

SCAG Region Value Pricing— Regional Express Lane Network

CONCEPT OF OPERATIONS

JUNE 2022



SCAG Region Value Pricing Project—
Regional Express Lane Network
(Contract Number 18-028-C01)

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TASK NOS. 1A AND C1
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Acronyms

AT PZEV	Advanced Technology Partial Zero Emissions Vehicles
ATMS	Advanced Transportation Management System
AVI	Automatic Vehicle Identification
CA MUTCD	California Manual on Uniform Traffic Control Devices
Caltrans.....	California Department of Transportation
CAV	Clean Air Vehicle
CCR.....	California Code of Regulations
CCTV	Closed-Caption Television
CEQA	California Environmental Quality Act
CHP	California Highway Patrol
CMS.....	Changeable Message Sign
ConOps.....	Concept of Operations
CSC.....	Customer Service Center
CTC.....	County Transportation Commission
CTOC.....	California Toll Operators Committee
DMV	Department of Motor Vehicles
DSDD	Design Standard Decision Document
EJ	Environmental Justice
ETC.....	Electronic Toll Collection
FHWA	Federal Highway Administration
FSP.....	Freeway Service Patrol
HOT	High Occupancy Toll
HOV 2.....	Two Occupant High Occupancy Vehicle
HOV 3.....	Three Occupant High Occupancy Vehicle
HOV 3+.....	Three or More Occupant High Occupancy Vehicle
HOV.....	High Occupancy Vehicle
I-	Interstate (highway)
IH.....	Interstate Highway
IIJA.....	Infrastructure Investment and Jobs Act
ILEV.....	Inherently Low-Emission Vehicle
JPA.....	Joint Power Authority
LA Metro	Los Angeles County Metropolitan Transportation Authority
LADOT.....	Los Angeles Department of Transportation
LED	Light Emitting Diode
LiDAR.....	Light Detection and Ranging
LOS	Level of Service
LPR.....	License Plate Recognition
MaaS.....	Mobility as a Service
MAP-21.....	Moving Ahead for Progress in the 21st Century
MHz.....	Megahertz
MLSP	Managed Lane System Plan
MOMS.....	Maintenance Online Management System
MPH	Miles per Hour
MPO	Metropolitan Planning Organization
MTC.....	Metropolitan Transportation Commission

MUTCD	Manual on Uniform Traffic Control Devices
NCHRP	National Cooperative Highway Research Program
OBU	On Board Unit
OCR	Optical Character Recognition
OCTA	Orange County Transportation Authority
PA/ED	Project Approvals and Environmental Document
PeMS.....	Performance Monitoring System
RCTC	Riverside County Transportation Commission
RFID.....	Radio Frequency Identification
RTA.....	Riverside Transit Agency
RTP/SCS.....	Regional Transportation Plan / Sustainable Communities Strategy
SANDAG.....	San Diego Association of Governments
SB	Senate Bill
SBCTA.....	San Bernardino County Transportation Authority
SCAG.....	Southern California Association of Governments
SOV	Single Occupant Vehicle
SR.....	State Route
TAP	Transit Access Pass
TCA.....	Transportation Corridor Agencies
TMC.....	Transportation Management Center
TOPD	Traffic Operations Policy Directive
VDS.....	Vehicle Detection System
VMT.....	Vehicle Miles Traveled

1 Introduction

1.1 BACKGROUND

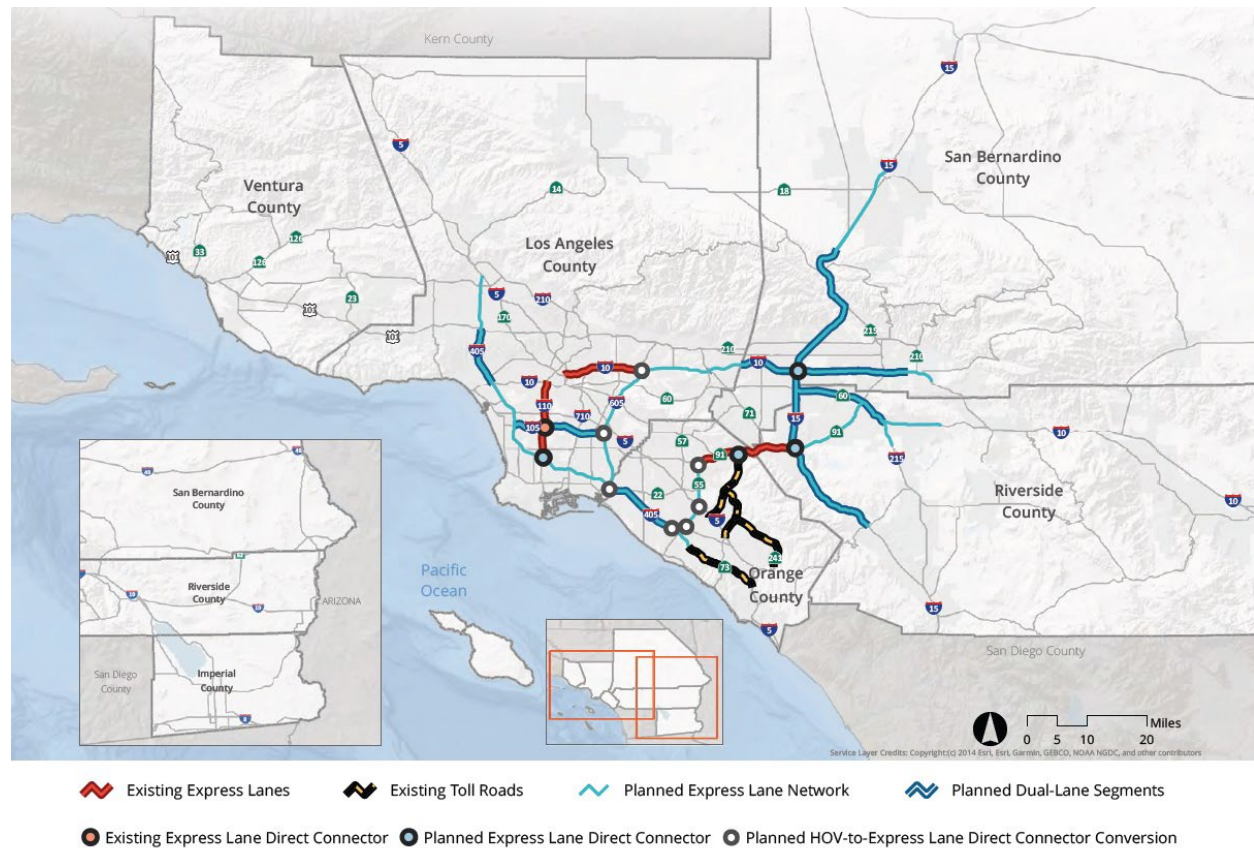
The Southern California Association of Governments (SCAG) prepared its first Regional Express Lane Network Concept of Operations (ConOps) document in 2016 as part of its *Express Travel Choices Study*. The study featured a stakeholder-led process that identified the regional express lane network to be implemented in three tiers over a 30-year period.

The ConOps provided a blueprint for integrating individual express lane projects into a regional system by identifying a comprehensive set of issues that should be addressed as individual express lane projects advanced. Through ongoing meetings, the stakeholders vetted each of these issues to formulate a set of technical policy recommendations to serve as a framework for establishing consistent and/or compatible operating, design, and policy rules for the regional network.

The preparation of a ConOps document is one of the initial steps in the systems engineering process and is used to facilitate collaborative decision making in identifying the policy, design, and operational requirements. SCAG's regional express lanes ConOps document served as a bridge between the needs and expectations of express lane users and the technical specifications used by the express lane sponsors, providing a comprehensive series of policy recommendations to guide the development of the express lane network in the SCAG Region.

The express lane network built on the region's extensive high occupancy vehicle (HOV) network and recently converted express lane facilities. It also emphasized the use of variably priced tolling, vehicle occupancy requirements, and access control as tools to manage traffic conditions on the express lanes to mitigate HOV degradation, enhance transit service, and provide a new mobility choice for travelers in the region. Per subsection (d) of 23 U.S.C. § 166, HOV and express lane facilities are considered "degraded" if the average traffic speed during the morning or evening weekday peak period (6:00 to 9:00 a.m., and 3:00 to 6:00 p.m.) is less than 45 miles per hour (mph) for more than 10 percent of the time over a consecutive 180-day period. SCAG incorporated a set of priority express lane corridors in its 2016-2040 Regional Transportation Plan / Sustainable Communities Strategy (RTP/SCS) update. SCAG updated the regional express lane network included in the 2020-2045 "Connect SoCal" RTP/SCS, working in close consultation with the County Transportation Commissions (CTCs). Figure 1-1 shows the fiscally constrained express lane network that was included in SCAG's 2020-2045 RTP/SCS.

Figure 1-1. Recommended Express Lane Network: 2020-2045 RTP/SCS Constrained Plan



Source: SCAG, 2020

With the encouragement of both the California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA), SCAG has updated its Regional Express Lanes ConOps document. The update revisits the different recommendations included in the 2016 Regional ConOps, and further focuses on a broader discussion of policy issues that have risen to the surface over the past five years – particularly those that would benefit from a more coordinated regional response. This approach is particularly important as the regional system continues to expand from three operational facilities in 2016 providing 56 lane miles, to five facilities providing nearly 79 centerline miles of new express lane capacity in 2021 – representing nearly \$1.8 billion in new investment – and one express lane corridor extending across a county line. An additional \$3.2 billion in new express lane capacity is currently under construction in the region, which will add 26 centerline miles of new capacity and two direct connector facilities to the regional network. As described in greater detail in Chapter 2, additional express lane corridors are in other phases of development and will ultimately form a contiguous network between Los Angeles, San Bernardino, Riverside, and Orange Counties.

1.2 THE REGIONAL CONOPS UPDATE PROCESS

SCAG began the regional ConOps update by holding virtual meetings with each of the stakeholders in June 2020 to confirm their current express lane activities, identify current challenges in the development of express lane projects, and engage in detailed discussions on the stakeholders' opinions on the technical policy recommendations made in the 2016 ConOps document. To these ends, SCAG held individual discussions with the following entities:

- Los Angeles County Metropolitan Transportation Authority (LA Metro)
- Orange County Transportation Authority (OCTA)
- Riverside County Transportation Commission (RCTC)
- San Bernardino County Transportation Authority (SBCTA)
- Caltrans Headquarters
- Caltrans District 7
- Caltrans District 8
- Caltrans District 12
- FHWA California Division

SCAG also convened a series of workshops with the stakeholders to review current opinions on the recommendations included in the 2016 ConOps document and discuss the challenges of implementing express lane projects in the SCAG Region today. The workshops provided an open forum for discussion, allowing the stakeholders to offer strategic recommendations on emerging issues and identify topics requiring further clarification and collaboration.

1.3 PURPOSE AND INTENDED AUDIENCE

Investment in express lane facilities is one of the most significant commitments in Connect SoCal and is by far the largest highway component of the 2020 RTP/SCS. Recognizing the importance of the express lane network to the SCAG Region, the primary intent of this ConOps update is to assist express lane stakeholders in building a successful express lane network. To do so, this document identifies the issues that need to be resolved, together with potential solutions to those challenges as the region advances the express lane network, recognizing that decisions are made in a wide range of contexts and processes.

As part of the ConOps process, SCAG has engaged with all the region's express lane stakeholders to update the technical and operational recommendations included in this document. The ConOps update provides a forum for ongoing dialog on the continuing development of the region's express lane network. Using the input received from stakeholders, this ConOps update provides a snapshot of the most current regional express lane developments. It also begins the process of identifying the individual express lane facilities to be included in 2024 RTP/SCS network.

Express lane facilities extend across county lines in the SCAG Region and within the next decade, the regional express lanes network will provide continuous connections between Orange, Riverside, San Bernardino, and Los Angeles counties. While coordination has occurred between individual CTCs, moving forward, there will be a need for greater regional cooperation as the network continues to expand and more express lane segments that cross county lines are created and become operational.

The Regional Express Lanes ConOps is intended to provide policymakers with a comprehensive and accessible understanding of the complex processes involved with developing individual express lane projects and the additional challenges of operating those facilities as a network. The stakeholders who are directly involved in the development, operation, and oversight of express lane projects are the primary audience for this ConOps update. These same agencies have collaborated with SCAG in the development of the initial regional ConOps document in 2016, as well as the current update. In addition, the ConOps is a valuable resource for public officials who develop the operational and financial policies that underpin express lane projects, as well as the decision-making bodies that approve them. However, the stakeholders did not go through any type of approval process for the recommendations contained in this ConOps.

This ConOps does not provide formal guidance. SCAG recognizes that implementing agencies require flexibility to meet their own needs and challenges, and that there needs to be a balance between regional coordination and local flexibility. SCAG's intent is to assist the region in meeting the challenges of implementing express lane projects in a coordinated manner to create a regional network that is seamless and as consistent as possible. However, agencies involved in the development of this report have not agreed to implement the proposed policies or recommendations in this ConOps.

1.4 EXPRESS LANES DEFINED

Express lanes, also commonly referred to as high-occupancy toll (HOT) lanes or priced managed lanes, are dedicated highway lanes where demand is managed by restricting access to certain eligible HOVs and alternative fuel vehicles, and by allowing other vehicles that do not meet the eligibility requirements to pay a variably priced toll to travel in the lanes. HOV-lane eligibility requirements typically include restrictions related to occupancy and vehicle type (e.g., motorcycles and low-emission vehicles). The first express lane project was implemented on State Route 91 (SR-91) in Orange County in 1995. The concept has since gained national recognition as an effective strategy to improve the efficiency and reliability of managed lanes, and has been implemented and planned in multiple locations around the U.S.

Express lanes provide free travel to transit vehicles, and toll-free or discounted travel for HOVs and other vehicles designated as being eligible to use the lanes, while charging a toll to other passenger vehicles that choose to use the lane. Express lane tolls are collected electronically via electronic toll collection (ETC) or license plate tolling systems, and typically vary in pricing based on the level of roadway congestion to ensure that a higher and more reliable level of service (LOS) is maintained in

the express lanes compared to that in the general-purpose lanes. As traffic in the express lanes (and sometimes in the adjacent general-purpose lanes) increases, the toll rates also increase to manage the number of vehicles entering the lanes. Toll rates typically decrease when traffic in the express lanes decreases, to incentivize more vehicles to use the existing capacity in the lane. Shifting vehicles from congested general-purpose lanes to the express lanes improves travel conditions in the general-purpose lanes, while managing the number of vehicles making this shift helps maintain free-flow operations in the express lanes. Under some circumstances, CTCs have implemented HOT lane additions as an alternative to increasing occupancy requirements in response to HOV lane degradation.

1.5 PROJECT AREA

The SCAG Region extends across Imperial, Los Angeles, Orange, Riverside, San Bernardino, and Ventura counties. The region's highway and arterial system features over 71,000 lane miles, which function as the backbone of the larger transportation network, serving 71 million trips each weekday. Nineteen out of every 20 trips made in the region rely either entirely or in part on the region's highway and arterial roadway system. While the regional express lanes network project area includes the entire SCAG Region, current and planned express lane facilities are located in the urban core, including Los Angeles and Orange Counties, and more densely populated areas of San Bernardino and Riverside counties. Imperial and Ventura counties have no current plans to implement express lanes.

1.6 REGIONAL GOALS AND OBJECTIVES

Defining regional express lanes network goals and objectives represents a critical first step in establishing a regional vision for the development of an express lane network, as well as for assessing the effectiveness of potential future express lane investments. These regional goals provide direction for determining when express lane facilities should be considered for implementation, how such facilities should be operated, and how effectively the system is expected to perform over time. Policies typically establish guidelines and thresholds for use in identifying the need for express lane facilities and measuring system performance.

Table 1-1 summarizes the goals and objectives for the SCAG Region express lane network, which were developed based on input and dialog received from SCAG's partners during the preparation of the first iteration of the SCAG Regional Express Lanes ConOps document, and which were confirmed as part of the current update.

Table 1-1. Goals and Objectives for the SCAG Regional Express Lane Network

GOALS	OBJECTIVES
Improve Mobility and Reliability	<ul style="list-style-type: none"> ▪ Reduce travel times and improve travel time reliability for customers and non-customers ▪ Manage travel demand and traffic congestion ▪ Maximize the performance of existing system infrastructure ▪ Maximize the use of technology management ▪ Provide mobility options and choices ▪ Improve transit service options, efficiency, and reliability ▪ Improve system connectivity ▪ Increase person throughput and optimize vehicle utilization
Improve Environmental Quality	<ul style="list-style-type: none"> ▪ Promote air quality benefits ▪ Enhance quality of life ▪ Reduce greenhouse gas emissions ▪ Implement projects in an equitable manner
Improve Safety	<ul style="list-style-type: none"> ▪ Preserve and enhance safety of the user
Provide Financial Sustainability and Accelerate Delivery	<ul style="list-style-type: none"> ▪ Leverage existing revenue sources and assets ▪ Access new or alternative revenue sources ▪ Accelerate project delivery to complete the system ▪ Support ongoing operations and maintenance ▪ Support enhanced transit service ▪ Plan future investments
Generate Public and Political Support	<ul style="list-style-type: none"> ▪ Support public outreach ▪ Publicize system benefits to customers and non-customers ▪ Identify and foster champions ▪ Facilitate equitable distribution of costs whereby users pay for what they use

The goals for the regional express lane network should also compliment Caltrans goals for the state, as articulated in its *2020-2024 Strategic Plan*. These include:

- Safety first;
- Cultivating excellence;
- Enhancing and connecting the multimodal transportation network;
- Strengthening stewardship and driving efficiency;
- Leading climate action; and
- Advancing equity and livability in all communities.

1.7 ORGANIZATION OF REPORT

This ConOps report is organized into 13 chapters. The initial four chapters focus on notable developments that have occurred since the completion of SCAG's initial ConOps document in 2016.

Chapter 2 includes a comprehensive discussion of the current extent and operational characteristics of the regional managed lane network, which includes both HOV and express lanes. This is followed by

an inventory of planned and proposed express lane developments in the SCAG Region and how they are reflected in Connect SoCal, SCAG's 2020-2045 RTP/SCS.

Chapter 3 identifies the key issues that have emerged during the preparation of this update, including the need for interagency coordination and the desire for both regional consistency and local flexibility. It also addresses vehicle occupancy rates, signage, and degradation of service on the HOV and express lane network.

Chapter 4 summarizes federal and state legislation that affects tolling and the implementation of express lanes. This includes an assessment of changes to federal requirements contained in the latest five-year transportation authorization act, the Infrastructure Investment and Jobs Act (IIJA), which was signed into law on November 15, 2021.

Chapters 5 through 12 update the technical content from the 2016 Regional Express Lanes ConOps document. The updates are informed by individual meetings between SCAG and each of the stakeholder agencies to review and update the recommendations from the 2016 document, as well as group discussions with the CTCs and the larger stakeholder group. Depending upon their needs and interests, readers may consult individual chapters as needed. The content is organized as follows:

- Chapter 5: Facility Design
- Chapter 6: Operating Concept
- Chapter 7: Technical Requirements
- Chapter 8: Enforcement and Incident Management
- Chapter 9: Performance Evaluation
- Chapter 10: Network Governance
- Chapter 11: Transit Integration
- Chapter 12: Roles and Responsibilities

Chapter 13 provides a summary of the policy recommendations included in the updated ConOps document. The summary is intended as a quick reference guide and should not be considered a comprehensive synopsis of the guidance provided in this document.

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2 Current and Planned Regional Express Lane Network

2.1 CURRENT EXPRESS LANE NETWORK

Since the completion of the 2016 ConOps document, there has been a great deal of express lane activity. In Los Angeles, Orange, Riverside, and San Bernardino counties, two new express lane facilities have opened to operations, and five new facilities are under construction. In addition, Caltrans Deputy Directive 43-R1, dated May 2015, requires Caltrans districts that currently operate, or are expected to operate managed lanes within twenty years, to prepare Managed Lanes System Plans (MLSPs) identifying all current and future managed lane facilities that are expected to come online in that period. Several MLSP documents have been completed in the SCAG Region. Metro's Board approved a Countywide ExpressLanes Strategic Plan in January 2017, which serves as the MLSP for Los Angeles County. OCTA has completed an Express Lane Network Phasing Study that builds off an earlier MLSP undertaken by Caltrans District 12, and Caltrans District 8 has also completed a MLSP for Riverside and San Bernardino Counties.

2.1.1 Operating Express Lane Facilities

As shown in Figure 2-1, construction has been completed on nearly \$2.0 billion in express lane expansions within the SCAG Region. At the time of this writing in January 2022, the SCAG Region has five operating express lane facilities. These facilities are all located on State highways and are operated by regional partners in cooperation and under agreement with Caltrans:

1. The 91 Express Lanes were the first operating express lane facility in the SCAG Region. The 10-mile, four-lane express toll-lane facility, which opened in 1995 at a cost of \$135 million, extends along the median of SR-91 from the Riverside County Line westward to SR-55, in Anaheim, in Orange County. The 91 Express Lanes have single points of access at each terminus with dedicated declaration lanes and no intermediate entrances or exits. OCTA is responsible for operating the facility.
2. The Interstate 110 (I-110) ExpressLanes in Los Angeles County between Adams Boulevard and the SR-91 freeway opened on November 10, 2012. This facility is operated by Metro and provides toll-free access to transit vehicles and two-occupant high occupancy vehicles (HOV 2+) at all times. The project converted the existing dual-lane HOV facility between Adams Boulevard and I-105, and single HOV lanes between I-105 and SR-91, to express lane operations.

3. The I-10 ExpressLanes opened on February 23, 2013, and extends along the I-10 corridor between I-605 and Alameda Street. The facility provides toll-free access to transit vehicles and HOVs with three or more occupants (HOV 3+) during peak periods, and transit vehicles and HOV 2+ during off-peak periods. The 14.2-mile facility reconfigured the existing single-lane HOV facility to provide one express lane in each direction within the existing right-of-way between Alameda Street and I-710, and two express lanes in each direction between I-710 and I-605. The combined cost of the I-110 and I-10 projects was \$79 million.
4. An 8-mile, \$1.4 billion extension of the 91 Express Lanes from the Orange County line to I-15 in Corona, in Riverside County, opened to service in March 2017. The facility, which is operated by RCTC, provides two express lanes in each direction and express lane direct connectors to and from I-15 south.
5. The 15-mile, \$470 million I-15 Express Lanes opened to service on April 10, 2021. The facility extends from SR-60 near the San Bernardino County line to Cajalco Road, in Corona, in Riverside County. The facility added two new express lanes in each direction to I-15, and is operated by RCTC.

Figure 2-1. Current Status of the Fiscally Constrained 2020 RTP/SCS Express Lane Network



Source: WSP, 2022

2.1.2 Express Lane Facilities Under Construction

Construction is currently underway on two new express lane facilities and two express lane direct connectors in the SCAG Region. Together these assets have a combined construction value of nearly \$3.4 billion.

1. Construction is expected to be complete in late 2023 on a 16-mile, \$2.08 billion I-405 express lane facility in Orange County from SR-73 to the Los Angeles County line. The project will add one express lane in each direction and convert an existing HOV lane to express lane operation, to provide a total of two express lanes in each direction. It will also include the construction of one new general-purpose lane in each direction between Euclid Street and I-605, as well as express lane connectors between I-405 and SR-73. The facility will be operated by OCTA and will feature policies mirroring those on the 91 Express, with pricing based on hour, day, and direction of travel.
2. Construction began in August 2020 on a \$930 million, dual-lane express lane facility on I-10 between I-15 and the Los Angeles County line, in San Bernardino County. The project will add one new express lane in each direction and convert an existing HOV lane along approximately eight miles from the Los Angeles County line to Haven Avenue in Ontario. East of Haven Avenue to I-15, the project will add two new express lanes in each direction. This facility will be operated by SBCTA.
3. RCTC is partnering with Caltrans to build the 15/91 Express Lanes Connector. The \$270 million facility will link the 15 Express Lanes to the 91 Express Lanes, providing new connections from the eastbound 91 Express Lanes to the northbound 15 Express Lanes, and from the southbound 15 Express Lanes to the westbound 91 Express Lanes. The connector will be completed in 2023. The project also will extend both the eastbound SR-91 outside general-purpose lane and the eastern end of the 91 Express Lanes approximately one-half mile east to Promenade Avenue in Corona to improve merge movements.
4. The Transportation Corridor Agencies (TCA) is partnering with Caltrans, OCTA, and RCTC to implement the \$380 million 241/91 Express Connector, which will provide new direct connector ramps between the northbound 241 Toll Road and the eastbound 91 Express Lanes, and from the westbound 91 Express Lanes to the southbound 241 Toll Road. Construction on the tolled facility is expected to be complete in 2026.

2.1.3 Programmed Express Lane Facilities

In addition to express lane projects that are currently open or under construction in the SCAG Region, another \$1.1 billion in express lane projects are funded and programmed to be completed by 2027:

- SBCTA partnering with Caltrans to extend the I-15 Express Lanes by six miles, from south of SR-60, in Riverside County, to Foothill Parkway in Rancho Cucamonga, in San Bernardino County, at an

anticipated cost of \$318 million. The project is in the final design phase and construction is anticipated to begin 2023.

- Metro is partnering with Caltrans to implement a 16-mile, dual express lane facility on the I-105 corridor between I-405 and I-605, in Los Angeles County, by 2027, at an anticipated cost of \$676 million.

2.1.4 Express Lane Facilities in Planning

Express lane stakeholders have also commenced or completed stand-alone Project Initiation Documents, ConOps reports, Project Approvals and Environmental Documentation (PA/ED), Environmental Impact Report/Environmental Impact Statements (EIS/EIR), or Plans, Specifications, and Estimates (PS&E) for express lanes to be implemented along several other major highway corridors in the SCAG Region.

In Los Angeles County, they include:

- An Environmental Impact Report/Environmental Impact Statement is being prepared for the I-605 Corridor Improvement Project which includes an alternative examining a 14.1-mile HOV conversion and possible widening on I-605, from Excelsior Drive south of I-105 to Ramona Boulevard north of I-10, that would provide two ExpressLanes in each direction. The project is slated to open in 2031, and will provide either one or two express lanes per direction.
- A PA/ED examining options for a 10-mile HOV conversion and possible widening on I-405 through the Sepulveda Pass, from I-10 to US 101, which is expected to be complete by 2028.
- A PA/ED examining a 17-mile extension of the I-10 ExpressLanes, from I-605 to the San Bernardino County line, converting an existing HOV lane to express lane operations and possibly providing a second express lane. The project is anticipated to be completed by 2028.

In Orange County, Caltrans District 12 has initiated a PA/ED to evaluate:

- A 16-mile HOV conversion and possible express lane widening on I-5 between the Los Angeles County line and SR-55. An implementation timeframe has not been finalized for this facility. The PA/ED is anticipated to be completed within three years from its initiation.

In Riverside County, a PA/ED is underway to assess:

- A southern extension of the I-15 Express Lanes, from Cajalco Road in Corona to State Route 74 in Lake Elsinore.

In San Bernardino County, they include:

- Final design (PS&E) for the extension of the I-10 Express Lanes from I-15 East to Pepper Avenue in Rialto.

- A PA/ED approving the extension of the I-15 Express Lanes from Cantu-Galleano Ranch Road in Riverside County to Duncan Canyon Road in Fontana.

2.1.5 Other Express Lane Developments

Other technical and policy developments that may influence future express lane development and operational policies in the SCAG Region include the following:

- **Reduced Violation Fees:** As part of its “Pay As You Go” pilot program, Metro modified its toll policy in January 2020 to remove the \$25 penalty for first violation notices and replace it with a \$4 fee designed to recover the costs of processing the violation only. The intent of this change was to reduce the financial burden on violators that access the ExpressLanes without transponders, so that it is not an excessive deterrent to ExpressLanes use. The duration of the “Pay-As-You-Go” pilot was extended as a result of the COVID-19 pandemic, and the pilot is ongoing as of January 2022. This extension was necessary to ensure that a sufficient volume of data could be collected to evaluate the effects of the pilot by the end of the term.
- **Automated Occupancy Declaration Verification:** Metro is preparing to launch a new system that automatically verifies the self-declared occupancies indicated by drivers’ transponder switch settings. This Occupancy Detection System will be used as a compliance tool to correct instances where a transponder has been inaccurately set to the toll-free HOV mode when there were not enough passengers in the vehicle to qualify. This helps ensure that all ExpressLanes users are charged the proper toll amounts when appropriate. The system uses roadside cameras to check vehicle occupancies and compare them against the transponder switch settings as vehicles traverse strategic toll points. The technology is designed to handle all common vehicle configuration and passenger arrangements, such as window tinting or children in car seats.
- Metro is also studying an HOV-5+ pilot for the I-10 ExpressLanes. The intent of the pilot is to preserve the ExpressLanes as a faster and more reliable travel option for transit users and to reduce occupancy misrepresentation.

2.2 CANDIDATE 2024 RTP/SCS UPDATE EXPRESS LANE NETWORK

As part of the SCAG Region express lane network ConOps Update, SCAG has collected feedback from the CTCs on the express lane facilities they would like to have considered for inclusion in the fiscally constrained plan in 2024 RTP/SCS update, which is limited to those projects that can be implemented with all known local, state, and federal funding sources. The proposed network is shown in Figure 2-2, and details on the length, termini, number of lanes, and current status of the individual segments in the proposed network are provided in Table 2-1. Table 2-1 also indicates whether the express lane segments proposed for inclusion in the 2024 RTP/SCS update were included in the current 2020 RTP/SCS express lane network. The information on project elements provided in Table 2-1 is subject to change as projects progress through the PA/ED process. As indicated in Table 2-1, and as can be seen by comparing the individual express lane segments included in Figure 2-1 and in Figure 2-2, the candidate 2024 RTP/SCS express lane network reflects the following developments:

- The proposed 2024 express lane network in Los Angeles County remains unchanged from the current 2020 RTP/SCS network, as Metro remains focused on the development of the Tier 1 projects identified in its 2017 Countywide ExpressLanes Strategic Plan. The Tier 1 projects are planned for implementation in the 2017-2027 timeframe.
- In Orange County, there are a number of changes between the existing 2020 RTP/SCS express lane network and the candidate segments for inclusion in the 2024 RTP/SCS update. These changes flow from the recommendations made in OCTA's 2021 Express Lane Network Phasing Study. OCTA has requested to remove the SR-55 from the candidate 2024 express lane network, as well as the segment of SR-73 between I-405 and the 73 Toll Road operated by TCA. OCTA has also proposed to include three new candidate express lane segments in the 2024 RTP/SCS network: 1) SR-91 from SR-55 to the Los Angeles County line; 2) SR-57 from I-5 to the Los Angeles County Line; and 3) I-5 from SR-55 to the Los Angeles County line.
- In Riverside County, RCTC has requested to remove the following express lane segments that are contained in the 2020 network from consideration in the 2024 RTP/SCS update: 1) SR-60 east of I-15; 2) I-215 south of SR-60; and 3) SR-91 between I-15 and SR-60.
- In San Bernardino County, SBCTA proposes no changes to the 2020 express lane network.

Although Caltrans District 8 has included other express lane corridors in its 2021 MLSP for Riverside and San Bernardino Counties, these projects do not have identified funding. As a result, RCTC and SBCTA have not opted to include them as candidate corridors in the 2024 RTP/SCS fiscally constrained express lane network.

Figure 2-2. Candidate Express Lane Network for Inclusion in the 2024 RTP/SCS Update



Source: WSP, 2022

Table 2-1. Candidate 2024 RTP/SCS Express Lane Network Segments

CANDIDATE EXPRESS LANES	FROM	TO	LENGTH	LANES (PER DIRECTION)	CURRENT STATUS	INCLUDED IN 2020 RTP/SCS
LOS ANGELES COUNTY						
I-110 Express Lanes	Adams Blvd.	SR-91	11	1 south of I-105 2 north of I-105	Open November 2012	Yes
I-10 Express Lanes	Alameda St.	I-605	14	1 west of I-710 2 east of I-710	Open February 2013	Yes
I-105 Express Lanes	I-605	I-405	16	2	Design ongoing	Yes
I-405	US 101	I-10	10	1 or 2	PA/ED ongoing	Yes
I-605	I-10	I-105	14	1 or 2	PA/ED ongoing	Yes
I-10	I-605	San Bernardino County	17	1 or 2	PA/ED ongoing	Yes
I-405	I-10	Orange County	29	1 or 2	Planned	Yes
I-605	I-105	I-405	9	1 or 2	Planned	Yes
I-405	I-5	US 101	9	1 or 2	Planned	Yes
ORANGE COUNTY						
91 Express Lanes	SR-55	Riverside County	10	2	Open 1995	Yes
I-405	Los Angeles County	SR-73	16	2	Construction ongoing	Yes
I-5	Los Angeles County	SR-55	14	1 to 2	PA/ED to commence early 2022	No
SR-91	Los Angeles County	SR-55	13	1	Planned	No
SR-57	Los Angeles County	I-5	11.5	1	Planned	No
RIVERSIDE COUNTY						
91 Express Lanes	Orange County	I-15	8	2	Open March 2017	Yes
I-15 Express Lanes	SR-60	Cajalco Rd.	15	2	Open April 2021	Yes
I-15	Cajalco Rd.	SR-74	14.5	2	PA/ED ongoing	Yes
SAN BERNARDINO COUNTY						
I-10	Los Angeles County	I-15	8	2	Construction ongoing	Yes
I-15	Foothill Blvd.	SR-60	6	2	Design ongoing	Yes
I-10	I-15	Ford St..	27	1 east of SR-210 2 west of SR-210	PA/ED approved	Yes
I-15	D Street	Foothill Blvd.	39.5	1 north of Oak Hill Rd. 2 south of Oak Hill Rd.	Planned	Yes

Source: WSP 2021

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3 Key Issues in the Update of the Regional ConOps

The ConOps update has been an issue-driven process that has focused on the challenges confronting the ongoing development of the express lane network in the SCAG Region. As part of the update process, the CTCs, Caltrans, and FHWA participated in a series of meetings and workshops to discuss obstacles and potential solutions to them. This section of the ConOps presents the issues of greatest concern to the stakeholders and the strategies that emerged from their discussions. SCAG believes that the issues included below would benefit from a coordinated, regional response, while also acknowledging the need for flexibility to address locally specific concerns and considerations.

Developing an integrated, multi-county express lane network with individual projects implemented by four separate county transportation commissions introduces challenges. While there is a great desire to achieve regional consistency across the network, potential differences from county to county are likely, if not inevitable. In certain cases, operational differences may occur within a single county. There is a need to retain flexibility and options as certain agencies have obtained authorization through detailed negotiations or one-off legislation, making the underlying statutory authority from one express lane project to the next inconsistent. Physical and topographical conditions may necessitate variations in design in certain locations. In addition, some express lane sponsors have built their facilities by leveraging future toll proceeds to borrow significant amounts of money, and may not have the resources to meet certain requirements aimed at promoting regional consistency. While consistency remains the goal, it will be important to prioritize customer-facing issues, including signage and messaging in as consistent a manner as possible, to help motorists navigate potential differences in operational policies, including occupancy requirements, toll rates, and the availability and added cost of license plate tolling. The overall goal is to develop a regional network that is seamless and easy to use for motorists in the SCAG Region, and that also affords opportunities for enhanced transit service.

3.1 OCCUPANCY REQUIREMENTS

Caltrans issued Traffic Operations Policy Directive (TOPD) 20-02, “Changing Vehicle Occupancy Requirements on Managed Lanes” on November 6, 2020. TOPD 20-02 eliminated confusion over which entities had the authority to modify express lane occupancy requirements with the following language:

Changes to occupancy requirements and toll policies on priced managed lanes are the responsibility of the entity that has the tolling authority. If a regional transportation agency has tolling authority, any such changes should be made in consultation with Caltrans.

The earlier lack of clarity regarding the decision making and approval process for modifying express lane occupancy requirements was due in large part to the many different documents and assessments that have been used to explore the issue of occupancy rates. These include:

- Environmental Approval Documents;
- Concept of Operations Documents;
- Traffic and Revenue Forecasts;
- Managed Lane System Plans;
- Biennial Managed Lane System Updates; and
- Service Degradation Action Plans.

Other factors complicating the development and modification of managed lane vehicle occupancy rules include FHWA's managed lane traffic degradation policies, toll discounts for low emission vehicles, restrictions in bond covenants for projects financed with toll-backed debt, and agreements or memoranda of understanding between Caltrans and individual express lane operators.

Since the opening of the SCAG Region's first express lanes, in 1995, decisions regarding express lane vehicle occupancy requirements and business rules have been made on a corridor-by-corridor basis. However, over the past decade, planning for express lane development has recognized that the discrete express lane segments will form a regional network with numerous linkages.

Caltrans TOPD 20-02 reinforces this notion, stating:

It may be desirable to raise occupancy requirements on all or some of the managed lane facilities in a region in order to provide regional consistency in operations. There may also be situations where occupancy requirements change at a jurisdictional boundary and consistency across the boundary is desired.

The following items should be considered when evaluating regional changes to occupancy requirements:

- *Where are the facilities in the district or in adjacent districts where occupancy requirements have been, or will be raised?*
- *Are there interconnecting facilities? HOT lane conversions should be considered on any facilities that connect other HOT lanes to address any operational gaps.*
- *HOV lanes should be converted to HOT lanes if an increase in vehicle occupancy requirements is expected to cause undesirable impacts on the general-purpose lanes.*

Currently, as shown in Table 3-1, there are a variety of vehicle occupancy policies on express lanes facilities within the SCAG Region. The CTCs rely on signage, their project websites, and public outreach

efforts to inform motorists of applicable vehicle occupancy and enforcement policies. To date, individual express lane developers have coordinated closely on vehicle occupancy rules and rates, and other issues, when express lane corridors have been extended across county lines, as with the extension of the 91 Express Lanes from Orange to Riverside County. However, in the future, it is possible that these vehicle occupancy policies could vary on certain cross-county express lane corridors. As occupancy policies continue to evolve, express lane operators should remain vigilant in keeping motorists informed of any differences in occupancy rules, as they navigate the regional express lanes network.

Table 3-1. Current and Proposed Occupancy Rates on SCAG Region Express Lane Facilities

EXPRESS LANE FACILITY	PROJECT SPONSOR	PROJECT STATUS	OCCUPANCY DECLARATION METHOD	OCCUPANCY REQUIREMENT FOR DISCOUNTED TRAVEL
I-10 ExpressLanes	Metro	Operating	Switchable transponder	<ul style="list-style-type: none"> ▪ HOV 3+ free ▪ HOV 2 50% peak discount (<i>Mon-Fri 5-9 a.m. & 4-7 p.m.</i>) ▪ HOV 2 free off peak
I-110 ExpressLanes	Metro	Operating	Switchable transponder	<ul style="list-style-type: none"> ▪ HOV 2 free
91 Express Lanes	OCTA/RCTC	Operating	Declaration lane	<ul style="list-style-type: none"> ▪ HOV 3+ 50% peak discount EB (<i>4-6 p.m. Mon-Fri</i>) ▪ HOV 3+ free WB, and EB off peak only
I-15 Express Lanes	RCTC	Operating	Switchable transponder	<ul style="list-style-type: none"> ▪ HOV 3+ 50% discount
I-405 Express Lanes	OCTA	Construction	Switchable transponder	<ul style="list-style-type: none"> ▪ HOV 3+ free ▪ HOV 2 peak toll (<i>first 3½ years</i>) ▪ HOV 2 free off peak (<i>first 3½ years</i>) ▪ HOV 2 tolls at all times (<i>after 3½ years</i>)
I-10 Express Lanes	SBCTA	Construction	Switchable transponder	<ul style="list-style-type: none"> ▪ HOV 3+ free

Source: WSP, 2021

3.2 SIGNAGE

Signage remains one of the most complex challenges in developing the regional express lane network. There is a clear relationship between signage, tolling policies, and business rules, making it important for decision makers not normally accustomed to focusing on such details to be aware of the implications of their policy decisions on signage. Achieving consistent business rules on express lanes in the SCAG Region will help facilitate consistent signage.

Express lane projects require the following types of signs:

- Vehicle Occupancy Definition signs
- Period of Operation signs
- Preferential Lane Advance Warning signs
- Preferential Lane Termination signs
- Toll Rate signs
- Toll Information signs
- Violation Information signs

During the PA/ED process, project designers need to work with the Caltrans District Traffic Signing Engineer to determine locations for all overhead sign structures. Express lane signing needs to be coordinated with the necessary general-purpose lane signs that are also required for the corridor. Closely spaced interchanges within express lane corridors make it increasingly difficult to find space for all required signs, and will necessitate close coordination with Caltrans. Typically, the majority of express lane signs are installed on overhead sign structures a minimum of 800 feet apart.

The Federal Manual on Uniform Traffic Control Devices (MUTCD) sets the minimum standards governing all traffic control devices to improve safety and mobility for all roadway users and improve efficiency in the transportation system. The MUTCD is maintained by FHWA and is revised periodically with inputs from practitioners, agencies, and other stakeholders. In California, the MUTCD is incorporated into the California Manual on Uniform Traffic Control Devices (CA MUTCD), which provides definitive guidance on signage and other traffic control devices for use in California. Section 2G, which describes requirements for preferential and managed lanes signs, with specific sections related to Signs for Priced Managed Lanes commencing at Section 2G.16. In 2021, FHWA issued a draft version of the first update of the MUTCD in 11 years. Part of the update focuses on new signage needs associated with the expansion of express lane networks in major regions around the country. As of this writing, it is unknown when FHWA will issue the new MUTCD. Whenever a new edition of the MUTCD is released, states typically have at least two years to adopt the new MUTCD. For California, this would take the form of a new edition of the CA MUTCD.

