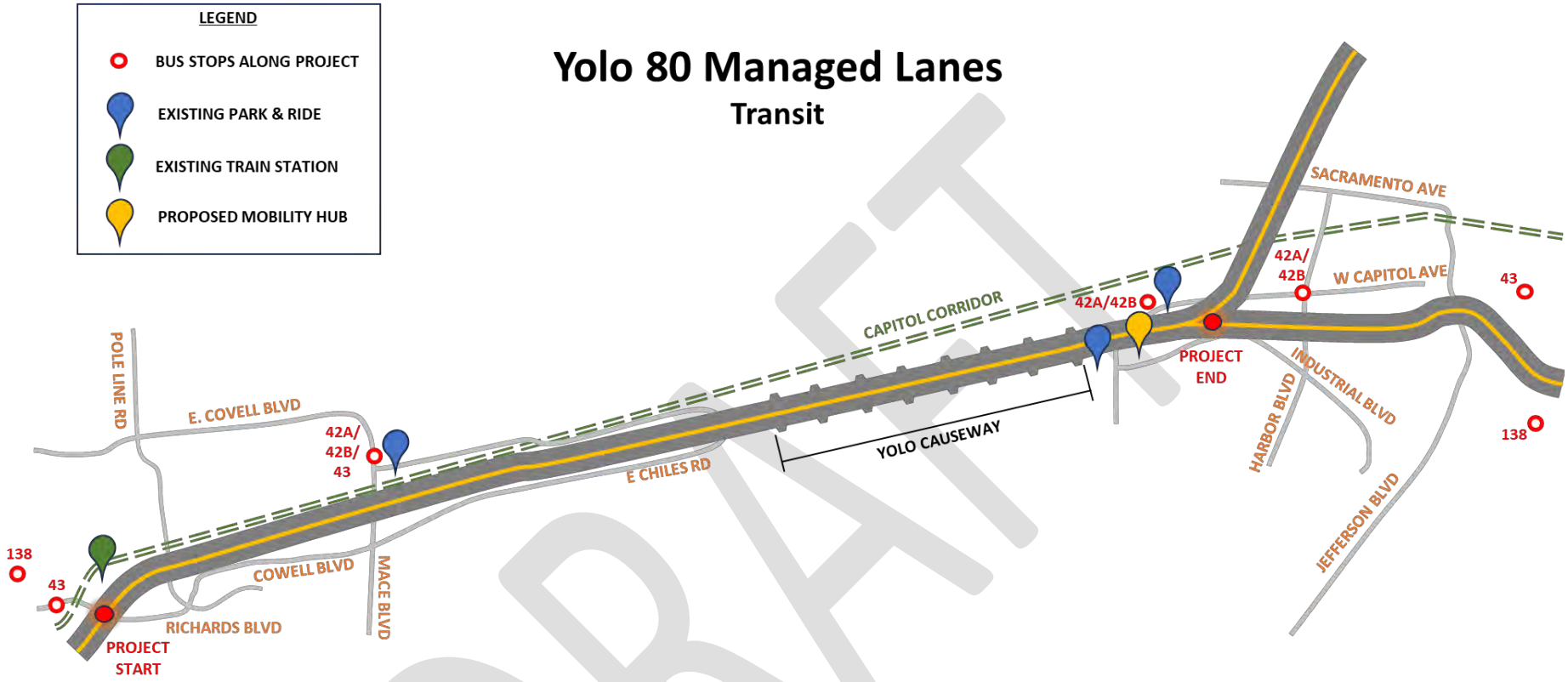

Figure 28: Phase 1 Yolo 80 Transit Map

7 TRAFFIC PERFORMANCE FORECASTS

The Interstate 80/US Highway 50 Managed Lanes Transportation Analysis Report (TAR, May 2023) documents and presents existing and anticipated future transportation conditions in the study area with and without the proposed project. As mentioned in Section 4, 9 alternatives (TAR Alternative 1-9) including a no-build alternative were analyzed in-depth in the TAR (May 2023).

- Alternative 1 – No Build.
- Alternative 2 (Add HOV) – Add a high-occupancy vehicle lane in each direction for use by vehicles two or more occupants (HOV2+).
- Alternative 3 (Add HOT2+) – Add a high-occupancy toll lane in each direction for use by vehicles with two or more occupants (HOT2+). Single-occupant vehicles would pay a fee for lane usage.
- Alternative 4 (Add HOT3+) – Add a high-occupancy toll lane in each direction for use by vehicles with three or more occupants (HOT3+). Vehicles with two occupants would pay a reduced toll, and SOVs would pay the full toll (HOT3+).
- Alternative 5 (Add Toll) – Add one express lane in each direction (i.e., everyone would pay a fee to use the lane, regardless of the number of occupants).
- Alternative 6 (Add Transit) – Add a transit-only lane in each direction.
- Alternative 7 (Convert HOV) – Repurpose the current number one general purpose lane in each direction for use by vehicles with two or more occupants (HOV2+); no new lanes would be constructed.
- Alternative 8 (Add HOV with Median Ramps) – Add a high-occupancy vehicle lane in each direction for use by vehicles with two or more occupants and build an I-80 managed lane direct connector.
- Alternative 9 (Add HOV without Enterprise Crossing) – Add a high-occupancy vehicle lane in each direction for use by vehicles with two or more occupants (HOV2+) without Enterprise Crossing, a planned bridge on Enterprise Boulevard at the deep-water ship channel.

Section 7.1 and 7.2 discuss the forecasted traffic performance measures for both the corridor and the region network. The performance measures from the opening year 2029 and horizon year 2049 models are reported with more specific details in the TAR (May 2023). A modified version of the SACSIM19 regional travel demand model was applied to forecast traffic volumes and performance measures for opening year 2029 and horizon year 2049 under typical weekday conditions. Induced VMT forecasts attributable to the project were prepared using the modified SACSIM19 model and the NCST calculator.

Section 7.3, 7.4 and 7.5 discuss the performance measures from the simulation analysis. Freeway operations were analyzed for the 6:00 to 10:00 AM and 3:00 to 7:00 PM peak periods using Vissim traffic simulation software so that congestion can be modeled across time and space.

Results from the traffic performance forecasts are summarized below to provide a high-level comparison of Project Alternatives. The forecast examines the operational performance for both the corridor and the region. The TAR (May 2023) includes more specific details and additional performance measures in addition to the critical metrics included in the ConOps.

7.1 Corridor Performance Measures

The Interstate 80/US Highway 50 Managed Lanes Transportation Analysis Report (May 2023) provides the network performance measure including Vehicle Hours Traveled (VHT), Vehicle Hours of Delay (VHD), Vehicle Miles Traveled (VMT), and Personal Miles Traveled (PMT). The performance measures are reported on both regional and corridor basis. The sub-sections below document the high-level corridor performance measures forecasted in opening year 2029 and horizon year 2049.

7.1.1 VHT

Table 6 presents the corridor daily VHT by alternative under opening year 2029 and horizon year 2049 based on the model output. These results are compared to the base year 2016 model output. Corridor VHT is expected to grow by 7 percent in 2029 and 56 percent in 2049 under the No Build Alternative (Alt 1). In 2029, the HOT 3+, express lane, transit lane, and HOV conversion alternatives (Alt 4-7) would have higher corridor VHT than the No Build Alternative, but the other build alternatives would have lower corridor VHT. Corridor VHT in 2049 would be highest for the No Build, transit lane, and HOV conversion alternatives (Alt 1, 6, and 7), which would have more corridor delay than the other alternatives. The transit lane and HOV conversion alternatives (Alt 6 and 7) include minor widening, which would reduce travel time compared to the no build alternative (Alt 1).

Alternative	2016	2029	2049
1 (No Build)	75,700 (Base Year)	81,100	117,000
2 (Add HOV)		80,600	94,800
3 (Add HOT2+)		80,300	94,900
4 (Add HOT3+)		81,200	96,200
5 (Add Toll)		82,500	96,800
6 (Add Transit)		84,600	107,400
7 (Convert HOV)		83,900	102,600
8 (Add HOV with Median Ramps)		80,700	94,700
9 (Add HOV without Enterprise Crossing)		80,200	94,000

Table 6: Corridor Daily VHT

7.1.2 VHD

Table 7 presents the corridor daily VHD by alternative under opening year 2029 and horizon year 2049 based on the model output. These results are compared to the base year 2016 model output. Corridor VHD is expected to grow by 22 percent in 2029 and 200 percent in 2049 under Alternative 1. In 2029, Alternatives 6 and 7 would have higher corridor VHD than Alternative 1, and the other build alternatives would have lower corridor VHD. Corridor VHD in 2049 would be

highest for Alternatives 1, 6, and 7. Alternatives 6 and 7 include minor widening, which would reduce travel time compared to Alternative 1. The corridor VHD for the other build alternatives would be less than half the Alternative 1 corridor VHD.

Alternative	2016	2029	2049
1 (No Build)	15,100 (Base Year)	18,300	44,300
2 (Add HOV)		12,500	19,600
3 (Add HOT2+)		12,100	19,600
4 (Add HOT3+)		13,500	21,900
5 (Add Toll)		15,200	23,00
6 (Add Transit)		20,600	36,500
7 (Convert HOV)		21,700	33,900
8 (Add HOV with Median Ramps)		12,500	19,400
9 (Add HOV without Enterprise Crossing)		12,400	19,100

Table 7: Corridor Daily VHD

7.1.3 VMT

Table 8 presents the corridor daily VMT by alternative under opening year 2029 and horizon year 2049 based on the model output. These results are compared to the base year 2016 model output. Corridor VMT is expected to grow by 4 percent in 2029 and 20 percent in 2049 under Alternative 1. In 2029, all build alternatives except Alternative 7 would have higher corridor VMT than Alternative 1. Corridor VMT in 2049 would be highest for Alternative 3 and lowest for Alternatives 6 and 7. These two alternatives would also be the only alternatives with a lower corridor VMT than Alternative 1.

Alternative	2016	2029	2049
1 (No Build)	3,741,100 (Base Year)	3,881,000	4,495,700
2 (Add HOV)		4,237,700	4,683,100
3 (Add HOT2+)		4,240,200	4,686,500
4 (Add HOT3+)		4,200,700	4,616,200
5 (Add Toll)		4,170,900	4,582,700
6 (Add Transit)		3,953,600	4,381,600
7 (Convert HOV)		3,867,200	4,276,800
8 (Add HOV with Median Ramps)		4,241,900	4,683,700
9 (Add HOV without Enterprise Crossing)		4,216,200	4,662,500

Table 8: Corridor Daily VMT

7.2 Regional Network Performance

The Interstate 80/US Highway 50 Managed Lanes Transportation Analysis Report (May 2023) provides the network performance measure including VHT, VHD, VMT, and PMT. The performance measures are reported on both regional and corridor basis. The sub-sections

below document the high-level regional performance measures forecasted in opening year 2029 and horizon year 2049.

7.2.1 Regional VHT

Table 9 presents the regional daily VHT by alternative under opening year 2029 and horizon year 2049 based on the model output. These results are compared to the base year 2016 model output. Regional VHT is expected to grow by 10 percent in 2029 and 50 percent in 2049 under Alternative 1. In 2029, Alternative 1 would have the lowest regional VHT, but as network delay increases, Alternative 1 would have the highest regional VHT by 2049. Regional VHT in 2049 would be similar across the build alternatives, with Alternatives 6 and 7 having the highest VHT.

Alternative	2016	2029	2049
1 (No Build)	1,686,900 (Base Year)	1,851,200	2,522,700
2 (Add HOV)		1,923,800	2,351,500
3 (Add HOT2+)		1,923,000	2,357,900
4 (Add HOT3+)		1,921,900	2,360,300
5 (Add Toll)		1,926,000	2,363,900
6 (Add Transit)		1,917,500	2,396,700
7 (Convert HOV)		1,928,200	2,373,400
8 (Add HOV with Median Ramps)		1,925,000	2,354,900
9 (Add HOV without Enterprise Crossing)		1,929,200	2,357,300

Table 9: Regional Daily VHT

7.2.2 Regional VHD

Table 10 presents the regional daily VHD by alternative under opening year 2029 and horizon year 2049 based on the model output. These results are compared to the base year 2016 model output. Regional VHD is expected to grow by 16 percent in 2029 and 132 percent in 2049 under Alternative 1. Similar to the VHT results, Alternative 1 would have the lowest regional VHD in 2029, but as network delay increases, Alternative 1 would have the highest regional VHD by 2049. Regional VHD in 2049 would be similar across the build alternatives, with Alternatives 6 and 7 having the highest VHD, which matches the VHT results.

Alternative	2016	2029	2049
1 (No Build)	230,600 (Base Year)	266,800	533,200
2 (Add HOV)		292,900	431,500
3 (Add HOT2+)		292,500	434,700
4 (Add HOT3+)		292,800	439,100
5 (Add Toll)		295,400	443,100
6 (Add Transit)		296,500	465,200
7 (Convert HOV)		302,100	452,100
8 (Add HOV with Median Ramps)		293,500	432,700
9 (Add HOV without Enterprise Crossing)		296,000	434,900

Table 10: Regional Daily VHD

7.2.3 Regional VMT

Table 11 presents the regional daily VMT by alternative under opening year 2029 and horizon year 2049 based on the modified SACSIM19 model output. These results are compared to the base year 2016 model output and do not fully account for induced VMT effects. Separate induced VMT forecasts using the NCST calculator are provided in Section 7.2.4. Regional VMT is expected to grow by 8 percent in 2029 and 35 percent in 2049 under Alternative 1. Similar to the VHT results, Alternative 1 would have the lowest regional VMT in 2029, but as network delay increases, Alternative 1 would have the highest regional VMT by 2049 as travelers shift to longer routes to reduce overall travel time. Regional VMT in 2049 would be similar across the build alternatives, with Alternative 6 having the highest VMT. While transit use may be higher in this alternative, passenger travel to train stations and park-and-ride lots would likely be higher than other build alternatives.

