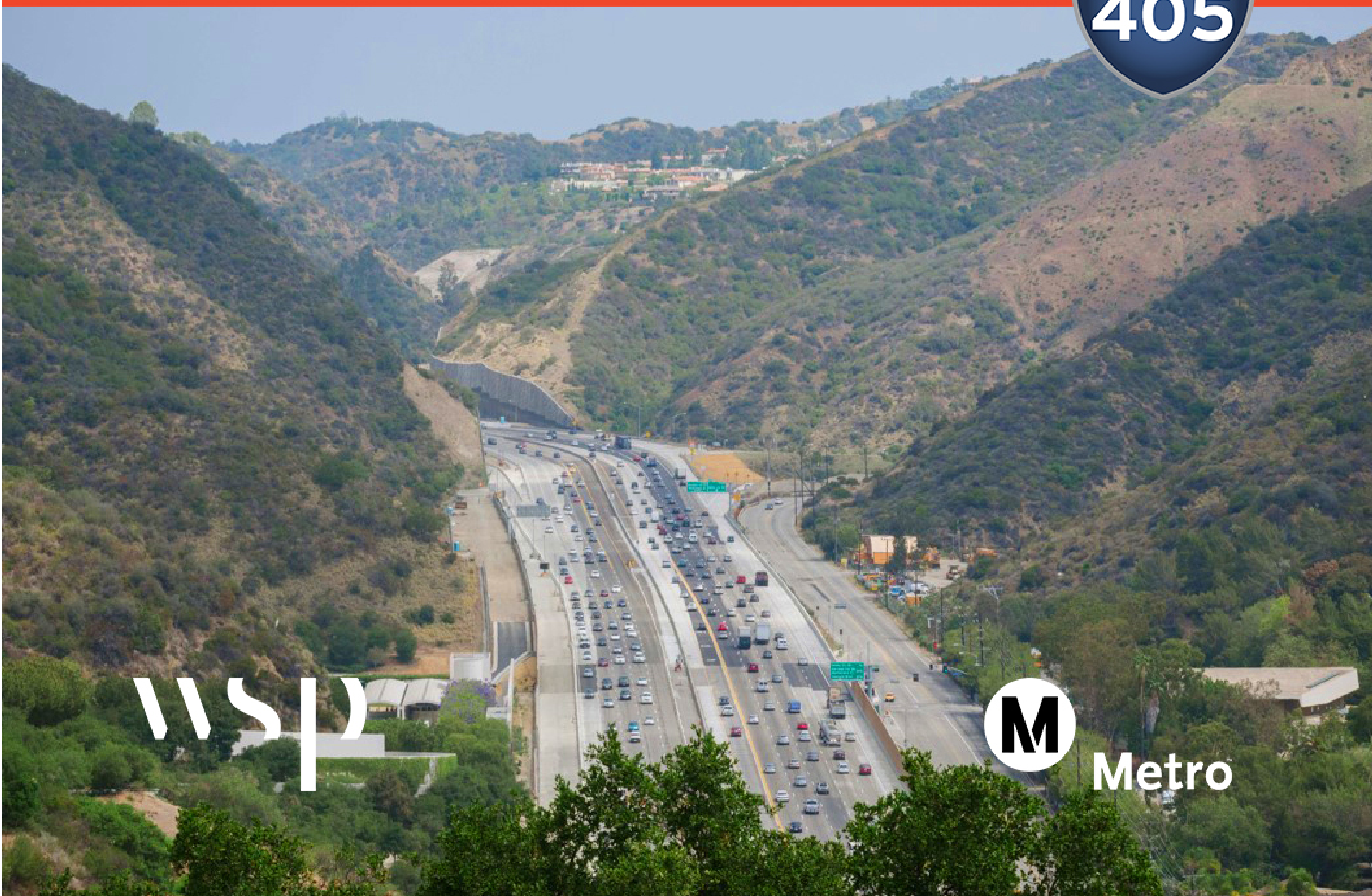
Los Angeles County
Metropolitan Transportation Authority

Interstate 405 (Sepulveda Pass) ExpressLanes Intermediate (Level II) Traffic & Revenue Study

FINAL REPORT

April 15, 2019



Interstate 405 (Sepulveda Pass) ExpressLanes Intermediate (Level II) Traffic & Revenue Study

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Table of Contents

1.0 EXECUTIVE SUMMARY .... ES-Error! Bookmark not defined.

1.1 Overview .... ES-Error! Bookmark not defined.

1.2 Methodology of T&R Study .... ES-Error! Bookmark not defined.

1.3 Stated Preference Survey .... ES-Error! Bookmark not defined.

1.3.1 Community Opinions ES-3

1.3.2 Level of Service ES-5

1.3.3 Person Throughput ES-5

1.3.4 Travel Times ES-7

1.3.5 Travel Speeds .... ES-Error! Bookmark not defined.

1.3.6 Weekday Toll Rates, Traffic and Revenue ES-7

1.3.7 Annual Potential Gross Toll Revenues ES-8

1.3.8 Annual Net Revenue Projections .... ES-Error! Bookmark not defined.

1.4 Next Steps ES-13

2.0 INTRODUCTION 1

2.1 Background and Objectives 1

2.2 Project Location and Regional Context 3

2.3 Previous and Related Studies 6

2.4 Study Approach 8

3.0 CURRENT CORRIDOR CHARACTERISTICS 10

3.1 Existing Highway System 10

3.2 Historical Traffic Trends 14

3.3 Traffic Demand Profile 16

3.3.1 Average Weekday Traffic 16

3.3.2 Day-of-Week / Daily Variations 21

3.4 Corridor Performance 23

3.4.1 Vehicle-Hours of Delay 23

3.4.2 Travel Times 26

3.5 Vehicle Classification and Occupancy 29

3.6 Congestion Analysis 32

3.6.1 Bottlenecks Analysis 32

3.6.2 HOV Ingress/Egress Location Analysis 36

4.0 STATED PREFERENCE SURVEY RESULTS 39

4.1 Survey Methodology 39

4.1.1 Sampling Plan 39

4.1.2 Survey Design 40
4.2 Survey Results Analysis 41
4.2.1 Respondent Travel Profile 41
4.2.2 Opinions on Congestion Pricing 48
4.2.3 Respondent Demographic Profile 54
4.3 Value of Time Estimation 58
4.3.1 Methodology 58
5.0 SOCIO-ECONOMIC GROWTH REVIEW 62
5.1 County Control Total Adjustments 62
5.2 Key Development Area Allocations 65
5.3 Socio-Economic Growth Findings 68
6.0 MODEL DEVELOPMENT & METHODOLOGY 70
6.1 SCAG TDM Base Year Validation 70
6.2 Rapid Toll Optimization Model (RapidTOM) 72
7.0 TOLL SCENARIOS MODELED 74
7.1 Toll Scenario Variables 76
7.1.1 Lane Configuration 76
7.1.2 Access Method 76
7.1.3 Toll Policy 79
7.1.4 HOV Toll Exemptions 80
7.1.5 Toll Operating Objectives 80
7.2 Toll Scenarios Considered and Selected 80
8.0 CORRIDOR TRAFFIC PERFORMANCE 82
8.1 Future No-Build Traffic Projection 82
8.2 Future Toll Scenario Traffic Projection 84
8.2.1 Estimated Weekday Demand 84
8.2.2 Express Lane Traffic Share 91
8.2.3 Express Lane LOS Breach 92
8.2.4 Travel Time Analysis 93
8.2.5 Travel speeds analysis 96
9.0 ESTIMATED WEEKDAY MODEL RESULTS 98
9.1 Context and Findings from the Weekday Model Outputs 98
9.2 Weekday Revenue and Trips by Time-Period for 2025 99
9.3 Weekday Daily Revenue by Scenario and Toll Operating Objective Case for 2025 107
9.4 Typical Toll Rates 112

9.5 Comparison to Existing ExpressLanes Toll Rates 115
10.0 ANNUAL GROSS TOLL TRAFFIC & REVENUE FORECASTS 116
10.1 Weekday-to-Annual Forecast Expansion 116
10.2 Traffic and Revenue Forecast Horizon 2024-60 117
10.3 Annual T&R Forecast Ramp-Up Adjustments 119
10.4 Annual Traffic and Potential Gross Toll Revenue 120
11.0 ANNUAL NET TOLL REVENUE FORECASTS 126
11.1 Gross-to-Net Toll Revenue Process 126
11.2 Revenue Adjustments and Costs Analyzed 128
11.2.1 General Assumptions 128
11.2.2 Leakage 128
11.2.3 Credit card fees 129
11.2.4 Toll Collection O&M Costs 129
11.2.5 Facility O&M Costs 130
11.2.6 Repair and Replacement (R&R) Costs 130
11.3 Net Revenue Forecast Results 130
11.3.1 Cases With Net Revenues Less Than Zero 131
11.3.2 Effects of HOV Occupancy Exemptions 131
12.0 TOLL SCENARIO VARIABLE SENSITIVITY TESTS 148
12.1 Sensitivity Test Results 148
12.1.1 Sensitivity Test Results for Scenario F2-z | Dual Lane 148
12.1.2 Sensitivity Test results for Scenario B2-z | Single Lane 152
12.1.3 Sensitivity Test Results - Additional Analysis 156
13.0 KEY TRAFFIC & REVENUE FINDINGS 161
13.1 Level of Service 161
13.2 Travel Times 161
13.3 Travel Speeds 162
13.4 Weekday Toll Rates, Traffic and Revenue 162
13.5 Annual Potential Gross Toll Revenues 164
13.6 Annual Net Revenue Projections 164
14.0 NEXT STEPS 169
14.1 Project Development Process 169

List of Tables

Table 1-1: Toll Rate Comparison: I-110 ExpressLanes vs. I-405 Sepulveda Pass (2025) ... ES-**Error! Bookmark not defined.**
Summary Table: All Scenarios in Years 2025 and 2040 Under the Objective of Optimized Mobility ES-12
Table 2-1: Previous and Related Studies 6
Table 3-1: Study Area List of On- and Off-Ramps by Direction 12
Table 3-2: HOV Ingress and Egress Locations by Direction 14
Table 3-3: I-405 Northbound Hourly GP and HOV Volumes 18
Table 3-4: I-405 Southbound Hourly GP and HOV Volumes 19
Table 3-5: Day-of-Week Variation Index on I-405 Northbound 22
Table 3-6: Day-of-Week Variation Index on I-405 Southbound 22
Table 3-7: I-405 Vehicle Classification Summary 30
Table 4-1: Sample Size Targets by Geographic Region 40
Table 4-2: Cost and Time-Savings Options 40
Table 4-3: Model Value of Time Estimation Results 59
Table 4-4: Estimated Values of Time (2015$/hr) 60
Table 5-1: SCAG Region 2015 Socioeconomic Data Forecast 63
Table 5-2: SCAG Region Compound Average Growth Rates (CAGR) 63
Table 6-1: VOT by Vehicle Class (2016$) 73
Table 8-1: 2040 No Build Daily Traffic Forecast 82
Table 8-2: Future No-Build Average Hourly Traffic Forecast – Northbound 83
Table 8-3: Future No-Build Average Hourly Traffic Forecast – Southbound 83
Table 8-4: 2025 I-405 ExpressLane Traffic Share 91
Table 8-5: 2040 I-405 ExpressLane Traffic Share 92
Table 8-6: Express Lane LOS Breach 93
Table 9-1: Typical Toll Rates per Mile in 2025 and 2040 – Single Lane Scenario Cases 113
Table 9-2: Typical Toll Rates per Mile in 2025 and 2040 – Dual Lane Scenario Cases 114
Table 9-3: Toll Rate comparison: I-110 ExpressLanes vs. I-405 Sepulveda Pass 115
Table 10-1: Traffic and Revenue Expansion Factors 117
Table 10-2: Future Inflation Assumptions 118
Table 10-3: Traffic and Revenue Ramp-Up Factors 119
Table 10-4: 2025 and 2040 Gross Revenues for Selected Scenarios | Year of Collection Dollars 121
Table 10-5: 2025 and 2040 Gross Revenues for Selected Scenarios | Constant 2016 Dollars 122
Table 11-1: O&M Cost and Revenue Adjustment 127
Table 11-2: 2025 and 2040 Net Revenues for Selected Scenarios | Year of Collection Dollars 133
Table 11-3: 2025 and 2040 Net Revenues for Selected Scenarios | Constant 2016 Dollars 134
Table 11-4: Scenario B2-z Net Revenue Results 137
Table 11-5: Scenario B3-z Net Revenue Results 139
Table 11-6: Scenario E2-z Net Revenue Results 141
Table 11-7: Scenario F1-z Net Revenue Results 143
Table 11-8: Scenario F2-z Net Revenue Results 145
Table 11-9: Scenario F2-z Net Revenue Results 147

List of Figures

Figure 1-1: Toll Scenarios Selected for Detailed Analysis ....ES-**Error! Bookmark not defined.**
ES Figure 1-1: Gross Toll Revenue in 2040 ....ES-9
Figure 1-2: Net Revenue Projections by Scenario ....ES-**Error! Bookmark not defined.**
Figure 2-1: Project Location 4
Figure 2-2: Existing I-110/I-10 ExpressLanes and Proposed I-405 Express Lanes 5
Figure 2-3: Modeling Variables Generating Different Toll Scenarios 9
Figure 3-1: I-405 Freeway Existing Lane Configurations 11
Figure 3-2: HOV Ingress and Egress Locations by Direction 13
Figure 3-3: I-405 Corridor AADT (2005-2014) 15
Figure 3-4: I-405 AADT Trends 16
Figure 3-5: I-405 ADT Map 17
Figure 3-6: I-405 Northbound On- and Off-Ramp ADT 20
Figure 3-7: I-405 Southbound On- and Off-Ramp ADT 21
Figure 3-8: I-405 All General-Purpose Lanes Vehicle-Hours of Delay by Day of Week 23
Figure 3-9: I-405 HOV Lane Vehicle-Hours of Delay by Day of Week 24
Figure 3-10: I-405 General Purpose Lane Vehicle-Hours of Delay by Hour of Day 25
Figure 3-11: I-405 HOV Lane Vehicle-Hours of Delay by Hour of Day 26
Figure 3-12: Average General-Purpose Lane Travel Time – Northbound 27
Figure 3-13: Average HOV Lane Travel Time – Northbound 27
Figure 3-14: Average General-Purpose Lane Travel Time – Southbound 28
Figure 3-15: Average HOV Lane Travel Time – Southbound 28
Figure 3-16: I-405 Vehicle Occupancies 31
Figure 3-17: I-405 Northbound Speed Contours 33
Figure 3-18: I-405 Southbound Speed Contours 35
Figure 3-19: I-405 Northbound HOV & GP Lane #1 Speed Contours 37
Figure 3-20: I-405 Southbound HOV & GP Lane #1 Speed Contours 38
Figure 4-1: Number of Survey Respondents by Home Zip Code 42
Figure 4-2: Most Frequently Traveled Freeways in addition to I-405 43
Figure 4-3: Reported Frequency of using I-405 between US-101 and I-10 44
Figure 4-4: Travel Purpose of Trips on I-405 45
Figure 4-5: Travel Mode of Trips on I-405 45
Figure 4-6: Distance Traveled on I-405 by Trip Purpose 46
Figure 4-7: Morning Trip Departure Time 47
Figure 4-8: Afternoon Trip Departure Time 47
Figure 4-9: Perception of Freeway Traffic by Morning Trip Departure Time 48
Figure 4-10: Perception of Freeway Traffic by Afternoon Trip Departure Time 49
Figure 4-11: Frequency of Using Carpool Lanes by Mode of Travel 50
Figure 4-12: Opinion on the News about Express Lanes 51
Figure 4-13: Comparison of Understanding of Express Lanes between Two Groups 51

Figure 4-14: Respondents Suggested Action on Very Congested Freeways 52
Figure 4-15: Would You Change Your Opinion Knowing How the Funds Will Be Used? 53
Figure 4-16: Support for Different Uses of Express Lane Revenues 54
Figure 4-17: Age and Gender 55
Figure 4-18: Age Distribution of Survey Respondents and Sampling District Population 55
Figure 4-19: Education Level 56
Figure 4-20: Ethnicity 56
Figure 4-21: Household Income 57
Figure 4-22: Household Income of Survey Respondents and Sampling District Population 57
Figure 4-23: Sample Stated Preference Choice Exercise 58
Figure 6-1: Model Development Process 70
Figure 7-1: Modeling Variables Generating Different Toll Scenarios 74
Figure 7-2: Toll Scenario Variable Values and Combinations 75
Figure 7-3: Existing Access Locations 77
Figure 7-4: More Restricted Access Locations 78
Figure 7-5: Existing and Proposed Toll Policies Collectively Tested 79
Figure 7-6: Toll Scenarios Selected for Detailed Analysis 81
Figure 8-1: 2040 Peak Hour Traffic Volumes – Single Lane – Mobility Optimization 85
Figure 8-2: 2040 Peak Hour Traffic Volumes – Dual Lane – Mobility Optimization 85
Figure 8-3: 2040 Peak Hour Traffic Volumes – Single Lane – Revenue Maximization 86
Figure 8-4: 2040 Peak Hour Traffic Volumes – Dual Lane – Revenue Maximization 86
Figure 8-5: 2040 Peak Hour Person Throughput – Single Lane – Mobility Optimization 87
Figure 8-6: 2040 Peak Hour Person Throughput – Dual Lane – Mobility Optimization 88
Figure 8-7: 2040 Peak Hour Person Throughput – Single Lane – Revenue Maximization 89
Figure 8-8: 2040 Peak Hour Person Throughput – Dual Lane – Revenue Maximization 90
Figure 8-9: 2040 Peak-Hour Travel Times – Single Lane 94
Figure 8-10: 2040 Peak-Hour Travel Times – Dual Lane 95
Figure 8-11: 2040 Peak-Hour Travel Speeds – Single Lane 96
Figure 8-12: 2040 Peak-Hour Travel Speeds – Dual Lane 97
Figure 9-1: Scenario B2 – Weekday Daily Results Summary – 2025 101
Figure 9-2: Scenario B3 – Weekday Daily Results Summary – 2025 102
Figure 9-3: Scenario E2 – Weekday Daily Results Summary – 2025 103
Figure 9-4: Scenario F1 – Weekday Daily Results Summary – 2025 104
Figure 9-5: Scenario F2 – Weekday Daily Results Summary – 2025 105
Figure 9-6: Scenario F3 – Weekday Daily Results Summary – 2025 106
Figure 9-7: Summary – Daily Revenue 2025 – Maximum Revenue 108
Figure 9-8: Summary – Daily Revenue 2025 – Optimized Mobility 108
Figure 9-9: Summary – Daily Trips 2025 – Maximum Revenue 109
Figure 9-10: Summary – Daily Trips 2025 – Optimized Mobility 109
Figure 9-11: Summary – Daily Revenue 2040 – Maximum Revenue 110
Figure 9-12: Summary – Daily Revenue 2040 – Optimized Mobility 110
Figure 9-13: Summary – Daily Trips 2040 – Maximum Revenue 111
Figure 9-14: Summary – Daily Trips 2040 – Optimized Mobility 111

Figure 10-1: Scenario B2 Toll & Exempt Trips | Gross Toll Revenue Results 123
Figure 10-2: Scenario B3 Toll & Exempt Trips | Gross Toll Revenue Results 123
Figure 10-3: Scenario E2 Toll & Exempt Trips | Gross Toll Revenue Results 124
Figure 10-4: Scenario F1 Toll & Exempt Trips | Gross Toll Revenue Results 124
Figure 10-5: Scenario F2 Toll & Exempt Trips | Gross Toll Revenue Results 125
Figure 10-6: Scenario F3 Toll & Exempt Trips | Gross Toll Revenue Results 125
Figure 11-1: Net Revenue Waterfall 126
Figure 11-2: Potential Net Revenues | Balance of Mobility & Revenue Scenarios 135
Figure 11-3: Scenario B2 Net Revenue Results 136
Figure 11-4: Scenario B3 Net Revenue Results 138
Figure 11-5: Scenario E2 Net Revenue Results 140
Figure 11-6: Scenario F1 Net Revenue Results 142
Figure 11-7: Scenario F2 Net Revenue Results 144
Figure 11-8: Scenario F3 Net Revenue Results 146
Figure 12-1: Reference Point F2-z 2025 Scenario Variable Comparison 149
Figure 12-2: Reference Point F2-z 2040 Scenario Variable Comparison 151
Figure 12-3: Reference Point B2-z 2025 Scenario Variable Comparison 153
Figure 12-4: Reference Point B2-z 2040 Scenario Variable Comparison 155
Figure 12-5: Dual Lane Scenario Sensitivity Analysis – 2025 Summary Table 157
Figure 12-6: Single Lane Scenario Sensitivity Analysis – 2025 Summary Table 158
Figure 12-7: Dual Lane Scenario Sensitivity Analysis – 2040 Summary Table 159
Figure 12-8: Single Lane Scenario Sensitivity Analysis – 2040 Summary Table 160
Figure 13-1: Net Revenue Projections by Scenario 165

List of Appendices

APPENDIX A - STATED PREFERENCE SURVEY RESPONDENTS CHARACTERISTICS ANALYSIS TECHNICAL MEMORANDUM

APPENDIX B - MODEL VALIDATION/CALIBRATION AND FORECASTING METHODOLOGY TECHNICAL MEMORANDUM

APPENDIX C - METRO EXPRESSLANES TOLL POLICY

APPENDIX D - TOLL RATE TABLES

APPENDIX E - NET TOLL REVENUE TABLES

DISCLAIMER

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Information and statements contained in this report are based on input and data provided to WSP by, and obtained from, Metro, Metro's consultants, WSP's subconsultants, Caltrans, and other sources. In the preparation of this report and the opinions contained herein, WSP makes certain assumptions with respect to conditions that may exist or events that may occur in the future that are subject to change.

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This report does not constitute a recommendation on the part of WSP or its subconsultants.

1. EXECUTIVE SUMMARY

1.1. OVERVIEW

The purpose of this Traffic and Revenue (T&R) study is to develop preliminary traffic and revenue forecasts for Phase 1 of the proposed I-405 express lanes on I-405 between U.S. 101 and I-10 in an effort to provide the Metro Board a reasonable basis for informed decision making. The study provides long-term traffic and revenue forecasts in the corridor for several different scenarios including a range of alternative lane configurations, access treatments, and toll policies. In summary, the objectives for this study are to:

1. Develop preliminary traffic and revenue forecasts for express lanes on I-405 Sepulveda Pass;
2. Test a wide range of potential toll rates and toll exemption policies;
3. Estimate total annual toll and toll-free trips in the express lanes along with gross toll revenue potential; and
4. Forecast net toll revenues to determine if revenues are sufficient to cover anticipated operations and maintenance (O&M) costs, and if so, roughly how much might be expected to be left over to contribute to capital funding via pay-as-you-go (pay-go) or debt financing.

The I-405 Sepulveda Pass corridor between US-101 and I-10 includes 4-6 general purpose (GP) lanes, with the southbound having 4 and the northbound having 5 for the great majority of the corridor segment, and a single high occupancy vehicle (HOV) lane in each direction, which currently experience high levels of congestion and degraded conditions. In addition to the mainline features, the 10-mile corridor contains 16 interchanges in the northbound direction, with 14 individual on-ramps and 12 off-ramps, and in the southbound direction, with 14 interchanges including 12 on-ramps and 11 off-ramps. These interchange features combined with several locations where lanes are reduced, can lead to excessive merging and weaving that contributes to the formation of bottlenecks, traffic flow breakdown, and periods of heavy congestion. The existing HOV lanes along the corridor contain 18 ingress and egress points in total. The corridor experiences higher than average traffic volumes regularly exceeding 300,000 vehicles per day, resulting in major weaving conflicts in both the HOV lane and the adjacent GP lanes causing significant traffic congestion.

Congestion on the I-405 Sepulveda Pass corridor leads to significant delay. GP lane vehicle hours of delay (VHD) range from about 20,000 daily VHD to more than 27,000 daily VHD, depending on day of the week. Delay in the single HOV lane in each direction ranges from 2,600 daily VHD to 4,400 daily VHD.

1.2. METHODOLOGY OF T&R STUDY

The highest overall peak hour throughput shown under the dual express lanes (HOV2+) scenario estimates 7,845 persons northbound and 5,949 southbound through the corridor.

The Southern California Association of Governments (SCAG) regional model and a separate toll optimization tool (RapidTOM) were used to develop forecasts for express lane toll paying customers and toll-free HOVs under different tolling operations and policy scenarios for two forecast years, 2025 and 2040.

The 2016 SCAG Regional Travel Demand Model (RTDM) was chosen for this study because it is the most recently validated model in the region with the ability to forecast express lane volumes. RapidTOM is then used to post-process the SCAG RTDM outputs to more thoroughly test different pricing rates and objectives, and to determine how tolls influence the distribution of traffic between the GP and priced express lanes.

A stated preference survey, conducted in 2015, collected opinions from existing corridor users. The results of the survey were used to help estimate corridor user values of time (VOT) as an indicator of the willingness to pay tolls for travel time savings and reliability. VOTs were segmented by income group and vehicle class.

Forecasts for overall corridor and express lane use are also related to the growth in population and employment in the region. In LA County, households are expected to grow by 0.6% per year and employment by 0.7% per year through 2040. Within the six county SCAG region, Orange, Riverside and San Bernardino Counties have higher employment growth rates, and Riverside and San Bernardino Counties also have slightly higher population growth rates in comparison to Los Angeles County.

Five key variables — lane configuration, access method, toll policy, HOV toll exemptions, and toll operating objective — were identified for defining and assembling different toll scenarios of interest for this study.

Six scenarios were selected for detailed traffic and revenue analysis using varying combinations of the five variables listed above. The scenarios analyzed are shown in **Figure 1-1**.

Figure 1-1: Toll Scenarios Selected for Detailed Analysis

Scenario	Lane Configuration	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objectives		
B2	Single Express Lane	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
B3	Single Express Lane	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
E2	Dual Express Lanes	Existing HOV Access	Existing / Proposed Toll & Discount Policies	HOV 3+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
F1	Dual Express Lanes	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
F2	Dual Express Lanes	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
F3	Dual Express Lanes	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue

1.3. STATED PREFERENCE SURVEY

The regional travel demand and toll optimization modeling yielded a range of traffic operations and revenue related performance measures. These performance measures provided the basis for detailed evaluation of the selected toll scenarios. The results and findings of the detailed evaluation are summarized as follows.

1.3.1. COMMUNITY OPINIONS

Approximately half of the users surveyed were making a work or school commute trip, and only one-third were traveling for social or recreational purposes. However, when presented with the express lanes concept, half of the respondents preferred adding express lanes to currently congested freeways to improve conditions, with another quarter of respondents undecided. Even among those who expressed a negative attitude to tolling, close to half of them eventually preferred express lanes over doing nothing after learning about how express lanes work.

A stated preference survey was completed to determine the value of time for the traffic and revenue modeling. The results present a descriptive analysis of the survey responses, including survey respondents' demographics, trip characteristics, and respondents' attitudes towards express lanes.

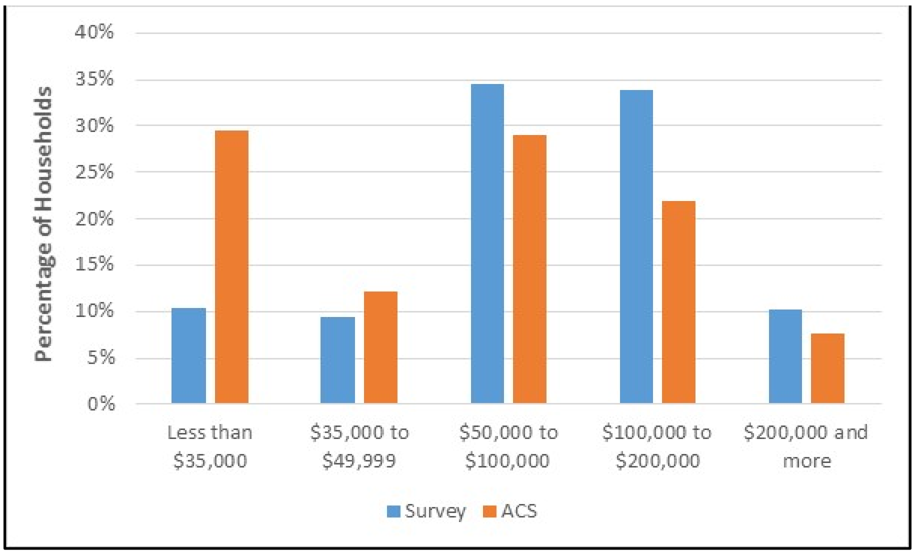
The survey sampled respondents that reside west of the I-110 and SR-2, ranging from Lancaster in the north to Long Beach in the south. The majority of the survey respondents live close to either I-405 or US-101. The zip code with the most survey responses recevied is located south of downtown Santa

Monica. Respondents were prescreened to ensure they traveled on I-405 at least once every two weeks.

With respect to the demographics of the 1,556 respondents, a majority (65 percent) were non-Hispanic white, 14 percent were Hispanic, 12 percent were Asian, 5 percent were African American, and 4 percent were from other ethnicity groups, including Native American, Middle Eastern and multiracial groups.

Figure 4-22 shows the comparison of household income distribution between survey respondents and all the households within the Sepulveda Pass corridor as identified by the American Community Survey (ACS) in the 2014 5-year release. On average, survey respondents exhibited higher household income than the ACS population in the Sepulveda Pass. A majority of the respondents, almost 70%, have household incomes in the range of $50,000 to $200,000.

Figure 4-22: Household Income of Survey Respondents and Sampling District Population



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Although almost half (49 percent) of the respondents said their purpose for travel is for work, only 18 percent of the respondents used I-405 five days a week. Survey respondents were then asked questions to gauge their opinions about traffic conditions on Los Angeles freeways. The majority of respondents stated that traffic conditions on LA freeways are often or always bad (nearly 80 percent). Only a small percentage (less than 2 percent) thought traffic conditions are often good or always good.

Overall, 50 percent of the survey respondents chose the option of adding express lanes to currently congested freeways, whereas 22 percent chose to continue the status quo. The remaining 28 percent selected “don’t know” or “refuse to answer”. Not surprisingly, people with neutral or positive attitudes towards tolling tend to choose the use of express lanes over maintaining the status quo in high numbers. Interestingly, even among those who expressed a negative attitude to tolling, close to half of them prefer express lanes over doing nothing (or other, unspecified solutions), after learning about how express lanes work.

1.3.2. LEVEL OF SERVICE

Under the baseline No Build condition with the existing HOV2+ toll policy, the I-405 HOV lanes are forecasted to have degraded level of service during portions of the AM peak period in the southbound direction, and during portions of the PM peak period in the northbound direction. Similar level of service (LOS) degradation is expected to be observed under any toll scenario operating with a peak period HOV2+ exemption.

LOS degradation / breaches occur under HOV2+ toll exempt scenarios during the AM and PM peak periods in select segments.

LOS degradation / breaches occur on select segments of the corridor only under HOV2+ toll exemption operations, and typically, but not exclusively, during the AM and PM peak periods. Scenario E2 with dual express lanes operating with an HOV3+ toll exemption and employing a policy whereby HOV2 vehicles and clean air vehicles would receive a 50% toll discount during peak periods is also expected to have some LOS degradation in the AM peak period.

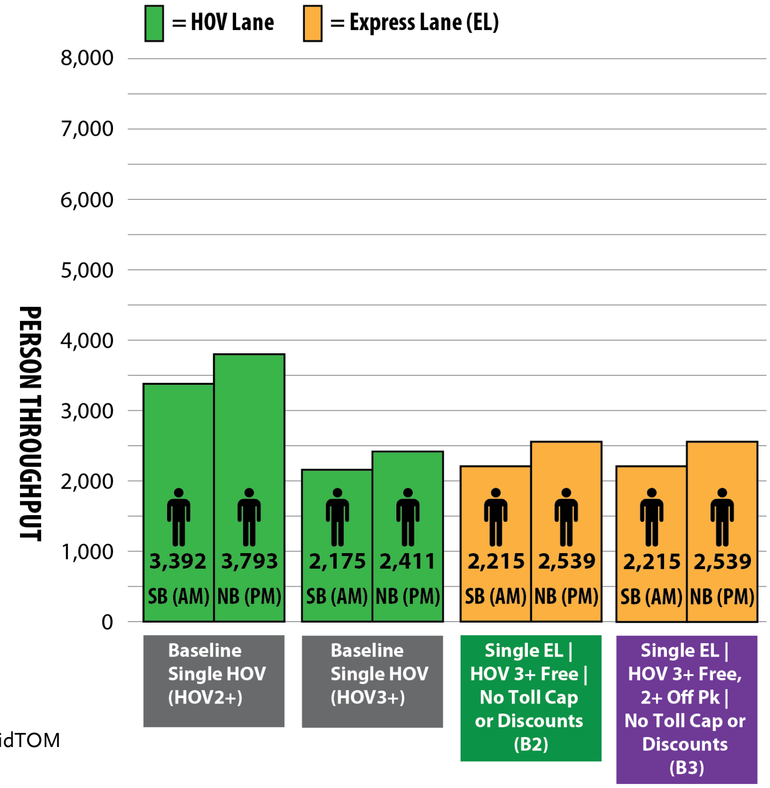
1.3.3. PERSON THROUGHPUT

The highest overall peak hour throughput shown under the dual express lanes (HOV2+) scenario estimates 7,845 persons northbound and 5,949 southbound.

In analyzing person throughput for the various toll scenarios, occupancy policy is the primary factor impacting person throughput.

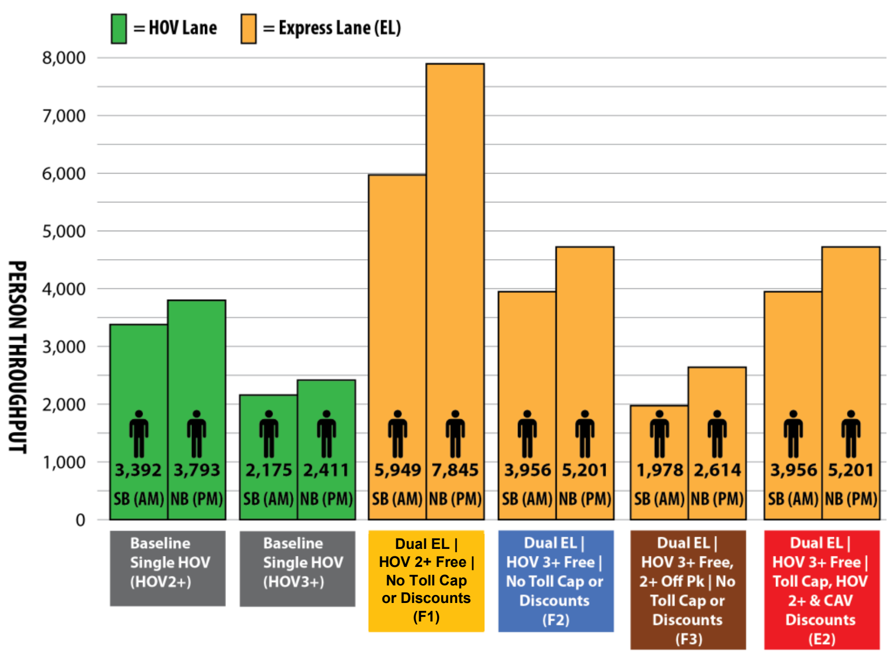
Because of the high percentage of HOV2 vehicles currently using the HOV lanes, the baseline single HOV2 scenario has the highest passenger throughput. Increasing occupancy requirements from HOV2 to HOV 3+ or HOV3 peak/HOV 2 off peak results in a shift in HOV2 vehicles from the HOV to GP lanes and a corresponding decrease in passenger throughput as shown in **Figure 8-5**. With the additional capacity in the dual express lanes scenarios, the person throughput is higher than the baseline single HOV or single ExpressLanes in almost all scenarios. The highest overall peak hour throughput is the dual express lanes (HOV2+) scenario, with 7,845 persons northbound and 5,949 southbound as shown in **Figure 8-6**.

Figure 8-5: 2040 Peak Hour Person Throughput – Single Lane – Mobility Optimization



Source: RapidTOM

Figure 8-6: 2040 Peak Hour Person Throughput – Dual Lane – Mobility Optimization



Source: RapidTOM

1.3.4. TRAVEL TIMES

Currently, the travel times in the HOV lanes are approximately the same when compared to the GP lanes. With the implementation of express lanes travel time can be about 9-11 min for the length for the corridor, while travel times in GP lanes may be decreased by as much as 15 minutes when compared to a single HOV 2+ baseline condition. The travel time savings offered by express lanes are greatest under the no maximum toll/no discounts scenarios, which conversely results in the highest GP lane travel times.

The travel time savings offered by express lanes in 2040 are greatest under the HOV 3+ and HOV 3+ peak/2+ off peak scenarios, as HOV 2+ vehicles are not allowed free access and are forced to use GP lanes which result in the longest GP lane travel times. In addition, the revenue maximization objective provides a travel time advantage over the mobility optimization objective in the ExpressLanes, as less travelers are willing to pay higher cost to use the express lanes. HOV 2+ and Clean Air Vehicle discounts also have a significant impact on travel time, as scenarios without any discounts (F2 and F3) result in the highest speed and shortest travel time in the ExpressLanes but the lowest speed and longest travel time in the GP lanes. It is also worth noting that, relative to baseline conditions, all scenarios under the mobility optimization objective are shown to improve southbound GP lane travel times by 15 to 20 minutes.

1.3.5. TRAVEL SPEEDS

Under current conditions, the average HOV lane travel speed in the corridor is only 25 to 35 mph in the peak period and direction, which is below the 45 mph operating standard for HOV lanes. If the existing HOV 2+ lane is converted to a single express lane operating at HOV 3+ at least in the peak periods, or widened to include dual express lanes, travel speeds are anticipated to improve to at least 59 mph under all six toll scenarios, with the greatest express lane travel speeds offered by the dual express lanes HOV 3+ scenario under the revenue maximization objective. In addition, GP lane travel speeds are expected to improve or remain consistent with the future no build scenarios with speeds between 34 mph and 53 mph during the southbound AM peak and between 26 mph and 46 mph during the northbound PM peak depending on the toll operating objective under all express lanes operations.

GP Lane travel speeds are expected to improve or remain consistent with the future no build under all express lanes operations scenarios.

1.3.6. WEEKDAY TOLL RATES, TRAFFIC AND REVENUE

Applying the maximum toll in accordance with the current Metro ExpressLanes Toll Policy (revised January 20, 2016) has a minimal impact on revenue projections, especially in the dual lane scenarios. Rather, it is policies that provide discounts for selected user groups (e.g., clean air vehicles and/or HOV 2 carpools when an HOV 3+ exemption is in effect) that increases express lane demand thereby reducing overall revenue despite causing toll rates to increase.

The I-405 Sepulveda Pass Scenario which is characterized by dual express lanes with existing HOV access locations, no maximum tolls, an HOV 2+ toll-exempt policy in the peak periods, and a toll operating objective that seeks the balance of mobility and revenue, which is most similar to the I-110 ExpressLanes, yield the following toll rates as shown in **Table 1-1**.

Table 1-1: Toll Rate Comparison: I-110 ExpressLanes vs. I-405 Sepulveda Pass (2025)

Corridor & Time Period	110 NB	405 SB	110 SB	405 NB
AM per Mile	$1.16	$0.98	$0.41	$0.38
PM per Mile	$0.45	$0.61	$0.78	$0.65
AM Total Trip	$12.76	$9.80	$4.51	$3.80
PM Total Trip	$4.95	$6.10	$8.58	$6.50

*Toll rates are expressed in current (2016) dollar values.

Toll rates for the total corridor trip (11 miles) on the I-110 ExpressLanes range from $4.51 in the AM Peak SB to $12.76 in the AM Peak NB in current (2016) dollar values. Toll rates for the total corridor (10 miles) on the I-405 Sepulveda Pass express lanes in 2025 range from $3.80 in the AM Peak NB to $9.80 in the AM Peak SB in current (2016) dollar values.