Toll rate signs introduce arguably the greatest challenges for express lane facilities. These signs display real-time toll amount information to users by identifying the cost to travel to specific destinations on the express lanes (usually the nearest point of egress and furthest point of egress at the end of a toll zone). Subsection 08a of Section 2G.17 of CA MUTCD 2014, Revision 6, provides guidance that states:

No more than two destinations should be shown on the [toll rate] sign. If multiple destinations are used, one of these destinations should be the furthest destination on the facility; the other destination(s) should be an intermediate interchange. The particular intermediate interchange to be shown on the [toll rate] sign should be determined on a case-by-case basis, depending upon local factors including the relative importance of the intermediate interchanges.

In addition to the two destinations provided on the toll rate sign, a third line is permissible to indicate the HOV eligibility requirement for a toll discount on HOT lanes, as illustrated as Sign R3-48a in Figure 2G-17 of CA MUTCD 2014, Revision 6.

Toll rate signage becomes more complex if express lane operators allow for different types of license plate toll transactions (such as license plate tolling), or when there are intersecting facilities where motorists have the options of traveling in two opposite directions. Per the requirements of the CA MUTCD, multiple toll rate signs would be required under these conditions.

Caltrans is developing a *Managed Lanes Guidelines* document that addresses signage and other design issues. This will include guidance on toll rate signs that will meet the needs of the traveling public and comply with the CA MUTCD limit of two destinations (plus any HOV requirements) on individual signs.

3.3 EXISTING FACILITY DEGRADATION

Title 23 of the United States Code, section 166 (23 U.S.C. § 166) requires that public authorities operating HOV and express lanes prepare an annual Degradation Report documenting the performance of HOV and express lane facilities. Per subsection (d) of 23 U.S.C. § 166, HOV and express lane facilities are considered degraded if the average traffic speed during the morning or evening weekday peak period (6:00 to 9:00 a.m., and 3:00 to 6:00 p.m.) is less than 45 miles per hour (mph) for more than 10 percent of the time over a consecutive 180-day period.

Within six months of determining that an HOV or express lane facility is degraded, public authorities are required to submit an Action Plan detailing the steps that they will take to make significant progress toward bringing the facility into compliance with the 45-mph average operating speed standard. If FHWA finds that the public authority has failed to bring a facility into compliance, it may impose program sanctions. Project owners may request a waiver of sanctions if they agree to undertake additional mitigation actions determined by FHWA. The federal degradation reporting and mitigation requirements are detailed in FHWA's September 2016 [*Federal-Aid Highway Program Guidance on High Occupancy Vehicle Lanes*](#).

Section 166 defines public authorities to include state departments of transportation, public entities designated by a state, or local governments with jurisdiction over the operation of an HOV or express lane facility. Although the CTCs currently operate all express lane facilities in the SCAG Region, compliance with FHWA degradation requirements is a Caltrans function. However, federal law would also allow express lane operators to prepare their own degradation reports, with Caltrans oversight.

Following FHWA requirements, Caltrans develops a tailored action plan for each degraded HOV and express lane facility to bring them into compliance with federal performance standards. The plans are based on detailed analyses of the causes of degradation. If states fail to make progress toward improving the operational performance of degraded facilities, per Title 23 Section 1.36 (23 U.S.C. §

1.36), FHWA may withhold payment of federal funds to the state and withhold approval of further projects until compliance or remedial action has been accomplished.

Caltrans completed its 2020 degradation analysis in June 2021, which revealed that Caltrans Districts 7, 8, and 12 had the highest amounts of degradation statewide. All three districts experienced degradation in the morning and afternoon peak hour periods. The levels of degradation in the morning were about 55 to 79 percent less than the levels seen in 2019, while levels of degradation in the afternoon decreased by 34 to 54 percent. These decreases are a result of reduced traffic volumes due to the COVID-19 pandemic. As a result of these decreases, Caltrans and FHWA agreed to update the action plans from the 2019 Degradation Report rather than preparing new action plans in 2020.

As shown in Table 3-2, several existing HOV and express lane corridors currently experience degradation during peak periods. These include HOV corridors where express lanes are in construction or under consideration. These include:

Table 3-2. Degraded Existing and Candidate Express Lane Facilities in the SCAG Region in 2020

DEGRADED FACILITY	LOCATION	STATUS
I-110 ExpressLanes*	Los Angeles County	Retrofitted HOV facility
I-10 ExpressLanes*	Los Angeles County	Retrofitted HOV facility
I-10 HOV Lanes	Los Angeles County	HOV to HOT conversion under consideration
I-105 HOV Lanes	Los Angeles County	HOV facility under consideration for widening / HOT conversion
I-605 HOV Lanes	Los Angeles County	HOV facility under consideration for HOT conversion
I-405 HOV Lanes	Los Angeles County	HOV facility under consideration for widening / HOT conversion
I-405 HOV Lanes	Orange County	HOT widening / HOV conversion under construction
I-5 HOV Lanes	Orange County	HOT widening / HOV conversion under consideration
SR-57 HOV Lanes	Orange County	HOT conversion under consideration
SR-91 HOV Lanes	Orange County	HOT conversion under consideration
SR-91 Express Lanes	Riverside County	Operational HOT widening
I-10 HOV Lanes	San Bernardino County	HOT widening / HOV conversion under construction

Source: Caltrans, 2021

*Not degraded prior to conversion to ExpressLane operations

One of the most effective strategies for addressing service degradation on HOV facilities is to increase vehicle occupancy requirements. However, this has the potential to reduce traffic on the lanes below their optimal utilization levels and drive more traffic into the general-purpose lanes. One strategy for optimizing the utilization of HOV lanes where occupancy requirements have been increased is to accompany the increase with a conversion to express lane operations, whereby toll paying vehicles can utilize the available capacity with varying toll rates designed to manage traffic flow on the lanes in order to avoid service degradation. Similarly, if service on existing express lanes becomes degraded, an increase in occupancy requirements can be considered, together with an adjustment to the variably priced toll rates, to manage traffic flows. Addressing service degradation on express lanes is less of an issue, since toll rates can be adjusted to address demand. To date, changes in vehicle occupancy

requirements have not been widely implemented on express lane segments operating in Southern California.

Caltrans Districts 7, 8, and 12 all completed Degradation Action Plans for degraded HOV and express lane facilities, in late 2021, identifying specific mitigation measures to improve the performance of degraded facilities.

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4 Federal and State Tolling Authorization

4.1 FEDERAL LEGISLATION

Historically, federal law has generally prohibited the imposition of tolls by states on federally funded facilities.¹ Under the *Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users*, Congress enabled several exceptions to the general prohibition. In the *Moving Ahead for Progress in the 21st Century Act* (MAP-21), passed on June 29, 2012, Congress expanded the exceptions for construction of new tolling capacity, but did little to expand existing toll pilot programs. On December 4, 2015, President Obama signed the *Fixing America’s Surface Transportation (FAST) Act*, a five-year authorization of surface transportation programs, which made some significant changes with respect to tolling, especially as it relates to express lanes. On November 15, 2021, President Biden signed the IJA. While IJA represents a significant bipartisan accomplishment to support investment in transportation infrastructure, including \$550 billion in new spending, the law prescribes only minor changes to statutes specifically related to express lanes.

4.1.1 Section 129 General Tolling Program

The 23 U.S.C § 129 General Tolling Program allows tolling on new highways and new lanes added to existing highways, and on the reconstruction or replacement of bridges, tunnels, and existing toll facilities, as of right², provided the number of toll-free lanes after construction is not less than the number of toll-free lanes before construction.³ Tolling agreements are no longer required for the construction of new capacity.

§ 11404(b) of the IJA amended § 129(a) to add a requirement that any toll facilities on the Interstate System and authorized under § 129 after November 15, 2021, are required to offer HOVs a discount rate or exemption.⁴ The only exception to this requirement is if the number of HOVs using the facility reduces the travel time reliability, consistent with the provisions of 23 U.S.C. § 166.

IJA has amended § 129 to include subsection (d), creating the “Congestion Relief Program” to provide funding grant opportunities for agencies in urbanized areas with populations of 1,000,000 or more to conduct planning, design, implementation, and construction of projects that reduce highway congestion, and to reduce the economic and environmental costs associated with that congestion.⁵

¹ 23 U.S.C. § 301.

² 23 U.S.C. § 129.

³ *Id.*⁴ 23 U.S.C. § 129(a)(10)

⁴ 23 U.S.C. § 129(a)(10)

⁵ 23 U.S.C. § 129(d), 23 U.S.C. § 129(d)(3) and 23 U.S.C. § 129(d)(4)

Deployment and operation of a system that implements or enforces high occupancy vehicle toll lanes, cordon pricing, parking pricing, or congestion pricing are identified as eligible projects under the Congestion Relief Program.⁶ IIJA also specifically authorizes the use of tolling on Interstate highways as part of a Congestion Relief Program project, subject to specific limitations on toll rates.⁷ The use of tolling on Interstate highways under this program is limited to no more than 10 urbanized areas.⁸ The minimum award for grants under the Congestion Relief Program is \$10,000,000.⁹ IIJA authorizes \$50,000,000 per year for fiscal years 2022 through 2026 to carry out the Congestion Relief Program, which is the successor to the Value Pricing Pilot program.¹⁰

4.1.2 Section 166 HOV/HOT Lanes

23 U.S.C § 166 governs the use of tolls on HOV lanes. It supersedes any requirements in § 129, since § 129 does not provide specific authority allowing vehicles that do not meet the occupancy limitation to operate on HOV lanes. Such authority can only come from § 166 and, therefore, its provisions apply to all conversions of HOV lanes to tolled operations.

Under § 166, existing HOV lanes may be converted to HOT lanes, subject to certain requirements. States must demonstrate that the existing HOV facility is not degraded, and that the presence of tolled vehicles will not result in degradation.¹¹ Automatic toll collection systems must be implemented on such projects, and toll revenue from such facilities is subject to the requirements of 23 U.S.C. § 129(a)(3).¹² Facilities tolled pursuant to § 166 are subject to ongoing annual reporting documenting conditions on the converted lanes.¹³

The IIJA includes an amendment to § 166(b) to add the ability for public authorities to allow blood transport vehicles in active service to utilize HOV lanes, if the vehicles are clearly identified as such.¹⁴

§ 166(d)(1) requires operating authorities to actively manage their HOV facilities, including those that have been converted to priced express lanes. If the performance of the facility has degraded, then multiple options are available to the operator for restoring performance, including changes to the allowance of toll vehicles, increasing occupancy requirements, and increasing capacity. § 166(c)(1) also requires all tolls charged to be in conformity with § 129, and if the conversion of HOV lanes to priced managed lanes is articulated in § 129(a)(1)(H), then the new HOV discount / exemption policy also applies to facilities authorized under § 166.

⁶ 23 U.S.C. § 129(d)(4)(B)

⁷ 23 U.S.C. § 129(d)(6)

⁸ 23 U.S.C. § 129(d)(6)(C)

⁹ 23 U.S.C. § 129(d)(5)(D)

¹⁰ Pub. L. 117-58 § 11101 (b)(1)(B)

¹¹ 23 U.S.C. § 166(d)(1).

¹² 23 U.S.C. § 129(a)(3)

¹³ 23 U.S.C. § 166(d)(1)

¹⁴ 23 U.S.C. § 166(b)(6)

4.2 STATE LEGISLATION

The most significant legislative development influencing the implementation of express lane projects in California since the completion of the 2016 Regional Express Lane Network Concept of Operations is SB 743. While SB 743 was passed in 2013, the bill did not go into effect until July 1, 2020. SB 743 modifies the California Environmental Quality Act (CEQA) to require project-level assessments of the effects of adding highway capacity on vehicle miles traveled, rather than traffic level of service. SCAG has initiated discussions with Caltrans and the CTCs on the application of SB 743 on express lane projects as part of the ConOps process and has summarized the discussions held to date in a separate document. SCAG will continue to coordinate with Caltrans and its regional partners on best practices for completing SB 743 analyses in connection with express lane projects. The remainder of this section discusses other state legislative issues that affect express lane development in California.

4.2.1 Existing Statewide Authorizing Legislation

State law grants Caltrans the authority to regulate franchises, licenses, or the privilege to construct or operate toll bridges or roads in the state.¹⁵ Legislative authorization to operate toll facilities was historically granted on a facility-by-facility basis and accomplished by direct authorization to develop and operate an express lane or engage a private partner in the development of a project.

In 2006, the California Legislature passed AB 1467 to allow regional transportation agencies¹⁶, in cooperation with Caltrans, to develop and operate HOT lane projects.¹⁷ AB 1467 required application to the California Transportation Commission, and limited the number of projects to four, with two projects in Southern California and two projects in Northern California.¹⁸ In 2011, the California Transportation Commission determined the Metropolitan Transportation Commission (MTC) to be eligible to develop and operate 285 miles of express lanes in the Bay Area, consistent with California Streets and Highways Code § 149.7. This included the conversion of approximately 150 miles of existing HOV lanes and the construction of 120 miles of new express lanes across multiple freeway corridors. No applications were able to be approved under this statute on or after January 1, 2012.¹⁹ The I-10 and I-110 ExpressLanes were also approved using the AB 1467 process. However, as described below, there was a provision in place that also required the Legislature to approve these facilities.

AB 798, signed into law on October 11, 2009, removed the requirement that the California Transportation Commission forward HOT lane project applications to the Legislature for approval, but did not substantively change the other restrictions under § 149.7 (c), which limited the number of

¹⁵ Sts. & Hy. Code, §30800-30813.

¹⁶ See Sts. & Hy. Code § 149.7. "Regional transportation agency" is statutorily defined to mean a transportation planning agency, a county transportation commission, any other local or regional transportation entity that is designated by statute as a regional transportation agency. Sts. & Hy. Code, § 143.

¹⁷ Sts. & Hy. Code, § 149.7(a).

¹⁸ Sts. & Hy. Code, § 149.7(c).

¹⁹ Sts. & Hy. Code, § 149.7(e).

projects and established the January 1, 2012, sunset date for approval of applications, effectively guaranteeing that any new HOT lane projects would require specific legislative authorization.

Projects in Southern California that have received tolling authority through the AB 194 process include the I-405 Express Lanes in Orange County and the I-105 ExpressLanes in Los Angeles County.

4.2.1.1 Assembly Bill 194

As discussed above, prior to 2016, state law limited the number of HOT facilities that can be approved under Streets and Highways Code § 149.7 to four projects, and prohibited the California Transportation Commission from approving applications after January 1, 2012.²⁰ Introduced during the 2015-2016 regular session, AB 194 amended § 149.7, to authorize regional transportation agencies and Caltrans to build and operate HOT lanes or other toll facilities without limit, subject to review and approval by the California Transportation Commission. The bill also removed the January 1, 2012, deadline for applications.²¹

As a result, AB 194 mainstreamed the ability of Caltrans and regional transportation agencies to implement express lane projects, subject to approval by the California Transportation Commission. This bill makes the authorization of a toll lane or toll road an administrative determination by the California Transportation Commission, rather than a legislative decision. Piecemeal legislation would no longer be required. Removing the limitations on the number of facilities and deleting the application deadline under § 149.7 enables more regional transportation agencies the opportunity to implement tolled facilities.²² Furthermore, giving California Transportation Commission administrative power to authorize toll facilities streamlines and potentially expedites the approval process. On October 9, 2015, Governor Brown signed AB 194 into law with the provisions of the bill taking effect on or before January 1, 2016.

²⁰ Sts. & Hy. Code § 149.7.

²¹ AB 194 (2015).

²² *Id.*

4.2.2 Metro I-110/I-10 Express Lanes Authorization

Metro was granted specific legislative authority to implement express lanes on I-10 and I-110.²³ In 2014, Senate Bill (SB) 1298 removed the sunset date on Metro’s authority and extended the program indefinitely.²⁴ The new law contains additional requirements for agreements between Metro, Caltrans, and the California Highway Patrol (CHP) to identify respective roles, responsibilities, and procedures for law enforcement.²⁵ Costs incurred by state agencies in the implementation or operation of the program and maintenance of the facilities in connection with the program shall be reimbursed from toll revenues.²⁶ Remaining revenues must be used in the I-10 and I-110 corridors for planning and construction costs of HOV facilities and improvement of transit services.²⁷ SB 1298 also authorized Metro to issue bonds to finance costs necessary to implement the program, and to finance expenditures payable from the revenues generated from the program.²⁸

4.2.3 RCTC I-15 Express Lanes Authorization

RCTC was granted legislative authority to develop and operate a HOT lane facility on I-15 under the provision of AB 768.²⁹ The I-15 Express Lanes project is one of the two HOT lane projects in Southern California authorized by Streets and Highways Code § 149.7, and upon approval by the California Transportation Commission, was codified in Streets and Highways Code § 149.8 by AB 1954.³⁰ To finance the costs of the HOT lane facilities, RCTC is authorized to issue bonds.³¹ Revenue generated from the facility must first be used to cover costs for capital outlay, operation and maintenance (including toll enforcement), repair and rehabilitation, indebtedness (and related financing costs), reserves, and administrative costs, which are limited to three percent of toll revenues.³² Excess toll revenues may be used for transit service or other operational or capacity improvements designed to reduce congestion on I-15.³³

²³ See Sts. & Hy. Code, § 149.9.

²⁴ SB 1298 (2014) http://www.dot.ca.gov/hq/innovfinance/public-private-partnerships/ab_1467_bill_20060519_chaptered.pdf

²⁵ Sts. & Hy. Code § 149.9(b)(1).

²⁶ *Id.*

²⁷ Sts. & Hy. Code, § 149.9(b)(2).

²⁸ Sts. & Hy. Code, § 149.9(h).

²⁹ Sts. & Hy. Code, § 149.8.

³⁰ AB 1954 (2008). In 2009, AB 798 deleted the requirement for the California Transportation Commission to forward the Section 149.7 applications for the four authorized facilities to the Legislature for approval or rejection.

³¹ Sts. & Hy. Code, § 149.8(c)(3).

³² Sts. & Hy. Code, 149.8(c)(1).

³³ Sts. & Hy. Code, 149.8(c)(2). These improvements could be anywhere along the SR 15 corridor, as the statute does not limit these projects to the HOT facility.

4.2.4 OCTA/RCTC 91 Express Lanes Authorization

In 1989, AB 680 added § 143 to the Streets and Highways Code³⁴ to allow for four privately funded demonstration transportation projects. The 91 Express Lanes on SR-91 in Orange County, which opened in 1995, was authorized under AB 680.³⁵ A private partner was originally granted those rights under a franchise agreement with Caltrans. OCTA bought the private entity out in 2003.³⁶ Prior to imposing tolls on SR-91 in Riverside County, OCTA was required to obtain approval from the Riverside County Board of Supervisors, RCTC, and the SR-91 advisory committee.³⁷ In 2008, SB 1316 authorized OCTA to relinquish its rights relative to SR-91 in Riverside County to RCTC, legally separating the segments of the SR-91 franchise and effectively allowing RCTC to proceed with planning and design for the extension of the 91 Express Lanes into Riverside County.³⁸ RCTC was granted broad authority to impose tolls, user fees, or other charges for use of the 91 Express Lanes in Riverside County for 50 years following the opening of the facility for public use.³⁹ In accordance with SB 1316, RCTC has an agreement with OCTA to coordinate operation of the 91 Express Lanes extension into Riverside County.⁴⁰

4.2.5 SBCTA I-10/I-15 Express Lanes Authorization

AB 914 authorizes SBCTA, by virtue of their role as the county transportation commission for San Bernardino County, to conduct, administer, and operate a value-pricing program on I-10 and I-15 in San Bernardino County.⁴¹ SBCTA is required to enter into cooperative agreements with Metro and/or RCTC to the extent the facilities extend to such respective counties and connect to, or are near similar toll facilities.⁴² The proposed provisions are similar to other tolled facilities in California.⁴³ SBCTA is allowed to issue bonds to finance project related costs, is required to use toll revenues for the benefit of the respective corridors, and may enter into agreements with Caltrans and CHP to provide for reimbursements from toll revenues for costs incurred in connection with implementation or operation of the program.⁴⁴ AB 914 limits administrative costs to up to three percent of toll revenues⁴⁵ and allows the conversion of HOV lanes to HOT lane operations.⁴⁶ On October 9, 2015, Governor Brown signed AB 914 into law, with the provisions of the bill taking effect on or before January 1, 2016.

³⁴ Section 143 of the Streets and Highways Code has since been amended to allow for public-private partnerships.

³⁵ A second project authorized in the region was for SR 57 in Orange County, which was ultimately never constructed.

³⁶ Pub. Util. Code, § 130240 et seq. (2007)

³⁷ *Id.*

³⁸ Pub. Util. Code § 130240(k).

³⁹ Pub. Util. Code § 130244(c)(6)

⁴⁰ Public Utilities Code § 130240(l).

⁴¹ AB 914 (2015), http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB914.

⁴² *Id.*

⁴³ See Sts. & Hy. Code §§ 149.1, 149.4, 149.5 and 149.6.

⁴⁴ AB 914 (2015), http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB914.

⁴⁵ *Id.*

⁴⁶ *Id.*

4.3 OTHER STATE LEGISLATIVE AND REGULATORY CONSIDERATIONS

There are other legislative and regulatory considerations that apply to the development and operation of a regional express lane network in Southern California. They are described below in further detail.

4.3.1 Coordination with Caltrans

The enabling legislation for HOT lanes mandates that an operator must develop and operate the facility in cooperation with Caltrans. Whenever a regional transportation agency will operate a HOT lane, the agency, and other stakeholders, as appropriate, shall enter into an operating agreement with Caltrans. The operating agreement defines overall roles, responsibilities, and requirements related to operation and maintenance of the HOT lanes. It outlines how the HOT lanes will be operated (i.e., business rules, vehicle occupancy requirements, etc.). It also addresses other topics such as risk management; data sharing; performance monitoring; and annual audits and reports. It explains how toll revenues are to be used and provides for reimbursement of any costs incurred by Caltrans associated with the operation of the lanes. In addition to the operating agreement, cooperative agreements will be needed to cover costs that are incurred relative to design and construction. Agreements shall also be made with the CHP for any specialized enforcement, as may be deemed appropriate. A separate agreement for maintenance of the HOT lane will also be needed.

4.3.2 User Fees

The distinction between fees (including tolls) and taxes is important because typically the imposition of a new tax or a tax increase requires legislative and/or voter approval, whereas an agency can set a fee administratively, with the appropriate statutory authority. To be considered a fee rather than a tax, a nexus relationship needs to exist between the collection of revenue and the use of that revenue. For example, the collection of tolls should be related to paying for the capital expenses and/or operations and maintenance of the tolled facility, or the broader system of tolled facilities, and related transportation infrastructure.

For projects receiving funding that is issued as part of the *California Transportation Financing Authority Act*, toll revenues must be applied towards debt service, operations, and maintenance over the life of the bonds, and must incorporate life-cycle costs for the project, including rehabilitation.⁴⁷ Lease agreements that are entered into pursuant to California's public-private partnership authority must require toll revenues to be applied toward payment of capital outlay costs, costs associated with operation and administration of the facility, reimbursement of state agencies for costs of service to develop and maintain the facility, and a reasonable return on investment for the private partner.⁴⁸

⁴⁷ Gov. Code § 64112(d) and 64112(e).

⁴⁸ Sts. & Hy. Code § 143(j)(1).

4.3.3 Rate Setting

The various pieces of California legislation authorizing specific facilities typically provide regional transportation agencies, such as Metro, OCTA, RCTC, and SBCTA, the authority to set rates on the respective facility.⁴⁹ The enabling legislation for the I-10 and I-110 ExpressLanes gives Metro broad authority to set toll rates, but requires a public hearing to be held prior to setting or increasing the toll.⁵⁰ RCTC has legislative authority to set toll rates on SR-91⁵¹ and I-15,⁵² subject to a minimum 30-day public review and comment period prior to adoption of the initial schedule and any subsequent changes.⁵³

For the most part, regional transportation agencies have broad authority to set toll schedules. This allows them to set toll rates in accordance with the goals and policies of the respective project. It is anticipated that any new legislation authorizing tolls would have similar language with respect to retaining flexibility for rate setting. Pursuant to AB 194, the sponsoring agency of a tolled facility shall be responsible for establishing, collecting, and administering tolls, and may include discounts and premiums for the use of the toll facility.

4.3.4 High-Occupancy Vehicle Lanes

Caltrans is responsible for maintaining operations of HOV lanes, which includes the authority to make operational changes (including to occupancy policies), provided they are compliant with federal and state regulations.⁵⁴ On November 6, 2020, Caltrans issued TOPD 20-02 titled *Changing Vehicle Occupancy Requirements on Managed Lanes* requiring vehicle occupancy to be evaluated as part of any proposal to convert HOV lanes to HOT lanes, and also requiring districts to evaluate if and where vehicle occupancy requirements should be changed during MLSP updates. TOPD 20-02 provided guidance for monitoring and evaluating vehicle occupancy requirements, addressing degraded HOV and HOT lane performance, and converting HOV lanes to HOT lanes. TOPD 20-02 also noted: “Changes to occupancy requirements and toll policies on priced managed lanes are the responsibility of the entity that has the tolling authority. If a regional transportation agency has tolling authority, any such changes should be made in consultation with Caltrans.”

Caltrans is expressly authorized to construct new HOV lanes on existing highways, subject to conducting competent engineering estimates of the effect of HOV lanes on safety, congestion, and highway capacity.⁵⁵ On November 6, 2020, Caltrans issued TOPD 20-01, titled *Managed Lane System Plan (MLSP) Guidelines*, providing districts with guidelines to be used when developing MLSPs. Deputy Directive (DD) 43R1, titled *Managed Lane Facilities*, which was published by Caltrans on May 29, 2015,

⁴⁹ See Sts. & Hy. Code §§ 149.1, 149.8. and 149.9.

⁵⁰ Sts. & Hy. Code § 149.9(7).

⁵¹ Pub. Util. Code § 130244(c)(1).

⁵² Sts. & Hy. Code § 149.8(c)(1).

⁵³ See Sts. & Hy. Code § 149.8(d) and Pub. Util. Code § 130244(c)(7).

⁵⁴ Veh. Code § 21655.5 gives Caltrans the ability to designate HOV lanes on state highways.

⁵⁵ Sts. & Hy. Code § 149.

previously established that “each district that currently operates, or expects to operate, managed lanes on the state highway system within the next 20 years must prepare an MLSP, in cooperation with regional transportation agencies and other stakeholders. The MLSP shall contain a list of each managed lane facility that is currently in operation or planned for operation within the next 20 years.” Managed lanes are defined in TOPD 20-01 as:

- High-occupancy vehicle (HOV) lanes.
- High occupancy/toll (HOT) lanes. These are HOV lanes that may also be accessed by tolled vehicles.
- Express toll lanes (ETL). All vehicles pay a toll to access these lanes; discounts may be offered for certain classes of vehicles, such as HOV.
- Bus lanes. These lanes are used by transit buses and other common carriers.
- Truck lanes. These lanes are used to separate commercial vehicles from general-purpose traffic. They may be tolled.
- Part-time lanes, where the shoulder is designated as a lane at certain times of the day; these lanes are usually reserved for HOV or bus use.

TOPD 20-01 outlines key elements of an MLSP and the process for developing an MLSP. The guidance indicates an MLSP should be used to provide input into the District System Management Plan (DSMP), corridor plans, and the area’s RTP/SCS, and be updated every four years, or at the discretion of the lead or partner agencies.

Various additional statutes require Caltrans and partner agencies to address specific design and operational policy considerations for HOV lanes and other managed lanes with HOV privileges. Signs notifying motorists of vehicle occupancy levels and hours of HOV usage are required to be posted.⁵⁶ Emergency vehicles (responding to a qualifying event), motorcycles, mass transit, and paratransit vehicles are exempt from access requirements.⁵⁷ To the extent proposed express lane facilities in the SCAG Region incorporate specific provisions to accommodate and incentivize HOV use, the construction and operation of HOV facilities will need to be developed pursuant to federal and state regulations relating to HOV lanes.

Caltrans Deputy Directive 43R1, *Managed Lane Facilities*, states: “Managed lanes are designed and operated in a manner that will not degrade the overall mobility and safety performance of the freeway. All appropriate guidelines, policies, procedures, and standards, including Caltrans’ Highway Design Manual design criteria, shall be applied when planning, designing, and operating managed lanes. Design features and operational strategies for managed lanes, and any changes to those features or strategies, shall be determined by Caltrans in cooperation with regional transportation agencies, CHP, and other affected stakeholders.” Caltrans’ 2018 *High-Occupancy Vehicle Guidelines for Planning*,

⁵⁶ Veh. Code § 21655.5

⁵⁷ *Ibid*

Design and Operations (HOV Guidelines) serve as “a ‘how to’ document for planners, designers and operators of mainline HOV facilities.” The *2018 HOV Guidelines*, although not intended to supersede design manuals and established standards, provide a comprehensive, consolidated reference on HOV lane requirements, and outline the process for planning, operating, designing, and enforcing HOV lanes. Caltrans is currently in the process of developing a new *Managed Lane Guidelines*, which will replace the *HOV Guidelines*.

4.3.5 Clean Air Vehicles

Per current policy, as codified in Title 23 of the Federal Code, the California Vehicle Code allows qualifying inherently low-emission vehicles (ILEV) and Advanced Technology Partial-Zero Emission Vehicles with the appropriate decals issued by the Department of Motor Vehicles (DMV) that confer their drivers authorization, to use HOV lanes regardless of vehicle occupancy.⁵⁸ The decals remain valid for four years, or until federal authorization expires.⁵⁹ Federal authorization is currently scheduled to expire in 2025 and does not appear to have been extended under IIJA. The California Air Resources Board maintains the list of eligible vehicles for these programs.⁶⁰ In the absence of any legislative changes or specific provisions of project specific authorizing legislation, express lanes developed within the SCAG Region will be required to treat ILEV and partial-zero emission vehicles with “Access OK” decals as qualifying for toll discounts, for as long as the decals remain valid. State law permits express lane operators to charge these vehicles a discounted toll. Metro has implemented this as a policy, as have the express lane operators in the San Francisco Bay Area. The DMV maintains a [list of expiration dates](#) for different types of decals on its website.

The California Toll Operators Committee (CTOC) has developed a process for recognizing qualified clean air vehicles for the purpose of charging these vehicles the correct toll. This process includes confirming eligibility and issuing a transponder that carries a clean air vehicle (CAV) indication value. This value is shared with the other operators so that the facility discount can be applied.

4.3.6 Toll Evasion Violation

California Vehicle Code § 40254 allows for detection of toll evasion by “automated devices, visual observation, or otherwise.” Toll violations are civil infractions.⁶¹ Existing law allows fines for non-compliance (and unpaid user fees) to be collected through an administrative process.⁶² Toll evasion penalties collected in accordance with § 40254, including all administrative and process service fees, as well as costs related to debt collection, are deposited into the account of the entity (public or private)

⁵⁸ Veh. Code §§ 5205.5 and 21655.9.

⁵⁹ Veh. Code § 5205.5(j). The Director of Transportation may also make a determination that federal law does not authorize the state to allow vehicles described in the statute to use HOV lanes regardless of vehicle occupancy. Veh. Code § 5205.5(i).

⁶⁰ Veh. Code § 5205.5(d).

⁶¹ Veh. Code § 40250(a).

⁶² Veh. Code § 40255.

authorized to collect tolls.⁶³ The statute does not make a distinction between whether the penalty is collected administratively, or as a result of a judicial process. As such, the entity authorized to collect the toll would receive the collected penalty regardless.

Citations issued by CHP officers for non-compliance with express lanes operating rules are typically issued under California Vehicle Code § 23302(a) and (b), for failure to pay toll, and 21461 (a), for failure to obey signs. Penalties for citations issued are distributed to state, county and judicial jurisdictions in accordance with state statutes

4.3.7 Interoperability

MAP-21 required that all highway toll facilities constructed with federal funds implement technologies or business practices that provide for nationwide operability.⁶⁴ AB 493 amended Streets and Highways Code § 27565 to allow toll facility operators in the state to implement technologies or business rules to comply with federal requirements.⁶⁵

Prior to AB 493, existing law prohibited transportation agencies from selling or otherwise providing personally identifiable information about their subscribers, with some minor exceptions such as for law enforcement purposes or to comply with the state's interoperability efforts.⁶⁶ It did not allow California toll operators to share information with out-of-state agencies. AB 493 makes narrow exceptions to existing privacy protections, by allowing operators of toll facilities on federal-aid highways to share information with other toll facility operators, but expressly limits the information to license plate number, transponder identification number, date and time of transaction, and identity of the agency operating the toll facility.⁶⁷ As part of an interoperability program, existing law would allow SCAG Region transportation agencies to share limited information with other states that may be useful for enforcing out-of-state toll violations.

California Streets and Highways Code § 27565 establishes the requirement for Caltrans to develop and adopt functional specifications and standards for an automatic vehicle identification (AVI) system to be used on toll facilities throughout California.⁶⁸ The Compatibility Specifications for Automatic Vehicle Identification Equipment developed in response to the requirements of § 27565 are codified in § 1700 of Title 21 of the California Code of Regulations, and outline the detailed specifications for all ETC systems installed in the state to ensure interoperability.⁶⁹ California has had interoperability with ETC throughout the state since the adoption of the Title 21 protocol in 1992. Streets and Highways Code §

⁶³ Veh. Code § 40251. That portion of the penalty collected attributable to issuance of the violation by CHP is given to the city or county where the violation occurred. *Id.*

⁶⁴ 23 U.S.C. § 1512.

⁶⁵ Sts. & Hy. Code § 27565.

⁶⁶ SB 168 (2010).

⁶⁷ Sts. & Hy. Code § 27565(e).

⁶⁸ Sts. & Hy. Code § 27565(a)

⁶⁹ CCR. § 1700

27565 was amended subsequent to the enactment of MAP-21 to facilitate implementation of technologies and business practices by California operators of toll facilities on the federal-aid highway system, in order to comply with the national interoperability requirement.⁷⁰ In response to the provisions of MAP-21 and § 27565, the CTOC recommended revising the Title 21 protocol to implement the International Standards Organization/International Electrotechnical Commission (ISO/IEC) 18000-63 standard for communications between tags and readers in the ultra-high frequency band (860 megahertz (MHz) to 930 MHz). Commonly referred to as 6C, this standard has been utilized for tolling since 2012 and has emerged as the preferred standard for tolling agencies across the United States, contributing to achieving national ETC interoperability. On November 28, 2017, § 1700 of Title 21 of the California Code of Regulations was revised to require all toll facility operators in California to develop the capability to read and process transponders using the 6C standard no later than January 1, 2019, whilst also providing for the legacy Title 21 protocol and replacement 6C standard to operate concurrently until January 1, 2024, unless explicitly approved by Caltrans to end sooner.⁷¹

FasTrak® is the branding used for compliant ETC systems throughout California. The FasTrak® brand name and logo, which are registered trademarks of TCA, is typically displayed on in-vehicle devices, signage, and marketing materials related to the compliant ETC system.

4.3.8 Imposition of Fines

The use of penalties and fines to enforce the use of express lanes or HOV lanes is accepted practice. The California Constitution prohibits the imposition of excessive fines.⁷² Where fines are legislatively established, they are subject to review under a principle of proportionality standard (i.e., whether the amount of the fine bears some relationship to the gravity of the offense it is designed to inhibit).⁷³ Where fines are set administratively, as a quasi-legislative function, the agency is presumed to have promulgated a reasonable rule and the challenger has the burden of demonstrating that the fine was set arbitrarily and capriciously.⁷⁴

In California, the Legislature has set a limit on the schedule of toll evasion penalties on a *per annum* basis.⁷⁵ Because this is a legislative function, the amount of these penalties would be reviewed using the principle of proportionality. With respect to traffic violations related to a vehicle's entrance into or exit from an HOV lane, the Judicial Council of California is responsible for setting the schedule of fines

⁷⁰ Sts. & Hy. Code § 27565(e).

⁷¹ CCR. § 1700.2 and 1700.3

⁷² Cal. Const. art. 1, § 17.

⁷³ *U.S. v. Bajakajian*, 524 U.S. 321, 327-328, 334, 336 (1998) (citing *Austin v. U.S.*, 509 U.S. 602, 609-610 (1993)).

⁷⁴ *Yamaha Corp. of America v. State Bd. of Equalization*, 78 Cal.Rptr.2d 1, 6 (1998) (citing *Wallace Berrie & Co. v. State Bd. of Equalization*, 40 Cal.3d 60, 65 (1985) (in reviewing the legality of a regulation adopted pursuant to a delegation of legislative power, the judicial inquiry is confined to the question whether it is arbitrary, capricious or without reasonable rational basis)).

⁷⁵ California Vehicle Code § 40258.

and maintaining the penalty schedule.⁷⁶ As an administrative agency asserting its quasi-legislative authority, any rule promulgated would be presumed reasonable by a court.

Enforcement of toll evasion and HOV use appears to be well established in California, and the implementation of an express lane network in the SCAG Region is unlikely to be met with any enforcement issues that have not been previously encountered in the state.

⁷⁶ Cal. Const. Art. VI § 6 grants the authority to the Judicial Council to adopt rules for court administration and rules of practice and procedure that are not inconsistent with statute. Ca. Rule of Court, rule 4.102, The Uniform Bail and Penalty Schedule, applies to occupancy violations of Vehicle Code Section 21655.5(b).

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5 Facility Design

The geometric design of individual express lane facilities will differ throughout the Southern California network based upon prevailing conditions and local desires and considerations. However, as the network expands to include interconnected facilities comprising one cohesive regional network, consistency in design treatments may become more important. The purpose of this chapter is to provide a basic understanding of geometric design and signing practices for a regional express lanes network in Southern California, so that individual projects within specific corridors may avoid inconsistencies and incompatibilities that could impact user experience. While this chapter provides design guidance and best practices for building the regional express lane network, it should not be construed as providing standards for individual design issues that must be resolved. Design standards will be governed by prevailing Caltrans and federal guidance.

5.1 DESIGN STANDARDS

Caltrans and FHWA have developed design manuals and guidelines that apply to various facets of express lane design, such as signing, striping, access, and separation treatment. All express lanes in Southern California will be implemented on Caltrans facilities; therefore, Caltrans and FHWA standards will need to be incorporated into the design of express lane projects. As express lanes are often implemented in highly constrained, urban environments, their design may require adaptations based on the physical circumstances and limitations of a particular freeway corridor. Deviations from these standards may require design exception approval from Caltrans or FHWA.

The following design standards and guidance documents should be referenced when designing express lanes:

- Caltrans *Highway Design Manual*, 7th Edition, May 2020
- Caltrans Standard Plans and Standard Specifications, 2018
- Caltrans High-Occupancy Vehicle Guidelines for Planning, Design and Operations, 2018
- Caltrans: System Plan for Managed Lanes on California State Highways, October 2020
- California Manual on Uniform Traffic Control Devices (Ca MUTCD), 2014, Revision 6, 2021
- Caltrans Deputy Directive DD-43-R1, *Manage Lane Facilities*, May 2015
- Caltrans *TOPD 11-02*, 2011
- American Association of State Highway and Transportation Officials: *A Policy on Geometric Design of Highways and Streets* (commonly referred to as Green Book), 7th Edition, 2018
- FHWA Priced Managed Lane Guide, 2012

- National Cooperative Highway Research Program (NCHRP) 15-49 *Guidelines for Implementing Managed Lanes*, 2016
- Additional applicable Caltrans standards, policies and procedures as they relate to the project

As project developers implement individual facilities, the established design standards, together with this ConOps for the SCAG Regional express lane network, will inform project design. Local agencies will likely have slightly differing objectives for express lanes facilities in their jurisdictions, and these differences may need to be reflected in the design of the regional network. For this reason, critical design criteria will inform whether a deviation from the established guidance is warranted. Key principles in considering deviations from the design guidance include:

- **Safety.** Deviations from design guidance should either have no change from or improve upon the perceived safety for express lanes and general-purpose lane travelers.
- **Operations.** Deviations should be oriented towards enhancing express lane operations and performance, and/or making necessary express lane maintenance easier and safer.
- **Customer Understanding.** Deviations should maintain consistency and customer understanding of use within and between facilities, particularly as they affect adjacent and connecting segments.

5.2 TYPICAL SECTION

The physical configuration of express lanes is driven by the location and design environment of the corridors within which express lanes will be deployed. Express lane improvements either involve adding capacity to existing highway corridors or converting existing HOV lanes to express lane operations. The construction of express lanes involves typical highway construction components such as paving, striping, drainage, utility coordination, and the construction of ramps, overpasses, and bridges. Express lanes also require infrastructure to support electronic toll collection, vehicle detection, and traffic monitoring, as well as significant signage for access and to display pricing information. In some cases, right-of-way acquisition may be necessary for roadway widening projects and for projects that involve conversion of an existing HOV lane, if the conversion triggers the need to modify access. Express lane projects can also be expected to require modifications to existing structures, signs, and barriers, and in some cases, existing interchange ramps.

5.2.1 Typical Section Recommendation

Standard shoulder and buffer design is desirable on express lanes to reduce crash rates and improve speed differentials. The typical express lanes standard roadway is defined by the Caltrans *HOV Guidelines* and is summarized in Table 5-1.

Typical Section:

Emphasize standard shoulder and buffer design to help reduce crash rates and friction due to speed differential between lanes.

Table 5-1. Typical Cross Section Standards Affecting Express Lanes (Adapted from Caltrans 2018 HOV Guidelines)

DESIGN ELEMENT	STANDARD
Lane Width	12 feet preferable; 11 feet minimum
Shoulder Width	10 feet preferable; 2 feet minimum
Separation Width	4 feet preferable; 2 feet minimum (not needed for continuous access facilities)
Access	2,000 feet minimum ingress/egress opening; minimum 800 feet per lane weaving distance to ingress/egress opening

This typical configuration may be reduced per Caltrans HOV Guidelines, which provides relative priority of reductions in lane, buffer, and shoulder widths at constrained locations. Deviations from mandatory standards are subject to Caltrans' Design Standard Decision Document (DSDD) Process. As plans are refined for each individual corridor, design exceptions to mandatory and advisory design standards may be identified. Where existing facilities were built to non-standard widths and lane configurations, they may be maintained under the express lane conversion, provided the consideration for safety, operations, and customer understanding can likewise be maintained. The Caltrans Project Development Procedures Manual outlines the DSDD process and provides a guide for documenting non-standard features, explaining why the non-standard feature may be retained or why improvements may be needed to achieve full standards, and obtaining Caltrans concurrence.