Alternative	2016	2029	2049
1 (No Build)	63,097,900 (Base Year)	67,803,500	85,249,400
2 (Add HOV)		69,891,500	82,246,400
3 (Add HOT2+)		69,869,900	82,366,100
4 (Add HOT3+)		69,788,500	82,220,400
5 (Add Toll)		69,839,100	82,154,200
6 (Add Transit)		69,378,300	82,651,100
7 (Convert HOV)		69,590,700	82,199,000
8 (Add HOV with Median Ramps)		69,923,800	82,339,500
9 (Add HOV without Enterprise Crossing)		69,981,600	82,330,400

Table 11: Regional Daily VMT

7.2.4 Induced VMT

Induced travel is the increase in the potential demand for travel due to the economic effect of reducing travel time and therefore travel costs. The build alternatives will widen I-80 and US 50 to provide additional travel lanes in the study area which will reduce travel times for passenger

and commercial vehicles. Typically, lower vehicle travel costs generate increases in vehicle travel demand due to the following causes.

Short-term responses

- New vehicle trips that would otherwise not be made
- Longer vehicle trips to more distant destinations
- Shifts from other travel modes to driving
- Shifts from one driving route to another

Longer-term responses

- Changes in land use development patterns (these are often more dispersed, low-density patterns that are automobile-dependent)
- Changes in overall growth

Table 12 presents the estimated short-term induced travel using the modified SACSIM19 travel demand model under 2029 and 2049 conditions plus the long-term induced travel based on the National Center for Sustainable Transportation (NCST) calculator. For the SACSIM19 model, induced VMT is the difference between the build and no build alternatives. For the NCST calculator, the estimate is based on the lane-miles that would be constructed. Alternative 1 would not construct new lanes, so no induced VMT would occur. For Alternatives 2 and 9, the project would construct about 28.4 lane-miles of new freeway lanes (HOV and auxiliary lanes). A portion of the project would convert existing GP to managed lanes on US 50 between I-80 and Jefferson Boulevard, so the total lane addition is less than the project length. Alternative 7 would have minor lane additions totaling about 0.7 miles. With the median ramps at I-80/US 50, Alternative 8 would construct about 29.6 lane-miles in total. The calculator does not estimate the induced VMT for transit-only lane alternatives (Alternative 6).

Alternative	SACSIM19 Daily VMT Change		NCST Long-Term Induced Daily VMT
	2029	2049	
1 (No Build)	-	-	-
2 (Add HOV)	+2,088,000	-3,003,000	+495,300
3 (Add HOT2+)	+2,066,400	-2,883,300	+495,300
4 (Add HOT3+)	+1,985,000	-3,029,000	+495,300
5 (Add Toll)	+2,035,600	-3,095,200	+495,300
6 (Add Transit)	+1,574,800	-2,598,300	-
7 (Convert HOV)	+1,787,200	-3,050,400	+12,300
8 (Add HOV with Median Ramps)	+2,120,300	-2,909,900	+516,000
9 (Add HOV without Enterprise Crossing)	+2,178,100	-2,919,000	+495,300

Notes: The SACSIM19 model includes two additional counties (Sutter and Yuba). Annual VMT converted to daily VMT using a factor of 300 to account for less travel on weekends and holidays. Long-term induced daily VMT estimated with an elasticity of 1.0 using NCST calculator based on 2019 VMT in the four-county MSA (El Dorado, Placer, Sacramento, and Yolo).

Table 12: Daily VMT Change and Induced VMT

7.3 Bottleneck Throughput

Opening year 2029 AM and PM peak period throughput at the primary bottleneck in each direction are reported in Table 13 and Table 14, respectively. In the eastbound direction, the main bottleneck is on I-80 at Mace Boulevard. In the westbound direction, the main bottleneck is on I-80 at the Yolo Causeway.

Performance Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
AM Peak Period									
Vehicles served	17,400	**19,200**	**19,200**	18,900	18,500	17,600	15,900	**19,200**	19,100
Persons served	27,400	**29,900**	29,500	28,700	28,600	27,900	25,500	**29,900**	**29,900**
PM Peak Period									
Vehicles served	19,000	**23,400**	23,100	22,600	22,300	19,000	11,800	23,100	22,100
Persons served	29,500	**36,500**	35,100	34,200	34,600	29,900	18,500	35,900	34,200

Notes: The peak periods are 6:00 to 10:00 AM and 3:00 to 7:00 PM. The lowest value is underlined, and the highest value is bolded.

Table 13: EB Peak Period Throughput: I-80 at Mace Blvd - Opening Year 2029

For eastbound I-80 at Mace Boulevard, the AM peak period would have low congestion under the build alternatives, so the vehicle served at the bottleneck would be similar across most alternatives. Alternatives 2, 3, and 8 would serve the most vehicles. Due to differences in average vehicle occupancy, Alternatives 2, 8, and 9 would serve the most people. For the PM peak period, Alternative 2 would serve the most vehicles and people although Alternatives 3 and 8 would serve almost as many. Alternative 7 would serve the fewest vehicles and people during both peak periods.

Performance Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
AM Peak Period									
Vehicles served	23,400	27,300	28,000	27,100	27,400	24,100	18,800	**28,200**	27,200
Persons served	36,900	42,600	42,800	41,300	42,700	38,500	30,100	**44,100**	42,800
PM Peak Period									
Vehicles served	17,900	**21,200**	21,000	21,100	20,700	17,900	16,800	21,000	21,000
Persons served	28,700	**33,800**	33,100	**33,800**	33,400	29,000	27,500	33,700	**33,800**

Notes: The peak periods are 6:00 to 10:00 AM and 3:00 to 7:00 PM. The lowest value is underlined, and the highest value is bolded.

Table 14: WB Peak Period Throughput: I-80 at Yolo Causeway - Opening Year 2029

For westbound I-80 at the Yolo Causeway, the AM peak period would be congested causing queues upstream on both I-80 and US 50. Alternative 8 would serve the most vehicles and people. Alternatives 2 through 5 and 9 would also serve about as many vehicles and people as Alternative 8. During the PM peak period, Alternative 2 would serve the most vehicles, but Alternatives 2, 4, and 9 would serve the most people. Like in the eastbound direction, Alternative 7 would serve the fewest vehicles and people at the main westbound bottleneck.

Horizon year 2049 AM and PM peak period throughput at the primary bottleneck in each direction are reported in Table 15 and Table 16, respectively. In the eastbound direction, the main bottleneck is on I-80 at Mace Boulevard. In the westbound direction, the main bottleneck is on I-80 at the Yolo Causeway.

Performance Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
AM Peak Period									
Vehicles served	19,300	21,000	**21,200**	21,000	21,100	18,800	15,900	21,000	21,100
Persons served	31,000	33,800	33,700	33,400	33,700	30,800	26,200	33,600	**34,000**
PM Peak Period									
Vehicles served	16,400	**22,500**	21,000	21,400	20,800	17,100	9,400	21,600	22,200
Persons served	25,900	**35,800**	33,000	32,900	32,200	27,200	15,800	34,100	35,300

Notes: The peak periods are 6:00 to 10:00 AM and 3:00 to 7:00 PM. The lowest value is underlined, and the highest value is bolded.

Table 15: EB Peak Period Throughput: I-80 at Mace Blvd - Horizon Year 2049

For eastbound I-80 at Mace Boulevard, the AM peak period would have low congestion under the build alternatives, so the vehicle served at the bottleneck would be similar across most alternatives. Alternative 3 would serve the most vehicles. Due to differences in average vehicle occupancy and travel patterns, Alternative 9 would serve the most people. For the PM peak period, Alternative 2 would serve the most vehicles and people although Alternative 9 would serve almost as many. Alternative 7 would serve the fewest vehicles and people during both peak periods.

Performance Measure	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
AM Peak Period									
Vehicles served	23,700	28,400	28,500	27,400	27,800	24,400	19,700	**29,700**	28,200
Persons served	38,000	45,600	43,600	41,900	43,100	39,500	32,100	**47,000**	45,300
PM Peak Period									
Vehicles served	20,400	23,100	**23,500**	21,400	22,300	20,100	17,300	23,100	22,900
Persons served	33,100	**37,800**	36,600	33,800	35,600	32,800	28,700	37,400	36,900

Notes: The peak periods are 6:00 to 10:00 AM and 3:00 to 7:00 PM. The lowest value is underlined, and the highest value is bolded.

Table 16: WB Peak Period Throughput: I-80 at Yolo Causeway - Horizon Year 2049

For westbound I-80 at the Yolo Causeway, the AM peak period would be congested causing queues upstream on both I-80 and US 50. Alternative 8 would serve the most vehicles and people. Alternatives 2 through 5 and 9 would also serve about as many vehicles and people as Alternative 8. During the PM peak period, Alternative 3 would serve the most vehicles, but Alternative 2 would serve the most people. Like in the eastbound direction, Alternative 7 would serve the fewest vehicles and people at the main westbound bottleneck.

7.4 Corridor Travel Time

Opening year 2029 AM and PM peak hour travel times for the general purpose (GP) and managed lanes are reported in Table 17 and Table 18, respectively. The travel time for three corridors is reported: I-80 between Kidwell Road in Solano County and US 50, US 50 between I-80 and SR 51/SR 99, and I-80 between US 50 and Truxel Road. The free-flow travel time is about 12 minutes for the first corridor and about 5 minutes for the other two corridors.

During the AM peak hour, eastbound average travel time in the general purpose lanes would be highest for Alternative 7 for I-80 from Kidwell Road to US 50 and from US 50 to Truxel Road. Compared to Alternative 1, the Alternatives 2 through 5, 8, and 9 would have a 30-second savings for I-80 from Kidwell Road to US 50 and three minutes or more for US 50 from I-80 to SR 51/SR 99 in the general purpose lanes.

In the westbound direction during the AM peak hour, the addition of the managed lane connector with the managed lane provides a lot of benefits allowing travel time savings to be maximized in most cases. Alternative 8 would have the lowest westbound travel times for all corridors and lanes except for the general purpose lanes for US 50, where Alternative 3 would be faster by about 40 seconds during the AM peak hour. GP lane travel time savings for Alternative 8 would be 14.5 minutes for I-80 from Truxel Road to US 50 compared to Alternative 1. Westbound travel time would be highest for Alternative 7 for US 50 from SR 51/SR 99 to I-80 at almost an hour for the general purpose lanes. Alternative 1 would be better than alternative 7, however it is still higher than alternatives 2-6, with a travel time of about 16 minutes for the same corridor. Alternatives 2 through 5, 8, and 9 would have the best average travel time of about 5 to 6 minutes. West of US 50, general purpose lane travel times would be similar across alternatives although Alternatives 1 and 7 would be about 30 seconds higher on average.

Path	Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
I-80 Eastbound: Kidwell Rd Off-ramp to US 50 Off-ramp	GP	13.2	12.8	12.8	12.8	12.8	12.8	**14.9**	12.7	12.8
	ML	n/a	12.4	12.5	12.4	12.4	**12.7**	12.6	12.5	12.4
US 50 Eastbound: I-80 to SR 51/SR 99 Off-ramp	GP	**9.9**	6.9	6.2	6.5	6.1	7.1	6.3	6.7	6.8
	ML	**5.7**	5.1	5.1	5.1	5.1	5.2	5.1	5.1	5.1
I-80 Eastbound: US 50 Off-ramp to Truxel Rd Off-ramp	GP	5.5	5.3	5.3	5.2	5.2	5.3	**5.6**	5.5	5.3
	ML	**5.3**	5.2	5.2	5.2	5.2	**5.3**	5.2	**5.3**	5.2
I-80 Westbound: Truxel Rd SB On-ramp to US 50 On-ramp	GP	22.4	**25.4**	19.1	25.3	23.4	16.6	17.4	7.9	25.2
	ML	14.0	16.9	12.9	12.8	13.2	8.6	7.1	5.3	**17.3**
US 50 Westbound: SR 51 On-ramp to I-80 On-ramp	GP	16.4	5.7	5.2	5.9	5.4	11.6	**59.3**	5.9	6.1
	ML	16.2	5.0	4.8	5.1	4.9	8.1	**32.6**	4.8	5.1
I-80 Westbound: US 50 On-ramp to Kidwell Rd Off-ramp	GP	14.2	13.8	13.7	13.7	13.7	13.8	**14.3**	13.7	13.9
	ML	n/a	12.8	12.8	12.8	12.8	12.9	**13.8**	12.4	12.8

Notes: Average travel time is reported in minutes. The AM peak hour is 7:00 to 8:00 AM. "GP" indicates GP lanes, and "ML" indicates the managed lane. Where no managed lane exists in Alternative 1, "n/a" is shown. The lowest value is underlined, and the highest value is bolded.

Table 17: AM Peak Hour Travel Time - Opening Year 2029

Similar to AM peak hour conditions, eastbound PM peak hour average travel time in the GP lanes would be highest for Alternative 7 for I-80 from Kidwell Road to US 50. Due to severe congestion, average GP lane travel time would be more than three hours for Alternative 7. Alternatives 3 through 5 and 8 would have the best travel times of about 30 minutes for the GP lanes and 18 to 20 minutes for the managed lanes. Peak hour travel time would be higher for Alternative 5 due to higher demand from 3:00 to 4:00 PM, which results in more peak hour congestion. Average travel time would increase later in the peak period due to increased congestion. Downstream on US 50, Alternatives 1 and 6 would have low travel times due to upstream capacity constraints, but Alternatives 4 and 5 would also have low travel times without the same constraints due to the capacity provided by the managed lane. Downstream on I-80, average travel time would be lowest for Alternatives 1, 6, and 7 due to upstream bottlenecks that constrain traffic volume from reaching this corridor. Longer travel times for the other alternatives would be caused by the I-5 bottleneck, which is outside the project area.

During the westbound PM peak period congestion is minimal because demand is lower, therefore most alternatives perform similarly. Westbound PM peak hour travel time for GP lanes would be highest for Alternative 7 for all three corridors. The other alternatives would have similar travel times for all three corridors. For the congested US 50 corridor, the GP lane travel time would be about twice the managed lane travel time.