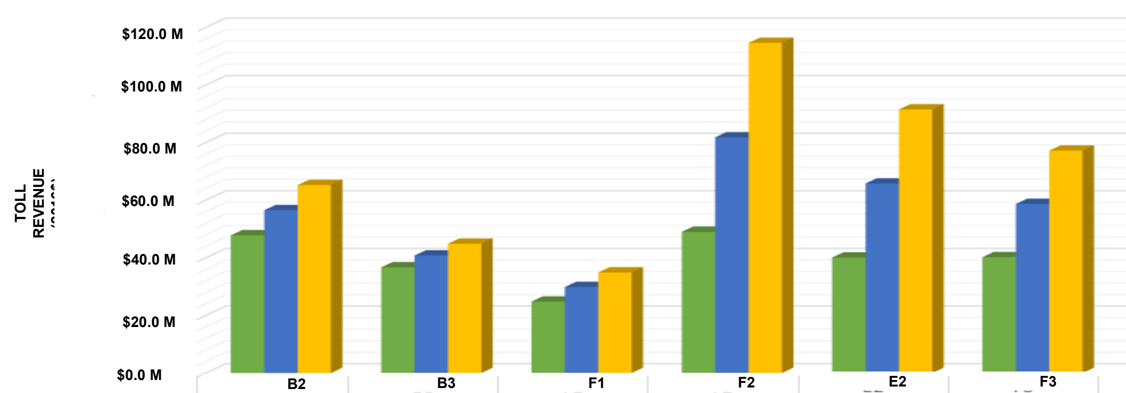
The expected I-405 Sepulveda Pass toll rates per mile in 2025 for the toll operating objective that balances mobility and revenue, when expressed in constant 2016 dollars, are very similar to and in most cases lower than those currently being experienced on the I-110.

1.3.7. ANNUAL POTENTIAL GROSS TOLL REVENUES

Potential gross toll revenues (revenue before operations and maintenance expenses, transaction costs, enforcement, and administration) in year 2025 (in year of collection dollars) range from about $14.3 M to $31.4 M across the range of scenarios under the mobility optimization tolling objective, and from $19.8 M to $72.9 M across scenarios under the maximum revenue tolling objective. By 2040 (**ES Figure 1-1**), the year of collection dollar revenue across the tolling operating objectives range from about $24.8 M to $49.0 M for mobility optimization, and from $34.9 M to $114.6 M for revenue maximization. The dual express lane scenario with an HOV 2+ exemption policy generated the lowest amount of revenue, while the dual lane and single lane scenarios with an HOV 3+ policy at all times provided the highest and second highest amount of revenue, respectively.

Gross Toll revenues in 2040 range from $63 M to $196 M depending on toll operating objective

ES Figure 1-1: Gross Toll Revenue in 2040



	B2	B3	F1	F2	E2	F3
Optimize Mobility	$47.8 M	$36.7 M	$24.8 M	$49.0 M	$40.1 M	$40.2 M
Avg of Optimal Mobility and	$56.5 M	$40.8 M	$29.8 M	$81.8 M	$65.8 M	$58.7 M
Maximum Revenue	$65.3 M	$44.9 M	$34.9 M	$114.6 M	$91.5 M	$77.2 M
Lane Configuration	Single	Single	Dual HOT	Dual HOT	Dual HOT	Dual HOT
Toll – HOV:	Full Toll	Full Toll	Free	Full Toll	50% Toll	Full Toll
Toll – HOV3+	Free	Free	Free	Free	Free	Free

1.3.8. ANNUAL NET REVENUE PROJECTIONS

Revenue adjustments associated with estimated costs of facility operations and maintenance, toll collection, initial implementation period, enforcement, leakage, and violations were accounted for in each of the six scenarios for each of the three toll operating objectives. **Figure 1-2** illustrates the net revenue projections for the six toll scenarios under the balance of mobility and revenue toll operating objective.

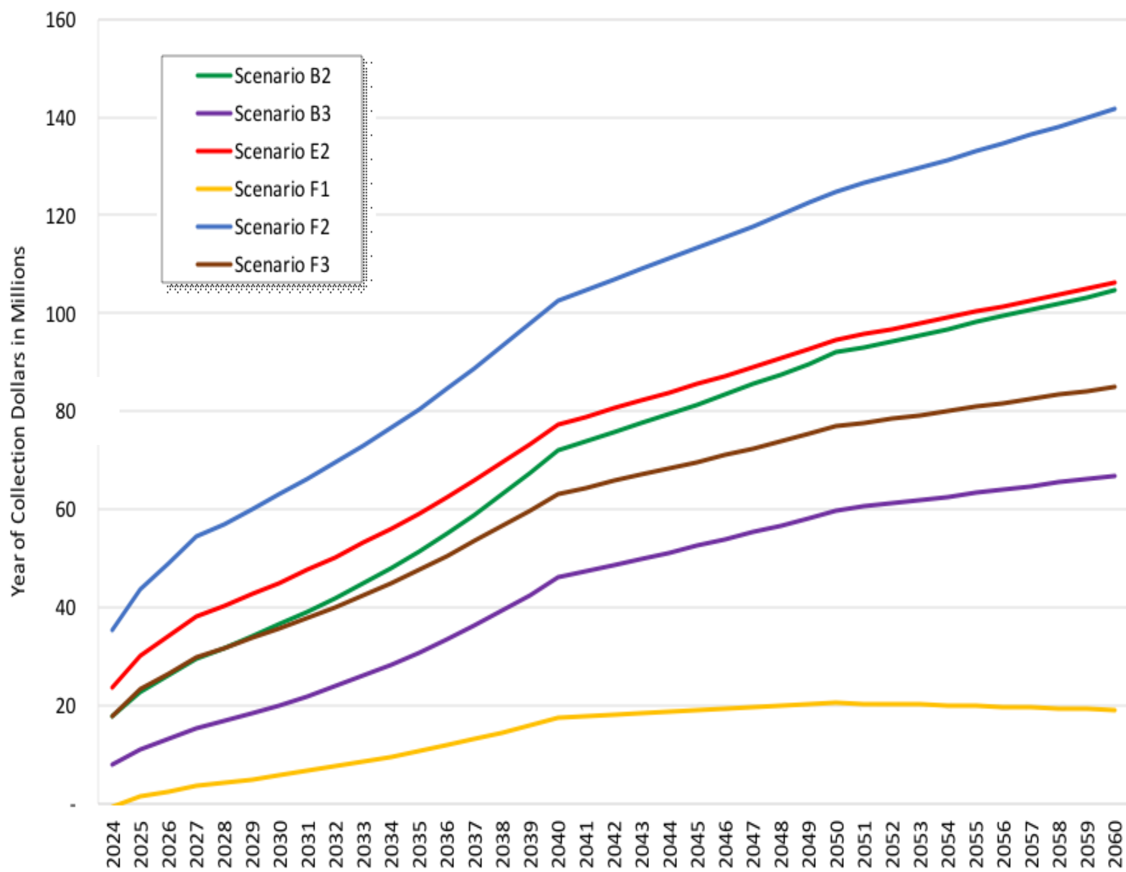
> **HOV occupancy exemption policy is, by far, the most significant determinant of net revenues among the six selected scenarios.**

As shown in the figure, Scenario F1, which pairs dual express lanes with an HOV 2+ exemption policy, demonstrates negative net toll revenues in the first year of operations. This scenario generally results in the greatest number of total trips in the express lanes and therefore the highest total transaction costs. Furthermore, toll-free trips under an HOV 2+ policy outnumber toll trips by a factor of up to nearly 5:1 depending on the operating objective, thereby reducing revenues, and when combined with the higher facility maintenance costs of dual lanes, the results reflect expenditures exceeding revenues for a period of one (1) to nine (9) years.

Scenario F2, which pairs dual express lanes with an HOV 3+ exemption policy, when operating under the maximum revenue objective, is projected to generate net revenues in excess of $154 million in 2040. Shifting to the other bookend, the optimized mobility operating objective, Scenario F2 is projected to achieve $48 million in net revenues in 2040, with the balance of mobility and revenue objective in the middle at about $101 million in 2040 as shown in **Figure 1-2**.

The hybrid Scenario set of F3, which employs an HOV 2+ exemption at off-peak times and an HOV 3+ exemption during peak periods, yields net revenues that fall in-between the HOV 2+ and HOV 3+ exemption cases, but slightly closer to the higher HOV 3+ exemption case.

Figure 1-2: Net Revenue Projections by Scenario



Summary Table: All Scenarios in Years 2025 and 2040 Under the Objective of Optimized Mobility

Year	Scenario	Lane Configuration (single or dual express lane)	Toll Policy (unconstrained dynamic pricing or existing/ proposed toll & discount policies)	HOV Toll Exemption (2+ or 3+)	Peak Travel Time (min)		Peak Speed (mph)		Gross Annual Toll Revenue (2016 $ in millions)
					HOV / ExpressLane(s)	General Purpose Lanes	HOV / ExpressLane(s)	General Purpose Lanes	
Bold indicates travel in the **AM** which is **southbound** and *italics* indicates travel in the *PM* which is *northbound*									
2016	**Existing**	N/A	N/A	N/A	N/A	N/A	**35** *25*	**43** *27*	N/A
2025	**Baseline**	N/A	N/A	N/A	HOV 2+: **10** / *9* HOV 3+ **9** / *9*	HOV 2+: **21** / *19* HOV 3+ **25** / *21*	N/A	N/A	N/A
2040	**Baseline**	N/A	N/A	N/A		HOV 2+: **40** / *23* HOV 3+ **46** / *26*	N/A	N/A	N/A
2025	**B2**	Single	Unconstrained	3+	**10** *10*	**↓6 (19)** *↓4 (17)*	**↑31 (66)** *↑35 (60)*	**↑4 (47)** *↑14 (41)*	**23.6**
	B3	Single	Unconstrained	2+ Off-Peak / 3+	**10** *10*	**↓6 (19)** *↓4 (17)*	**↑ 30 (65)** *↑34 (59)*	**↑9 (52)** *↑16 (43)*	**17.0**
	E2	Dual	Existing	3+	**11** *10*	**↓4 (21)** *↓2 (19)*	**↑ 34 (69)** *↑38 (63)*	**↑7 (50)** *↑16 (43)*	**25.1**
	F1	Dual	Unconstrained	2+	**11** *10*	**↓1 (20)** *↓2 (17)*	**↑ 34 (69)** *↑38 (63)*	**↑10 (53)** *↑19 (46)*	**14.3**
	F2	Dual	Unconstrained	3+	**10** *10*	**↓3 (22)** *↓2 (19)*	**↑ 34 (69)** *↑39 (64)*	**↑5 (48)** *↑14 (41)*	**31.4**
	F3	Dual	Unconstrained	2+ Off-Peak / 3+	**10** *10*	**↓3 (22)** *↓2 (19)*	**↑ 34 (69)** *↑38 (63)*	**↑10 (53)** *↑19 (46)*	**25.1**
2040	**B2**	Single	Unconstrained	3+	**11** *10*	**↓17 (29)** *↓6 (20)*	**↑24 (59)** *↑29 (54)*	**↓1 (42)** *↑10 (37)*	**47.8**
	B3	Single	Unconstrained	2+ Off-Peak / 3+	**11** *10*	**↓17 (29)** *↓6 (20)*	**↑24 (59)** *↑29 (54)*	**↓1 (42)** *↑10 (37)*	**36.7**
	E2	Dual	Existing	3+	**11** *10*	**↓19 (27)** *↓8 (18)*	**↑29 (64)** *↑33 (58)*	**↓1 (42)** *↑12 (39)*	**40.1**
	F1	Dual	Unconstrained	2+	**11** *10*	**↓15 (25)** *↓5 (18)*	**↑ 31 (66)** *↑34 (59)*	**— (43)** *↑13 (40)*	**24.8**
	F2	Dual	Unconstrained	3+	**11** *10*	**↓20 (26)** *↓6 (20)*	**↑ 31 (66)** *↑34 (59)*	**↓4 (39)** *↑9 (36)*	**49.0**
	F3	Dual	Unconstrained	2+ Off-Peak / 3+	**11** *10*	**↓20 (26)** *↓6 (20)*	**↑ 31 (66)** *↑34 (59)*	**↓1 (42)** *↑9 (36)*	**40.2**

Existing, baseline, and proposed tolling scenarios are listed in the **Summary Table**. The proposed scenarios' speeds and travel times were compared against the 2016 existing and 2025/2040 baseline values, respectively. Scenario F1 analyzed a HOV 2+ occupancy policy and therefore was compared against the HOV 2+ baselines, whereas the other scenarios analyzed a HOV 3+ or HOV 3 peak/2 off peak so they were compared against an HOV 3+ baseline. In the table, a green arrow denotes faster speeds or shorter travel times, a yellow dash means there was no change, and a red arrow denotes slower speeds and/or longer travel times. The number next to the arrow is the difference between the proposed scenario's value and the existing or baseline condition. The number in parentheses is the forecasted speed or travel time.

Overall, build scenarios show an improvement in speeds for both lanes. While GP lane speeds are better than HOV lane speeds under current conditions, if ExpressLane(s) is/are implemented, speeds would improve in both GP and ExpressLanes. An exception to this is in the year 2040, where GP lane speeds either stayed the same or decreased slightly in the southbound direction. Speeds in the ExpressLane(s) would increase by about 30mph in both directions in years 2025 and 2040. In 2025, GP lane speeds would increase by about 10mph in the both directions. In 2040, in the northbound direction, speeds increase by 10.5mph.

As most speeds increase, travel times decrease in the GP lanes for both years. Travel times decrease about 10 minutes in 2025 and 2040. The largest travel time savings occurs in the year 2040 during AM peak, at about 18 minutes. Travel times on ExpressLanes were not compared against the baseline because the variation was too small to make a useful comparison. The difference between the proposed scenarios' ExpressLanes travel times and that of the baseline was just 1 – 2 minutes.

Overall, implementing any of the toll policies would improve driving conditions for both ExpressLanes and GP lane drivers in 2025 and 2040, with the exception of AM peak on the GP lanes in 2040.

1.4. NEXT STEPS

This study provides preliminary information on the feasibility of express lanes through the I-405 Sepulveda Pass. Although the study provides information to gauge the viability of express lanes on the I-405, more detailed investigation, analysis and design are required as part of a project development process.

The Project Approval/Environmental Document (PA/ED) process may also indicate the need for an investment grade traffic and revenue study (Level 3) to be completed depending on the project funding package proposed by the project sponsor. Specifically, the award of a TIFIA loan, bonding mechanisms, or private financing would all require a more detailed traffic and revenue analysis.

Once a locally preferred alternative is approved and the PA/ED process is completed, the project would enter a Final Design phase, including the preparation of detailed design plans, specifications, and estimates (PS&E) necessary for construction. If necessary, right-of-way acquisition, legal agreements, and permitting would also take place concurrent to final design. An investment grade traffic and revenue study may include, but not be limited to, the following additional, project-specific efforts:

- Updated and expanded stated preference survey / value of time study that focuses on Sepulveda commuters
- Additional trip origin-destination survey / data collection
- Independent, detailed socio-economic (population and employment) forecasts
- Additional traffic data collection on volumes and travel times by time of day, direction and vehicle class
- Updated travel demand modeling, augmented with more refined operational analysis (microsimulation) and toll simulation/optimization/diversion analysis

2.0 INTRODUCTION

This report documents the analysis and results of an intermediate (Level II) Traffic and Revenue (T&R) study performed for proposed tolled express lanes along the Sepulveda Pass section of Interstate 405 (I-405) in Los Angeles County. The study covers a range of express lane scenarios and was prepared for the Los Angeles County Metropolitan Transportation Authority's (Metro) Congestion Reduction Department by WSP in 2017. Much of the information included in this report was submitted previously in technical memoranda and other interim documents. This report groups together and summarizes all aspects of the study, and presents traffic and revenue forecasts for the proposed express lanes under six different toll scenarios, each of which was examined for a range of toll operating objectives.

The study builds upon prior studies conducted in the corridor and considered the planned capacity expansion as tolled express lanes, using variable toll rates which would be dynamically set based on changing levels of traffic demand and congestion in each travel direction. For purposes of estimating traffic and revenue, the study assumed both the conversion of the existing high-occupancy vehicle (HOV) lanes to single express lanes in both the northbound and southbound directions of the I-405, as well as the addition of a second express lane in each direction that would extend about 10 miles from the US-101 to I-10 Freeways. Currently, the HOV lanes along this stretch of the I-405 experiences very degraded to extremely degraded conditions, according to the 2016 California High-Occupancy Vehicle Lane Degradation Determination Report, prepared by Caltrans[1]. By federal definition, an HOV lane is considered degraded if the average speed of traffic during morning or evening weekday peak commute hour periods is less than 45 miles per hour (mph) for more than 10 percent of the time over a consecutive 180-day period.

While not officially intended for use in direct support of actual project financing, the study was conducted with a detailed level of effort surpassing that of many intermediate T&R studies, including a comprehensive traffic data collection program, review of growth forecasts, a stated preference survey to assess user values-of-time, and model validation and calibration efforts. These tasks were included in this intermediate-level study to provide sufficiently reliable results for Metro to make informed decisions on toll policy, project configurations, and funding alternatives. Most of these elements will need to be updated or further refined as part of a future investment-grade (Level III) traffic and revenue study, to be conducted closer to the actual time of project financing and applied to a preferred toll scenario, as necessary.

2.1 BACKGROUND AND OBJECTIVES

In November 2012, Metro completed a Sepulveda Pass Systems Planning Study[2] that defined broad concepts and financial strategies for possible highway and transit options for a 30-mile corridor area between Sylmar and Los Angeles International Airport (LAX). Among the system concepts proposed was the implementation of express lanes along the I-405 Freeway. The Systems Planning Study considered improvements that would extend up to 30 miles between the northern San Fernando Valley and LAX; however, the study found that the highest levels of congestion relief

[1] 2016 California High-Occupancy Vehicle Lane Degradation Determination Report (October 2017), prepared by Caltrans.

[2] Metro Sepulveda Pass Systems Study - Final Compendium Report (November 2012), prepared by Parsons Brinckerhoff.

could be achieved by constructing an initial highway project in the 10-mile Sepulveda Pass segment between the US-101 and the I-10 Freeways.

Since the 2012 Study, Metro has considered the phased implementation of capacity improvements within the Sepulveda Pass Corridor starting with the proposed conversion of the existing HOV lanes to express lanes, which is anticipated to generate sufficient toll revenue to help subsidize the construction of a high-capacity rail tunnel. This was the recommendation of the 2015 Sepulveda Pass Corridor Financial Strategy, prepared by Sperry Capital[3]. The report recommended several next steps, including the exploration of alternative project delivery methods, a need for more project definition and an approach to securing environmental approvals.

The Measure R Expenditure Plan set aside $1 billion to the Sepulveda Pass corridor. And in November 2016, Los Angeles County voters approved Measure M — a new half-cent sales tax transportation measure. The Sepulveda Pass Corridor is part of the Measure M expenditure plan, broken down into three phases, with approximately $9.7 billion in total funding. Phase 1, with $260 million in funding, includes implementation of express lanes on the I-405 between the US-101 and I-10 with an opening date of Fiscal Year (FY) 2026. Phase 2, with approximately $5.7 billion in funding, includes a fixed-guideway transit service between the San Fernando Valley and the Westwood area of Los Angeles, with an opening year of FY 2033. Phase 3, with approximately $3.8 billion in funding, involves extending the Phase 2 project southward to Los Angeles International Airport (LAX), with an opening year of FY 2057.

As of this writing, Metro is conducting a Transit Feasibility Study to identify and evaluate a range of high-capacity transit concepts to serve this congested I-405 corridor with possible connections to the Metro Orange Line, the Metro Purple Line, the Metro Expo Line, and LAX. The purpose of this Transit Feasibility Study is to evaluate transit options for Phases 2 and 3 only.

The purpose of this T&R study is to develop preliminary traffic and revenue forecasts for the Phase 1 proposed I-405 express lanes in order to provide a reasonable basis for informed decision making by the Metro Board. The study also provides long-term traffic and revenue forecasts in the corridor for several different scenarios covering a range of alternative lane configurations, access treatments, and toll policies. In summary, this study's objectives are to:

1. Develop preliminary traffic and revenue forecasts for express lanes on I-405 Sepulveda Pass;
2. Test a wide range of potential toll rates and toll exemption policies;
3. Estimate total annual toll and toll-free trips in the express lanes along with gross toll revenue potential; and
4. Forecast net toll revenues to determine if revenues are sufficient to cover anticipated O&M costs, and if so, roughly how much might be expected to be left over to contribute to capital funding via pay-as-you-go (pay-go) or debt financing.

It is also worth noting that Metro is seeking ways to expedite project delivery of the Sepulveda Pass improvements. Through Metro's Office of Extraordinary Innovation, the agency has received unsolicited Public-Private Partnership (P3) proposals to accelerate the preferred ultimate

[3] Metro Sepulveda Pass Transit Corridor Financing Strategy (2015), prepared by Sperry Capital, Inc.

improvement in the corridor. This T&R study will provide useful traffic and toll revenue information to inform those discussions.

2.2 PROJECT LOCATION AND REGIONAL CONTEXT

The I-405 is a major north-south interstate highway in southern California, approximately 73 miles in length, running along the southern and western parts of the Greater Los Angeles Area from Irvine in the south to near San Fernando in the north. I-405 is generally aligned parallel to and west of Interstate 5. The entire route is known as the northern segment of the San Diego Freeway.

The I-405 Freeway is ranked as one of the most traveled urban highways in the nation. Sections of it are traversed by approximately 300,000 vehicles per day. According to the Federal Highway Administration, that number is expected to grow by nearly 50 percent to 447,000 by 2025. INRIX's 2015 Traffic Scorecard ranks seven sections of the I-405 among the top 300 most congested corridors in the country.

The I-405 corridor is the only major north-south freeway within the densely populated areas between West LA and Downtown LA, crossing the Santa Monica Mountains and connecting the San Fernando Valley and the LA basin. The Sepulveda Pass segment is generally the most congested portion of the I-405 corridor due to the trip generation effects of high population density in the area and proximity to several employment centers located in West LA (i.e., Santa Monica, UCLA, Veterans Administration, Westwood), exacerbated by the steep grades over the Santa Monica Mountains affecting capacity and traffic performance. In addition, its interchanges with US-101 and with I-10, each consistently rank among the five most congested freeway interchanges in the United States.

In May 2014, Metro and Caltrans completed the Sepulveda Pass Improvements Project, which added an HOV lane in the northbound direction and associated changes to freeway entrances, exits, and underpasses along a 10-mile stretch through the Sepulveda Pass between the I-10 and US-101. That capacity was quickly consumed by the high-level of latent traffic demand in the corridor, and soon after opening of the HOV lanes the facility began to experience degraded performance with speeds routinely falling below 45 mph during the peak periods.

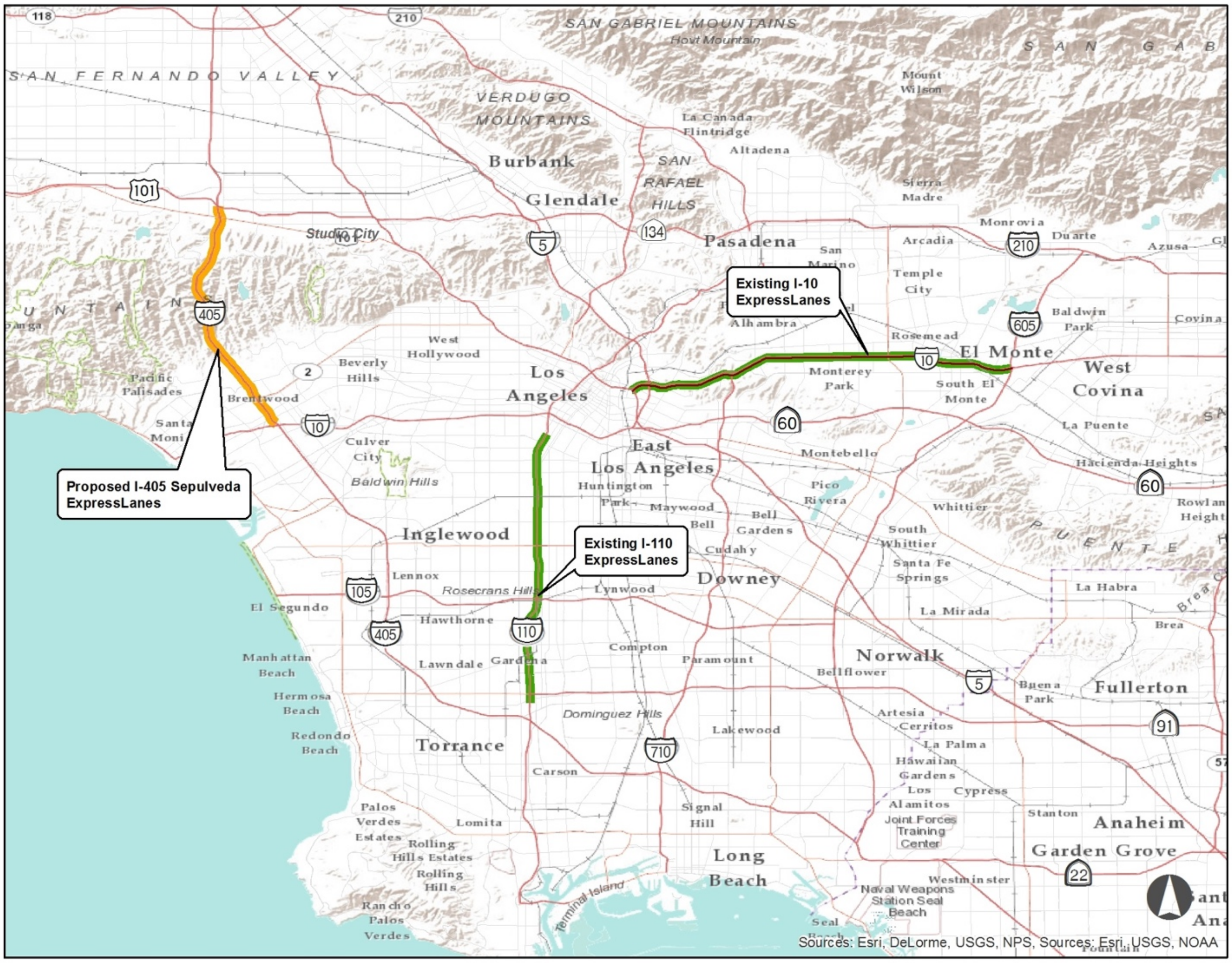
Figure 2-1: Project Location

Source: WSP, 2017

For analysis purposes, the proposed I-405 express lanes would extend between the US-101 interchange to the north and the I-10 interchange to the south, a distance of about 10 miles (see **Figure 2-1**). It is important to note that no engineering or detailed traffic analysis has been conducted to-date to determine the logical termini and project terminus, which will be the subject of future studies. The purpose for this study was to determine the toll traffic and revenue potential for this heavily congested segment.

Figure 2-2 shows the location of the proposed I-405 express lanes in relation to the two existing express lanes currently operated by Metro (i.e., the I-110 and I-10 ExpressLanes south and east of downtown LA, respectively). It is anticipated the proposed I-405 express lanes would be operated in a similar fashion to the existing express lanes feeding into downtown Los Angeles, although it would not connect directly to the I-110 and I-10 ExpressLanes. Furthermore, the proposed I-405 express lanes project is also included as a Tier 1 project in Metro's 2017 Countywide ExpressLanes Strategic Plan and the adopted SCAG 2016 Regional Transportation Plan/Sustainable Communities Strategy. Therefore, the I-405 express lanes constitute an important part of the existing and planned regional network of express lanes throughout southern California.

Figure 2-2: Existing I-110/I-10 ExpressLanes and Proposed I-405 Express Lanes



Source: WSP, 2017

2.3 PREVIOUS AND RELATED STUDIES

Recently, Metro, Caltrans, SCAG, the sub-regional Council of Governments, and the City of Los Angeles have all initiated some type of transit or roadway improvements study touching on the Sepulveda Pass Corridor. However, a long-term solution that includes a high-capacity transit system and tolled highway solution within the Sepulveda Pass Corridor remains to be determined. **Table 2-1** highlights the major studies and actions that have been completed to-date.

Table 2-1: Previous and Related Studies

Studies/Actions	Issues Covered
Metro I-405 Level II Traffic and Revenue Study (Ongoing)	Development of an Intermediate Level 2 Traffic and Revenue Study for the potential implementation of express lanes on Interstate 405 (I-405) Sepulveda Pass Corridor between Interstate 10 (I-10) and US Highway 101 (US 101). The study seeks to identify potential toll revenue for various alternatives related to the project by developing preliminary traffic and revenue forecasts for the potential express lanes, estimating total annual gross toll revenue potential and testing alternative lane configurations, access, tolling and HOV discount scenarios, and determining if net revenues are sufficient to cover anticipated capital and O&M costs. This report represents the culmination of this study effort.
SCAG I-405 Master Plan (Ongoing)	SCAG, in coordination with Metro, OCTA, and Caltrans Districts 7 and 12, is developing a long-range I-405 Corridor Master Plan (spanning approximately 73 miles from I-5 in Los Angeles County to I-5 in Orange County). This Master Plan is intended to serve as a blueprint to provide recommended guidance on integrating transportation improvements and strategies underway along the corridor to meet county and regional needs.
City of Los Angeles Westside Mobility Plan (Completed)	The Westside Mobility Plan is a blueprint for transportation planning through 2035. This plan is comprehensive in nature, multimodal in scope, and address required short-, medium- and long-term actions. Further, the plan addresses the land use-transportation connection and is cognizant of climate change initiatives. The study evaluated rail transit options for the Green Line extension, the Lincoln Boulevard and Sepulveda Boulevard corridors, and for other potential connecting corridors.
Los Angeles County Traffic Improvement Plan (Measure M, November 2016)	A new half-cent sales tax transportation measure (Measure M), approved by Los Angeles County voters in November 2016 in part providing billions of dollars to accelerate the Sepulveda Pass project which might lead to a possible opening of the first phase of the project as early as 2026. There are two projects included in the Los Angeles County Traffic Improvements Plan for the Sepulveda Pass Corridor: 1) Sepulveda Pass Corridor (Express Lanes/Busway) (P3 Candidate); and 2) Sepulveda Pass Corridor (Rail) (P3 Candidate).
Metro Sepulveda Pass Transit Corridor Financing Strategy (January 2015)	Evaluation of financing strategies for the Sepulveda Pass Transit Corridor. The report used data from prior studies to outline a funding strategy for developing a multi-modal project that is financially constrained using federal guidance planning criteria. The report examined six options that included a summary of cost estimates potential funding sources. The options ranged in cost from $2B to $29B in year of expenditure dollars.

Studies/Actions	Issues Covered
Sub-Regional Mobility Matrices for San Fernando Valley, Westside Cities, and South Bay Cities (2015)	The Mobility Matrices serve as a starting point for the Metro LRTP, scheduled for adoption in 2018. The Matrices include subregional goals and objectives to guide future transportation investments, including some form of an alternative multimodal linkage from West LA to the SF Valley through the I-405 Sepulveda Pass. The matrices also include multimodal improvement recommendations within those sub-regions.
Metro I-405 Sepulveda Pass Improvements Project Evaluation Study (2015)	Compared traffic flow on the I-405 in the Sepulveda Pass before and after the Sepulveda Pass Improvements Project.
Metro Board Motion #66.1 (2014)	Directed staff, in part, to report on a strategy "to support current acceleration and innovative finance efforts" for three projects, including the Sepulveda Pass Corridor.
Metro/Caltrans I-405 Sepulveda Pass Improvements Project (2014)	Project improved mobility on Sepulveda Pass by adding 10-mile HOV lane on the NB segment between I-10 and US-101, replacing Skirball Center, Sunset, and Mulholland bridges, realigning on/off ramps, widening underpasses and constructing retaining and sound walls.
Metro Sepulveda Pass Corridor P3 Industry Forum (May 2013)	Forum held for civic, business and community leader to examine public-private partnership (P3) funding options for the Sepulveda Pass Corridor Program. Agenda focused on project life-cycle costs and Metro P3 program objectives.
Metro East San Fernando Valley Transit Corridor Study (2013)	Metro, along with the cities of Los Angeles and San Fernando, completed a feasibility study for a major mass transit project that would traverse the northern portion of the Sepulveda Pass Corridor. Alternatives reviewed included: No Build, Curb-running BRT, Median-running BRT, Low-floor Light Rail Transit (LRT)/Tram, and LRT.
Metro Feasibility Study of Converting I-405 HOV Lanes to HOT Lanes between the I-10 and US-101 (2013)	Analyzed the feasibility of converting existing HOV lane(s) on the I-405 between the I-10 and US-101 into HOT lane(s). Key factors reviewed for accessing the feasibility of converting an HOV lane(s) into HOT lanes(s) included constructability (ROW, capital costs); toll revenue potential; transit benefits; and public perception/institutional requirements (tolling authority arrangement).
Metro Sepulveda Pass Corridor Systems Planning Study (2012)	Objectives were to examine what could be done quickly, with little environmental impact and within the Measure R budget to improve travel in the Sepulveda Pass. The study also reviewed longer-term higher capacity solutions.
SCAG Corridor System Management Plan-LA County I-405 Corridor Comprehensive Performance Assessment and Causality Analysis (2009)	Detailed performance and current trends for the I-405 Sepulveda Pass corridor on which future investment decisions can be based.
Metro's Long-Range Transportation Plan (2009)	San Fernando Valley I-405 Corridor Connector (mode TBD) established as one of 12 transit projects awarded funds by Measure R.
Measure R Expenditure Plan (2008)	Identified the San Fernando Valley I-405 Corridor Connector as a medium-term project slated to open in 2039 at a cost of $2.468 B.
Caltrans I-405 Transportation Concept Report (2000)	Identified the ultimate build conditions for the I-405 Freeway. Separates I-405 in LA County into segments, and identifies needed improvements for the next 20 years within each segment based on future demand as estimated at that time.

2.4 STUDY APPROACH

The toll traffic and revenue forecasts prepared for this study are derived from outputs generated from the SCAG Regional Travel Demand Model (SCAG TDM) and ECONorthwest's Rapid Toll Optimization Model (RapidTOM)©. The SCAG TDM was chosen for this study because it is the most recently validated model in the region with the ability to forecast express lane volumes. RapidTOM is then used to post-process the SCAG TDM outputs to more thoroughly test different pricing rates and objectives, and to determine how tolls influence the distribution of traffic between the GP and priced express lanes.

The study began with a review of all prior studies and a comprehensive data collection effort. The data collection was conducted by System Metrics Group, Inc., a sub-consultant to WSP. Existing 2016 base year traffic data was collected for the freeway mainline and ramp locations, including speeds, travel times, vehicle classification and occupancies, accidents, and bottleneck locations. This dataset was used to summarize the current corridor conditions as well as to validate and calibrate the SCAG TDM. WSP also purchased GPS-based origin and destination (OD) travel data from StreetLight Data, a firm that provides "big data" that can be used to understand travel behavior patterns. This data was used to help validate OD trip tables found in the SCAG TDM.

In addition, WSP reviewed the latest socioeconomic land use forecasts provided by SCAG. This review assessed the reasonableness of the updated forecasts, in light of current development activity, land availability and historical trends. Some minor adjustments to the updated SCAG forecasts were suggested and subsequently incorporated into the SCAG TDM for use in developing the traffic projections specifically for this study.

The study also included analysis of stated preference survey data, which were collected for the corridor as part of a separate effort by Metro in 2015. Data were collected using a computer- assisted survey technique, with more than 1,566 surveys completed by sampling households located in one of nine districts comprising the corridor area. The objective of the survey was to identify values of time (VOT) and motorist's willingness to use potential express lanes. Some minor adjustments to the VOT assumptions were made, and incorporated into the SCAG TDM and separate toll optimization process. Specifically, the VOT for all trip purposes except home-based university and home-based school were updated to reflect the average VOTs estimated from the 2015 SP survey, or derived from the stated preference estimates based on typical relationships between home-based work VOTs and VOTs for other trip purposes.

Upon completion of the SCAG TDM validation and calibration, the next step was to generate the non-tolled demand forecasts for the single- and dual-lane baseline conditions for 2025 and 2040 model forecast years, with the express lanes simulated as 2+ occupancy HOV lanes to approximate the maximum volumes that might result from express lane operations with only 3+ carpools to be exempted from tolls. The SCAG TDM provides the overall demand, and resulting traffic conditions, for the entire corridor, considering the lane configuration and capacities, regional population and employment, trip origin-destination patterns and other characteristics, and the conditions on the rest of the regional network.

The outputs from the SCAG TDM, which are divided by five distinct daily time periods, were used to seed RapidTOM and complete the toll optimization process. Specific pricing algorithms, ingress/egress points, occupancy requirement for exemptions, and other related toll policies that can be varied to create different toll scenarios, were simulated at this stage. The outputs from

RapidTOM include toll and toll-free traffic volumes by segment on the express lanes, and toll-free volumes in the GP lanes, both by time period and direction. The express lane volumes are converted to corridor toll and toll-free trips, so as to represent distinct "customers" traveling in the corridor. Additional RapidTOM outputs include revenues, speeds, and level of service (LOS) metrics by time period and direction, including indication of when certain outputs breech a set threshold (e.g., instances where speeds drop below the 45 mph minimum operational speed requirement as prescribed in U.S. Code Title 23, Section 166.)

These data were aggregated to weekday daily figures for a range of traffic and revenue related performance measures, which were then extrapolated to annual traffic and revenue forecasts over a 35+ year forecast horizon.

This T&R study considered a number of physical, toll, and policy variables, shown in **Figure 2-3** below, that collectively comprise 72 different combinations of tolling scenarios. With the exception of lane configuration, which is determined within the SCAG TDM, the simulation and assessment of the impacts of these variables are determined within the toll optimization process. The advantage of the use of combined tools is the ability to test a range of pricing operating objectives (algorithms), exemptions policies, and special toll discounts or premiums by vehicle class.

Figure 2-3: Modeling Variables Generating Different Toll Scenarios

Lane Configuration	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objective
Single Express Lane	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Mobility Optimized
Dual Express Lanes	More Restrictive Access Locations	Existing / Proposed Toll & Discount Policies	HOV 2+ Off-Peak / HOV 3+ Peak	Balance of Mobility & Revenue
			HOV 2+ Exempt	Maximum Revenue

The range of scenarios initially considered and the final six (6) scenarios evaluated across all three toll operating objectives described above, for a total of 18 cases, is described in **Chapter 7.0**.

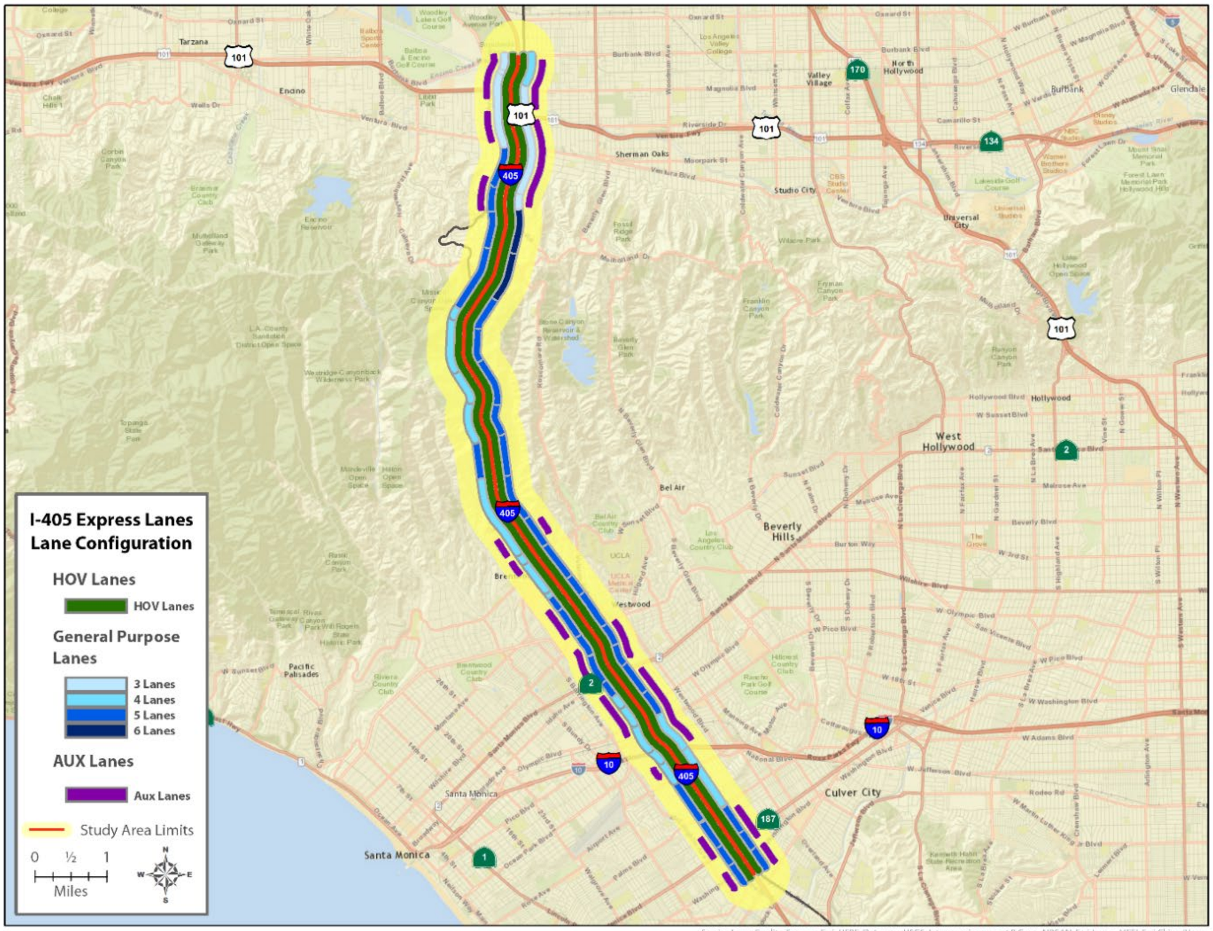
3.0 CURRENT CORRIDOR CHARACTERISTICS

This chapter summarizes existing traffic conditions, travel patterns, traffic operations, and other corridor conditions in the I-405 Sepulveda Pass corridor to better inform the development of the traffic and revenue study. The information provided in this chapter includes a brief description of the highway system, an overview of historical traffic trends along the corridor, and detailed information on current travel demand and traffic operations. Detailed traffic information is summarized for existing traffic volumes, vehicle mile traveled (VMT), travel times, speeds, and vehicle hours of delay (VHD). For traffic operations analysis, the data collected extend a short distance north of the US-101 interchange and south of the I-10 interchange.