5.3 SEPARATION TREATMENT

During congested periods of the day, express lanes typically operate at higher speeds than adjacent general-purpose lanes. Given the speed differential and potential impact upon operations and safety, effective strategies for separating express lanes from the general-purpose lanes are important. The earlier a preference for separation treatment can be made, the earlier decisions regarding access and design tradeoffs (if necessary) can be made. The choice in separation design will also play a large role in operational feasibility, affordability, and overall constructability. Separation treatments may also have important lifecycle impacts upon maintenance, safety, enforcement, and incident management.

The design of most express lanes provides separation from general-purpose lanes using a combination of painted buffers, traffic channelizers, concrete barriers, and possibly grade separation. Some facilities have implemented a more open, continuous access design on primarily single-lane facilities using either a broken or solid lane line for lane separation. These options are addressed in more detail below.

5.3.1 Painted Line / Buffer Separation

Most existing HOV lanes in Southern California employ a painted buffer to delineate HOV lanes or express lanes from the adjacent general-purpose lanes. In 2012, California adopted the national MUTCD pavement markings standards for managed lanes. Today, physical barriers and striping should comply with the guidance found in CA MUTCD 2014, Revision 6, Chapters 3D (Markings for Preferential Lanes) and 3E (Markings for Toll Plazas), which stipulate:

- Prohibited access is indicated by a painted buffer marked with one or two sets of wide solid double white lines, with white chevron markings if buffer space is wider than four feet (Figure 5-1 and Figure 5-2). Most Express Lane facilities in the SCAG Region are contiguous with the general-purpose lanes and use the striping with a single set of white lines shown in Figure 5-2.
- Permitted (open or continuous) access is indicated by a wide broken single white lane line within the allocated buffer space where crossing the buffer space is permitted (Figure 5-3).

Figure 5-1. Pavement Striping for Buffer Separated Express Lanes

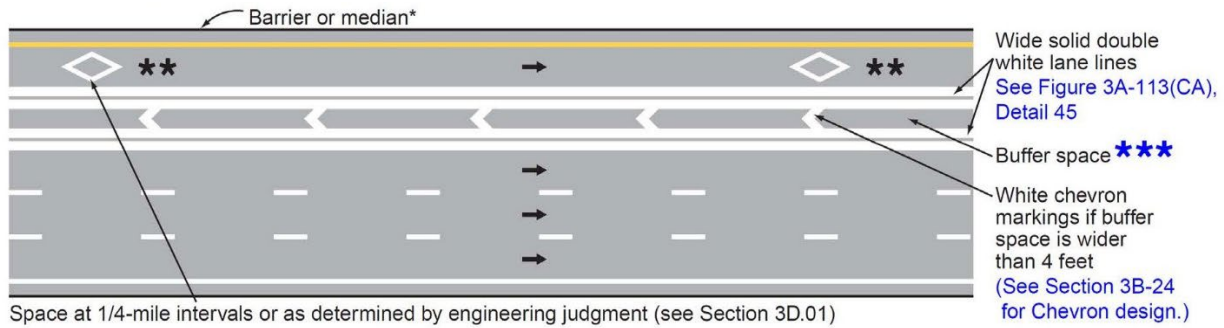


Figure 5-2. Pavement Striping for Contiguous Preferential lanes Where Enter/Exit Movements Are Prohibited

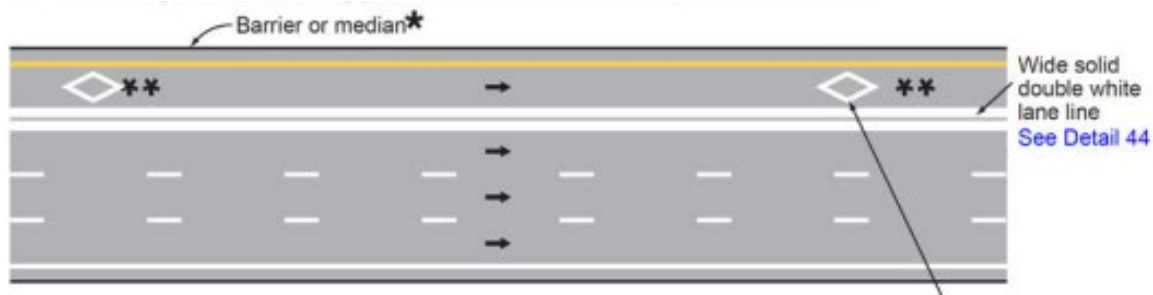
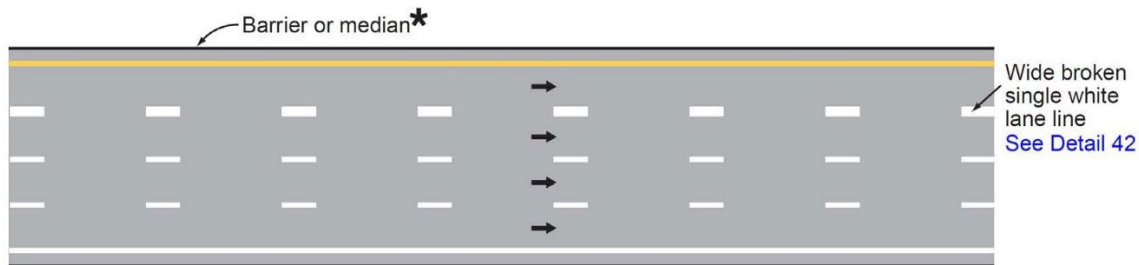


Figure 5-3. Pavement Striping for Continuous Access Express Lanes



The solid yellow stripe buffer—a notable feature of HOV lane markings in California over the past few decades—has been phased out and replaced with wide solid white stripes.

5.3.2 Channelizers / Delineators

Traffic channelizers – also known as delineators, pylons, or tubular markers – may be used to delineate a managed lane, improve driver comfort to operate with a speed differential, and reduce buffer crossing violations. The channelizers are placed at frequent intervals in the buffer area to create a perceived physical barrier to actively discourage motorists from moving in or out of the lanes in undesignated areas. The first operational express lanes facility, the 91 Express Lanes in Orange County, has continually operated with channelizers since December 1995 (see Figure 5-4). They were also tested unsuccessfully on the I-10 and I-110 ExpressLanes in Los Angeles County. RCTC has installed channelizers on the I-15 Express Lanes, and also on their portion of the SR-91 Express. Per the CA MUTCD, channelizers are 36 inches in height with white posts, and reflectors shall conform to the pavement markings. The posts may be surface mounted or anchored below the surface. The spacing of the channelizers depends on speed and traffic volumes, and they should be centered within the striped buffer area so that the installation and replacement of the posts does not affect other pavement markings.

Figure 5-4. SR-91 Express Lanes in Orange County with Channelizer Separation



The width of the buffer where the channelizers are located affects friction between the express lanes and the general-purpose lanes. On I-95 in Miami and SR-91 in Orange County, the 2- to 4-foot buffer (split evenly between express lanes and the general-purpose lanes) separates traffic and preserves better speeds in the express lanes. However, illegal buffer crossings and vehicle strikes occur regularly, requiring an estimated 30 to 50 percent of the channelizers to be replaced on an annual basis. By comparison, the 16-foot buffer on the I-10 facility in Houston provides substantial separation of traffic, ensuring minimal illegal crossings and the effective elimination of vehicle strikes of the channelizers.

5.3.3 Concrete Barrier Separation

Despite significantly higher capital cost and right-of-way requirements, concrete barriers continue to be used to separate some express lanes. Examples where barrier separation may be used include:

- Contra-flow or reversible segments where the express lanes operate adjacent to oncoming traffic.
- Facilities that employ direct access ramps for access to and from the express lanes.
- Facilities intended to serve long distance trips with little or no intermediate access points.
- Facilities where the risk of revenue leakage and/or performance degradation must be minimized to the best extent possible (e.g., facilities that were financed with debt or private investment that require reliable revenue streams to meet repayment obligations).

Moveable barriers provide additional operational flexibility while maintaining the benefits of positive separation. These special barriers are used for reversible and contraflow facilities that experience a clear peak directionality, such as the I-15 Express Lanes in San Diego County. However, they also entail on-going operations and maintenance expenditure requirements.

5.3.4 Separation Comparisons

All the separation treatments described above are in active use in Southern California. Furthermore, all express lanes operators generally report that they are satisfied with their chosen systems of lane separation treatment. Each separation option offers advantages and disadvantages, as noted in Table 5-2.

Table 5-2. Advantages/Disadvantages of Separation Types

SEPARATION	ADVANTAGES	DISADVANTAGES
Painted Line / Buffer	<ul style="list-style-type: none"> ▪ Lowest capital and ongoing maintenance costs ▪ Flexibility of operational options ▪ Flexibility for roadway reconfiguration ▪ Diversion for incident management ▪ Allows easy access to emergency vehicles 	<ul style="list-style-type: none"> ▪ Required enforcement of buffer crossings ▪ Lower reliability of performance due to friction and buffer crossings ▪ Greater risk of revenue leakage
Channelizer / Delineator	<ul style="list-style-type: none"> ▪ Lower capital and ROW costs ▪ Flexibility for roadway reconfiguration ▪ Ease of diversion for incident management (channelizers can be driven over or removed) ▪ Allows access to emergency vehicles ▪ Reduces risk for buffer crossings ▪ Reduces risk for revenue leakage 	<ul style="list-style-type: none"> ▪ Highest ongoing maintenance expenses ▪ Requires closure of lanes to replace channelizers ▪ Limits access to left-side shoulder ▪ Buffer crossings are still possible potentially affecting performance
Concrete Barrier	<ul style="list-style-type: none"> ▪ Lower maintenance costs than channelizers ▪ Highest speed differentials ▪ No buffer crossings ▪ Minimal risk for revenue leakage ▪ Easier to maintain performance 	<ul style="list-style-type: none"> ▪ Highest capital and ROW costs ▪ Higher drainage costs ▪ High cost for access treatments ▪ More difficult incident management ▪ Inflexibility for operational changes

5.3.5 Separation Treatment Recommendation

Multiple factors are involved in the selection of the most appropriate separation treatment, including operational performance, flexibility, safety, and cost. Each project may have different goals, objectives, market characteristics, funding considerations, and field conditions that favor one type of treatment over another. From a driver's point of view, differences in separation treatment used across facilities in Southern California probably has a minimal impact on driver experience, unless such differences contribute to detrimental operating conditions. For example, an express lane that transitions from channelizer separation to painted buffer separation may create an inconsistent experience if speeds in the buffer-separated segment were to drop due to drivers not feeling as comfortable traveling at high speeds without having channelizer separation. Safety should be another factor when considering the application of separation treatments across connected facilities. If differences in treatment cause driver confusion or contribute to erratic driver behavior, then it may be appropriate to consider separation treatments that are consistent across facilities.

*Separation Treatment:
Within the parameters of existing guidance, retain flexibility for implementing agencies to determine the lane separation treatment that best meets the objectives and needs of the specific project.*

5.4 ACCESS TREATMENT

Access treatments control how vehicles can enter and exit express lanes. Separation treatments described above are applied to facilities where access is largely precluded, to preserve express lane operating conditions. Such facilities are referred to as limited access, which is the predominant access type used on Southern California express lanes.

Caltrans TOPD 11-02 suggests two types of express lane access treatments: limited access design and continuous access design. As limited access comes in multiple forms, this ConOps splits limited access into two distinct types: 1) direct connector ramps and 2) at-grade weaves. Limited access treatments provide the ability to regulate where vehicles enter and exit express lane facilities. When properly located and designed, limited access offers a safe means of accommodating access movements while minimizing operational impacts caused by friction between the express lanes and general-purpose lanes. However, because limited access design does restrict opportunities for drivers to access the express lanes, these facilities must balance the desire for operational efficiency with the ability for the lane to be well utilized. Future changes in traffic patterns may introduce the need to revisit limited access treatments on express lanes. Continuous access, on the other hand, addresses these concerns by maximizing the ability for customers to enter and exit the facility at any point, just as with movements between adjacent general-purpose lanes. Several different express lane access treatments are described in greater detail below.

5.4.1 Limited Access - Direct Connector Ramps

Direct connector ramps in the form of median drop ramps from overpasses or direct freeway-to-freeway connections provide direct ingress and egress to and from express lanes. This access approach is most commonly associated with barrier and/or channelizer separation designs, as they do not require cross-facility weaving to enter the express lanes. In fact, the primary benefit of direct connector ramps is the ability to provide access without requiring weaving movements across the general-purpose lanes. As a result, direct connector ramps can provide the greatest efficiency, safety, and capacity, while effectively eliminating the operational impacts of weaving and merging movements in the general-purpose lanes. The design of direct connector ramps should follow the American Association of State Highway and Transportation Official's Green Book design standards for freeway entrance / exit ramps. Caltrans provides additional guidance in TOPD 11-02, stating: "Drop ramps and direct connectors should be considered where substantial congestion in the general-purpose lanes exists or is expected and there is a significant local demand for access to or from the [express] lanes."

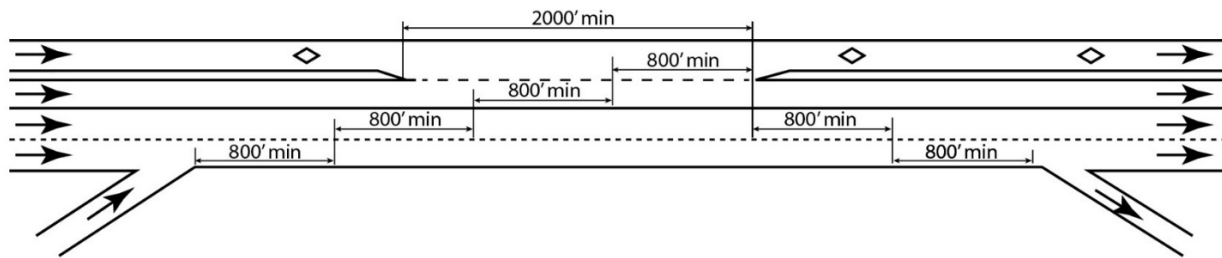
Due to the design requirements for barrier-separation between opposing flows, 50-mph design speeds, and sufficient speed-change, merge, and diverge lengths, the provision of direct connectors requires substantial right of way and significant capital costs. For these reasons, high ramp traffic volumes are typically necessary to warrant the construction of direct connectors, although safety considerations due to high merge volumes and the provision of transit services may justify the use of direct connector ramps.

5.4.2 Limited Access - At-Grade Weaves

In most settings, limited-access express lanes are accessible via designated at-grade ingress and egress locations. Physical barriers and/or striping within the buffer space separate the express lanes from general-purpose lanes between access points, so the design of the at-grade weaves is critical to maintaining operational functionality on both the express and general-purpose lanes. Caltrans TOPD 11-02 requires that traffic operational analysis be used to determine the type and location of proposed access openings. Limited access design should also consider origin-destination patterns, proximity to on- and off-ramps, and transit routes operating in the corridor. As described below, there are three common approaches for providing at-grade openings:

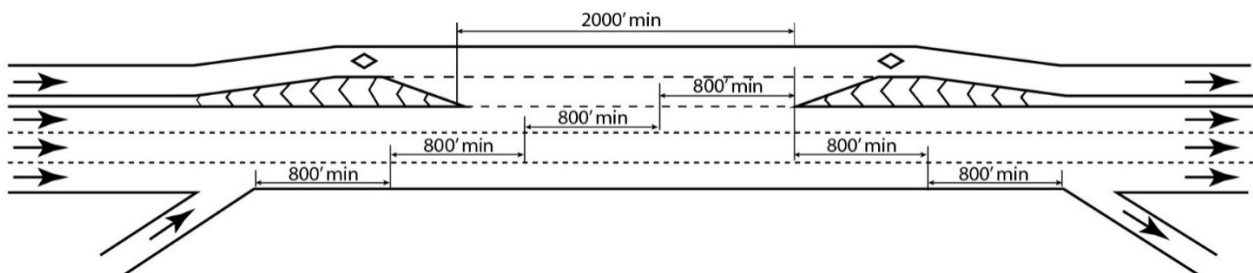
- *Weave Zones*, as described in Caltrans TOPD 11-02, provide opportunities for combined ingress and egress with short breaks to the physical barriers or striping at designated locations (see Figure 5-5). The minimum distance for these weave zones is 2,000 feet, although traffic operations analysis should be performed to ensure the access openings are sufficient to accommodate projected weaving volumes. The weave zone should be located such that drivers entering the freeway from upstream on-ramps or exiting to downstream off-ramps have at least 800 feet per lane change between the weave zone and the freeway ramps. Weave zones are generally used only on buffer separated facilities.

Figure 5-5. Weaving Zone Access Design, Caltrans TOPD 11-02, 2011



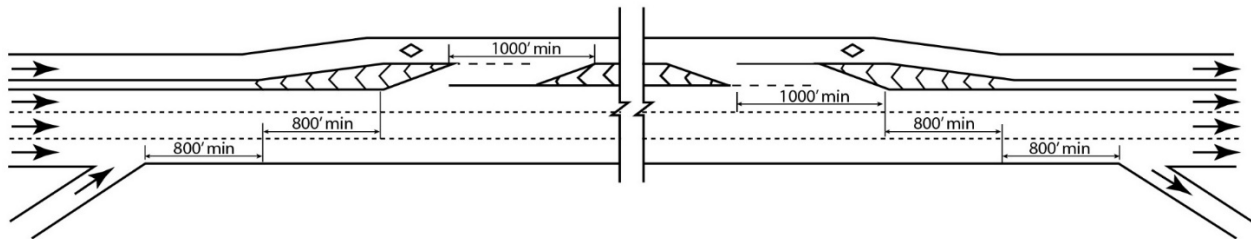
- *Weave Lanes* are similar to weave zones in that they accommodate both ingress and egress movements. However, ingress and egress movements are facilitated by the addition of a dedicated lane that isolates the weaving traffic from both the express and general-purpose lanes. This configuration reduces the potential for unstable flow due to speed differential between the express lanes and general-purpose lanes, and the associated acceleration and deceleration of merging traffic. Weave lanes, as illustrated in Figure 5-6, may be used with any type of separation treatment. However, additional right of way may be required to accommodate a weave lane. Furthermore, it should be noted that some jurisdictions have observed general-purpose drivers using weave lanes to bypass general-purpose lane queues without having the intent to enter the express lanes. This requires specific considerations for the use of these treatments, especially in very heavily congested corridors where there is a greater incentive for queue jumping.

Figure 5-6. Weave Lane Access Design, Caltrans TOPD 11-02, 2011



- *Merge Lanes*—also known as slip ramps—provide dedicated and separated ingress and egress to the express lanes, as shown in Figure 5-7. Like weave lanes, merge lanes provide drivers the opportunity to adjust their speeds to match the lane they are merging into. But because ingress and egress are separated, the potential for unstable traffic flows is even further reduced, as conflicts are avoided in the access lane. Separating the ingress and egress movements with merge lanes also reduces the potential for general-purpose drivers to utilize the lane as a queue jump without having the intent to enter the express lanes.

Figure 5-7. Merge Lanes Access Design, Caltrans TOPD 11-02, 2011



5.4.3 Continuous Access Design

Continuous access design permits vehicles to enter an express lane at any point. Separation from the general-purpose lanes is provided by a single wide broken line. There are no designated access locations in a continuous access design, which allows for reduced weave concentrations and greater operational flexibility when compared to limited access. However, without positive separation, there is a greater reliance on tolling equipment to control the number of vehicles that would choose to enter the lanes. This includes a greater frequency of pricing signs, traffic detection, and toll points to ensure that drivers know the cost to travel in the express lanes and that the system can reliably detect and charge vehicles who would choose to enter throughout the facility.

While most express lanes in the country, including all express lanes in Southern California, still employ limited access design treatments, continuous access as a design treatment for express lanes has become more prevalent, including facilities that utilize near-continuous access, which features a combination of continuous access with limited access at strategic locations (e.g., toll zones, areas of recurrent heavy congestion, areas with design constraints). Continuous access design has been increasingly used for HOV lanes in Caltrans Districts 8 and 12. Examples of express lanes that employ continuous access include I-35W in Minneapolis and SR 167 in Seattle. The I-580 and I-880 Express Lanes in the Bay Area also both feature near-continuous access treatments.

5.4.4 Access Comparisons

Per the guidance provided by Caltrans in TOPD 11-02, both limited access and continuous access treatments should be considered when designing express lane projects. Table 5-3 highlights the comparative advantages and disadvantages for each access type described above.

Table 5-3. Advantages / Disadvantages of Access Types

ACCESS TREATMENT	ADVANTAGES	DISADVANTAGES
Direct Connectors	<ul style="list-style-type: none"> ▪ Higher vehicle throughput ▪ Significantly reduces toll evasion ▪ Eliminates friction in the general-purpose lanes from weaving traffic 	<ul style="list-style-type: none"> ▪ High cost / more right of way ▪ Requires accommodation on arterials ▪ Increased infrastructure maintenance ▪ Precludes access from general-purpose lanes
At-Grade Weave	<ul style="list-style-type: none"> ▪ Transition lanes may be accommodated with restriping ▪ Reduces toll evasion ▪ Enables access control 	<ul style="list-style-type: none"> ▪ Concentrates weaves at access zones, potentially resulting in safety or operational concerns at access locations ▪ Requires enforcement of access violations ▪ Local jurisdictions opposing distance between access points
Continuous Access	<ul style="list-style-type: none"> ▪ Lowest cost ▪ Reduces weave concentrations ▪ Greatest market flexibility ▪ Reduces need for public education on how to enter/exit the lanes 	<ul style="list-style-type: none"> ▪ No buffer between the express lanes and general-purpose lanes ▪ Greatest potential revenue leakage and difficulty securing debt financing ▪ Limited ability to mitigate operational impacts due to friction and weaving ▪ May require more frequent signage and toll equipment

5.4.5 Access Treatment Recommendation

Southern California express lanes will likely continue to utilize limited access designs given the familiarity and history of these facilities in the region. However, to preserve flexibility, continuous access should not be entirely excluded from future consideration. Near-continuous access that combines elements of continuous access and limited access is starting to be used in the Bay Area and could prove to have benefits in Southern California. This hybrid approach provides limited access in areas where there is an operational need to restrict access, and allows other areas to have unrestricted access.

Specific access treatment recommendations include:

- Existing and planned direct connector ramps are preferred for freeway-to-freeway movements to maximize throughput and minimize weaving.
- Operational analysis along with geometric considerations should drive decisions about whether to use direct connectors, at-grade weave zones, weave lanes, and merge lanes, including features and dimensions specific to the access design.

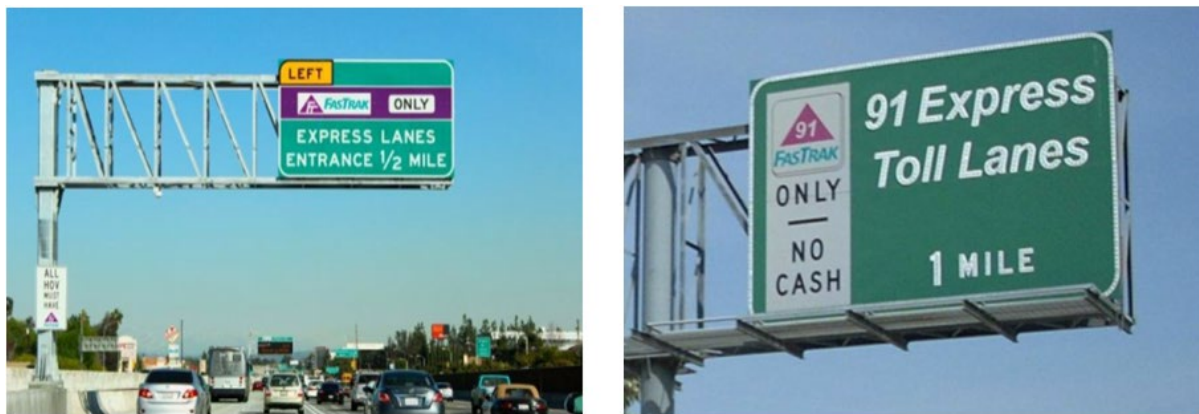
5.5 EXPRESS LANE SIGNAGE

The signing requirements for express lanes in California, including the SCAG Region, are governed by the CA MUTCD. The purpose of the CA MUTCD is to provide uniformity in the design, placement, and use of signs, signals, and pavement markings, to reduce driver confusion and promote safety and operational efficiency. The CA MUTCD provides specific guidance and requirements for the type and placement of signs at the beginning, end, and at intermediate access locations of limited access express lanes, including regulatory, advisory, and guide signs. Striping and pavement markings for express lanes are also specified. The CA MUTCD incorporates the FHWA MUTCD, expanding on the latter document to include specific requirements of signage, signals, striping, and other traffic control devices in California. The current version of the CA MUTCD is Revision 6 to the 2014 CA MUTCD, which became effective on March 30, 2021.

Guide signs and regulatory signs for express lanes shall be developed in accordance with Chapter 2F, Toll Road Signs and 2G, Preferential and Managed Lane Signs of the 2014 CA MUTCD. Chapter 2G designates use of the ETC system pictogram (the FasTrak® logo) and the use of a purple background for portions of signs providing information specifically related to requirements for ETC accounts. The signs described in this section assume that all vehicles in express lanes are required to be equipped with a valid FasTrak® transponder and that pay-by-plate options are not deployed as a primary toll collection option (which would require different sign standards, as any vehicle could access the lane).

Figure 5-8 illustrates examples of the placement of the FasTrak® logo and purple background coloring on entrance signs to Southern California express lanes, including those used on the I-110 ExpressLanes in Los Angeles, which comply with the current CA MUTCD requirements. In contrast, the 91 Express Lanes, which opened in 1995, prior to the purple color and other express lanes signage guidance first prescribed in the 2009 MUTCD, uses a white background to denote the FasTrak® requirement.

Figure 5-8. Express Lanes Entrance Signs in Southern California (Left: I-110 ExpressLanes in Los Angeles; Right: SR-91 Express Lanes in Orange County)



Overhead-mounted pricing signs display the toll amount to travel to downstream locations. In accordance with the guidance in the CA MUTCD, pricing signs should conform to the following:

- The total number of lines on the sign cannot exceed five.
- No more than two tolled destinations are to be displayed on the signs.
- The basic configuration of the sign must be maintained: the “EXPRESS LANE” header panel, followed by a line indicating the “type” of toll, followed by two lines of toll rates, and then a footer panel that can be used to display the HOV eligibility, the discount on the HOT lanes, or lane status (open/closed) with a changeable message sign (CMS) inset.
- Only one type of toll rate is to be displayed per line. If multiple forms of payment are accepted, the toll rate sign should display the rate for the form of payment expected to be used by most travelers. (It should be noted that exceptions to this requirement have been made, allowing certain express lane operators to post both FasTrak and pay-by-plate toll rates on the same sign. However, Caltrans has indicated that it will be less inclined to consider exceptions moving forward.)

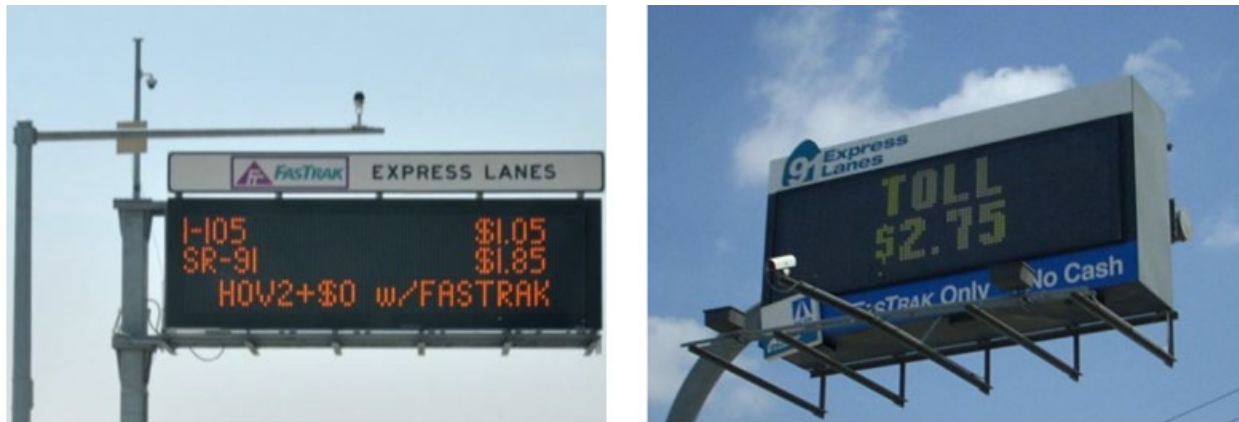
As the network of express lanes in the SCAG Region continues to develop, there will be circumstances arising that warrant the need to display more than two tolled destinations. For example, when direct connectors are provided to connect two different express lanes, there is often a need to display two prices corresponding to downstream destinations for each of the connectors along with a third price corresponding to a downstream destination on the continuing facility. According to the current version of the CA MUTCD, displaying more than two tolled destinations is not recommended. Therefore, such a situation would either require the use of multiple signs or gaining special approval to deviate from the standard, as gaining an exception to this standard would likely be difficult.

Changeable message technology should be used to indicate toll rates that vary by time of day or in response to changing traffic conditions. Pricing signs can use a combination of static and changeable elements, as illustrated in Figure 5-9, or be fully changeable, as depicted in Figure 5-10. Each type of sign has its advantages and disadvantages. Static signs with changeable insets are generally less expensive and can provide independent connectivity options when two operators may need to display pricing information (which may be important at jurisdictional boundaries, where the express lanes cross operational jurisdictions). By comparison, full CMSs provide flexibility to change messaging without fabricating a new sign, and can be used to provide additional information during incidents. Fully changeable signs are more expensive to deploy and maintain, and can be less easily readable compared to static signs, depending on the age of the sign and the display type utilized.

Figure 5-9. Example Combination Static/Changeable Pricing Signs for Express Lanes, CA MUTCD 2014



Figure 5-10. Example Full Changeable Message Signs for Express Lanes in the SCAG Region (Left: I-110 Express Lanes in Los Angeles; Right: 91 Express Lanes in Orange County)



5.5.1 Express Lanes Signage Recommendation

Express lanes in the SCAG Region reflect how signage requirements have evolved over the years. As the network expands and individual projects connect to one another, consistency in signage across facilities will become more important. Because signs are the primary method of communicating express lane rules to drivers, consistency is needed to ensure a seamless driver experience across multiple facilities. As the network grows, sign changes and updates may be needed for several reasons:

- If a new facility connects with an older facility that is not compliant with the current version of the CA MUTCD, it may be necessary to modify the signage of the older facility depending on how different the signage appears from a driver’s perspective. It may also be possible to extend the pre-existing signage to the new facility to avoid unnecessary costs for the existing facility.

- Pricing signs may need to be updated to reflect new destinations as express lanes are extended and connected to one another. This may involve modifying destinations or adding new destinations, subject to being compliant with the CA MUTCD.
- Business rule changes may be required to ensure consistency across connected facilities or to ensure that existing facilities continue to provide an enhanced LOS. Such changes will require updates to express lane regulatory signs.

Signage:

Express lane signage being designed for new facilities must be consistent with the CA MUTCD.

A growing network of express lanes may necessitate signage changes/updates.

Southern California express lane operators should stay engaged with future CA MUTCD updates.

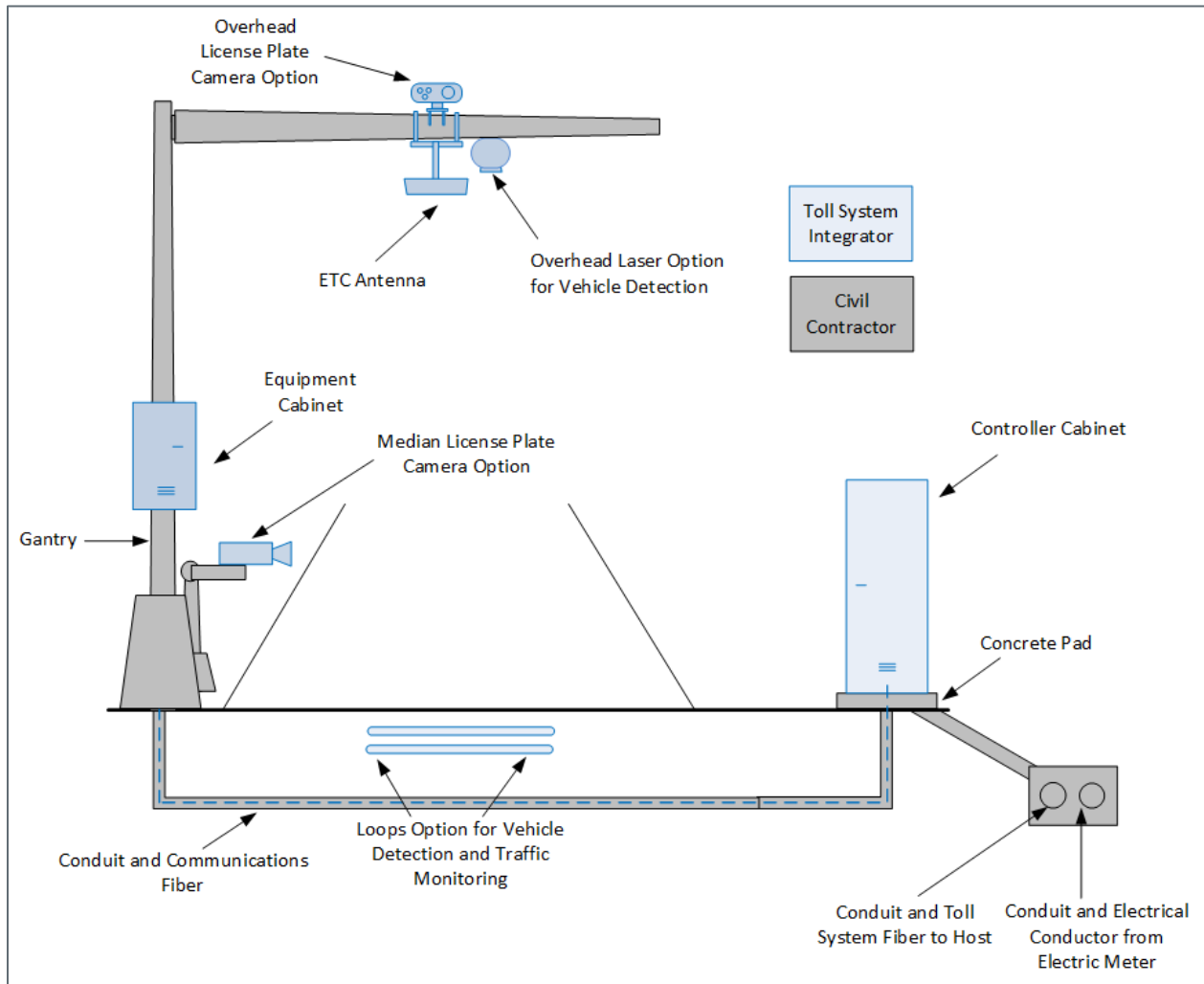
As new Caltrans guidelines and future updates to the FHWA MUTCD and the CA MUTCD are developed, Southern California express lane operators should be engaged to provide input and to understand how changes may impact their projects. Changes to guidelines and requirements can have impacts on existing facilities, including the potential need to bring existing signage into compliance. There is also a lack of guidance on the timing requirements for upgrading signage.

5.6 TOLL COLLECTION INFRASTRUCTURE

Express lanes require civil, communications, and power infrastructure to support the ETC system. The ETC system is responsible for monitoring traffic, setting toll rates, communicating information to motorists, and identifying vehicles for toll payment. All overhead facilities shall be designed per the latest loading and vibration standards from the Caltrans Division of Engineering Services. The following elements are typically included as part of the ETC system:

- Toll points consist of infrastructure and equipment capable of detecting in-vehicle transponders and license plates. As shown in Figure 5-11, toll points include infrastructure typically installed by a civil contractor that is used to support equipment installed by a toll system integrator. Toll points use antennas mounted above the lane to detect FasTrak® transponders, and use license plate cameras to take pictures of vehicle license plates. On limited access facilities, toll points are typically located just downstream of ingress points, and are ideally not located along horizontal curves or in areas where there may be radio frequency interference. CHP observation areas may be located in close proximity to toll points for effective enforcement, as described in more detail later in this chapter.

Figure 5-11. Example Toll Point



- Adequate lighting must be provided at signs so that they are clearly visible at night, as well as at toll points. Video enforcement and license plate tolling cameras must also include lights to illuminate license plates during nighttime hours and enable the accurate capture of license plate images. Poor lighting and low contrast due to overexposure, reflection, shadows, or plate background color or style can interfere with these systems.
- Pricing signs, as discussed in the previous section, are used to communicate the toll rate to travel to downstream destinations. These signs are installed in advance of ingress and egress points on limited access facilities to allow drivers in the general-purpose lanes to decide whether to enter the express lanes, and to allow drivers in the express lanes to decide whether to continue traveling in the lanes upon approaching a new price segment.
- Traffic monitoring stations are located throughout an express lane to detect traffic characteristics such as speed, density, and volume. For dynamically priced express lanes, this information is used

by the ETC system to set toll rates. Traffic monitoring stations are also important for monitoring and reporting on express lanes performance over time.

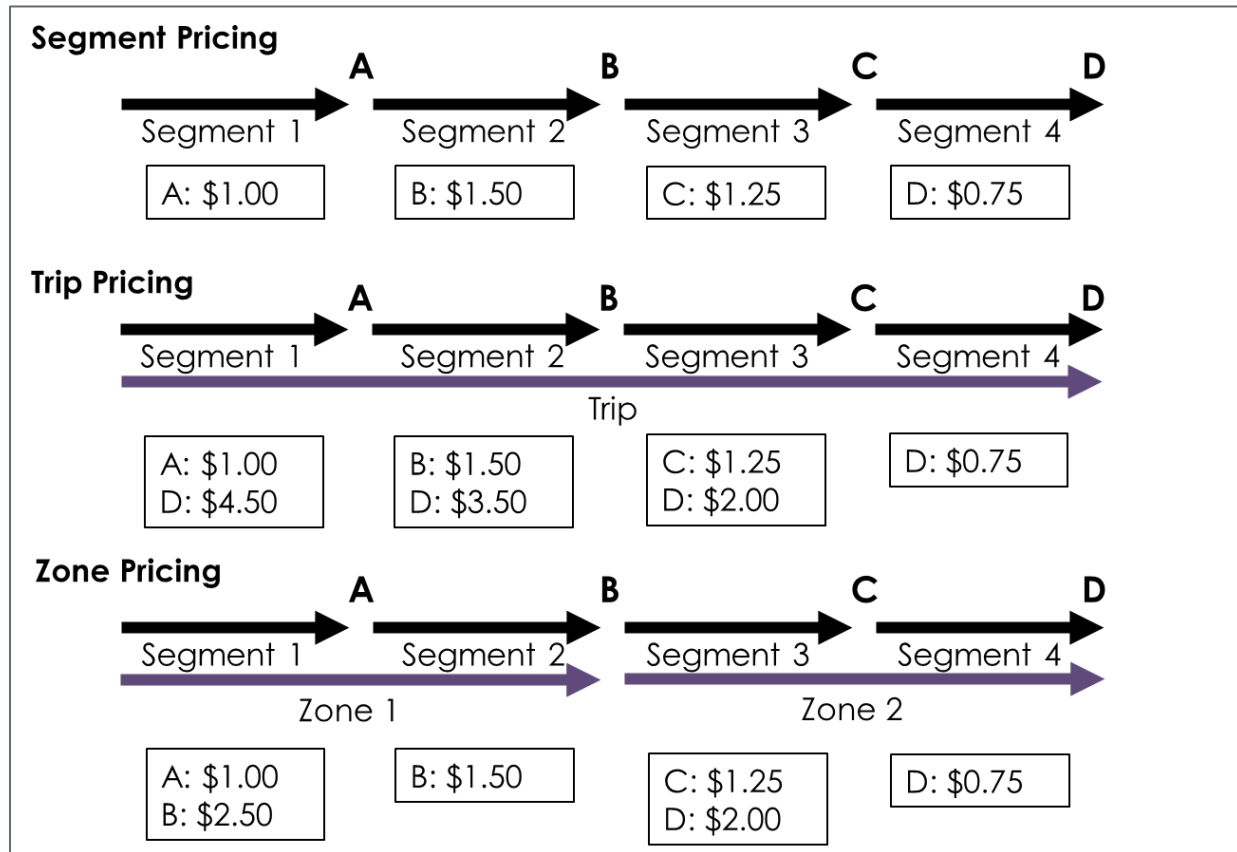
- Closed Circuit Television (CCTV) cameras are used to monitor express lane operating conditions and to validate that pricing signs and other changeable message signs are displaying the correct information. CCTV cameras should be installed to allow for viewing of the entire express lane corridor.
- The toll system host serves as the central database and processor for the ETC system. It receives information from roadside equipment, calculates toll rates, assembles toll transactions to form trips, and sends information to the customer service center to be posted to customer accounts.
- Maintenance of ETC systems is the responsibility of the system integrator.

5.6.1 Tolling Segments

Express lanes are typically divided into defined tolling segments for the purposes of assigning toll rates. Tolling segments are used to divide corridors into smaller pieces that can be separately priced based on conditions within the segment limits. Toll segment limits are typically based on analysis of traffic patterns along the corridor to make sure that traffic characteristics within the limits of a segment do not vary drastically and can be managed by the toll set for the segment. For limited access facilities, segments are typically defined between ingress and egress points so that toll rates can be set to manage the demand for each point of ingress onto the facility. For example, the 91 Express Lanes are divided into two toll segments, which are separated by the intermediate ingress/egress location at the Orange County/Riverside County line.