Path	Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
I-80 Eastbound: Kidwell Rd Off-ramp to US 50 Off-ramp	GP	34.6	34.6	30.3	28.2	29.1	35.9	**194.8**	31.7	42.0
	ML	n/a	21.3	19.8	17.8	18.7	26.8	**115.6**	19.5	21.7
US 50 Eastbound: I-80 to SR 51/SR 99 Off-ramp	GP	11.6	17.5	15.1	13.2	12.7	12.7	**19.3**	17.3	20.4
	ML	**9.7**	6.5	6.1	6.0	5.9	5.9	7.0	6.4	7.1
I-80 Eastbound: US 50 Off-ramp to Truxel Rd Off-ramp	GP	7.1	23.2	25.1	**25.9**	24.7	11.2	6.1	24.4	24.8
	ML	5.8	8.3	8.9	**9.3**	9.1	6.0	5.3	7.6	8.5
I-80 Westbound: Truxel Rd SB On-ramp to US 50 On-ramp	GP	5.3	5.3	5.3	5.3	5.2	5.3	**10.2**	5.2	5.3
	ML	5.2	5.1	5.1	5.1	5.1	5.1	**7.3**	5.0	5.1
US 50 Westbound: SR 51 On-ramp to I-80 On-ramp	GP	10.0	10.4	10.4	9.6	10.0	10.5	**19.0**	10.2	9.5
	ML	6.3	5.3	5.3	5.2	5.3	5.4	**7.3**	5.3	5.1
I-80 Westbound: US 50 On-ramp to Kidwell Rd Off-ramp	GP	12.4	12.3	12.2	12.4	12.2	12.2	**14.0**	12.2	12.4
	ML	n/a	12.0	12.0	12.0	12.0	11.9	**12.2**	12.1	12.0

Notes: Average travel time is reported in minutes. The PM peak hour is 4:00 to 5:00 PM. "GP" indicates GP lanes, and "ML" indicates the managed lane. Where no managed lane exists in Alternative 1, "n/a" is shown. The lowest value is underlined, and the highest value is bolded.

Table 18: PM Peak Hour Travel Time - Opening Year 2029

The Horizon year 2049 AM and PM peak hour travel times for the GP and managed lanes are reported in Table 19 and Table 20, respectively.

During the eastbound AM peak period, congestion is minimal because demand is lower, therefore most alternatives besides alternatives 1 and 7 perform similarly. In the AM peak hour, eastbound average travel time in the GP lanes would be highest for Alternative 7 for I-80 from Kidwell Road to US 50 and on US 50 from I-80 to SR 51/SR 99. Travel times for the managed lane would be highest for Alternative 1 which has the shortest managed lanes. Compared to Alternative 1, the Alternatives 2 through 5, 8, and 9 would have a two-minute savings for each of these corridors for the GP lanes. Eastbound travel time on I-80 from US 50 to Truxel Road would be similar under all alternatives.

In the westbound direction, Alternative 8 would have the lowest AM peak hour travel time for I-80 from Truxel Road to US 50 with GP and managed lane travel time less than half that for Alternative 1. Westbound travel time would be highest for Alternative 7 for US 50 from SR 51/SR 99 to I-80 at 56 minutes for the GP lanes. Alternative 1 would be better with about 24 minutes. Alternatives 2, 3, 5, 8, and 9 would have the best average GP lane travel time of about 6 minutes. West of US 50, travel times would be similar across alternatives although Alternatives 1 and 7 would be about 30 seconds higher on average.

Path	Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
I-80 Eastbound: Kidwell Rd Off-ramp to US 50 Off-ramp	GP	14.9	12.8	12.9	12.9	12.9	13.1	**19.3**	12.8	12.8
	ML	n/a	12.5	12.5	12.5	12.5	12.7	**13.8**	12.5	12.5
US 50 Eastbound: I-80 to SR 51/SR 99 Off-ramp	GP	8.4	6.2	6.0	6.2	6.0	6.2	**9.9**	6.4	6.0
	ML	**7.8**	5.1	5.1	5.1	5.1	5.2	5.6	5.1	5.1
I-80 Eastbound: US 50 Off-ramp to Truxel Rd Off-ramp	GP	**5.5**	5.2	5.2	5.2	5.2	5.2	5.4	5.2	5.2
	ML	5.3	5.2	5.2	5.2	5.2	**5.4**	5.1	5.3	5.2
I-80 Westbound: Truxel Rd SB On-ramp to US 50 On-ramp	GP	20.9	25.2	24.0	24.9	24.5	20.9	20.7	8.6	**25.5**
	ML	11.2	14.2	13.0	10.7	11.8	8.4	7.3	5.3	**14.4**
US 50 Westbound: SR 51 On-ramp to I-80 On-ramp	GP	23.6	5.6	5.5	8.7	5.9	15.8	**56.1**	5.8	5.7
	ML	20.8	5.0	5.0	6.5	5.1	10.1	**28.2**	4.8	5.1
I-80 Westbound: US 50 On-ramp to Kidwell Rd Off-ramp	GP	14.1	13.8	13.7	13.7	13.7	13.8	**14.2**	13.8	13.8
	ML	n/a	12.8	12.8	12.8	12.8	12.9	**13.6**	12.5	12.8

Notes: Average travel time is reported in minutes. The AM peak hour is 7:00 to 8:00 AM. "GP" indicates GP lanes, and "ML" indicates the managed lane. Where no managed lane exists in Alternative 1, "n/a" is shown. The lowest value is underlined, and the highest value is bolded.

Table 19: AM Peak Hour Travel Time - Horizon Year 2049

The biggest traffic operational benefits from this project can be seen during the PM peak period in the eastbound direction. Similar to AM peak hour conditions, eastbound PM peak hour average travel time in the GP lanes would be highest for Alternative 7 for I-80 from Kidwell Road to US 50. Due to severe congestion, average GP lane travel time would be more than three hours for Alternative 7 and more than an hour for Alternative 1. Alternatives 2 through 4 and 9 would have the best travel times of 35 to 40 minutes for the GP lanes and 15 to 18 minutes for the managed lanes. Peak hour travel time would be higher for Alternative 5 due to higher demand from 3:00 to 4:00 PM, which results in more peak hour congestion. For Alternative 8, travel time would be higher due to one less GP lane for vehicles to queue in between Enterprise Boulevard and US 50 with the addition of the median ramp. Downstream on US 50, travel time would be similar across alternatives since speeds would be controlled by congestion in downtown Sacramento beyond the project limits. Downstream on I-80, average travel time would be lowest for Alternatives 1, 6, and 7 due to upstream bottlenecks that constrain traffic volume from reaching this corridor. Travel time would be higher for Alternative 8 because more traffic can reach the bottleneck at I-5/I-80 with the median ramp for HOVs at I-80/US 50.

Westbound PM peak hour travel time for GP lanes would be highest for Alternative 7 for all three corridors. Alternatives 2, 4, 5, 8, and 9 would provide a 4.5-minute GP lane travel time savings for I-80 from Truxel Road to US 50 compared to Alternative 1. Alternative 3 would have a longer travel time due to congestion at the Reed Avenue off-ramp. There would be about a three-minute managed lane travel time savings for Alternatives 2 through 6, 8, and 9. For US 50 from SR 51/SR 99 to I-80, Alternative 1 would have the lowest GP lane travel time due to capacity constraints in downtown Sacramento. The build alternatives, except for Alternative 7,

would provide about a 1.5-minute travel time savings for the managed lane compared to Alternative 1. Downstream on I-80 west of US 50, congestion is less, but the build alternatives, except for Alternative 7, would still provide about a 1-minute travel time savings over Alternative 1.

Path	Type	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
I-80 Eastbound: Kidwell Rd Off-ramp to US 50 Off-ramp	GP	73.8	35.8	38.6	37.5	62.7	75.3	**193.3**	55.4	38.4
	ML	n/a	16.8	17.2	14.9	24.6	44.3	**116.8**	28.2	17.6
US 50 Eastbound: I-80 to SR 51/SR 99 Off-ramp	GP	20.1	19.6	19.5	19.8	18.7	18.6	**22.8**	21.6	19.2
	ML	**17.5**	7.2	7.2	7.2	6.6	6.1	7.3	7.5	7.3
I-80 Eastbound: US 50 Off-ramp to Truxel Rd Off-ramp	GP	14.5	20.6	23.4	22.8	9.1	11.3	6.2	**25.5**	21.2
	ML	**14.5**	7.6	8.1	8.1	5.6	6.1	5.2	7.8	7.5
I-80 Westbound: Truxel Rd SB On-ramp to US 50 On-ramp	GP	10.1	5.6	6.5	5.7	5.5	7.0	**19.5**	5.6	5.6
	ML	**8.2**	5.2	5.3	5.1	5.1	5.3	6.6	5.1	5.1
US 50 Westbound: SR 51 On-ramp to I-80 On-ramp	GP	8.1	9.9	9.8	9.6	9.8	8.3	**19.9**	10.6	15.0
	ML	6.7	5.3	5.1	5.1	5.2	5.1	**7.2**	5.3	5.9
I-80 Westbound: US 50 On-ramp to Kidwell Rd Off-ramp	GP	13.2	12.5	12.3	12.3	12.2	12.4	**13.6**	12.3	12.3
	ML	n/a	12.1	12.1	12.0	12.0	12.0	**12.2**	**12.2**	12.1

Notes: Average travel time is reported in minutes. The PM peak hour is 4:00 to 5:00 PM. "GP" indicates GP lanes, and "ML" indicates the managed lane. Where no managed lane exists in Alternative 1, "n/a" is shown. The lowest value is underlined, and the highest value is bolded.

Table 20: PM Peak Hour Travel Time - Horizon Year 2049

7.5 Deficient Traffic Operations

Table 21 summarizes the freeway analysis segments with deficient operations for the opening year 2029. A project deficiency occurs for a freeway segment when the LOS is E or F west of the Mace Boulevard overcrossing or the LOS is F east of the Mace Boulevard overcrossing. Consistent with the California Environmental Quality Act (CEQA) guidelines, traffic operational performance as measured by automobile LOS cannot be considered as a project impact for the environmental analysis. The deficient operations were determined for each of the four hours during the AM and PM peak periods. The total number of analysis segments varies by alternative, so the percentage of deficient analysis segments is also listed.

Peak Period	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
AM	**163 (29%)**	111 (21%)	97 (19%)	108 (21%)	97 (19%)	144 (28%)	160 (29%)	95 (18%)	114 (22%)
PM	160 (29%)	217 (42%)	215 (41%)	202 (39%)	207 (40%)	176 (34%)	**266 (49%)**	217 (42%)	239 (46%)

Notes: Operations are deficient if LOS E or F west of Mace Boulevard and LOS F east of Mace Boulevard. The lowest value is underlined, and the highest value is bolded.

Table 21: Hourly Segments with Deficient Operations - Opening Year 2029

During the AM peak period, Alternative 1 would have the most deficient segments with 29 percent. Alternative 8 would have the fewest segments, although Alternatives 3 and 5 would

have almost the same percentage. During the PM peak period, almost half of the segments would be deficient under Alternative 7. Alternative 1 would have the fewest segments at 29 percent. Both Alternatives 1 and 6 would have significant congestion extending upstream of the analysis area in the westbound direction. The alternatives with higher capacity (Alternatives 2 through 5 and 8) would have 39 to 42 percent deficient segments.

Table 22 summarizes the freeway analysis segments with deficient operations for the horizon year 2049. The deficient operations were determined for each of the four hours during the AM and PM peak periods. The total number of analysis segments varies by alternative, so the percentage of deficient analysis segments is also listed.

During the AM peak period, Alternative 1 would have the most deficient segments with 43 percent. Alternative 8 would have the fewest segments at 13 percent. Alternatives 3, 5, and 9 would be next at about 21 percent for all three alternatives. During the PM peak period, Alternative 1 would again have the most deficient segments at 62 percent. Both Alternatives 4 and 5 would have the fewest deficient segments at about 44 percent.

Peak Period	Alt 1	Alt 2	Alt 3	Alt 4	Alt 5	Alt 6	Alt 7	Alt 8	Alt 9
AM	**241 (43%)**	109 (21%)	109 (21%)	132 (25%)	108 (21%)	160 (31%)	222 (41%)	69 (13%)	108 (21%)
PM	**346 (62%)**	276 (53%)	274 (52%)	236 (45%)	230 (44%)	275 (53%)	314 (57%)	256 (50%)	280 (54%)

Notes: Operations are deficient if LOS E or F west of Mace Boulevard and LOS F east of Mace Boulevard. The lowest value is underlined, and the highest value is bolded.

Table 22: Hourly Segments with Deficient Operations - Horizon Year 2049

7.6 Alternative Comparison

According to the Interstate 80/US 50 Managed Lanes Transportation Analysis Report (May 2023), Alternative 1 (No-build) and 7 (Existing GP Lane converting) have the worst operational performance among the alternatives in the modeled years from the simulation results. Alternative 6 (Add transit only lane) would not perform well compared to the other alternatives, though throughput could be improved if additional bus service were provided, the forecasted passenger vehicle volume would be constrained by the network capacity.

Alternatives 2 (Add HOV) and 8 (Add HOV with Managed Lane Connector Ramp) have the best performance results based on metrics such as general purpose peak hour travel time, average network speed, and vehicles/persons served. However, there is no significant overperformance compared to Alternative 3 (Add HOV 2+), 4 (Add HOT 3+), and 5 (Add Express Lane) in the measurements of vehicle hours of delay, vehicle hours of travel, average speed, vehicles served, and persons served. There is a potential weaving concern for Alternative 3 through 5 in the transition zones between the HOT to HOV lanes at the beginning and end of the managed lanes facility. However, this can be mitigated through proper access design, advanced signages, as well as dynamic or valued based variable pricing which can control the volume on the managed lane.

Adding the price component to the managed lane system has many benefits contributing to

traffic operation and congestion management. Dynamic pricing can leverage real-time traffic data to control the volume, v/c ratio, and speed on the managed lanes to maintain an acceptable level of service most of the time, which HOV alone may not achieve. Value-based variable pricing can also leverage recent traffic flow patten to inform efficient demand management. Priced managed lanes encourage alternative transportation (public transit, carpooling, biking, or reduced trip demand), while enabling a reduced environmental impact. Besides operational benefits, revenue generated from tolls can be reinvested into operation and maintenance of toll equipment, transportation infrastructure, including maintenance and improvements to the managed lanes themselves or other transportation projects in the region.

Note that the preferred alternative has not yet been selected, and this document contains results from analysis of Alternative 4 which provides significant operational benefits and O&M support through the discussion across other sections in the ConOps.

8 ROLES, RESPONSIBILITIES, AND INSTITUTIONAL REQUIREMENTS

The implementation and operation of the I-80 Managed Lanes Project will require close collaboration among multiple stakeholder organizations. This section of the ConOps describes the roles and responsibilities of the different stakeholders, as well as related institutional and legislative requirements to advance the deployment of the Project.