3.1 EXISTING HIGHWAY SYSTEM

The current lane configurations along this stretch of the I-405 Freeway is depicted in **Figure 3-1**. The corridor includes multiple general-purpose (GP) lanes and a single high occupancy vehicle (HOV) lane in each direction. The northbound HOV lane was completed in 2014. The number of directional GP lanes generally ranges from 3 to 6 lanes along the corridor. As displayed, there are several locations where lanes are reduced abruptly, which can lead to excessive merging and weaving that often manifests in the formation of bottlenecks, traffic flow breakdown and increased congestion.

Figure 3-1: I-405 Freeway Existing Lane Configurations



Source: System Metrics Group, Inc.

Table 3-1 identifies the interchanges, entrance ramps and exit ramps along the study corridor by direction and milepost. There is a total of 16 interchanges in the northbound direction, with 14 individual entrance ramps and 12 exit ramps. In the southbound direction, there are 14 interchanges including 12 entrance ramps and 11 exit ramps.

Table 3-1: Study Area List of On- and Off-Ramps by Direction

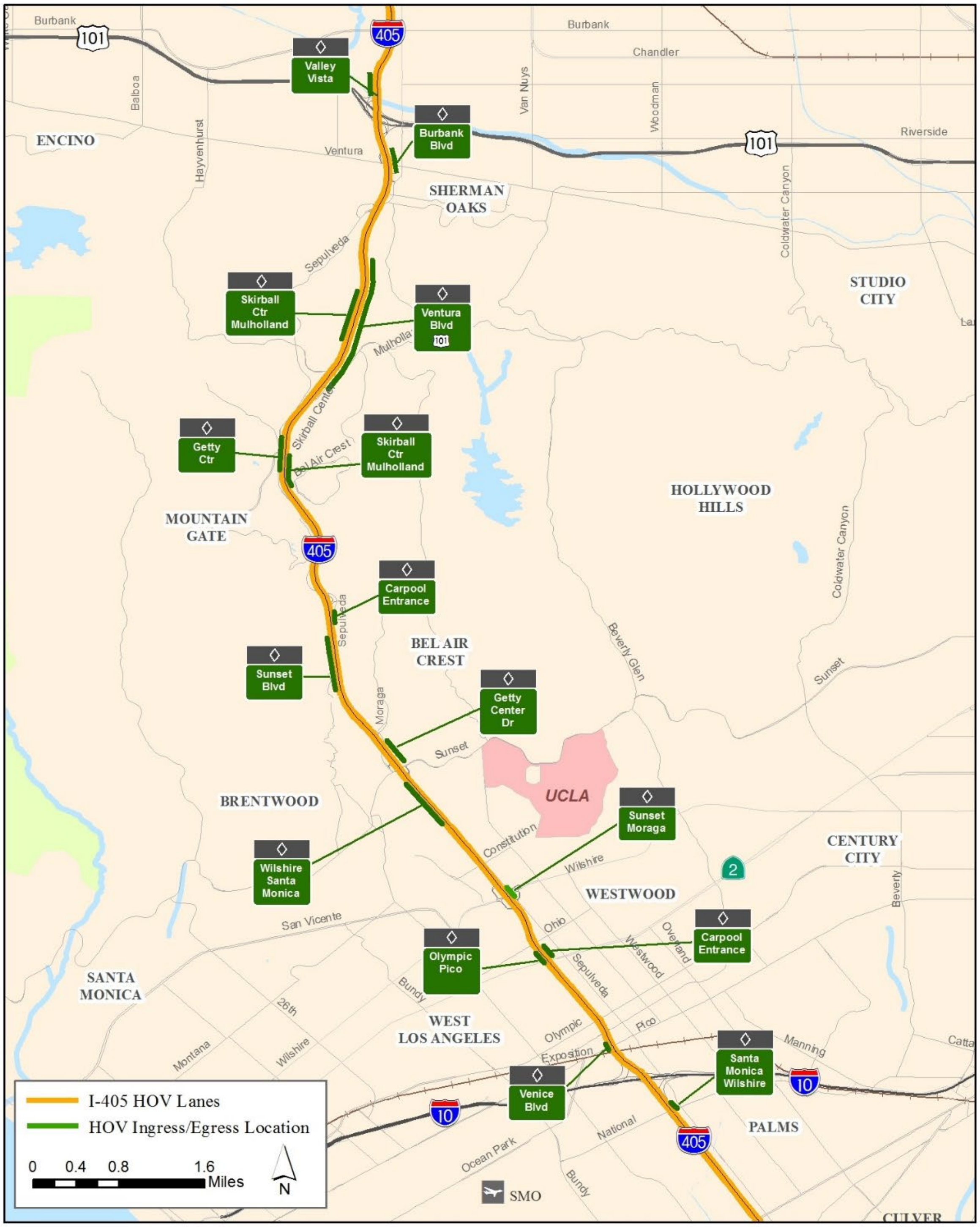
Dir	Ramp Name	Ramp Type	Postmile	
			Abs PM	Ca PM
Northbound	Burbank Blvd	Off	63.9	40.2
	US-101	On (NB)	63.4	39.6
		On (SB)	63.2	39.4
	Ventura/Valley Vista	On	63.0	39.2
	US-101	Off	62.7	38.9
	Ventura Blvd	Off	62.4	38.6
	Skirball Ctr/Mulholland	On	60.8	37.0
		Off	60.5	36.7
	Getty/Sepulveda	On	58.5	34.7
		Off	58.3	34.6
	Moraga Dr	On	57.3	33.5
		Off	57.1	33.3
	Sunset Blvd	On EB	56.8	33.0
		Off	56.6	32.8
	Wilshire Blvd	On	55.5	31.7
		Off	55.1	31.4
	SR-2	On	54.8	31.0
		Off	54.5	30.7
	Olympic/Pico	On	53.9	30.2
	I-10	On (EB)	53.7	29.9
		On (WB)	53.4	29.6
		Off (EB/WB)	52.9	29.1
	National Blvd	Off	52.7	28.9
	Venice/Washington	On	51.6	27.9
		Off	51.5	27.8
	Culver Blvd	On	51.2	27.4

Dir	Ramp Name	Ramp Type	Postmile	
			Abs PM	Ca PM
Southbound	Burbank Blvd	On	63.9	40.1
	US-101	Off	63.5	39.8
	Ventura Blvd	On	62.9	39.1
	Valley Vista/Sepulveda	Off	62.4	38.6
		On	62.0	38.2
	Skirball Ctr/Mulholland	Off	60.6	36.9
		On	60.3	36.5
	Getty Ctr Dr	Off	58.8	35.0
		On	58.4	34.7
	Church/Sunset	Off	56.9	33.1
		On (Church/Sunset)	56.8	33.0
		On (EB)	56.7	32.9
	Wilshire Blvd	Off	55.5	31.7
		On (WB)	55.4	31.6
		On (EB)	55.2	31.4
	SR-2	Off	54.8	31.0
		On	54.5	30.7
	National Blvd	On	52.7	28.9
	I-10	Off	53.7	30.0
	Olympic/Pico	Off	53.9	30.1
	Venice/Washington	Off	51.6	27.9
		On	51.5	27.8
	Washington/Culver	Off	51.2	27.4

Source: System Metrics Group

Figure 3-2 shows the current HOV access locations along the I-405 between US 101 and I-10, while **Table 3-2** details all 18 HOV lane ingress and egress points along the entire study corridor. As shown in the figure, some ingress and egress locations are located in close proximity, which can exacerbate traffic turbulence generated by weaving and increased congestion in both the HOV lane and the adjacent GP lanes.

Figure 3-2: HOV Ingress and Egress Locations by Direction



Source: WSP

Table 3-2: HOV Ingress and Egress Locations by Direction

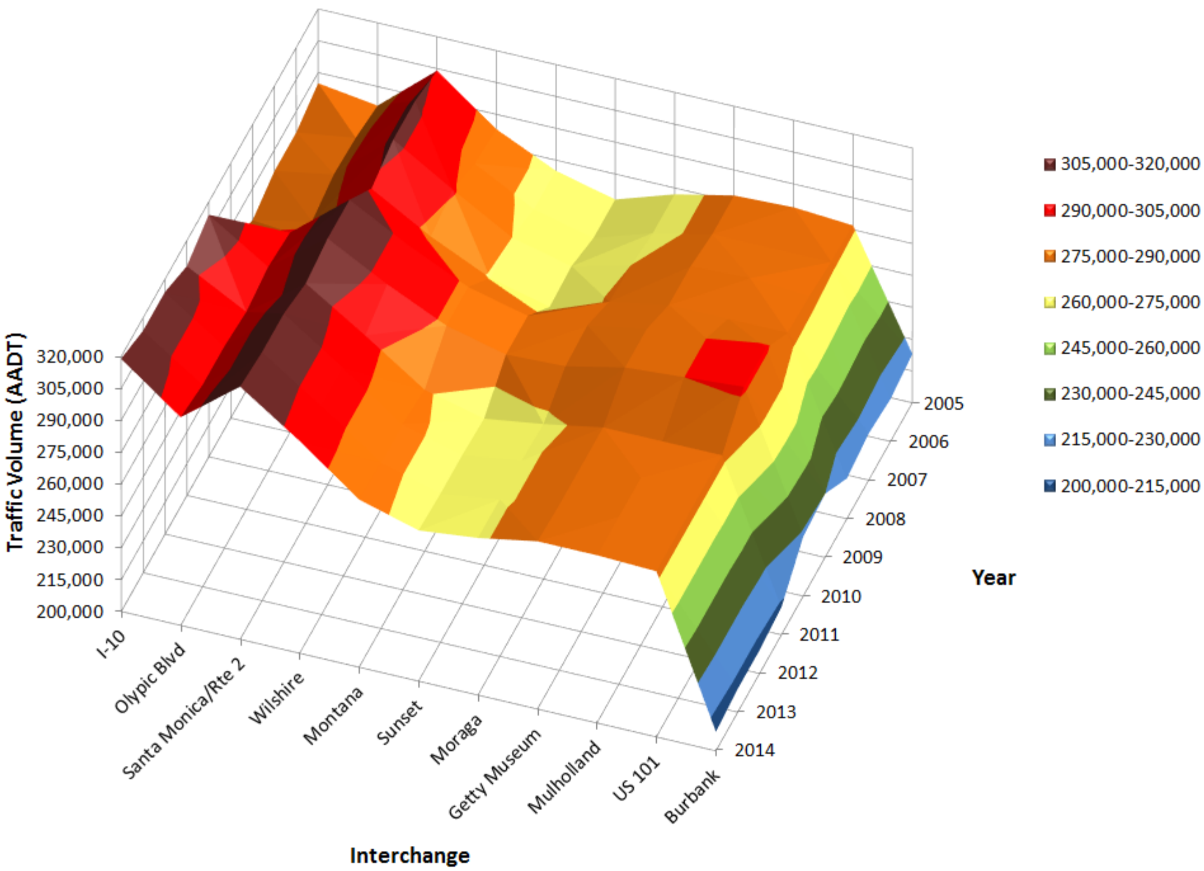
Dir	Loc#	Location Postmiles				Length	Location Description
		Start		End			
		AbsPM	Ca PM	AbsPM	Ca PM		
Northbound	1	53.0	29.2	53.3	29.5	0.2	NB Off to National and just north of I-10 Separation
	2	54.4	30.6	54.7	30.9	0.3	Just north of SR-2/Santa Monica Blvd Off Ramp
	3	55.3	31.5	55.6	31.8	0.3	At Wilshire Blvd Interchange
	4	57.0	33.2	57.5	33.7	0.4	Starts at NB Off to Moraga gore; Ends just north of NB On Fr Moraga
	5	58.2	34.4	58.4	34.6	0.2	Starts just south of Getty/Sepulveda Off and ends just south of Getty On
	6	59.5	35.7	59.9	36.1	0.4	Ends approx. 0.5 mi south of Skirball/Mulholland
	7	60.6	36.8	61.9	38.1	1.3	Starts adjacent to entrance to Skirball Park & Ride and ends adjacent to Briarwood/Deerhorn
	8	62.6	38.8	62.8	39.0	0.2	Near Ventura on-ramp
Southbound	1	63.6	39.8	63.3	39.5	0.3	At SB Off to US101 to just north of US101 WB OC
	2	62.3	38.5	62.0	38.2	0.3	Just south of SB Off to Valley Vista/Sepulveda
	3	60.1	36.3	59.8	36.0	0.2	Starts at Getty/Sepulveda SB On to just north of Getty Center
	4	58.4	34.6	57.6	33.8	0.8	Starts at Getty/Sepulveda On to just north of Getty Center
	5	56.5	32.7	56.0	32.2	0.4	b/n SB On Sunset and SB Off Wilshire
	6	54.8	31.0	54.5	30.7	0.3	At SR-2 Interchange
	7	53.8	30.0	53.5	29.7	0.3	At I-10 Interchange

Source: System Metrics Group, Inc

3.2 HISTORICAL TRAFFIC TRENDS

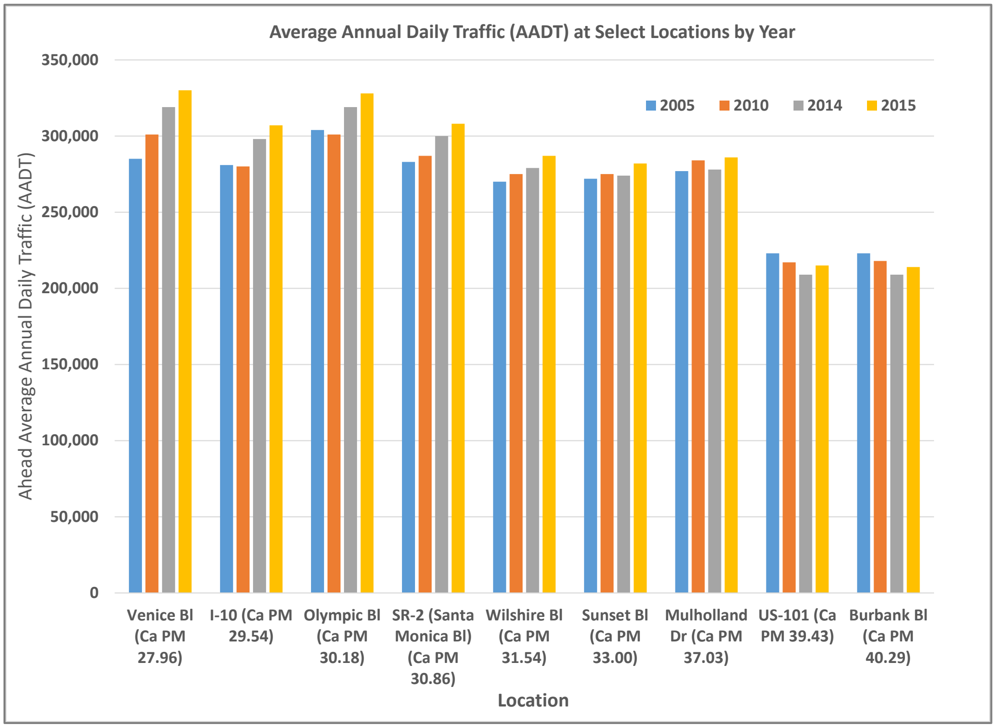
A review of historical traffic trends is provided here to add context to the development of the traffic and revenue analysis. **Figure 3-3** depicts the average annual daily traffic volumes (AADT) along I-405 Freeway between 2005 and 2014. As shown in the figure, AADT volumes have steadily increased over this period, with the highest daily traffic occurring near the Santa Monica Boulevard/Route 2 interchange and rapidly decreasing north of I-101 interchange. **Figure 3-4** further details I-405 Freeway AADT variations over a similar period (2005-2015). For some locations on the southern end of the study corridor, AADT has grown steadily since 2010. For some northern locations, AADT diminished slightly in 2014 and resumed growth in 2015.

Figure 3-3: I-405 Corridor AADT (2005-2014)



Source: Caltrans Traffic Volume Book

Figure 3-4: I-405 AADT Trends



Source: Caltrans Traffic Volume Book

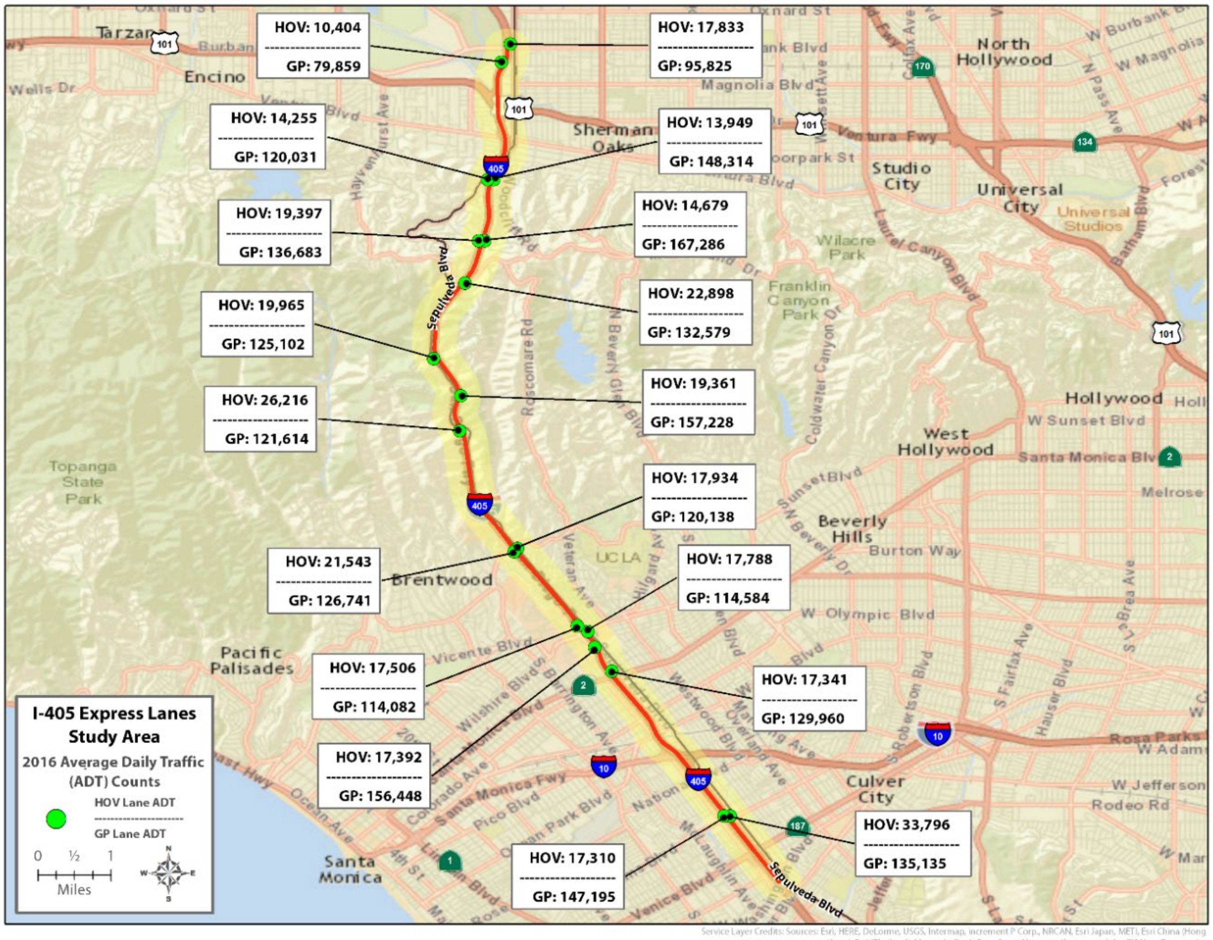
3.3 TRAFFIC DEMAND PROFILE

This section summarizes average weekday traffic characteristics for both HOV and GP lanes, including variations throughout a typical week.

3.3.1 AVERAGE WEEKDAY TRAFFIC

The weekday Average Daily Traffic (ADT) for the I-405 Freeway is shown in **Figure 3-5**, for both HOV and GP lanes. The displayed information was extracted from the Caltrans Performance Measurement System (PeMS), and represents non-holiday weekday ADT from October 2016. As shown in the figure, northbound GP ADT ranges from around 96,000 (near Burbank Blvd) to more than 167,000 (between Sepulveda Blvd and Mulholland Drive). Southbound GP ADT ranges from around 80,000 (at Burbank Blvd) to around 156,000 (near Sunset Blvd). Northbound HOV ADT can range from nearly 14,000 (near Valley Vista Blvd) to nearly 34,000 (just south of I-10), with southbound HOV ADT ranging from just over 10,400 (near Burbank Blvd) to around 26,200 (near Getty Center Dr). **Table 3-3** and **Table 3-4** show the average hourly flows for GP lanes and HOV lanes in the northbound and southbound directions, respectively. The hour of the day is noted in the left column of each table.

Figure 3-5: I-405 ADT Map



Source: PeMS, October 2016

Table 3-3: I-405 Northbound Hourly GP and HOV Volumes

	General Purpose									HOV								
AbsPM	52.3	54.7	55.3	56.7	59.0	60.7	61.3	62.2	64.1	52.3	54.7	55.3	56.7	59.0	60.7	61.3	62.2	64.1
Location	Palms Blvd (s/o National)	Santa Monica	Wilshire	Sunset	Getty/ Sepulveda	Skirball/ Mulholland	Royal Ridge	Valley Vista	Burbank	Palms Blvd (s/o National)	Santa Monica	Wilshire	Sunset	Getty/ Sepulveda	Skirball/ Mulholland	Royal Ridge	Valley Vista	Burbank
Lanes	5	5	5	5	5	5	6	6	4	1	1	1	1	1	1	1	1	1
0	2,481	2,212	2,040	2,296	2,768	2,417	2,989	2,656	1,983	351	130	137	142	164	326	115	111	228
1	1,575	1,311	1,219	1,343	1,634	1,407	1,869	1,530	1,212	169	44	49	51	54	183	43	40	107
2	1,117	887	816	905	1,073	965	1,305	1,040	937	91	16	17	16	21	115	16	16	61
3	1,203	864	716	753	868	732	1,063	837	731	87	14	12	12	14	97	13	11	43
4	2,656	1,751	1,303	1,267	1,368	1,130	1,527	1,267	1,063	291	54	51	48	43	142	27	25	72
5	6,392	4,790	3,235	2,905	3,218	2,692	3,237	2,937	2,381	1,141	282	258	234	211	343	128	118	224
6	8,033	7,420	5,219	4,595	5,349	4,258	5,269	4,825	3,176	2,197	587	522	487	404	687	227	205	307
7	8,084	8,469	6,509	6,322	7,858	6,205	7,546	7,091	4,006	2,427	841	717	690	619	981	335	306	413
8	8,087	8,454	6,624	6,509	8,424	6,743	8,203	7,763	4,077	2,326	923	778	737	672	1,167	380	336	423
9	8,017	8,114	6,347	6,157	7,934	6,545	8,065	7,466	3,978	2,203	906	811	789	714	1,079	418	381	480
10	7,817	7,676	6,126	6,128	7,717	6,670	8,084	7,412	4,422	2,154	1,009	947	934	866	968	537	490	678
11	7,592	7,481	6,179	6,427	8,133	7,021	8,536	7,752	4,970	2,032	1,029	1,004	1,005	972	1,027	597	552	809
12	7,496	7,530	6,383	6,778	8,667	7,560	9,096	8,289	5,814	1,991	1,095	1,093	1,091	1,133	1,118	705	647	1,004
13	7,563	7,764	6,800	7,147	9,299	8,259	9,791	8,936	6,467	1,984	1,237	1,264	1,260	1,380	1,302	920	854	1,212
14	7,167	7,154	6,684	6,979	9,564	8,163	10,122	8,866	5,937	1,938	1,311	1,380	1,386	1,539	1,468	1,113	1,042	1,372
15	5,903	5,687	6,155	6,616	9,313	7,732	10,171	8,483	5,269	1,739	1,169	1,276	1,330	1,561	1,558	1,364	1,330	1,466
16	5,128	4,891	5,564	6,148	8,730	7,140	9,974	8,104	5,070	1,454	1,046	1,189	1,232	1,413	1,550	1,371	1,342	1,393
17	5,268	4,741	5,341	6,050	8,561	6,858	9,727	7,766	4,812	1,450	1,008	1,158	1,182	1,385	1,500	1,373	1,325	1,405
18	5,671	4,840	5,294	5,994	8,731	7,299	9,863	8,390	5,480	1,633	1,005	1,135	1,209	1,424	1,470	1,401	1,370	1,486
19	6,036	5,732	5,796	6,472	9,329	8,041	10,385	9,198	5,779	1,617	1,063	1,182	1,248	1,533	1,526	1,261	1,223	1,420
20	6,259	6,453	6,002	6,625	8,984	7,855	9,839	8,895	5,618	1,428	925	1,076	1,113	1,300	1,460	971	909	1,173
21	6,294	6,437	5,815	6,316	8,038	6,866	8,414	7,689	4,991	1,290	733	780	783	896	1,205	632	605	879
22	5,306	5,412	4,916	5,418	6,771	5,820	7,129	6,487	4,328	1,057	556	583	589	642	985	448	431	696
23	3,989	3,889	3,502	3,987	4,899	4,201	5,082	4,634	3,324	745	359	369	366	403	640	284	279	484
Average Daily Traffic (ADT)	**135,135**	**129,960**	**114,584**	**120,138**	**157,228**	**132,579**	**167,286**	**148,314**	**95,825**	**33,796**	**17,341**	**17,788**	**17,934**	**19,361**	**22,898**	**14,679**	**13,949**	**17,833**

Source: PeMS, October 2016

Table 3-4: I-405 Southbound Hourly GP and HOV Volumes

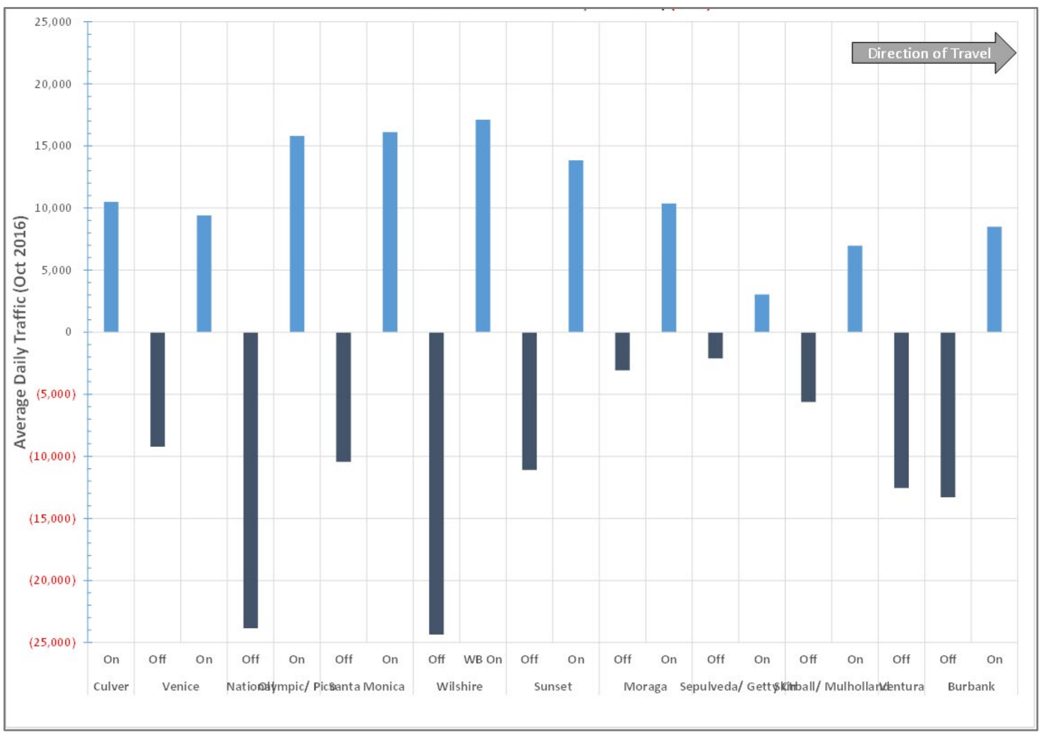
	General Purpose									HOV								
Abs_PM	52.3	55.1	55.4	56.7	58.5	59.6	61.3	62.2	63.9	52.3	55.1	55.4	56.7	58.5	59.6	61.3	62.2	63.9
Name	Palms Blvd (s/o National)	Santa Monica	Wilshire	Sunset	Getty/ Sepulveda	Skirball/ Mulholland	Royal Ridge	Valley Vista	Burbank	Palms Blvd (s/o National)	Santa Monica	Wilshire	Sunset	Getty/ Sepulveda	Skirball/ Mulholland	Royal Ridge	Valley Vista	Burbank
Lanes	5	6	5	4	4	4	5	5	4	1	1	1	1	1	1	1	1	1
0	2,323	1,919	1,277	1,423	1,218	1,348	1,647	1,267	996	29	37	37	43	238	40	29	17	13
1	1,300	1,144	777	872	736	821	1,107	791	692	9	11	12	13	152	12	9	5	4
2	1,081	1,221	686	780	623	714	1,065	713	683	10	8	11	9	152	9	8	5	4
3	1,250	1,413	958	1,114	991	1,123	1,474	1,105	1,075	20	24	24	32	198	34	30	20	17
4	2,835	2,918	2,489	2,864	2,835	3,030	3,371	3,015	2,793	173	196	205	253	498	236	268	217	206
5	5,641	6,262	5,642	6,389	6,855	7,030	7,634	7,260	5,698	618	825	832	1,106	1,379	1,133	1,360	1,199	1,144
6	7,067	7,560	6,232	6,983	7,025	7,101	7,885	6,668	3,184	777	1,032	1,031	1,473	1,523	1,348	1,439	1,319	1,012
7	8,273	9,213	6,748	7,143	6,584	6,466	7,409	5,782	2,253	887	1,057	1,063	1,560	1,384	1,321	1,207	1,096	728
8	8,292	9,680	7,143	7,488	6,786	6,754	7,336	5,932	2,288	1,046	1,122	1,129	1,594	1,440	1,433	1,291	1,155	840
9	8,361	9,547	7,141	7,460	6,851	6,717	7,026	5,592	2,490	905	1,120	1,148	1,570	1,459	1,432	1,308	1,123	830
10	8,381	9,133	6,709	7,237	6,692	6,554	6,493	5,637	3,632	928	1,156	1,164	1,504	1,457	1,432	1,298	1,074	781
11	8,423	9,071	6,440	6,921	6,712	6,659	7,021	6,288	4,814	1,015	1,158	1,169	1,507	1,462	1,420	1,357	1,083	576
12	8,385	9,124	6,390	6,941	6,896	6,836	7,624	6,864	5,242	1,067	1,189	1,180	1,437	1,530	1,381	1,346	953	502
13	8,254	8,976	6,411	6,980	6,893	7,030	7,710	7,120	5,032	1,205	1,111	1,137	1,322	1,548	1,262	1,224	729	464
14	7,711	8,577	6,096	6,807	6,754	7,026	7,420	7,029	4,990	1,301	1,139	1,134	1,262	1,488	1,169	1,110	636	478
15	7,185	7,925	5,768	6,714	6,480	6,702	7,082	6,563	4,709	1,220	1,111	1,101	1,122	1,390	999	996	590	481
16	6,680	7,614	5,445	6,368	6,262	6,607	7,001	6,419	4,684	1,080	972	953	1,026	1,369	938	933	562	471
17	6,506	7,691	5,412	6,490	6,353	6,829	7,345	6,620	5,027	1,068	843	861	958	1,483	889	913	587	486
18	6,622	7,786	5,482	6,441	6,581	6,985	7,534	6,888	4,729	1,076	852	881	1,087	1,530	1,029	1,050	677	487
19	7,055	7,954	5,546	6,346	6,154	6,473	6,959	6,502	3,952	1,078	839	876	974	1,372	903	846	477	327
20	7,253	6,754	4,844	5,400	5,068	5,254	5,823	5,254	3,401	882	669	639	690	1,039	621	557	289	219
21	7,516	6,055	4,388	4,903	4,449	4,705	5,361	4,650	3,214	508	489	477	516	914	483	433	239	184
22	6,392	5,244	3,676	4,057	3,545	3,870	4,411	3,730	2,599	286	299	311	335	748	304	268	141	108
23	4,409	3,666	2,380	2,623	2,272	2,468	2,948	2,342	1,683	120	134	133	151	464	136	117	60	45
Average Daily Traffic (ADT)	**147,195**	**156,448**	**114,082**	**126,741**	**121,614**	**125,102**	**136,683**	**120,031**	**79,859**	**17,310**	**17,392**	**17,506**	**21,543**	**26,216**	**19,965**	**19,397**	**14,255**	**10,404**

Source: PeMS, October 2016

The ADT from the I-405 Freeway entrance and exit ramps are shown in **Figure 3-6** and **Figure 3-7**, for northbound and southbound ramps, respectively. This information is also based on PeMS data from October 2016. Entrance ramp ADT is shown in blue as a positive number, and exit ramp ADT is shown in black as a negative number. As shown in **Figure 3-6**, the highest northbound entrance ramp volumes were reported at Wilshire Blvd, Santa Monica Blvd, and Olympic/Pico Blvd (ranging from 15,800 – 17,100 ADT). The Wilshire Blvd and the National Blvd exit ramps, south of I-10, had the highest reported northbound exit ramp ADT values (approximately 24,000 ADT).

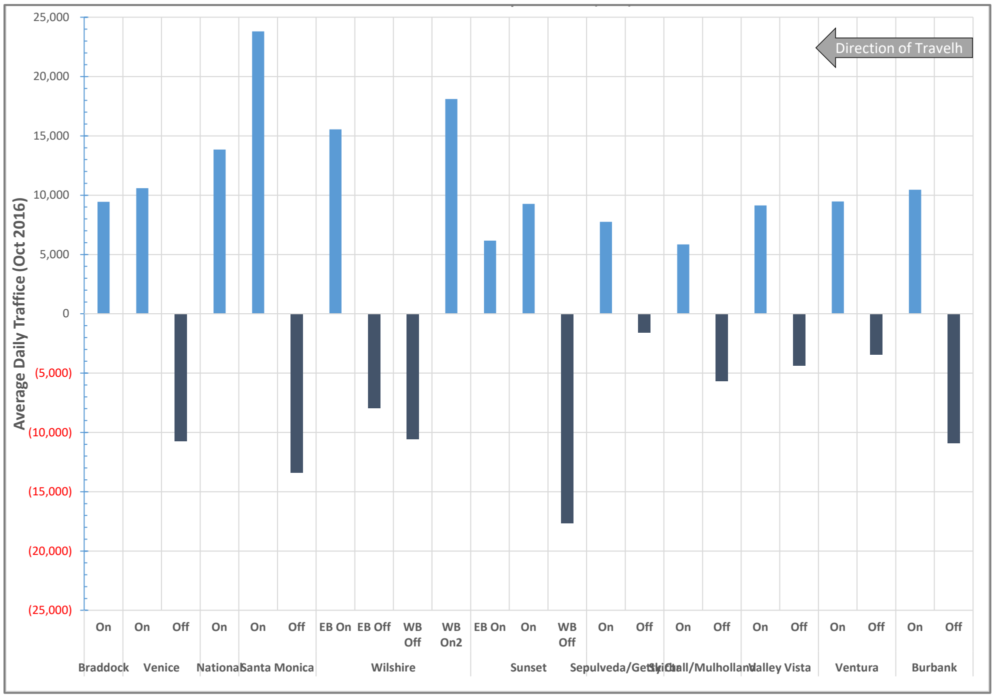
In the southbound direction, shown in **Figure 3-7**, the Sunset Blvd. westbound exit ramp reported approximately 17,600 ADT, with no other exit ramp reporting more than 10,900. The Santa Monica Blvd. entrance ramp had approximately 23,800 ADT, the highest entrance ramp volume on the corridor, with the Wilshire Blvd westbound entrance ramp estimated to be approximately 18,100 ADT.

Figure 3-6: I-405 Northbound On- and Off-Ramp ADT



Source: PeMS, October 2016

Figure 3-7: I-405 Southbound On- and Off-Ramp ADT



Source: PeMS, October 2016

3.3.2 DAY-OF-WEEK / DAILY VARIATIONS

The data presented in this section illustrate the day-of-week and hourly variations in traffic conditions for GP lanes and HOV lanes along the I-405 Freeway. Data demonstrating the variation in traffic were obtained from the Caltrans PeMS system for a representative two-week period in May 2016. To make daily traffic volumes comparable among locations with different volume levels, daily volumes were converted to index values, by dividing traffic volume for each day by the average daily volume for the week at that location. The higher the index is, the heavier traffic and likely longer the delay travelers experience. **Table 3-5** and **Table 3-6** summarize day-of-week index values for select locations on the northbound and southbound, respectively.

As shown in **Table 3-5**, northbound GP lane volumes on I-405 follow the same overall trend from Monday to Thursday, reflecting the influence of heavy commuter traffic. Weekday volumes generally increase throughout the week, reaching a high between Wednesday and Friday. Weekend volumes, particularly Saturdays, are significantly higher than weekday volumes in nearly all locations. The southbound GP lanes are significantly different from the northbound direction in terms of daily traffic patterns (see **Table 3-6**). In the southbound direction, daily traffic volumes from Monday to Thursday are generally higher than the rest of the week, indicating that some portions of the southbound GP lanes are highly utilized by commuter traffic.