There are essentially three types of schemes in use to apply and communicate toll rates with tolling segments. Each strategy affects the physical design of the express lane and requires a different layout for pricing signs and other tolling infrastructure. Figure 5-12 illustrates these three strategies using a hypothetical corridor divided into four segments that terminate at Destinations A, B, C, and D. The figure also illustrates the corresponding destinations and tolls that would need to be shown on pricing signs for each strategy (shown in rectangles).

Figure 5-12. Managed Lane Pricing Concepts



Segment pricing is a strategy that displays pricing information for one tolling segment at a time. As shown in Figure 5-12, pricing signs only show a single price for the upcoming toll segment, requiring customers to decide whether to enter/stay in the express lanes upon approaching each new toll segment. Segment pricing is the easiest to implement from a toll system design and signing perspective. It also allows for the greatest flexibility in terms of demand management because drivers can be influenced to get in/out at many points along their trip, which is an aspect that may also make segment pricing the least friendly from a customer perspective.

Trip pricing provides customers with the price to travel to the end of an express lane and locks them into the toll to travel the entire length of a facility upon entering. As shown in Figure 5-12, pricing signs typically show the price to travel to the end of the current segment and the price to travel to the end of the express lane. Unlike segment pricing, customers only have to make a single decision at the start of their trip and are locked into the toll for their entire trip. However, for long facilities, end-to-end pricing can lock drivers into a price for long distance travel, which minimizes the ability to manage demand when traffic conditions change.

Zone pricing is a hybrid strategy between segment pricing and end-to-end pricing. On longer corridors, zones can be defined so that the prices are guaranteed to intermediate destinations instead of the end

of the facility. Customers are locked into the price to travel the entire length of the defined zone. Like the limits established for toll segments, the intermediate destinations chosen to define the limits of toll zones should take into consideration the ability of the zone toll to effectively manage demand within the zone. Ideally, these limits should also try to reflect important destinations within the corridor. In the example in Figure 5-12, two zones are defined; Zone 1 is defined to include Segment 1 and Segment 2, and allows the price to travel to Destination B to be displayed within the first zone, and the price to travel to Destination D to be displayed within the second zone. This strategy allows customers to see prices to travel to destinations that are further than one zone away, but also preserves flexibility to manage demand on longer corridors.

5.7 ENFORCEMENT PROVISIONS

Express lanes require effective enforcement policies and programs to operate successfully. Enforcement of vehicle occupancy requirements is critical to protecting eligible vehicles' travel time savings and safety. Visible and effective enforcement promotes fairness and maintains the integrity of the facility to help gain acceptance among users and nonusers. As express lanes cater to a wider array of users through pricing, enforcement is made more complicated. Among the greatest challenges in implementing express lanes is identifying qualified carpool vehicles for toll-free or discounted use on the facility. Persistent violation problems can breed disregard for enforcement and result in a significant loss of toll revenue on the express lanes, as well as increase corridor congestion. The consequences of unchecked violations resulting from enforcement challenges affect not only mobility, but also revenue. Enforcement related issues are discussed in greater detail in Section 8.1 of the ConOps document. In addition to enforcement areas, express lanes should provide turn-around features for enforcement and emergency response vehicles. Turn-around locations should be considered in design for both enforcement and incident management for express lane facilities.

5.8 TRANSIT AND CARPOOL CONSIDERATIONS

Express lane design should seek to maximize use by transit, carpools, and vanpools to the greatest extent possible given the implementing agency's tolling policy and the need to repay toll-backed debt. This includes consideration of nearby transit stations and park-and-ride lots when designing express lane access locations. It is important to engage transit operators early in the design process to get input that may improve transit accessibility. Transit vehicles often require longer weaving distances between express lane access locations and freeway ramps. When adequate weaving distances are not provided, transit vehicles can impede traffic flows. This issue should be assessed as plans for express lanes are formulated. When feasible, direct access ramps should be considered to facilitate reliability and greater throughput by transit and high-occupancy vehicles.

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6 Operating Concept

This chapter of the ConOps explores the different operational aspects of the regional express lane network. While consistent operational policies are desirable, unique corridor characteristics and specific local needs may result in deviations in certain areas. Nonetheless, to attain regional consistency, the following operational policies are recommended as best practices:

- **All Cashless Tolling:** Tolls shall be collected electronically at freeway travel speeds from vehicles equipped with a FasTrak® transponder, or other appropriate mobile technology. There will be no toll booths or other stop-and-pay mechanisms.
- **Transponders:** All vehicles using the express lanes, regardless of occupancy or other eligibility criteria, will be required to have switchable transponders in order to receive discounted tolls. Vehicles without a transponder will have an image of their license plate captured and an invoice or violation notice will be sent to the registered owner of the vehicle. In the future, mobile applications may prove effective as a replacement to transponders.
- **Self-Declaration:** Express lanes customers who desire discounted or toll-free travel, as available, will need to self-declare based upon vehicle eligibility. The use of switchable transponders will be standard practice throughout the SCAG Region for this purpose (although, some express lane corridors in the SCAG Region may have differing self-declaration requirements), including the SR-91 Express Lanes, which use declaration lanes.
- **Variable Pricing:** The amount charged to express lanes customers will vary based upon predicted (time of day) or current (dynamic) traffic conditions, and will be assessed cumulatively based upon the number of tolled segments traveled.
- **Differential Payment Classes:** Regardless of the actual toll rates in effect at any given time, there may be two or three payment classes in effect: 1) full toll, 2) discounted toll, and/or 3) no toll. For example, the toll rate may vary based on vehicle occupancy, vehicle classification, toll collection method (e.g., electronic transponder or license plate capture), and/or other forms of delineation.
- **Eligible Vehicles:** Automobiles, motorcycles, transit vehicles, buses, vans, and light commercial vehicles may use express lane facilities, subject to the other requirements listed above. Vehicles towing a trailer, large trucks, and any other vehicles subject to a 55 mile per hour speed limit are prohibited from using the express lane network, regardless of the number of occupants.

These different aspects of the express lane network are discussed in subsequent sections of this chapter of the Concept of Operations document.

6.1 ELECTRONIC TOLL COLLECTION

6.1.1 All Cashless Tolling

Cashless tolling is required for express lanes, per 23 USC 166(b)(4)(B). This is facilitated by ETC technology, which also enables the use of variably priced tolls as a tool to manage highway traffic flows and volume, based on time of day, prevailing traffic conditions, vehicle occupancy, and travel demand. Together with advanced traffic management and traveler information systems, transportation agencies now have a set of enhanced tools for more effective and dynamic traffic management. Exclusive use of ETC is essential on express lanes because of the inherent travel delay and congestion associated with manual toll collection. ETC systems utilize AVI technology to detect the identification of all vehicles passing toll collection points. License Plate Recognition (LPR) with optical character recognition (OCR) technology further enhances the capabilities of transportation agencies in collecting both toll payments and violation fees from vehicles traversing the express lanes.

As discussed in Section 4.3.6, MAP-21 required that all highway toll facilities constructed with federal funds implement ETC systems that provide for nationwide interoperability. Subsequently, AB 493 amended the California Streets and Highways Code § 27565 to require toll facility operators in the state to implement technologies or business rules to comply with federal requirements. To maintain consistency and interoperability with other express lane and toll facilities in California, tolls on the regional express lanes network in the SCAG Region will be collected electronically, per the revised specifications detailed in Title 21 of the California Code of Regulations (CCR) implementing the 6C standard.

6.1.2 Transponders

HOV motorists will be required to have a CTOC-compliant radio frequency identification (RFID) transponder in order to receive discounted express lane tolls. Each transponder will be coded with a unique identification number that is linked to a valid ETC account with a CTOC member agency (see Section 12.6.3 for a list of CTOC members), and the account will be debited for the toll amount due when the transponder is read at a tolling point.

As available technology evolves—including progress toward national ETC interoperability whereby customers with ETC accounts would be able to pay tolls electronically on any toll facility in the country using a single account—ETC requirements in California may evolve as the express lane network is completed. This includes the potential for transponders registered with non-CTOC member agencies to be utilized on toll facilities within the SCAG Region. Regardless of what the exact transponder requirements are when any given express lanes facility opens, they will be consistent with current CTOC and national standards.

Use of RFID transponders is recommended as the primary means for tolling and enforcement due to its lower cost, higher accuracy, and high market penetration. Video-based tolling is possible with current toll collection systems. Optimally, license plate tolling should be implemented on a consistent

basis. However, video license plate capture is currently being used as a secondary means of toll collection in parts of the SCAG Region, and only for enforcement purposes in others. The region should strive for consistent license plate tolling policies, particularly as more express lane corridors cross county lines. As technology continues to improve, the use of smart phone applications in place of RFID transponders should also be explored.

6.1.3 Self-Declaration

As the regional express lane network is developed, Southern California partner agencies will face greater enforcement requirements compared to those on the HOV system. Providing sufficient personnel to enforce both occupancy and toll evasion across all facilities may be expensive. Whereas automated occupancy verification is not yet ready to be deployed for primary enforcement purposes, current technologies can help focus manual enforcement efforts on the most likely occupancy violators and identify behavioral patterns of recurrent violators. Furthermore, automated toll payment enforcement using LPR to identify toll violators is already deployed.

Altogether, these options provide opportunities for self-declaration of occupancy to aid automated tolling and enforcement solutions. There are two primary mechanisms for self-declaration currently used in Southern California: 1) declaration lanes and 2) switchable transponders. Other self-declaration options include pre-registration of eligibility, which is currently used on a limited basis in the SCAG Region for establishing toll-exempt accounts for transit vehicles, emergency vehicles, and other official use vehicles, as well as app-based declaration technologies, such as the GoCarma system, which is used in the Dallas Fort Worth Metroplex.

6.1.4 Declaration Lanes

To date, the enforcement of express lanes facilities requires visual inspection by law enforcement officers. One strategy to ease the burden of visual enforcement is to provide dedicated “declaration” lanes that qualified HOVs and other exempt vehicles may use to access express lane facilities. This approach is used on the 91 Express in Orange County and Riverside County, as shown in Figure 6-1. Vehicles that comply with occupancy requirements (and permitted toll-free or discounted toll use) are physically separated from toll-paying vehicles at the toll collection points, and enforcement personnel only verify the occupancy of vehicles in the declaration lane. Toll evasions in the tolled lane(s) are captured by LPR technologies and enforced through established business rules. This method reduces the total number of users that enforcement personnel must positively verify for system compliance. Although there are advantages to physically separating HOV from non-HOV users in toll zones, this strategy requires significant amounts of right-of-way not only for the separation but also for enforcement, detention, and citation. In Southern California, many potential express lane corridors have physical constraints that present challenges to both implementation and enforcement. In addition, separate lanes for each vehicle class could increase weaving either side of toll-zones, leading to increased potential for congestion and crashes.

Figure 6-1. Declaration Lanes on 91 Express Lanes in Orange County



Source: WSP, 2022

6.1.5 Switchable Transponders

This method provides a technological option for the driver to declare carpool status from within the vehicle using a switchable transponder, as implemented on I-10 and I-110 in Los Angeles, 15 Express Lanes in Riverside County, as well as in the Bay Area, Colorado, Virginia, and the state of Washington. Additional strategies, such as carpool registration and photo-based toll collection and enforcement, can be used in this method. As used in Los Angeles County, switchable transponders allow the customer to declare occupancy status on the transponder itself.

One type of switchable transponder uses a binary mechanism (i.e., toll or no-toll), such as that used in Virginia (Figure 6-2a). The transponder currently utilized by Metro in Los Angeles County transmits multiple identification codes to associate the correct toll for a vehicle based upon its occupancy status (Figure 6-2b). These identification codes are associated with single occupant vehicles (SOVs), HOV 2, and HOV 3+ settings directly on the transponder. For compliant HOVs, the user declares the vehicle's status on the transponder (i.e., switching the tag to HOV 2 or HOV 3+), and the appropriate toll rate (including zero dollars) would be charged. If the same vehicle is being operated without the required occupancy, the driver is required to declare appropriately on the transponder, and the correct toll would be charged. If no transponder is present (or if it is malfunctioning), LPR would be used as a secondary means of enforcement to ensure full toll payment from the user (regardless of vehicle class or occupancy status). Switchable tags eliminate the need for physical declaration lanes or the use of HOV registration programs, and they allow maximum flexibility for changing occupancy and pricing policies over time, such as the increase to HOV 3+ and discounted tolling for HOV 2 in the future. In addition, this functionality could be offered through mobile smart phone applications in the near future, as related technologies continue to evolve. Implementing agencies within the SCAG Region should retain flexibility to accommodate these technologies as they become available.

Figure 6-2. Switchable Transponders, E-ZPass Flex and Metro FasTrak®



6.1.6 License Plate Toll Collection

License plate recognition (LPR) technology is used for enforcement, and can also be used as a secondary means of toll collection. Vehicles without a transponder will have an image of their license plate captured and an invoice or violation notice will be sent to the registered owner if the vehicle information is not linked to an active CTOC account in good standing. Before implementing license plate tolling, express lane operators should consider the operational policies on neighboring express lane facilities and the potential for increasing violations on those that do not allow license plate tolling, due to drivers making the false assumption that they may access the facility without a transponder.

The use of LPR tolling can increase usage of express lanes by allowing vehicles without RFID tags to use the lanes. This can be an advantage for some express lanes that are experiencing low utilization. However, when an express lane is experiencing high volumes, tolling by plate may increase the number of users, potentially causing greater congestion on the express lane. Therefore, there are more traffic management challenges to consider when considering plate tolling.

Video capture and associated LPR technology typically has a higher cost due to image processing and verification. There is also greater toll leakage compared to RFID tolling, due to limitations of OCR technology in reading license plates accurately during inclement weather, glare, and other poor lighting conditions, the challenges of reading a wide variety of vanity and out of state plates accurately. In addition, operators must wait for motorists to remit license plate tolls after receiving a bill, whereas funds are transferred instantaneously with transponder tolls. Most operators that use video tolling as a secondary means of toll collection charge a toll premium to offset the additional cost associated with the use of video capture technology. In California, the amount of the toll premium is determined by the operator, in accordance with state statutes regarding the setting of fees.

Because of this premium, additional signage is needed to provide the information necessary to ensure that motorists are aware of the difference between tag toll and plate toll rates. This introduces signage challenges. CA MUTCD limits the number of lines of information that may be displayed on any given sign, including by limiting the allowable number of listed destinations to two per sign. If there are multiple destinations, and a premium on plate tolling, an express lane may require multiple destination price signs and/or additional guide signs with information about the plate premiums.

In addition to signage challenges, Table 6-1 illustrates the premiums for license plate tolling options that are currently used on express lane facilities or proposed for new express lanes. As shown in Table 6-1, there are many different policies in operation across the SCAG Region. This diversity in policies can cause confusion for motorists and increased violations on express lane facilities that do not allow license plate tolling, underscoring the need for clear signage. While express lane sponsors prefer to have the flexibility to establish their own license plate tolling policies, those policies should be formulated as early in the express lane development process as possible, to provide time to mitigate any potential conflicts.

Table 6-1. Southern California License Plate Toll Policy Examples

JURISDICTION	CURRENT OR PROPOSED LICENSE PLATE TOLL POLICY
LA Metro	"Pay as You Go" – Base toll and \$4.00 processing fee
OCTA	Not provided on 91 Express or the I-405 Express Lanes
RCTC	Not provided on 91 Express or the I-15 Express Lanes
SBCTA	License Plate Toll Rates – 1.5 times the FasTrak® toll plus \$0.50
TCA	"Pay Toll Now" – Peak period rates at all times

Source: WSP, 2021

6.2 HOV OCCUPANCY / EXEMPTIONS

Multiple sections of California law pertain to HOV policies on express lanes. State authorizing legislation provides the authority for the operating agency to set rates and HOV policies on the respective facilities. TOPD 20-02 reiterates this legislation, stating: "Changes to occupancy requirements and toll policies on priced managed lanes are the responsibility of the entity that has the tolling authority. If a regional transportation agency has tolling authority, any such changes should be made in consultation with Caltrans."

For Southern California, the expressed desire of state legislation and related Caltrans guidance is to maintain jurisdictional primacy over immediate HOV access decisions. As such, the primary options for Southern California partner agencies to consider regarding HOV occupancy policy are as follows:

- **HOV 2+ toll-free or discounted tolls on current HOV 2+ lanes.** Similar to the occupancy policies currently in place on I-110 in Los Angeles and I-15 in San Diego, this approach yields minimal available capacity for express lanes toll paying customers in peak periods and may not be viable on certain corridors due to demand exceeding supply.

- **HOV 3+ toll-free or discounted toll during peak periods; HOV 2+ during off-peak periods.** This approach mirrors the current occupancy requirements on Metro’s I-10 ExpressLanes. This policy may generate customer confusion, due to differences existing between peak versus non-peak policies, and may potentially yield reduced available capacity for toll-paying express lanes customer use during off-peak periods than the remaining two options.
- **Full-time HOV 3+ toll-free or discounted toll policy.** This option would provide a 24-hour HOV 3+ policy, whereby any HOV 3+ vehicle receives toll-free or discounted access to the express lanes at any time, and SOVs and HOV 2s are always charged a full toll. This policy reflects that of the 15 Express Lanes in Riverside County, as well as the I-10 Express Lanes in San Bernardino County. This approach is being studied on a number of express lane corridors in Southern California, and has already been adopted on existing express lane facilities in Florida, Georgia, and Virginia.
- **HOV 3+ toll-free during off-peak periods; full or discounted tolls charged to HOV 3+ during peak periods.** This policy reflects that of the SR-91 Express Lanes in Orange and Riverside Counties, where discounted tolls are provided to eastbound HOV-3+ vehicles during peak travel times on certain days of the week.

Express lane development in Southern California generally features a hybrid occupancy approach, with converted, legacy HOV facilities providing free or discounted tolls to HOV2+ vehicles and newer, capacity-adding facilities generally converging upon an HOV 3+ policy. Although in some cases, the HOV3+ occupancy policy is explicitly intended to make projects financially viable, in others it is used for traffic management purposes to provide dependable, congestion-free trips for transit users and toll-paying customers on the express lanes.

Transit vehicles and motorcycles are eligible for toll-free travel on express lane facilities at all times. Vehicles that are eligible to utilize HOV lanes in accordance with applicable federal or state statutes will generally be allowed toll-free or discounted toll access to express lanes, including carpools and vanpools carrying the required number of occupants and emergency vehicles (responding to a qualifying event). In terms of HOV use of express lanes in the SCAG Region, HOV 3+ toll-free or discounted tolls during peak periods; maintain HOV 2+ during off-peak periods (Option 2 above) is recommended as the default condition for facilities involving the conversion of existing HOV 2+ lanes to express lanes operations, while a full-time HOV 3+ toll-free or discounted toll policy is recommended for facilities involving new construction. This combination of policy options best achieves the balance of maintaining HOV occupancy requirements on existing facilities for a majority of the day, restoring peak period performance on degraded facilities, improving overall corridor throughput, and preserving high-quality capacity for multi-occupant vehicles. A higher level of occupancy requirements (Option 4) is permitted wherever the implementing and/or operating agency determines a peak period HOV-3+ full or discounted toll policy is necessary to maximize corridor performance or desirable to enhance revenue generation.

6.2.1 Options for Administering Occupancy Policies

OCCUPANCY DECLARATION AND OCCUPANCY DETECTION

As discussed earlier in this chapter, self-declaration is the current state of practice in the region. Most express lanes use either a declaration lane or switchable transponders to establish in-vehicle occupancy. Due to the nature of self-declaration, a high level of enforcement is necessary to verify that HOV rules are not being violated. However, there are emerging technologies that could make occupancy detection and enforcement less onerous, including roadside detection systems and Bluetooth applications.

LA Metro is preparing to launch a new system that automatically verifies the self-declared occupancies indicated by drivers' transponder switch settings. This Occupancy Detection System will be used to correct instances where a transponder has been inaccurately set to the toll-free HOV mode when there were not enough passengers in the vehicle to qualify. This helps ensure that all ExpressLanes users are charged the proper toll amounts when appropriate. The system uses roadside cameras to check vehicle occupancies and compare them against the transponder switch settings as vehicles traverse strategic toll points. The technology is designed to handle all common vehicle configuration and passenger arrangements, such as window tinting or children in car seats.

In Dallas Fort Worth area, the violation of the occupancy requirements on express lanes was found to be between 30 and 50 percent after increasing required occupancy from HOV 2+ to 3+. Based on this challenge, agencies piloted a Bluetooth application branded as GoCarma that allows for self-declaration and detection. Currently, the system needs an additional Bluetooth device to communicate with roadside detection equipment. If all occupants have the appropriate application installed, the applicable discounts can be applied to the vehicle. However, if the system detects anomalies or atypical usage, the system can suspend accounts and users will lose the occupancy discount. Other technology firms, including RideFlag, are developing self-contained mobile phone applications that use the camera in the phone to allow for drivers and passengers to self-certify that they meet the occupancy requirements. Advanced technologies such as these should be monitored for future deployments throughout the SCAG Region.

6.3 CLEAN AIR VEHICLE EXEMPTIONS

The use of HOV lanes by qualifying low emission vehicles, regardless of the number of occupants, as well as toll-free access to express lanes by the same vehicles has consequences for the performance of the lanes, and may contribute to degraded conditions. Accordingly, the current policy on most express lane facilities in the SCAG Region is to provide a 15 percent discount to drivers of qualified clean air vehicles regardless of the number of occupants that are travelling in the vehicle.

The Southern California partner agencies should consider discontinuing HOV lane access and toll-free express lane use by ILEV and advanced technology partial zero emissions vehicles (AT PZEV) without

the required minimum number of vehicle occupants during peak periods, based on the findings of performance measurements conducted by Caltrans. When degraded conditions are observed in more than 40 percent of express lane miles in the region during an off-peak period, express lane access for ILEV and enhanced AT PZEV without the required minimum number of vehicle occupants should be discontinued for the corresponding off-peak period. Recognizing the existing high level of utilization on many regional HOV lanes, especially during peak periods, and the extent of the current level of express lane degradation in the region, discontinuing HOV and express lane use by ILEV and enhanced AT PZEV should be applied consistently across the region to minimize the potential for driver confusion due to inconsistencies between corridors.

It should be noted that discontinuing CAV discounts would run counter to executive orders published by Governors Brown and Newsom directing state agencies within the executive branch to do all that they can to support the purchase and use of clean air vehicles. Even though the Caltrans is mandated by law to remove CAV access from HOV lanes when they reach a certain LOS, it has not exercised that law because of the executive orders directing it to support the implementation of CAV technologies.

6.4 HOURS OF OPERATION

Given the high utilization rates on the 700-mile HOV and express lanes network in the SCAG Region, all HOV and express lanes facilities in Los Angeles, Orange, San Bernardino, and Riverside counties operate 24 hours a day, seven days a week, with the exception of SR-14 between Santa Clarita and Palmdale and SR-60 from Day Street to Redlands Boulevard in Moreno Valley. Given this important precedent and continued heavy demand for express lanes throughout the day, all express lane facilities will continue to operate 24 hours a day, seven days a week.

It is important to note, however, that changes in certain operational requirements including occupancy rules may be needed during peak periods. Additional travel demand analysis conducted as a component of project development will be completed to determine if increased peak period occupancy rates may be needed on other corridors in the SCAG Region. Furthermore, traffic performance will be monitored on an on-going basis for all operational facilities, and partner agencies will take appropriate actions to improve performance of any facilities for which average peak period travel speeds fall below the 45-mph minimum speed threshold prescribed in 23 U.S.C. § 166.

6.4.1 Hours of Operation Recommendations

The Southern California partner agencies agreed that all express lane facilities will operate 24 hours a day, seven days a week.

6.5 TOLLING SYSTEM POLICIES

6.5.1 Pricing Model

Multiple mechanisms exist for pricing an express lane facility. The two most relevant to Southern California (i.e., time-of-day (or: “static variable”) pricing and dynamic pricing), are described below.

TIME OF DAY PRICING

Static variable pricing according to a set time of day schedule is actively used on the 91 Express Lanes in Orange and Riverside County⁷⁷, all Denver area priced managed lanes (I-25, US 36, and I-70), and all Houston area express lane facilities (Interstate Highway (IH)-10, IH-45, US 290, and US 59). To be most effective, variable pricing requires a high enough differential in toll rate to manage traffic levels, reflecting the variability in demand levels by time of day and day of the week. OCTA and RCTC review traffic service and toll rates on the 91 Express lanes on a quarterly basis and adjust tolls to ensure that the pricing levels are achieving the desired operational outcomes.

With time-of-day pricing, tolls vary according to a fixed schedule, with different prices charged based on direction of travel, day of the week, and hour of the day. The rates are determined based on actual detected travel conditions in the corridor and vary according to anticipated demand and congestion. The performance of express lane facilities using time of day pricing should be evaluated on a regular basis to ensure that free flow conditions are being maintained in the express lanes. If travel conditions on the express lanes deteriorate in a given time period, then the rates should be increased. Similarly, rates can also be lowered when the express lanes are found to have excess capacity that is not being used effectively.

On the 91 Express Lanes, performance is monitored on a daily basis and evaluated every three months. Based on the results of this evaluation, rates are adjusted if over- or under-utilization is detected during two subsequent three-month monitoring periods. Surveys have found that customers using the 91 Express Lanes like the price certainty and predictability associated with time-of-day pricing.

DYNAMIC PRICING

Dynamic pricing is used on most California express lanes, including I-10 and I-110 (Los Angeles County), I-15 (Riverside County), I-15 (San Diego County), I-580 and I-680 (Alameda County), I-680 (Contra Costa County), and I-880 / SR-237 (Santa Clara County). Dynamic pricing utilizes toll rates that vary in real time based on actual travel conditions observed in the corridor. Real time traffic data is obtained using vehicle detection devices capable of determining values such as lane occupancy, traffic volume, and speed, in real time. A tolling algorithm then uses these values to determine changes in traffic conditions (typically traffic density), and to calculate the appropriate toll to charge. The toll can be raised or lowered in response to traffic conditions, as appropriate, to influence express lane

⁷⁷ Static variable pricing is also applied to the existing direct connector between the 91 Express Lanes and the I-15 Express Lanes in Riverside County; dynamic pricing is used on the I-15 Express Lanes in Riverside County.

operations. If traffic density in the express lanes (and/or the adjacent general-purpose lanes) increases, tolls are increased to discourage additional vehicles from entering the lane. When traffic density decreases in the express lanes (and/or the adjacent general-purpose lanes), the toll rate decreases to encourage more paying motorists to use the lanes. Toll rates are adjusted in regular intervals that may be as frequent as every three minutes. Express lane operators also have the ability to override the dynamic pricing systems during incidents, lane closures, or special events.

While dynamic pricing requires real-time monitoring and response capability, the pricing structure must be sufficiently robust to account for variations in markets, geospatial access, and demand over time.

DIFFERENTIAL PAYMENT CLASSES

The applicable price for access can vary for different users. Discounts or exemptions may be applied for vehicles that meet applicable occupancy standards (e.g., HOV 2+, HOV 3+, etc.), vehicle type (e.g., CAV, motorcycle, bus, etc.), vehicle classification (e.g., passenger vehicle, truck, etc.), or other criteria. Furthermore, pricing differentiation can be associated with the individual account. Although policy drives the application of price differentiation, technology determines the ability to categorize users. The ability to differentiate by user is dependent upon a system for segmenting users.

Differential payment classes can be distinguished using self-declaration or pre-registration. As described previously, self-declaration requires HOVs or those users that meet other qualifying criteria to self-declare using a designated lane or switchable transponder to receive an exemption or discount. Pre-registration provides the opportunity for declaration at the user account level. This can be accomplished either by registration of eligibility on a per-trip or permanent basis (as is done for carpools on I-85 in Atlanta and I-95 in Miami), or by the establishment of differential accounts (e.g., establishing a non-revenue account class, as is often done for transit providers, emergency services, roadside assistance, etc.).

PRICING MODELS IN SOUTHERN CALIFORNIA

In Southern California, the use of FasTrak® transponders is preferred as a primary means for tolling and enforcement. Violation enforcement is conducted by LPR for those vehicles not equipped with valid FasTrak® transponders. Individual agencies could also choose to use video-based tolling as a secondary means of toll collection, recognizing the higher costs associated with the image processing and verification, and the inherent limitations of OCR.

Most express lane facilities in Southern California utilize switchable transponders as the primary means of occupancy declaration, promoting regional consistency. Southern California partner agencies may choose to utilize lane-based declaration in lieu of switchable transponders. Additionally, express lane operators may use either time of day or dynamic pricing systems, as individual corridors warrant, whose application has been researched in established traffic and revenue studies.

Different variable pricing models have been used on express lane projects in Southern California and throughout the U.S., including time of day static variable pricing and dynamic pricing. In addition, tolls may be charged at the facility level, where the same toll is applied regardless of where a given motorist accesses the facility in question. Longer facilities are often broken down into a series of toll segments, each of which has a different cost. In some cases, groups of toll segments may be aggregated into toll zones where motorists are provided with a guaranteed price for traveling across all of the toll segments in the zone when they first enter the zone, as is the case on the existing Metro ExpressLanes.

6.5.2 Minimum and Maximum Toll Rates

Whereas time of day pricing yields definitive low and high tolls, dynamically priced express lanes facilities often use maximum and minimum toll rate caps to provide context for the management of the system. Minimum toll rates ensure that some level of revenue is collected from toll paying customers during periods of low demand, offsetting operations costs. Maximum toll rate caps prevent toll rates from reaching levels that could cause negative public reaction. However, they also restrict the toll system's ability to price properly during periods of highest demand. If volumes in the express lanes continue to increase after the maximum toll rate is reached, the toll system can close access to the lanes to all paying vehicles, leaving the lanes to operate in an HOV only mode until demand is reduced and the system has returned to a manageable state. This approach is currently utilized by Metro on the existing I-10 and I-110 ExpressLanes.

If used, minimum and maximum toll rates should be evaluated and adjusted periodically to account for changes in the value of time savings to drivers, along with other economic factors, to ensure that speeds in the express lanes are being maintained above the minimum 45 mph threshold.

TOLL RATE RECOMMENDATIONS

Minimum and maximum toll rates may be established on dynamically priced facilities; however, toll rates should be established with careful consideration, to ensure that they do not inadvertently restrict the ability to use pricing to manage demand.

6.5.3 Segment-Based and Zone-Based Pricing

In longer corridors, express lanes are often divided into smaller toll segments and/or zones. Segment-based and/or zone-based pricing is used because a single toll rate is not capable of managing demand across the entire corridor, as varying conditions could warrant lower or higher toll rates on certain portions. For the purposes of the SCAG regional express lanes network, the following definitions of segment, zone, and corridor are used:

- *Segment* is the portion of the express lanes between adjacent access points;
- *Zone* is a pre-specified group of contiguous express lanes segments;⁷⁸ and

⁷⁸ Zone is also used in the context of toll zone to describe the point within a pricing segment where the ETC equipment is installed on the express lanes to detect those vehicles using the lane as the basis for charging a toll.

- *Corridor* is the overall extent of the express lane facility.

SEGMENT-BASED PRICING

Segment-based pricing applies a separate toll rate to each defined segment along the corridor, based on traffic conditions within that segment. In this way, segments with higher levels of congestion will have higher toll rates, but without causing unnecessary increases in other segments where demand does not justify such increases. The prevailing toll rate for each defined segment is charged to any vehicle detected in the express lanes within the limits of the segment.

The beginning and end points of pricing segments are usually defined by the contiguous access points for a limited access facility, or proximate interchanges with other highways or major streets for a continuous access facility. Ideally, traffic volume characteristics within a given segment should not vary drastically. Bottleneck locations should be captured within a single segment. The length of most toll segments varies from two to four miles, although specific conditions may warrant segments of different lengths. The length of a segment will also be constrained by the fact that demand will need to be effectively managed along the entire length of the segment.

Multiple segments can be aggregated into a pricing zone or corridor for the purposes of communicating and guaranteeing toll rates to customers for multiple destinations. I-10 and I-110 ExpressLanes in Los Angeles County, the I-15 in Riverside County, and the 91 Express Lanes in Orange and Riverside Counties each apply segment-based pricing whereby the toll is calculated for each toll segment and aggregated for the respective corridors. This pricing methodology allows the driver to pay for only the segment(s) they access, while also allowing them to see the prevailing toll to traverse the entire length of the corridor.

Although the toll rate for a particular segment is determined based on traffic conditions within the segment, toll systems should incorporate the ability to take traffic conditions in adjacent segments into consideration when calculating the toll rate for any given segment. This allows the toll system to increase the toll rate upstream of a segment that is experiencing heavy congestion, to ensure that the express lanes within the segment do not become over-utilized.

PRICING BY ZONE

Toll zones may similarly be defined by freeway ingress and egress points, by minimum or maximum distance thresholds, or by spatial relation to an important decision point or common destination. From the system perspective, zone pricing enables the separation of zones with differential travel demands or operational needs, so that they can be properly managed through the application of independent tolls being charged for each respective zone. For example, a zone in a highly congested corridor section may be managed for performance objectives, whereas a zone in a lightly and/or infrequently congested area may be managed for revenue generation.

A zone-based pricing structure is used to break up guaranteed pricing in longer express lanes corridors. As express lanes corridors are extended, guaranteeing pricing from too far away can inhibit the ability to manage traffic farther downstream as demand increases over time, because the driver may have already locked in a lower toll rate, earlier in their trip. This approach is being used by the Utah Department of Transportation for the I-15 Express Lanes in Salt Lake City (Figure 6-3), and by the Florida Department of Transportation for the I-95 Express Lanes in Miami.

For the I-15 Express Lanes in Salt Lake City, toll rates are calculated across seven separate toll zones, each with multiple segments along the 72-mile corridor. The tolls are charged independently for each zone, regardless of how many segments are traveled within the zone. This requires drivers to reassess their desire to use the lanes at the start of each zone. Drivers traveling along multiple zones on the I-15 Express Lanes in Salt Lake City will incur separate tolls for each zone they access, with the tolls accumulating as they proceed from one zone to the next to build the total trip cost. Figure 6-3 illustrates the zone structure utilized for pricing the I-15 Express Lanes in the Salt Lake City area.

Figure 6-3. I-15 Express Lanes Zone Map



Source: Utah Department of Transportation

With the opening of Phase 2 of the 95 Express Lanes, the facility now has two separate pricing zones, with each comprised of multiple pricing segments. Drivers entering the facility are shown toll rates for travel to the end of each of the segments within the first pricing zone, guaranteeing their rate up to that point. As drivers transition from the first zone to the second zone, the toll rate for travel to the end of each of the segments in the second zone is displayed, requiring drivers to reassess their willingness to pay to stay in the lanes. This approach creates a decision point between zones, allowing the operating agency to better manage demand within the respective zones. Figure 6-4 illustrates the zone structure for the 95 Express Lanes in Miami.

Zone-based pricing can also be used to reduce the incentive to weave in and out of the express lane to avoid a toll collection point. If a zone includes multiple pricing segments and a single prevailing toll rate is charged for accessing the zone regardless the number of tolling points or pricing segments traversed, then this incentive is eliminated. SBCTA is proposing this structure on the I-10 and I-15 Express Lane projects currently being developed in San Bernardino County to eliminate weaving in and out.

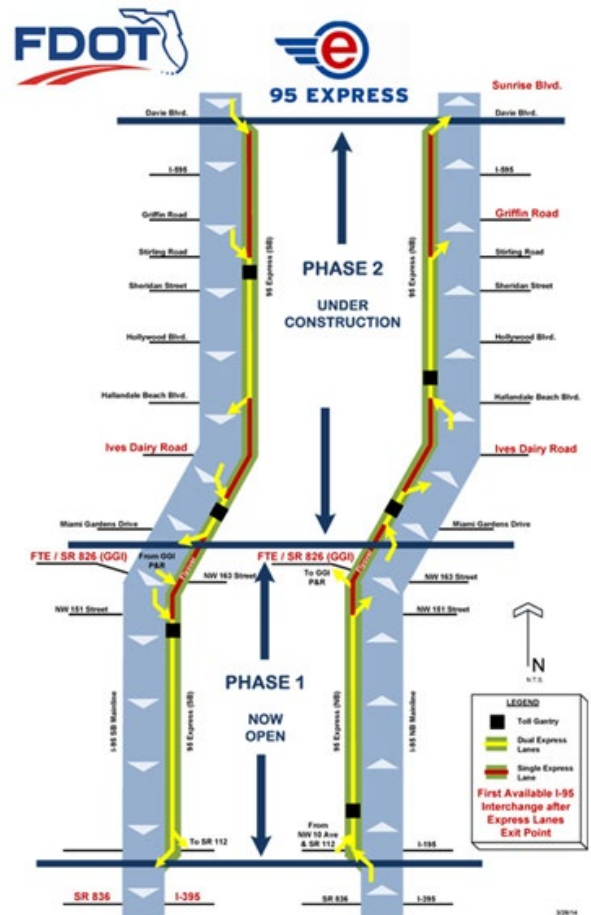
PRICING STRUCTURE RECOMMENDATIONS

Southern California partner agencies agree to analyze travel sheds and trip patterns for extended segments and/or zones or multiple facilities to develop pricing models that serve most users, likely using proximity to freeway-to-freeway interchanges (where trips tend to disperse) as decision points for network users. Noting that, on a network, there is often an imbalance in the demand for different trip destinations at the points of divergence, demand balancing at these points may require upstream differential pricing and increases in directional capacity. Various methods of pricing can co-exist. In determining pricing zones, facility travel sheds, interconnectivity, and logical termini should be evaluated.

6.5.4 Toll Communications

Customers are advised of the prevailing toll rate upstream of entry points via destination-based pricing signs incorporating changeable message elements, as specified in the CA MUTCD. The prevailing price

Figure 6-4. 95 Express Zone Map



a customer sees when making a choice to use the lane is locked in once they enter for the destinations signed (and all points in between). To do so, the tolling system opens a customer transaction when a vehicle initially accesses the express lane, but the system does not process the completed trip transaction until the vehicle passes the final toll gantry before leaving the facility, at which point the transaction is closed.

The destinations shown on the signs will be determined by the pricing structure, which will take into account facility travel shed, interconnectivity with other corridors, logical termini and major destinations, and the corresponding segment- and/or zone-based pricing structure. The pricing indicated for each destination shown should be locked in at the time the vehicle is first detected using the express lanes within the respective pricing zone, to effectively provide a toll rate guarantee. For longer corridors encompassing multiple distinct travel sheds, pricing zones should be divided at logical termini to provide an appropriate decision point to communicate new toll rates for destinations in the subsequent zone, thereby allowing drivers to reassess whether to continue in the lanes or exit. Where multiple pricing zones are utilized to represent distinct travel sheds or multiple logical termini, progressive overlapping of destinations in subsequent zones should not occur on signage to avoid establishing an expectation of a toll rate guarantee beyond the current zone; in other words, destinations on signage should only include those destinations for which there is guaranteed pricing within the particular zone. Regardless of the specified destinations or established termini, communication with motorists must appear uniform to minimize the potential for customer confusion.

6.6 BUSINESS RULES

As plans for the SCAG regional express lanes network are refined, operators need to develop business rules that describe how the various situations that arise in the day-to-day operation of the express lanes should be handled by their back-office accounting and customer service center. Given the nature of the network, this will inevitably involve multiple partner agencies. Each operator will maintain a different set of business rules for each facility. The business rules are living documents that are updated as the express lanes system is developed, allowing project stakeholders to vet, refine, and agree upon the different policies that are needed to operate the express lanes system. The partner agencies acknowledge that changes in business rules on the part of one operator may affect utilization of the express lane network and compliance with federal and state requirements. Each operator will develop business rules specific to the goals and objectives of the particular facility, and consistent with the characteristics of their organizational and facility-specific operational structure.

6.6.1 Use of Toll Revenue

While the SCAG regional express lane network will generate toll revenue, in accordance with state statutes, the use of these revenues must be prioritized to cover the costs involved in financing, constructing, operating, and maintaining the network. In many cases, the use of project revenues is governed by bond covenants and other legal agreements associated with project-related debt. If there

is excess revenue after debt servicing, operations, and maintenance obligations are met, it can be used at the discretion of the project sponsors.

TOLL REVENUE ALLOCATION

Toll revenue allocation occurs at the facility level and reflects the policies established by the project operator, local jurisdictional requirements, and the way in which the project is financed. Revenue expenditure policies may also differ between express lane facilities owned by the same operator, depending on their respective financing arrangements. Given the expansive extent of the regional express lane network and the different institutional structures policies within the SCAG Region, there will be a variety of revenue allocation policies on individual projects.

For example, it is a policy requirement that all toll facilities in Orange County are self-financed, relying on toll revenues alone. Other revenue sources, such as local or county sales tax measures, may not be used to finance toll roads in Orange County. This policy drives the development and design of toll facilities in Orange County, as they must be financed on a stand-alone, limited recourse basis. This requires a careful balance between the design of the toll facilities and the revenues they will generate. Projects must be sized so that they can be financed by the expected toll proceeds within the terms and conditions specified by the covenants underlying the toll revenue bonds used to finance them. While certain enhancements or expansions may be attractive from other public policy perspectives, they are not possible if they increase capital construction costs to the point where a toll project is no longer financeable on the resulting toll revenues alone.

Some express lanes on the network will involve the conversion of existing HOV facilities, and may require relatively minor capital improvements, whereas others will involve the reconstruction of entire highway corridors where there may be improvements to, or expansions of, the general-purpose lanes to accompany new express lanes. Furthermore, right-of-way acquisition, environmental approvals, and requirements to mitigate environmental impacts, including increases in vehicle miles traveled (VMT), can add to the cost of implementing express lanes, especially where lane mile capacity is being added. These factors may require developing unique toll allocation policies for more complex projects.