8.1 Capital Area Regional Tolling Authority

In 2024, Caltrans, YoloTD, and SACOG signed a joint powers authority agreement to form the Capital Area Regional Tolling Authority (CARTA) or "The JPA". The partnering agencies have participated in focused engagement meetings to review Project features, such as tolling operational characteristics, business requirements, schedule, roles and responsibilities, pricing strategies and long-term goals. The planning, construction, operations, and maintenance of the Project will be accomplished in a collaborative and efficient manner through resource pooling, coordinating regional efforts, unifying management structure, sharing costs, and ensuring public accountability, outlined and agreed upon by the JPA.

The roles and responsibilities of each party of the JPA will be outlined by cooperative agreements including, but not limited to:

- Invoicing
- Reporting
- Performance monitoring
- Staffing Requirements
- Policy Agreements and Approval
- Vendor and Consultant Contracts
- Negotiations and Change Management
- Ensuring that facility is meeting federal performance requirements
- Developing action plans to address managed lanes degradation.

8.2 Caltrans

Caltrans operates and maintains the State Highway System (SHS) and will operate the system in the event of a major incident. Caltrans is the owner and operator of the SHS and has a significant role in the development and implementation of managed lanes. The rules and regulations that guide highway design and traffic operations are the purview of Caltrans. In addition, the environmental review process of FHWA was assigned to Caltrans, and the acquisition of Right-of-Way (ROW) is guided by State ROW acquisition statutes. Caltrans is also responsible for monitoring lane operations and identifying degraded facilities. Caltrans District 3 is leading the environmental approval process, producing design plans, and conducting assessment of managed lanes alternatives on the Yolo 80 Managed Lanes.

In Yolo 80 Managed Lanes operations, Caltrans will be responsible for:

- To be determined once JPA agreement is more finalized

8.3 Yolo Transportation District

Yolo Transportation District (YoloTD), founded in 1989, is Yolo County's congestion management agency in charge of funding and implementing transit and capital projects to ensure a balanced and sustainable transportation system. YoloTD operates the Yolobus network that provides reliable local and intercity bus routes in Sacramento, West Sacramento, Southport, Davis, Woodland, Cache Creek, Madison, Esparto, Capay, Knights Landing, and Vacaville.

YoloTD, in coordination with Caltrans and SACOG, is responsible for preparing the AB 194 application for tolling authority, development of the governance structure, and funding allocation for this Project.

Once Yolo 80 Managed Lanes is in operations, YoloTD will be responsible for the following:

- To be determined once JPA agreement is more finalized

8.4 Sacramento Area Council of Governments

The Sacramento Area Council of Governments (SACOG) is a regional planning agency located in the Sacramento, California area. SACOG plays a vital role in coordinating and facilitating various aspects of regional planning and development in the Sacramento region. SACOG is responsible for regional funding distribution (TCEP) for the Yolo 80 Managed Lanes Project.

8.5 Federal Highway Administration

The Federal Highway Administration (FHWA) is the agency within the U.S. Department of Transportation that supports State and local governments in the planning, design, and construction of the National Highway System. FHWA provides financial resources and technical assistance for a coordinated program of public roads that service the transportation needs of Federal and Indian lands via the Federal Lands Highway Program. FHWA maintains project level approval for projects that are deemed as Projects of Division Interest (PoDI), which typically include major ITS projects such as Express Lanes and projects costing over $500 million.

FHWA's role in the Yolo 80 Managed Lanes Project includes:

- Reviewing and approving improvements and lane operations on Federal Aid Highway Routes
- Preparing and managing the PoDI Stewardship and Oversight Plan.
- Providing lessons learned and recommending best practices.
- Providing oversight and project review.
- Reviewing the Concept of Operations and approving the Systems Engineering Management Plan (SEMP).

8.6 California Highway Patrol

The California Highway Patrol (CHP) is the law enforcement agency with patrol jurisdiction over all California highways and serves as the state police. Its primary purpose is to assure the safe

convenient and efficient transportation of people and goods on California's highway system. CHP's roles on the I-80 Managed Lanes will include:

- Performing on-site enforcement of vehicle eligibility (i.e., HOV and Clean Air Vehicle) requirements.
- Enforcing buffer-crossing violations in express lanes.
- Leading coordination and implementation of response functions related to incidents or other disruptions on the express lanes and GP lanes.
- Providing lane closure enforcement for installation and maintenance activities when required by policy, contract, or agreement.
- Enforcing all violations of the California Vehicle Code.

CARTA intends to establish a comprehensive agreement with CHP for the enforcement of the Yolo 80 Managed Lanes.

8.7 System Integrators

CARTA will need to partner with a system integrator as part of I-80 Managed Lanes toll system development. A system integrator will be responsible for designing, installing, and operating the toll collection system on the I-80 Managed Lanes. System integrators provide two main functions: designing and installing the required toll collection system and communication equipment in the lanes and functioning as back-office system (BOS) provider, maintenance, ticketing and asset management.

8.8 California Toll Operators Committee

The California Toll Operators Committee (CTOC) is a collaborative organization of California's toll facility operators/owners, primarily concerned with developing protocols and resolving issues related to electronic toll collection (ETC) interoperability. CTOC is currently coordinating statewide efforts to change electronic toll collection protocols within California from those defined in Title 21, Chapter 16 of the California Code of Regulations (CCR), commonly referred to as Title 21, to those prescribed in International Standards Organization (ISO) 18000-63, commonly referred to as 6C, in accordance with national toll interoperability requirements introduced in the Moving Ahead for Progress in the 21st Century (MAP-21) Act that was enacted in 2012. The 6C protocols will apply to the toll collection system to be installed as part of the I-80 Managed Lanes.

8.9 California Transportation Commission

The California Transportation Commission (CTC) was established in 1978 by Assembly Bill 402 (Chapter 1106, Statutes of 1977) with the intent of establishing a single, unified California transportation policy framework. The Commission replaced and assumed the responsibilities of four independent bodies: The California Highway Commission, the State Transportation Board, the State Aeronautics Board, and the California Toll Bridge Authority.

The CTC's involvement with the I-80 Managed Lanes includes:

- Designating CARTA eligible to implement and operate the Yolo 80 Managed Lane Projects per the authority granted in AB 194. The CTC will need to approve the Caltrans toll facility application to operate the I-80 Managed Lanes, which is anticipated for 2029.
- Approving the programming of any state funds, if used to fund the I-80 Managed Lanes Project.

9 OPERATIONAL POLICIES

This section is intended to describe the operational policy considerations discussed with stakeholders as part of the Yolo 80 Managed Lanes Project (the "Project") ConOps process. CARTA will need to establish a wide range of operational policies prior to beginning Project operations. These operational policies will determine which vehicles will be allowed access to the managed lanes, which vehicles qualify for a reduced toll or toll exempt access, as well as the framework for determining and communicating the appropriate toll rate to travelers along the Yolo 80 Managed Lanes Project corridor. Operational policies will also dictate the type of in-vehicle equipment managed lane users will need to have, and the type of customer accounts that will need to be established to use the managed lane. The operational policies established by CARTA will influence the user experience of the Yolo 80 Managed Lanes Project and impact the traffic performance and revenue potential of the proposed facility.

It should be noted that this section seeks to capture options and considerations for operational policies discussed with ConOps stakeholders at the time of this writing. Operational policies will be further informed through concurrent T&R and Equity analyses, and further detailed later in project development. However, it should be noted that the intent is to maintain operational policy consistency with other regional managed lane corridors to the greatest extent possible, while also ensuring that the facility meets performance expectations, and the business rules align with all partnering agencies goals.

9.1 Hours of Operation

The Yolo 80 Managed Lanes will likely operate between 5am – 8pm, seven days a week. This tolling policy may be adjusted based on operations, traffic demand, and the policies of other regional express lane facilities. Policy consistency is important for minimizing driver confusion and help to maximize the efficiency of traffic operations and the overall performance of both Express Lanes and GP lanes.

Currently, MTC is analyzing weekend hours of operations for Yolo 80 Managed Lanes Project in Solano County. The policies of the Solano 80 Express Lanes may influence the final policies and business rules of the Yolo 80 Express Lanes.

9.2 Vehicle Eligibility

Vehicles eligible to use Yolo 80 Managed Lanes will be determined by Federal and state law, in addition to the business rules ultimately established for the facility. Vehicles eligible for Yolo 80 Managed Lanes access include two-axle vehicles, buses, and motorcycles. Whereas other vehicles such as trucks with more than two axles, school buses, and vehicles with trailers will be prohibited from accessing the Yolo 80 Managed Lanes per California law prohibiting these vehicles from traveling in the leftmost freeway lanes. Eligible vehicles with characteristics such as meeting established vehicle occupancy rates, transit vehicles, motorcycles, qualifying Clean Air Vehicles (CAV), emergency vehicles, and others may be able to travel in Yolo 80 Managed Lanes at either a reduced or no cost toll rate, as described in the following sections.

9.2.1 Toll Exempt/Discounted Vehicles

The pricing introduced by Express Lane facilities creates an opportunity to establish different payment classes based on overall goals of the facility. On Express Lanes, applied toll rates can vary for different users depending on policy priorities and the goals of the facility. For instance, policies can grant toll discounts or exceptions based on vehicle occupancy, vehicle type, vehicle classification, or other criteria. Express Lane facilities in California are required by law to offer discounts or exemptions to certain types of vehicles. Doing so can incentivize beneficial activities, such as carpooling, transit utilization, and the use of low-emission vehicles. However, they also have an impact on demand management capability, revenue, operations, customer service center systems, and enforcement. It is important to assess toll discounts or exemptions early during project development to evaluate the anticipated effects on the operational performance of the Express Lanes.

Given CARTA has goals regarding performance measures, equity, regional consistency, VMT, and financial sustainability, protocols for changing or updating these payment classes periodically will be considered. This practice can better enable the facility to meet desired goals, and result in better performance over time. This is further underscored by Federal Law 23 U.S.C. § 166, which requires HOV lanes that allow access by non-HOV's (usually by paying a toll) to meet minimum traffic performance standards. Specifically, if an HOV lane is determined to be degraded, steps must be taken to mitigate the issue within 180 days by increasing HOV lane occupancy, varying tolls on non-HOVs, discontinuing non-HOV use, or increasing HOV lane capacity. An HOV facility becomes degraded if it fails to maintain a minimum average operating speed of 45 mph, 90 percent of the time over a consecutive 180-day period during morning or evening weekday peak hour periods.

California statute dictates the following vehicles to be eligible for toll discounts and exemptions on Express Lanes.

- Qualifying HOVs
- Transit
- Motorcycles
- Clean-Air Vehicles (current regulations set to expire 2025)
- Qualifying Emergency Response Vehicles

9.2.1.1 High-Occupancy Vehicles

Vehicles meeting established occupancy requirements are eligible for toll-free travel per California Streets and Highways Code Section 149 (SHC § 149) and Title 23 of the U.S. Code, Section 166 (23 U.S.C. § 166). Caltrans is currently assessing a vehicle occupancy requirements on Yolo 80 Managed Lanes. T&R and TAR results identify that an occupancy requirement of HOV3+ to receive full discount will result in greater operational performance. However, it should be noted that the ultimate occupancy requirements for toll-free or discounted travel on Yolo 80 Managed Lanes will be finalized later in the project development process. The T&R analysis provides insights on impact of various HOV occupancy requirements on potential net-revenue, HOV degradation, and corridor performance. In addition to facility revenue and traffic

performance, consideration will also be given to the HOV occupancy requirements of other regional Express Lane facilities to offer customers a level of consistency between corridors.

9.2.1.2 Transit Vehicles

One of the primary goals of Express Lane facilities is to improve person throughput along the managed corridor. As such, public transit buses and paratransit vehicles as defined in California Vehicle Code Section 21655.5 (CVC § 21655.5) will be allowed free travel in Yolo 80 Managed Lanes at all times. 23 U.S.C. § 166 permits all over-the-road buses servicing the public to utilize toll facilities under the same rates, terms, and conditions as public transportation vehicles. Therefore, toll-free travel will be offered to all transit vehicles, whether publicly or privately operated. Future business rules will be established to determine whether buses will be recognized in the system through the use of non-revenue toll tags, or whether the tolling of transit vehicles would be preempted through some other back-office process.

9.2.1.3 Motorcycles

Motorcycles are eligible for toll-free travel in Express Lanes per CVC 21655.5(b) and 23 U.S.C. § 166. The Yolo 80 Managed Lanes will offer toll-free access to motorcycles. At the time of this writing, motorcycles are anticipated to require transponders to receive a toll exemption.

9.2.1.4 Clean Air Vehicles

CVC § 21655.9 and CVC § 5205.5 allows California certified clean air vehicles (CAVs) with decals issued by the Department of Motor Vehicles (DMV) to use Express Lanes toll-free or at a reduced rate. However, the statute does not mandate the rate of reduction. The CAV decal program is subject to authorization by FHWA and therefore could end sooner than specified in California law, which is currently set to expire on September 30, 2025, prior to anticipated Yolo 80 Managed Lanes commencement date.

It should be noted however that with the growing number of qualifying CAV vehicles on California roadways, many agencies are beginning to offer only minimal discounts for CAVs on Express Lane facilities. For instance, the Los Angeles Metro Board established its CAV discount policy in 2018 to provide a 15 percent toll discount for single occupant CAVs on all Metro Express Lanes facilities. Prior to that time, LA Metro provided toll-free access to all qualified CAVs utilizing the I-10 or I-110 Express Lanes. The OCTA I-405 Express Lanes project also intends to offer a discount or exemption to CAV vehicles with the appropriate decal. However, the amount of that discount has not yet been determined. Any CAV toll discount must consider the impact of the policy on potential Express Lane degradation.

At the time of this writing, CARTA intends to offer a toll discount based on CVC § 5205.5 as well as regional consistency with other express lane facilities in the Bay Area. However, the ultimate CAV toll policy will be determined later in project development, pending vehicle code regulations at the time of tolling commencement.