Table 3-5: Day-of-Week Variation Index on I-405 Northbound

Location	Sun	Mon	Tue	Wed	Thu	Fri	Sat
General Purpose Lanes							
Wilshire	0.98	0.99	0.99	1.00	1.01	1.00	1.04
Sunset	0.99	0.99	0.98	1.00	1.01	1.00	1.04
Getty Center Dr	0.97	0.99	0.99	1.01	1.02	1.00	1.02
Skirball	0.97	0.98	0.98	1.00	1.02	1.01	1.04
Vista Valley	0.93	1.00	1.01	1.02	1.04	1.00	1.00
HOV Lanes							
Wilshire	1.12	0.92	0.91	0.93	0.96	1.03	1.14
Sunset	1.11	0.92	0.90	0.94	0.97	1.03	1.14
Mulholland	0.84	1.02	1.03	1.06	1.06	1.03	0.96
Vista Valley	1.09	0.89	0.89	0.90	0.99	1.10	1.14

Source: PeMS, May 2016

Table 3-6: Day-of-Week Variation Index on I-405 Southbound

Location	Sun	Mon	Tue	Wed	Thu	Fri	Sat
General Purpose Lanes							
Vista Valley	1.00	1.00	0.98	0.98	0.99	0.99	1.06
Bel Air Cr	0.97	1.02	1.01	1.01	1.01	0.97	1.01
Getty Center Dr	0.94	1.03	1.02	1.02	1.02	0.98	0.99
Sunset	0.95	1.03	1.02	1.02	1.03	0.96	0.98
Wilshire	0.97	1.03	1.01	1.01	1.03	0.96	1.00
HOV Lanes							
Vista Valley	0.99	0.92	0.95	0.97	1.01	1.05	1.11
Getty Center Dr	0.96	1.01	1.01	1.01	1.01	0.97	1.02
Sunset	1.04	0.93	0.93	0.98	0.99	1.03	1.10
Wilshire	1.10	0.92	0.93	0.96	0.98	0.98	1.13

Source: PeMS, May 2016

For HOV lanes along the I-405 corridor, the day-of-week variation index showed the lanes are heavily used on Fridays and weekends, primarily due to heavy weekend recreational carpooling traffic, often referred to as “fampools”.

3.4 CORRIDOR PERFORMANCE

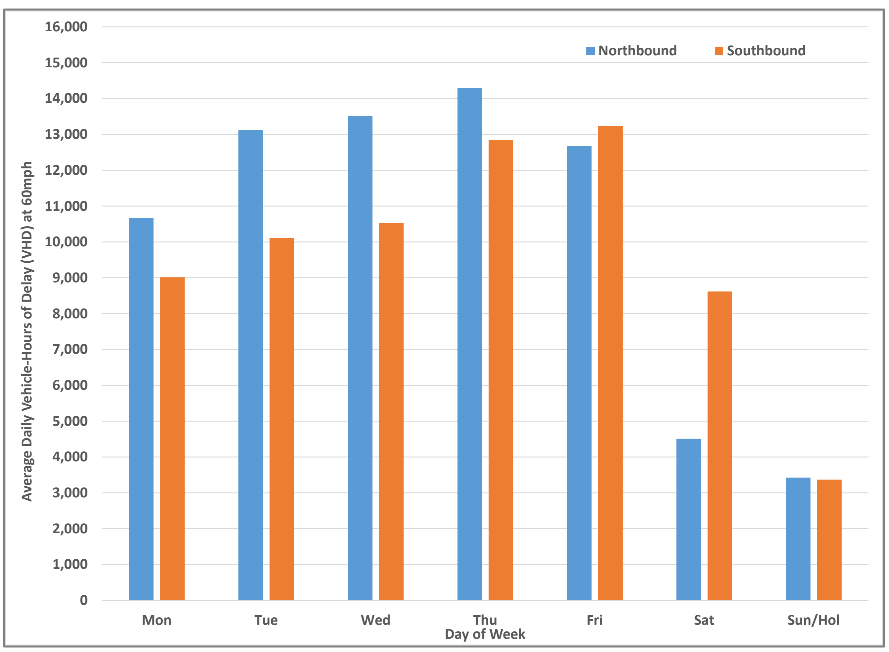
Typical corridor performance in terms of delay and travel time is another important consideration. This section details typical vehicle hours of delay, and travel time information to better inform regarding variations in performance of the I-405 Freeway.

3.4.1 VEHICLE-HOURS OF DELAY

This section describes recurring delay on the I-405 Freeway. Aggregate traffic congestion can be measured in terms of travel delay, which is defined as the actual travel time minus the travel time under uncongested conditions for all vehicles traversing a corridor. This measure is reported as vehicle-hours of delay (VHD). This analysis of the I-405 freeway utilized a free flow speed of 60 mph, as well as data extracted from the Caltrans PeMS database from October 2016, sourced from all traffic detectors between Venice Blvd. and Burbank Blvd.

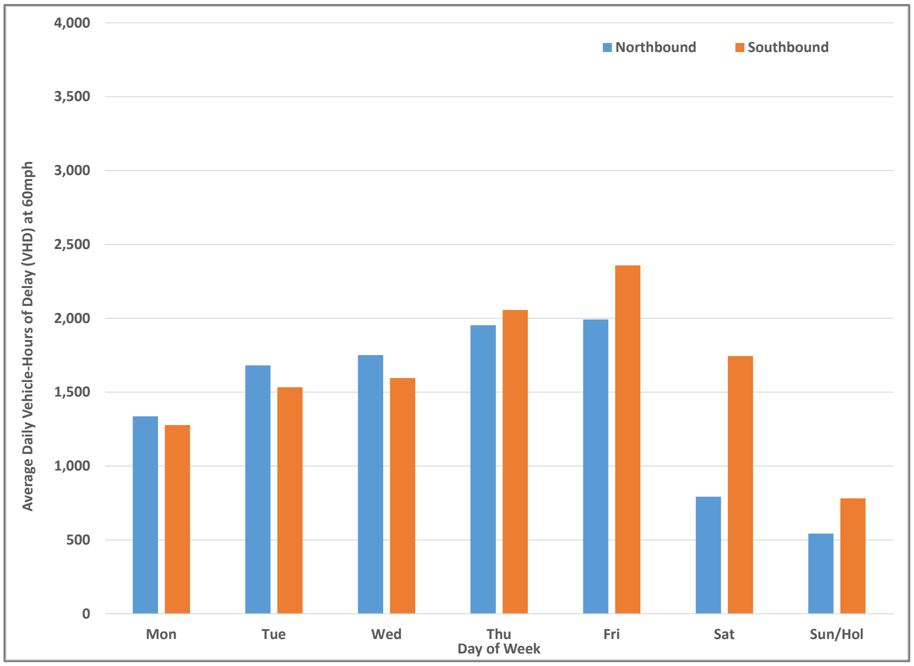
Average VHD by day of week is shown in **Figure 3-8** for I-405 GP lanes, while HOV lane VHD is shown in **Figure 3-9**. **Figure 3-8** reveals that congestion tends to increase as the week progresses from Monday to Thursday, with Thursday being the most congested day in the northbound direction. In the southbound direction, Friday is the most congested day reporting nearly 13,200 VHD on an average day. **Figure 3-9** shows similar results for the HOV lane in each direction. Friday in the southbound direction is the most congested day with nearly 2,400 VHD, followed closely by Thursday with nearly 2,100 VHD.

Figure 3-8: I-405 All General-Purpose Lanes Vehicle-Hours of Delay by Day of Week



Source: PeMS, October 2016

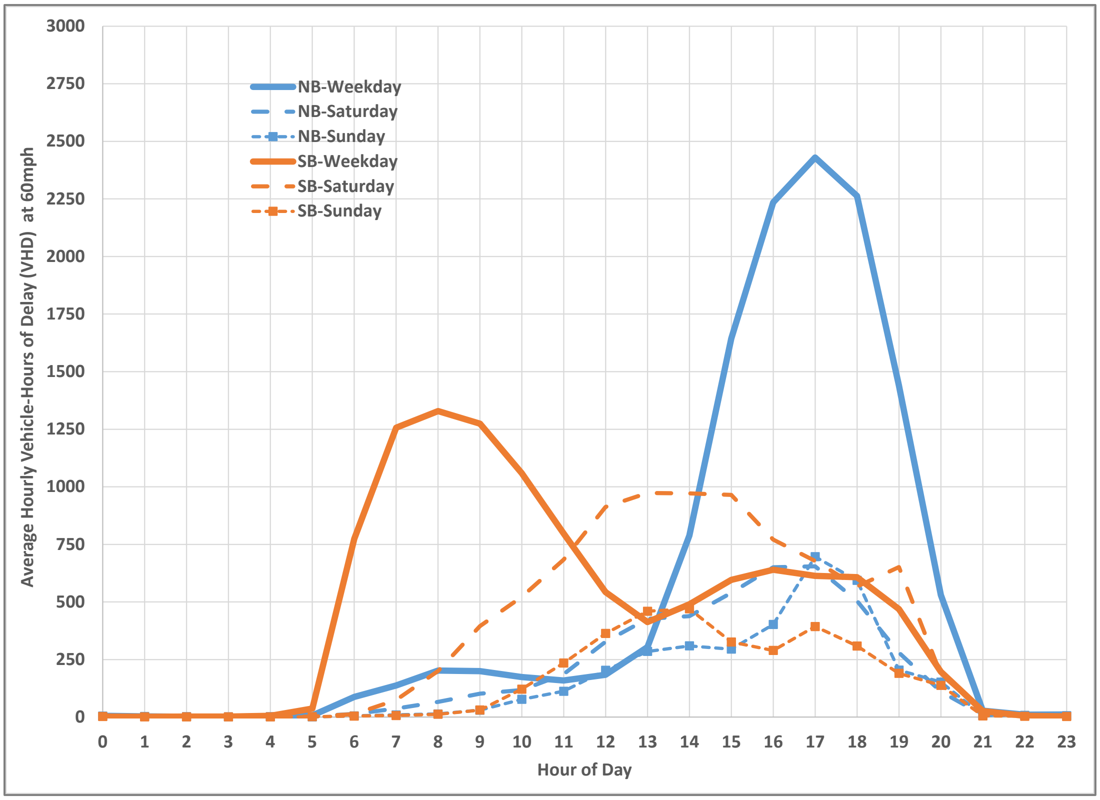
Figure 3-9: I-405 HOV Lane Vehicle-Hours of Delay by Day of Week



Source: PeMS, October 2016

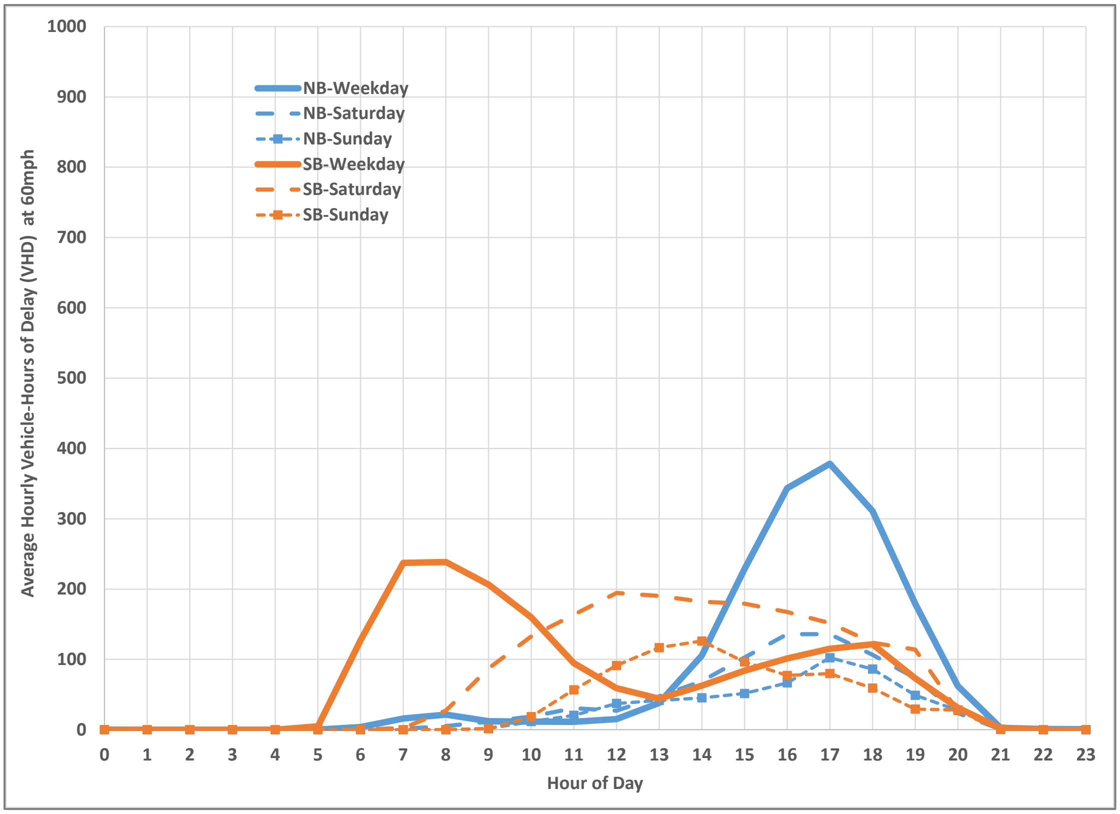
Figure 3-10 and **Figure 3-11** show VHD throughout the day for I-405 GP and HOV lanes. Values represent an average day in October 2016. The greatest level of delay in the I-405 GP lanes is observed during the 5:00 PM hour in the northbound direction on weekdays, with nearly 2,400 VHD. The southbound GP lanes have a lower level of delay overall, with the maximum levels of delay observed during 7:00 AM peak hour with just over 1,300 VHD. **Figure 3-11** shows a much lower level of congestion in the HOV lanes, relative to GP lanes, with the northbound weekday 5:00 PM hour reporting just nearly 380 VHD.

Figure 3-10: I-405 General Purpose Lane Vehicle-Hours of Delay by Hour of Day



Source: PeMS, October 2016

Figure 3-11: I -405 HOV Lane Vehicle-Hours of Delay by Hour of Day



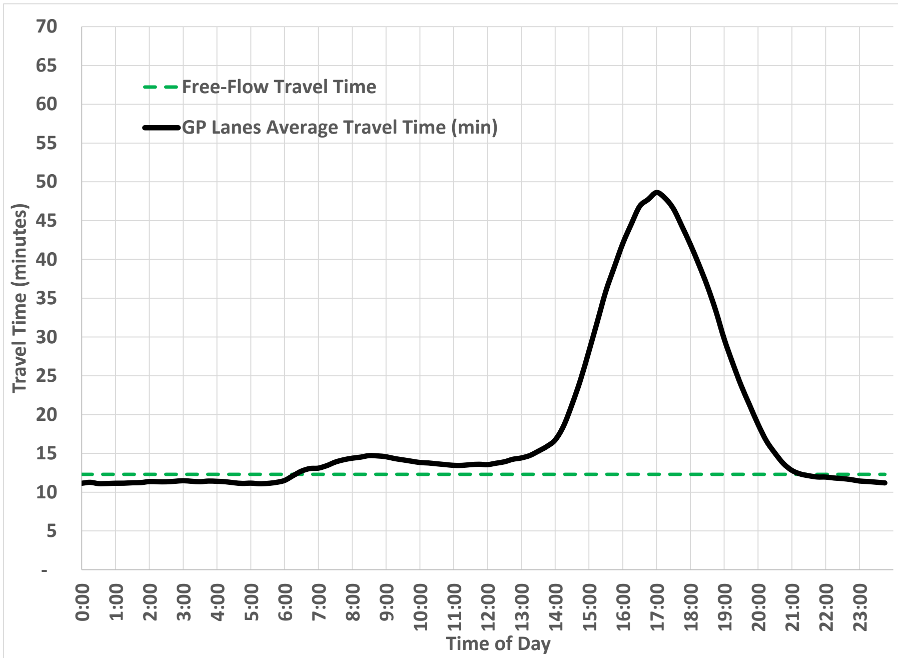
Source: PeMS, October 2016

3.4.2 TRAVEL TIMES

The INRIX dataset was used to analyze speeds and travel times in the I-405 GP and HOV lanes. The dataset reports segment speeds at one-minute intervals for each day of the year. For the purposes of this analysis, the data were aggregated to 15-minute intervals for each non-holiday weekday in 2016. The average travel times were calculated for the GP and HOV lanes. **Figure 3-12** and **Figure 3-13** summarize average northbound travel times for the I-405 GP and HOV lanes. Southbound travel times are shown in **Figure 3-14** and **Figure 3-15**.

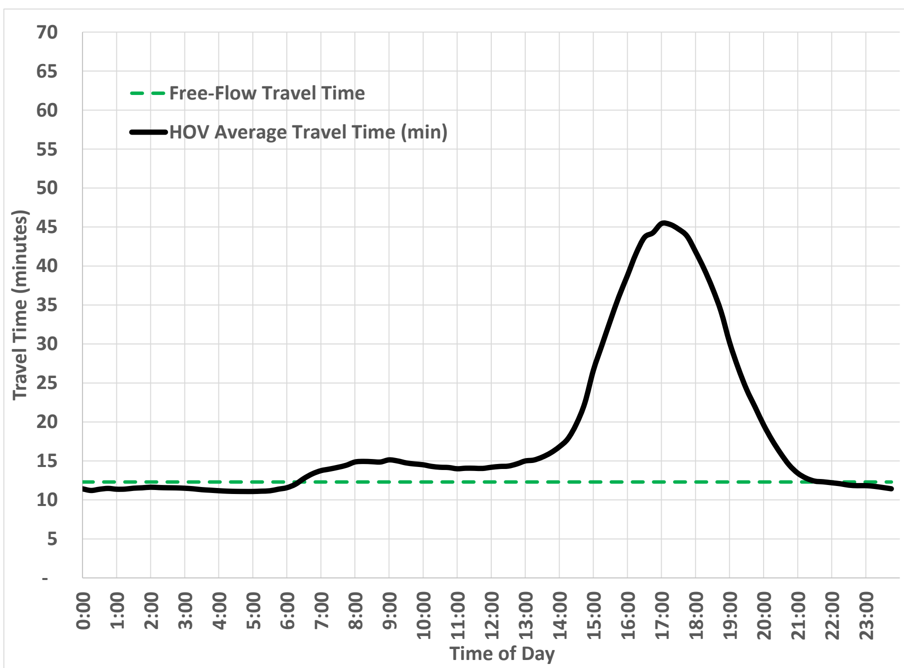
In the northbound direction, there is a PM peak period starting after 2:00 PM and extending to just after 8:00 PM. For GP lanes, northbound travel times peak during the 5:00 PM hour when travel times average around 48 minutes to traverse the corridor compare to a free-flow travel time of around 12 minutes. For the HOV facility, travel times show a similar pattern, peaking around 5:00 PM when it can take around 45 minutes to travel the corridor.

Figure 3-12: Average General-Purpose Lane Travel Time – Northbound



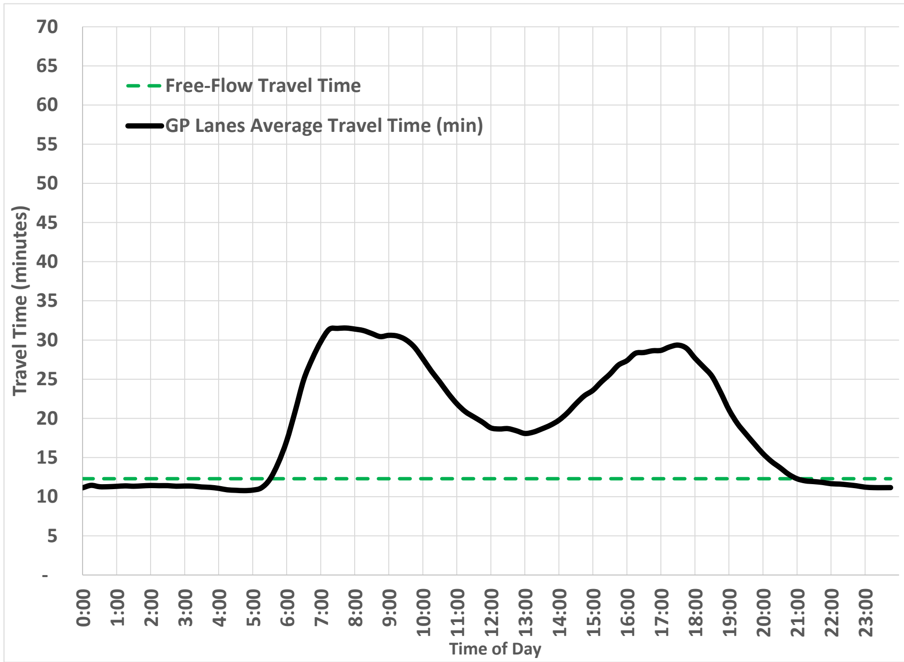
Source: 2016 INRIX

Figure 3-13: Average HOV Lane Travel Time – Northbound



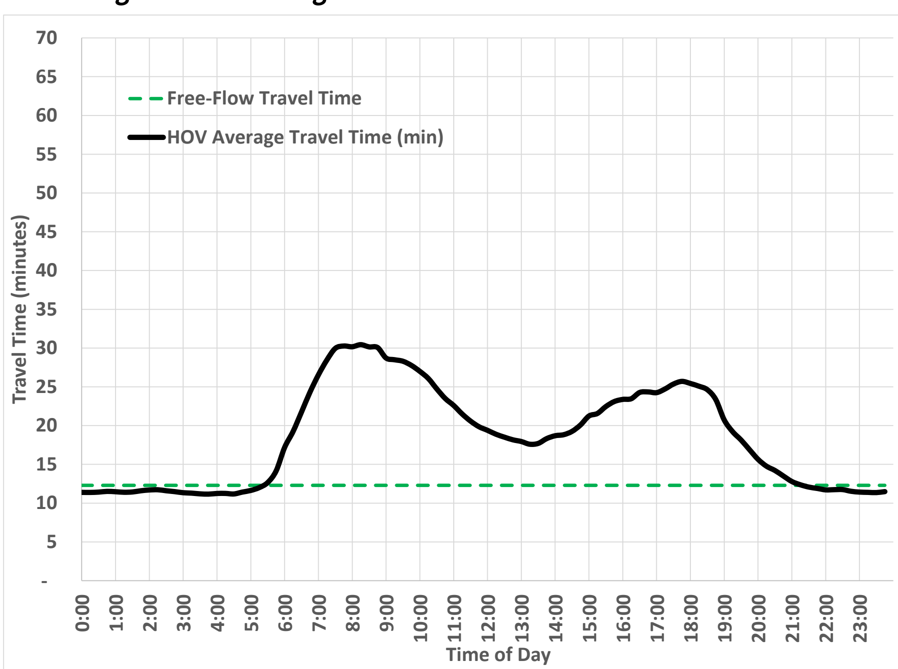
Source: 2016 INRIX

Figure 3-14: Average General-Purpose Lane Travel Time – Southbound



Source: 2016 INRIX

Figure 3-15: Average HOV Lane Travel Time – Southbound



Source: 2016 INRIX

In the southbound direction, there are two peak periods. An AM peak period occurs from the 5:00 AM hour to after 10:00 AM. Travel times can exceed 31 minutes during the 7:00 AM to 9:00 AM period in the southbound GP lanes. Similarly, southbound AM travel times of around 30 minutes are observed in the HOV lanes.

Southbound PM travel times begin to dramatically worsen after 2:00 PM and peak around 5:45 PM when travel times on the GP lanes are just under 30 minutes. The southbound HOV lane travel times also peak around 5:45 PM at around 25 minutes.

3.5 VEHICLE CLASSIFICATION AND OCCUPANCY

To gain an understanding of vehicle classification and occupancy within the I-405 corridor, hourly vehicle classification counts were conducted on June 1, 2016 and June 2, 2016 for the AM, midday (MD), and PM peak periods at two locations (Skirball/Mulholland and Sunset). **Table 3-7** presents the summary results. Passenger vehicles represent the greatest majority of travel on the corridor. Registered California Clean air vehicles also represent nearly 10 percent of overall HOV mix. In accordance with California statutes, vehicles that currently qualify as clean air include those designated with white decals as meeting the California super ultra-low emission vehicle (SULEV) standard for exhaust emissions and the federal inherently low-emission vehicle (ILEV) evaporative emission standard, and those designated with green decals for meeting the California Enhanced Advanced Technology Partial Zero-Emissions (Enhanced AT PZEV) or Transitional Zero-Emission (TZEV) standards for exhaust emissions.

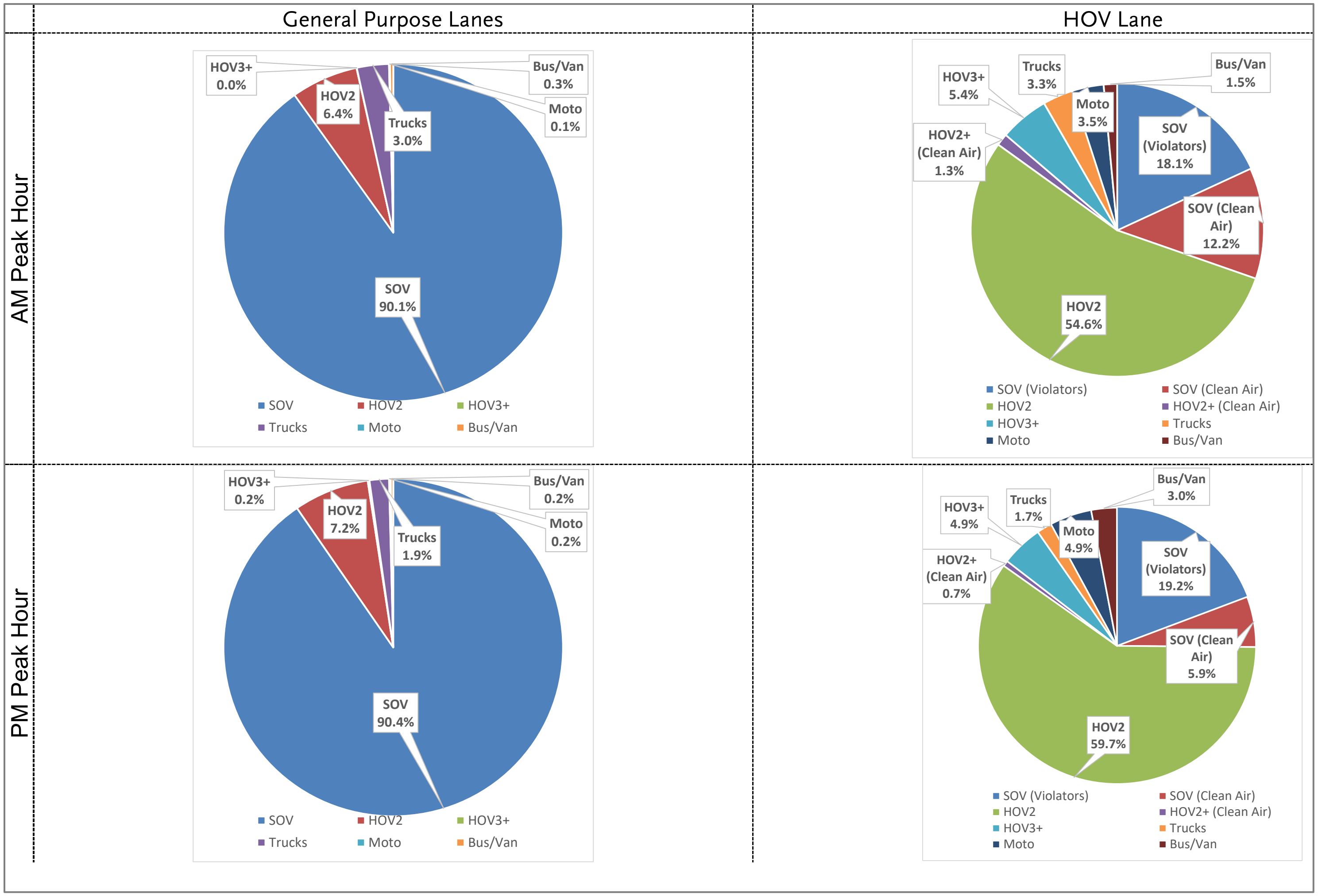
Table 3-7: I-405 Vehicle Classification Summary

Facility	Dir	Time Period	Passenger Vehicle	2 Axle Vehicle	3 Axle Vehicle	4+ Axle Truck	Buses	Motorcycle	Vanpool	Clean Air	Total Vehicles
General Purpose (GP)	NB	AM	94%	2%	0%	2%	0%	0%	0%	2%	100%
		MD	92%	3%	0%	2%	0%	0%	0%	2%	100%
		PM	96%	1%	0%	1%	0%	0%	0%	2%	100%
		NB Total	**94%**	**2%**	**0%**	**2%**	**0%**	**0%**	**0%**	**2%**	**100%**
	SB	AM	94%	2%	0%	1%	0%	0%	0%	2%	100%
		MD	93%	3%	1%	1%	0%	0%	0%	2%	100%
		PM	95%	1%	0%	1%	0%	0%	0%	3%	100%
		SB Total	**94%**	**2%**	**0%**	**1%**	**0%**	**0%**	**0%**	**2%**	**100%**
	GP Totals		**94%**	**2%**	**0%**	**1%**	**0%**	**0%**	**0%**	**2%**	**100%**
HOV	NB	AM	82%	2%	0%	0%	1%	4%	0%	10%	100%
		MD	91%	1%	0%	0%	0%	3%	0%	4%	100%
		PM	82%	0%	0%	0%	1%	7%	1%	9%	100%
		NB Total	**86%**	**1%**	**0%**	**0%**	**1%**	**5%**	**0%**	**7%**	**100%**
	SB	AM	74%	5%	0%	0%	1%	5%	0%	15%	100%
		MD	91%	1%	0%	0%	1%	2%	0%	5%	100%
		PM	89%	1%	0%	0%	1%	4%	0%	5%	100%
		SB Total	**84%**	**3%**	**0%**	**0%**	**1%**	**4%**	**0%**	**9%**	**100%**
	HOV Totals		**85%**	**2%**	**0%**	**0%**	**1%**	**4%**	**0%**	**8%**	**100%**
Corridor Totals			**92%**	**2%**	**0%**	**1%**	**0%**	**1%**	**0%**	**3%**	**100%**

Source: System Metrics Group, Inc.

Figure 3-16 presents summary vehicle occupancies also collected in the field at the same count locations. Trucks are presented separately since occupancy counts for trucks were not easily recorded. Almost 20 percent of the vehicles using the HOV lanes were observed to be violators, determined to be single occupancy vehicles that are not qualifying clean air vehicles. This observation underscores the greater violation issue facing many HOV facilities and express lanes in both southern and northern California. Eliminating these violators would create additional capacity on the HOV lane and improve overall HOV (or express lanes) performance.

Figure 3-16: I-405 Vehicle Occupancies



Source: System Metrics Group, Inc.

3.6 CONGESTION ANALYSIS

Major bottlenecks are the primary cause of recurrent congestion. Other factors impacting levels of congestion include incidents, special events, and weather. A bottleneck is observed as a location where travel demand exceeds the effective carrying capacity of the roadway. A freeway bottleneck can be caused by a sudden reduction in effective capacity, such as a physical loss of a lane, an abrupt change in vertical or horizontal alignment (i.e. a steep grade or sharp curve), or when heavy merging and weaving takes place near on and off-ramps.

A merging issue may occur at HOV ingress/egress location if a bottleneck is formed at the location of the access point. This analysis identifies HOV lane access locations that currently have potential merging issues that could be further impacted by the implementation of express lanes.

3.6.1 BOTTLENECKS ANALYSIS

Northbound Bottlenecks

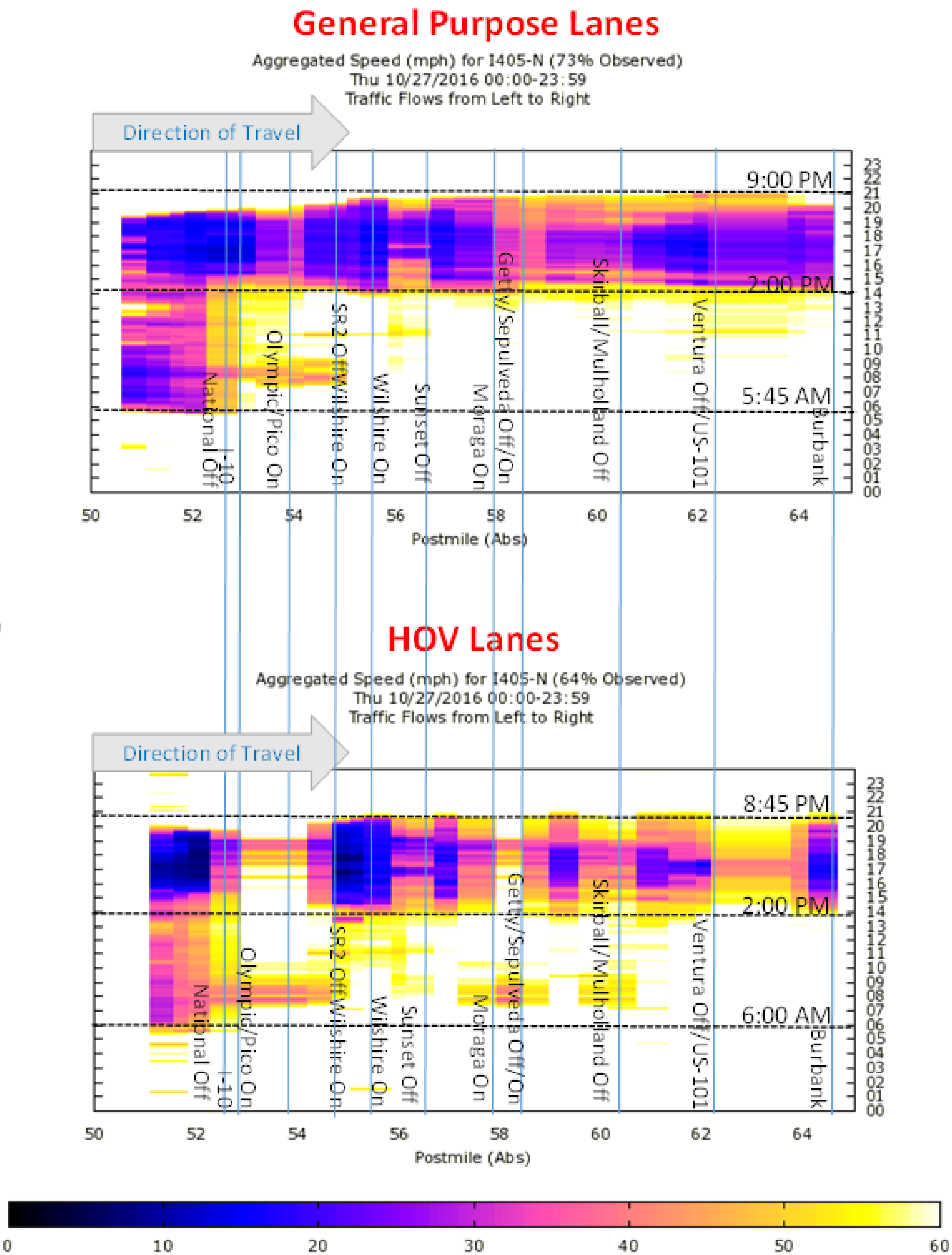
Figure 3-17 is a speed contour plot, sometimes referred to as a “heat map”, for the northbound direction of I-405. This contour plot arrays PeMS data to depict the location of the bottlenecks for both the GP and HOV lanes on the corridor. This plot presents traffic conditions on October 27, 2016, which was a “typical” day for traffic in terms of travel demand, congestion, and number of incidents for all fall 2016 non-holiday weekday.

The absolute postmile for both plots is represented by the x-axis. The y-axis is the hour of the day. The direction of travel along the corridor is from the left of the graph to the right. Speeds are shown by the different colors with very slow speeds shown as black and dark blue, and higher speeds as a lighter yellow. Where there is no color, the speeds at that location and time exceeds the free-flow speed at 60 mph. The darker the color, the more congested that location is at that time of day.

The Nordhoff northbound bottleneck in the San Fernando Valley north of the study corridor is the largest bottleneck on the corridor and frequently backs upstream nearly 8.5 miles to the vicinity of the Skirball/Mulholland interchange. The closely-spaced bottlenecks near the I-10 interchange (i.e., Olympic/Pico and National) are also major contributors to northbound delay and often interact with one another to compound congestion. These locations also generate significant congestion during the AM peak period.

The bottlenecks at Wilshire Blvd, SR-2 (Santa Monica Blvd), and National Blvd have the greatest impact on the HOV facility as illustrated by the very dark colors in the figure during the PM peak period. Santa Monica Blvd and National Blvd bottlenecks also impact the HOV facility during the AM peak period with moderate slowing appearing just upstream of Santa Monica Blvd interchange and severe slowing occurring upstream of I-10 at National Blvd.

Figure 3-17: I-405 Northbound Speed Contours



Source: PeMS, October 2016

Southbound Bottlenecks

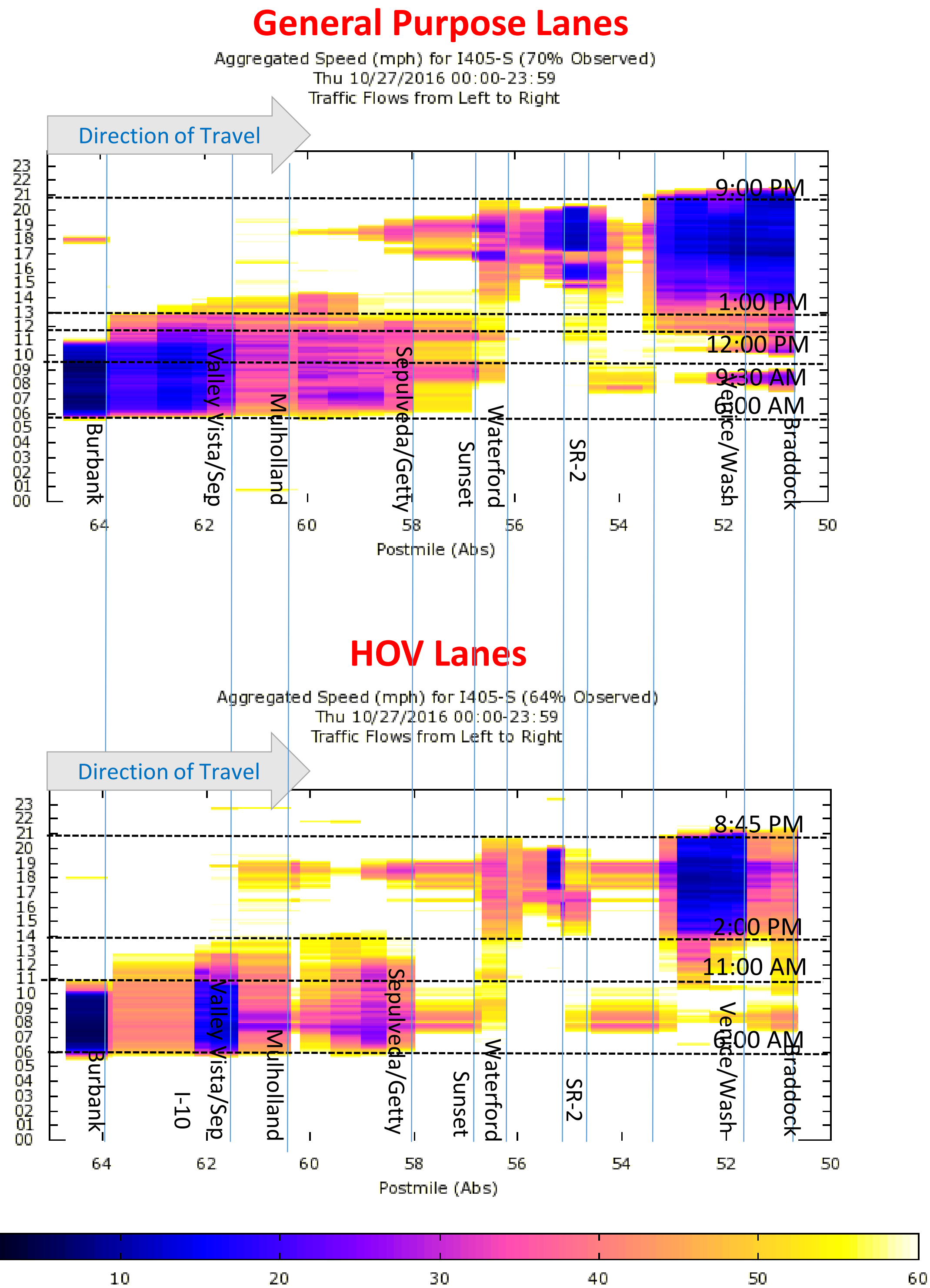
Figure 3-18 is the PeMS speed contour for the southbound direction with the direction of travel also represented from left to right as in the previous figure. As with the northbound direction, bottlenecks outside of the study area often extend upstream into the study area.

The bottleneck at Howard Hughes Parkway in the Fox Hills area of Los Angeles generates significant congestion with queues often extending north through the I-10 interchange at the southern end of the study corridor during the PM peak period. Another significant PM peak period bottleneck occurs just south of Santa Monica Blvd interchange, and there is a minor bottleneck that occurs between the Sunset Blvd on ramp and the Wilshire Blvd off ramp.