In the event that there are additional revenues available after financing, operation, and maintenance costs, and reserves have been met, a policy decision will need to be made on how the remaining revenues would be used. For example, Metro has Net Toll Reinvestment Policy, which applies to revenues generated by the I-10 and I-110 ExpressLanes.⁷⁹ The Metro policy directs that toll revenues must first be used to pay for maintenance, administration, and operation of the ExpressLanes. All remaining revenue must be used in the respective corridor from which it was collected to provide a direct congestion reduction benefit through investments in transit, active transportation, and highway improvements.

⁷⁹ [Metro ExpressLanes Strategic Plan](#) (2017), Appendix C, page 2.

In a system as extensive as the envisioned Southern California express lanes network, some express lane segments will generate excess revenues, some will break even, and others will operate at a deficit. Subject to local debt policies, one possible approach to this situation could be to use the excess revenues from facilities generating a profit to cover the revenue gap for segments operating at a deficit, while continuing to enhance system continuity. Based on the current structure of the CTCs and Caltrans districts in the SCAG Region, such revenue sharing would be expected to occur at a county- or district-level, rather than at a subregional or regional level.

6.7 INTERFACES WITH OTHER NETWORKS

There are several projects and ITS deployments within the SCAG Region with which the regional express lane network will need to interface. This section of the ConOps document describes the effects of these interfaces upon the operation of the express lane network. The overarching goal is for the individual express lane facilities in the region to function as a seamless network that allows users to travel between express lanes operated by different agencies while maintaining a familiar look and feel across discrete facilities. The policies and practices identified in this chapter would help to achieve this goal through actions aimed at promoting a consistent and coordinated experience for end users.

In addition, it will be necessary for individual corridor toll systems to communicate with each other to ensure that the operating conditions on one express lanes facility do not adversely affect conditions on contiguous or intersecting facilities. For example, an express lane that closes to non-HOV vehicles when demand approaches the critical operating threshold could affect another facility operated by a different agency. The same is true if an express lane is closed to all vehicles due to a traffic incident.

Similarly, individual express lane corridors should also communicate in real time with regional ITS, advanced transportation management system (ATMS), and traveler information systems, to ensure the relevant information is disseminated to users of the corridors and the wider traveling public. While coordination between the different tolling systems in the SCAG Region is essential, there are no plans to integrate express lane toll systems. For more information on regional systems integration, please see section 8.5 – Transportation Management Initiatives.

6.8 EQUITY PROCESS

To be successful, SCAG and its regional partners will have to engage the Southern California community in an open, transparent, and inclusive process for evaluating the potential social equity and environmental justice (EJ) concerns associated with the regional express lane network. As interest in pricing alternatives on freeways has grown, it is not uncommon that there may be concerns that pricing proposals are unfair to transit-dependent or low-income populations. Potential equity concerns may be addressed by improving transit services in express lane corridors, and by providing subsidies to low-income transit and express lane users. These and other types of policies can be important to overcoming equity concerns and the resulting public reluctance of roadway pricing. Despite the many

social and economic benefits afforded by road pricing, educating the public on the value of tolling requires a careful analysis of the distribution of costs and benefits across different socioeconomic groups, especially where the associated impacts may be felt by a large and diverse number of people.

6.8.1 Non-Discrimination and Environmental Justice

An equity evaluation should include the framework laid out by the federal government and the state of California regarding various regulations and guidelines to prevent discrimination against EJ communities. In addition, SCAG can rely on the overarching mission documented in the adopted 2020-2045 *Connect SoCal* RTP/SCS, to ensure that transportation system investments are equitable in terms of benefits and impacts to EJ communities:

“SCAG’s EJ program includes two essential elements: public outreach and technical analysis. Specifically, it is SCAG’s role to ensure that when transportation system investment decisions are being made, low-income and minority communities have adequate opportunity to participate in the decision-making process and receive an equitable distribution of benefits, while not bearing a disproportionate share of burdens.”

SCAG REGIONAL TRANSPORTATION PLAN EJ ANALYSIS

The adopted SCAG 2020-2045 RTP/SCS, *Connect SoCal*, also states:

“A critical element in the development of Connect SoCal is the completion of a comprehensive EJ analysis. SCAG also conducted an extensive EJ outreach program with regional EJ stakeholders to maximize participation of all communities that may be affected by the development and implementation of Connect SoCal. SCAG established a separate set of [18] performance measures to evaluate Connect SoCal impacts on designated EJ communities throughout the region.”

The 18 performance measures are categorized into four EJ-focused questions:

- 1) How will this impact quality of life?
- 2) How will this impact health and safety?
- 3) How will this impact the commute?
- 4) How will this impact transportation costs?

Travel behavior varies by race, ethnicity, gender, age, health condition, household size and composition, income level, place of residence, and other factors. In addition to the direct toll charges, requirements such as deposits or down payments to obtain a transponder, the need for a credit card or checking account to set up a payment account, and minimum balance requirements may make it harder for people to access the system. Language barriers or other difficulties in comprehension may also discourage some travelers from using the system. While it is not practically possible to detail all the possible impacts that the regional express lane network might have on different groups of people,

the equity assessment that is ultimately implemented should be prepared to take the four EJ-focused questions into consideration.

APPLYING EQUITY PRINCIPLES/BEST PRACTICES TO TOLLED FACILITIES

Many congestion pricing proposals have encountered substantial public resistance and even intense opposition. In general, tolling opponents have raised a number of objections including: (1) drivers are paying for what has traditionally been free; (2) drivers are paying twice for same facilities (gasoline and diesel taxes + tolls); and (3) there are disproportionate distributions of costs and benefits.

Tolling is generally considered more equitable where it is used to finance new express facilities such as the 91 Express Lanes in Orange County⁸⁰. But it should be noted that pricing also addresses some of the added costs of congestion that are being imposed on all motorists from overuse during peak periods by collecting fees from at least some drivers. Since the regional express lanes network may consist of both new express lanes and HOV lane conversions, attention should be paid to justifying the need for tolling (e.g., demand management, funding the project, paying for repairs, replacement, etc.), as well as defining and providing information to the public on alternative financing mechanisms to assure the public that the costs imposed are being fairly apportioned according to various equity criteria. It is important to note that all freeway users (including even low-income drivers) may benefit indirectly from express lane projects, as those willing to pay to enter the premium lanes will not be competing for space on the existing general-purpose lanes. In addition, express lane projects can also provide new mobility choices and facilitate enhanced transit services for transit users.

A survey of drivers on the 91 Express Lanes in Orange County found that households earning below \$50,000 annually used the lanes about as often as those earning \$200,000 or more. Similarly, a survey of Metro ExpressLanes users found that 19% earned less than \$50,000. Another study showed that 19 percent of peak period users had household incomes below \$40,000, and only 21 percent of peak period users had household incomes above \$100,000⁸¹. A study of the I-15 Express Lanes in San Diego County found strong support among all income levels⁸².

Still, one of the most frequent criticisms of express lanes is that they primarily benefit high-income drivers who can afford to pay a toll for premium travel, while low-income drivers are forced to ride on the more congested general-purpose lanes or take other routes. The impression that express lanes primarily benefit the wealthy is a powerful impediment to achieving widespread public acceptance for these pricing mechanisms, despite that other finance mechanisms such as sales and fuels taxes are often more regressive in nature.

⁸⁰ Schweitzer and Taylor, 2008

⁸¹ Sullivan, 2000

⁸² Zmud and Arce, 2008

While express lanes utilization generally increases with household income, as shown by studies of the Minnesota I-394 project and the 91 Express Lanes,⁸³ it should be noted that—absent targeted discounts or subsidies for low-income motorists—voluntary tolls can still be considered regressive since they require a higher proportion of income from low-income households. However, the cost can vary depending on “geographic context and the other choices available to low-income motorists.”⁸⁴

Examples of this approach include lifeline credits that are offered to low-income motorists using the San Francisco Bay Bridge, to counter the costs of tolls to cross the span between Oakland and San Francisco. In Southern California, Metro’s Low Income Assistance Plan offers low-income residents of Los Angeles County a per-household account set-up fee waiver equal to the cost of the required transponder, about \$25, for accounts related to the I-110 and I-10 ExpressLanes projects and waives the \$1.00 monthly maintenance fee. Metro has also addressed the needs of transit riders along the two toll corridors by offering frequent transit riders (many of whom are low-income) a \$5 toll credit for using a Transit Access Pass (TAP) card on certain routes more than 16 times each month. As shown by these examples, concerns over high toll prices can be addressed by offering certain populations discounts or rebates, special promotions, or other cost reducing measures.

6.8.2 Recommendations for Designing an Equity Process

The main objective in undertaking equity analyses for express lane projects should be to understand how the proposal will affect specific EJ communities and other underserved populations, how it can be made more fair for all, and how barriers to accessing the express lanes can be reduced. Equity evaluations should look at both short-term and long-term impacts, and build in flexibility to respond if conditions change. Experience has shown that public engagement is crucial in addressing concerns about and building public support for road pricing proposals. The most common impediments to public acceptance of controversial new policies such as tolling often stem from the perception that public participation will have no impact on outcomes, and that project decisions have already been made, with equity concerns only considered as an afterthought. Local communities should be engaged in a process that provides a wide-ranging, meaningful public dialogue about the proposed network (e.g., how it will be financed, how the revenues will be collected and spent, what the equity impacts may be, and how any negative consequences can be mitigated). As done on the 2020-2045 Connect SoCal RTP/SCS, SCAG and its partner agencies can draw on lists of key stakeholder individuals and organizations, including local community advocates, environmental groups, and unions, to develop specific outreach strategies to reach EJ communities and other underserved populations.

The direct costs of express lane projects will be borne primarily by those who pay the tolls to access them. One focus of equity assessments could be determining whether these costs fall disproportionately on particular groups (both as total costs, and as a percentage of household income), and whether this distribution of costs is fair and reasonable in light of users’ ability to pay, benefits

⁸³ Pattenson, 2007; Supernak et al., 2002; Sullivan 2000

⁸⁴ Schweitzer, 2009, p. 2

received, and/or costs imposed. Some equity categories that an implementing agency should consider when undertaking an express lane EJ analysis include:

- **Individual/Group Equity:** Depending upon how express lanes are financed, some individuals could be negatively affected by express lane projects in that they contribute fuel or sales tax revenues that are spent to fund express lane projects constructed on corridors that they will not likely use to travel. The evaluation should consider how sources of funding may impact different groups, and whether any imbalance can be mitigated by changing the ways that tolling revenues are invested. For example, negative effects on transit-dependent populations could be possibly mitigated by providing fare subsidies or discounts for use on the express lanes to transit users.
- **Modal Equity:** Equity evaluations should also consider the distribution of indirect costs and other non-economic factors, like whether current carpoolers may be diverted onto the general-purpose lanes, whether general-purpose lane users may experience more traffic congestion, or whether other groups might elect to travel by different modes, or otherwise alter their trip-making behavior, as a result of express lane projects.
- **Geographic Equity:** Noise, air quality, and traffic impacts on local communities and neighborhoods generated by the regional express lanes network should also be evaluated. Other potential impacts could include changes in land use patterns that might take place due to changes in accessibility, and local traffic impacts affecting residents and businesses in low-income or disadvantaged areas.

Most congestion pricing studies assume travelers can assign some monetary value to the time saved from avoiding delays caused by congestion. Low-income drivers may place an especially high value on travel time savings, if they must, for example, get to work on time or risk losing employment, or pick up a child from daycare by a certain time in order to avoid a fee. While higher income individuals generally place a greater value on the time saved from avoiding congestion, and will find it easier to bear the additional cost and thus gain the most benefits of express lanes, the fact that any driver will have the option to use the tolled lanes in situations when the value of time saved exceeds the toll charged implies that drivers across the income spectrum may benefit from the operation of express lanes in the SCAG Region. Additionally, all drivers, irrespective of income levels, may benefit from travel time savings in the general-purpose lanes as a result of other drivers using express lanes rather than the general-purpose lanes.

Additional policies that could increase the chances that low-income and other drivers will benefit from express lane operations could include: (1) giving exemptions, discounts, subsidies, or rebates to encourage express lanes use; (2) offering credits for alternative transportation services; and (3) allowing different methods for toll payment, such as cash accounts, to accommodate low-income and/or unbanked users. The key question will be whether such initiatives can be designed and implemented to successfully achieve a more equitable distribution of the costs and benefits that have been identified. Equity assessments should also consider whether there are travel alternatives for those who

may not drive or have access to an automobile, but who may benefit from more express bus service or other transit improvements, such as vanpools in the corridor, or within the region more generally.

While it is essential to ensure the express lanes remain accessible and do not disproportionately impact low-income users, it is also important to protect against over-incentivizing use of the express lanes by single occupant vehicles. This could result in increased congestion on the express lanes and contribute to the express lanes falling into degraded status per Federal standards described in Section 4.1.2.

Equity considerations should not end when an express lane project is approved or opened to service. Since it is impossible to foresee all the possible impacts, it is important to have procedures to monitor the express lanes program on an ongoing basis, in order to identify any issues that may arise. The touchstone of a successful equity evaluation process should be whether there is consensus that the proposal, together with any accompanying transportation enhancements, improves mobility and accessibility for all populations without disproportionately disadvantaging or harming EJ and other disadvantaged communities. An ongoing process for analyzing equity implications should be undertaken for every express lane project to understand the effects on all potential users and to determine appropriate strategies to identify and ameliorate equity impacts and concerns over time.

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7 Technical Requirements

7.1 TOLL COLLECTION

A regional express lane network requires a variety of equipment, software, and communications infrastructure to facilitate pricing highway lanes to manage traffic flows and LOS based on time of day and travel demand. Combining this capability with an ATMS and traveler information systems greatly expands the toolbox for more effective management of the overall regional transportation network. ETC consists of the following primary components:

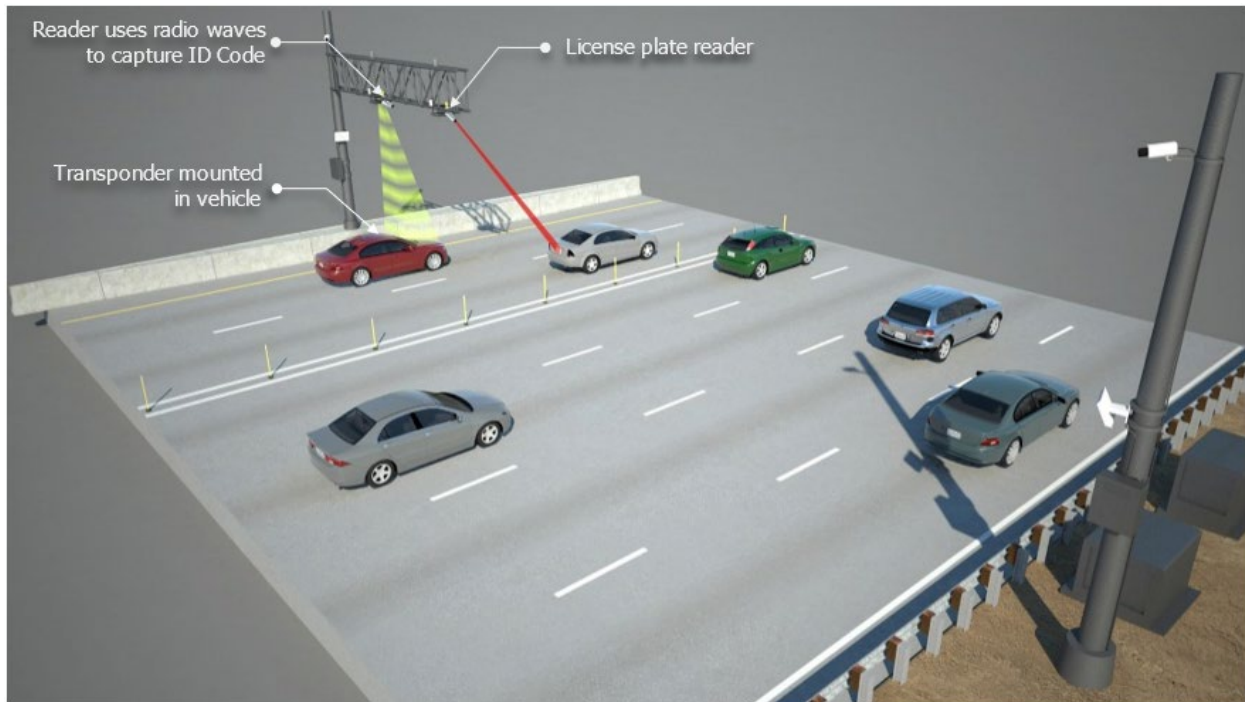
- **Collecting the toll**—Although, historically, toll collection involved a direct cash transfer at a toll booth, ETC for express lanes purposes requires a transfer of data via electronic technology with money changing hands through other means. Regardless, it is necessary to ensure that the correct toll is collected, and that toll avoidance and user fraud is discouraged.
- **Setting the toll rate**—The toll rate must be set and clearly conveyed to users. Traditionally, tolls are fixed amounts based upon vehicle characteristics such as number of axles. Tolls can be assessed at a point on the road or based upon the distance traveled. Advances in traffic conditions monitoring now allow toll rates to vary based on the level of congestion and the number of vehicle occupants, which is critical to the use of pricing as a congestion management tool, as is the case with express lanes.
- **Enforcement against violations**—While most users will pay the required toll to use the express lanes, some will try to evade payment. Like any business, toll collection enterprises must identify, quantify, and mitigate these potential losses. The primary goal of enforcement is to ensure that there is an acceptable level of compliance, and that enforcement efforts are fair and consistent.
- **Management and accounting**—Toll collection, audit, accounting, maintenance, security, customer service, and enforcement must be managed, with a full accounting of all revenues and costs associated with the operation.

Technology, coupled with agency business rules, is a principal enabler of all four components of toll collection related to express lanes. The following sections describe these components and the underlying technologies utilized for express lanes operations, including tolling, in more detail.

7.1.1 Collecting the Toll

Under Title 23 of the U.S. Code, cashless ETC is required on all HOT lanes. This concept is also referred to as open road tolling, and its components are shown in Figure 7-1.

Figure 7-1. Automatic Vehicle Identification Technology for Open Road Tolling



Source: SBCTA I-10 & I-15 Corridor Project Concept of Operations Report (2019)

ORT depends on the ability to identify every vehicle that passes a tolling point at normal highway operating speeds, effectively eliminating the need for any delay to the traveler to allow for payment of the toll. The mechanics for implementing this process vary, and are discussed in more detail later in this chapter, but the underlying concept is that infrastructure installed along the roadway identifies a vehicle that is typically linked to a pre-registered account, and the account is subsequently automatically debited for the amount of the toll. Alternatively, the registered owner of the vehicle is identified through vehicle registration databases and notified via postal mail to provide payment of the toll(s).

7.1.2 Setting the Toll Rate

The concept behind setting rates for express lanes tolls is to maximize the productivity of the facility by managing vehicle demand to maintain a desired minimum travel speed. For converted express lanes facilities that integrate HOV considerations, the pricing is structured to sell any available excess capacity to non-HOV or otherwise ineligible users (e.g., SOV). Therefore, traffic conditions must be monitored in real-time to ensure that travel speeds are being maintained and that there is excess capacity available to sell, at any given time. This information is used to set the toll rate for the additional drivers who wish to use the lanes. The rate is dynamically set at a level to attract or discourage additional toll paying drivers from entering the facility. The implications of this type of operation require that: (1) information of real time traffic conditions will be needed to determine the toll; and (2) toll paying drivers will need to be notified of the toll rate at a point before they enter the express lanes.

A key consideration is whether toll paying users will be charged one rate regardless of where they enter the express lanes, or a rate based upon the portion of the facility that they traversed. The first express lane facilities in California – SR-91 in Orange County and I-15 in San Diego – had only one entrance and exit, which made the first approach practical. However, the newer express lane facilities in the SCAG Region have multiple points of access and egress. Charging based on entry segment is accomplished by reading transponders within each segment travelled and aggregating these individual “reads” into a single trip for which the user is charged. Typically, business rules allow for the toll rate for the entire trip to be locked in, based on the prevailing toll rate at the time the vehicle saw the price sign for the relative toll segment or trips. As corridors expand and connect to one another, tolling zones and segments need to be designed to balance demand management effectiveness with customer ease of use.

Vehicle classification is also typically a factor in setting the toll rate for an express lane. In the SCAG Region, classification is done both for vehicle type and occupancy. For example, Metro currently charges a toll based on vehicle occupancy, vehicle type, and time of day. Separate categories are selectable on the transponder for SOV, HOV 2+, and HOV 3+, while CAVs are identified at the vehicle level, if they are eligible for a discounted toll rate. Certain vehicle types, such as transit buses and motorcycles, are excluded from toll charges, and do not need to carry a transponder.

7.1.3 Enforcement

The introduction of ETC without gates and toll collectors has resulted in the deployment of supplemental technology to identify toll evaders and enforce payment of the required tolls. The primary goals of enforcement are to ensure that there is an acceptable level of compliance, and that enforcement activities are fair and consistent.

There are three main types of violations that need to be enforced on express lane facilities:

- **Toll evasion** – Toll evasion enforcement seeks to capture vehicles that are using the tolled lanes but knowingly not paying the corresponding toll. Typically, this enforcement is done automatically via the toll equipment.
- **Eligibility** – Eligibility enforcement seeks to capture unauthorized vehicles using the facility, or users misrepresenting their allowed category of use (e.g., incorrect occupancy level). Enforcement in this case is typically a combination of detection and notification technologies, along with law enforcement participation.
- **Proper use** – In some cases vehicles may enter an express lane facility when it is closed to traffic, or at a non-designated location. These so-called “proper use” violations are typically handled by law enforcement via visual inspection, but enforcement of such violations may also be aided by technologies that detect whether vehicles entered or exited the facility at an unauthorized location.

7.1.4 Management and Accounting

Any type of regional express lanes network will require operations staff to monitor the system and coordinate with other local agencies, such as Caltrans and CHP. The operations staff are also responsible for reconciling account validity and toll collection with other tolling agencies within California. The operator staff must have access to workstations that interface with the toll system and provide the ability to monitor express lane operations, override toll prices if conditions in the express or general-purpose lane warrant, and coordinate with the Freeway Service Patrol and CHP in the event of incidents. These systems also typically automate the regular retrieval of toll account status information from a central clearing house to ensure that motorists with ETC accounts from other “away” agencies are charged the correct toll, and that the transaction information is transmitted to the away toll operator.

The technology-based infrastructure used to implement express lanes operations has multiple components that are integrated to make one complete system. It is important to monitor the different hardware and software components for errors, failures, and any inconsistencies. The industry uses the broad term of Maintenance Online Management System (MOMS) to reference the technology infrastructure that monitors all of the components and sends an alert when there is an error. With a regional system, there could potentially be several individual MOMS responsible for different facilities that would be sending status and error data to a central back-office or toll system integrator.

7.2 ROADSIDE EQUIPMENT

Implementation of a regional express lanes network will require the design, installation, and operations and maintenance of a variety of technologies and communications infrastructure in the field. This field infrastructure is where the fundamental toll collection process happens within the context of the associated agency business rules.

7.2.1 Lane Controller

The lane controller manages and automates the real-time control of the various equipment in the lane. The controller receives data from in-lane equipment, systems, and sub-systems, and pre-processes and forwards the information to the host controller that is typically housed at a central location off premises. The lane controller is often housed in roadside cabinets or dedicated roadside equipment shelters. The controllers will store updated account status files, communicate between all devices in the field and the host controller, and record transactions. Given that this device is effectively the front line, with respect to collecting and processing toll transactions based on agency business rules,

Figure 7-2. Typical Lane Controller Cabinet



additional considerations for power and communications redundancy is important. Figure 7-2 shows a typical lane controller cabinet.

7.2.2 Automatic Vehicle Identification

AVI is used to identify individual vehicles for purposes of tolling. Within the SCAG Region, two different ETC technologies have been deployed, often concurrently: 1) a RFID-based reader and transponder system; and 2) LPR systems.

RADIO FREQUENCY IDENTIFICATION

RFID-reader- and transponder-based ETC systems are made up of an antenna, reader, and in-vehicle transponder (also commonly referred to as a toll tag). In California, these systems are collectively branded as FasTrak®, and they must be developed to be compliant with 6C (passive RFID) protocol operating at 915 MHz, which is the successor to the legacy (semi-passive RFID) Title 21 protocol being phased out by January 1, 2024, for all agencies using FasTrak®. The antenna is typically mounted on an overhead gantry or mast arm and connected to the reader, which can be collocated on the gantry or housed in a lane side cabinet. The antenna will emit a radio signal forming a read zone beneath the gantry. As a vehicle enters the read zone, the toll tag in the vehicle will be activated by the signal being transmitted by the antenna and will reflect back to the reader the unique identification number associated with the tag. The identification number and time stamp are then sent to the lane controller, which packages the information to send to a centralized host computer (see section 7.4.1). The host then combines this and other information to form a trip transaction that is then sent to the back-office accounting system (see section 7.5), where the customer’s account is debited for the toll. Tolls for exempted vehicle classes such as HOVs, vanpools, buses, or emergency response vehicles are set at zero or appropriately discounted. A Metro ExpressLanes read zone with antennas, readers and LPR camera systems is shown in Figure 7-3.

Figure 7-3. Example Electronic Toll Collection Read Zone



The main reason for transition to 6C was a national mandate from the federal government and a statewide concerted effort by CTOC to bring forth national interoperability. 6C is an open-source RFID protocol commonly used nationwide, and transponders based on it are very inexpensive to produce. However, given that the implementation of national interoperability has evolved into not mandating a single protocol, the SCAG partner agencies may wish to consider the use of now-common multi-protocol readers that can read 6C, as well as other protocols such as the legacy Title 21 protocol (while it is being phased out) and other common ones such as SeGO (custom 6B) and EZ-Pass (TDM). Section 7.3 discusses transponder technology in more detail.

LICENSE PLATE RECOGNITION

LPR is used both as an AVI system and primary tolling mechanism, as well as an enforcement technology within the SCAG Region. As shown in the example in Figure 7-4, the system consists of a camera typically mounted to an overhead structure, and a lighting assembly to provide proper illumination in varying daylight, glare, and weather conditions. Metro, OCTA, and RCTC currently utilize LPR systems for enforcement purposes in cases when a vehicle's toll tag is not detected, read incorrectly, or is determined to be invalid as it passes through a read zone. Upon

Figure 7-4. Example License Plate Recognition Camera Illumination Equipment



detection of a vehicle without a valid transponder, the camera is triggered, and images are captured of the vehicle's rear license plate. The light assembly is typically either a set of high intensity filtered or unfiltered light emitting diode (LED) strobes, infrared, or always-on visible lights angled to stay out of the customer's line of sight. The light assembly can be designed to dim during the night to minimize glare with the data it receives from a light sensor.

Once images are captured, they are scanned by OCR software that locates and deciphers each license plate character. Any plates that are not recognizable by the OCR software within a predefined level of accuracy are sent for human review and verification. This information is used to charge the accounts of customers who have registered vehicles in advance. For vehicles that are not registered, this license plate number is used to determine the owner's name and address through querying of vehicle registration records. The registered owner of the vehicle is either sent an invoice for the toll or issued a violation notice. The specific process including the type of notice sent depends on the business rules used on the express lane facility.

TCA has offered a pay by plate option for drivers using the toll roads in Orange County without a FasTrak® transponder, since May of 2014. For those drivers, the LPR system is the primary toll collection system, as opposed to an enforcement tool. Several express lanes and toll facilities in the U.S. also utilize LPR to provide a pay by plate option for toll collection. Due to the substantially higher operation, verification, and accounting costs associated with the use of LPR as a primary toll collection option, most agencies using this option charge a higher toll for pay by plate compared to the toll charged to those using a transponder on the same facility. Metro has recently introduced a Pay as You Go option as a pilot for potential customers who do not have a valid FasTrak® transponder account. The technology remains a toll evasion violation enforcement system, but the previously applied \$25 violation fee has been replaced with a \$4 processing fee to be paid within 30 days to avoid additional

penalties. Figure 7-5 illustrates the differential toll rates for transponder (Good to Go!) and pay by plate (pay by mail) ETC options on the SR-520 Floating Bridge near Seattle.

7.2.3 Vehicle Detection System

Vehicle detection systems (VDSs) are used with managed lanes for the purpose of defining a toll transaction and for monitoring traffic flows. As part of the toll system, the VDS is placed in conjunction with the AVI systems, and serves to trigger a message to the AVI system when a vehicle enters the read zone. Additional

detection deployed along express lanes and the general-purpose lanes also enable the capability to monitor the performance of traffic in the corridor and to use the data received to determine the toll rate necessary to manage demand. A typical VDS for tolling can include inductive loops or magnetometers embedded in the pavement, an overhead or roadside point detection device (typically infrared / laser sensor), stereoscopic cameras, or a treadle. Less accurate microwave or radar VDS can also be used for traffic monitoring and dynamic pricing.

Within the SCAG Region, inductive loops have been the preferred detection technology for the Caltrans performance monitoring system (PeMS). However, other technologies have also been deployed that do not require in-pavement installation. Loops are installed in the pavement and are used to detect the presence of vehicles travelling over the loop (commonly referred to as “lane occupancy”), the number of vehicles passing over the loop during a given period (commonly referred to as “traffic count” or “lane volume”), the size and/or type of each vehicle passing over the loop (commonly referred to as “vehicle classification”), and the speed of each vehicle passing over the loop. Loops are a series of wires that are installed in small cuts in pavement, which are sealed after the wire is placed and connected by cables to a roadside cabinet. The inductive loops act as antennas that measure the change in magnetic field to determine trigger points and vehicle characteristics. Loops work in diverse weather conditions and are accurate for detecting vehicles when the loops are not damaged or receiving interference from other sources. Since loops are installed in pavement, they can be damaged over time as heavy vehicles pass over them. Loop damage often occurs with asphalt-paved surfaces, due to movement in the asphaltic cement surface, and less so when loops are installed in roadways with a concrete-cement surface. Although loops suffer the possibility of being damaged, when properly maintained, they have been shown to be reliable for enabling detection and obtaining speed, volume, and/or lane occupancy statistics at the tolling points.

Figure 7-5. Example Differential Toll Rate Sign



Source: Washington State Department of Transportation (WSDOT)

Self-contained in-pavement sensors (sometimes referred to as pucks or studs) provide a detection solution that can measure lane occupancy, speed, and volume. These sensors are typically magnetometers installed in the pavement at predefined intervals in each lane. Units are embedded in the pavement and can typically operate for up to 5 years without the need for maintenance or external power. In-pavement units communicate wirelessly with access points installed along the roadside. The units perform well under most environmental conditions and are not susceptible to damage by heavy vehicles or normal pavement movement (although some states have experienced issues with these devices due to salt penetration associated with snow removal). The data is very accurate for determining speed, volume, and lane occupancy, but the technology is not accurate enough for trigger points. The Metro I-110 and I-10 ExpressLanes use in-pavement sensors for speed and lane occupancy detection outside of the toll points, to support traffic monitoring and the dynamic pricing algorithm.

Microwave or radar sensors differ from loops in that they are primarily used to detect vehicle speed across multiple lanes. The units are typically mounted on a pole perpendicular to traffic, making them far less intrusive and easier to maintain than devices installed within the pavement. These sensors work in diverse weather conditions and can detect speed and classify vehicles across multiple lanes, and often for both directions, of a highway (dependent on total lane count and width). Microwave or radar sensors, however, are subject to problems of occlusion, which occurs when a large vehicle like a truck blocks the detection of a smaller vehicle traveling beside it. These devices can also experience echo when the waves are reflected off hard surfaces like pavements and barriers. Microwaves and radar sensors are not typically used as trigger points for toll gantries, as the technology does not provide the accuracy required to trigger transponder reads and LPR cameras.

In contrast to microwave sensors, point detection devices, such as overhead laser scanners, can be used as trigger points for toll gantries. Laser scanners are mounted overhead of vehicles for each lane and use a laser “curtain” to detect vehicles. This laser curtain can detect vehicle presence, speed, and size. This technology does experience detection issues under poor environmental conditions (such as heavy fog, rain, dust, or snow) that block or scatter the laser curtain. More advanced laser applications include light detection and ranging (LiDAR) technology, which is more accurate than typical infrared sensor applications, but which suffers from similar issues under poor environmental conditions.

Roadside point detection devices provide another alternative for detecting speed, volume, classification, and lane occupancy using a combination of a transmitter that projects a matrix of infrared-light beams and a receiver that detects the beams and the duration of breaks in the beams. The devices are non-intrusive to the pavement; they are typically mounted on either side of the roadway a few inches above the level of the pavement, so that the light beams can pass beneath the passing vehicles. As a vehicle passes, the light beams are broken temporarily as they get blocked by the wheels. The receiver detects and records the series of breaks in the matrix of light beams, allowing the speed of the vehicle and the wheel configuration for each vehicle across the roadway to be calculated. Roadside point detection devices are highly accurate for determining speed, volume, classification, and lane occupancy, and are used for automated speed enforcement in some jurisdictions. Roadside

point detection devices are subject to vehicle occlusion, although the effects from vehicle occlusion are very limited, requiring adjacent vehicles to have very similar speeds, tire size, and axle configuration to affect detection. These devices can also be affected by occlusion in extreme weather conditions, such as heavy snow accumulation blocking the light beams. Some other drawbacks of these devices in high density applications include road geometry limitations and relatively high cost.

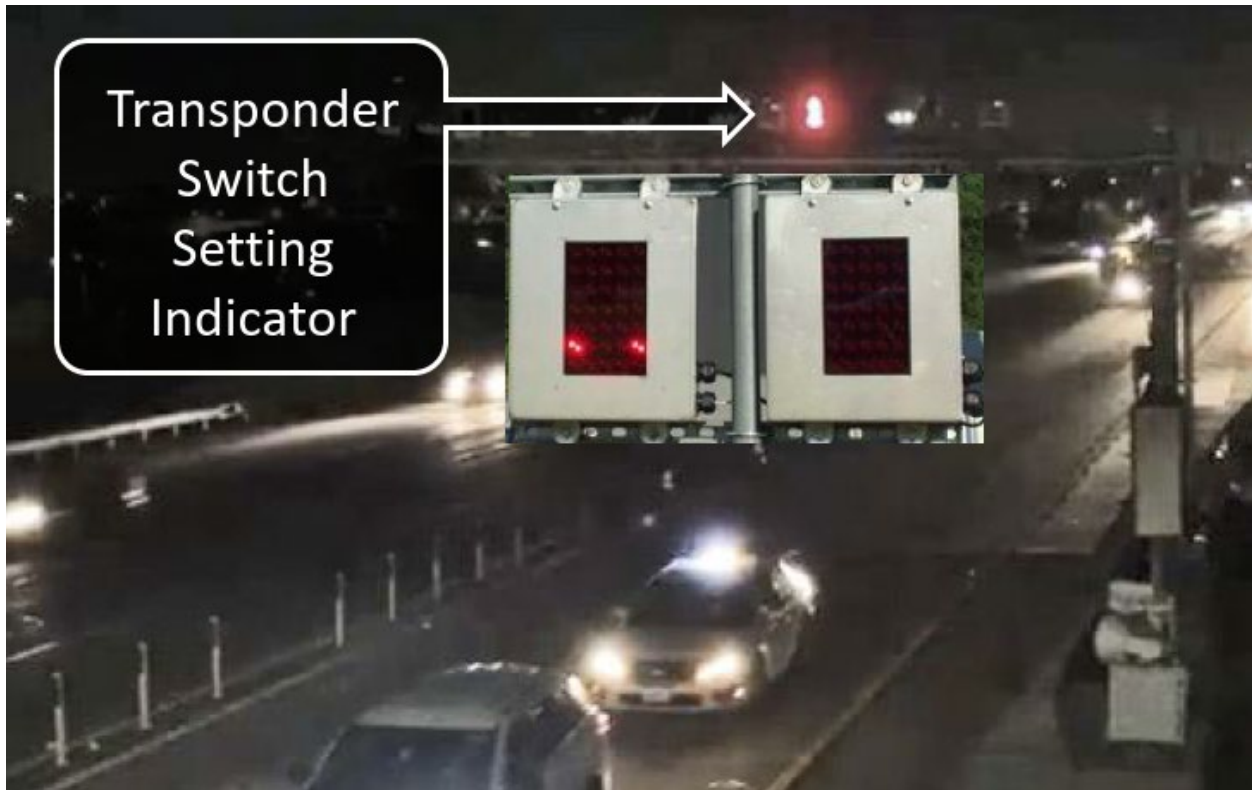
Stereoscopic cameras have recently been gaining ground in the United States. These cameras can provide highly detailed, three-dimensional representations of vehicles at high speeds, and provide another non-intrusive technology option for detecting and classifying vehicles, with the potential for higher accuracy. One of its advantages over other non-intrusive light-based technologies is that it works under poor environmental conditions without significant degradation. In addition, this technology has significant potential to improve over time with advances in artificial technology applications. However, practical applications in the United States (including Southern California) have rendered mixed results for transaction formation purposes. Also, these camera systems are relatively more expensive than other VDS technologies, so that cost needs to be factored in, as it can vary widely based on the amount of devices needed on the express lanes facility.

Treadles are in-pavement devices that detect vehicles by measuring weight as vehicle tires roll over the device. Treadles must be installed along the full width of the lane and are more complex to install than loops in that a greater portion of the roadway must be cut away to implant the treadle in the pavement. These devices work well in all weather conditions and are a reliable solution for trigger point detection; however, treadles provide inconsistent speed data and are expensive to maintain.

7.2.4 Enforcement Signals

Enforcement signals are strategically placed in the proximity of selected toll zones, and will alert officers to the presence of vehicles without a valid transponder, drivers self-declaring as an eligible toll-free user, and/or the occupancy declared by the driver. Enforcement signals are linked to the lane controller and will illuminate according to set parameters when vehicles pass through the tolling point. An enforcement signal can take the form of a colored light or array of lights (as depicted to the left of the illuminator in Figure 7-4), or an LED alpha-numeric display, as in Metro's transponder switch setting indicator (see Figure 7-6). The color of the enforcement signal lights should not be red or amber, as those colors tend to be used to alert drivers to stop or slow down. Enforcement signals that are visible upstream and downstream can enable officers to perform roaming enforcement. In addition, design provisions should also be undertaken to ensure that enforcement signals are clearly visible from enforcement observation locations.

Figure 7-6. Metro I-10 ExpressLanes Transponder Switch Setting Indicator LED



Source: Adapted from Metro

7.2.5 Roadside Automated Occupancy Enforcement

Automated occupancy enforcement uses technology to detect the occupancy within a passing vehicle to aid enforcement of express lanes that require drivers to declare their occupancy. This technology is being piloted by Metro on the I-10 and I-110 ExpressLanes, and has previously been tested by Caltrans and various CTCs in both Southern California and the San Francisco Bay Area. Automated occupancy enforcement has improved over the years, with two technologies showing promise as a viable option for detecting the number of occupants in a vehicle. These two emerging technologies either use infrared cameras on the roadside or a vehicle on-board unit (OBU; see section 7.3.2).

Infrared camera-based systems use at least two cameras to detect occupancy. One camera is mounted overhead and captures images through the windshield of each vehicle. The second camera is mounted to the side of the lane to capture images of the back seat area of each vehicle, as shown in Figure 7-7. Software is then used to analyze the images to detect the number of occupants within a given vehicle.

Figure 7-7. Occupancy Detection System installed on I-10



Source: Metro

The second technology uses an OBU to capture and/or verify information provided by in-vehicle systems, such as airbag and seat belt detectors, or dashboard cameras in equipped vehicles.

Although such systems have yet to be permanently deployed for express lanes occupancy enforcement purposes, the results of recent testing by Los Angeles Metro have shown the potential for such systems, such as their pilot Occupancy Detection System, to support and enhance current enforcement efforts. Automated enforcement systems may be useful as a secondary tool for enforcement personnel, but not necessarily as a replacement for pursuit and apprehension of willful violators of HOV policies as the primary means of enforcement. The CHP may use the system to screen vehicle occupancy at the toll collection point, allowing officers to focus enforcement efforts by only pursuing vehicles that the detection system has identified as potential violators. Additionally, the automated enforcement system could be used to recognize repeated suspected violators on the facility, especially when coupled with toll collection data, to identify and predict when these violators are likely to use the facility. Furthermore, these systems can be used for soft enforcement, either as a psychological warning (e.g., advance signs stating, “*Notice: Enforcement Cameras in Use*”) or in the form of a letter to suspected violators articulating suspicion of violation. Ultimately, in the short-term, these systems are only a supplement to the required physical, in-field presence by CHP.

7.2.6 Changeable Message Signs

CMSs – also referred to as “variable message signs” or “dynamic message signs” – are a widely deployed tool in Southern California used to support traffic management and traveler information functions. For tolling operations, CMSs are typically located throughout the corridor to communicate the toll and travel time information to drivers. CMSs can include static signs with a small section that is electronically changeable, or full matrix signs that can be used to display custom messages. Examples of both options are provided in Figures 5-9 and 5-10.

A customizable CMS includes a series of LEDs capable of displaying alpha-numeric characters. CMSs are sized to display the needed character height and message size, according to the standards and guidelines in the CA MUTCD. Typically, these signs display the amount of toll drivers must pay to travel to specific destinations, but they can also display messages that provide drivers with information on the status of the lane or travel times. Example messages include: “HOV ONLY,” “LANE CLOSED,” or “ACCESS 1 MILE.” These messages can be automatically controlled by the host controller or overridden manually by the Transportation Management Center (TMC) for incident management or other operational reasons. To ensure that the price shown on the sign is accurate, a fixed camera is typically located with a view of the sign. These cameras can take an image capture every time the pricing changes to keep a record of verification of the displayed toll rate if a customer disputes a price. CMSs deployed to support tolling typically also provide pricing or traveler information.