9.2.1.5 Exempt Vehicles

CVC 23301.5 provides toll exemptions on Express Lanes for emergency response vehicles traveling to or from emergency calls. On the Yolo 80 Managed Lanes, CARTA will need to establish agreements with the local emergency response agencies that will outline the

protocols associated with toll free access. Pursuant to CVC 23301.5, an emergency vehicle is exempt from any requirement to pay a toll or other charge under the following circumstances:

- The authorized emergency vehicle is properly marked (i.e., California Highway Patrol (CHP), Sheriff, Fire, Police, Ambulance)
- The vehicle is responding to an "urgent" or emergency call that does not include any personal, commuting, training, or administrative use.
- The driver of the vehicle determines that use of the Express Lane will likely improve availability, response, and arrival time to the emergency.

Many agencies also allow toll-free Express Lane access to vehicles associated with the exempt account of a public safety agency, mass-transit agency, or maintenance provider that serves the Express Lanes. Maintenance vehicles could include those utilized by Caltrans or their contractors performing maintenance activities on Yolo 80 Managed Lanes. These vehicles may be required to carry a transponder linked to a non-revenue account, or tolls could be screened out through some other back-office function.

9.3 Toll Payment and Declaration

Toll payments for the Yolo 80 Managed Lanes will be facilitated in part by electronic toll transponders. Transponder-based toll collection is a proven, accurate solution with relatively low transaction costs. Transponders used for the Yolo 80 Managed Lanes will need to comply with California interoperability standards for toll collection. Title 21 of the California Code of Regulations specifies the protocol for the exchange of transponder information for toll facilities in California. These transponders are branded as FasTrak® and can be used on any of the California toll facilities. The CTOC maintains toll interoperability throughout the state and has developed a plan to transition from the current Title-21 tolling protocol to ISO 18000-63 (known as 6C) protocol. The 6C protocol offers significantly lower transponder costs and is an established standard in the toll industry. 6C transponders come in a variety of forms including a transportable hard case form that allows for occupancy declaration and a non-removable sticker form (Figure 29). It is envisioned that the transition from the legacy Title 21 protocol to the new 6C protocol will be fully deployed by the time the Yolo 80 Managed Lanes are implemented.

Figure 29: FasTrak® Sticker Transponder

Consistent with the BAIFA, Alameda CTC, SMCEL JPA, and VTA Express Lanes, it is anticipated that the Yolo 80 Managed Lanes will require vehicles eligible for an occupancy-based toll exemption or discount to have a switchable transponder (Figure 30). Switchable transponders provide the benefit of allowing drivers to self-declare their vehicle occupancy rate, thereby

eliminating the need to provide declaration lanes for qualified HOV vehicles such as the 91 Express Lanes facility. Vehicles traveling with a switchable transponder set in a high-occupancy setting will be detected by the toll system and the appropriate toll discount will be applied.

Figure 30: Switchable Transponder

Public outreach and coordination other regional operators will be required to ensure that holders of "legacy" FasTrak® electronic transponders without the occupancy declaration switch are well informed about the requirement for a switchable transponder for free/discounted access to the Yolo 80 Managed Lanes.

Future business rules will define how discounts are applied in unique situations, such as if users switch their occupancy declaration mid-trip, or if multiple transponders are detected. For example, if a customer is read as a single occupant vehicle (SOV) at one toll point, then HOV3 at another toll point within the same trip, the business rules will determine which tag setting holds priority. In the scenario where more than one transponder is read in a single vehicle, business rules will define the hierarchy to be used for payment or the application of discounts.

Vehicles using the Express Lanes without a transponder will be detected by license plate recognition (LPR) cameras. If there is no account associated with the license plate, then the license plate will be matched to the address of the vehicle's registered owner for issuance of a license plate toll bill to collect the toll payment. In practice, an additional fee or surcharge may be applied to license plate tolls to account for the required license plate image review, vehicle registration review, and billing functions. Yolo 80 Managed Lanes policies concerning potential surcharges for license plate tolling, and toll violations for non-payment will be defined by future business rules of the facility.

License plate tolling will make the Express Lanes available to more users, but it increases the risk of potential congestion and higher tolls on the Express Lanes, revenue leakage due to unidentifiable plates or registered owners, and longer periods of time to collect toll revenue.

The option for vehicles to access Express Lanes and pay a toll via LPR image capture, without the use of a transponder, is used on several facilities throughout the country. Due to the additional costs associated with image review and payment processing, this toll payment option typically includes a license plate surcharge in addition to the base toll rate applied to the vehicle. This option is currently being implemented by LA Metro as part of the "Pay-as-You-Go" program on the I-10 and I-110 Express Lanes. The system will bill the registered vehicle owners

without transponders for their toll plus an additional $8.00 administrative fee. Vehicles using the pay-by-plate tolling would not be eligible for any toll exemptions or discounts.

Other toll payment and declaration options should be monitored as the Yolo 80 Managed Lanes advances further in project development. Smartphone applications are used by multiple agencies throughout the country outside of California to declare vehicle occupancy. Using these tools, a vehicle preregisters for a qualifying HOV trip on an application linked to a preexisting account. There are various ways to verify occupancy status using these tools, including user submitted time-stamped photos of the vehicle interior, or the proximity of multiple smart phones with activated smart phone applications within the same vehicle. These emerging technologies may be integrated into future California Express Lane operations.

9.4 Pricing and Toll Rates

Another important aspect for consideration as part of the Yolo 80 Managed Lanes Project is the preferred pricing model. Express Lane projects throughout the country have showcased multiple pricing mechanisms, including time-of-day and dynamic pricing, as well as other considerations such as zone pricing, and differentiated payment classes. These different models are summarized below.

9.4.1 Traffic Performance Thresholds

Performance requirements set forth in Federal Law 23 U.S.C. § 166 consider a managed lanes facility to be degraded if it fails to maintain an average operating speed of 45mph for 90 percent of the time over a consecutive 180-day period during morning or evening weekday peak hour periods.

The primary goal of pricing will be to ensure adherence to the performance requirements. Pricing will consider a combination of traffic performance thresholds to determine the toll price, such as Express Lane speeds, GP lane speeds, Express Lane volume, GP lane volume, Express Lane density, GP lane density and Express Lane capacity. Specific performance standards will be developed further during future project development. However, at the time of this writing, it is anticipated that CARTA will establish an average speed performance threshold, such as 55-60 mph, to guide the development of business rules and operating policies.

9.4.2 Pricing Model

To effectively manage congestion and utilize facility excess capacity, the Yolo 80 Managed Lanes will use a time-of-day (TOD) zone-based pricing model. Toll rates will be assessed and adjusted periodically to manage varying time of day and seasonal traffic demand in the Express Lanes. Toll rates are calculated for each toll zone, which is the smallest unit of pricing in a corridor and constitutes the distance between a consecutive entry and exit point. See Section 5.3 for proposed toll zones.

If necessary, toll operator staff can manually override the pricing by changing the toll or reverting to HOV-Only mode when conditions warrant (e.g., for incident management and

routine maintenance). Manual overrides may also be required when there are discrepancies between what a driver may see on a pricing sign versus what is charged in the Host. This can occur when there is a communications failure between the Host and Roadside equipment where real-time pricing information is not transmitted or received in time. CCTV monitoring and system alerts are used to inform toll operator staff of these instances.

Toll rate setting requires careful consideration and analysis to implement prices that will effectively manage traffic demand. Time of day patterns will be informed by roadside vehicle detection equipment which provides speeds, volumes, and capacity metrics. Any changes to toll rates and toll setting procedures will be approved by CARTA.

Time-of-day or variable pricing operates based on a predetermined schedule that adjusts toll rates to reflect levels of congestion typically experienced in the Express Lane corridor. Tolls for time periods with higher levels of congestion are set to be higher than tolls for less congested periods. Time-of-day tolls can vary based on direction, day of the week, and hour of the day. Toll schedules for facilities with time-of-day pricing are typically posted on the operating agency's website so that customers can make informed decisions before traveling. Time-of-day pricing is currently used on the 91 Express Lanes and is planned for use on the I-405 Express Lanes in Orange County. Time-of-day pricing is also in use on Express Lanes in the Denver and Houston areas. Although this method provides price certainty and predictability for drivers, it tends to function best on facilities with a low degree of variability in traffic conditions. The most effective applications of this method involve a system for monitoring and adjusting toll rates over time. On the 91 Express Lanes, performance is monitored daily, with evaluation and adjustments to pricing made every three months.

The use of a dynamic pricing system continues to be explored as an alternate pricing model. Dynamic pricing responds to real-time traffic conditions, offering flexibility for toll adjustments. Widely employed, including in northern California express lanes, it actively manages demand during non-recurring congestion but requires extensive staffing and monitoring due to proprietary algorithms.

9.4.3 Minimum/Maximum Tolls

With the assumption of the use of dynamic pricing for the Yolo 80 Managed Lanes, CARTA will need to have the capability to establish a minimum and/or maximum toll rate. The purpose of minimum toll rates is to ensure that the costs of operations and maintenance are covered when traffic demand is low. Additionally, a minimum toll rate may be applied to ensure a particular level of service for Express Lane customers during all times of day.

Maximum toll rates are a price cap for a toll zone that is put in place to ensure that toll rates do not grow to the level of triggering public or political challenges. Policy makers should evaluate and make periodic adjustments to any maximum toll rate to account for changes in the ability to maintain operating conditions as demand grows. Minimum and maximum toll rates can be consistent for all zones within the facility or can vary depending on length and zone value.

It should be emphasized that the intent of Express Lane pricing is to manage demand for the facility. If a zone within an Express Lane reaches a maximum toll and is experiencing degraded conditions for an extended period, the maximum toll price is no longer effective in congestion

management. In this scenario, CARTA may consider a policy that would revert the HOT lanes to "HOV only" until overall demand returns to a manageable status.

9.4.4 Use of Project Revenue

California law requires that toll revenues generated from Express Lanes be reinvested in the corridor from which they were generated. Toll revenues generated on Yolo 80 Managed Lanes will first be used to pay for the cost of operations, including roadway and equipment maintenance, administration, toll collection, customer service, CHP enforcement, and Freeway Service Patrol (FSP).

As described previously, the T&R study results will be used to help inform future operational policies and business rules. The revenue forecasts and cost estimates generated through the T&R and PA&ED processes will be used to prepare an expenditure plan that will assess the use of Yolo 80 Managed Lanes revenues for considerations such as debt repayment for capital construction costs, operation and maintenance costs, corridor improvements, transit services, equity-based toll programs, VMT growth mitigation programs, and other net-excess revenue priorities.

CARTA, as the owner of the facility, will assume liability for the express lanes, and ensure sufficient funding for the routine maintenance, operation, rehabilitation, and replacement of express lanes infrastructure (to be funded by toll revenue when possible). CARTA will define and identify the needs to be addressed in the expenditure plan to address ongoing operations and maintenance costs. CARTA will also develop and implement an expenditure plan for any net excess revenues generated. Net excess revenues could be used for other projects or programs that maintain or improve the safety, operation, or travel reliability for any transportation mode in the corridor or provide or improve travel options in the corridor. Net excess revenue could be used to fund an equity program, should CARTA wish to pursue one.

9.5 Equity

Partnering agencies will develop an equity program that seeks to maximize benefits and minimize burdens of the project for those who experience high transportation burdens and other disparities. Key steps will include:

- Conduct an Equity Study to analyze the individuals who experience high transportation burdens in the project area and potential measures to reduce those burdens.
- Establish an Equity Program Advisory Committee comprised of local stakeholders with lived experience of transportation burdens, state and national experts in transportation equity, and other key stakeholders that meets regularly to shape the Equity Program.
- Leverage work from equity framework development and gather available data to establish a baseline/existing condition for transportation equity in the project area.
- Work with trusted Non-Governmental Organizations (NGOs) and community-serving organizations to survey targeted populations/communities about their transportation options and needs, awareness and impressions of tolled lanes and suggestions for needed transportation improvements.

- Review existing transportation equity programs, particularly tolling equity programs, and conduct literature review to identify best practices. Examples include SM101 Equity Program, MTC EL START Program, and LA Metro Low-Income Assistance Plan.
- Develop potential options for transportation equity program including options for "in-lane" programs (such as tolling discounts and transit improvements that utilize the lane) and "out of lane" programs (such as traffic calming in neighborhoods adjacent to the freeway).
- Solicit input from advisory committee, community-serving organizations, partners and key stakeholders on equity program options and evaluation criteria.
- Conduct final evaluation and prepare draft final Equity Program.

The framework for incorporating principles and practices of transportation equity into all aspects of Tolling Advance Planning process. The framework will be one of the first phases of work conducted in this scope, and will identify a set of core values, guiding principles and implementation practices to be carried out by all staff and consultants working on the project. Implementation practices may include:

- Equity trainings for all project staff and consultants.
- Briefings for decisionmakers, staff and consultants on the historical and present-day disparities that exist in the project area and how they relate to the project.
- Engaging experts in transportation equity to participate in drafting and/or review draft work products.
- Soliciting input from equity experts as well as those with lived experience in the local area on scopes of work, proposed analyses and sources of data that would best illuminate potential disparities, benefits, and burdens.

9.6 VMT Growth Mitigation Strategies

As documented in Section 7, the proposed project alternatives indicates that adding capacity, for both tolled alternatives and non-tolled alternatives would result in some level of net VMT growth over time from the induced demand. Meanwhile the NCST calculator indicates a reduction in VMT long term. The traffic operation analysis proves that the managed capacity addition with tolling contributes to the bottleneck throughput relief, corridor travel time reduction and deficiency operation reduction. To mitigate the VMT growth, the following strategies will be considered and analyzed through the study:

- Carpool and vanpool incentives, plus enhanced mobility hub to encourage travelers to increase vehicle occupancy (Alternatives 3, 4 and 5)
- Dynamic pricing strategy to control the Express Lane usage to reduce the overall travel demand on the corridor (Alternatives 3, 4 and 5)

Specific efforts are being incorporated in the project or under consideration as VMT mitigations efforts with the local agencies that align with CAPTI include:

- Voluntary Trip Reduction Program in Yolo County (Expand current program provided by Yolo Commute, to include features such as community-based travel planning, ridesharing, transit pass subsidies, and pay-per-mile auto insurance.)
- Expand Capitol Corridor Frequency between Oakland and Sacramento
- Microtransit in Yolo County (Expand transit service to add flexible route buses with more frequent service and/or longer service hours.)
- Subsidize Monthly Transit Passes in Yolo County
- Reduce Transit Fares (Reduce the monthly bus fare for Yolobus and Capitol Corridor)
- Expand Causeway Connection Route 138
- Expand Unitrans

The identified VMT reduction strategies and mitigation measures summarized above are proposed to be implemented within the project corridor, where applicable, or to be included in future improvements within the corridor. It should be emphasized that potential mitigation measures associated with the Build Alternatives are preliminary at this time as the true extent of required mitigation has not yet been confirmed. Future agreements and/or further design engineering refinements may also change the mitigation measures recommended for implementation along with the Yolo 80 Managed Lanes.