The traffic flows and associated merges and weaves at interchanges in the vicinity of US-101 generate congestion in the AM peak period. Depending on conditions, bottlenecks can form at either the on ramp or the off ramp at Valley Vista/Sepulveda just south of US-101. Bottlenecks are also generated at successive downstream interchanges at Skirball/Mulholland and at Getty/Sepulveda. The southbound off ramp to US-101 also creates backups.

There is a major AM period HOV bottleneck at the Burbank Blvd interchange at the northern part of the study area. The HOV facility is also impacted in the AM peak period by congestion at the Valley Vista/Sepulveda interchange, and to a lesser extent, at Skirball/Mulholland, and the Getty/Sepulveda locations. In the PM peak period, there is a major HOV bottleneck at the Venice/Washington interchange area and a smaller HOV bottleneck between Santa Monica Blvd and I-10.

Figure 3-18: I-405 Southbound Speed Contours



Source: PeMS, October 2016

3.6.2 HOV INGRESS/EGRESS LOCATION ANALYSIS

Figure 3-19 is similar to **Figure 3-17** above in that it shows northbound speed contours. A major difference in this graph is that it shows the locations of the HOV ingress/egress points on the corridor by red dashed lines along with GP lane #1 speed contours for comparative purposes. Lane #1 is the lane adjacent to the HOV lane.

In the northbound direction, several locations were identified that may have merging issues:

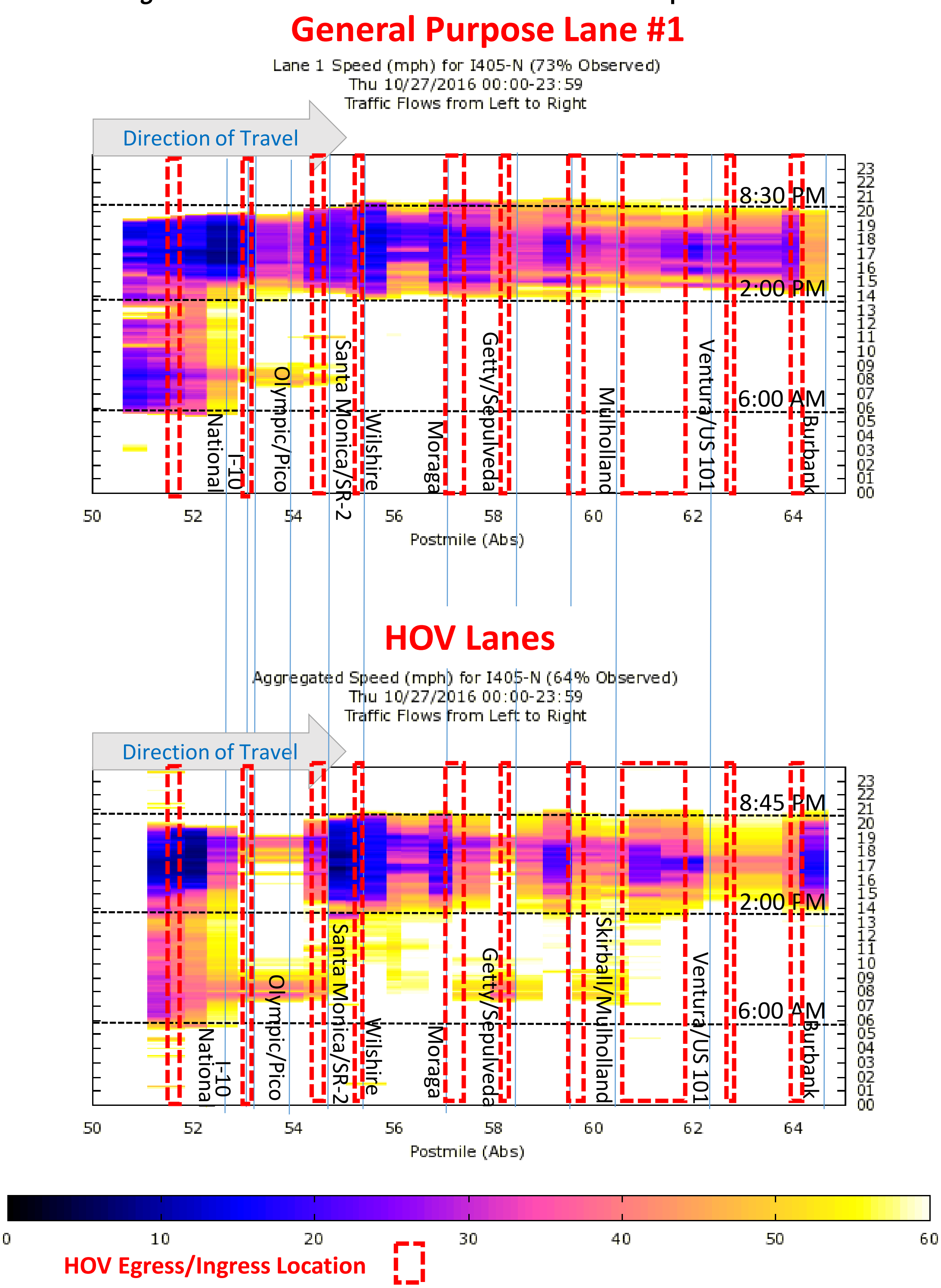
- Between the NB Off to National and just north of I-10 at the Olympic/Pico on ramp
- At the SR-2 off-ramp
- Just north of the Moraga Ave on-ramp
- Just south of the Skirball/Mulholland off-ramp
- At the Ventura Blvd interchange
- At the Burbank Blvd interchange

Figure 3-20 shows the HOV and GP lane #1 speed contours for the southbound direction. There are several southbound locations that may have merging issues:

- At the US-101 interchange
- At the Skirball/Mulholland interchange
- Just south of the Getty/Sepulveda on ramp
- Between the Sunset Blvd on-ramp and the Wilshire Blvd off ramp
- At the SR-2 on-ramp

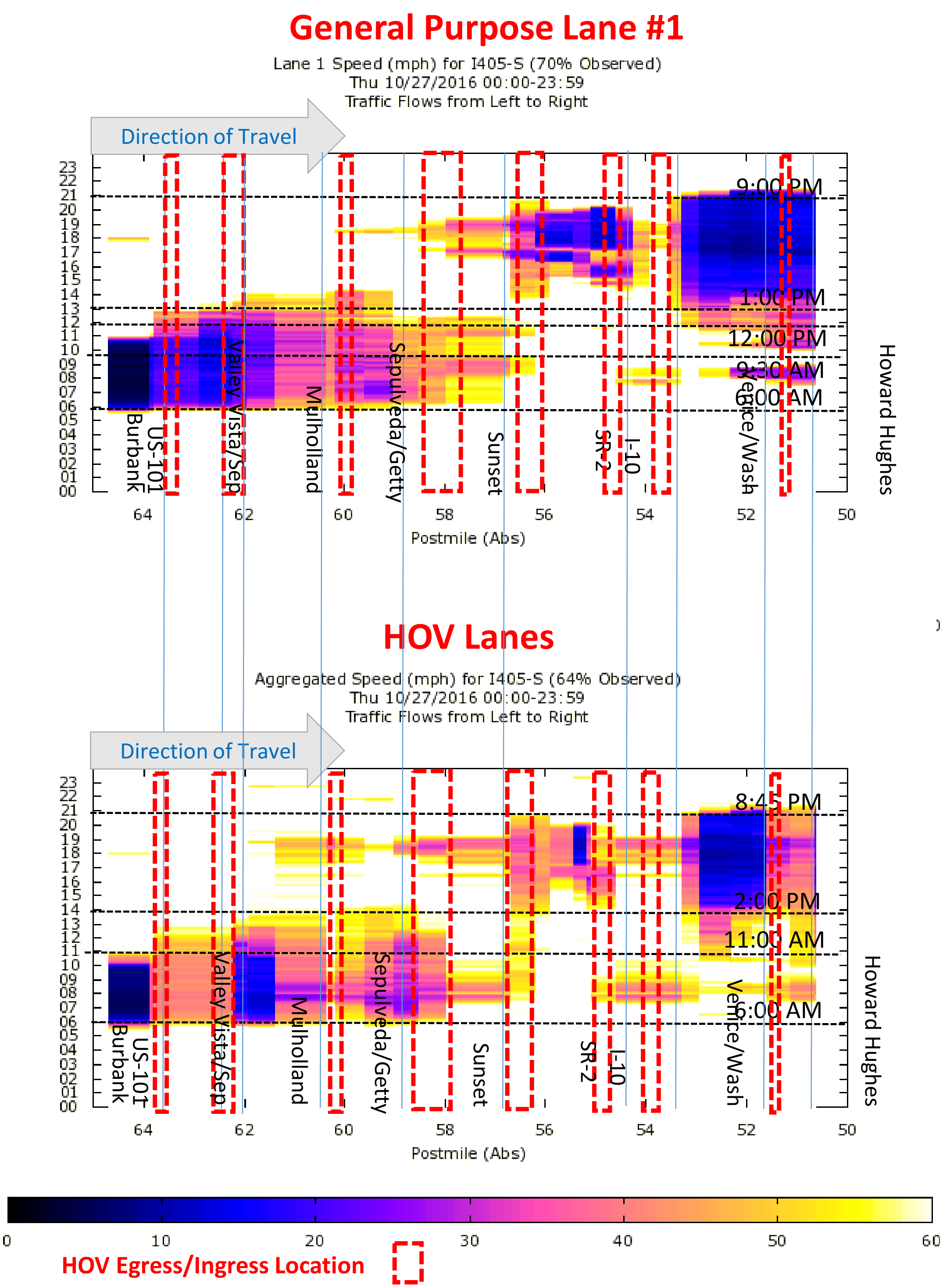
This analysis identified six northbound and five southbound HOV ingress/egress locations where potential merging issues occur. A merging issue was identified for access points that had an associated bottleneck on the HOV facility and adjacent GP lane. These are locations that could be more severely impacted if merging volumes increase at that location.

Figure 3-19: I-405 Northbound HOV & GP Lane #1 Speed Contours



Source: PeMS, October 2016

Figure 3-20: I-405 Southbound HOV & GP Lane #1 Speed Contours



Source: PeMS, October 2016

Metro

4.0 STATED PREFERENCE SURVEY RESULTS

Metro conducted a stated preference survey of I-405 drivers in 2015 to support the study of the feasibility and revenue potential of a tolled express lanes and premium transit line deployment in the Sepulveda Pass corridor. The survey was intended to provide I-405 traveler preference information to properly calibrate the study's traffic and revenue modeling effort, and to better inform about the viability of express lanes within the corridor. The survey assessed I-405 corridor driver's willingness to pay tolls, the likely frequency that a tolled facility would be used, and attitudes towards paying tolls. A total of 1,566 complete surveys were obtained by Redhill Group as part of a separate market research contract in 2015, by sampling households located in one of nine districts. The districts were identified through previous research as likely home locations for motorists using the target corridor segment. The final sample consisted of motorists that travel on the corridor at least once every two weeks and reside within the sampling area (see **Figure 4-1**). The survey asked three different types of questions:

- Socio-economic questions about the survey respondents, and questions about their typical travel patterns
- Attitudinal questions about the transportation services in the Los Angeles region
- Stated preference questions that explored willingness to pay for express lanes

This section describes the design and methodology of the survey, summarizes survey findings, and details the estimation of appropriate Values of Time (VOT) to be used during the I-405 traffic and revenue modeling effort. For further details and the survey questionnaire, see **Appendix A**.

4.1 SURVEY METHODOLOGY

This section describes the survey sampling and design methodology that was used to most accurately assess the sentiments of I-405 corridor drivers.

4.1.1 SAMPLING PLAN

In the interest of completing the survey in the most timely and cost-effective manner, the sampling plan for this project focused on sampling from a population that is highly likely to use the target corridor. The sampling targets were based on zip code areas, with higher sampling rates assigned to areas in close proximity to the corridor. This sampling strategy excluded corridor travelers that live outside of the focus region.

Respondents were recruited using online panels and via phone recruiting, and all respondents were screened based on two criteria: (a) use regional freeways at least once a week, and (b) use the desired I-405 freeway segment at least once every two weeks.

The sample was also balanced in proportion to I-405 use by residents of six geographic regions defined by Metro, and detailed in **Table 4-1**. A total of 1,566 surveys were completed, which met or exceeded all geographic targets. Additional surveys were also completed to help balance the demographic profile of the full sample.

Table 4-1: Sample Size Targets by Geographic Region

District	2	3	4	5	6	15	Total
Quota	150	400	250	250	250	100	1,400
Incidence	40%	79%	26%	34%	20%	23%	NA

Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

4.1.2 SURVEY DESIGN

Respondents were recruited via online, mobile phone random digit dialing (RDD), and listed phone samples to complete the survey online. The survey was implemented online to enable complex option selections and rotations that reflect the individual respondent's travel patterns while providing balanced feedback across multiple cost-benefit options.

Questions were asked in two formats; first in a "Yes/No" format when asked about tradeoffs of cost vs. time savings, and then in a continuous 0-100 percentage likelihood of use format in a separate set of questions. The first approach most directly addresses the question of what respondents are most likely to do on a general basis. The latter approach provides information about how often corridor motorists will use the express lanes taking into consideration the knowledge that many motorists will elect to use the express lanes only under certain circumstances rather than all, or none of the time.

For the "Yes/No" questions, respondents were first split into three categories based on the normal distance travelled on the target corridor with the "low" category being four to five miles, the "medium" category six to nine miles, and the "high" category being ten-plus (10+) miles for the full length of the corridor.

Metro wanted to explore nine different cost-benefit tradeoff options for each trip length. To avoid respondent fatigue, each respondent received a random set of six of the nine options. In this way, feedback for all nine options was collected for an equally sized and representative subset of the full sample. The different cost and time-savings options are presented in **Table 4-2** reflecting the variation based on trip length.

Table 4-2: Cost and Time-Savings Options

Distance	Time Saved	Cost #1	Cost #2	Cost #3
4-5 miles	7	$2	$4	$6
4-5 miles	11	$2	$4	$6
4-5 miles	18	$2	$4	$6
6-9 miles	11	$3	$6	$9
6-9 miles	17	$3	$6	$9

Distance	Time Saved	Cost #1	Cost #2	Cost #3
6-9 miles	29	$3	$6	$9
10+ miles	18	$5	$10	$15
10+ miles	28	$5	$10	$15
10+ miles	48	$5	$10	$15

Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Respondents were also split into the three trip-length categories for the 0-100 percent likelihood of use questions, and the time savings and cost options were the same as for the "Yes/No" questions. The only difference is that they used a "slider bar" to drag their likely frequency of use to between zero and 100 percent. In addition to the Stated Preference survey the online survey included traditional demographics, travel behavior on the I-405 Corridor, and awareness and attitudes about congestion pricing options.

4.2 SURVEY RESULTS ANALYSIS

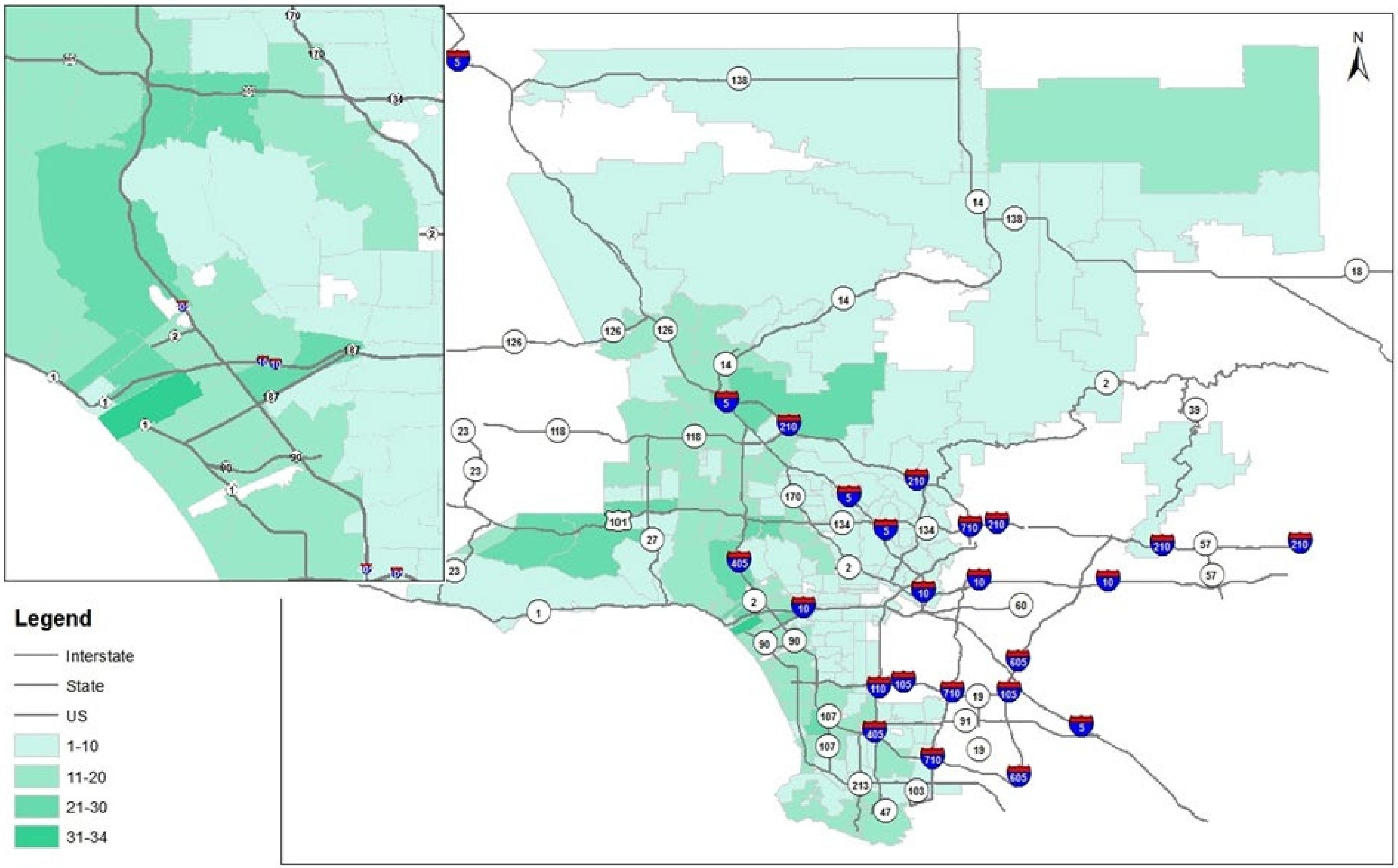
This section presents a descriptive analysis of the survey responses, including survey respondents' demographics, trip characteristics, and respondents' attitudes towards express lanes.

4.2.1 RESPONDENT TRAVEL PROFILE

Figure 4-1 shows the number of survey respondents based on their home zip code. The survey sampled respondents that reside west of I-110 and SR-2, ranging from Lancaster in the north to Long Beach in the south. The majority of the survey respondents live close to either I-405 or US-101. The zip code with the most survey respondents is located south of downtown Santa Monica.

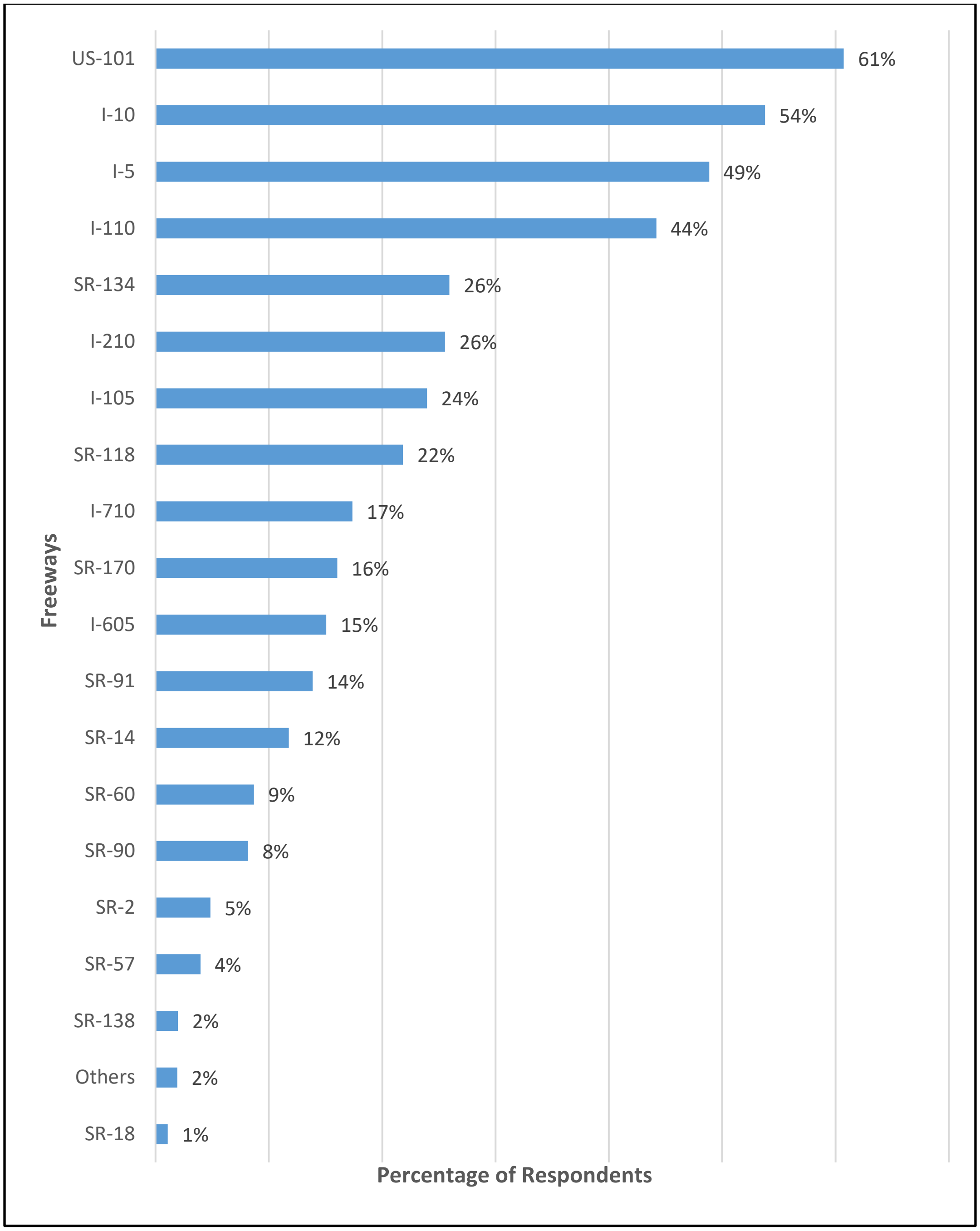
Respondents were pre-screened to ensure they travel on I-405 at least once every two weeks. The vast majority of them also use other freeways: only 4 percent of the respondents report using I-405 exclusively, while 33 percent of the respondents used two to three freeways including the I-405, 44 percent of the respondents used four to six freeways including the I-405, and less than 20 percent of the respondents used seven or more freeways. The other freeways most frequently used by I-405 travelers include the US-101, I-10, I-5, and I-110. **Figure 4-2** shows the listed freeways in order of their popularity among survey respondents.

Figure 4-1: Number of Survey Respondents by Home Zip Code



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Figure 4-2: Most Frequently Traveled Freeways in addition to I-405

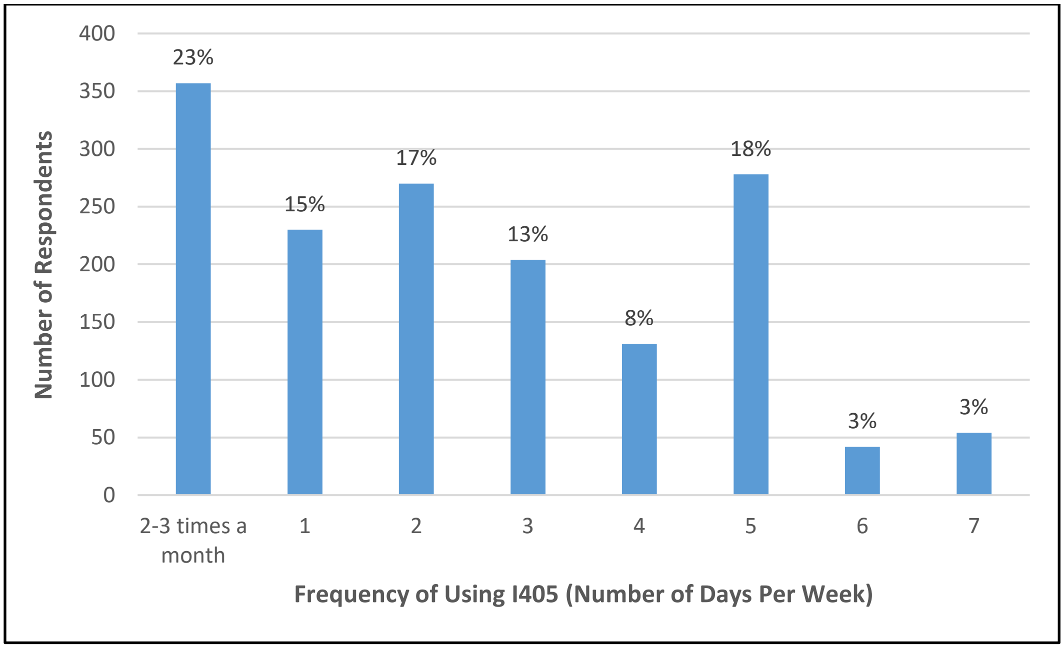


Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Respondents also reported how frequently they used the study segment, namely the section of I-405 between the US-101 and the I-10 Freeways. They were also asked the most common reason for traveling on I-405. **Figure 4-3** and **Figure 4-4** show the frequency and reason for using I-405, respectively. Although almost half (49 percent) of the respondents said their purpose of travel was for work, only 18 percent of the respondents used I-405 five days a week.

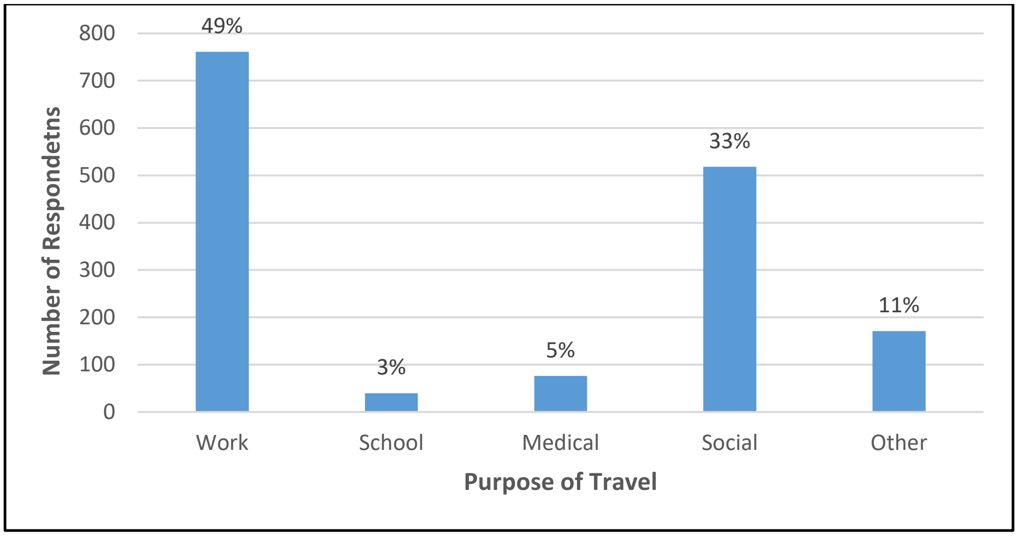
As can be seen from **Figure 4-3**, the majority (55 percent) of the respondents used the study segment less than 3 times a week, while a small percentage of them (6 percent) used I-405 six or seven days a week. The second most popular reason for traveling on I-405 was for social activities, as shown in **Figure 4-4**. In addition, 3 percent of the respondents used I-405 for school and 5 percent used it for medical visits.

Figure 4-3: Reported Frequency of using I-405 between US-101 and I-10



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

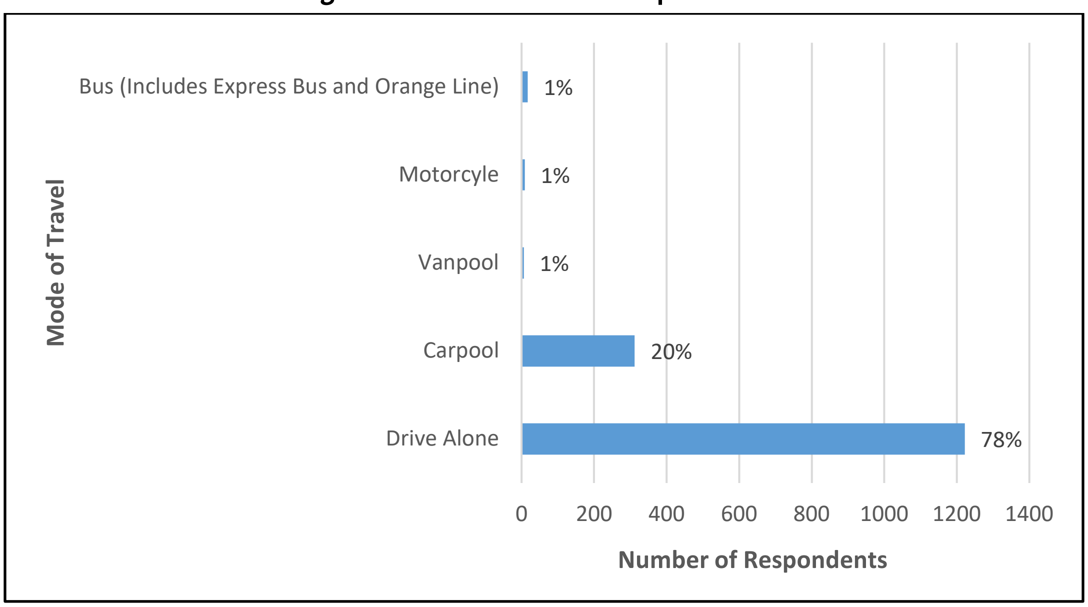
Figure 4-4: Travel Purpose of Trips on I-405



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

When asked about their mode of travel, an overwhelming majority (78 percent) of the survey respondents indicated that they generally drove alone on I-405, while about 20 percent of the respondents carpooled. Less than 3 percent reported taking a bus or traveling by motorcycle or vanpool, as shown in **Figure 4-5**.

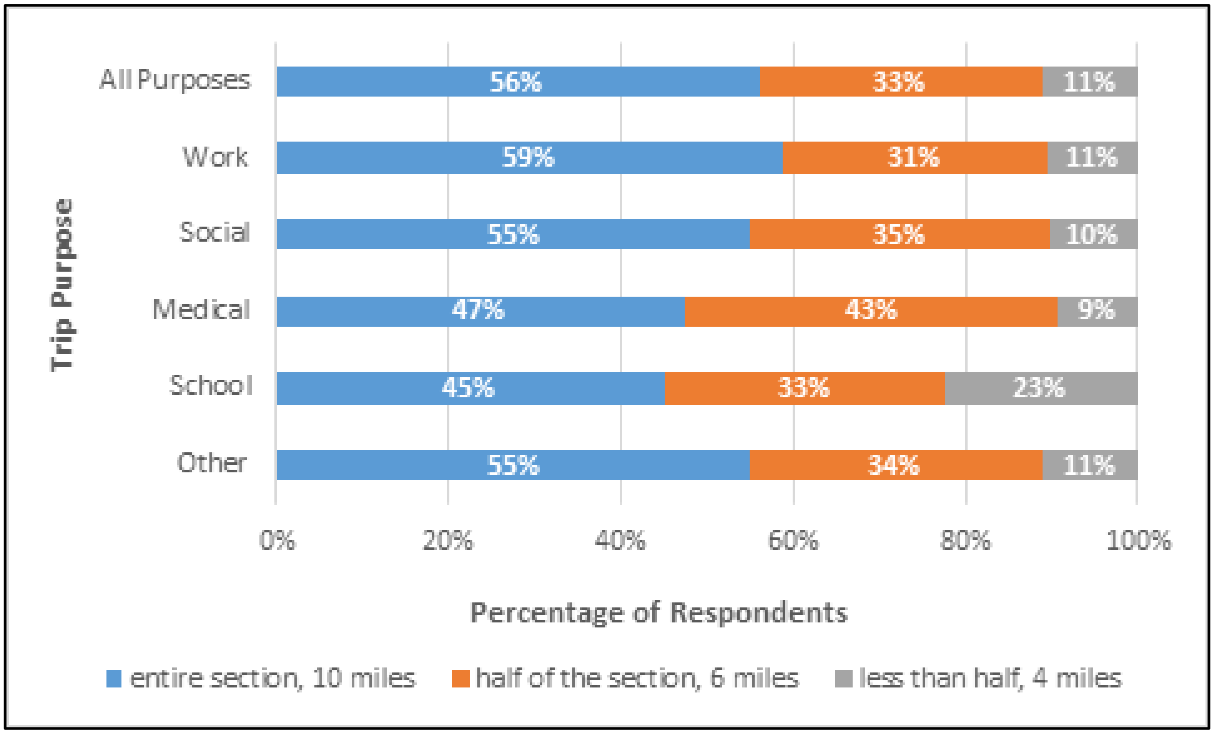
Figure 4-5: Travel Mode of Trips on I-405



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Figure 4-6 shows the reported distance traveled on I-405 between US-101 and I-10 by the survey respondents. Just over half of the respondents (56 percent) traveled the entire section regardless of the trip purpose, 33 percent traveled half of the entire section, and 11 percent traveled 4 miles or less of the 10-mile section. This pattern applies to all the trip purposes except for school trips, where the travel distance tends to be shorter than for other purpose trips.

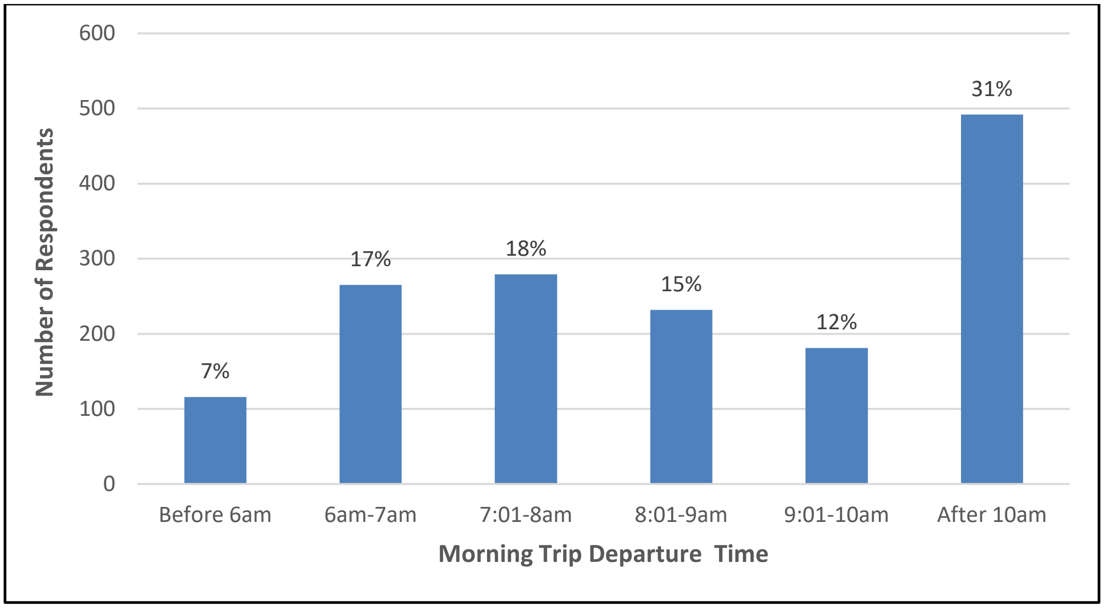
Figure 4-6: Distance Traveled on I-405 by Trip Purpose



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

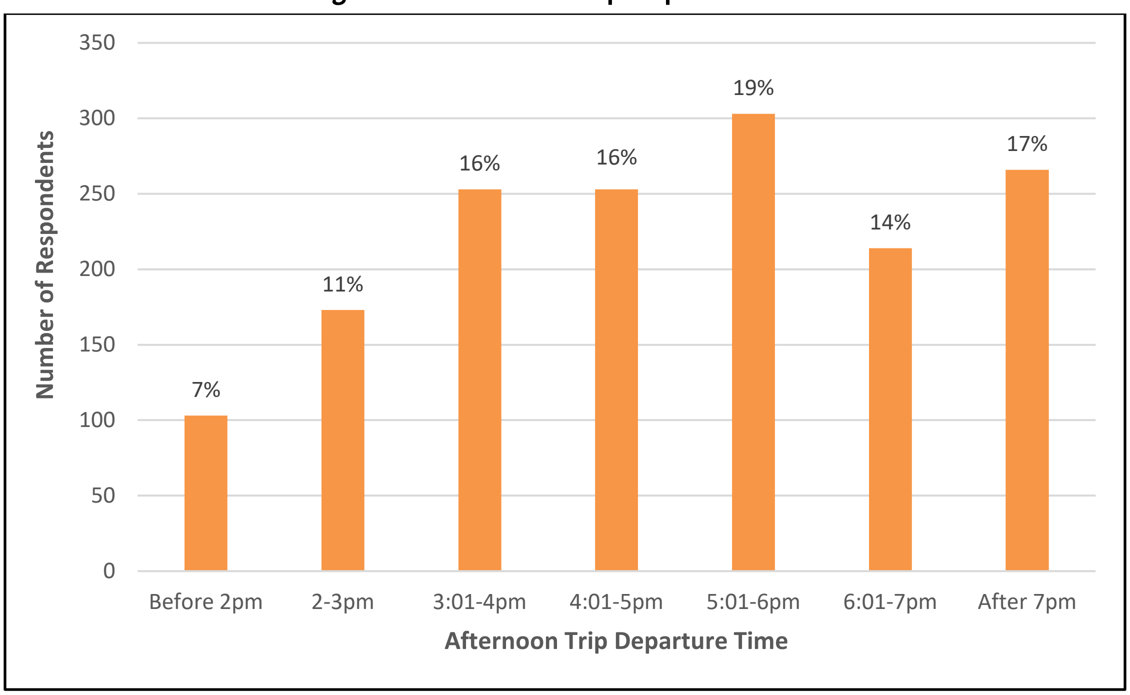
Respondents were asked the usual departure time for morning and afternoon/evening travel. The responses are shown in **Figure 4-7** and **Figure 4-8**. Surprisingly, the most frequent morning departure time was after 10 AM. The second most frequent departure time is the typical commute hours of 6 AM to 8 AM. Afternoon trip departure times were more spread out, partly because more options were offered to respondents. Except for a small number of people that traveled between noon and 3 PM, afternoon/evening departure times are nearly evenly distributed between 3 PM. and 7 PM.