7.2.7 Closed Circuit Television Cameras

CCTV cameras should be placed strategically in express lane corridors to provide visual imagery of the toll lanes, the toll equipment, and the general-purpose lanes, to allow the operators to monitor the freeway travel conditions and look for incidents. Cameras can be fixed to show only certain areas of the express lanes, or can be provided with full pan, tilt, and zoom capabilities to allow operators to control and view multiple areas of the lanes. The cameras deployed on the express lanes will be primarily used for toll lane operations, including LPR, CMS verification, and traffic monitoring, but can also be integrated with the various Caltrans district TMC and associated video distribution systems. When sharing system cameras, operator priority can be set so toll operators always have the highest priority status for operation of the toll lane cameras.

7.3 IN-VEHICLE EQUIPMENT

7.3.1 In-Vehicle Electronic Toll Collection Equipment

The primary in-vehicle system for electronic toll collection in California is a FasTrak® transponder, of which there are many variants. First deployed by TCA in 1994, FasTrak® transponders can be used on any express lane, toll road, or toll bridge in California. Additionally, a transponder can be acquired from any toll agency currently in operation in the state, including those issuing transponders in the SCAG Region (i.e., Los Angeles Metro, OCTA, RCTC and TCA, all of whom are members of CTOC). CTOC’s

mission is to evaluate and recommend the adoption of in-vehicle ETC technologies. As such, any new technologies or methodologies adopted by one agency that may impact the ability of other agencies to process tolls must be reviewed, and likewise adopted, by CTOC.

ETC systems within SCAG Region express lanes must satisfy several technological needs, including:

- Users being detected by systems designed, implemented, maintained, and operated by different agencies throughout the state for identification and toll assessment;
- An orderly transition from legacy Title 21 to ISO/IEC 18000-6C standards;
- Accounting for SOV, HOV 2 and HOV 3+ declaration methods; and
- Flexibility to account for new technology and procedures.






There are two primary variations of transponders available for use in the SCAG Region's express lanes: (1) static and (2) switchable.

Static transponders have a unique electronic signature that is linked to the transponder issuer (i.e., the agency) and the user account (i.e., the customer). Any successful read by the toll zone will apply a full toll charge to the user account. Any vehicle-class discounts or nullifications (such as for CAVs) will be handled by the collecting agency's back-office. HOV users will receive appropriate consideration only for facilities featuring a declaration lane or using alternative HOV validation systems (see section on Occupancy Detection and Declaration, below).

Switchable transponders allow drivers to self-declare their occupancy status as SOV, HOV 2, or HOV 3+ users. The customer changes the occupancy setting physically on the transponder prior to arrival in the express lanes, based upon the number of individuals in the vehicle. The transponder then transmits a unique electronic signature that differs for each occupancy setting, linked to the transponder issuer and user account. This signature allows the tolling system to recognize the occupancy status of vehicles that are read, and relies upon enforcement officers to visually verify that vehicles are in compliance.

Table 7-1 identifies the transponder devices and use conditions that are accepted on the SCAG Region express lanes.

Table 7-1. Transponders Currently Accepted on SCAG Region Express Lanes

TRANSPONDER NAME	IMAGE	TYPE	MOUNTING	STANDARD
Standard FasTrak®		Static	Windshield, Velcro	Title 21
External FasTrak®		Static	Front Plate, Screw Mount	Title 21
Sticker FasTrak®		Static	Windshield, Adhesive	ISO/IEC 6C
FasTrak® Flex (<i>legacy</i>)		Switchable	Windshield, Velcro	Title 21
FasTrak® Flex (<i>new</i>)		Switchable	Windshield, Adhesive	ISO/IEC 6C

As technologies evolve, agencies may evaluate the potential for integration with in-vehicle technology provided by vehicle manufacturers. In addition to technology affixed to the vehicle, agencies are now exploring the use of mobile phone applications for toll payment and occupancy declaration, in the future. Mobile device applications are increasingly of interest based on their potential ability to collect toll payments and declare carpools with only minimal gantry infrastructure, and without the need to provide the more costly switchable 6C transponders (as compared to static 6C stickers). Currently, much of the discussion regarding mobile devices centers on account management, transponder replacement, and occupancy declaration, with each representing increasingly viable options for consideration. Several companies have developed mobile applications to replace a toll transponder in the vehicle. One example (Figure 7-8), GeoToll®, has integrated 6C protocols into the Android and Apple phone platforms, allowing the phone itself to act as the transponder. The company has conducted a pilot deployment with Los Angeles Metro in 2019, but this technology has not yet been fully deployed.

Figure 7-8. GeoToll® Mobile Toll Payment Application



Source: GeoToll®

7.3.2 In-Vehicle Occupancy Detection and Verification Equipment

As compared to roadside systems, in-vehicle systems comprise automated mechanisms for declaring and verifying the number of occupants from within the vehicle directly to the toll collection system.

There are two mechanisms for doing such currently in development: (1) in-car sensors (used in contemporary vehicles for airbag and seat belt warnings) and (2) mobile verification.

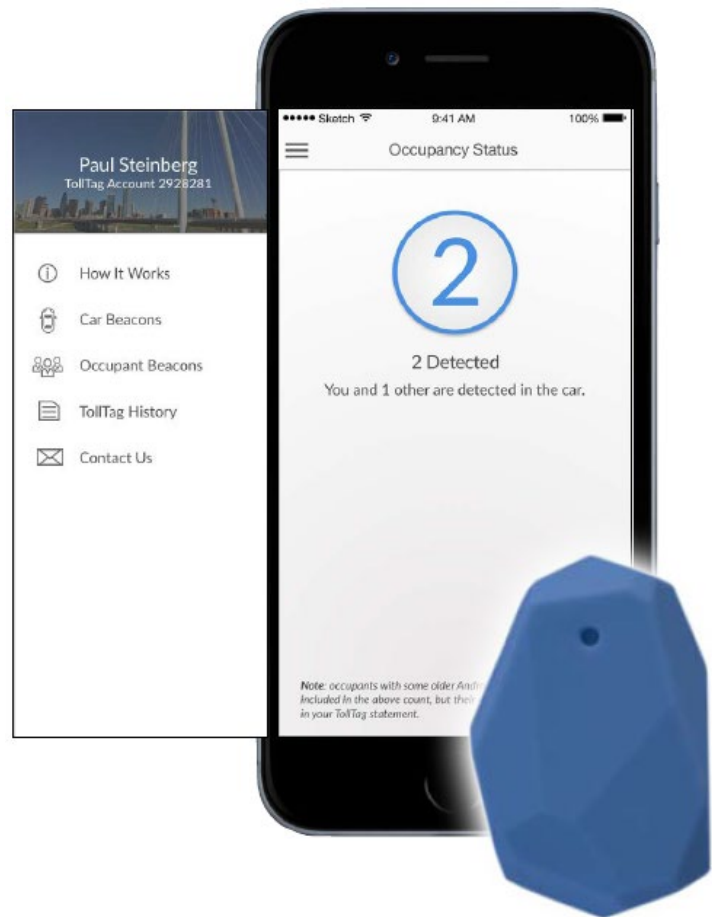
In-car sensors, such as the Delphi Passive Occupant Detection System, have been used in select vehicle models and trims for restraint and airbag deployment purposes. Although the systems' primary function is safety, the information contained could be used in conjunction with in-vehicle telematics to transmit occupancy data to operators. For this system to work, each vehicle needs an OBU to be installed using a custom hardwired solution that connects the vehicle to the ETC system. As equipped vehicles use the express lanes, the OBU would report the vehicle's occupancy wirelessly to the toll point to declare the occupancy of the vehicle. However, there are currently no standards for this information transmission, and many vehicles using the express lanes do not have the sensors installed.

Additionally, the emergence of connected vehicle technologies, which integrate OBU that allow vehicle-to-vehicle, as well as vehicle-to-infrastructure communications using cellular technology offers the potential for ETC systems to access in-vehicle sensor information to help verify current vehicle occupancy. As connected vehicle technologies further evolve, regional express lanes operators should contemplate integration of roadside equipment to make use of the data being made available, as well as the potential for communicating information related to current traffic conditions and toll rates back to the vehicle.

Mobile verification tools, including Carma® and RideFlag, use a combination of mobile phones and Bluetooth beacons (Figure 7-9). Carpoolers must have Bluetooth enabled on their smartphones or, if the occupant does not have a capable

phone, a Bluetooth beacon that stands in proxy to an equipped smartphone. Altogether, the devices transmit status as a compliant carpool to the toll operator. The operator, in turn, applies the applicable toll-free or discounted-toll rate for the vehicle as a modification to the toll transaction. This system is in use in Texas on select express lanes and toll facilities, but it has not yet been deployed in California.

Figure 7-9. Mobile Verification Tools



Source: Carma®

7.4 CORRIDOR MANAGEMENT SYSTEM

Corridor management systems are made up of the various component systems required to support pricing and ETC in an express lane corridor. The system collects data from the field infrastructure and processes that information in accordance with the operating agency business rules for pricing and traffic performance to generate and post toll rates, charge the correct tolls to customers, and operate the express lanes.

Corridor management systems include the following key components.

7.4.1 Host Controller

The host controller is the central server that stores the system database, communicates with the lane controller, detection systems, CCTV, and other field devices, and processes the incoming data streams. The host controller assigns the transactions to accounts and processes violations. It also applies and processes all the pricing and traffic performance related business rules, lane transactions, and trip transaction data, to support the dynamic pricing algorithm, trip building functions, and revenue and operational reporting for the toll system. The host controller also directly interfaces with the customer's account management back-office system.

7.4.2 Detection Interface

Detecting real time traffic conditions is an essential element of operating an express lane corridor. Detection information is used to set toll rates within the corridor itself and to provide data to measure corridor performance over time. The detection interface provides the linkage between the detection devices located in the field and the host controller. Data collected in the field is transmitted to the host controller via the detection interface as the basis for determining the appropriate toll rate, and to charge the correct toll to customers based on their observed use of the facility.

7.4.3 Trip Assembly

Trip assembly is required when there are multiple tolling points on a corridor that allow drivers to use one or more segments of the toll road to complete their journey. If drivers only pass one toll point, then the transaction process is straight forward since the toll is only for that one segment. When a driver passes through two or more consecutive toll segments, a trip assembly process must be used to accurately determine the correct toll according to the established business rules. For example, on a dynamically priced toll facility that requires pricing for segments to be determined when the driver enters the first tolling point, the system must assemble the trip at the prevailing toll rate when the driver passed the first tolling point even if the price changed after the driver passes subsequent tolling points. The trip assembly process must recognize and construct the correct trip based on transponder and/or LPR information.

7.4.4 Dynamic / Manual Pricing Interface

As described in Section 6.5.1 of this ConOps report, pricing models for express lanes facilities in the SCAG Region generally fall into one of two approaches: (1) time-of-day (static variable) pricing or (2) dynamic pricing. Time of day pricing applies a pre-determined pricing schedule that varies the toll rate depending on the time, day of the week, direction of travel, and holiday status. Rate adjustments for time-of-day tolling are often completed at quarterly or annual scheduled intervals. Dynamically priced toll facilities will vary the segment toll rates in real time based on defined business rules that are typically associated with the travel demand or traffic performance in the corridor.

Both of these pricing models can charge a toll on a per mile, segment/zone, trip, or classification basis. A per-mile toll charges drivers for every mile traveled within a corridor. Segment- or zone-based tolling charges drivers a fixed price for the segment or zone that has been traversed, as typically defined by entry and exit points along a corridor. Trip-based tolling determines charges based on how many times a driver uses a corridor, or is determined based on the total number of segments or zones that a driver passes through. Lastly, classification-based pricing determines the correct charge based on vehicle type, vehicle classification, occupancy status, and/or other defining characteristics. Various combinations of these toll charging methods are employed for express lanes.

With dynamically priced facilities, a pricing algorithm is used to determine the toll rate for each segment at any given time, according to the business rules. The pricing algorithm typically calculates the toll per mile basis for each segment and multiplies the per mile rate by the length of the segment to establish the published segment rate. The pricing algorithm often has the capability to set a minimum toll and a maximum toll, and typically takes into account the current volume, speed, and/or density of traffic in the express lanes (and/or the adjacent general-purpose lanes) to calculate the price. For example, Metro's I-110 and I-10 ExpressLanes operate with a dynamic pricing model that discourages SOVs from entering the lanes if traffic density in the lane increases and/or speeds begin to decrease below 45 mph. Under such conditions, the toll rate for those segments increases until the traffic density decreases and speeds in the lanes increase. If the speed falls below 45 mph for a set period, the dynamic pricing model reverts the lanes to HOV-only status to reduce demand and preserve traffic flow for transit and eligible HOV users.

Toll rates on facilities with dynamic pricing are generally updated at frequent intervals of every three to five minutes, which means that motorists do not see a constant change in price. In addition, pricing algorithm parameters can be set so that the price will only vary by a designated minimum amount. Although algorithms are automated, they should be continuously monitored to ensure they are responding effectively to operating conditions. Operators also have the ability to override dynamic pricing algorithms when conditions warrant, such as for incident management and routine maintenance.

7.4.5 Maintenance Online Management System

Most toll operators use a MOMS to monitor all the components of the facility. MOMS can be programmed to send an alert when there is a system or device issue. MOMS monitor all hardware, network, and software components for errors, failures, or any inconsistencies. MOMS can be set up to send emails, texts, or other alerts to maintenance staff, the system integrator, or whoever is responsible for remedying the problem.

In addition to monitoring for issues, MOMS can be used for reporting and routine maintenance scheduling. Reports can be generated to show system up-time, time to respond to issues, and time to remedy issues. In terms of maintenance scheduling, MOMS can track when maintenance should be performed, when it was last performed, and what items were fixed by maintenance crews.

Lastly, MOMS can be used to store asset information such as asset tags assigned to equipment, spare equipment inventory, and item procurement information. This adds accountability for all of the equipment installed or stored, and it ensures that spare parts are available.

7.5 CUSTOMER SERVICE CENTER / BACK-OFFICE

For the tolling entities within the SCAG Region, various customer service centers (CSCs) provide public-facing services and the ability to process tolling transactions for their customers. A typical CSC includes face-to-face customer services, as well as phone and web-based customer interactions. These facilities typically house the hardware and software infrastructure that make up the back-office systems needed to process the tolling information transmitted from toll points in the field. The back-office systems also provide the core account and tolling management services, and are responsible for charging, tracking account balances, and providing information to both customers and the service center. The Metro ExpressLanes CSC in El Monte, shown in Figure 7-10, is one example of such a facility.

Figure 7-10. Metro ExpressLanes Customer Service Center located at the El Monte Transit Center

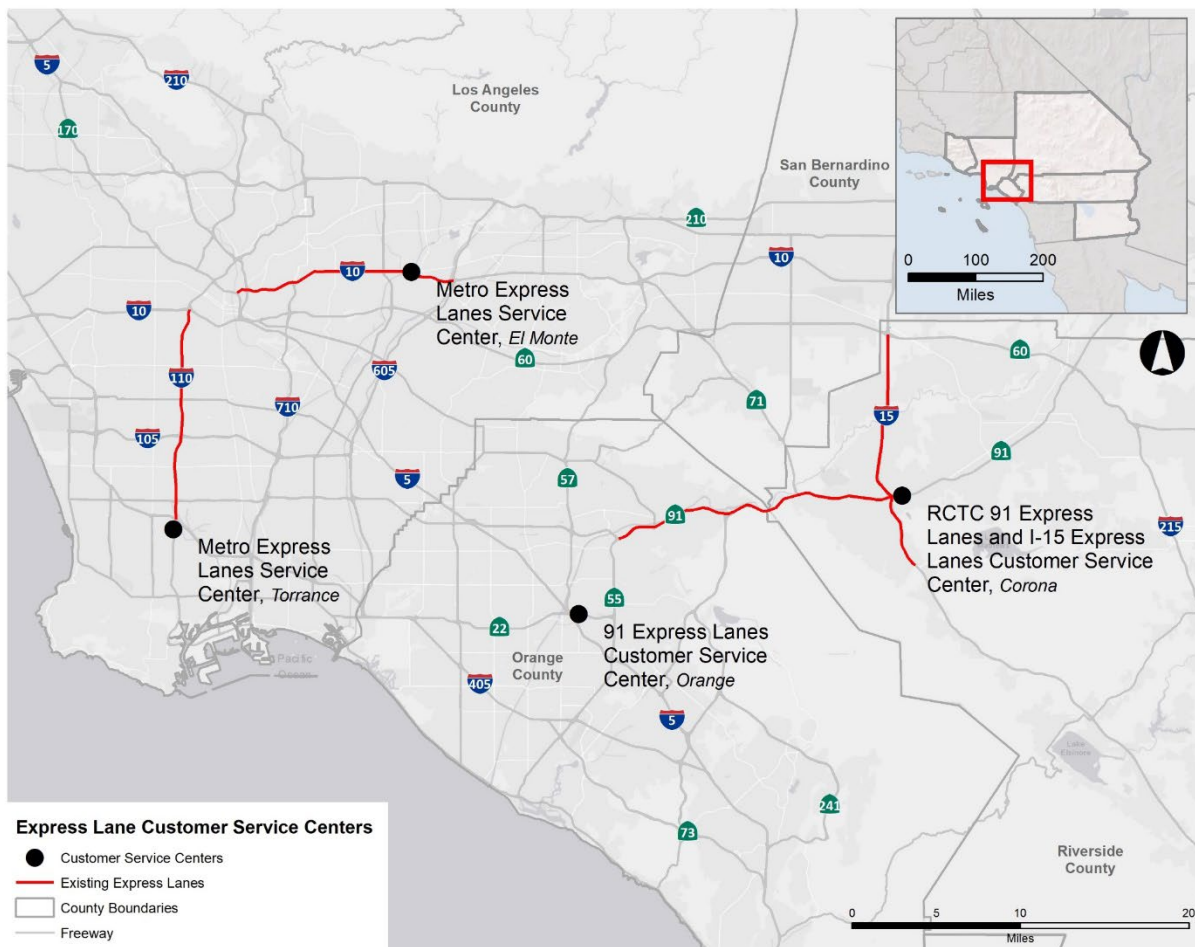


Currently, each operating tolling agency in the SCAG Region maintains its own customer service center and back-office facility, although OCTA and RCTC have executed an agreement to consolidate CSC and back-office functions for the 91 Express Lanes. One potential mechanism to increase regional efficiency would be to establish a regional CSC and back-office operation that could provide a

consistent customer experience and a central facility to process toll transactions from participating agencies in the SCAG Region. This approach has been used in the Bay Area to provide a one-stop shop for the seven Caltrans-owned Bay Area toll bridges, the Golden Gate Bridge, and the expanding MTC express lanes network, all of which use one consolidated CSC operated by the Bay Area Toll Authority.

Implementation of a regional CSC and back-office systems would require an interface for the different tolling systems to utilize data from the field infrastructure. This integration would allow for a consistent user experience and increase efficiencies for the participating agencies with a single entity providing transaction, account management, and enforcement functions. Figure 7-11 shows the existing customer service centers for the express lane facilities currently operating in the SCAG Region.

Figure 7-11. Express Lanes Customer Service Center Locations



Source: WSP, 2021

Regardless of the scope of any particular CSC, corridor management and account management systems are typically maintained at these facilities, and include the following features.

7.5.1 Account Management

The CSC and back-office system must support all aspects of account management for express lane customers. More specifically, account management activities include:

- Maintenance of the toll accounts through a dedicated website and interactive voice response telephone system, as well as staffed CSC counters and telephone services. Each platform allows the customer to perform all cost-related account services, such as account sign-up, payment modification, account statement, and vehicle information modification, as well as many other toll facility-related account services.
- Most ETC accounts are automatically linked to credit or debit cards so that tolls can be paid automatically. Payments by check are often accepted either via the U.S. Postal Service or in person at the CSC. Cash payments are often also accepted at the CSC, which is important for customers without bank or credit card accounts. In the future, there is the potential for cash toll account holders to be able to use toll vending machines to check their account status and add value using cash at various locations.
- Oversight of any equity or discount programs to ensure that accounts are correctly verified and that users are not abusing the program.
- Financial accounting, including the processing and reconciliation of all customer payments, fees, and credits, and reconciliation of fees and revenues against system transaction records for each express lane facility.
- Coordination with third-party retail partners for the distribution of transponders and for the pre-payment of tolls.

Additional details related to key specific express lanes account management functions are provided in the following sections.

VIOLATIONS PROCESSING

Violation processing includes the full life cycle of violations, reviewing and verification of OCR results for LPR, obtaining names and addresses of vehicle owners from the DMV, printing and mailing notices, processing payments, reconciling financials, and administering appeals. Performance measures for these functions would include the accuracy of reviewed images and notices, the timeliness of invoicing and payment processing, and the timeliness of vehicle owner identification.

TRANSPONDER ACCOUNT MANAGEMENT

Transponder account management, including: account openings and closures; filling transponder orders; maintaining an inventory of all transponders; assessing fees; applying credits; processing customer statements; and notifying customers of account irregularities, such as transponder failures or the expiration of bank or credit cards used for automatic payments.

7.5.2 Regional Consolidated Back-Office System

As with the CSC, a regional consolidated back-office system would generate efficiencies for express lane operators in the SCAG Region. A regional consolidated back-office system could be responsible for tracking toll transactions, account management, violation management, maintenance systems, and transponder distribution for participating agencies. This integration would allow for a more consistent customer experience and increase efficiencies for each tolling agency, and might also enable economies of scale that may potentially lower the costs associated with processing toll transactions. The following are a list of some advantages and disadvantages of a regional consolidated back-office system:

- Advantages:
 - Economies of scale to lower per transaction costs;
 - Single management center to oversee multiple toll corridors;
 - Possibility for 24-hour corridor monitoring;
 - Single point of contact for customer service and account management;
 - Possibility for consolidated and consistent business rules; and
 - New tolling agencies or facilities have reduced startup costs.

- Disadvantages:
 - Integration of existing tolling agency systems could be complex;
 - Possibility of separate business rules for different agencies adds to system complexity;
 - Added complexity when implementing new features or services;
 - System disruptions will affect all operators in the region;
 - Possible financial reconciliation challenges due to multi-agency interactions;
 - Lack of control over level of customer service provided;
 - Difficulty in implementing facility specific delays; and
 - Lack of control over violation enforcement processes.

The San Francisco Bay Area consolidated the CSCs previously operated by the Bay Area Toll Authority, the Golden Gate Bridge Highway Transportation District, and Caltrans into a single regional CSC in 2005. This created an improved customer experience with a single source for customer service account management and a single entity to perform violations processing. During the first phase, the contracted tolling vendor operated the separate existing service centers. The second phase merged operations, developed joint business rules, combined customer databases, and created a new public website to allow customers to maintain their accounts. The Bay Area Toll Authority administers the toll revenues from the Bay Area's seven state-owned bridges, including funding the capital improvement and rehabilitation of the bridges. It also manages FasTrak® accounts for all toll agencies operating in the Bay Area, including those operating express lanes within the region.

7.6 INTEGRATION WITH REGIONAL TRANSPORTATION MANAGEMENT INITIATIVES

This section discusses how a regional express lanes network could interact with other regional transportation and technology installations to provide added value to the travelling public.

7.6.1 Regional Traveler Information Integration

The Southern California Traveler Information System, known as go511, is operated by the Los Angeles County Service Authority for Freeway Emergencies, which serves the five counties of Los Angeles, Ventura, Orange, San Bernardino, and Riverside. The service provides regional travel information to the traveling public, including information on traffic conditions, transit services, and – within Los Angeles County – information on the Metro ExpressLanes. The go511 interactive voice response telephone system currently acts as the portal for callers inquiring about the Metro ExpressLanes. When a user selects ExpressLanes, the system transfers the caller to a separate interactive call center operated by the ExpressLanes contractor. This is the current extent of the integration between the systems.



Previous sections discussed opportunities for express lanes to relay information to the traveling public via mobile devices or in-vehicle navigation systems. Additional consideration could be given to how the traveling public could interact with 511 or other similar systems. For example, in the Bay Area, the regional traveler information system makes use of the RFID transponder infrastructure to anonymously generate travel time and speed data for 511. Tag readers have been installed along major corridors to read tags, allowing for the calculation of speeds and travel times. The associated readers would be configured so that they would not generate audible indications to the motorist through in-vehicle transponders. As additional transponders are deployed throughout the SCAG Region to support the regional express lane network, this method of field data collection could become a viable alternative to in-pavement vehicle detection sensors. This method will also help with corridors under construction, or when the in-pavement sensors have been removed or damaged. Portable transponder readers could also be set up to provide accurate travel time data as needs arise or change. Information on travel conditions could be disseminated to the public by third-party traffic data providers (e.g., Inrix® or Google) to allow drivers to make informed choices on whether to use or avoid construction areas.

The SCAG Region could benefit from increased integration of these different systems, including express lanes, into 511. Traffic data, CCTV feeds, and travel time information from the corridor management system could all be disseminated to the public through the 511 system. However, there could also be disadvantages to pursuing such integration, including cost and lack of control over the availability of customer service due to layered technology.

7.6.2 Regional Advanced Transportation Management System Integration

Caltrans owns and operates a regional ATMS, which is an integrated platform for monitoring and managing the transportation network from their TMCs. Even without co-locating, there is an opportunity to enhance the interface between express lanes operations and the Caltrans ATMS. With appropriate usage rights and permissions, the two systems could share CCTV video, incident and speed data, and corridor management status information. Deployment of additional tag readers in the SCAG Region could also be used to augment detection capabilities on the freeway network.

Each Caltrans district has their own TMC where operators monitor traffic conditions throughout the district, and each has the ability to dispatch resources to respond to incidents. The CHP has regional dispatch centers co-located at five Caltrans district TMCs, including those in Districts 7, 8, and 12. Each of the express lane operators has a similar traffic monitoring/management facility where they can watch traffic on the express lane, monitor the toll rates, and adjust or disable them, as needed. Moving forward, the SCAG Region express lane stakeholders may want to explore the possibility of co-locating the express lane traffic management centers in their respective Caltrans districts to capture the efficiencies of co-locating express lanes and freeway operations staff, as well as the CHP, in a central facility to manage the transportation network in a more coordinated fashion. The intent would be to facilitate communication between the operators, Caltrans, and CHP, enabling increased coordination of incident and event management, roadway facilities closures, traffic analysis, and other aspects of day-to-day operations.

Transit agencies in the SCAG Region have deployed or are planning to deploy individual ATMS's. Transit management centers use ATMS to manage transit service operations. These centers should also share information with other similar programs. With their large vehicle fleets, transit operators often know of incidents and can provide first-person information about the nature of incidents affecting the express lanes and TMC operators. In turn, the ATMS system could benefit from speed data of the express lanes corridors to augment bus data for real-time bus travel times.

FREEWAY SERVICE PATROL INTEGRATION

The Freeway Service Patrol provides courtesy roadside assistance to reduce traffic congestion by managing traffic incidents along with the CHP, Caltrans, and local agencies. The Freeway Service Patrol often provides the front-line support to clear minor incidents, and should be directly integrated with express lanes operations. Service trucks should be exempted from incurring tolls on the express lanes, recognizing that many vehicles are owned by private sector companies who are under contract to cover certain express lane corridors. Integration can be as simple as having operators call one another to report and clear incidents, or as complex as integrating systems to track and assign service vehicles to incidents.

CONNECTED VEHICLE

The connected vehicle effort is still in nascent stages, even though significant planning has taken place over the past decade. This technology has begun to gain traction, with agencies vying for federal funding to deploy pilot projects. Connected vehicle technologies could be used to enhance express lane operations, which include:

- Congestion management;
- Vehicle smoothing (optimal vehicle spacing, speed, braking);
- Incident detection;
- Planned navigation information;
- Vehicle speeds;
- Vehicle occupancy detection (see Section 7.3.2);
- In vehicle payment systems (instead of transponders; see Section 7.3); and
- In vehicle display of pricing, CMS messages, incident notification, next entrance/exit.

CORDON AND AREA PRICING SUPPORT

Cordon and area pricing systems levy charges to enter congested activity centers. The goal is to reduce traffic congestion within these typically heavily congested core areas, and the roadways that provide access to them, by shifting trips to other modes, times of day, routes, and destinations. Several Asian and European cities have implemented successful area pricing schemes to ease regional congestion with nominal effects on local business. These systems have been implemented with either RFID transponders (e.g., Singapore) or LPR technology (e.g., London). GPS technologies could also be used to collect the fees, as is currently proposed as part of the updating of the system in Singapore.

SCAG has been studying the possible use of cordon pricing within Los Angeles County. In addition, Metro's Traffic Reduction Study is exploring this concept to determine whether it can improve mobility, while supporting health and economic goals. Integrating such a concept with other tolled and express lanes facilities would require an interface between cordon and area pricing schemes, and other tolled facilities in the region. Details would need to be resolved on how a cordon or area pricing policy would interface with existing express lanes to ensure that appropriate business rules were developed together with an understanding of the effects of area pricing on the demand and revenue generation potential for express lanes. This is most important when express lane corridors pass through or end in a pricing zone. Business rules and signage would need to be consistent to provide a seamless experience for drivers. In addition, interoperability or a singular toll consolidator would be helpful in facilitating the financial reconciliation process that is handled by the back-office accounting system.

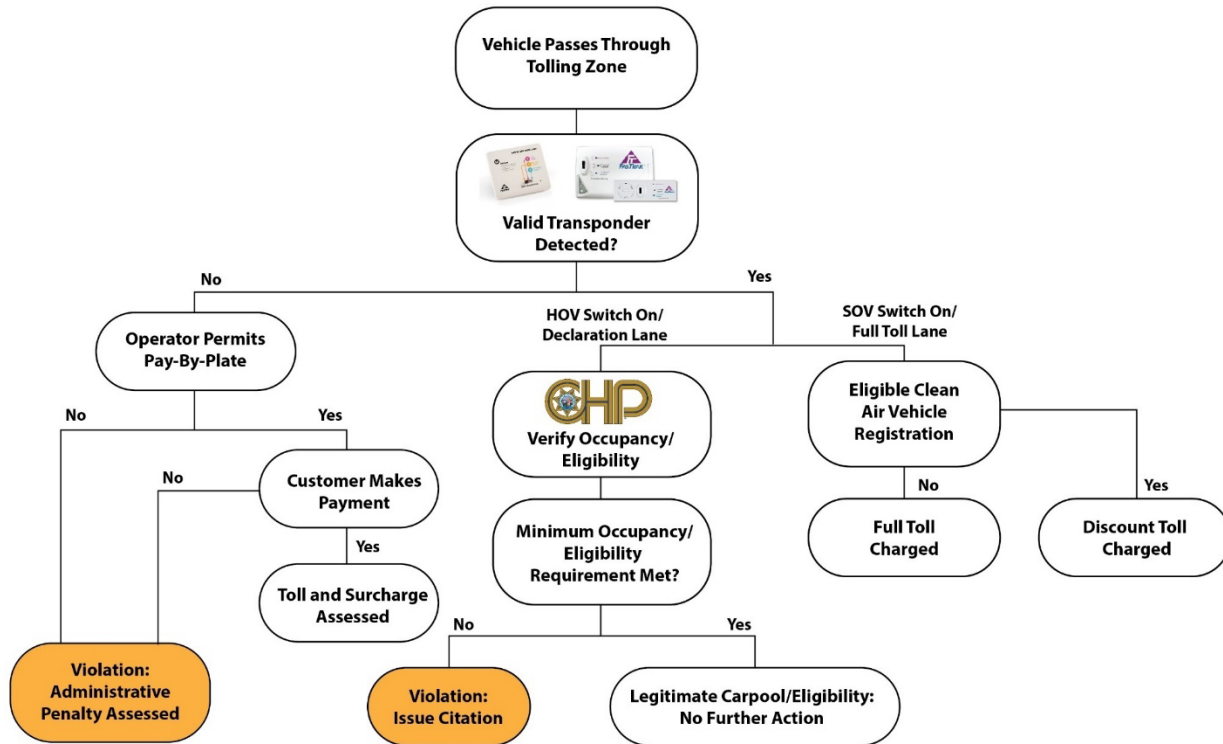
8 Enforcement and Incident Management

Express lanes require effective enforcement practices to operate successfully. Enforcement of vehicle occupancy requirements and buffer crossing violations are critical to protecting eligible vehicles' travel time savings and safety. Visible and effective enforcement promotes fairness and maintains the integrity of the facility to help gain acceptance among users and non-users alike. Among the greatest challenges in implementing express lanes is identifying qualified carpool vehicles for toll-free or discounted toll use on the facility. Persistent violation problems can breed disregard for enforcement and result in a significant loss of toll revenue on the express lanes, as well as increase corridor congestion. The consequences of unchecked violations affect not only mobility, but also revenue generation.

Enforcement facilities and technologies are addressed in Section 5.7, and Sections 7.1 to 7.3, of the ConOps, respectively. Figure 8-1 illustrates the typical enforcement process after a vehicle passes through an express lane tolling zone. For HOV users, a switchable transponder or use of a declaration lane with a valid static transponder is required. A violation occurs if a vehicle is not equipped with a valid transponder (if applicable), or if a motorist declares their vehicle as an HOV when it does not meet minimum occupancy or eligibility requirements.

Incident management is also a critical element for consideration in the operation and enforcement of express lanes facilities. A response to a crash or disabled vehicle on an express lane can be similar in practice to incident response on a general-purpose lane, which requires coordination between the appropriate partnering agencies involved in the operations of the express lanes (e.g., CHP, Caltrans Districts 7, 8 and 12, Metro, OCTA, RCTC, and SBCTA). However, the revenue component of express lanes can place an even greater emphasis on efficient incident response and clearance. Additionally, customers may be diverted into or out of an express lane by emergency responders, which requires nullification of enforcement events by the express lane operator.

Figure 8-1. Typical Express Lanes Enforcement Process



Source: WSP, 2021

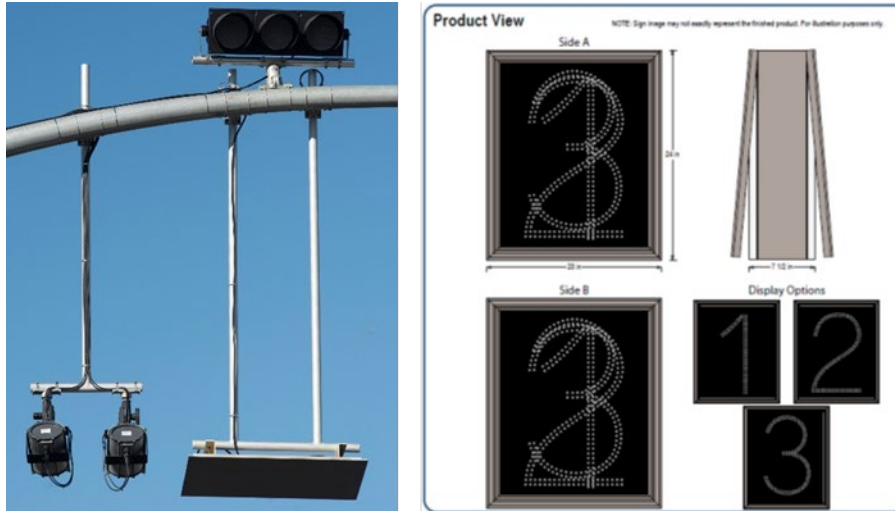
8.1 ENFORCEMENT PROVISIONS

Express lanes should include observation areas where CHP officers can safely observe vehicles traveling in the facility, as well as enforcement areas where officers can safely pull vehicles over. Observation areas typically consist of a break in the median barrier where CHP vehicles can park and safely observe vehicles as they pass by. These areas are ideally located in close proximity to a toll point equipped with an enforcement beacon that indicates the switch status of FasTrak Flex® transponders (see Figure 8-2). Enforcement beacons are typically installed so as to be visible to CHP officers parked downstream and to officers that may be following vehicles through a toll point. The beacons allow the officer to compare the number of occupants visible in the vehicle to the FasTrak Flex® tag setting to identify potential violators.

Observation areas should be designed in accordance with Section 6.4 of Caltrans' *HOV Guidelines for Planning, Design and Operations*. These guidelines are intended to maintain safe conditions for CHP officers to observe and enforce. CHP should also be consulted during the design phase to get input on enforcement locations and other preferences that may serve to ultimately enhance CHP's effectiveness in enforcing the express lanes business rules. With the presence of CHP personnel, the goal is to discourage violators from accessing the express lanes. Experience on the I-110 and I-10 ExpressLanes has indicated that toll and HOV violation rates are greatly reduced when CHP is actively

conducting enforcement activities within the corridor⁸⁵, emphasizing the importance of active enforcement to deter violations and improve compliance using express lanes.

Figure 8-2. Example Enforcement Beacons



Emerging technologies provide options for automated vehicle occupancy detection primarily using infrared imaging and recognition of human occupants in the vehicle. Although such systems are expensive and have yet to be permanently deployed for express lanes occupancy enforcement purposes, the results of recent testing may suggest that the potential exists for such systems to support and enhance current enforcement efforts by CHP. Automated enforcement systems may be useful as an additional secondary tool for enforcement personnel, but not a replacement for pursuit and apprehension of willful violators of HOV policies as the primary means of enforcement. CHP may use the system to screen vehicle occupancy at the toll collection point, allowing officers to focus enforcement efforts by pursuing vehicles that the detection system has identified as a potential violator. Additionally, the automated enforcement system could be used to recognize repeated suspected violators on the facility, especially when coupled with toll collection data, to identify when these violators are likely to use the facility. Furthermore, the systems can be used for soft enforcement, either as a psychological warning (e.g., advance signs stating: “Notice: Enforcement Cameras in Use”) or as a letter to suspected violators articulating suspicion of violation.

⁸⁵ “I-110 and I-10 Express Lanes Demonstration Report: Customers and Collaboration” Draft Report (August 2014), prepared by WSP, on behalf of LA Metro/Caltrans District 7, for the California State Legislature. [URL unavailable]

8.2 VIOLATIONS

For the purpose of express lanes enforcement, violations are classified into three types: (1) Eligibility Violations; (2) Toll Violations; and (3) Buffer Crossing Violations. The following sub-sections detail the types of violations and general enforcement practices within the SCAG Region.

8.2.1 Eligibility Violations

Eligibility violations pertain to the specific policies established by the operating agency on each individual express lane facility that determine if a given vehicle qualifies for toll exemptions and/or toll discounts. Vehicles that do not meet the eligibility requirements will be required to pay the toll to drive in the express lanes (failure of which is a toll violation and discussed in the next section). Currently, technologies for fully automated enforcement of vehicle occupancy are still in development and will likely not be available for large-scale implementation as an independent inspection mechanism within the next five years. Therefore, the enforcement of eligibility violations is conducted by CHP through visual inspection, in conjunction with supporting technologies, which may include automated validation technologies.

METRO EXPRESSLANES

As of 2021, Metro provides toll-free access to eligible HOV 2+ on the I-110, and HOV 3+ vehicles on I-10, at all times. HOV 2+ vehicles must pay a toll during a.m. and p.m. peak weekday periods on I-10, but travel toll-free at other times. To receive toll-free access, vehicles must be equipped with a FasTrak Flex® transponder associated with a valid FasTrak® account. Prior to making the trip on the I-10 and I-110 ExpressLanes, users declare their eligibility status by manually toggling the transponder slide switch according to the correct vehicle occupancy. Along the ExpressLanes, enforcement beacons with numeric displays are installed on toll gantries, allowing CHP officers to clearly associate vehicle eligibility compliance with the numeric display. The enforcement beacons will be triggered, displaying a number, when a self-declared toll-free vehicle passes through the toll zone. If automated enforcement systems are utilized, information may be shared on suspected violators to CHP observers. CHP officers will enforce the eligibility violations by monitoring the beacons and visually inspecting the vehicles to ensure that they meet the eligibility requirements.

Metro provides a 15 percent toll discount to eligible CAVs displaying a valid decal, as required by California Vehicle Code §21655.9. The vehicle must be equipped with FasTrak® transponder and be pre-registered for use on Metro's express lanes.⁸⁶

OCTA EXPRESS LANES

Like the Metro ExpressLanes, all vehicles driving on OCTA's 91 Express Lanes facility are required to have a FasTrak® transponder mounted in the vehicle and associated with a valid FasTrak® account. However, the 91 Express Lanes operates with a different self-declaration method. Instead of requiring

⁸⁶ Metro requires registration of eligible CAVs at: <https://www.metroexpresslanes.net/clean-air-vehicles-form/>

a switchable transponder, eligible vehicles (i.e., HOV 3+, motorcycles, disabled plates, and disabled veterans) are required to utilize a declaration lane while driving through the toll collection zone. The declaration lane allows CHP officers to focus on vehicle eligibility (three or more occupants visible, or CAV compliant decal) in a dedicated lane without having to observe every passing vehicle in the 91 Express Lanes. However, as discussed in earlier chapters, HOV declaration lanes require additional right-of-way. Similar to the Metro ExpressLanes, CHP is contracted for their enforcement services. CHP officers will monitor the facilities from three specific enforcement areas, as well as along the corridor, and visually inspect the vehicles utilizing the declaration lane to verify eligibility. Eligible vehicles may travel on the express lanes toll-free using the declaration lane, except for Monday through Friday from 4 PM to 6 PM in the eastbound direction, at which time eligible vehicles receive a 50 percent toll discount.

RCTC EXPRESS LANES

RCTC operates two express lanes with different operating environments for discounts. On the RCTC 91 Express Lanes, RCTC shares all enforcement designs and policies with those of OCTA, described above. On the RCTC 15 Express Lanes, HOV 3+ receive a 100 percent discount for travel (this could be reduced to 50% in the future), whereas CAVs receive a 15 percent discount. HOV 3+ use a switchable transponder, with the same function and CHP observation as that of Metro. CAVs additionally need a transponder registered with CAV status, similar to Metro.