10 TECHNICAL REQUIREMENTS

The Yolo 80 Managed Lanes Project will require tolling hardware, software, and communications equipment to establish an electronic toll collection (ETC) system. The ETC system allows for tolling facilities to operate as Open Road Tolling (ORT) within the defined ROW. The system includes Roadside Equipment that collects transactional data, a Toll System Host that processes this data into trips and applies pricing, a Traffic Monitoring System and Traffic Management Center to monitor the Express Lanes and related traffic performance, Customer Service functionality to manage accounts and assist patrons, a Back-office System to manage the trip transactions, invoices, violations, and manage revenue, and managed lane lighting and power system to enhance safety and reliability. System details and requirements are described in the following sections.

10.1 Electronic Toll Collection

The Yolo 80 Managed Lanes will utilize an ETC system to identify vehicles travelling in an Express Lane, read a transponder, photo detect a vehicle QR tag or take pictures of the license plates associated with a vehicle for identification purposes, and bill the vehicle a calculated toll rate based on where they enter and exit the system. The ETC system will be developed and procured from a Toll System Provider, and it will utilize roadside equipment and automatic vehicle identification (AVI) and violation enforcement systems (VES) to detect users and a toll system host to process data and assemble toll transactions; a Toll System Host that will process data and calculate rates; a Traffic Management Center to monitor performance; a Customer Service Center (CSC) to assist customers with account management, and a back-office system for financial reconciliation.

The Yolo 80 Managed Lanes system will operate as an ORT facility which lets vehicles travel at freeway speeds without needing to stop to collect tolls. The system uses Radio Frequency Identification (RFID) and/or photo detect read a toll tag linked to an account to collect tolls, or high-speed cameras to capture images of license plates. If the customer's account has their license plate noted, the image of their plate gets posted to their account. Otherwise, the license plate image is processed, and the plate is looked up via DMV records and an invoice or violation notice is sent to the vehicle's registered owner.

Toll evasion and occupancy enforcement is handled by CHP, who visually inspect the number of passengers in the vehicle and reconcile against a beacon light indicating declared occupancy. Drivers can declare vehicle occupancy via a switchable toll tag, or potentially via back-office declaration or app usage or automatic vehicle occupancy detection in the future. This system is described in detail below.

10.2 State and National Interoperability

The CTOC was established to create interoperable tolling guidelines within the state of California and has led the development of technical specifications. As the primary resource for interoperability and coordination among existing tolling facilities, CTOC provides guidance on

technology, operating policies, legislation, and regulations regarding the operations and implementation of toll facilities in California.

Effective January 1, 2019, California Code of Regulations adopted the ISO 18000-63 (referred to as 6C) protocol for AVI, which requires state toll facility operators to follow functional specifications and standards for ETC. CTOC developed a transition plan for the replacement of legacy Title 21 protocol with the 6C protocol. All California toll agencies that utilize AVI technologies are required to discontinue supporting Title 21 protocol on January 1, 2024, unless this date is extended. It is expected that by the time the Yolo 80 Managed Lanes project begins operations, Title 21 will have fully transitioned out and 6C protocol will be the standard protocol for transponder transactions in California.

In addition to state interoperability guidelines, there are set of business rules and requirements that agencies must maintain to be recognized as nationally interoperable. These business rules include, but are not limited to, marketing requirements, account requirements, reconciliation requirements, data interchange requirements, reporting requirements, performance requirements, fees, and testing requirements. The International Bridge, Tunnel & Turnpike Association (IBTTA) has developed business rules for National Interoperability (NIOP) standards and describes how toll transactions and toll information is exchanged between four participating regions and local hubs. These business rules were adopted by IBTTA in May 2023 and should be reviewed periodically as updates are made to ensure compliance.

10.2.1 Transponder Characteristics

The Yolo 80 Managed Lanes will require customers to have a switchable toll tag to receive carpool discounts. Toll payments can be made via transponder or license plate toll. All transponders will come branded with the FasTrak® logo and will be provided by the toll services provider/CSC. Since Title 21 protocol will likely be obsolete at the time of opening, the transponders distributed will follow 6C protocol or other future standards. Unlike Title 21 protocol, 6C RFID transponders draws its power from the roadside reader and does not require an internal battery inside the transponder housing, making it lightweight and more cost effective. The Yolo 80 Managed Lanes facility may distribute both sticker tags and switchable tags for use within the system. Customers must have a switchable transponder to declare that they meet occupancy requirement and receive toll discounts; otherwise, trip will be charged at single occupant toll rates.

10.3 Toll Operations Overview

Toll operations are achieved through a combination of solutions and technologies to ensure optimized travel times through the toll facility. The Yolo 80 Managed Lanes will use Time-of-Day (TOD) pricing to achieve this goal. Dynamic pricing allows toll rates to fluctuate based on real-time traffic conditions. The following equipment and functions are used to support the toll operations and price travel correctly:

- **Roadside Equipment:** All the devices, structures, infrastructure, and networking installed at each read point to collect vehicle, lane occupancy (density), and speed data

to identify a vehicle, read a toll transponder, and capture an image of the vehicle license plate.

- **Toll System Host:** The central database that receives data from roadside equipment at the different toll zones and assembles transactions recorded at each zone into a single trip, known as "trip building."
- **Traffic Management Center (TMC):** The command center for traffic operations and coordination of activities associated with incident management. Real-time information is sent to the TMC for proper price monitoring, overrides, and emergency response.
- **Customer Service Center (CSC):** The location and service that provides all customer interfaces required to operate an Express Lanes facility. With the CSC, customers can create and manage their individual accounts, and can receive assistance from CSC staff with issues they may encounter.
- **Back-office System (BOS):** The software and hardware solution that receives roadside data and process it into financial transactions to bill customers. The BOS serves as both the system of record for these financial transactions, and the interface for customer service functions.
- **System Maintenance:** The functions required to keep the ETC Roadside equipment, Toll System Host, and all related hardware and software working properly to ensure system availability and accuracy.
- **Other Interfaces:** All the connection points to the toll system to share relevant data in a compliant manner.

Figure 31 below shows the basic toll System Architecture.

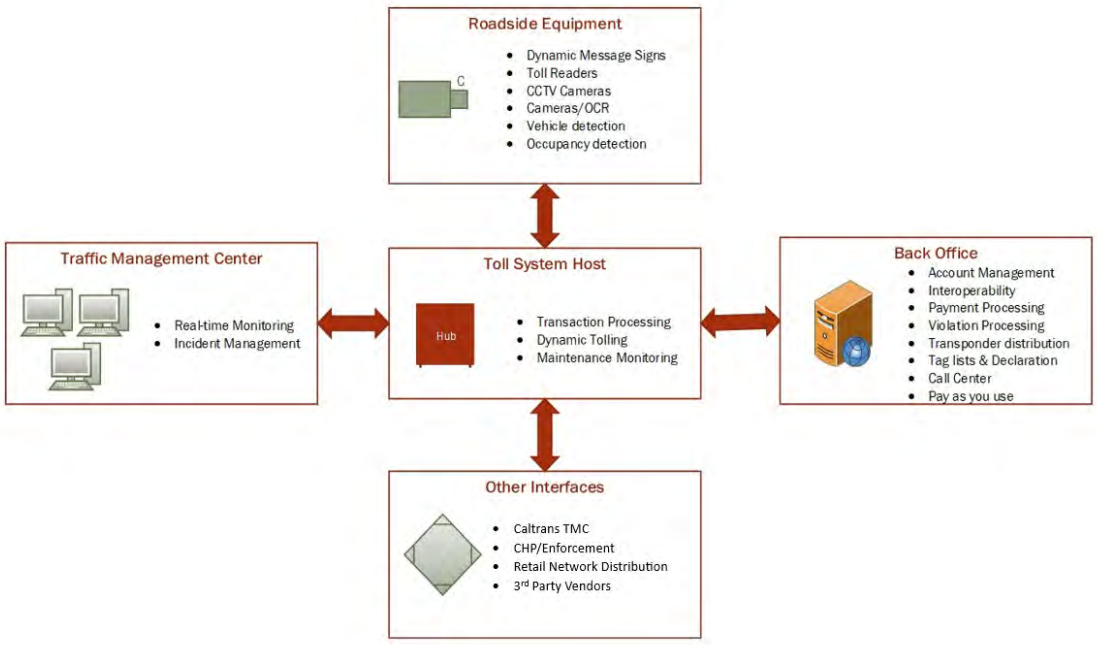

Figure 31: Toll System Architecture

10.4 Roadside Equipment

The Yolo 80 Managed Lanes will utilize various sets of roadside equipment at each of the including tolling points to detect vehicles, identify them, build trips, and record information for violations as they pass through a toll zone. The equipment includes transponder readers and high-speed digital cameras to verify transactions, read license plates, and automatically collect tolls from customers as part of an ETC program. Other elements will include Express Lanes pricing signage, complete CCTV coverage of the entire Express Lane facility to support safety and operations, power service, and communications linking the electronic infrastructure to a centralized toll operations office. Information must be captured and processed in real time so that traffic conditions can be closely monitored, and pricing accurately calculated.

ETC equipment will be installed in the lane median and on overhead gantries or sign structures. Placement of toll points were determined based on physical geometry, the provision of power and communications, existing signs and infrastructure, dedicated ingress and egress locations, and direct connectors and access ramps. While the placement and function of each of these subsystems can vary based on the technology used and the provider, the vehicle identification equipment and license plate readers are typically installed overhead per lane.

10.4.1 Toll Zone Equipment

Toll zone equipment is required for relaying real-time traffic operations data to the Toll System Host for ETC. However, beyond the direct connection and data flows between roadside equipment the Toll System Host, the ownership and maintenance of roadside equipment is also typically linked contractually to the Toll System Host. These contractual obligations are often combined since it is common for a single Toll System Integrator (TSI) to install and maintain both the roadside equipment and the Toll System Host. Figure 32 describes a typical configuration of roadside equipment.

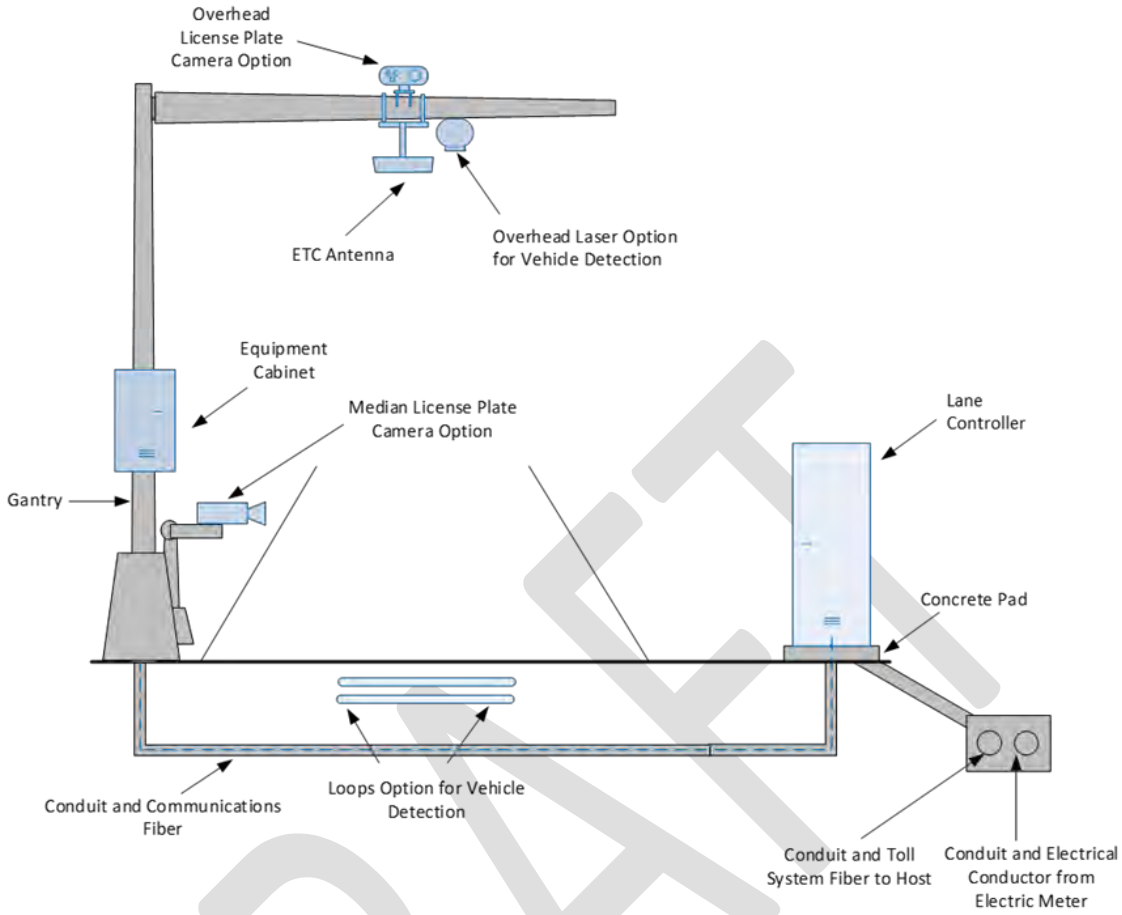

Figure 32: Roadside Equipment Detail

The following descriptions provide a brief overview of the function of each equipment type:

- **ETC Antenna** – RFID technology used to read toll tags. Unique toll tag IDs are used by the back-office to build trips and charge tolls automatically.
- **Overhead or Median License Plate Cameras and Illuminators** – License plate reader triggered as vehicle passes under gantry. License plate images collected in this manner are visually confirmed in back-office processes and used to issue tolls and/or violations for users without toll tags.
- **Gantry** – Overhead structure onto which electronic toll collection system components (e.g., toll reader, radars, cameras, antenna, beacon) are mounted.
- **Overhead Laser Option for Vehicle Detection** – Technology options to trigger camera or classify vehicle types.
- **Conduit, Communications Fiber, and Electrical Conductor** – Conduit conducts fiber connections that provides real-time communications from roadside equipment to Toll System Host and electrical conductor for power. This requires coordination/permitting/easements to tap into existing utilities.