Figure 4-7: Morning Trip Departure Time



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Figure 4-8: Afternoon Trip Departure Time

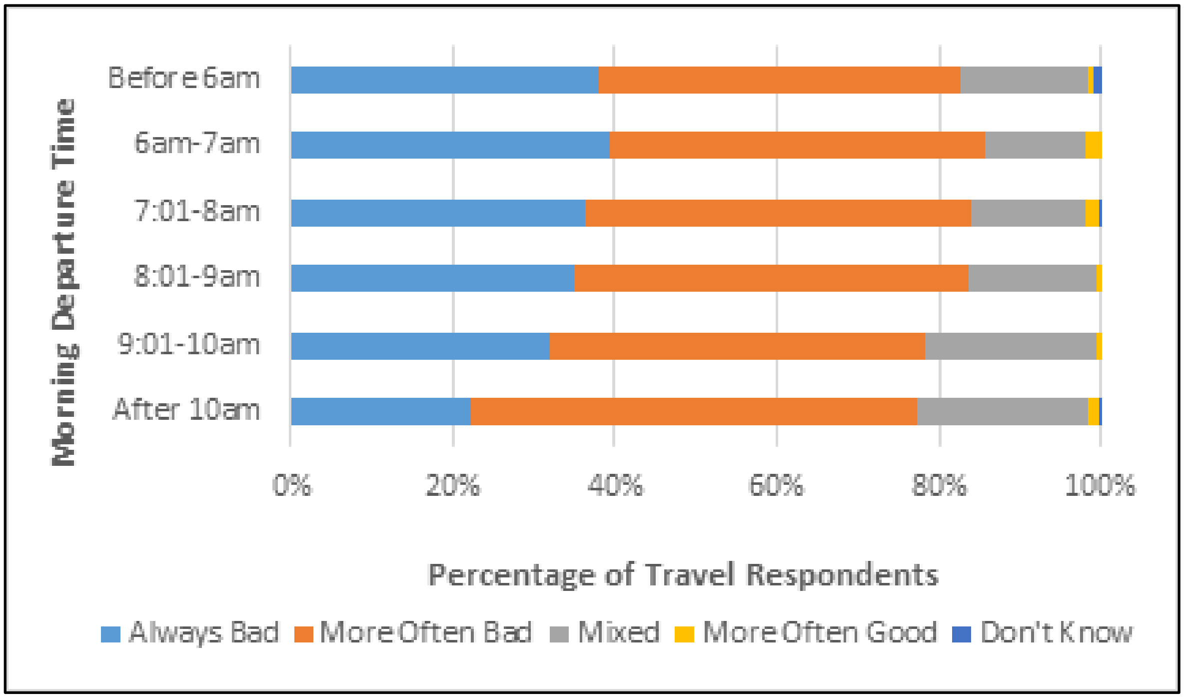


Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

4.2.2 OPINIONS ON CONGESTION PRICING

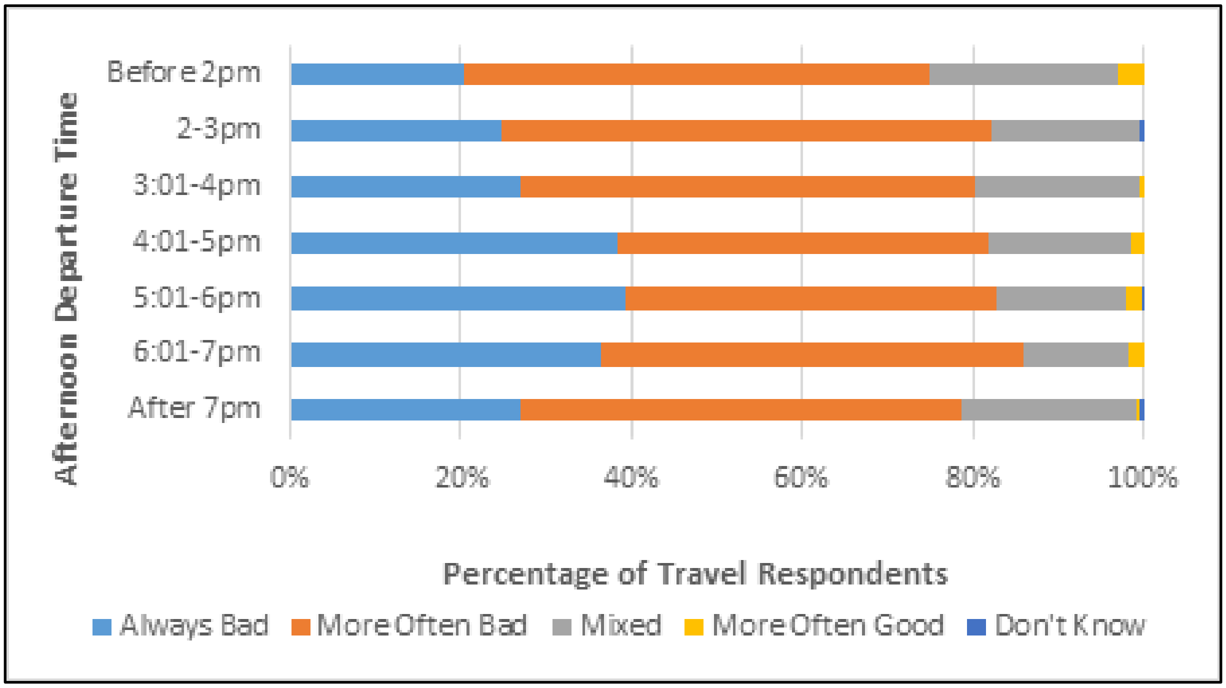
Survey respondents were asked questions to gauge their opinions about traffic conditions on Los Angeles freeways and attitudes towards congestion control methods including congestion pricing. Regarding traffic conditions on Los Angeles freeways, the vast majority of respondents stated they are often or always bad (nearly 80 percent). Only a small percentage (less than 2 percent) thought traffic conditions are often good or always good. As can be seen from **Figure 4-9** and **Figure 4-10**, people who traveled during the peak hours tend to exhibit a more negative opinion on the traffic conditions than off-peak travelers.

Figure 4-9: Perception of Freeway Traffic by Morning Trip Departure Time



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Figure 4-10: Perception of Freeway Traffic by Afternoon Trip Departure Time

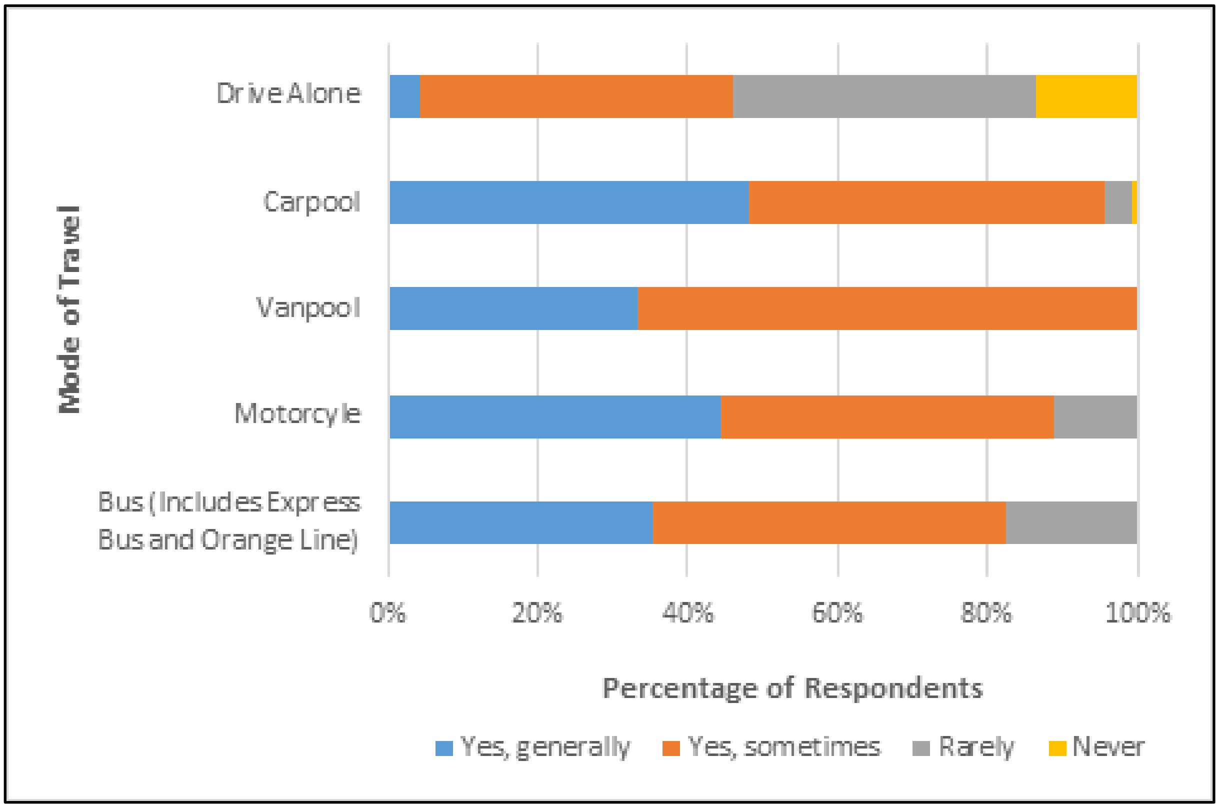


Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

When asked to evaluate current traffic conditions relative to conditions a year prior to the survey, 45 percent of the survey respondents thought the congestion on Los Angeles freeways had gotten worse, 47 percent thought conditions stayed the same, and only 5 percent thought traffic had gotten better.

Out of the 1,566 survey respondents, 10 percent indicate they have never used the carpool lane when traveling on the freeways as summarized in **Figure 4-11**. Among the rest, 48 percent sometimes used the carpool lane, 36 percent rarely used the carpool lane, and 15 percent would generally drive on the carpool lanes. However, when this is looked at in combination with reported mode for travel, only 4 percent of the drive-alone respondents claimed to generally drive in the carpool lane while a significant 42 percent of drive-alone respondents indicate they sometimes drive in the carpool lane.

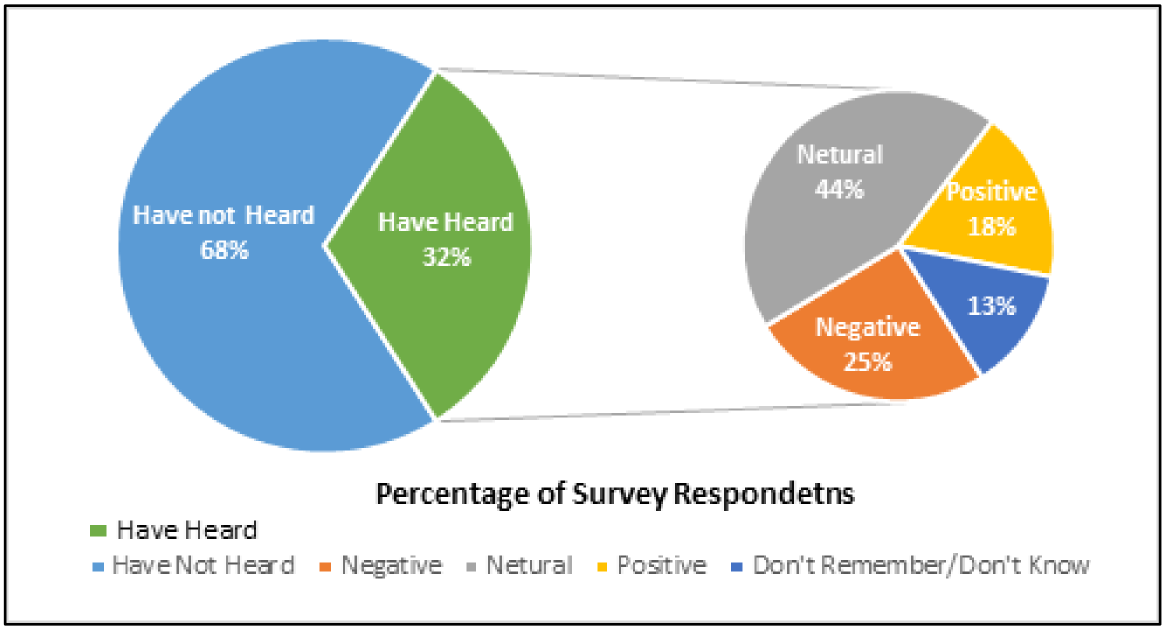
Figure 4-11: Frequency of Using Carpool Lanes by Mode of Travel



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Respondents were also asked about their awareness of the existing express lanes on I-110 and I-10. The answers are shown in **Figure 4-12**. Nearly two-thirds of the survey respondents (68 percent) claimed they had not heard news on either TV or radio about the express lanes in the last six months. Among the 32 percent that had heard about the express lanes on the news, 44 percent regarded the news as neutral, and 25 percent thought it was negative. Only 18 percent reported hearing positive news.

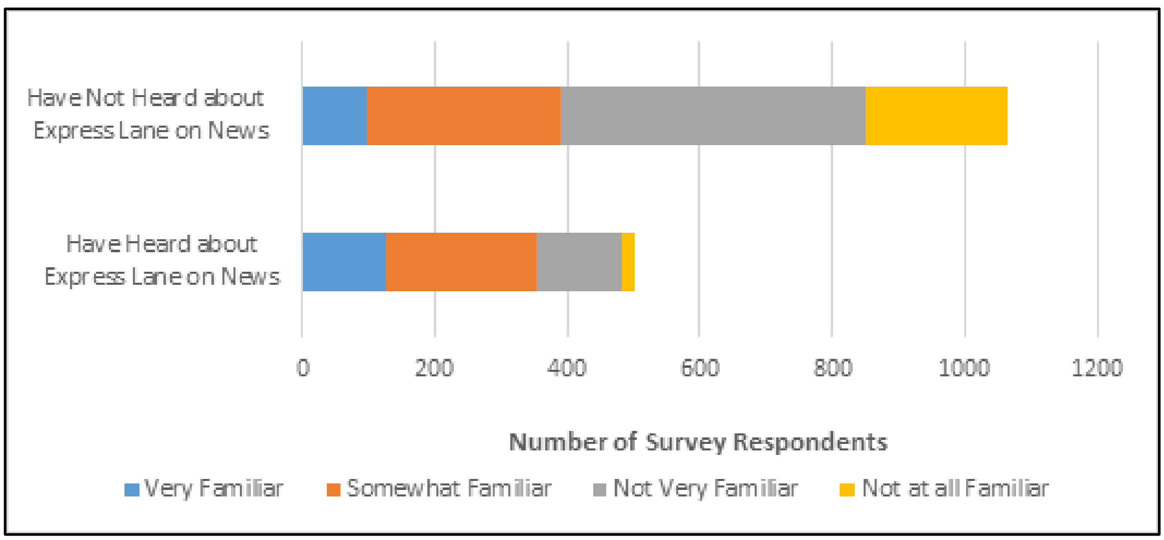
Figure 4-12: Opinion on the News about Express Lanes



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

When asked about their familiarity with how the I-110 and I-10 ExpressLanes work, about half of the respondents indicate being at least "somewhat familiar". Not surprisingly, mention of the express lanes in the media appears to influence people's familiarity with them. As shown in **Figure 4-13**, about three-quarters of those who have heard news of the express lanes are at least somewhat familiar with them, compared with less than half for those that have not heard about them.

Figure 4-13: Comparison of Understanding of Express Lanes between Two Groups



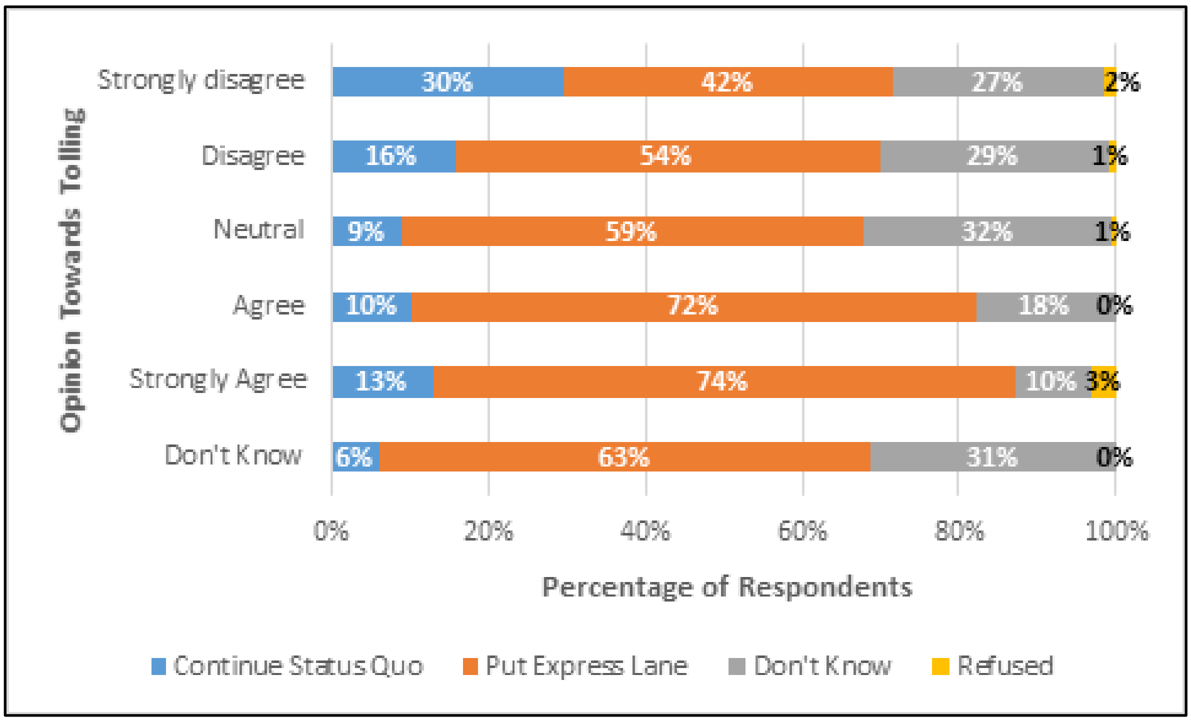
Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Respondents were offered the following description of the express lanes operations, and then asked whether similar strategies should be deployed in other corridors.

> "Express lanes help increase the average speed in the regular freeway lanes by shifting some traffic out of the regular lanes and into the express lanes. This works by letting some single drivers use the express lanes when there is extra room there by paying a toll. Qualified carpools can still use the express lanes for free, and the toll for a single driver increases as needed to keep the average speed in the express lanes at 45 mph or higher."

Overall, 50 percent of the survey respondents chose the option of adding express lanes to currently congested freeways, whereas 22 percent chose to continue the status quo. The remaining 28 percent selected "don't know" or "refuse to answer". **Figure 4-14** shows the responses of whether to put express lanes on very congested freeways relative to attitude towards tolling. Not surprisingly, people with neutral or positive attitudes towards tolling tend to choose putting express lanes over maintaining the status quo in high numbers. Interestingly, even among those who expressed a negative attitude to tolling, close to half of them prefer express lanes over doing nothing (or other, unspecified solutions), after learning about how express lanes work.

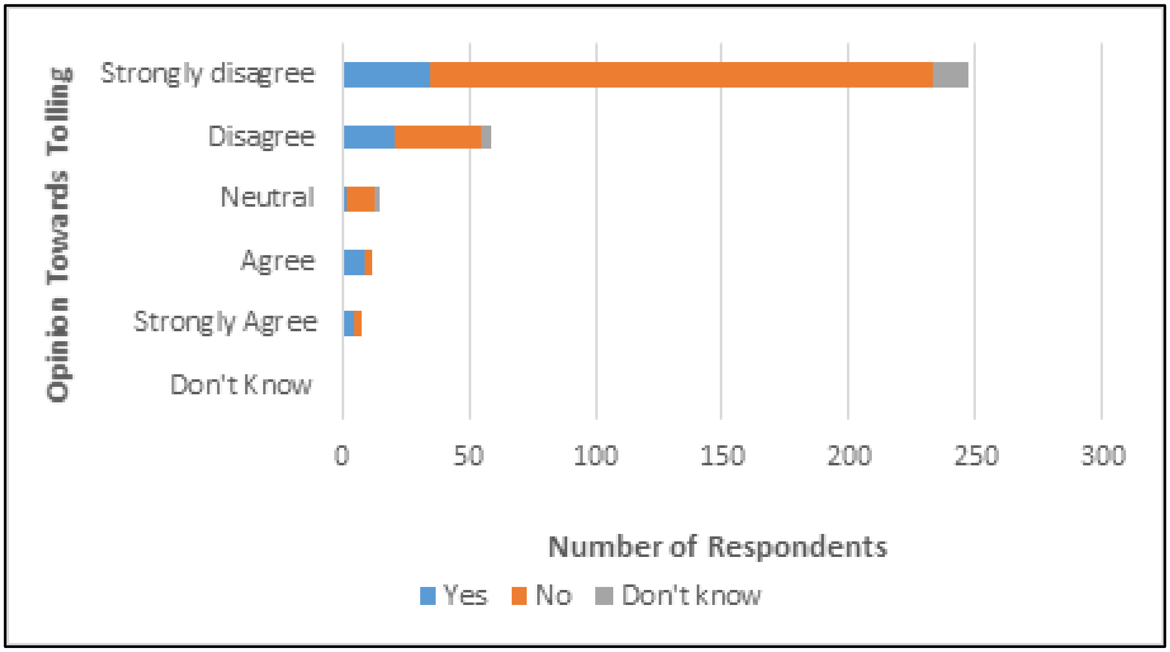
Figure 4-14: Respondents Suggested Action on Very Congested Freeways



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Respondents who chose to continue the status quo were then told that the revenues generated from the express lanes would be used to increase transit services near the congested freeways. They were asked if knowing the uses of the funds would change their opinion on implementing express lanes. The answers are shown in **Figure 4-15**. The majority (73 percent) stated they would not change their opinion (i.e., they still prefer to do nothing over express lanes), while 21 percent said they would change their opinion. As can be seen, most of those who would not change their opinion are strong tolling opponents in the first place.

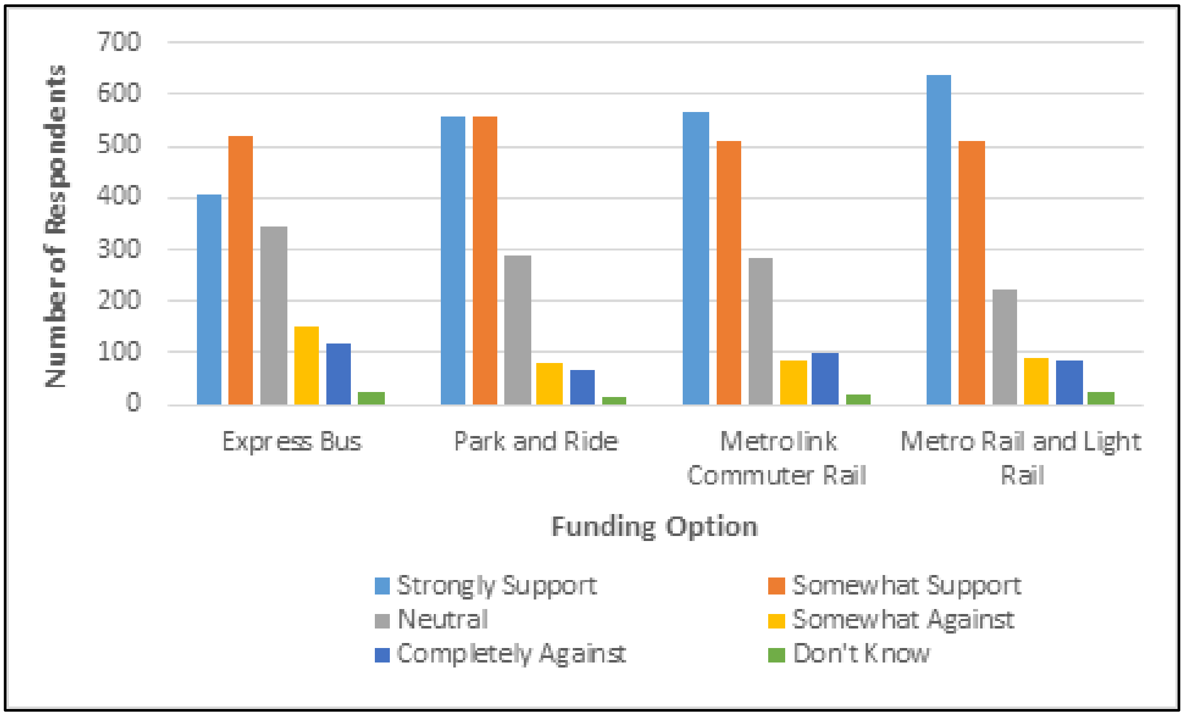
Figure 4-15: Would You Change Your Opinion Knowing How the Funds Will Be Used?



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Respondents were asked to rate how strongly they support four alternative uses of toll revenues. The results are shown in **Figure 4-16**. Among the four options, investing in Metro Rail and Light Rail garnered the highest support, as 72 percent of the respondents strongly supported or somewhat supported funding Metro Rail and Light Rail. This is followed by investing in park-and-ride lots and Metrolink service, both of which had almost equal number of supporters. The least preferred option was express bus, as less than 60 percent of respondents were in favor of using toll revenue to fund express bus service.

Figure 4-16: Support for Different Uses of Express Lane Revenues



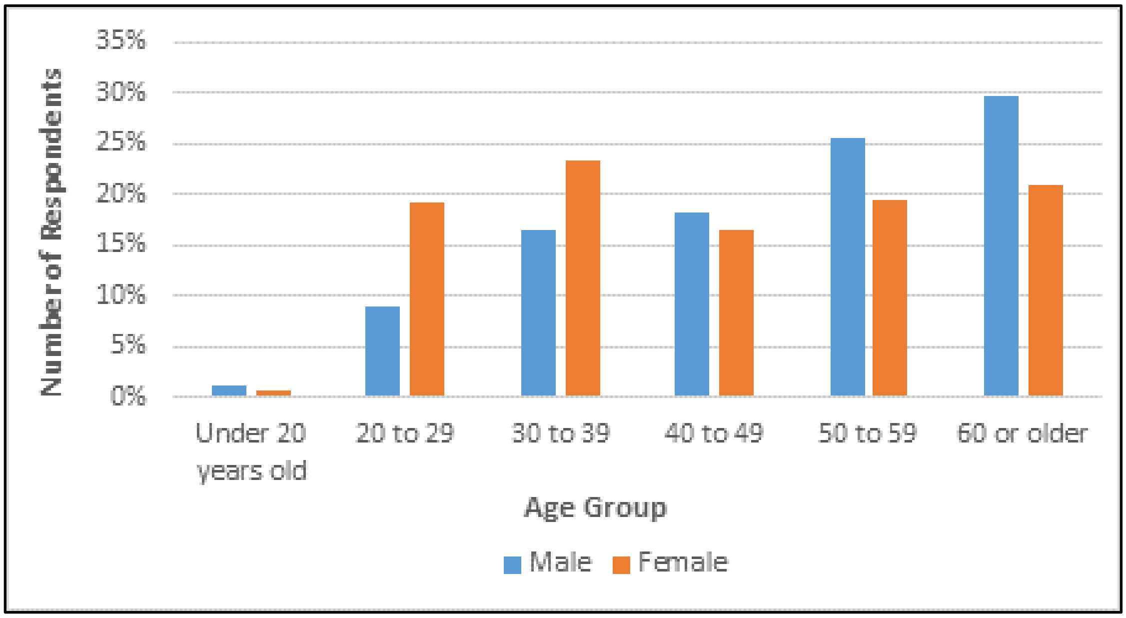
Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

4.2.3 RESPONDENT DEMOGRAPHIC PROFILE

Respondents were asked a few questions to help assess their demographic profile. Where possible, the survey respondents profile is compared with similar statistics from the American Community Survey (ACS), and compiled for the population that lives in the districts that were targeted for sampling. It is important to keep in mind that the target population for this survey is different (by design) from the population of the sampling districts. Specifically, the target population is sampling district residents that commute 4 or more miles on I-405 at least once every two weeks.

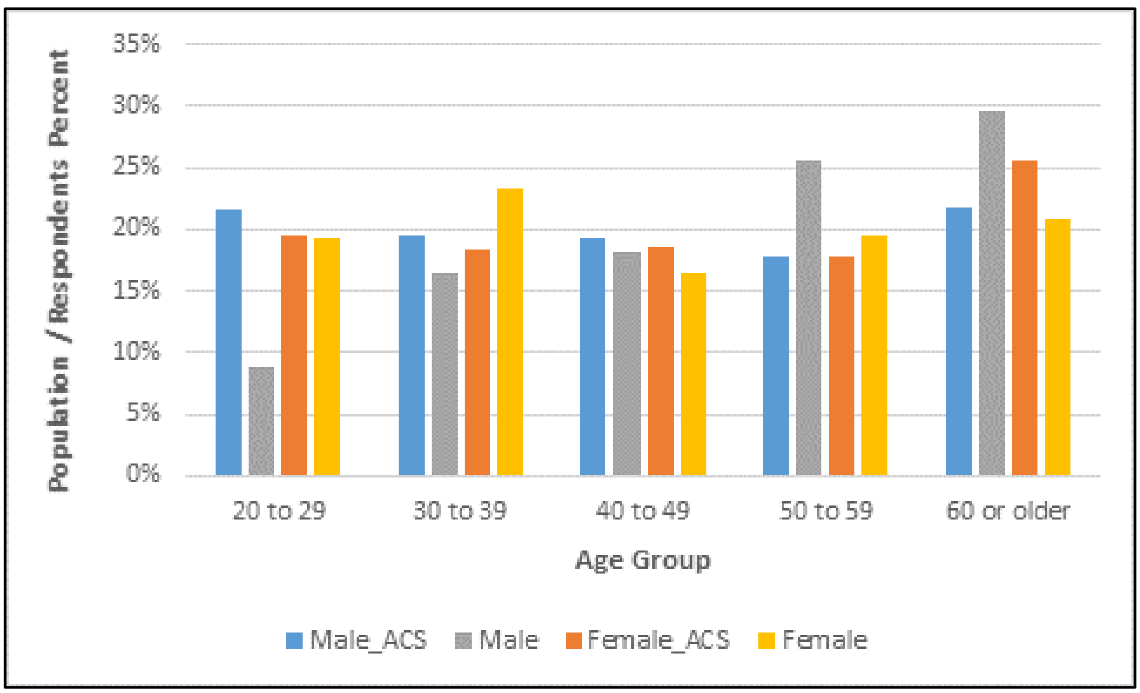
Figure 4-17 shows the age and gender distribution of the survey respondents. Among the 1,566 respondents of the survey, about half of them were female and half of them were male. Almost all the respondents were over 20 years old. There were more male respondents in the older age group, while female respondents were more evenly distributed across age groups. **Figure 4-18** compares the age distribution of survey respondents with the population of the target districts, as reported by the ACS 2014 5-Year release. Persons younger than 20 years old were excluded from this comparison. This figure shows that the survey tends to under-represent the younger male population.

Figure 4-17: Age and Gender



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

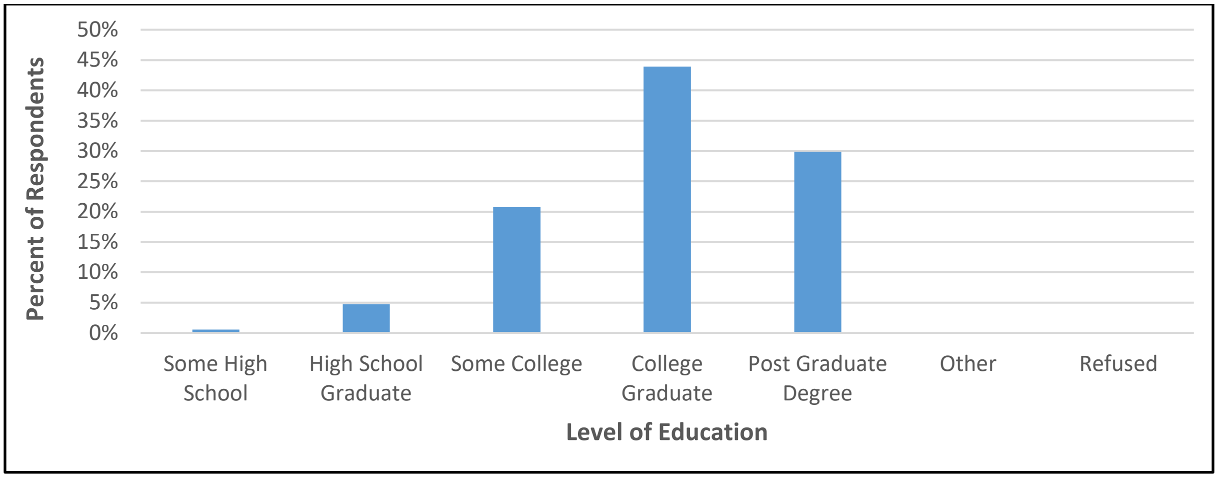
Figure 4-18: Age Distribution of Survey Respondents and Sampling District Population



Source: 2014 American Community Survey

Figure 4-19 shows the education level of the survey respondents. Most of the respondents had at least some college education: 43 percent were college graduates and 30 percent had a post graduate degree.

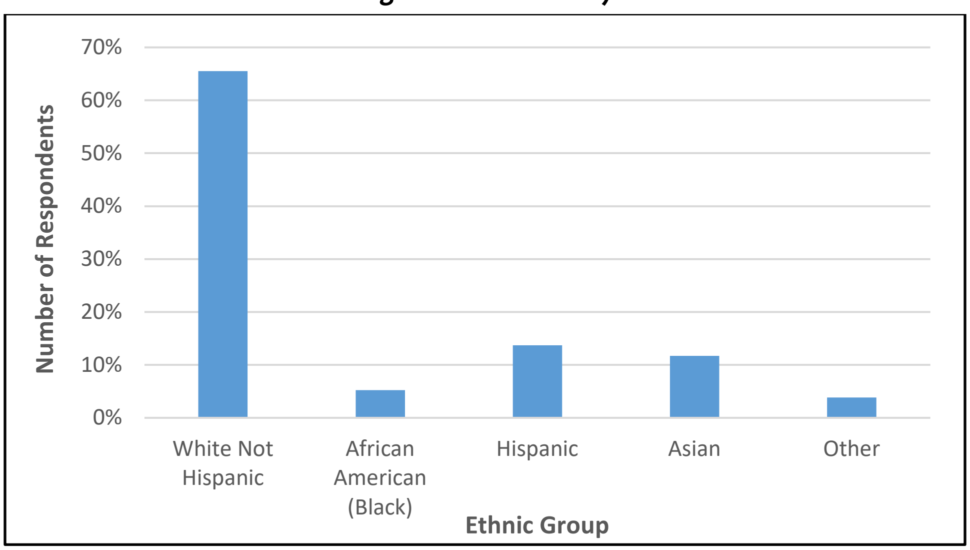
Figure 4-19: Education Level



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Figure 4-20 shows the ethnic distribution of the survey respondents. As can be seen, the majority (66 percent) of the respondents were non-Hispanic white, 14 percent were Hispanic, 12 percent were Asian, 5 percent were African American, and 4 percent were from other ethnicity groups, including Native American, Middle Eastern and multi-racial groups.

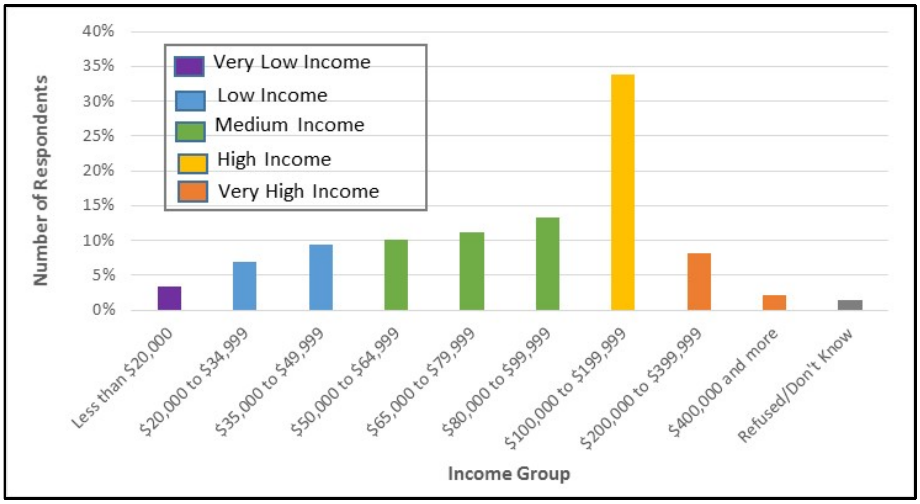
Figure 4-20: Ethnicity



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

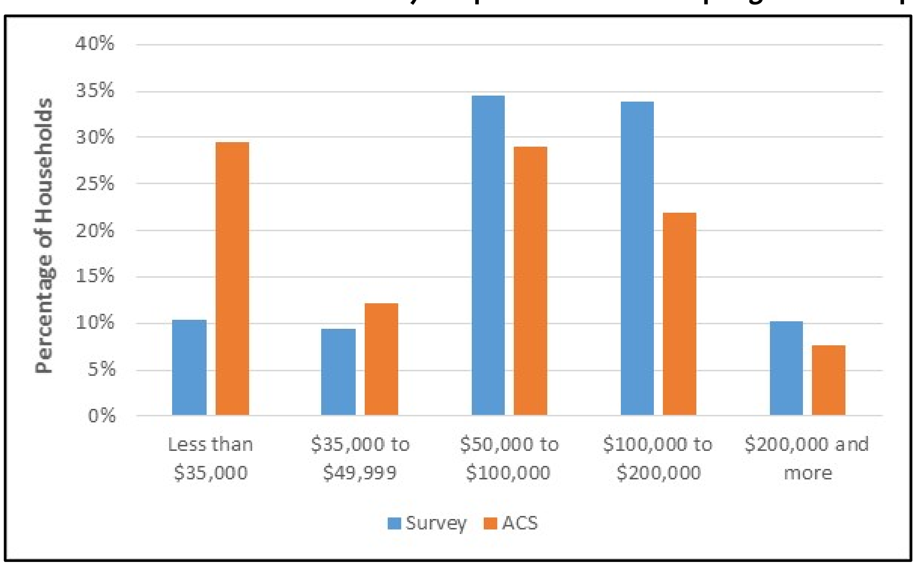
Figure 4-21 shows the household income distribution of the survey respondents. The distribution shows that the majority of people belong to the medium (34 percent) and high (33 percent) income groups, whereas few were in the very low (3 percent) and very high (10 percent) income groups. **Figure 4-22** shows the comparison of household income distribution between survey respondents and all the households within the target districts (based on the ACS 2014 5-Year release). On average, survey respondents exhibited higher household income than the overall target district population.

Figure 4-21: Household Income



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

Figure 4-22: Household Income of Survey Respondents and Sampling District Population



Source: Metro 2015 Stated Preference Survey, administered by Redhill Group

4.3 VALUE OF TIME ESTIMATION

4.3.1 METHODOLOGY

The stated preference portion of the survey presented each respondent with scenarios that described two situations: traveling on the freeway under conditions similar to those experienced today, and traveling on hypothetical express lane scenarios (see **Figure 4-23**). Respondents were asked to choose between the two options. Each respondent was presented with six such choices.

Figure 4-23: Sample Stated Preference Choice Exercise

29. Now please consider travel on the 405 freeway 2-3 years in the future. Congestion will likely be worse than today, but there will now be 2 Express Lanes in each direction. You will be presented with 6 different scenarios based on different levels of congestion. For each one, indicate if you would chose the Express Lanes for a faster trip by paying a toll, or chose the regular lanes which would be slower.

Use the Express Lanes that would take 12 minutes and cost $5.00, or the regular lanes that would take 60 minutes.

☐Express lanes
☐Regular lanes

By choosing between the regular GP lanes and express lanes, respondents reveal their willingness to pay for travel time savings. Their answers can be used to measure willingness to pay in terms of value of time (VOT). For this analysis, VOT was measured by estimating a binary logit choice model. A logit choice model estimates the probability of choosing an alternative as a function of two types of attributes: direct utility that is based on observable, measurable attributes, and indirect utility that is unobservable. In this case, the direct utility is based on travel time and travel cost. The indirect utility is assumed to be a random variable, and is typically referred to as the error term[4]. The probability of choosing the express lane alternative over the GP lane alternative is given by the following expression:

$$Pr_{EL} = \frac{e^{U_{EL}}}{e^{U_{EL}} + e^{U_{GPL}}}$$

Utility of each alternative is a linear combination of time and cost:

$$U_i = \beta_i^1 + \beta_i^2 \times time_i + \beta_i^3 \times cost_i$$

[4] The functional form of a discrete choice model arises from the assumed distribution of the random error term or indirect utility. In the case of a logit model, the error term is assumed to follow the extreme value distribution. It is common in the travel demand field to assume this type of distribution for discrete choice models, because the extreme value function is similar in shape to a normal distribution, but with the important advantage of resulting in close form probability expressions.

The β^n coefficients of this utility function are parameters that can be estimated using the stated preference survey data, using a method called maximum likelihood estimation. The VOT is derived from these parameters, specifically as the ratio of the time and cost coefficients, and is typically expressed in dollars per hour.

Various specifications of the utility functions were estimated, exploring differences in VOT with respect to household income, trip purpose, and trip time-of-day. There are other respondent attributes that could be explored, however, it is important to note that in the SCAG regional travel demand model, VOT can only be expressed in terms of trip market segments defined by trip purpose, peak vs. off-peak travel, and annual household income (defined by three broad categories – less than \$35,000, \$35,000 to less than \$75,000, and \$75,000 or more).