SBCTA EXPRESS LANES

SBCTA express lanes will operate on the I-10 corridor, with HOV 3+ eligible to use the lanes toll-free. HOV 3+ will be required to use a FasTrak Flex® switchable transponder to receive toll-free access. CAVs must be registered, and will receive a 10 percent toll discount on the I-10 Express Lanes when they become operational. SBCTA has not yet set a CAV discount for its future I-15 Express Lane facility.

8.2.2 Toll Violations

In corridors where use of transponders is mandatory for all vehicles, toll violation enforcement is typically accomplished with LPR systems. The LPR cameras will take a picture of the license plate of any vehicle that passes through a toll zone without a properly mounted toll tag. The license plate image will then be used to associate the transaction(s) with a valid account, or to issue a toll violation to users without an established account.

Express lane operators may offer a surcharge on the use of non-transponder, LPR-based toll transactions:

- Metro operates a “Pay as You Go” surcharge of \$4 for all transactions on Metro’s express lanes in lieu of a FasTrak® transponder. The LPR system identifies the vehicle’s license plate, and Metro’s back-office sends a *Pay as You Go Notice of Toll Evasion Violation* invoice to the registered vehicle’s owner.

- SBCTA proposes to share a function common with TCA, in which vehicles without a transponder may pay their tolls online using the Pay Online feature within five days after their trip to avoid a toll evasion violation. Per SBCTA policy, the applicable LPR rate is equal to 1.5-times the posted FasTrak® toll rate, plus \$0.50.
- OCTA and RCTC do not allow LPR-based toll transactions on their respective sections of the SR-91 Express Lanes.
- RCTC does not allow LPR-based toll transactions on the 15 Express Lanes.

8.2.3 Buffer Crossing Violations

As described in Chapter 5, express lanes are typically separated from the general-purpose lanes by painted buffers, traffic channelizers, or barriers. Painted buffers and traffic channelizers allow for higher chances of physical crossings of vehicles between the express lanes and the general-purpose lanes. Therefore, the enforcement of buffer crossing violations is required on express lane facilities using these separation treatments. The CHP is responsible for enforcing the ingress and egress restrictions for the express lanes. Vehicles that enter or exit the facility illegally will be subjected to a citation from the CHP. This is also considered a moving violation, which will result in a point on the violator's driving record.

8.3 ENFORCEMENT ROLES AND RESPONSIBILITIES

The toll operator is responsible for enforcing toll violations. All express lane operators in the SCAG Region use the LPR system (described in Section 7.2.2) to identify vehicles, match to DMV records, and process toll evasion violation notices. The CHP is tasked with enforcing vehicle occupancy rates, express lane eligibility requirements, and moving violations, including illegal entry into the express lanes.

8.4 INCIDENT MANAGEMENT

Express lane operators in California are required to develop Express Lanes Incident Management Plans as part of their toll facility agreements with Caltrans. These plans are typically developed by the toll system operators. They identify the business rules and protocols that are put into place for responding to different types of incidents when they occur, such as providing CHP with the ability to override express lane signs under specified circumstances. Express lane operators also have contracts with their local Freeway Service Patrol (FSP) division to provide dedicated incident response coverage during periods of peak utilization. This helps them to clear incidents in a timely manner and maintain travel reliability on the express lanes. The Caltrans District 7, 8, and 12 TMCs are the command centers for traffic operations along the highway system. Express lane operators may also maintain independent TMCs for their facilities. Caltrans and CHP work together with the express lane operators to coordinate

activities associated with incident management. The TMC will coordinate with CHP officers on the scene of the incident and assist in the dispatch of Caltrans maintenance resources, emergency vehicle response, and the Freeway Service Patrol, as required.

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9 Performance Measurement and Evaluation

Performance measurement and evaluation for express lane projects accomplishes three important and interrelated purposes:

- Ensuring that the express lanes are functioning as efficiently as possible, and making adjustments to operational policies as needed;
- Quantifying and validating the different benefits express lanes provide; and
- Documenting the successful deployment of congestion pricing to garner public support for future express lane projects.

One of the initial steps in the implementation of express lane projects is the identification of project goals and a set of performance metrics that will be used to assess the extent to which those goals are being achieved. The regional express lanes stakeholder group assembled by SCAG for the Express Travel Choices Study identified the goals provided in Section 1.6 of the ConOps for the regional express lanes network. These regional goals should be reflected in the development of individual express lane facilities in the SCAG Region.

It is best for project sponsors to formulate plans to evaluate and measure the performance of express lane projects in time to collect baseline data at least one full year prior to the start of construction. This allows project sponsors to identify recurring patterns and assemble comprehensive baseline data against which the incremental effects of the express lanes can be compared once they are operational. Performance monitoring programs should capture operational conditions on the express lanes, as well as the adjacent general-purpose lanes and any transit services operating in the corridor. While federal and California state reporting requirements call for annual performance reports, monthly or quarterly reporting of key performance metrics is also often helpful in garnering support for express lane facilities.

*Performance Measurement:
Performance on all regional express lanes should be continuously monitored for compliance with federal standards, to address state requirements, and to confirm local and regional performance objectives.*

9.1 FEDERAL REQUIREMENTS

As discussed in Section 3.3 of this ConOps report, federal law requires express lane operators to maintain performance monitoring programs to determine whether express lane and HOV projects

constructed with federal funding become degraded – meaning that average speeds fall below 45 mph 10 percent of the time or more during a.m. or p.m. peak periods.

To comply with federal requirements, Caltrans prepares an annual *California High-Occupancy Vehicle Facilities Degradation Report* that identifies HOV and express lane facilities in California that do not meet federal performance standards. However, federal law would also allow express lane operators to prepare their own degradation reports, with Caltrans oversight. In addition, Caltrans District Offices prepare facility-specific annual Action Plans identifying mitigation measures to remediate the performance of all degraded facilities.

In addition to the federally mandated degradation reporting process, Caltrans Districts 7, 8 and 12 all develop a *Managed Lane Annual Report*⁸⁷ documenting the performance of all HOV and express lanes in their respective Districts.⁸⁸ These reports provide manually counted data of vehicle volumes, occupancy rates, and vehicle classifications for all managed lanes in the two counties. The Annual Report is used to inform the annual state-wide degradation report, as well policy decisions on managed lane facilities in Los Angeles County.

9.2 STATE REQUIREMENTS

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 California Transportation Commission for permission to implement new high occupancy toll lane projects. Section 149.7 also requires sponsoring agencies to provide any information or data requested by the Commission or the Legislative Analyst. The California Transportation Commission is also required to prepare an annual summary report on the progress of the development and operation of any toll facilities authorized pursuant to Section 149.7. It may submit this report as a section in its annual report to the Legislature, pursuant to Section 14535 of the Government Code. Express lane sponsors should coordinate with the California Transportation Commission to identify any performance data to include in annual reports to the California State Legislature.

9.3 MONITORING PROGRAMS

Project sponsors should identify the universe of issues that potentially require tracking and rationalize them with the overall goals established for the regional express lanes network and the funds available to support the performance monitoring program. According to the *NCHRP Guidelines for Evaluation*

⁸⁷ <https://dot.ca.gov/-/media/dot-media/district-7/documents/dist-favs/ml/2016-managed-lane-annual-report-ct-dist-07-a11y.pdf>

⁸⁸ Caltrans Districts 8 and 12 have previously prepared HOV Lane Annual Reports consistent with Caltrans HOV guidelines.

and *Performance Measurement of Congestion Pricing Projects*⁸⁹, as different measures are considered, the monitoring team should consider the following issues:

- How is the measure collected—with real time detection equipment, regular counts or surveys, or one-time surveys?
- Is the data already collected, or would a new effort be needed to do so?
- Which agency is best placed to collect the data?
- What is the cost of collecting the data?
- Should the data be collected internally or by an outside vendor or contractor?
- What is the benefit of having the data?
- How would the data be used?
- What levels of resources are available to support collecting the data?
- Are cooperating agencies able to provide data within their existing budgets, or would they require additional funding to be able to do so?
- Will construction activities or other externalities be likely to skew or otherwise influence the data collected during the baseline period, and, if so, how should this be reconciled?

By considering these issues, the monitoring team develops an understanding of which potential measures will deliver essential information, and which of them do not necessarily provide the same level of utility.

9.3.1 Suggested Performance Metrics

Once the project goals and areas with performance specifications are identified, individual performance metrics to be used in the performance monitoring plan are established. The optimal set of metrics enables the project sponsor to have a clear understanding of how well the project is performing, and to what extent it is meeting its various goals and standards, without being overly costly or requiring inordinate effort or time to collect. It is good practice, while establishing performance metrics, to consider how the data for each metric will be collected, the frequency of collection, the ease of collection, and overall cost of collection. No single set of performance metrics should be incorporated into a performance monitoring program. Rather, the project sponsor should tailor the performance metrics to align with the regional express lanes network goals, community concerns, agency needs, project configuration and operational policies, and the resources available for monitoring the facilities.

⁸⁹ Perez, Benjamin Gerry, Reno Giordano, and Heidi Stamm. *Evaluation and Performance Measurement of Congestion Pricing Projects*. Vol. 694. Transportation Research Board, 2011, pp 19.

Table 9-1 lists various suggested performance measures and level of detail for reporting, such as by general-purpose, HOV, and express lanes, or by time of day. The performance measures for the network will need to be developed in greater detail and reviewed between the project partners.

Table 9-1. Express Lane Performance Measures

PERFORMANCE MEASURES	LEVEL OF REPORTING
Traffic Operations & Safety Performance	
Vehicle Throughput	GP & HOV/HOT lanes; a.m. peak, p.m. peak, off-peak, daily, annual
Speeds	GP & HOV/HOT lanes; a.m. peak, p.m. peak, off-peak
Corridor Mode Share	SOV, HOV, bus, rail, ride share, exempted vehicles
Person Throughput	GP & HOV/HOT lanes
Accident Rates	GP & HOV/HOT lanes; a.m. peak, p.m. peak, off-peak, daily, annual
Transit Performance	
Corridor Transit Ridership – bus and rail	A.M. peak, P.M. peak, off-peak, daily, annual
Park-and-Ride Utilization (bus and rail)	Lot counts
On-Time Performance	Travel time/on time/excess wait
In-Service Transit Travel Speeds	Speeds/average speeds
Vanpool Utilization	Ridership/boardings
Public Acceptance	
General Public Opinion	By income group, HOT users, transit riders, solo drivers
Enforcement	
Toll Evasion Rate	Traffic stops/responses
HOV Violations	Violations/citations/fines
Revenue and Electric Toll Collection System	
Number of FasTrak® accounts	Number of accounts
FasTrak® transponders issued	Number of transponders
Number of transactions	A.M. peak, P.M. peak, off-peak, daily, weekly, monthly and annual
Toll Revenue Receipts	A.M. peak, P.M. peak, off-peak, daily, weekly, monthly and annual
Toll Rates	A.M. peak, P.M. peak, off-peak, daily, weekly, monthly and annual
Toll Collection Costs as % of Toll Receipts	Percentage
Accuracy of Transactions	Percentage
Greenhouse Gas Emissions	
Corridor-Specific Daily VMT and VHT	By vehicle type, including transit
Fleet Composition	Percentages

Source: NCHRP Report 694, 2011

9.3.2 Data Collection Options

CALTRANS PERFORMANCE MONITORING SYSTEM

Caltrans uses the PeMS system to monitor and analyze the operational performance of state highways. PeMS serves as a central repository to collect, store, and analyze traffic data from vehicle detector stations and traffic census stations. The PeMS system includes an online database that provides real-time and historical traffic data collected from detectors placed on state highways. Caltrans reports data

on HOV lanes separately from general-purpose lanes. Each detector station covers a set length of the freeway, with data available for each individual lane, including the HOV facilities located on those freeways. This data is collected every 30 seconds and transmitted to a centrally located database, where it is reviewed for consistency and aggregated to 5-minute intervals. These 5-minute data sets can then be further aggregated into hourly time blocks

The reliability of the vehicle detectors has historically been a problem, with substantial numbers of these devices not working at any given point in time. This has hampered data collection and evaluation efforts to monitor the performance of state highways in California. For this reason, specific attention should be given to prioritizing the installation and maintenance of detection devices in express lanes corridors to support performance monitoring efforts. Caltrans is monitoring the performance of vehicle detection on express lane and HOV facilities to ensure the highest level of degradation analysis capabilities. This involves maintaining vehicle detectors in working order and installing new detectors in strategic locations to gain a clearer understanding of the performance of the managed lanes.

TOLL COLLECTION SYSTEMS

Express lane tolling systems also serve as an important source of data, given that they capture all vehicles traveling on the express lanes, including those equipped with FasTrak® transponders and those using license plate tolling. Discrepancies in data between existing state monitoring systems and tolling systems are not unusual among express lane systems. While it is relatively straight forward to ascertain the number of vehicles using the managed lanes, it is particularly challenging to obtain accurate information on the person throughput of express lanes facilities. This is exacerbated by the fact that motorists are able to violate express lane occupancy policies by setting their switchable transponders to indicate that they have HOV status even when there is only one person in the vehicle. As a result, it may be necessary to rely on multiple systems and supplemental manual counts to gain an accurate understanding of travel conditions and the number of people being carried on the managed lanes. The following section provides two different methodologies for conducting manual vehicle occupancy counts.

MANUAL VEHICLE OCCUPANCY COUNTS

In addition to the federally mandated degradation reporting process, Caltrans District 7 also prepares a *Managed Lane Annual Report*⁹⁰ documenting the performance of all HOV and express lanes in Los Angeles and Ventura counties. Unlike the data flowing from automated systems, this report provides observed data on vehicle volumes, vehicle occupancy rates, and vehicle classifications for all managed lanes in the two counties. These counts are made by observers on pedestrian overcrossings above the highway corridor with a side view of the express lanes across the general-purpose lanes. The counters use counting devices – clipboards equipped with clickers – to manually record a sample of the number of vehicles in different occupancy and vehicle categories. Designated vanpools are assigned an

⁹⁰ <https://dot.ca.gov/-/media/dot-media/district-7/documents/dist-favs/ml/2016-managed-lane-annual-report-ct-dist-07-a11y.pdf>

assumed occupancy of 6+ and buses are noted as being ¼, ½ or full based on the occupants observed. Other Caltrans Districts also collect data and develop reports, but do not make them publicly available.

It is also possible to conduct manual occupancy counts using the floating car or “carousel” methodology on dual lane facilities. This relies on a survey vehicle being driven in the right express lane while an observer or counter records the vehicle occupancy of vehicles passing in the left lane. The floating vehicle travels at a speed that is considerably slower than the flow of the ExpressLanes traffic, forcing vehicles to pass on the left-hand side to maximize the number of observations made.

9.3.3 Customer Satisfaction Surveys

Express lane operators may wish to conduct periodic surveys to understand their customers’ level of satisfaction with the express lanes, and to develop a better understanding of how the lanes are used. The customer satisfaction surveys can provide information on issues such as:

- Customer’s frequency and time of use, trip purposes, and origins and destinations;
- Relative importance that customers place on specific performance standards;
- Measure the customer’s overall satisfaction with their experience and if they believe the express lanes are meeting specific standards; and
- Identify customer’s current exposure to communications from project sponsors, and preferences for future communications.

9.3.4 Annual Performance Reports

Express lane operators can also prepare annual performance reports on their express lane corridors. As an example, Metro prepares an annual operations performance report for the 10 and 110 ExpressLanes that provides details on customer accounts, transponders issued, trips taken, trip characteristics, average speeds, enforcement, and average tolls paid. This report is presented to the Metro Board on an annual basis.

10 Network Coordination

As described in greater detail in Chapter 12, all express lane projects in Southern California have been implemented by the CTCs, working in coordination with Caltrans and FHWA. The CTCs also conduct environmental clearance and design efforts for future express lanes projects. While this model is expected to continue in the future, as the network expands and more express lane corridors extend across county lines and intersect with other facilities, there will be an increased need for coordination. With new technologies and an increasingly interconnected network, independent conversations between individual express lane operators alone will not be adequate to ensure a positive user experience. This chapter of the ConOps document discusses the different forums and best practices for coordinating the development and operation of the express lanes network in the SCAG Region.

10.1 FORUMS FOR COORDINATION

There are multiple forums that are being used to coordinate all phases of the planning, implementation, and operation of express lane projects in Southern California. There is no single recommended platform for coordination. Rather, express lane sponsors should use the interactions that occur in the normal course of their work to facilitate coordination on the development of the express lane network with peer and stakeholder organizations.

10.1.1 SCAG Express Lane Stakeholder Group

As described in Section 1.2, SCAG has convened a stakeholder group to support the development of the Regional ConOps update. This group includes representatives of the CTCs from Los Angeles, Orange, Riverside, and San Bernardino counties, together with representatives of Caltrans and FHWA. The stakeholder group has facilitated regional discussions of the express lane policies included in this ConOps update, as well as coordination on the response to SB 743. Following the completion of this ConOps update, SCAG intends to convene the stakeholder group on an annual or semi-annual basis to provide a forum for coordination as the SCAG Region advances the express lane network.

10.1.2 California Toll Operators Committee

As described in Section 12.6.3, CTOC is an industry organization comprised of toll facility operators and owners in California. It focuses on the technology and operational issues associated with operating toll facilities, and holds a standing call every other month to discuss current tolling issues. CTOC provides an excellent forum for coordination on the latest technical developments, such as automated occupancy detection and national electronic tolling interoperability. It also has the added benefit of being a state-wide organization that allows toll operators in the SCAG Region to benefit from the latest toll technology and operational developments in other parts of the state.

10.1.3 Standing Inter-Agency Coordination Meetings

Many transportation agencies have standing coordination meetings with nearby peer agencies. One such example is a regularly scheduled call between OCTA, SCAG, the San Diego Association of Governments (SANDAG), and Caltrans. The meeting provides an opportunity to coordinate on building interregional connectivity and includes a standing agenda item on I-5. SANDAG has plans to implement interregional corridor managed lanes on I-5, from SR-56 to the Orange County line, as well as to add toll lanes on the I-15 between SR-78 in Escondido to the Riverside County line.⁹¹ Given that most highway capacity projects in Southern California involve the development of express lanes, it would be beneficial for express lanes to be included as a recurring agenda item on other existing or future standing inter-agency coordination meetings.

10.2 CROSS-COUNTY EXPRESS LANE COORDINATION

Bilateral CTC-to-CTC coordination is essential when a single express lane corridor extends across county lines. Such coordination often focuses on operational issues, as well as the necessary legal and financial protocols to maintain firewalls between the CTCs. The extension of the SR-91 Express Lanes from its original terminus into Riverside County created the first cross-county facility to operate in the SCAG Region, and benefitted from close collaboration between OCTA and RCTC. Ongoing coordination for the 91 Express Lanes occurs at monthly meetings of an Oversight Committee comprised of five OCTA Board members and five RCTC Board members. This representation allows the oversight committee to make decisions that will be implemented, and has been highly effective.

Bilateral coordination is currently under way between RCTC and SBCTA on the extension of the I-15 express lanes into San Bernardino County. Metro and SBCTA also hold regularly scheduled meetings to coordinate the eventual development of a cross-county express lane facility on the I-10 corridor. In addition, OCTA and Metro have participated in project development team meetings with Caltrans District 12 during the initial project development phases for the proposed I-5 Express Lanes project in Orange County.

Local experience has demonstrated that coordination on the development of cross-county express lane linkages should start early during the environmental approval phase, as policy directives often shape the physical design of express lane projects. Decision points regarding access locations and connectivity options should also be made early in the project development process, during the environmental approval phase, to avoid suboptimal solutions or the need for time consuming re-evaluations.

Ongoing communication and coordination are essential when developing cross-county express lane facilities. The respective CTCs should negotiate a master agreement, or term sheet, early on, to identify what is being agreed regarding responsibilities, finances, and coordination mechanics. The CTCs

⁹¹ Figures A-5 and A-6 of the *San Diego Forward: The 2021 Regional Plan*.

should also establish working groups to drill down into the details in such areas as toll operations, finance, civil design, and the concept of operations. While it is preferable for the working groups to be staffed by CTC employees, they may also include consultants. It is also helpful to establish an executive committee of board members that is empowered to make decisions as issues arise. The master agreement should be followed by a more detailed operational agreement that reflects the recommendations of the different working groups and the results of the ConOps process.

10.3 EXPRESS LANE AGREEMENTS

A wide variety of agreements are needed to gain permissions and formalize the business procedures that are necessary to operate an express lane facility. The exact number of agreements needed for the different express lanes facilities to be built as part of the SCAG Region express lane network will be driven by their level of institutional complexity, with those extending across county lines likely being the most challenging. At a minimum, these will include toll facility agreements with Caltrans, as well as agreements on design and construction, maintenance, information sharing with other toll operators in California, and agreements with CHP on enforcement of the express lanes.

10.3.1 91 Express Extension Agreements

The most comprehensive set of existing express lanes agreements developed to date in Southern California involve the extension of the 91 Express into Riverside County. While it was implemented as two separate projects, customers perceive the 91 Express Lanes as a seamless facility. To achieve that vision, the two agencies followed a two-step process. First, OCTA and RCTC entered into a Cooperative Agreement that established the procedures for the two agencies to oversee the construction of the extension, operate and maintain the new and existing segments, and interact with customers once the expanded facility was completed. This agreement took approximately three years to complete, and addresses design, construction, and start-up requirements for the extension.

The partner agencies then negotiated a more detailed tripartite agreement with the private sector toll system operator of the 91 Express Lanes in Orange County, outlining how it would operate the combined facility, and identifying the roles, responsibilities, and costs that each of the three entities would be responsible for. The tripartite agreement took one-and-a-half years to negotiate. The two CTCs also negotiated construction activities, closures, account procedures, maintenance fees, and the sharing of revenues, all of which were memorialized in a ConOps document.

As an example of the types of agreements that are necessary to implement a cross-county express lane project successfully, RCTC executed a total of 17 interagency agreements with OCTA and nine other entities to govern the implementation and operation of the 91 Express extension, as shown in Table 10-1. The timing and sequencing of these agreements offers a sense of timing for when agencies sponsoring cross county facilities might benefit from initiating similar discussions.

Table 10-1. RCTC 91 Express Extension Interagency Agreements

AGENCY	DATE	AGREEMENT TITLE / DESCRIPTION
FHWA		
1	8/18/2009	FHWA/Caltrans/RCTC Section 129 Tolling Agreement (federal tolling authority)
2	6/4/2012	FHWA/Caltrans/RCTC High Profile Project Agreement (FHWA Major Project Agreement)
3	7/2/13	United State Department of Transportation/FHWA/RCTC Transportation Investment Finance Innovation Act Loan Agreement
Caltrans		
1	1/18/2008	Caltrans/RCTC Environmental Phase Cooperative Agreement
2	5/14/2012	Caltrans/RCTC Toll Facility Agreement (long-term Operations & Maintenance phase)
3	7/25/2012	Caltrans/RCTC Design-Build Phase Cooperative Agreement (roles, responsibilities, cost allocation, Caltrans oversight/inspection/etc.)
4	3/17/2017	Caltrans/RCTC Toll Facility Maintenance Agreement (future agreement to contract for specific, routine maintenance services)
OCTA		
1	12/16/2011	Orange County Transportation Authority/RCTC Cooperative Agreement (agreement between both agencies to jointly operate & maintain a single express lanes facility, also design-build phase)
2	5/24/2013	Orange County Transportation Authority/RCTC/Cofiroute USA (three-party operation & maintenance agreement to share the existing operator, roles, responsibilities, scope, costs)
3	10/23/2014	Orange County Public Works Right of Entry
CHP		
1	7/1/2016	RCTC/CHP Toll Facility Police Services Agreement (future agreement to contract for violation enforcement services)
TCA		
1	4/10/2014	TCA/RCTC License Agreement (use of the Transportation Corridor Agency's (TCA's) trademarked FasTrak® logo for RCTC's toll facilities)
City of Corona		
1	1/9/2011	City of Corona/RCTC Cooperative Agreement (agreement for all phases of work)
2	2011	Freeway Agreement (between City of Corona and Caltrans, but RCTC serves as the coordinator/facilitator)
Riverside County		
1	6/5/2012	Riverside County/RCTC Cooperative Agreement (agreement for all phases of work)
Railroad/Utility		
1	9/2012 – 7/2014	RCTC/Burlington Northern and Santa Fe Railroad Agreements
2	2012-2015	RCTC/Utility Company Agreements

Source: RCTC, 2022

10.4 INTERSECTING EXPRESS LANE PROJECTS

As shown earlier, in Figure 2-1 and Figure 2-2, as the regional express lane network expands, there will be an increasing number of intersecting express lane corridors. With the opening of the RCTC I-15 Express Lanes in April 2021, the I-15 and SR 91 corridors became the first two express lane facilities to directly intersect in the SCAG Region. While current and future intersecting express lane facilities will be located within the same county and implemented by a single project sponsor, there are several challenges with connecting express lane facilities that may require augmented coordination. These include:

- Toll zones and trip building;
- Toll rates and algorithms;
- Signage; and
- Interconnections.

Project sponsors should also be prepared to make adjustments to operational parameters after the intersecting facilities become operational. For example, when the I-15 project opened to operation in Riverside County, RCTC found that they needed to adjust their original plans for defining toll zones, because it was not possible to sign and guarantee toll rates on the I-15 Express Lanes for motorists entering the 91 Express Lanes at the Orange County line. Motorists on the 91 Express Lanes now see the price for continuing their trips on the I-15 Express Lanes when they arrive at the facility.

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11 Transit Integration

Expansion and enhancement of transit and complementary shared travel modes can be key to the development of sustainable and accessible transportation options in the Southern California region. With the advent of state legislation such as SB 743, as well as a federal policy that prioritizes transit investments, exploring the synergies between transit and express lanes where feasible in the SCAG Region can be strategically important. Express lanes can create a valuable opportunity for transit agencies to expand and improve express bus service, enhancing the productivity of the regional transportation system⁹². By using variable pricing to provide more sustainable traffic flows, express lanes can create efficient and reliable transit corridors out of previously congested freeways. In fact, several of the earliest examples of managed lanes projects in the United States were first developed as fully dedicated busways in the 1960s and 1970s (e.g., IH-10 in Houston and I-10 in Los Angeles), which later evolved into carpool lanes, and now operate as express lanes. Operating express bus service on express lanes can offer several key benefits:

- **Shorter Travel Times.** By maintaining minimum travel speeds, travel time is reduced compared to general-purpose lanes and HOV lanes, which can become relatively more congested.
- **Improved Travel Time Reliability.** Similarly, by maintaining minimum travel speeds and avoiding unpredictable congestion, travel times become more reliable, and on-time performance is improved. When the Northwest Corridor in Metropolitan Atlanta opened in 2018, bus transit times were reduced by such a degree that service times were pushed back 15 minutes to allow customers increased rest.
- **Lower Operating Costs.** Decreasing travel times and improving reliability translates into a cost savings for transit operators who no longer need to account for as much uncertainty in the schedule.
- **Increased Person Throughput.** Express bus service operating on express lanes can move more people in fewer vehicles than private automobiles, increasing the person throughput on the facilities, which is often one of the stated goals of express lane programs.
- **Increased Carpooling and Transit Use.** Transit buses and eligible HOV users benefit from both travel time savings as well as toll-free (or discounted) use of the express lanes, which can be effective at attracting new carpool and transit riders. Additional increases in transit ridership can be accomplished when express bus services are improved or expanded in conjunction with express lanes development and operation.

⁹² In the context of express lanes, express bus service commonly refers to public transit bus services that operate in part along the freeway with limited stops to provide higher travel speeds and expedited travel times between more distant origin and destination points.

- **Reducing VMT.** Getting sufficient people out of individual vehicles and onto buses for some of their trips can translate into potential reductions in VMT.
- **Reducing Greenhouse Gas Emissions.** Reduced single-occupancy vehicle trips, paired with practices such as bus electrification, have the potential to reduce greenhouse gases and other harmful pollutants.
- **New Revenue Source.** The express lane toll revenue provides a potential new funding source for transit service enhancements along the corridor.
- **Addressing Equity Concerns.** By using express lane revenue to enhance transit service along the corridor, it is also possible to address some of the frequently raised equity concerns surrounding toll lanes.
- **Building Public Support.** Incorporating high quality transit on express lanes can help build support for an otherwise controversial project. Expanding transit can help in combatting the “Lexus lanes” misconception.

In addition to traditional transit options (e.g., express bus service or freeway bus rapid transit), advances in technologies and policies have made intermediate capacity options (e.g., vanpools and shared use vehicles) more feasible for mass use on express lanes. Physical design elements such as direct access ramps can greatly improve transit connectivity and efficiency.

What is most important is not just the deployment of different modes on express lanes, but their integration extending beyond the physical footprint of the express lane facility. Future advances in vehicle automation, electrification, and multimodal integration will make it easier to provide first-and-last mile feeder services connecting major trunk line routes, which is a priority to support an increasingly aging population and reduce the transportation sector’s environmental footprint. Examples of such integration include shared mobility hubs, which can combine smart parking, transit centers, electric vehicle charging, car or ride sharing, active transportation, and even automated shuttles in a way that is scalable over time as new integration concepts and technologies develop. Multimodal integration also includes advances at the software level, such as with trip planning and seamless electronic payments. The increase in modal options, as well as their integration, enhances many of the transit-related benefits previously highlighted, as it provides more options for people to reduce their dependence on single-occupancy vehicle trips.

For these reasons, many transit agencies have introduced express bus service on express lanes and are considering enhancing their multimodal options along express lanes corridors. More specifically, the performance of transit service depends on travel patterns, as well as design and policy factors, such as location of access points, fare policies, and funding. Incorporating these design and policy considerations into the express lanes program requires extensive coordination early in project development between the tolling agency or authority and the transit agency, which could be part of the same entity (e.g., LA Metro), but are often separate entities.

This chapter of the ConOps leverages lessons learned from express lane projects with frequent transit service. The discussion on transit is framed first from the perspective of physical design, followed by a discussion on policy considerations. The chapter then provides an overview of the existing SCAG Region express bus services and a discussion to identify corridors where future transit service (primarily in the form of bus transit) and other multiple occupancy uses may benefit the most from the introduction of express lanes. The chapter concludes with policy recommendations.

11.1 PHYSICAL DESIGN CONSIDERATIONS

Many of the physical design considerations for integrating bus service on express lanes are similar to those for HOV lanes, which have well-established design criteria. Based on the review of existing facilities, the following factors should be considered in the planning and design of transit service on express lanes:⁹³

- **Maintain Minimum Level of Service.** If managed properly, pricing levels should maintain a minimum LOS on express lanes at all times. This is a characteristic of express lanes not shared with HOV lanes, and can provide a benefit for transit operators. However, if prices are constrained, the express lanes could become congested, degrading transit service. Appropriate pricing policies are of particular importance when converting existing HOV lanes to express lanes, to ensure that expanded access does not degrade speeds and transit service. In addition to LOS on the facility, it is also important to monitor the LOS at ingress and egress points to avoid conflicts with merging and diverging vehicles.
- **Provide Direct Access/Drop Ramps.** Many express lanes are located in the center of the freeway, limiting ingress and egress, and requiring weaving across multiple lanes to enter to or exit from the freeway. Where high frequency bus service is anticipated, designing for express lanes should include consideration of direct access ramps that avoid the need for transit vehicles to cross multiple general-purpose lanes, which can be particularly challenging for buses. Any proposed direct ingress and egress locations should be taken into consideration in developing routing along the express lanes.
- **Provide Park-and-Ride Lots with Direct Access Ramps.** Most express lanes have at least one park-and-ride lot within a mile of the facility. In several cases, the revenue from express lanes facilities has been used to fund construction of new park-and-ride lots, thereby expanding access to transit. When locating park-and-ride lots, access to the express lanes is an important consideration. Ideally, buses would have direct access from the park-and-ride lots to the express lanes, which may be a challenge along facilities with existing park-and-ride lots.
- **Bus fleet electrification.** In the past decade, many transit agencies in California have electrified their bus fleets in response to the need to reduce greenhouse gas emissions and harmful pollutants generated by transit vehicles, and to prepare for a state requirement that transit fleets be zero

⁹³ Newmark, 2014

emission by 2040. The IIJA also includes \$5.6 billion in dedicated funding for low- and no-emission buses, so it is expected that the continued electrification of bus fleets will accelerate in coming years.

- **Determine Whether Stations will be In-Line or Off-Line.** The *Caltrans HOV Guidelines* establish clear definitions of in-line and off-line transit stations. In-line stations are contiguous to the express facility and serve pedestrian passengers and feeder transit lines, as well as transfers with other routes on the facility. Benefits of in-line stations include right-of-way savings, eliminating the need for ramp construction, and time savings. Drawbacks include noise and air pollution for the passenger, longer walking distances, increases in transfers, and expensive handicap access.

With in-line stations, a passing lane is necessary to accommodate through traffic. The platform could be in the center of the lanes or to the side. Center platforms provide less width, provide for easy transfers and are less expensive. However, buses generally load on the right side, which is a challenge for center platform stations. Off-line stations are not contiguous with the express lanes, but are close enough to receive direct bus service. They are often located at park-and-ride lots, large employment centers, and major transit centers. Off-line stations require either a direct connector ramp or a drop-ramp, and also result in longer travel times. Off-line stations generally provide better pedestrian access than in-line stations.

Table 11-1 includes a comparison of the benefits and drawbacks of in-line versus off-line stations.

Table 11-1. In-line station benefits and drawbacks

BENEFITS	DRAWBACKS
<ul style="list-style-type: none"> ▪ Increased efficiency for bus operators since they do not have to exit the express lane or merge in general traffic ▪ Over-/underpass station ramps also create possible access points for other modes 	<ul style="list-style-type: none"> ▪ Isolated, noisy stations ▪ Right-of-way constraints make this a costly option (less problematic for over-/underpass stations, but these could have costly seismic challenges) ▪ Difficult to access, not multi-modal

Figure 11-1 shows a median express bus station along I-110 in Los Angeles, while Figure 11-2 depicts an adjacent express bus station with a direct-connector ramp along I-15 in San Diego, as examples of express bus operations on express lanes in Southern California. In Los Angeles, one of the reasons identified for the lower-than-expected express bus ridership on I-110 was the isolated, noisy freeway environment of stations.⁹⁴ Making transit a more comfortable end-to-end experience should be an important consideration.

⁹⁴ Schaffer, Alexander. Passenger Exposure to Noise at Transit Platforms in Los Angeles. UCLA Luskin Center for Innovation, 2012. https://www.transitwiki.org/TransitWiki/images/6/69/Noise_Transit_Platforms.pdf

Figure 11-1. Los Angeles Metro In-line stations



Source: LA Metro

Figure 11-2. Direct Access Ramps, I-15, San Diego



Source: SANDAG

11.2 POLICY CONSIDERATIONS

Each express lane project entails a unique set of policy considerations that influence transit integration, such as whether a portion of express lanes revenues will be dedicated to transit service. Establishing policies that improve transit service and capacity is also often helpful in building public support for

express lane projects, and can help achieve equity objectives. The following policy considerations can encourage transit integration:⁹⁵

- **Multimodal approach.** Due to their linear configurations and typical locations in densely settled urban and suburban corridors, express bus service can be integrated effectively with express lane projects. However, in order to encourage increased transit utilization, express bus service should also be integrated with other modes (e.g., feeder bus services, rail, vanpools, shuttles, car-hailing, ride-hailing, public scooters, public bicycles), which may or may not travel in the express lanes. A major component of attracting ridership is increasing transit connectivity, not only via the kinds of infrastructure improvements described in earlier sections (e.g., direct connectors, mobility hubs), but also by establishing partnerships across county boundaries to achieve regional objectives. For example, the Metrolink San Bernardino and Riverside Lines and the Metro Gold Line all provide substantial east-west transit capacity paralleling the I-10 Express Lanes and the SR-60 and I-210 HOV lanes. Agencies will need to be thoughtful as to how express bus services are deployed in the context of these major investments in rail.
- **Enhance connectivity.** Providing multiple modes that physically integrate is not sufficient. Another important aspect is coordinating operations so to minimize transfer times, thereby increasing the value of the time and reliability benefits gained by riding on express lanes. An example of improved connectivity at the operational level is the concept of connection protection, where operators modify their departure times slightly to guarantee that the majority of users are able to make their connections. This is a simple concept, in theory, but it is challenging to implement and requires extensive coordination between transit operators.
- **Coordinate Multiple Transit Operators.** It is not uncommon to have multiple transit agencies operating service on a single express lane facility. Transit vehicles are typically allowed to utilize the express lanes without paying a toll. Ideally, the express lane transit operators would coordinate all service on a facility and market the service clearly to the public.
- **Dissuade Shifts to Driving.** One of the potential unintended consequences of converting HOV lanes to express lanes is that some existing transit riders may decide to start paying to drive alone in the express lanes. Some transit agencies have addressed this concern by pricing the express facilities at a minimum rate that is at least equivalent to the transit fare, so there is never an out-of-pocket price advantage for solo driving. For example, in Los Angeles, tolls in the morning and afternoon peak periods for the full trip on the ExpressLanes must be at least 1.5 times the Metro Bus Rapid Transit fare.
- **Set Fares to Reflect Service.** Express buses operating in express lanes provide faster and more reliable trips compared to those operating on general-purpose or HOV freeway lanes, allowing transit agencies to justify higher fares on these routes. This type of premium service may also include greater comfort and amenities for passengers. Some transit agencies, including the Los

⁹⁵ Newmark, 2014

Angeles Department of Transportation (LADOT), have also established distance-based fares for express bus service operating on express lanes facilities.

- **Consider Shifts from Parallel Transit Service.** In evaluating transit ridership gains on express lane facilities, it is important to consider whether the riders are new to transit or if they are existing transit riders who are shifting from parallel routes. It is recommended that agencies conduct rigorous before and after evaluations, which may include ridership surveys on surrounding routes.
- **Encourage vanpooling and increased occupancy in setting occupancy policies.** For example, in Los Angeles County, Metro approved an HOV 5+ pilot which was designed to encourage greater use of vanpools and bus ridership but was postponed due to the COVID-19 pandemic. Vanpools tend to be reliable transit options and are often permitted free travel on express lanes facilities. Incentivizing increased occupancy supports maintaining high levels of service, increasing productivity while also providing choice and access to commuters. While increasing vehicle occupancy requirements may not be a universal solution to address oversaturated freeway HOV lane capacity challenges under all circumstances, Express Lane operating agencies may consider occupancy rate rule changes as one tool among many for addressing freeway lane oversaturation.
- **Capitalize on Express Lanes Media as a Transit Marketing Opportunity.** While no longer a new concept, express lanes still often receive a great deal of free media attention during planning, construction, and opening. Savvy transit agencies can capitalize on this media attention to market both existing, as well as new, transit service in the corridor.
- **Establish Strong Brand Recognition.** Introducing new bus service along express lanes provides an opportunity for transit agencies to brand a premium transit service. Marketing the service as different from traditional transit service may appeal to new riders and may allow agencies to charge a higher fare for express routes. Metro has branded its express bus service on the I-10 and I-110 as the J Line (Silver Line) and includes the route on its Metro Rail and Busway Map to emphasize it as premium service.
- **Institute Revenue Transfer Policies.** Perhaps one of the most critical policies to establish is determining how toll revenues will be used. The dispensation of toll revenues is often strictly controlled on express lane projects funded with toll-backed debt, but in certain cases, policy decisions can be made to direct a certain portion of express lane toll revenues to support transit operations or make other local transit investments.
- **Leverage Federal Funding Opportunities.** Federal programs, such as the Value Pricing Pilot Program, have provided initial funding for the development of several express lane initiatives. The Congestion Relief Program created under the IIJA continues this precedent, and includes funding for the “deployment and operation of mobility services, including ... commuter buses, commuter vans, express operations, paratransit, and on-demand microtransit” as eligible projects under the program.⁹⁶ The IIJA also includes a 35 percent increase in transit funding, as well as grant programs for major highways, bridges, and rail projects, projects of regional significance, bus electrification,

⁹⁶ 23 U.S.C. § 129(d)(4)(C)

and small start projects that have been used to fund bus shoulder lanes in the SCAG Region. Project sponsors in the SCAG Region can consider pursuing these funding opportunities to integrate improved transit service into their express lane projects.

- **Establish Transit Rewards Program.** Metro established one of the first transit rewards programs in the country when it implemented service on the I-110 and I-10 ExpressLanes. The program was suggested by local residents through Metro’s extensive public outreach efforts. It incentivizes transit use along the corridors and addresses equity concerns. Registered TAP card holders can earn a \$5.00 credit for use on the I-10 and I-110 ExpressLanes after taking 16 one-way bus trips on the corridors. The Georgia State Tollway Authority subsequently implemented similar transit rewards for its Georgia Xpress service. These pioneering examples have led other agencies to consider providing express lane toll credits to regular transit passengers.
- **Adopt Interoperable Fare System.** Interoperability between different tolling facilities has been a long-established requirement in California. However, interoperability with transit accounts is still not feasible in the short term, so a more manual process is needed to establish fare cross subsidization or modal shift incentives, such as a transit rewards program, or future integrated and differentiated fare policies. If multiple agencies are involved in the operations of the toll lanes and transit service, this will require close interagency coordination. CalSTA is encouraging interoperability for transit accounts through the California Integrated Travel Project. This initiative has the goals of standardizing contactless fare collection and customer-facing, real-time transit information across California, and verifying eligibility for transit discounts.
- **Mobility as a Service (MaaS).** Beyond interoperable fare systems is the concept of MaaS, which looks to incorporate traveler information and trip planning with a seamless payment mechanism across modes and trip legs, to maximize the convenience and choice for travelers. Providing this convenience to users is an important tool to get more transit riders using services that operate within express lane corridors. This strategy can evolve as interoperability, instrumentation, communications, and data transmission advance. Developing a platform that works may include data sharing, operational policies, and funds management coordination and agreements.