- **Lane Controllers** – Critical link and interface point between the lane peripheral equipment and the back-office Toll System Host computer system for each toll point. These are typically servers configured for outside environments.
- **Cabinets** – Enclosures for accessible read point equipment, including lane controllers.

Additional critical system components not depicted include:

- **Variable Toll Message Sign (VTMS) –** Overhead pricing sign with LED panels to communicate Express Lane toll rate to motorists. Placed before all points of entry into the Express Lanes.
- **Traffic Monitoring Station (TMS) –** Detector that measures traffic conditions in all lanes. Used to inform dynamic pricing system of speeds, volumes, and densities both on the Express Lanes and GP lanes.
- **Network Peripherals –** switches and media converters necessary for the communications network.
- **Closed Circuit Television (CCTV)** – Allows remote viewing real time footage to monitor lane operations and incident response.
- **Uninterruptable Power Supply or Generators –** Battery backup in case of power failure.
- **Heating, Ventilation, and Air Conditioning (HVAC)** – Fan/cooling for equipment in roadside cabinets (depending on solution).

10.4.2 Pricing Signs

As described in Section 5.6, pricing signs will be placed upstream of the start of the Express Lanes and downstream of on ramps, or on the on ramp, to ensure that customers are informed of the toll rate prior to entering the express lane facility. The pricing signs will be overhead electronic signs that will consist of dynamic message panels installed within a static sign.

The pricing signs will also display messages related to the status of the lanes, occupancy requirements, or incident management. Express Lane operators at the TMC will be able to implement manual overrides in the event of an incident, maintenance, or price adjustment. CCTV cameras will be placed upstream of pricing signs to always ensure TMC visibility.

Pricing signs will be connected to roadside controllers that receive real-time data communications from the Toll System Host through the backhaul fiber connection. Pricing will be updated based on this real-time data as defined in Section 10.5.1 , and new prices will be distributed to the pricing signs per a system configurable time interval.

10.4.3 Occupancy Declaration Systems

The Yolo 80 Managed Lanes will utilize a self-declaration occupancy system utilizing switchable tags. Before beginning their journey, drivers select the number of occupants in their vehicle using the appropriate designation on their switchable tag to declare occupancy and to receive the corresponding toll rate. Occupancy enforcement occurs with the combination of visual inspection by CHP to verify that the occupancy matches a beacon light triggered at each read point that corresponds with the switchable tag setting selected.

The toll system procured should be flexible and can accommodate future occupancy declaration and detections systems. Some systems that are being developed or are in pilot phases including app-based declaration systems, camera-based automated detection systems, and other methodologies such as infrared or heat-based systems. Additionally, the system should also be flexible to accommodate back-office declaration schemas, where a customer may temporarily designate occupancy in conjunction with a 6C sticker tag.

10.4.4 Monitoring and Data Collection Equipment

Various Intelligent Transportation System (ITS) sensors and equipment will be utilized in both the Express Lanes and GP lanes throughout the corridor to monitor corridor performance and operations. The equipment detects vehicles and provides information on traffic volume, density (lane occupancy), and speed. This data will also be used to calculate the dynamic price that is displayed on the pricing signs. Traffic monitoring stations and roadside vehicle detection equipment will be installed and connected to the TMC to monitor real-time conditions, and to coordinate response actions with CHP, Caltrans, the Toll System Provider, and other third parties as needed.

Various hardware and technologies are available for vehicle detection and can be mounted overhead along with the AVI and license plate readers, in pavement, or side mounted. CCTV cameras capable of pan/tilt/zoom functions will also be utilized to provide a full range of visual coverage on the Express Lanes, as shown Figure 33 below. The location of CCTV cameras will be dependent on the placement of toll points and known bottleneck locations on the facility. They may also be used to allow for visual confirmation of signs displaying toll rates. The CCTV cameras can be mounted on the same structures as other roadside equipment or on separate poles depending on the need.

Figure 33: Example Pan/Tilt/Zoom CCTV Camera

10.4.5 Communication Network Equipment

The Yolo 80 Managed Lanes system will utilize a fiber optic communications network to connect all roadside equipment to the Toll System Host, the TMC, and CSC. This is also referred

to as the backhaul network. Caltrans will be responsible for installing and maintaining this backhaul network up to the points of demarcation with the toll equipment, but the TSI will be responsible for monitoring the network status and health, as well as reporting any system issues to Caltrans or its designee for corrective action.

Roadside system devices are connected to the trunk line of this network by fiber optic laterals. Ethernet is typically used for short runs communicating devices with roadside cabinets, though media converters may be required if the equipment is outside of ethernet distances. Any copper or coaxial connections (typically between readers and antennas) are usually within a 100 ft cable run. Switches and routers for Layer 2 and Layer 3 communications complete the basic network set up. Wireless or leased communications are sometimes used for some, or all read point locations or communications hubs to serve as a redundant method of communications.

The network for the Yolo 80 Managed Lanes system must have high uptime and reliability. As such, redundant networks should also be installed. This could include secondary fiber networks in different conduits or alternate routing paths through secondary switches, wireless connections, or stand-alone functionality if communications lines are unavailable. This reduces or eliminates single points of failure.

In addition to efficiency and redundancy, security is a priority for the communications network. For overall security, switches typically support remote access and terminal access systems using a secure shell protocol. Logical topologies such as VLAN (Virtual Local Access Network) and VRF (virtual routing and forwarding) commonly implemented in these networks to reduce congestion also provide an additional security benefit.

10.5 Toll System Host

The TSI develops and provides the Toll System Host (also called the Operational Back-Office, or OBO). The Host is a central database that receives data from roadside equipment at the different toll zones and assembles transactions recorded at each zone into a single trip, known as “trip building.” The Host also reconciles license plate data and sets toll prices through time-of-day schedules or dynamic pricing algorithms. It also serves as the interface for reporting, controls the lane or zone controllers that are deployed along the toll facility, and provides roadside equipment monitoring, maintenance ticket tracking, and traffic performance monitoring.

Because the Host is a critical system, it is usually deployed in a redundant manner for business continuity. The Hosts can be set up as a primary and secondary configuration where the secondary is activated when the primary loses functionality, or in an active-active configuration where data is sent to two separate hosts simultaneously so that either can become the “primary” at any given time without any loss of data.

Redundant Hosts should also be deployed with physically separated geographies so that a disaster in one location does not impact functionality of the other host deployed in a different location. Additionally, many toll agencies are requesting Host functionality that is cloud-based. This reduces the reliance on physical infrastructure deployed at the toll agency’s property and

allows the system to use distributed networking and computational power to increase scalability and reliability. However, this may increase monthly hosting and communications costs to have a cloud-based solution that offers greater flexibility and faster disaster recovery.

10.5.1 Trip Building

Trips are formed and charged based on the collection of traveled zones within an entry and exit to the corridor in the same direction of travel within a reasonable travel window. To ensure the customer does not incur duplicate trips or is overcharged, business rules will be in place that the toll system applies to minimize the frequency of such cases. Charged toll rates are locked with the start of the trip when a vehicle is detected at the first toll zone.

10.6 Traffic Management Center

The Caltrans District 3 TMC is in Rancho Cordova, CA and staffed by Caltrans operators as well as representatives from the CHP. It serves as the command center for traffic operations and coordination of activities associated with incident management in District 3. The TMC will provide real-time traffic data to operators and have a configurable video wall to display live feeds from CCTV cameras and other traffic management tools.

The TMC will coordinate with CHP officers on the scene of the incident and other involved parties to assist in the dispatch of Caltrans maintenance resources, emergency vehicle response and towing services as required. Incident management procedures will be defined and documented, so that a guidebook is available when incidents occur in the toll facility.

Typical TMC activities include:

- Incident logging and reporting
- Performing manual overrides to support congestion and incident response lane modes
- Assisting Caltrans and maintenance personnel during lanes closures and incidents,
- Coordinating with CHP personnel
- Conducting bulk trip transaction adjustments and corrections, such as during lane closure

10.7 Customer Service Center

The CSC provides all customer service activities required to operate an Express Lanes facility. The CSC receives trip transactions from the Toll System Host and becomes the customer interface for those transactions and charges. The CSC should offer at least one physical office to assist patrons in person, a toll-free telephone line to assist patrons via phone or interactive voice response (IVR) system, and web interfaces for self-help. The CSC is responsible for the following:

- Phone calls
- Walk-in center support for face-to-face interactions
- Toll tag distribution
- Account management

- Violation disputes
- Online touchpoints (chat, email, mobile app)
- Operational reporting
- Mail house functions

The CSC typically operates during normal business hours and is staffed with personnel who are trained about the program and customer service. Customers can use the customer service centers to open accounts, close accounts, acquire transponders, make payments, and resolve violation disputes, amongst other services related to their accounts. A toll-free number is provided for customer service and account management functions. The call center utilizes an IVR system to route customer calls and aid in account management, payments, and customer support.

A website will also be developed where individuals can access information about the program. The website also offers customers the opportunity to manage accounts, make payments, and contact customer service. Mail service is provided for enrollment, payment, transponder distribution, and violation resolution. The CSC functions can be performed in-house by JPA staff or contracted out to a third-party provider or other public toll agency.

10.7.1 Cash Payment Locations

In addition to online account management that requires an Express Lane customer to have a valid credit card or active bank account, the Yolo 80 Managed Lanes are also anticipated to allow cash-based payments. This accommodation would allow Express Lane customers to replenish FasTrak® accounts, make payment for license plate tolls, or resolve violation notices in person with cash. These payments could be made at the physical CSC facility anticipated for implementation near the Yolo 80 Managed Lanes. In addition, CARTA may establish partnerships with nearby retailers to provide additional opportunities for cash-based toll payments. As an example, MTC and Golden Gate Bridge Highway & Transportation District (GGBHTD) maintains partnerships with many participating retail and grocery store locations throughout California. Cash Payment locations for Bay Area tolls can be found here: https://www.bayareafastrak.org/en/tolls/cashLocationsMap.html

Accommodating cash payments in this manner would further Yolo 80 Managed Lanes equity goals described in section 9.5.

10.8 Back-Office System Functionality

The Back-Office System (BOS) receives roadside data and process it into financial transactions to bill customers. The BOS serves as both the system of record for these financial transactions, and the interface for customer service functions, whereby customers can manage their individual accounts, and as the system where the CSC can access account and transactional data to assist customers. BOS functions can be performed in-house by the tolling agency using the Toll System Integrator's software, contracted out to the Toll System Integrator or other third party, or performed by a partnering toll agency and their BOS through an operational

agreement that details responsibilities, integration touch points, costs, and revenue reconciliation functions. Core BOS functionality is described below:

- **Account Management:** The account management functions cover the methods by which customers open, replenish, and close accounts, as well as link license plates and transponders for their vehicles. The system also assesses fees and credits, processes customer statements, records reciprocity with other agencies, and allows for troubleshooting and customer support.
- **Customer Service Interfaces:** This includes all the ways in which a customer interacts with the toll system operator, including telephonic access for live support, Interactive Voice Response systems, website access to the customer-facing account management system, and access through mobile apps.
- **Financial Accounting:** Financial accounting includes the processing and reconciliation of all customer payments, fees and credits, and reconciliation of fees and revenues against system transaction records.
- **Payment Options:** Most electronic toll collection accounts are automatically linked to credit or debit cards, or to a customer's bank account for the automatic payment of tolls. Payment by check or cash will be supported.
- **Violation Processing Management:** Violations are assessed when a customer does not properly pay for tolls within a predetermined amount of time. Violations are assessed in addition to the original toll amount. Violation processing includes the full life cycle of violations, reviewing system-read license plates, obtaining names and addresses from the DMV, printing and mailing notices, processing payments, reconciling financials, and administering appeals. Violation revenues are typically recognized after the expected revenue from the original toll amount, in some cases can take months or years to collect, if they are collected at all. Aging and write-off policies must be determined for adequate tracking of these revenues. Performance measures would include accuracy of reviewed images and notices, timeliness of invoicing and payment processing, and timeliness of vehicle owner identification.
- **Transponder Inventory Management**: This function includes transponder orders processing, distribution, activation, and replacement. Inventory management and adequate warehousing and distribution space must be provided to support these functions. Operational support for the distributing inventory to third party retail outlets is also required.

10.9 System Maintenance

The ETC Roadside equipment, Toll System Host, and all related hardware and software must be properly maintained to ensure ETC system functionality and accuracy. All hardware and physical components will be asset tagged and logged into a maintenance system for tracking, repair status, and replacement. The Toll System Integrator will also track and record software and firmware versions, the dates of any updates, and software license information. Maintenance coverage will be required 24/7. If lane closures are required to address any issues with equipment deployed in the field, they will be conducted in a way that minimizes any

impacts to traffic and should be scheduled after hours or outside of peak commute times when practical. The Toll System integrator will notify Caltrans and CHP of any needed closures as soon as possible, and any lane closures will comply with Caltrans Standard Plans and Standard Special Provisions for Temporary Traffic Control Systems.

CARTA will be responsible for maintaining all physical structures related to the toll systems, as well as providing power to each toll point, on its own, through an agreement with Caltrans, or through a third-party contract. While Caltrans will have the responsibility to install the communications network infrastructure, the Toll System Integrator (TSI) will be responsible for monitoring communications network performance and maintenance of all switches and other communications equipment delivered as part of the toll system once installed. The TSI will work to ensure the ETC system is fully functional and monitored and restored when network issues arise. Prior to opening the Express Lanes, maintenance requirements will be developed and will specify appropriate thresholds and penalties if requirements are not met.

10.10 Other System Interfaces

External coordination between the ETC and other systems is needed to support the tolling operations, either directly or indirectly. The full extent of these services is not known, but the following interfaces have been identified and should be anticipated.