Selected model estimation results are shown in **Table 4-3**. In all cases the estimated coefficients are significant, exhibit the correct sign, and exhibit the correct magnitude. Model B shows a full segmentation of the cost coefficient across household income. Under the hypothesis of VOT increasing with income, we would expect the cost coefficient to decrease with income. As shown in **Table 4-3**, while in general the cost coefficient increases with income, the relationship is not monotonic.

Table 4-3: Model Value of Time Estimation Results

Explanatory variable	Model A Aggregate VOT		Model B VOT by income group		Model C VOT income scalar = 0.2		Model D VOT income scalar = 0.4		Model E VOT income scalar = 0.6	
	Coef.	t-Stat	Coef.	t-Stat	Coef.	t-Stat	Coef.	t-Stat	Coef.	t-Stat
EL Constant	-0.368	-2.5	-0.324	-2.1	-0.371	-2.5	-0.578	-3.9	-0.851	-5.9
Travel time (min)	-0.057	-11.0	-0.057	-10.8	-0.055	-10.6	-0.048	-9.7	-0.040	-8.6
Toll cost (cents)	-0.259	-13.6								
Income \$400k or more			-0.230	-4.3						
Income \$200k - \$400k			-0.234	-7.8						
Income \$100k - \$200k			-0.251	-11.7						
Income \$80k - \$100k			-0.274	-9.5						
Income \$65k - \$80k			-0.269	-8.8						
Income \$50k - \$65k			-0.335	-9.3						
Income \$35k - \$50k			-0.283	-8.4						
Income \$20k - \$35k			-0.264	-7.6						
Income less than \$20k			-0.300	-5.9						
Toll cost / Income□[(1)]					-0.619	-13.3	-1.178	-11.7	-1.887	-9.5
Rho-squared (0)	0.239		0.247		0.240		0.199		0.190	
Rho-squared (C)	0.146		0.154		0.145		0.108		0.090	

(1) Income expressed in thousands of dollars.

An alternative specification was explored, where the toll cost is expressed relative to the household income, as follows:

$$U_i = \beta_i^1 + \beta_i^2 \times time_i + \beta_i^3 \times (cost_i/income^{\gamma})$$

These models were estimated by varying the value of the γ coefficient between 0.2 and 0.8. As shown in **Table 4-3**, the best fit to the data is obtained with γ=0.2, which indicates a relatively small effect of household income on VOT. The analysis found no difference in average VOT with respect to trip purpose or time of day (these results are not shown in the table). It is possible that the lack of relationship between VOT and trip purpose and time-of-day is due to the lack of relating the choice experiments to a particular trip. That is, trip purpose and time-of-day were derived from answers to typical travel, rather than identifying an actual trip taken. To avoid this ambiguity, stated preference survey designs often contextualize the choice experiments by pivoting off the cost and time attributes of the choices relative to an actual, experienced trip.

Table 4-4 shows the VOTs (in 2015 dollars) currently used in the SCAG 2016 RTP/SCS regional travel demand model (TDM), along with VOTs derived from the Sepulveda Pass model estimation results. The mode choice component of the SCAG TDM, where the binary toll choice is modeled, stratifies VOT by three household income groups and by trip purpose. The primary trip purpose segmentation for VOT segmentation is home-based work (which includes university trips), home-based other (which includes shopping, recreation and serve passenger trips), and non-home based. By definition, the non-home based trips are not segmented by household income. Therefore, the table shows the SCAG TDM VOT for home-based work and home-based other trips. These model VOT values are compared to the corresponding VOTs derived from the stated preference-based estimation. In the case of Models C, D and E, the median income of each income group is used to apply the estimated VOT function. In the case of Model B, the table shows VOTs for the income aggregation that best approximates the SCAG TDM income groups.

Table 4-4: Estimated Values of Time (2015$/hr)

Household Income Range	Median	SCAG 2016 RTP/SCS TDM		Model B VOT by income group	Model C VOT income scalar = 0.2	Model D VOT income scalar = 0.4	Model E VOT income scalar = 0.6
		HBW	HBO				
Income $150k or more	$180,200	$17.40	$5.90	$13.90	$15.00	$19.40	$29.00
Income $75k - $150k	$90,900	$17.40	$5.90	$12.60	$13.10	$14.80	$19.20
Income $35k - $75k	$48,000	$10.50	$3.50	$11.10	$11.50	$11.40	$13.10
Income less than $35k	$18,500	$3.50	$1.20	$12.40	$9.50	$7.80	$7.40

Source: WSP

The VOTs used in the SCAG TDM are asserted values based on industry best practices. In general, the VOT for HBW trips is expected to be approximately one-third of the average hourly wage rate, while the VOT for non-work trips is expected to be approximately one-third of the HBW VOT. It is important to note that the SCAG TDM VOTs apply to all trips, while the values estimated from the stated preference survey were based on motorists only. Transit users tend to exhibit lower VOTs than motorists. In the SCAG region, the majority of transit users are persons from low income households. Therefore, it is not surprising that the survey estimated VOTs exhibit higher VOTs for the lowest income group. The more interesting results are for the high income groups. The models that exhibited the best fit to the survey data (Models B and C) show lower VOT for the high income groups than the SCAG TDM. Model D shows a more reasonable escalation of VOTs with respect to income, while Model E might be over-estimating the high income VOTs.

In terms of applying these results to the SCAG TDM, the most straight-forward approach is simply to replace the model HBW VOTs with the values estimated for Model D (or a different, preferred set of results). The HBO VOTs would be estimated following the industry rule-of-thumb of one-third of the HBW VOT. Alternatively, given that the SCAG TDM input data includes the median income for each TAZ, segmented by income group, it is possible to apply a TAZ-specific VOT, which may better capture differences in prevailing household incomes throughout the region. However, this alternative method requires access to the SCAG TDM source code. Additional information on the VOT used in this forecast can be found in **Table 6-1**.

5.0 SOCIO-ECONOMIC GROWTH REVIEW

As discussed previously, the toll traffic and revenue forecasts included in this I-405 study are based on the SCAG 2016 RTP/SCS Regional Travel Demand Model (SCAG TDM) and ECONorthwest's Rapid Toll Optimization Model© (RapidTOM). The SCAG TDM model relies on projected future population and employment growth estimates throughout the region to drive the model. As part of the I-405 study process, SCAG 2040 regional population and employment growth projections were reviewed and compared to development planned and underway in the vicinity of the corridor. This review was undertaken to confirm county-level control totals for population and employment, and to examine the allocation of county totals to the traffic analysis zones that will be used to inform results of the I-405 express lanes traffic and revenue study.

The SCAG TDM model uses the 2016 RTP/SCS socioeconomic data set, which has a base year of 2012 and future year of 2040. The dataset includes population, household, school enrollment and employment projections for Ventura, Los Angeles, San Bernardino, Riverside, Orange, and Imperial counties in a traffic analysis zone (TAZ) framework consisting of 11,267 total TAZs. The growth forecast review comprised two primary elements that are described in this section: 1) calibration of county-level control totals for each element to the base year (2015) and future year (2040), and 2) review of TAZ allocations of households and jobs in key development areas within the I-405 corridor that could most directly impact traffic volumes on the freeway.

5.1 COUNTY CONTROL TOTAL ADJUSTMENTS

Control totals are the aggregations of TAZ forecasts in a county for a single variable in a given year, such as population or households. For instance, Los Angeles County has 5,697 TAZs, the sum of which for population in 2012 is 9.918 million. The I-405 study analysis model calculates a percentage of the county control total for each TAZ in the SCAG base data, and uses this percentage to allocate a share of a revised county control total to each TAZ in the forecast output. For this data review, the 2012 base year control totals were adjusted to 2015 to reflect the most recent available actual socioeconomic data at the county-level. The 2012 TAZ allocations were used as a proxy for 2015, subject to certain adjustments noted in **Section 5.2**.

Table 5-1 shows the control total adjustments made to convert the 2012 data to 2015. The 2015 data was adopted from demographic information kept by Caltrans for each county.

Table 5-1: SCAG Region 2015 Socioeconomic Data Forecast

County	Households (1,000s)			Employment (1,000s)		
	2012	2015	Change	2012	2015	Change
Los Angeles	3,255.4	3,285.4	29.95	4,242.6	4,318.4	75.80
Orange	999.4	1,015.3	15.94	1,526.2	1,539.5	13.28
Ventura	269.3	270.7	1.36	332.3	323.6	(8.69)
Riverside	694.5	706.0	11.53	616.7	648.1	31.42
San Bernardino	615.4	620.5	5.14	659.5	697.2	37.74
Total	5,833.9	5,897.8	63.9	7,377.2	7,526.7	149.6

Source: SCAG RTDM

For the 2040 projections, peer agency forecasts of households, population, and jobs were reviewed and adjusted to the 2016 RTP/SCS 2040 forecast year county control totals. The 2040 control total data were adopted from Caltrans forecasts which, for Los Angeles and Orange counties, were within 2 percent of SCAG's 2040 forecasts. The Caltrans forecasts were updated more recently and reflect a more conservative forecast of growth in the Inland Empire and Ventura County than SCAG. Given the passage of the Measure M transportation sales tax in Los Angeles County and related transportation investments that are expected to draw people to the more urban locations, it was considered reasonable to adopt the more conservative Caltrans forecasts for these areas.

The control total forecasts shown in **Table 5-2** include an average regional growth of approximately 41,000 households and 71,000 jobs per year between 2015 and 2040. This growth projection is commensurate with historical absolute annual growth rates of about 45,000 households and 73,000 jobs per year in the study area between 1995 and 2015. Riverside and San Bernardino are forecast to have the highest compound annual growth rates for both households and jobs.

Table 5-2: SCAG Region Compound Average Growth Rates (CAGR)

	Households			Employment		
County	2015	2040	CAGR	2015	2040	CAGR
Los Angeles	3,285.4	3,837.6	0.6%	4,318.4	5,114.0	0.7%
Orange	1,015.3	1,151.0	0.5%	1,539.5	1,946.1	0.9%
Ventura	270.7	291.3	0.3%	323.6	357.9	0.4%
Riverside	706.0	888.4	0.9%	648.1	931.3	1.4%
San Bernardino	620.5	758.5	0.8%	697.2	957.3	1.2%
Total	5,897.8	6,926.8		7,526.7	9,306.6	

Source: SCAG RTDM

From 2007 to 2010, Los Angeles County lost over 330,000 jobs during the Great Recession, and finally surpassed peak employment from 2007 in 2015. From 2015 to 2040, Los Angeles County is expected to add over 550,000 households and close to 800,000 jobs total, accounting for about half of the region's total growth.

From 2016 to 2021, an average of 28,300 new housing permits are expected to be issued each year in Los Angeles County, many of which will be in the form of high-rise multifamily housing projects in the downtown area[5]. Downtown area growth will account for much of the County's growth over the next 10 years, however this is not expected to affect the I-405 corridor as directly as the smaller scale developments in those areas closer to the corridor.

The Northern Los Angeles County region has the largest amount of buildable land for new development and will continue to grow over the long-term. In 2015, Los Angeles County added 94,700 jobs (2.2 percent annual increase)[6] and the unemployment rate declined from 8.3 to 6.7 percent from 2014 to 2015[7]. Total employment is expected to grow at an average of 0.9 percent per year from 2016 to 2021, with the fastest growing jobs sector being health and education[8]. This job growth rate will not be sustained over the long-term and, as has happened in the past, strong growth periods such as these will be balanced out by recessionary periods in which job growth slows or job losses are incurred.

In December 2015, the U.S. Federal Reserve System raised short-term borrowing rates for the first time in ten years. Citing job growth trends and healthy unemployment levels, this move signals confidence in the U.S. economy's near-term fundamentals and a departure from the monetary policy geared towards stemming the losses from the Great Recession. In the longer-term, the SCAG region growth forecast reflects several fundamental characteristics of Southern California that have impacted growth in the past.

i. The diverse mix of employment, including high tech manufacturing (electronics, medical devices, defense equipment, etc.), leisure and hospitality jobs, retail jobs, medical services jobs to assist the aging population, and educational service jobs to fuel future innovation and economic growth.

ii. Continued migration of certain manufacturing sector components, such as distribution, which is migrating within the SCAG region to less expensive operating environments such as the Inland Empire, and others (mainly less advanced manufacturing processes) that could continue moving off shore.

iii. Continued strong growth in Los Angeles County employment. The County's recent growth and rapid recovery from recession is a significant departure from historical trends and suggests there could be a structural shift in the role of Los Angeles County employment within the SCAG region. The county has averaged over 100,000 new jobs over the past 4 years, representing 54 percent of the regional job growth over the period. In previous

[5] Caltrans Los Angeles County Economic Forecast (2016).

[6] LAEDC 2016-2017 Economic Forecast & Industry Outlook.

[7] Caltrans Los Angeles County Economic Forecast (2016).

[8] Caltrans Los Angeles County Economic Forecast (2016).

expansionary periods, Los Angeles County's share of regional growth was 39 percent (1993 to 2001) and 30 percent (2002 to 2007).

iv. Continued housing / jobs imbalance in certain key parts of the region, particularly Orange County, where the build-out of remaining vacant land is arguably within the forecast horizon. Even under current plans where far more land will be dedicated for residential development than commercial, long commute times will be the norm for many Orange County workers seeking less expensive residential options outside the county.

v. The trend towards infill development in established areas may provide a counterbalancing effect to the issues noted above in (iv). Research and field observations suggest that this trend is accelerating and will impact employment and household development patterns sooner rather than later. This is consistent with national trends showing stronger employment growth in urban cores versus suburban areas, which is a departure from the past half century or more of metropolitan growth patterns. It remains to be seen if these trends reflect a short-term, cyclical pattern driven by factors such as demographic shifts, including lifestyle preferences of the growing Millennial age group, or a permanent, structural shift that will continue to channel employment and housing demand towards urban cores in the longer term.

vi. California has developed a reputation as a challenging location to operate a business, and some businesses have relocated to more business-friendly states such as Arizona, Nevada, Texas, and Utah. Despite this reputation, during the recovery from the Great Recession, the state had one of the strongest rebounds relative to other states and the U.S. as a whole. This trend suggests that the fundamentals of the California economy remain strong despite perceptions of an unfriendly business environment.

5.2 KEY DEVELOPMENT AREA ALLOCATIONS

The second element of the growth forecast review was adjusting the socioeconomic data at the TAZ level to reflect known changes to development in specific TAZs. Internet research and interviews with Los Angeles city planning department staff were conducted to confirm the timing and quantity of expected major developments along the I-405 corridor, and to research developments that may not have been included in the 2016 RTP/SCS growth forecasts.

The majority of these instances were major redevelopment projects that had moved ahead in the planning process since the SCAG 2016 RTP/SCS data set was developed. No major developments were uncovered that had been completed by 2015, therefore no TAZ-level adjustments were made to the 2015 dataset, though several projects are currently under construction and expected to be completed by 2020, which will be reflected in the 2040 dataset.

One example of such an adjustment is the City of Champions Stadium complex where the Los Angeles Rams will play starting in 2019. This decommissioned race track was not contemplated for redevelopment of this scale until last year. Now, massive plans for an entertainment complex are being implemented and need to be reflected in those respective TAZs in future years. This review only focused on large developments in the cities adjacent to the I-405. Several projects not included in the regional forecasts were identified and found to be in advanced stages of planning or already under construction, and would certainly be completed by 2040.

Voters in Los Angeles passed Metro's Measure M half-cent sales tax increase to fund new public transit projects and infrastructure improvements. While it is too early to forecast the full impact of the proposed Measure M projects and programs, an increase in redevelopment of areas around the proposed new transit stations is expected. Some of the projects described below are the start of this anticipated growth in mixed-use transit-oriented development.

The following is a description of major projects in Key Development Areas:

- **Sunkist:** The Sunkist Development Project includes plans for the former Sunkist Growers, Inc. headquarters in Sherman Oaks to be renovated and retained as creative office space, and for new construction of 300 multi-family apartments, 40,000 square feet of retail, and 7,000 square feet of restaurant space. The project will be completed in 2018.
- **NoHo West:** A new mixed-use community will be built on the site of the old Laurel Plaza shopping center in North Hollywood. The 25-acre site will include over 640 new apartment units, and 190,000 square feet of office and retail space, including a cinema. The project will be completed in 2018.
- **1560 Lincoln Blvd:** The 1560 Lincoln Project in Santa Monica is a 5-story mixed-use building that will include 100 units of multi-family apartments and 13,680 square feet of ground floor neighborhood-serving retail and commercial space. The project was approved in 2015.
- **Santa Monica Gateway and Millennium East Village:** Santa Monica Gateway is a new creative office campus in Santa Monica's new Bergamot Transit Village near the Expo Line's Bergamot light rail station. The project will consist of two new 4-story buildings with a total of 200,000 square feet of office space and 9,000 square feet for retail. Delivery of the project is expected for Q2 of 2017. Just east of the Santa Monica Gateway project, the Millennium East Village project is also under construction. The old mobile home park will be transformed into a 5-story mixed-use community with 374 multi-family units, 38 of which will be affordable housing, and almost 25,000 square feet of commercial space.
- **Landmark Apartments:** Landmark Apartments is a proposed high-rise development on the 2.8-acre site of a former supermarket in West Los Angeles. The plans include a 34-story structure with 376 multi-family units, 16 of which will be affordable housing, and an 18,000-square-foot park which will front Wilshire Boulevard. Completion is expected in 2020.
- **Martin Expo:** The Martin Expo Town Center project will build new retail, residential, and a 10-story office tower a block away from the Expo Line's Expo/Bundy station. Plans include 516 apartments, a 35,000-square-foot grocery store, 18,000 square feet of restaurant space, 46,000 square feet for general retail, and 150,000 square feet of creative office space. Of the 516 planned apartments, fifteen percent will be workforce housing and five percent will be for very low-income tenants. Developers aim to break ground in early 2018.

- **Casden Sepulveda:** The Casden West L.A. project proposes to replace an old cement plant with 595 apartments and 15,000 square feet of ground-floor commercial space. The development would be near the Expo/Sepulveda station as well as both existing and planned bus stops.
- **Century City Center:** The Century City Center plan will reconfigure and renovate existing buildings and outdoor areas within the Westfield Century City shopping mall for approximately 362,000 square feet of additional retail space, 118,000 square feet of new office space, and 262 luxury condominiums. The project will replace two existing office buildings adjacent to the shopping center. The project will be completed in phases starting in 2017.
- **Sony Pictures:** Sony Pictures Entertainment relocated its corporate offices to the recently completed 23,000-square-foot 4-story office building in Culver City. The project redesigned an existing building and added almost 10,000 square feet of new floor area.
- **Corporate Pointe**: A 7-story office building with approximately 281,000 square feet in Culver City to be completed in 2017.
- **Samitaur:** The project will be approximately 52,000 square feet of retail and restaurant space in Culver City to be completed in 2018. Platform project is 230,000 square feet of mixed-use under construction. Ivy Station project is 148-room hotel, 58,000 square feet of retail and restaurant, 196,000 square feet of office, and 200 units to be completed in 2019.
- **Culver Studios:** Culver Studios, an independent production facility will add 139,000 square feet of additional office to be completed in 2019. Directly across from this studio at the corner of Culver Boulevard and Washington Boulevard is an empty lot named Parcel B. This site will become 118,000 square feet of new commercial space to be completed in 2018.
- **West LA College:** West Los Angeles College plans to add 92,000 square feet of building space to their campus in Culver City by 2017. The College anticipates a growth from approximately 10,200 students enrolled in the fall of 2015, to a future student population of almost 19,000 students.
- **Cumulus TOD:** The Cumulus TOD Project at an 11-acre parcel next to the Expo Line's La Cienega/Jefferson station is planned for 1,218 residential units and 300,000 square feet of commercial and retail space. The development would demolish multiple structures currently on site. Construction was expected to begin in 2018, but pushback from the community due to plans for as many as 30 stories has put the project on hold.
- **Museum & Academy:** The Academy of Motion Picture Arts and Sciences is opening an Academy Museum of Motion Pictures in the Miracle Mile area in Los Angeles in 2018. The Museum will have a 1,000-seat cinema, outdoor plaza, and exhibition space as well as programming dedicated to the film industry. The new building will be 208,000 square feet and replace the former Macy Co. department store. A new office tower is also slated to open in the Miracle Mile. The 13-story building will replace a surface parking lot with 254,000 square feet of office and retail space. The project is expected to be completed in 2019.

- **Metro Station:** As part of Metro's Westside Subway Extension of the Purple Line, a new station will be added at Wilshire and Fairfax in 2023, making the Miracle Mile area widely accessible by transit.
- **Rams Stadium:** The City of Champions Revitalization Initiative will bring the National Football League (NFL) Rams back to Los Angeles and replace the Hollywood Park racetrack in Inglewood with a 298-acre mixed-use sports development. The project includes a brand new 80,000-seat stadium as well as a smaller entertainment venue for 6,000 people, approximately 890,000 square feet of retail, 780,000 square feet of office space, a 300-room hotel, and up to 2,500 residential units of primarily apartments and townhouses. The new NFL Network studio and headquarters will be housed at this new NFL Campus. The project will also have 25 acres of open space, public parks, a manmade lake, and pedestrian trails and bike paths. Construction commenced in early 2017, and the stadium will be finished in 2019. The entire project is expected to be completed in 2023. The South Bay Transit Corridor Rail Project, which is a proposed project to be funded under Measure M, would extend Metro light rail south to Inglewood and areas of Los Angeles' South Bay, connecting the City of Champions Revitalization Initiative to mass transit.
- **Compton Brickyard:** A total of 1.2 million square feet of light industrial park across two buildings in is planned for the site of a former clay mining and brick manufacturing operation in Compton. Construction has begun and the project is scheduled to be completed sometime this year.
- **Promenade at Downey:** The Promenade at Downey project is located north of Interstate 105 off Lakewood Boulevard and celebrated its grand opening earlier this year. The new mixed-use lifestyle center consists of 1.5 million square feet of retail, restaurant, and office space on 77 acres.
- **Goodman Logistics**: The Goodman Logistics Center in Santa Fe Springs totals 1.2 million square feet across three buildings. The logistics distribution center is located at the east end of I-105, accessible to major interstates, the Ports of Los Angeles/Long Beach, Los Angeles International Airport, and BNSF intermodal rail yard.
- **Sage Aria:** Two residential projects at the intersection of Artesia Boulevard and Bloomfield Avenue in Cerritos will together add over 300 units. Sage Apartments has 132 units under construction and Aria Apartments recently completed 197 units.

The areas south of the I-405 study area along the coast such as Manhattan Beach and Hermosa Beach are primarily built out, and our analysis did not show significant household or employment growth in those areas.

5.3 SOCIO-ECONOMIC GROWTH FINDINGS

The following summarizes the main findings of the growth forecast review:

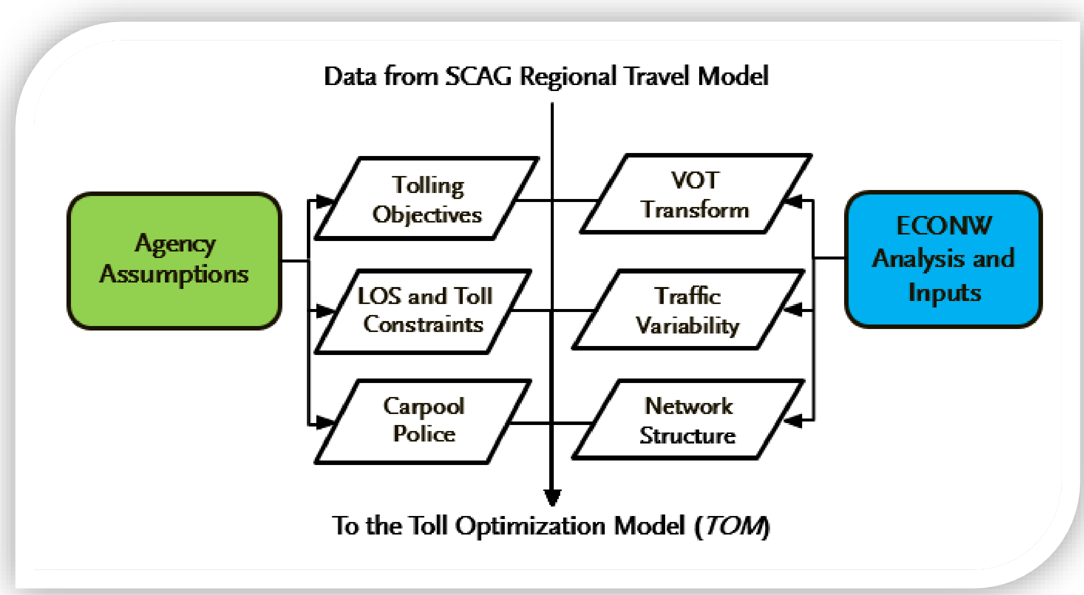
- The SCAG 2016 RTP/SCS growth forecasts are commensurate with the Caltrans forecasts. The Caltrans forecasts at the county level were adopted for this Study since they are more recent and reflect slightly more conservative growth assumptions (i.e., they assume somewhat lower growth rates).
- Historic growth patterns are likely to be maintained in the future, given the diverse mix of employment, migration of certain manufacturing sectors to less expensive parts of the region, and continued residential growth in infill areas and areas of relatively lower-cost land. Los Angeles County is likely to continue to exhibit strong growth in employment over the long term.
- The TAZ level forecasts were adjusted to include multiple large developments already in advanced planning or construction stages, which were not anticipated at the time of the 2016 RTP/SCS.

6.0 MODEL DEVELOPMENT & METHODOLOGY

Toll traffic and revenue forecasts for this I-405 study are based on the SCAG 2016 RTP/SCS Regional Travel Demand Model (SCAG TDM) and ECONorthwest's Rapid Toll Optimization Model© (RapidTOM). The SCAG TDM was chosen for this study because it is the most recently validated model in the region with the ability to forecast HOV lane and express lane volumes. This regional model provides the traffic conditions on all corridors, considering lane configuration, population and employment, and the adjacent regional network. RapidTOM facilitates rapid simulation of toll policy and network alternatives without requiring cumbersome additions to the regional model. RapidTOM simultaneously determines equilibrium lane volumes, speeds, toll levels, hourly revenues, and travel times for express lanes. The model also allows scenarios that are consistent with agency-stated objectives, including any constraints imposed regarding carpool policy, minimum level of service criteria, minimum and/or maximum toll levels, etc.

This section provides an overview of the development of the toll and revenue model using the regional SCAG TDM and RapidTOM models. **Figure 6-1** illustrates the key elements of model development, while model validation and forecasting methodology is detailed in **Appendix B**.

Figure 6-1: Model Development Process



Source: ECONorthwest

6.1 SCAG TDM BASE YEAR VALIDATION

The SCAG TDM was validated to 2012 conditions prior to its use in the production of the SCAG 2016 RTP/SCS. While the SCAG TDM meets industry standards for region-wide validation, the model exhibits larger than desirable deviations from observed traffic counts at a corridor level. To mitigate the difference between the model estimates and the observed counts, a corridor-level validation was undertaken. The purpose of the corridor validation is to correct, via adjustment to global model parameters, any systematic deviation found between the 2015 observed and estimated volumes. The model was validated to the following data sources:

- PeMs traffic counts, by time-period, direction and lane type, where available
- Ramp entrance and exit counts collected for this study
- Vehicle occupancy counts, collected at the Sunset Boulevard and Skirball Center Drive overcrossings
- Sub-regional trip origin and destination (OD) patterns, synthesized from vehicle GPS trip traces. The data are expressed in terms of a trip index, comparable to the model estimates once expressed relative to the region totals.

The initial validation of the model to observed traffic conditions at a corridor level showed that the model tended to over-estimate peak period traffic in both general purpose and HOV lanes. The model also tended to over-estimate midday traffic but underestimate night time volumes, particularly in the HOV lane. The comparison also showed that the model tended to estimate longer-than-observed trip lengths. And finally, it also showed that the model tended to overestimate the share of carpools in the general-purpose lanes.

The following model parameter modifications were implemented to address the issues listed above, as well as to update the model to reflect Value of Time (VOT) findings from the stated preference survey:

- The diurnal factors were modified to shift traffic from peak to off-peak periods.
- The trip distribution model was recalibrated to average trip lengths that were approximately 10% shorter than the model-estimated 2015 average trip lengths, by purpose and time-period.
- The VOT for all purposes except home-based university and home-based school were updated to reflect the average VOTs estimated from the 2015 stated preference survey, or derived from the stated preference estimates based on typical relations between home-based work VOTs and VOTs for other trip purposes.
- The scale factors used to compute VOT for carpool trips were reduced to better reflect that many carpools consist of persons from the same household, especially parents driving children, and therefore the trip costs are not shared proportionally among all carpool passengers.
- The minimum distance required to travel on an HOV lane was raised to 0.5 miles, to reduce the incidence of very short carpool trips using the HOV lanes.
- The mode choice model was recalibrated to readjust the region-wide mode shares, given the updates listed above.

6.2 RAPID TOLL OPTIMIZATION MODEL (RAPIDTOM)

Determining base traffic conditions is the starting point for the process that finds the tolling scheme that best meets a policy objective, such as travel time minimization or revenue maximization. In an express lane setting, tolls and revenues are extremely sensitive to corridor vehicle volumes. Small errors in volume estimates have amplified effects on annual revenue estimates. Thus, it is important that the regional model forecasts are reasonable.

In addition, the variable, dynamic nature anticipated for the tolls proposed to be charged on the I-405 express lanes poses a unique challenge to any regional model. The SCAG TDM forecasts demand with a temporal resolution of 3 to 4 hours (peak periods) and 6 hours in the mid-day. This means that the model estimates demand based on travel time and tolls that represent, at best, the average over each 3- to 6-hour time-period. However, within these periods, tolls could vary as frequently as every 5 to 15 minutes depending on traffic conditions. This common practice of calculating an average toll over the entire period for demand modeling can produce substantially biased toll traffic and revenue estimates. The bias results from the highly non-linear relationship between traffic volumes and travel times. To avoid these biases, tolls and toll traffic are forecasted by explicitly accounting for the temporal variability in traffic levels, based on typical corridor-specific diurnal profiles obtained from the Caltrans PeMs system. This detailed temporal estimation is performed using the RapidTOM model developed by ECONorthwest.

RapidTOM optimizes toll traffic and revenue under various optimization criteria and lane policy rules. Its output includes traffic on the GP lanes and on the express lanes, derived corridor performance such as speeds and travel times, toll rates for each vehicle class, and revenue estimates. RapidTOM is seeded with segment-by-segment volumes from the SCAG TDM, for each time-period and direction. To maintain as much consistency as possible with the assumptions about toll route choice behavior built into the SCAG TDM, RapidTOM preserves the forecast of vehicles by user class produced by the model as well as the corridor entry and exit volumes. For this study, the model forecasts traffic for drive-alone vehicles, carpools (2 and 3+ occupancy), and three heavy-duty truck classes. In addition, RapidTOM is consistent with the SCAG TDM regarding the following key demand and operational factors:

- Volume Delay Function Parameters. Each roadway segment is characterized by a Bureau of Public Roads (BPR) type volume delay function (VDF) with four parameters.
- Lane Configurations and System Capacity. RapidTOM uses the lane configurations and system capacity as depicted in the regional model.
- Values of Time. The mean values of travel time used in the RapidTOM analysis are the same as those employed in the regional model. RapidTOM uses a distribution of VOT, instead of a mean. **Table 6-1** presents the mean values of time used in the modeling by vehicle class in 2016 dollars.

Table 6-1: VOT by Vehicle Class (2016$)

Vehicle Class	Mean Value of Time per Hour
Single-Occupant Vehicle	$17.40
Two-Occupant Vehicle	$27.20
Three-Plus-Occupant Vehicle	$31.90
Light Truck	$41.30
Medium Truck	$52.00
Heavy Truck	$55.80

Source: ECONorthwest's RapidTOM

7.0 TOLL SCENARIOS MODELED

At the outset of this study, five variables were identified for defining different toll scenarios to be considered for initial and subsequent detailed analysis. **Figure 7-1** lists the five variables and the different values available for testing each variable, from which to define the toll scenarios of interest.

Figure 7-1: Modeling Variables Generating Different Toll Scenarios

Lane Configuration	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objective
Single Express Lane	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Mobility Optimized
Dual Express Lanes	More Restrictive Access Locations	Existing / Proposed Toll & Discount Policies	HOV 2+ Off-Peak / HOV 3+ Peak	Balance of Mobility & Revenue
			HOV 2+ Exempt	Maximum Revenue

Lane configuration (i.e., single versus dual express lanes) was coded within the SCAG TDM prior to the toll optimization processing step using RapidTOM. The latter four variables — access, toll policy, HOV exemption, and toll operating objective — are handled solely in the toll optimization step.

The range of outcomes for the above five variables comprise 72 different combinations. For purposes of this study, a toll scenario is defined by the values taken on by the first four variables — lane configuration, access method, toll policy, and HOV toll exemption. The fifth variable — toll operating objective — defines one of three toll operating objectives (which might be considered to roughly correlate to differing pricing algorithm assumptions) that can be applied to each toll scenario.

Figure 7-2 illustrates the 72 variable combinations, arranged to assign each case a unique alphanumeric code. For example, Scenario B2 pairs a single express lane with existing HOV access locations, unconstrained dynamic pricing, and an HOV 3+ toll exemption. Scenario B2-x adds the specific case of the maximum revenue toll operating objective.

Figure 7-2: Toll Scenario Variable Values and Combinations

Scenario	A	B	C	D
Lane Configuration	Single Express Lane			
Access Method	Existing HOV Access Locations		More Restrictive Access Locations	
Toll Policy	Existing/Proposed Metro Toll & Discount Policies	Unconstrained Dynamic Pricing	Existing/Proposed Metro Toll & Discount Policies	Unconstrained Dynamic Pricing
HOV Toll Exemptions	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3
Toll Operating Objective	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z

Scenario	E	F	G	H
Lane Configuration	Dual Express Lanes			
Access Method	Existing HOV Access Locations		More Restrictive Access Locations	
Toll Policy	Existing/Proposed Metro Toll & Discount Policies	Unconstrained Dynamic Pricing	Existing/Proposed Metro Toll & Discount Policies	Unconstrained Dynamic Pricing
HOV Toll Exemptions	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3	HOV 2+ Exempt 1 HOV 3+ Exempt 2 HOV 2+ Off Peak & 3+ Peak 3
Toll Operating Objective	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z	Maximum Revenue x Optimized Mobility y Balance of Mobility & Revenue z

7.1 TOLL SCENARIO VARIABLES

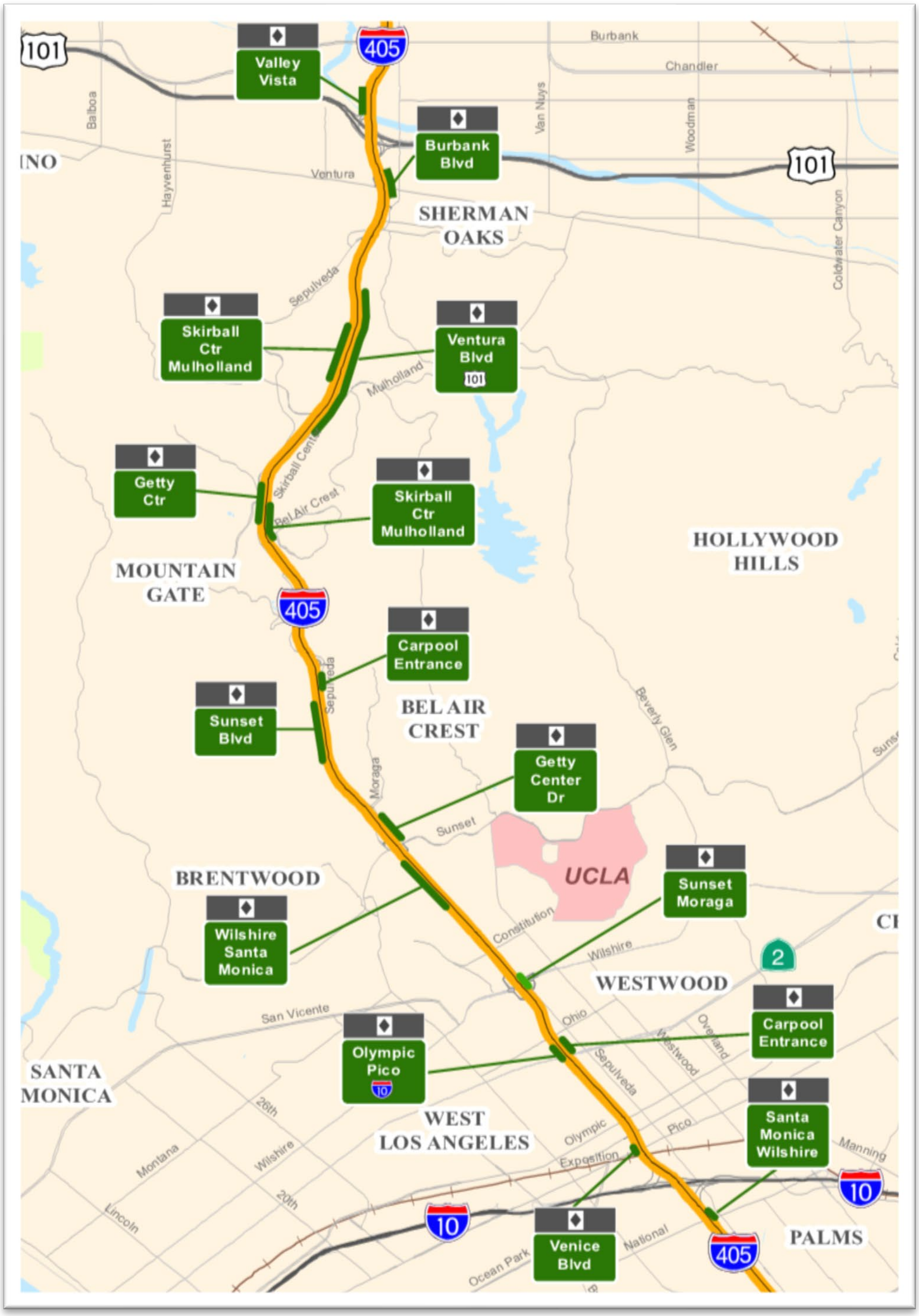
7.1.1 LANE CONFIGURATION

Two cases were tested, a single express lane in each direction and dual express lanes in each direction. For the latter, the added capacity in the corridor increases the level of demand assigned to the corridor in the SCAG TDM modeling process. This, in turn, impacts the typical toll rates from the toll optimization modeling process, resulting in less variance between the single and dual lane cases than would result if both cases were simulated to serve the same traffic volume.