11.3 OPPORTUNITIES FOR TRANSIT SERVICE IN SCAG REGION

The SCAG Region is well served in the urban core by express bus services operating on the region’s freeways. Much of the existing and future express bus service is concentrated in business centers in Los Angeles and Orange Counties, and other regional activity centers including Corona and San Bernardino. However, the freeways surrounding these regional centers are often subject to bottlenecks and heavy traffic congestion, especially during peak commuting times. Although much of the current service operates on the existing HOV lanes network, where present, even these lanes can become heavily congested, making the travel times unreliable. Establishing a network of express lanes with express bus service feeding into the regional centers could improve transit travel time reliability.

- **Los Angeles County:** Several express bus routes operate in corridors with planned or existing express lanes. LADOT, Santa Clara Transit, and LAWA Flyway operate routes serving the future I-405 express lane corridor, as well as nearby park-and-ride facilities. Metro may consider adding new bus services on its planned I-605 express lane (this corridor has limited park-and-ride availability). However, Antelope Valley Transit, Santa Monica Big Blue Bus, LADOT, Foothill Transit, Metro, and Montebello Bus Lines all operate bus services in Los Angeles County that do not utilize existing or planned express lane corridors.
- **Orange County:** OCTA operates express bus service on planned and/or existing express lane corridors along I-5, I-405, SR 57 and SR 91. These corridors are also well-served by park-and-ride lots.
- **Riverside County:** The Riverside Transit Agency and OCTA currently operate express bus services along planned or existing express lanes on I-15 and SR 91, but there are relatively few park-and-ride facilities on the I-15 corridor.
- **San Bernardino County:** As part of its I-10 Express Lanes, SBCTA is working with Omnitrans to integrate express bus service into the facility. Omnitrans currently runs Express Bus Route 290 along the I-10 corridor. This freeway express bus route runs along I-10 and connects the downtown San Bernardino Transit Center with Arrowhead Regional Medical Center, Ontario Mills, and the Montclair Transit Center. Once the I-10 Express Lanes are built, Route 290 would be able to use approximately 24 miles of the HOV or express lanes on I-10, resulting in a reduced travel time of approximately 50 percent compared to local bus services. The route is designed to maximize transfer potential to Foothill Transit's Silver Streak in Montclair, Metrolink trains, and other Omnitrans routes for better regional connectivity.

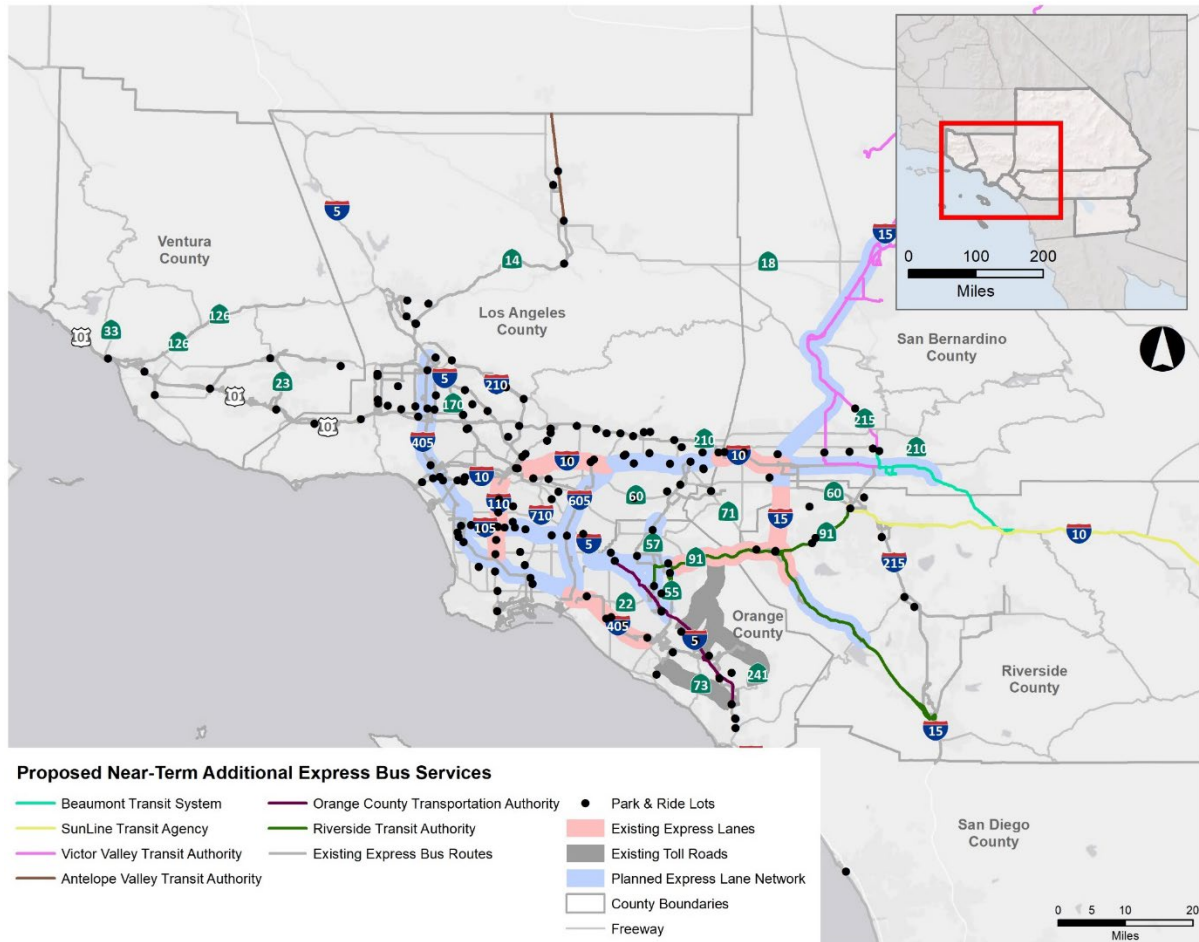
Omnitrans is also considering several locations along I-10 that may be suitable for implementing key bus stop locations, allowing greater transit connectivity and opportunities to accommodate trip transfers for existing and future customers. Preliminary engineering concept plans are being reviewed with SBCTA, Caltrans, and Omnitrans that implement bus stop locations along interchange ramps at Mountain Avenue and Sierra Avenue, to accommodate trip transfers between the express bus line and primary local bus routes. These bus stops appear feasible for implementation, lie within the project footprint, and will be further developed to finalize the preliminary design of the bus stops at these locations.

As shown in Figure 11-3, there are many current or future HOV and express lanes that are already served by express bus service. However, there are others including some segments of I-5, I-10, I-15, I-105, I-110, and SR-91, where express bus routes could be added, and still others located where express bus services is not warranted.

Figure 11-4 shows future/expanded express bus service by agency, according to SCAG. Beaumont, SunLine, and Victor Valley lines plan to introduce new bus services, while Antelope Valley, OCTA, and Riverside plan extensions of existing services. Most of the new or augmented services are in heavily traveled, relatively densely developed corridors. With the exception of SunLine Transit's planned

routes, all new bus services will operate in existing or planned express lane corridors. Access to park-and-ride facilities is mixed. Further study is necessary to determine whether expanding express bus service along corridors with sparse current service and lower density development is warranted, or whether more efficient complementary options could improve accessibility and help reduce VMT.

Figure 11-4. Future/Expanded Express Bus Service in SCAG Region by Agency



Source: SCAG; WSP, 2021

11.4 TRANSIT INTEGRATION RECOMMENDATIONS

As the SCAG Region looks to expand the regional express lane network, the integration of high-quality bus service from a multimodal perspective will be essential. The success of transit service on several express lane facilities, such as the I-110 and I-10 ExpressLanes in Los Angeles County, demonstrates that express lanes can benefit not only solo drivers and HOVs, but also bus and vanpool riders. The ability to provide more frequent and reliable service has the potential to change how transit is viewed and used. Implementing agencies should keep in mind the following recommendations as the regional express lane network advances:

1. **Integrate transit planning into the early planning process.** It is critical to engage with the transit operators early, to understand where and how transit services can be integrated into express lane project designs and what physical infrastructure needs and service requirements, such as geometric considerations, direct access ramps, park-and-ride or shared mobility facilities, vehicle types, and performance expectations, should be incorporated.
2. **Identify express bus routes that connect regional centers.** Develop a comprehensive understanding of corridor travel patterns to determine where express bus service would be most efficient. Express bus service on express lanes is best suited for long-distance commuting trips. The SCAG Region would benefit from express bus service that connects suburban outlying communities to downtown Los Angeles, central Orange County, northwestern Riverside County, western San Bernardino County, and other activity centers.
3. **Explore integration of modes complementary with express bus.** As express bus routes prioritize connecting regional centers and maximizing operational productivity, it is important to plan these services from an integrated perspective, considering other connecting modes at transit centers, park and ride facilities, or shared mobility hubs. Also, it is important to prioritize other transit modes that can directly utilize the express lanes, especially vanpools.
4. **Adopt performance-based occupancy policies.** California’s legal requirement to curb and mitigate VMT increases due to highway capacity expansion will have important implications for how express lanes are planned and operated. For example, occupancy requirements are an important component of the efficient operations of express lanes, which also need to attract a sufficient toll paying customer base to be able to manage congestion at equitable prices.
5. **Establish clear revenue spending plans.** The operating agency for the express lanes should work with its partners and adopt policies that clearly specify how express lane revenues will be distributed, and who bears the costs of maintenance. Transit service operations should be a consideration in the project financial planning and revenue distribution, where appropriate. Equity should be considered as part of this equation, to ensure that disadvantaged communities are able to benefit directly or indirectly by the provision of transit on express lanes. This can be incentivized through potential subsidies and fare discounts, and by ensuring the enforcement does not fall disproportionately on disadvantaged communities.
6. **Identify the lead agency to coordinate and market express bus service.** Transit service is most successful when the service provided by various operators is well coordinated and marketed as a single unified program. This also provides an opportunity for transit service to rebrand itself as a premium service benefiting from the advantages afforded by operating within express lane facilities.
7. **Pursue federal and state funding opportunities.** Incorporating express bus service on express lanes opens up new federal and state funding opportunities for transit and multimodal projects, which express lanes may not qualify for on their own, including the federal Congestion Relief

Program grants, Small Starts grants, and Cap and Trade funding, as well as California's Transit and Intercity Rail Capital Program.

8. **Adopt an integrated toll and fare collection system.** Establishing toll and fare collection systems that link to the same account results in not only improved convenience for passengers, but also allows for the implementation of transit incentives, such as those available to Metro TAP card and ExpressLanes customers. Allowing for trip planning and payment via a MaaS platform that incorporates transit use rewards and incentives can also help to increase the convenience and attractiveness of using transit on express lanes.
9. **Prioritize regional operational consistency.** While every county, operating agency, corridor, and community demands different designs and operational policies for their express lanes, as an interconnected express lanes network forms across the SCAG Region, there are opportunities to establish regional policy frameworks and criteria that help provide seamless and productive travel for all types of vehicles, including transit. Consistency in enforcement policies, occupancy and alternative mode access policies, signage, toll business rules, and transit integration will help to drive a more productive and equitable transportation system.
10. **Leverage private sector innovation.** Rapid advances in technologies (e.g., connected and automated transit vehicles, video and LiDAR detection systems, smartphones, and GPS), as well as new mobility schemes (e.g., ride hailing, car sharing, MaaS) provide challenges, but also opportunities to increase transit use on express lanes. The importance of advanced technologies in express lanes cannot be understated, as high person throughput networks require the application of technology beyond traditional ITS and toll system deployments on express lanes. In this regard, partnerships with the private sector, as well as the integration of innovative solutions that provide increased comfort and access to facilities and services, can accelerate the delivery of express lanes and maximize user satisfaction.

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12 Roles and Responsibilities

The implementation and operation of express lane projects requires close collaboration among multiple organizations. This chapter of the Regional ConOps describes the roles and responsibilities of the different stakeholders in advancing express line projects.

12.1 COUNTY TRANSPORTATION COMMISSIONS

The CTCs have been the sponsoring agencies leading the development of all express lane projects currently operating or under construction in the SCAG Region. The County Transportation Commissions Act was enacted in 1976, ultimately leading to the creation of the CTCs in each of the SCAG regional express lane network study area counties.⁹⁷ In establishing the CTCs, the Legislature recognized public demand for efficient transportation infrastructure, and the need for coordinated planning and policy to accomplish necessary improvements.⁹⁸

The CTCs were also designated as Congestion Management Agencies in 1990 with the passage of Proposition 111, which doubled the state motor fuel tax and required that each county designate a county-wide body to implement programs to keep traffic conditions manageable.⁹⁹

Working in partnership with Caltrans and FHWA, to date, the CTCs have taken the lead in implementing all operational express lanes facilities in the region and in conducting feasibility, environmental clearance, and design efforts for nearly all future express lanes projects. It is assumed that the CTCs, as well as Caltrans, will serve in this role and oversee the construction of future express lanes projects within the SCAG Region. However, certain functions, such as toll collection, back-office accounting operations, and customer service may be consolidated and centralized.

Additional information on the four CTCs developing the different corridors that form the SCAG Region express lane network are provided below.

12.1.1 Los Angeles County Metropolitan Transportation Authority

Branded as Metro, the Los Angeles County Metropolitan Transportation Authority is the state-chartered regional transportation planning agency and public transportation operating agency for Los Angeles County. Metro was formed in 1993 through the merger of the Southern California Rapid Transit District and the Los Angeles County Transportation Commission. It is responsible for transportation planning, policy, and funding programs in Los Angeles County, and it is also the county's

⁹⁷ Cal. Pub. Util. Code §130000

⁹⁸ Cal. Pub. Util. Code §130001

⁹⁹ The Traffic Congestion Relief and Spending Limitation Act Of 1990, California Proposition 111 (1990)

primary transit provider. The agency operates the third-largest public transportation system in the United States, with over 2,000 buses and nearly 90 miles of rail transit lines.

Metro operates the I-10 and I-110 ExpressLanes and is also studying the possible conversion of HOV lanes in other highway corridors in Los Angeles County to express lane operation. The agency is also currently developing Plans, Specification and Estimates for express lanes to be constructed along I-105 from I-405 to I-605, and conducting PA/EDs for express lanes options on I-10 from I-605 to the San Bernardino County line, I-405 from I-10 to US 101, and I-605 between the I-105 and I-10 freeways.

12.1.2 Orange County Transportation Authority

OCTA is the primary transportation agency in Orange County, California, and was formed in 1991 through the consolidation of seven separate transportation agencies. OCTA is responsible for formulating transportation policy and funding priorities in Orange County, and for all transportation planning activities. OCTA operates bus service in Orange County and administers the M2 local sales tax measure. In 2003, OCTA took over the operation of the 91 Express Lanes.

OCTA is adding one new general-purpose lane and one new express lane in each direction along the 16-mile corridor of I-405 between SR 73 and I-605. The new express lanes will combine with the existing high occupancy vehicle (HOV) lane to create two express lanes in each direction in the I-405 median from SR 73 to I-605. The I-405 Express Lanes will include single lanes connecting to/from the SR-73 to the I-405 at the southern end of the 405 Express Lanes, and to/from the I-605 and the SR-22 at the northern end of the 405 Express Lanes.

OCTA also has a cooperative agreement with RCTC to support the seamless operations of the 91 Express Lanes, in Orange County and Riverside County, respectively.

12.1.3 Riverside County Transportation Commission

RCTC was created by the California Legislature in 1976. The agency plans and implements transportation and transit improvement projects in Riverside County. Unlike Los Angeles and Orange counties, RCTC does not provide transit services in Riverside County. The Riverside Transit Agency (RTA), which was established as a joint power authority (JPA) in 1975, is the transit provider for the western portion of Riverside County. One of RCTC's primary responsibilities is administering Measure A, which is a half-cent sales tax funding highway, local streets, and transit projects throughout Riverside County. RCTC also allocates all state and federal transportation funding in Riverside County.

In 2017, RCTC completed the extension of the 91 Express Lanes eight miles eastward from the Orange County Line to the I-15 interchange, by converting an existing HOV lane to express lanes operation and adding a second express lane in each direction. Although the OCTA and RCTC 91 Express Lanes are two separate projects with their own independent financing, they provide a seamless experience to customers. While the two express lanes facilities share the same branding, separate back-office accounting systems track tolls accruing in each of the two counties and disburse toll proceeds to the

two counties accordingly. OCTA and RCTC established a joint advisory board to negotiate and agree on a set of business procedures that will achieve the goal of seamless operations.

The SR-91 extension provides a model of the type of collaboration that is necessary when implementing an express lanes project that extends across county lines. The project has required the execution of a total of 17 interagency agreements between RCTC and nine other entities ranging from FHWA to local utility companies. These agreements are discussed in greater detail in Section 10.3 of this document.

RCTC also opened its 15-mile, \$470 million I-15 Express Lane facility between Cajalco Road and SR-60 near the San Bernardino County line on April 10, 2021. This facility has added two new express lanes in each direction to I-15. RCTC is currently planning for the 14.5-mile southerly extension of the I-15 Express Lanes from Cajalco Road to SR-74, and is also coordinating with SBCTA for the extension of the I-15 Express Lanes north into San Bernardino County.

12.1.4 San Bernardino County Transportation Authority

SBCTA – formerly the San Bernardino Associated Governments – is the transportation planning agency for San Bernardino County. SBCTA is responsible for cooperative regional planning and furthering an efficient multi-modal transportation system countywide. As the County Transportation Commission, SBCTA supports freeway construction projects, regional and local road improvements, train and bus transportation, railroad crossings, call boxes, ridesharing, congestion management efforts, and long-term planning studies. SBCTA administers Measure I, the half-cent transportation sales tax approved by county voters in 1989 and renewed in 2004 to extend to 2040. While SBCTA allocates funding for transit in San Bernardino County, transit services are provided by six local transit agencies. SBCTA was established in 1973, when the County of San Bernardino approved a JPA to create the organization as a Council of Governments, and has taken on additional transportation functions throughout its history. On January 1, 2017, the County Transportation Commission, local transportation authority, service authority for freeway emergencies, and the local congestion management agency were consolidated into a single entity: SBCTA. San Bernardino Associated Governments continues as a Joint Powers Authority functioning as a Council of Governments.

SBCTA is constructing a \$930 million, 10-mile, dual-lane express lane facility on I-10 between the Los Angeles County line and I-15. The project will add one new express lane in each direction and convert an existing HOV along approximately eight miles, from the Los Angeles County line to Haven Avenue. East of Haven Avenue, the project will add two new express lanes in each direction for approximately two miles to the junction with I-15. SBCTA also has plans to extend the I-15 express lanes by six miles from the Cantu-Galleano Ranch Road in Riverside County north to Foothill Boulevard by 2025, at an anticipated cost of \$318 million.

12.2 CALTRANS

Caltrans manages more than 50,000 miles of California's highway and freeway lanes, provides inter-city rail services, permits more than 400 public-use airports and special-use hospital heliports, and works with local agencies to implement transportation projects. As owner of the state highway system, Caltrans has a large role in express lanes development and implementation.

Caltrans' express lanes roles include:

- Reviewing and approving all environmental documentation, design, and operation plans relating to construction and maintenance activities within state right-of-way;
- Monitoring the operation of the freeway and initiating corrective actions, when needed, to ensure motorist safety;
- Collaborating with project sponsors/local agencies in developing the tolling facility agreements between project sponsors and Caltrans;
- Operating a TMC in each of the Caltrans Districts. Through the TMCs, Caltrans may request override of the express lanes toll display messages by the toll system operator when an event occurs that warrants an override;
- Controlling regional ATMS systems;
- Maintaining all roadway elements of the express lanes, other than the toll collection equipment, unless any of the express lane project sponsors hire a contractor for this purpose. If a project sponsor contracts with Caltrans for a higher level of maintenance (e.g., more frequent sweeping), it will reimburse Caltrans for these services. A Maintenance Agreement with Caltrans will be executed prior to approval for construction for individual express lanes projects;
- Monitoring the performance of HOV lanes;
- Owning and maintaining the PeMS system;
- Maintaining Title 21 requirements, consistent with statutory instructions; and
- Supporting CHP in incident management.

In 2009, Caltrans published the *California HOV/Express Lane Business Plan* to establish a framework to “lead the state to easily implement more flexible and effective system management strategies for HOV and express lanes.” A key aspect of the Business Plan was a focus on “those aspects of HOV and express lane development and operations that can and should be addressed at a state level to increase California's ability to manage congestion with HOV and express lanes.” In part, the Business Plan emphasized Caltrans desire to take a more prominent role in leading the development and implementation of express lanes projects within the state.

Consistent with Business Plan, Caltrans District 12 is preparing to conduct a PA/ED examining potential options for the conversion of the existing HOV lane and expansion to accommodate two express lanes in each direction along I-5 in Orange County from the Los Angeles County line to SR-55. The I-5

Managed Lanes PA/ED is expected to commence in early 2022 and take less than three years to complete.

Caltrans will issue new *Managed Lane Guidelines* in 2022. The guidelines will update and replace past guidance, including TOPD 11-02 titled *High Occupancy Vehicle Guidelines for Planning, Design, and Operations* and issued in 2011. TOPD 11-02 provided supplemental guidance for the planning, design, and implementation of HOV and express lanes project on state highways in California. TOPD 11-02 influenced the planning, design, and implementation of all managed lanes projects developed since 2011, and addressed design considerations for lane separation and access, engineering study requirements, and performance evaluation.

The 2021 Managed Lane Guidelines will incorporate other directives issued by Caltrans, including TOPD 20-02, which provides guidance on changing vehicle occupancy requirements on managed lanes, and which is described in greater detail in Section 3.1 of this document.

In May 2015, Caltrans issued Deputy Directive 43-R1 on Managed Lane Facilities, which requires each district that operates or plans to operate managed lanes to develop a managed lanes system plan in cooperation with regional agencies. Caltrans is in the process of updating this policy, but has not determined the timing of a final release. The current directive also outlines the following provisions for priced managed lane facilities:

- Tolls shall be collected electronically to manage demand;
- Toll revenues shall first be used for facility debt service, capital expenses, maintenance, and operations, including CHP enforcement activities;
- Excess toll revenues shall be used towards the improvement or preservation of safety, operations, or travel reliability for any mode or travel option in the corridor from which the toll was collected, unless otherwise dictated by state requirements; and
- A toll revenue expenditure plan, concept of operations, incident management plan, and enforcement plan shall be created during the development or operation of each facility by the responsible agency.

12.3 FHWA

FHWA is the agency within the United States Department of Transportation supporting state and local governments in the planning, design, and construction of the National Highway System, via the Federal Aid Highway Program. 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 High-Profile projects, which include major ITS projects. FHWA has designated all express lane projects as High-Profile projects due to the integration of ITS elements, such as electronic toll collection.

FHWA's express lanes roles include:

- Reviewing and approving improvements and lane operations on Federal Aid Highway Routes;
- Facilitating research and the exchange of information on lessons learned and recommended best practices;
- Providing oversight and review of individual projects; and
- Approving ConOps and Systems Engineering Management Plans for all ITS projects.

In September 2016, FHWA issued its [*Federal-Aid Highway Program Guidance on High Occupancy Vehicle Lanes*](#). This document provides guidance on the administration and application of federal statutory provisions pertaining to express lane and HOV facilities, including annual degradation reporting and certification.

12.4 CHP

CHP is the law enforcement agency that has patrol jurisdiction over all California highways, and serves as the state police. CHP's express lanes roles include:

- Performing on-site enforcement of express lane eligibility (i.e., HOV, Access OK) requirements with the support of local agency provided tools;
- 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 general-purpose lanes. CHP will communicate to the toll system operator and to the customer service center when incidents require the use of express lanes to divert traffic;
- Providing lane closure enforcement for installation and maintenance activities when required by policy, contract or agreement; and
- Enforcing motor vehicle violations.

Project sponsors will need to negotiate agreements with CHP for their enforcement of individual corridors. In many cases, project sponsors opt to pay CHP to implement enhanced enforcement in express lanes corridors. It is expected that each of the operating agencies in the SCAG Express Lane Network study area will negotiate their own agreements with CHP, and that those agreements will be amended as new express lanes facilities open to service.

12.5 SCAG

Founded in 1965, SCAG is a JPA under California state law, established as an association of local governments and agencies that voluntarily convene as a forum to address regional issues. Under federal law, SCAG is designated as the Metropolitan Planning Organization (MPO) for the six-county

Southern California region, and under state law, SCAG is designated both as a Regional Transportation Planning Agency and a Council of Governments.

The SCAG Region encompasses six counties (Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura) and almost 200 cities, in an area covering more than 38,000 square miles. The agency develops the long-range regional transportation plan, including sustainable communities' strategy and growth forecast components, the regional transportation improvement program, the regional housing needs allocation, and a portion of the South Coast Air Quality management plan.

In addition to the various cities and counties, the SCAG Region also encompasses six CTCs – the four express lane operators described above, as well as the Ventura County Transportation Commission and the Imperial County Transportation Commission – that hold the primary responsibility for programming and implementing transportation investments in their respective counties. In addition, SCAG's bylaws provide for representation of Native American tribes and Air Districts in the region on the Regional Council and Policy Committees.

SCAG is not an implementing or operating agency, and does not play a lead role in the development of express lane facilities in Southern California. However, as an MPO, it is responsible for encouraging regional coordination among the counties as they advance planning and design efforts for express lanes projects. In addition, federal law also requires that SCAG, as the MPO, be consulted by express lane operators on toll placement and rates for express lanes implemented on Interstate facilities in the SCAG Region.

SCAG developed its initial regional vision for an express lane network in Southern California through its Express Travel Choice Study and then included a set of priority express lane corridors in its 2016-2040 RTP/SCS. More recently, it included an updated express lane network in its 2020-2045 RTP/SCS, working in close consultation with the CTCs. SCAG will use the information garnered from the regional ConOps update in the identification for the express lane network to be included in the 2024 RTP/SCS update.

Moving forward, SCAG will continue to engage collectively with Metro, OCTA, RCTC, and SBCTA as they advance their express lane projects. This will facilitate coordination on technical, operational, and policy issues, as well as SB 743 compliance, to support the CTCs in building a successful regional express lane network.

12.6 OTHERS

This section of Chapter 12 identifies other entities that are expected to be involved in varying capacities in the planning, design, and operation of express lane projects.

12.6.1 System Integrators

The sponsors of express lane projects in Southern California will likely need to retain the services of a system integrator to design, install, and operate toll collection systems on their managed lanes. System integrators provide two main functions: (1) designing and installing the required toll collection and communication equipment in the lanes, and (2) operating the back-office accounting and CSC. When a project sponsor implements its first toll project, it typically retains a system integrator to install the necessary equipment and operate the back-office and CSC for a designated period of time—often up to five years. When implementing subsequent toll projects, the sponsor could have a different system integrator install ETC equipment in the lanes, but it is typically advisable to have a single back-office and CSC covering all its toll facilities.

There are currently several different private-sector system integrators operating the ETC systems on toll roads and express lanes in the SCAG Region. Rather than keeping their separate system integrators, the CTCs could opt to consolidate certain aspects of their operations to use a smaller number of integrators, or even a single entity, to operate all express lanes in the region. While this would achieve certain efficiencies, it could also introduce challenges, as the different CTCs are likely to have different operational policies and toll structures on their facilities. However, if toll structures, hours of operation, and eligibility requirements are relatively consistent across the region, then the argument for having a smaller number of system integrators is compelling. Current plans in the Bay Area, for example, call for the Bay Area Toll Authority to collect tolls on all express lane facilities to be implemented by MTC and its partner agencies.

Given that separate back-office operations are currently in place in several Southern California counties, it is likely the respective agencies will continue their use of these separate back-offices in the short- to medium-term. However, as older systems and existing equipment is replaced, there may be opportunities to consolidate and achieve cost savings and greater efficiencies of scale. The Bay Area has a single regional back office for all express lane facilities in the region. It is not clear if there is a desire for such consolidation in the SCAG Region, or a clear path forward to achieve it. Regardless of the number of system integrators operating express lanes facilities in the SCAG Region, all of them will need to use FasTrak® and be compatible with CTOC standards and the national transponder protocol that is currently under development, as required under Title 23.

12.6.2 Transportation Corridor Agencies

TCA consists of two JPAs formed under provisions of California law and agreements between Orange County and several of its constituent cities. Senate Bill 1413 (Chapter 1402, Statutes of 1987) provided authorization for TCA to plan, finance, construct, and operate the San Joaquin Hills Transportation

Corridor (SR-73) and Foothill/Eastern Transportation Corridor (SR-133, SR-241 and SR-261) toll roads. The toll roads were financed through non-recourse toll revenue bonds and development impact fees. Similar to the CTCs, TCA's board of Directors is comprised of elected officials from cities and county supervisorial districts within the JPAs, who are appointed to serve.

TCA holds the registered trademark to the FasTrak® name and logo that is used to brand all ETC systems within the state of California. Each agency implementing an express lane project will need to execute or modify existing license agreements with TCA to use the FasTrak® name and logo. TCA currently uses FasTrak® transponders, including the newer 6C sticker tags, to collect tolls on its facilities. Although TCA and other express lane operators use switchable transponders, the sticker tags do not allow motorists to declare their occupancy rates to obtain free or discounted use of express lane facilities.

TCA, in partnership with Caltrans, OCTA, and RCTC, is pursuing the development of the SR-241/91 Express Lanes direct connector ramp, which will feature dynamic pricing to manage the demand on the connector. In addition, SBCTA has retained TCA to collect tolls on the I-10 Express Lanes using a Transcore system. For these reasons, close coordination with TCA will continue to ensure compatibility and mutual benefit between the TCA toll road network and existing and future express lane facilities.

12.6.3 California Toll Operators Committee

CTOC is a collaborative organization of California's toll facility operators and owners, primarily concerned with developing protocols and resolving issues related to ETC interoperability. CTOC's current members include:

- Alameda County Transportation Commission
- BATA
- Caltrans
- Golden Gate Bridge Highway and Transportation District
- Metro
- OCTA
- RCTC
- SBCTA
- SANDAG
- Santa Clara Valley Transportation Authority
- Sunol SMART Carpool Lane JPA
- TCA

CTOC's members have a standing quarterly conference call to discuss current tolling issues. CTOC also has an express lane subcommittee that meets on a quarterly basis to discuss issues related to express lane operations. CTOC is coordinating closely with the IBTTA in its work to vet and establish a national ETC interoperability standard. CTOC also coordinates with the Alliance for Toll Interoperability, which has been established by IBTTA as a hub for sharing license plate and transponder data.

CTOC provides the clearinghouse for all toll operators in California to exchange transaction and account information for all toll systems using FasTrak®. This clearinghouse function allows the individual operators to reconcile toll charges for the use of their respective facilities by account holders belonging to other member agencies. In doing so, the clearinghouse provides the forum for member agencies to comply with statewide tolling interoperability requirements.

CTOC has also established the FasTrak Flex® brand for electronic toll collection systems within California that utilize self-declaration of vehicle occupancy using a switchable transponder.

12.6.4 California Transportation Commission

California Transportation Commission was established in 1978 by AB 402 with the intent of providing a single, unified California transportation policy. The Commission replaced and assumed the responsibilities of four independent bodies: (1) The California Highway Commission, (2) the State Transportation Board, (3) the State Aeronautics Board, and (4) the California Toll Bridge Authority.

The California Transportation Commission includes eleven voting members and two non-voting ex-officio members. Of the eleven voting members, nine are appointed by the Governor, one is appointed by the Senate Rules Committee, and one is appointed by the Speaker of the Assembly. The two ex-officio non-voting members are appointed from the State Senate and Assembly (usually the respective chairs of the transportation policy committee in each house).

The California Transportation Commission is responsible for the programming and allocation of funds for the construction of highway, passenger rail, and transit improvements throughout California. The Commission also advises and assists the Secretary of the Business, Transportation, and Housing Agency (or successor agency), and the Legislature, in formulating and evaluating state policies and plans for California's transportation programs. The Commission is also an active participant in the initiation and development of state and federal legislation that seeks to secure financial stability for the state's transportation needs.

The California Transportation Commission's involvement with the SCAG Region express lane network is expected to include:

- Finding CTCs eligible to implement and operate express lanes projects;
- Reviewing and approving any P3 arrangements that might be used on express lanes projects; and
- Approving the programming of any state funds, if used to fund express lanes.

12.6.5 Freeway Service Patrol

The FSP is a joint program provided by the California Department of Transportation (Caltrans), the California Highway Patrol (CHP), and local transportation agencies. FSP drivers patrol freeways in privately owned tow trucks and vehicles during hours of peak congestion, responding to incidents. They clear debris from freeways and provide towing and minor auto repairs. Express lane operators typically have contracts with the FSP to provide specified incident response coverage on their facilities.

12.6.6 Express Lane Stakeholders

In certain cases, stakeholders, including municipalities located along express lane corridors and neighborhood groups, influence the development of express lane projects. This usually begins through the public outreach efforts that are conducted as part of the environmental approval process. Outreach programs can identify design or operational elements that are responsive to the needs and concerns of local stakeholders. When this occurs, it can be expected to enhance public support for express lane projects.

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13 Policy Recommendation Summary

Table 13-1 provides an abbreviated summary of recommended express lane facility design, operating concept, performance measurement and evaluation, delivery and governance, and transit integration policy recommendations outlined as part of this document. The table is intended as a quick reference of policy recommendations, but should not be considered a comprehensive synopsis of the guidance of this document.

Table 13-1. Policy Recommendation Summary

POLICY	RECOMMENDATION
FACILITY DESIGN	
Typical Section	<ul style="list-style-type: none"> ▪ The physical configuration of express lanes is driven by the location and design environment of the corridors within which express lanes will be deployed ▪ Emphasize full standard for outside and inside shoulder and buffer design to reduce crashes and friction ▪ The following cross section standards are recommended: <ul style="list-style-type: none"> – Lane width 12 feet preferable; 11 feet minimum – Shoulder width 10 feet preferable; 2 feet minimum – Separation width 4 feet preferable; 2 feet minimum – Access 2,000 feet minimum ingress/egress opening Minimum 800 feet per weaving lane distance to opening
Separation Treatment	<ul style="list-style-type: none"> ▪ The design of most express lanes provides separation from general-purpose lanes using a combination of painted buffers, traffic channelizers, and/or concrete barriers ▪ Access and separation treatments should be addressed on a corridor-by-corridor basis ▪ Keep limited access as the norm, but have the flexibility to explore open access where practicable
Access Treatment	<ul style="list-style-type: none"> ▪ Continue to utilize limited access designs ▪ To preserve flexibility, continuous access should not be entirely excluded from consideration ▪ Operational analysis along with geometric considerations should drive decisions about whether to use at-grade weave zones, weave lanes, and merge lanes ▪ Existing and planned direct connector ramps are preferred for freeway-to-freeway movements to maximize throughput and minimize weaving ▪ As volumes increase on managed lanes in Southern California, additional direct connectors are likely to be needed
Express Lane Signage	<ul style="list-style-type: none"> ▪ All signage on the regional express lane network must be consistent with the CA MUTCD ▪ Per CA MUTCD guidance, express lanes signs are effectively limited to three lines of toll rate information comprising the toll rate to only two locations, and a third line indicating HOV eligibility, where applicable ▪ During the PA/ED process, project designers should coordinate with the Caltrans District Traffic Signing Engineer to determine locations for all overhead sign structures

POLICY	RECOMMENDATION
	<ul style="list-style-type: none"> ▪ Express lane operators should strive toward consistency in signage across the regional express lane network to provide a seamless experience for express lane customers ▪ Consistent business rules help facilitate consistent signage
OPERATING CONCEPT	
Vehicle Occupancy Rates	<ul style="list-style-type: none"> ▪ Changes to occupancy requirements and toll policies on priced managed lanes are the responsibility of the entity that has the tolling authority. If a regional transportation agency has tolling authority, any such changes should be made in consultation with Caltrans ▪ Express lane developers should coordinate closely on occupancy rates when express lane corridors extend across county lines ▪ As occupancy policies evolve, express lane operators should remain vigilant in keeping motorists informed of any differences in occupancy as they navigate the regional express lanes network
Toll Collection	<ul style="list-style-type: none"> ▪ CTOC-compliant RFID transponders are the preferred primary means for toll collection ▪ Video-based tolling is possible with current toll collection systems, but it should be implemented on a consistent basis by all express lane operators in the region ▪ Violation enforcement will be conducted by LPR on facilities that do not allow video-based tolling
HOV Occupancy / Exemption	<ul style="list-style-type: none"> ▪ The goal underpinning occupancy requirements is to ensure that express lanes are not underutilized ▪ Occupancy rates should be expected to differ on single- and dual-lane express lane facilities ▪ HOV occupancy policy should be based on adopted program goals for mobility, person and vehicle throughput, revenue, and managed lane performance ▪ The primary HOV occupancy policy options are: <ul style="list-style-type: none"> – Maintain HOV 2+ toll free or discounted on current HOV 2+ lanes – Adopt HOV 3+ toll free or discounted toll during peak periods and HOV 2+ during off-peak periods – Adopt full-time HOV 3+ toll free or discounted tolls – Adopt HOV 3+ toll-free during off-peak periods and full or discounted HOV 3+ tolls during peak periods
Exemptions	<ul style="list-style-type: none"> ▪ The following vehicle types should generally be allowed toll-free or discounted express lane access: carpools and vanpools carrying the required number of occupants, emergency vehicles (responding to a qualifying event), mass transit buses, motorcycles, and paratransit vehicles. ▪ CAV discounts should be consistent in Southern California; a 15 percent discount is the current norm on most express lane facilities
Hours of Operations	<ul style="list-style-type: none"> ▪ Express lane facilities will operate 24 hours a day, seven days a week
Toll Rate	<ul style="list-style-type: none"> ▪ Minimum and maximum toll rates may be established, but should be carefully considered to ensure they do not restrict the ability to use pricing to manage demand ▪ Dynamic tolling algorithms may be less effective in managing demand if there are toll caps ▪ Toll rates may vary dynamically in real-time based on traffic congestion conditions. Alternatively, static variable pricing may be used, with rates set based on time of day, day of the week, and direction of travel ▪ Static variable pricing avoids the issue of minimum tolls

POLICY	RECOMMENDATION
Pricing Model	<ul style="list-style-type: none"> ▪ Variable pricing using a segment or zone-based model is recommended, as a single toll rate is not capable of managing demand across entire corridors ▪ Facility travel sheds, interconnectivity, and logical termini should be evaluated when determining pricing segments or zones ▪ The pricing model should minimize the occurrence of breakdown conditions
Toll Communication	<ul style="list-style-type: none"> ▪ Toll communication must comply with CA MUTCD ▪ Toll rate pricing structure should be communicated to drivers through destination-based CMS, showing the price to no more than two destinations within a toll segment, toll zone, or facility ▪ Once toll rates are communicated to drivers, the price is locked in over the corresponding toll segment, zone, or facility
Business Rules	<ul style="list-style-type: none"> ▪ Express lane operators will develop business rules specific to the goals and objectives of the facility, and consistent with characteristics of existing operations structure ▪ The SCAG Region would benefit from greater consistency in express lane business rules
Revenue Allocation	<ul style="list-style-type: none"> ▪ Revenue should be allocated to cover debt service and operational expenses, with residual monies dedicated to transit or other transportation enhancements in the corridor, at the discretion of the operator and their revenue allocation requirements ▪ Projects financed with toll revenues often have a required funding allocation in their funding documents ▪ Moving forward, revenues may also need to be allocated to mitigate for VMT impacts as prescribed under SB 743
Network	<ul style="list-style-type: none"> ▪ Prioritize customer-facing issues to enhance user experience ▪ Implementation of a regional express lanes network requires collaboration and coordination across multiple agencies, requiring partnering organizations to coordinate on issues of regional significance
Equity Process	<ul style="list-style-type: none"> ▪ An ongoing process for analyzing equity implications should be undertaken for every express lane project, to understand the effects on all potential uses, identify appropriate strategies to mitigate equity impacts and concerns over time, and engage stakeholders ▪ Agencies should have the flexibility to address the relevant equity issues in their areas
Degradation Reporting	<ul style="list-style-type: none"> ▪ 23 U.S.C. § 166 requires that public authorities operating HOV and express lanes prepare an annual Degradation Report documenting the performance of HOV and express lane facilities ▪ Compliance with FHWA degradation requirements is a Caltrans function ▪ Within six months of determining that an HOV or express lane facility is degraded, public authorities are required to submit an Action Plan detailing the steps that they will take to make significant progress toward bringing the facility into compliance with the 45-mph average peak period operating speed standard ▪ There needs to be a clear nexus between mitigation measures and the causes of degradation ▪ Mitigation measures must be programmed to be implementable within three years
Performance Measurement	<ul style="list-style-type: none"> ▪ Performance on all regional express lanes should be continuously monitored to ensure compliance with federal standards, state requirements, and local goals and objectives

POLICY	RECOMMENDATION
	<ul style="list-style-type: none"> ▪ Performance measurement should be used to ensure that the express lanes are functioning as efficiently as possible, and to adjust operational policies as needed
NETWORK COORDINATION	
Forums for Coordination	<ul style="list-style-type: none"> ▪ Multiple forums should be used to coordinate all phases of the planning, implementation, and operation of express lane projects: <ul style="list-style-type: none"> - SCAG Stakeholder Groups – <i>Policy Issues / SB 743</i> - CTOC – Technical / Tolling Issues - Bilateral CTC to CTC Coordination - <i>Cross-County Express Lane Agreements / Legal & Financial Issues</i>
TRANSIT INTEGRATION	
Transit	<ul style="list-style-type: none"> ▪ Transit integration can be an important tool in mitigating the effects of capacity expansion projects on increases in VMT and achieving compliance with SB 743, and should include carpools, vanpools, buses, rail, and transportation network companies ▪ Potentially enhance effectiveness of express lanes by integrating transit considerations into the planning, design, and operation of facilities to accommodate transit ▪ Express lanes can create a valuable opportunity for transit agencies to expand and improve express bus service ▪ Engage with transit operators early in the planning process to identify needs, such as direct access ramps, park-and-ride facilities, vehicle types, and performance expectations, and integrate them into the project design



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