- **Traffic Management Center**: Providing data feed from the CCTV cameras installed as part of the toll facility will allow Caltrans TMC operators to observe and monitor traffic performance within the corridor. Caltrans operators have capabilities to identify issues/incidents, dispatch resources, and alert motorists of issues. Any additional data sharing/integration needs agreed upon by both parties will be also established.
- **California Highway Patrol:** CHP enforcement officers will require user information during enforcement activity. Account information (identification and status) will assist in the determination of violations and potentially reduce the length of time of on-road investigations.
- **Retail Network Distribution**: Depending on the distribution model, a third-party ordering and inventory management system may need to be developed. This system should track the number of toll tags ordered and sent, the amount of funds collected for any deposits, and any commissions paid.
- **Third Party Vendors**: Providing open-source data regarding toll rates, travel speed, and occupancy requirements will allow third-party vendors, such as mobile app developers, to distribute real-time information and conditions to the public.
- **CSC/Back-office Providers:** If Caltrans uses a partner agency for CSC functions and financial back of office reconciliation, interfaces must be developed to send roadside data through the Toll System Host and to the partner agency's financial back office for processing. The same is true for CSC functions taken on by the partner agency.

11 ENFORCEMENT AND INCIDENT MANAGEMENT

The Express Lanes require effective enforcement policies and programs to operate successfully. Enforcement will be critical to ensure travel time savings for Express Lane customers, and safety for all travelers along the Yolo 80 Managed Lanes Project corridor. Visible and effective enforcement as part of the Yolo 80 Managed Lanes Project will promote fairness, maintain effective operations of the facility, and ultimately contribute to the success of the Project to meet established goals.

For the purposes of Yolo 80 Managed Lanes enforcement, violations are classified into three types per the CVC: (1) eligibility violations, (2) toll violations, and (3) buffer crossing violations. CHP will lead Yolo 80 Managed Lanes enforcement efforts as the designated enforcement agency for Express Lanes throughput California. CARTA and CHP will need to enter into an agreement defining enforcement roles and responsibilities, and compensation for CHP enforcement activity for the Yolo 80 Managed Lanes Project. At the time of this writing, it is not anticipated that enforcement related agreements will be needed between CARTA and local agencies.

The proposed procedures, equipment and responsible entities needed to enforce these violation types are described below. It should be noted that enforcement related Express Lane design assumptions are discussed below.

11.1 Eligibility Violation Enforcement

Yolo 80 Managed Lanes business rules are anticipated to require vehicles using the Express Lanes to have a FasTrak® transponder to receive toll-free or discounted access. Eligible carpool vehicles will be required to have a switchable transponder that allows drivers to declare vehicle occupancy as HOV2 or HOV3+. Drivers that falsely declare an occupancy setting resulting in a discounted toll or toll exemption will risk a citation from CHP. To enforce vehicle occupancy rates, CHP officers will correlate visual inspections of vehicle occupancy with enforcement beacon displays in one of two ways:

1. By observing enforcement beacons from observation areas. The beacons will display either a flashing color or numeric image corresponding to the vehicle's transponder switch setting. CHP officers will conduct visual inspections of passing vehicles to determine if the observed occupancy rates are consistent with the display on the enforcement beacon.
2. By observing enforcement beacons while following vehicles through a toll zone. Enforcement beacons will also be visible as vehicles approach toll gantries, enabling CHP to enforce vehicle occupancy requirements from moving patrol vehicles.

At least one CHP observation zone will be placed in each direction of the corridor, which will serve as a location where officers can safely park their vehicle in the median and monitor Express Lane users for occupancy violations or illegal double white line/delineator crossings.

Observation zones will be placed in proximity with toll zone equipment, including transponder readers and flashing beacons. Beacons will display a distinct light or an LED number representing the number of occupants, as declared by the user.

While identifying locations where observation zones can be placed within project scope, primary considerations include inside shoulder width and a tangent long enough to accommodate the length of a bi-directional observation zone. The engineering team identified two feasible options for the placement of bi-directional observation zones:

1. East of Mace
2. Between Pole Line Rd overcrossing just west of Mace Blvd

Observation zones will be designed to meet High-Occupancy Vehicle Guidelines, with a width of 22 ft, length of 2600 ft, and a minimum taper of 50:1, as shown in Figure 34**Error! Reference source not found.**.

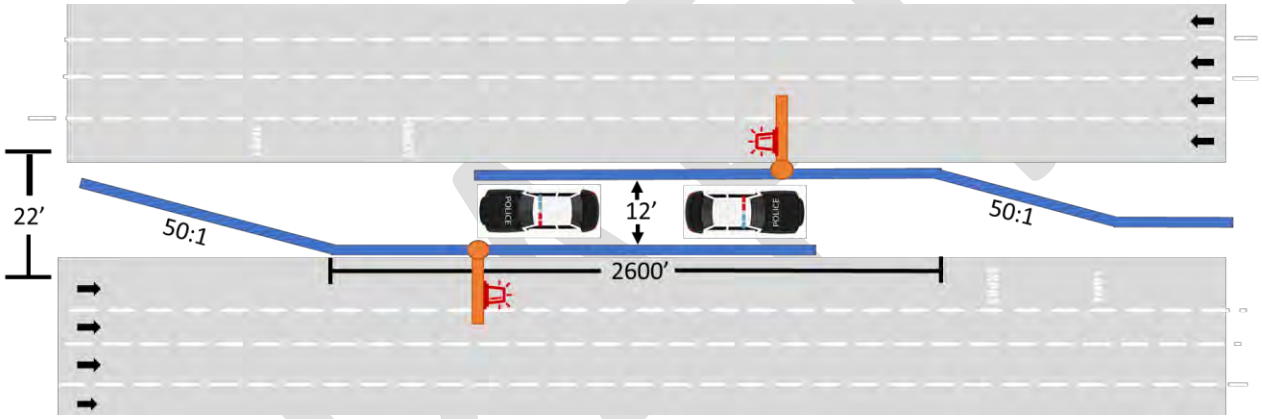

Figure 34: CHP Observation Zone

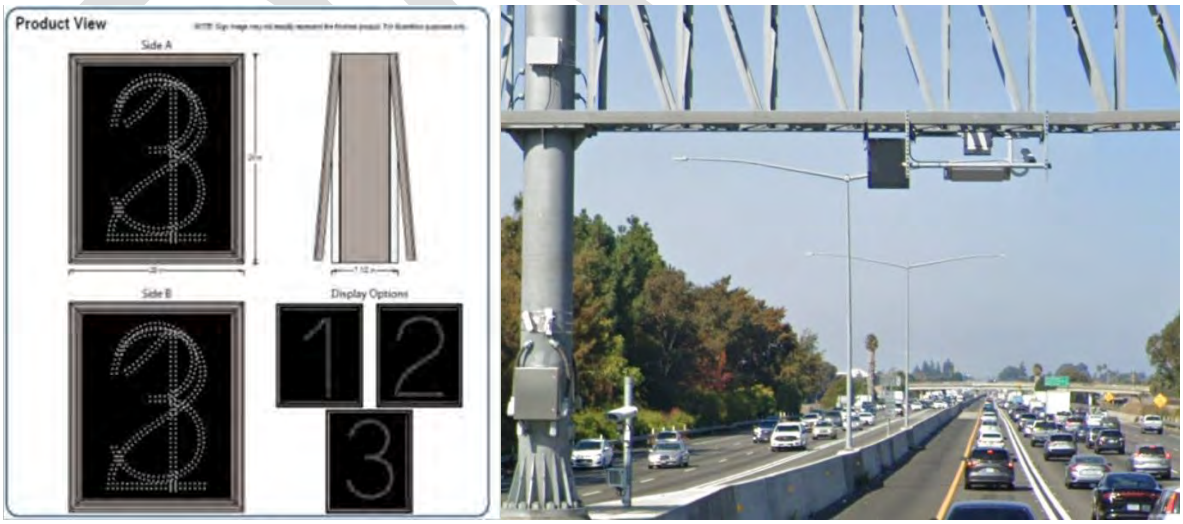

Figure 35: Enforcement Beacon - Two Way LED Panels

In addition to CHP enforcement, the facility may implement occupancy detection technology in both directions of the corridor. The occupancy detection system (ODS) will consist of a front camera, side camera, illuminators, and an overhead laser trigger. ODS will take several images of the vehicle and use image processing algorithms to detect the number of people in a vehicle which is then be compared against the self-declared tag setting. Besides the detection system, a growing number of Express Lane agencies outside of California are relying on smartphone applications (such as CARMA or Rideflag) to allow drivers to opt-in occupancy declarations. The systems then use various methods to verify legitimate carpooling including advanced algorithms or user submitted images. In addition, Connected Vehicle Systems under development by various manufacturers may soon be able to use seat detectors and on-board units to communicate the number of occupants roadside units integrated into tolling infrastructure.

Although not proposed for initial operations of the Yolo 80 Express Lanes, these emerging technologies may be realistic options in the future to supplement CHP officer enforcement and improve equity of occupancy enforcement.

11.2 Toll Violation Enforcement

As discussed previously, a toll-payments on the Yolo 80 Express Lanes will be made by vehicles with a valid transponder with an associated account. It is also anticipated that toll payments will be allowed through license plate image capture. The tolling system will identify vehicles that do not have valid transponders and captures images of their license plates. The images are then used to associate the transaction with a toll account when a transponder is not read, or to look up the registered owners address in the case of a license plate toll. License plate numbers are identified using LPR technology and are then typically confirmed manually. License plate confirmation and the issuing and tracking of invoices will occur as part of back-office functions. Violations would then only be issued if customers do not make required toll payments after receiving an invoice under established business rules.

11.3 Buffer Crossing Violations

The Yolo 80 Express Lanes are proposed to be continuous access; however, in locations where restricted access may be introduced buffer crossing must be enforced. It is a violation of the California Vehicle Code to cross the double solid white lines. The CHP will be responsible for enforcing buffer crossing violations on the Yolo 80 Managed Lanes along with other moving violations. This will be done primarily from patrol cars operating on the lanes. Signs will be posted along the Express Lane corridor informing motorists of the fine for buffer crossing violations. This is consistent with existing Express Lane buffer crossing protocols throughout California.

11.4 Incident Management

The CHP will ultimately be responsible for incident management on the Yolo 80 Express Lanes. Procedures for clearing incidents and maintaining Express Lane operations during incidents will be developed as part of an incident management plan (IMP) between CARTA, CHP, and other stakeholders. The agreement will identity response protocols for incidents of different types, together with the incident management functions of the TMC, CHP, FSP, and system integrator.

12 PERFORMANCE REQUIREMENTS

Performance assessment and evaluation of the Yolo 80 Managed Lanes Project will serve a variety of purposes. Real-time performance data will be used to set dynamic toll rates on the Express Lanes to ensure that free-flow conditions are maintained. Performance data will also be used to optimize the operation of the Express Lanes and calibrate dynamic pricing algorithms. From the operation monitoring perspective, proactively analyzed performance data can inform freeway operators and decision makers to identify potential challenges on the corridor and set long-term plans ahead of the performance failure. In addition, CARTA can disseminate Express Lane performance information to interested parties including but not limited to executive management, elected officials, stakeholders, and the public to validate their performance and demonstrate the benefits they provide to the traveling public.

12.1 Federal and State Performance Requirements

Federal law requires Managed Lanes to have performance monitoring programs to ensure that projects constructed with federal funding are not degraded per guidance outlined in Federal Law 23 U.S.C. § 166 (reference Section 9.4.1 for more detail). To comply with federal requirements, Caltrans prepares an annual California High-Occupancy Vehicle Facilities Degradation Report and Action Plan. This report identifies HOV and Express Lane facilities in California that do not meet federal performance standards. In addition, Caltrans District Offices have developed Action Plans to remediate cases of performance degradation with input from Caltrans' Headquarter Traffic Operations and FHWA.

At the state level, Assembly Bill 194 modified Section 149.7 of the California Streets and Highways Code allowing regional transportation authorities to apply directly to the CTC for permission to implement new high occupancy toll lane projects. Section 149.7 was modified to include the following reporting requirement (h):

> A sponsoring agency that develops or operates a toll facility pursuant to this section shall provide any information or data requested by the commission or the Legislative Analyst. The commission, in cooperation with the Legislative Analyst, shall annually prepare a summary report on the progress of the development and operation of any toll facilities authorized pursuant to this section. The commission may submit this report as a section in its annual report to the Legislature required pursuant to Section 14535 of the Government Code.

CARTA will need to coordinate with the CTC to identify performance data that the CTC may require on the Yolo 80 Managed Lanes to include in its annual report to the California State Legislature.

12.2 Identification of Performance Metrics

As the Yolo 80 Managed Lanes Project advances further in project development, CARTA will track any emerging issues and develop a set of proposed performance metrics for the Express Lanes. As potential measures are considered, the following issues should be considered:

- What types of performance measurement to be defined?
- What types of performance data to be collated?
- How is the performance data to be collected – with real-time detection equipment, regular counts or surveys, or one-time customer surveys?
- How often should the data to be collected?
- Which agency is best placed to collect the data?
- What agency is responsible to ensure the quality of data collected? What's the QAQC procedures of the data?
- What is the cost of collecting the data? Which agency is responsible for the cost?
- Should the data be collected internally or by an outside vendor or contractor?

In order to demonstrate that the Yolo 80 Managed Lanes meet Federal and State operational standards, the JPA may consider the following performance metrics:

- Travel time savings
- Average vehicle speed
- Mode shift to carpool, transit, or vanpool
- Person throughput
- Transportation access for the priority populations

12.3 Performance Monitoring and Reporting

12.3.1 Data Collection

Performance data for the managed lanes will come from the automated toll collection and traffic monitoring systems that are used to operate the lanes. These systems can be programmed to generate automated reports that can be formatted to meet varying requirements. These systems include roadway detection devices that collect data on traffic speeds, volumes, density, and throughput. This information is conveyed in real time and can be archived in standardized templates used to generate weekly and monthly performance reports. Field counts are also commonly used to validate and, if need-be, calibrate the information derived from toll collection systems.

12.3.2 Performance Reporting

CARTA will develop performance reports to provide regular updates on how the managed lanes are preforming. Reports may include all or some of the following:

- The financial performance of the priced managed lanes
- How net toll proceeds are used

- Violations statistics
- Reward program activity
- Monthly average travel speeds
- Average AM and PM peak-period travel speeds
- Total number of vehicle trips
- Number of transponders issued
- Equity Program account openings
- Total number of HOV-only operations