7.1.2 ACCESS METHOD

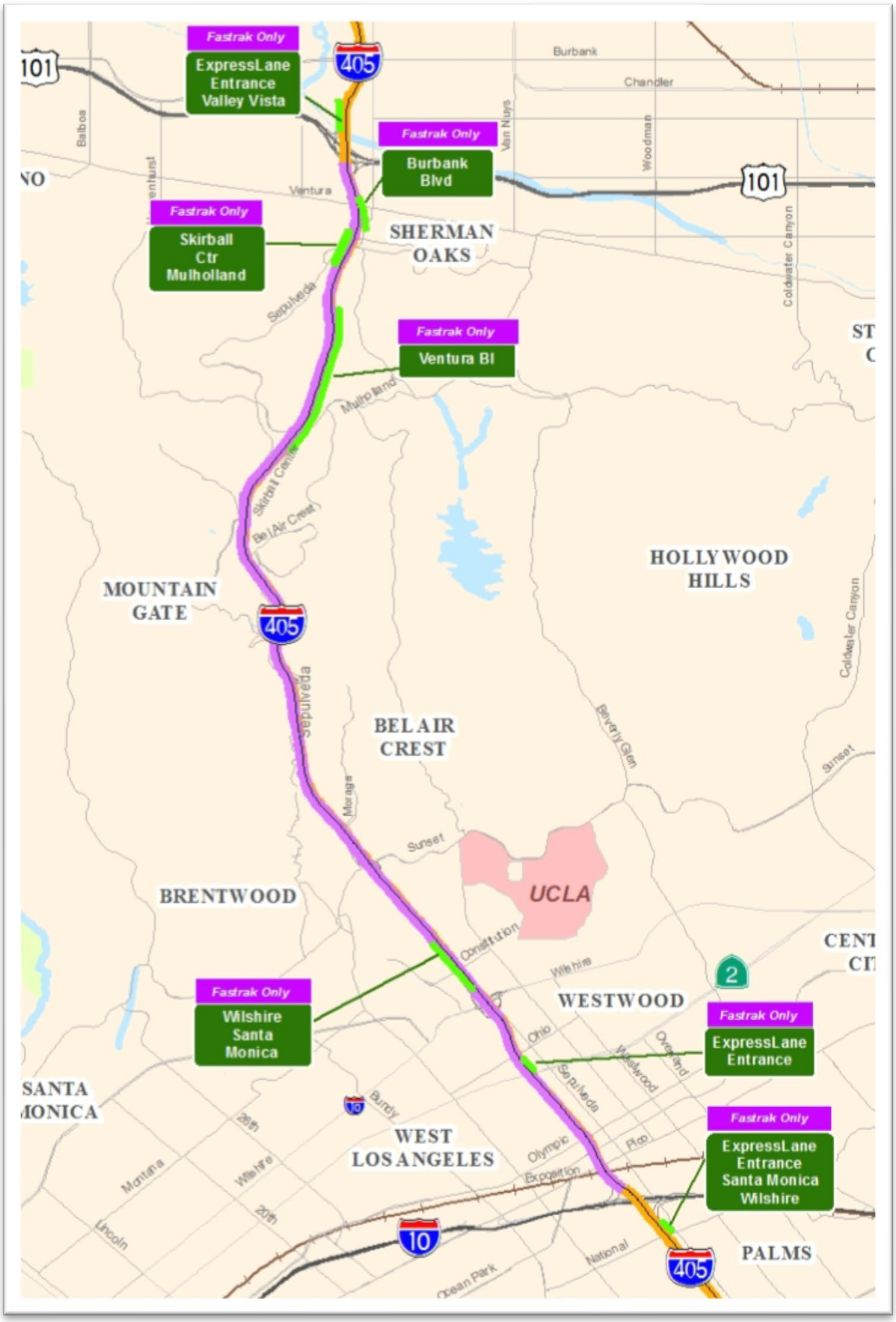
Two cases were also tested for access method. The first assumed the same ingress and egress locations as the existing single HOV lane in the corridor as shown in **Figure 7-3**. The second, more restrictive case assumed ingress and egress were limited to the north and south corridor endpoints and five locations in-between those points along the 10-mile corridor as shown in **Figure 7-4**. Ingress/egress locations for the restrictive access option were selected to evaluate the impact to traffic and revenue for pass-through travel between the San Fernando Valley and West Los Angeles.

Figure 7-3: Existing Access Locations



Source: WSP

Figure 7-4: More Restricted Access Locations



Source: WSP

7.1.3 TOLL POLICY

For this variable, two bookend sets of toll policies were considered. At one end of the spectrum — "existing / proposed toll & discount policies" — Metro's existing minimum and maximum toll policies were maintained and combined with two other policy proposals, HOV and clean air vehicle discounts. Metro currently imposes off-peak and peak period minimum toll rates of $0.10 and $0.35 per mile, respectively, with a maximum toll that was $1.40 per mile at the beginning of 2016. The Metro Board adopted a policy that allows the maximum toll to increase by $0.10 per mile when the daily duration of congestion and performance degradation from increasing traffic density warrants to ensure continued reliability of the express lanes and to minimize "HOV Only" occurrences (see **Appendix C**). In practice, the policy allows the maximum toll escalation process to occur up to three times per year, thereby setting a cap on the increase in the maximum toll of $0.30 per mile per year. The traffic and revenue forecasts under the "existing / proposed toll & discount policies" case assume that the maximum toll will increase by $0.30 each year as a system wide policy, such that by the time that I-405 is scheduled to open in 2024, the maximum toll per mile is $3.80.

Layered in with the minimum and maximum tolls is a 50% toll discount for clean air vehicles (which currently have HOV privileges in the regional HOV lane network, in accordance with state statutes); this discount would be in effect whenever such a vehicle did not have the required person occupancy for an HOV exemption. A similar discount was assumed for 2 person HOVs during times when only 3+ HOVs would receive a toll exemption. As such, payment of the "full" posted dynamic toll would be confined to non-clean air vehicles with one occupant.

The alternative case to these policies assumes no maximum tolls and no discount policies, and is referred to as "unconstrained dynamic pricing". Under an unconstrained dynamic pricing policy, tolls will rise and fall with traffic to ensure that performance is not degraded. There are no limits on how high the tolls can rise to ensure free-flow speeds in the express lanes.

Figure 7-5 summarizes the two toll policy cases tested in terms of discounts, exemptions, and maximum toll rates per mile.

Figure 7-5: Existing and Proposed Toll Policies Collectively Tested

Toll Policy	HOV Toll Exemption	Clean Air Vehicle Discount	2 Person HOV Peak Period	Maximum Toll per Mile in 2025*	Maximum Toll per Mile in 2040*
Existing/Proposed Metro Toll & Discount Policies	HOV 2+ Exempt HOV 3+ Exempt HOV 2+ Off Peak | HOV 3+ Peak	50%	Exempt 50%	$4.10	$8.60
Unconstrained Dynamic Pricing	HOV 2+ Exempt HOV 3+ Exempt HOV 2+ Off Peak | HOV 3+ Peak	None	Exempt None	None	None

* Maximum toll rates are expressed in year of collection dollars

7.1.4 HOV TOLL EXEMPTIONS

Both HOV2+ and HOV3+ toll exemption cases were modeled across the five daily time periods in the SCAG TDM and RapidTOM platforms. This allows the assembly of a third case from those model outputs whereby a 2+ carpools would be exempt (toll-free) during the midday, evening and night off-peak periods and 3+ carpools would be exempt during the AM (morning) and PM (afternoon) peak periods. Those vehicles not meeting these occupancy requirements would be toll paying customers, paying either the full toll or a 50% discounted toll depending on the toll policy case selected in each toll scenario. A single lane HOV2+ scenario was not modeled as current conditions in the single HOV2+ lane on I-405 between I-10 and US 101 cannot accommodate a significant number of single-occupant vehicles while meeting federal performance standards.

7.1.5 TOLL OPERATING OBJECTIVES

The toll optimization process allows for the testing of two "bookend" toll operating objectives. The first, "maximum revenue" seeks to price the express lanes in a manner that will provide the maximum time savings to, and maximum revenue from, the express lane users. This objective tends to result in lower, below capacity volumes in the express lanes, thereby leaving more vehicles in the GP lanes, which tends to cause larger spreads in the relative speeds between the two types of lanes when the GP lanes are congested.

The second bookend, referred to here as "optimized mobility", seeks to minimize the overall corridor delay cost in both the express and GP lanes. This objective tends to result in more fully utilized express lanes with lower differentials in speeds between the express and GP lanes, and lower revenues resulting from the lower toll rates required to attract the higher volumes in the express lane, which also leads to lower speeds, time savings per vehicle, and thus, willingness to pay higher tolls.

In actual operations, most express toll lane operators set pricing algorithm parameters to yield performance that falls somewhere in-between these two bookend objectives. As such, a third, more reasonable real-world case was created as a post process that balances these two bookend operating objectives, referred to as the "balance of mobility and revenue" case. This third case is presented for the annual traffic, gross, and net toll revenue projections

7.2 TOLL SCENARIOS CONSIDERED AND SELECTED

As previously noted, the five variables shown in **Figure 7-1** result in 72 potential combinations. Of these, preliminary analysis was performed for 51 combinations to help understand the effects of changing multiple variables and screen the options down to a more manageable number for detailed analysis.

Using the alphanumeric coding identified in **Figure 7-2**, the combination of a single express lane with the existing access method, unconstrained dynamic pricing toll policy, HOV3+ vehicles exempt at all times would be referred to as Scenario B2, with Scenario B2-x representing the case where the toll operating objective is to maximize revenue. Elsewhere in this report, a banner such as the example below for the case of Scenario B2-x, is used to remind the reader what variable values apply to the scenario being presented.

B2-x	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Maximum Revenue

Metro staff ended up selecting six (6) toll scenarios for detailed traffic and revenue forecasts. This selection represents 18 cases, with the three toll operating objectives being tested for each scenario. For typical weekday modeling outputs, this report focuses on providing results for the two bookend toll operating objectives, maximum revenue and optimized mobility. Later in this report where typical toll rates, annual traffic, and annual gross and net revenue forecasts are presented, the third toll operating objective — balance of mobility and revenue — is introduced. This balanced objective serves as the center of a range of traffic and revenue outcomes, providing the most realistic expectation for the proposed I-405 express lanes.

Figure 7-6 summarizes the six toll scenarios covered in detail throughout the rest of this report.

Figure 7-6: Toll Scenarios Selected for Detailed Analysis

Scenario	Lane Configuration	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objectives		
B2	Single Express Lane	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
B3	Single Express Lane	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
E2	Dual Express Lanes	Existing HOV Access	Existing / Proposed Toll & Discount Policies	HOV 3+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
F1	Dual Express Lanes	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
F2	Dual Express Lanes	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue
F3	Dual Express Lanes	Existing HOV Access	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+	Mobility Optimized	Balance of Mobility & Revenue	Maximum Revenue

8.0 CORRIDOR TRAFFIC PERFORMANCE

This chapter provides a high-level summary of the projected traffic performance characteristics associated with the I-405 express lanes project. In addition to revenue generation, the intent behind the deployment of express lanes in the Sepulveda Pass corridor would be to relieve congestion and provide travel benefits to drivers in both the general purpose and the express lanes. This chapter provides an overview of these potential benefits in terms of peak-period traffic volumes or throughput, peak-period average speeds, and peak-period travel times. As noted in earlier chapters, these projected traffic performance benefits were developed using the SCAG TDM, for establishing total corridor demand for each forecast year, and RapidTOM, for estimating the allocation of vehicles to GP and express lanes.

8.1 FUTURE NO-BUILD TRAFFIC PROJECTION

To serve as a baseline comparison to future toll scenarios, No-Build traffic projections were prepared for HOV and GP lanes for the years 2025 and 2040 under various HOV occupancy requirements (HOV2+ & HOV3+). Each baseline projection included I-405 corridor and SCAG network highway improvements programmed for completion by 2015 and 2040, respectively. **Table 8-1** summarizes projected 2040 traffic conditions. It is worth noting that heavy truck traffic represents the largest increase in traffic volumes, which is expected to grow 49% and 35% in the northbound and southbound directions, respectively (over 1% per year). Traffic in the GP lanes is expected to grow from 0.4 and 0.8 percent per year between 2015 and 2040, while HOV lane volumes are expected to increase between 1.3 and 1.6 percent over the same period. This modest growth in regular vehicle traffic, and large growth in truck traffic, indicates that the corridor is already operating above capacity during peak-periods, and that freight movements could be the largest contributor to future traffic congestion.

Table 8-2 and **Table 8-3** provide more detail by time of day for both the 2025 and 2040 baseline No-Build traffic scenarios. As shown in the tables, future GP traffic is highest in the northbound direction during the midday (9AM – 3PM) period, while HOV volumes are highest in the evening. These patterns remain consistent regardless of occupancy policy or future year. In the southbound direction, GP traffic is projected to be highest during the midday (9AM – 3PM) in 2025, and the PM peak-period (3PM – 7PM) in 2040. HOV lane volumes are highest in the AM period (6AM – 9 AM) for both 2025 and 2040.

Table 8-1: 2040 No Build Daily Traffic Forecast

Vehicle	2015			2040			Change		
	GP	HOV2+	Total	GP	HOV2+	Total	GP	HOV2+	Total
Northbound									
DA	108,900	-	108,900	113,500	-	113,500	4%	-	4%
SR2	8,900	12,700	21,500	8,200	14,400	22,600	-8%	13%	5%

Vehicle	2015			2040			Change		
	GP	HOV2+	Total	GP	HOV2+	Total	GP	HOV2+	Total
SR3+	3,000	4,200	7,200	2,700	4,800	7,500	-10%	14%	4%
Trucks	13,000	-	13,000	19,400	-	19,400	49%	-	49%
Total	133,800	16,900	150,600	143,800	19,200	163,000	7%	14%	8%
Southbound									
DA	104,200	-	104,200	108,900	-	108,900	5%	-	5%
SR2	8,000	15,900	23,900	8,100	17,000	25,000	1%	7%	5%
SR3+	2,600	5,300	7,900	2,600	5,700	8,200	0%	8%	4%
Trucks	10,900	-	10,900	14,700	-	14,700	35%	-	35%
Total	125,700	21,200	146,900	134,300	22,700	156,800	7%	7%	7%

Source: RapidTOM

Table 8-2: Future No-Build Average Hourly Traffic Forecast – Northbound

Location	2025				2040			
	Baseline HOV2+		Baseline HOV3+		Baseline HOV2+		Baseline HOV3+	
	GP	HOV	GP	HOV	GP	HOV	GP	HOV
6 – 9 am	7,860	940	8,110	700	8,440	1,020	8,700	760
9 am – 3 pm	8,680	1,050	8,940	790	8,820	1,050	9,080	790
3 -7 pm	8,600	1,240	8,920	930	8,720	1,200	9,020	900
7 – 9 pm	7,990	1,210	8,280	920	8,150	1,240	8,450	930
9 pm -6 am	3,190	450	3,300	340	3,710	510	3,830	380

Source: RapidTOM

Table 8-3: Future No-Build Average Hourly Traffic Forecast – Southbound

Location	2025				2040			
	Baseline HOV2+		Baseline HOV3+		Baseline HOV2+		Baseline HOV3+	
	GP	HOV	GP	HOV	GP	HOV	GP	HOV
6 – 9 am	7,200	1,430	7,550	1,080	7,260	1,380	7,600	1,040
9 am – 3 pm	7,430	1,320	7,760	990	7,420	1,300	7,740	980
3 -7 pm	7,400	1,070	7,670	800	7,500	1,180	7,800	890
7 – 9 pm	6,330	1,000	6,570	760	6,900	1,050	7,150	790
9 pm -6 am	3,430	430	3,530	330	3,810	470	3,930	360

Source: RapidTOM

8.2 FUTURE TOLL SCENARIO TRAFFIC PROJECTION

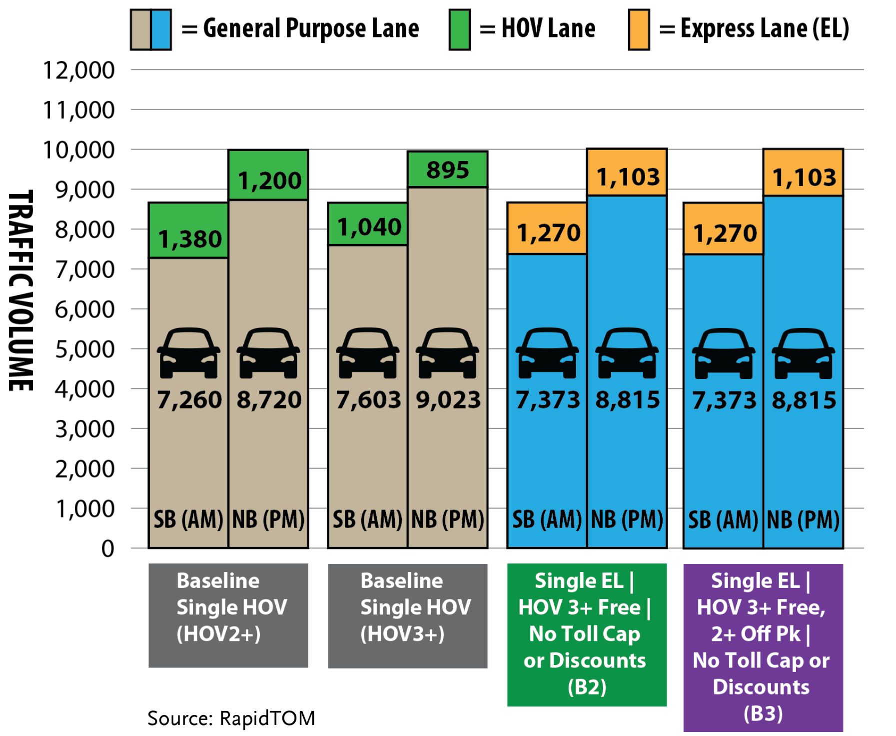
This section presents projected future traffic conditions for the six different toll scenarios discussed in **Chapter 7.0**, including summaries of peak-directional throughput, LOS breach, travel time, and travel speed characteristics for both HOV and express lanes. All future toll scenario projections were developed with the RapidTOM tool, following the modeling methodology outlined in **Chapter 6.0**.

8.2.1 ESTIMATED WEEKDAY DEMAND

The estimated peak-period directional vehicle volumes for the I-405 Sepulveda Pass corridor are summarized in **Figure 8-1** through **Figure 8-4** for each toll scenario in the year 2040, for both northbound and southbound travel in both the GP and HOV lanes. This is intended to represent the relationship between GP and express lane traffic and to give an indication of overall corridor efficiency under each scenario. **Figure 8-1** and **Figure 8-2** show volume characteristics for the RapidTOM Mobility Optimization objective, comparing baseline HOV2+ and HOV3+ scenarios to other express lane scenarios. As shown in **Figure 8-2**, overall express lane vehicle throughput is highest in the Dual express lanes (HOV2+) scenario, due to greater express lane capacity and access to 2-person vehicles. However, GP volumes are highest under the Dual express lanes (HOV3+) scenario, likely because of the HOV2+ vehicles that no longer use the express lane. Results for the Revenue Maximization objective shown in **Figure 8-3** and **Figure 8-4** indicate a similar pattern, although overall express lane volumes are lower and overall GP lane volumes are higher, relative to **Figure 8-3**.

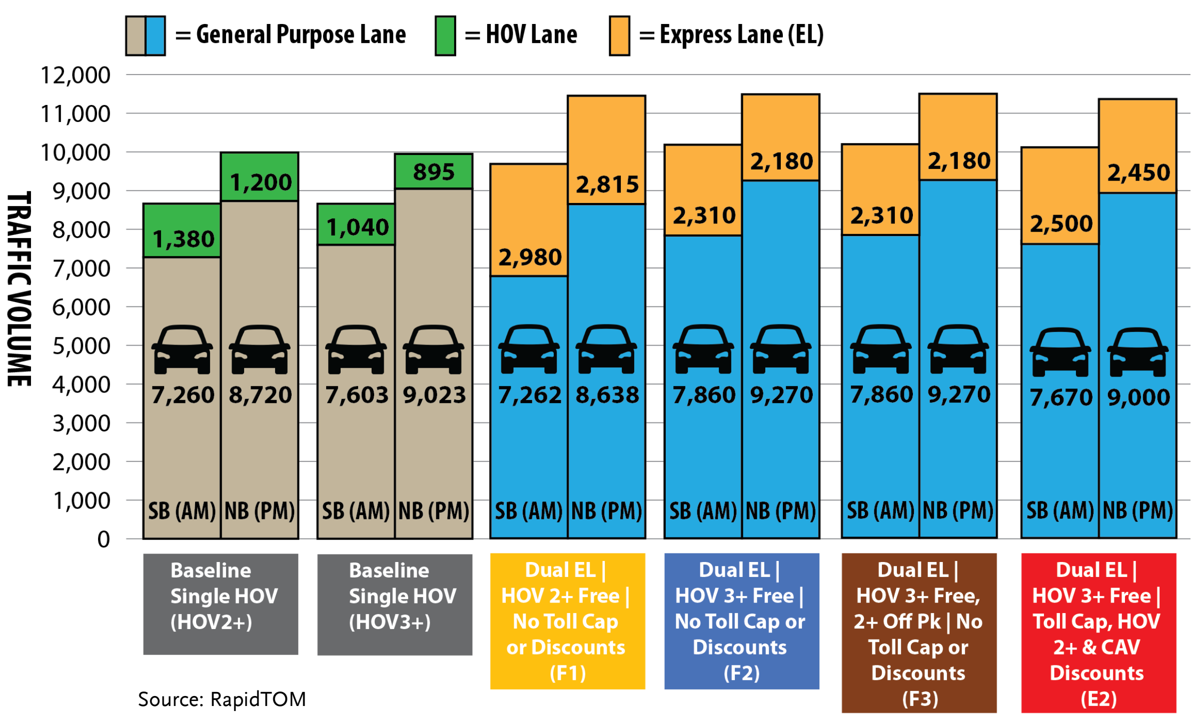
Figure 8-5 through **Figure 8-8** highlight the projected 2040 person throughput characteristics for HOV and express lanes, for all scenarios in both the northbound and southbound direction. As expected, these figures highlight a similar pattern to the vehicle volume information, where Dual express lanes carry significantly more people under than single lane under most scenarios. The highest peak-hour person throughput values are shown under the Dual express lanes (HOV2+) scenario in **Figure 8-6** and **Figure 8-8**. This pattern remains consistent for both the Mobility Optimization and Revenue Maximization objectives, although person throughput following Mobility Optimization is slightly higher.

Figure 8-1: 2040 Peak Hour Traffic Volumes – Single Lane – Mobility Optimization



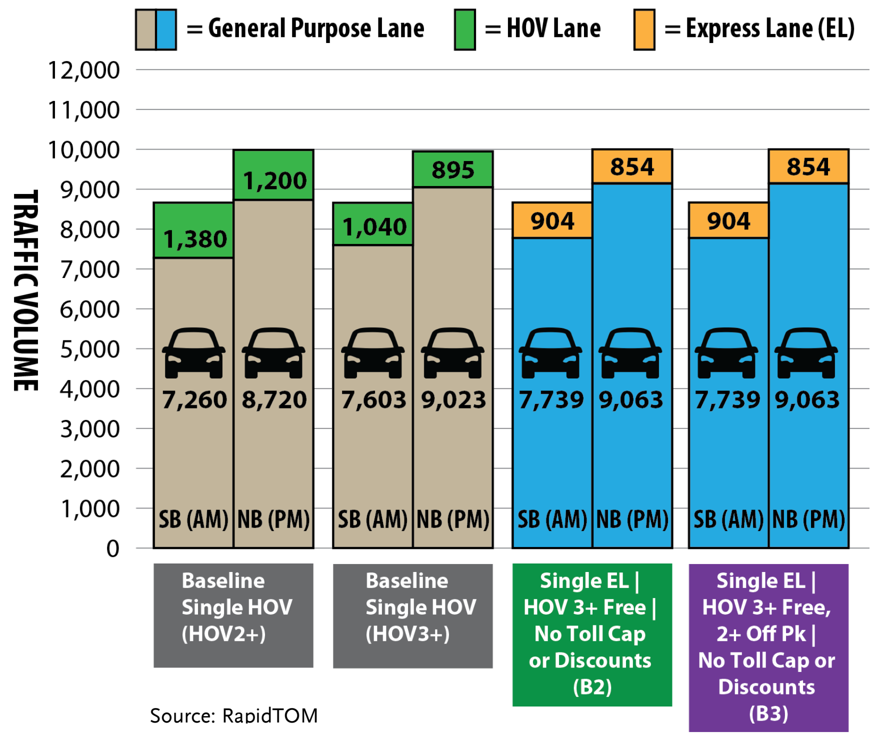
Source: RapidTOM

Figure 8-2: 2040 Peak Hour Traffic Volumes – Dual Lane – Mobility Optimization



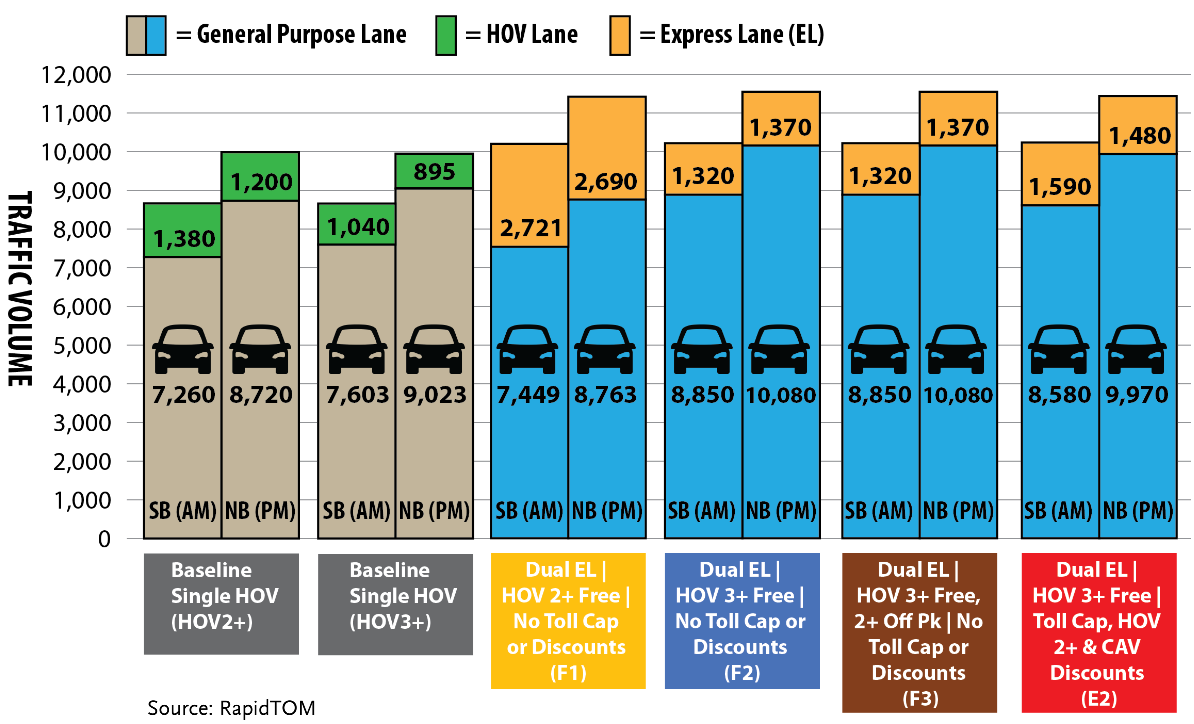
Source: RapidTOM

Figure 8-3: 2040 Peak Hour Traffic Volumes – Single Lane – Revenue Maximization



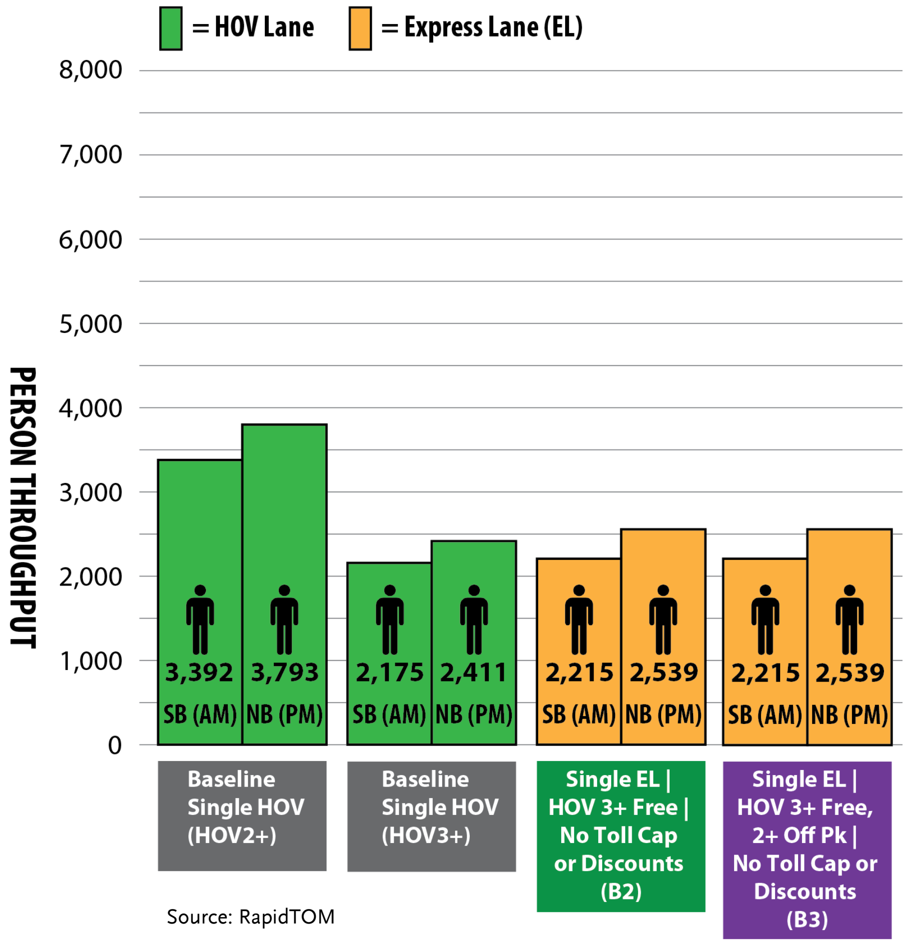
Source: RapidTOM

Figure 8-4: 2040 Peak Hour Traffic Volumes – Dual Lane – Revenue Maximization



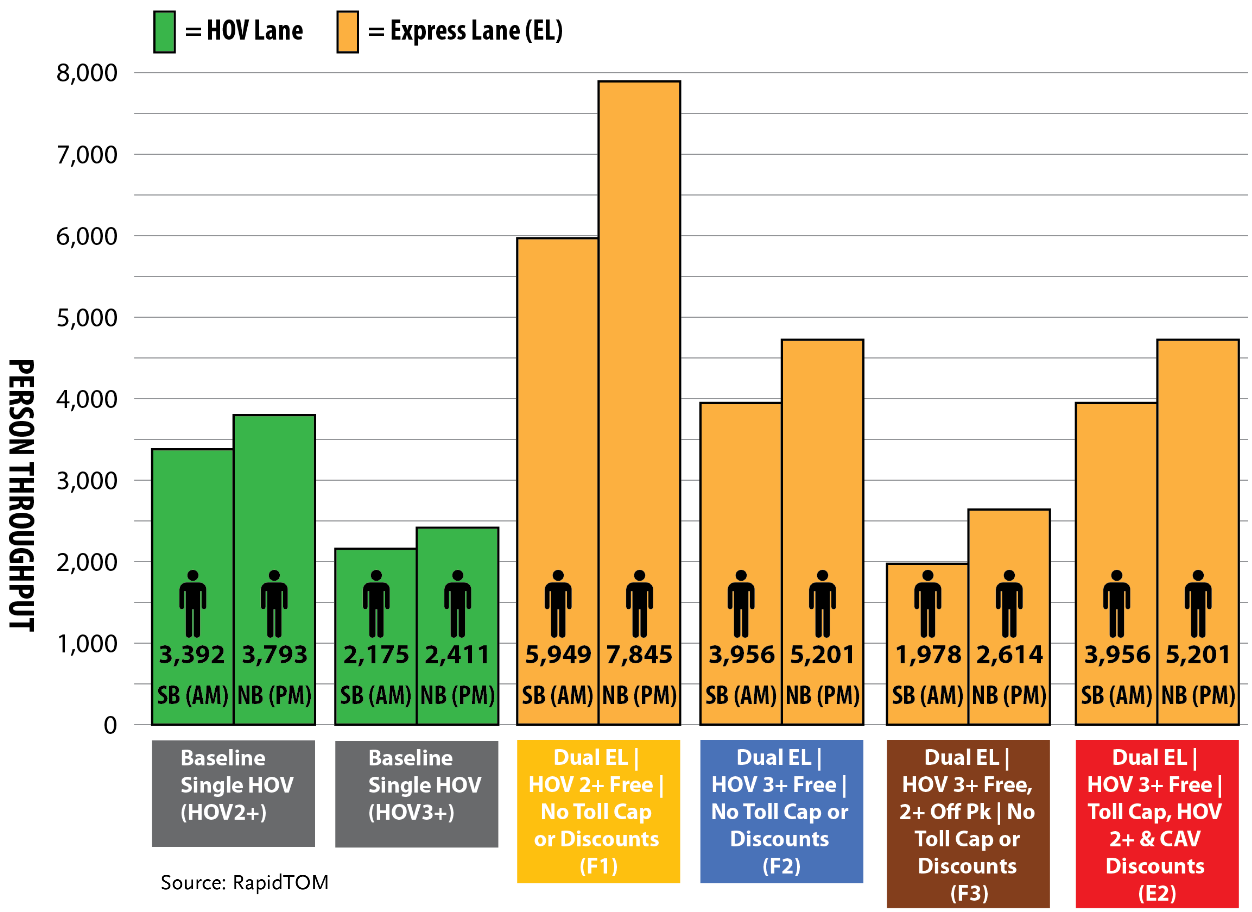
Source: RapidTOM

Figure 8-5: 2040 Peak Hour Person Throughput – Single Lane – Mobility Optimization



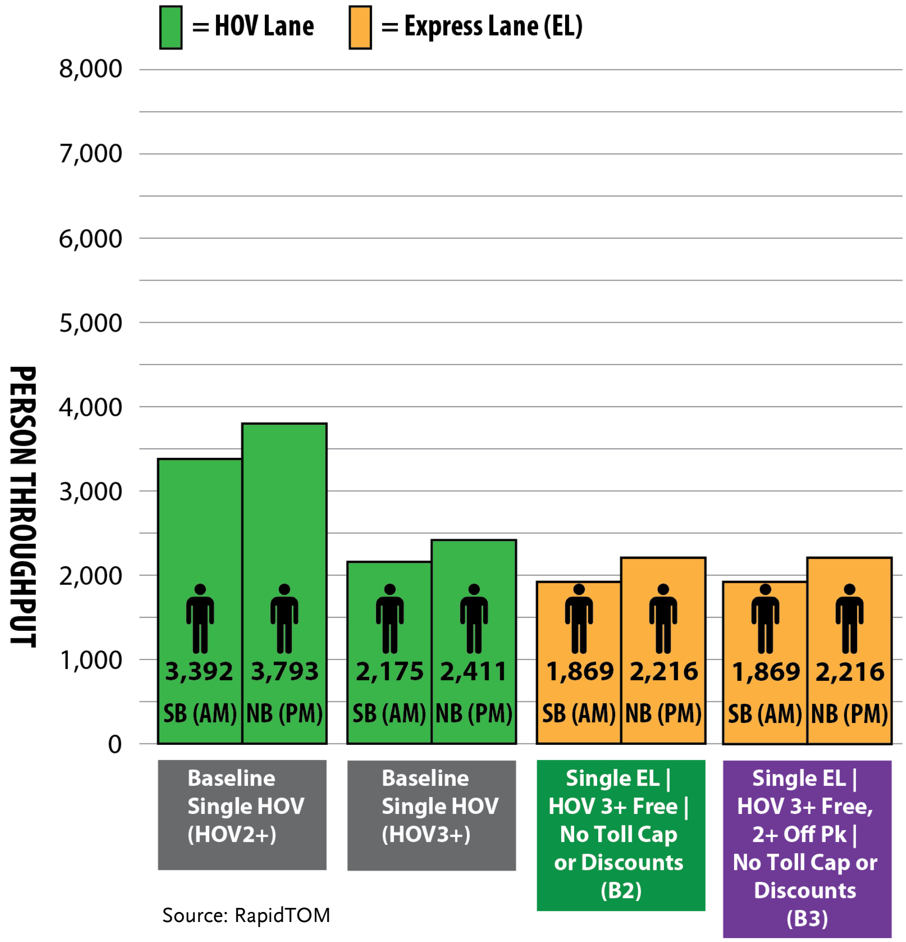
Source: RapidTOM

Figure 8-6: 2040 Peak Hour Person Throughput – Dual Lane – Mobility Optimization



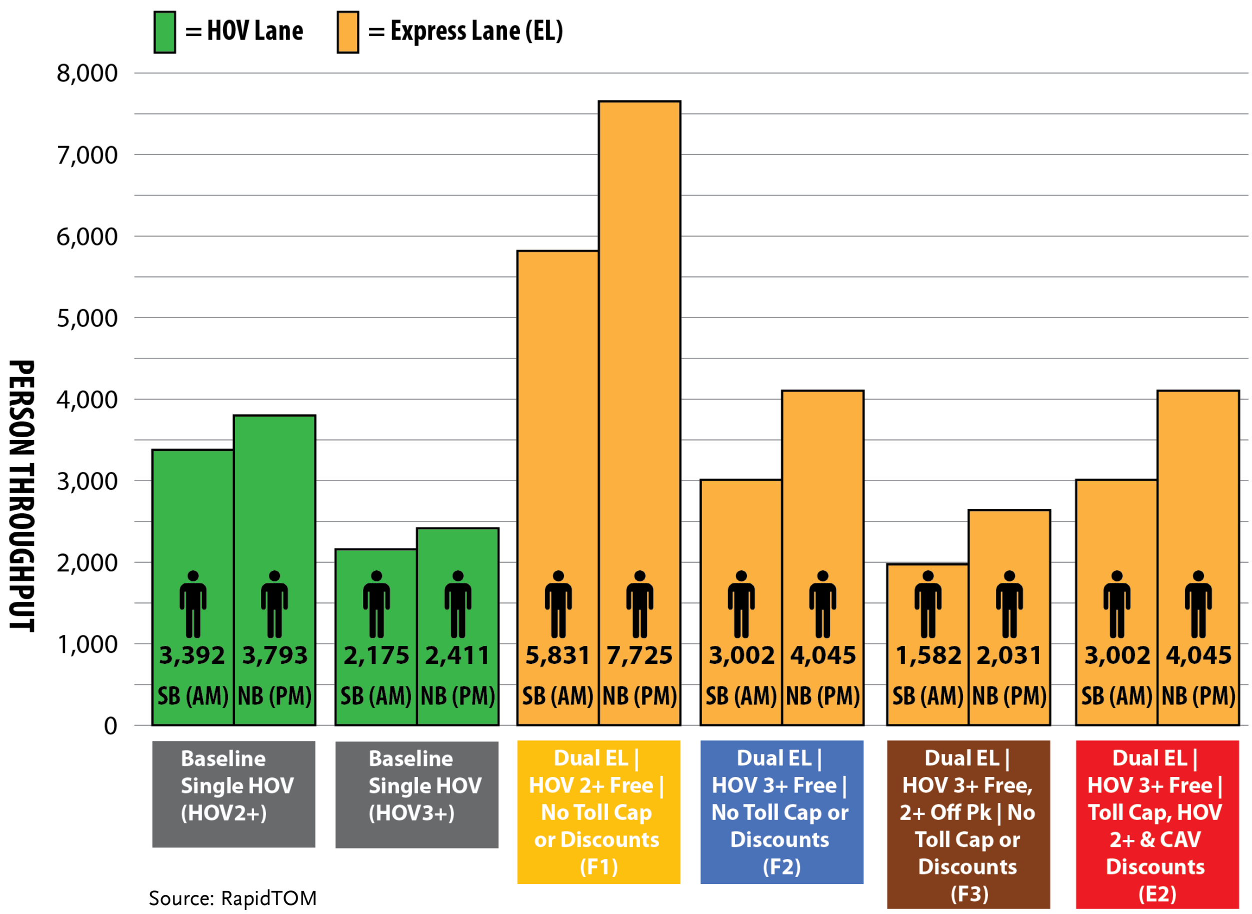
Source: RapidTOM

Figure 8-7: 2040 Peak Hour Person Throughput – Single Lane – Revenue Maximization



Source: RapidTOM

Figure 8-8: 2040 Peak Hour Person Throughput – Dual Lane – Revenue Maximization



Source: RapidTOM

Overall, the corridor is estimated to have higher demand in the PM northbound direction than the AM southbound direction resulting in longer delay to northbound travel during the PM peak-period. Consequently, even when a revenue maximization strategy is implemented, the northbound express lanes are estimated to carry similar amounts of traffic under all Dual express lanes scenarios. This could indicate that northbound 2-person carpoolers would be willing to pay a full toll for a travel time benefits when GP lanes are more congested. However, it is worth noting that although person throughput information indicates a similar pattern, the Dual express lanes (HOV2+) scenarios is expected to carry significantly more people during the peak hour compared to other Dual express lanes scenarios.

8.2.2 EXPRESS LANE TRAFFIC SHARE

Table 8-4 and **Table 8-5** show the total estimated demand of various I-405 corridor segments under each toll scenario, along with the projected share of express lane traffic in the segment. As shown in the tables, I-405 between Wilshire Blvd and US-101 is expected to have a higher share of express lane traffic than the segment from Wilshire Blvd to I-10. This is estimated to be the case in both peak travel directions, and across all express lane scenarios. The highest overall share of express lane traffic is expected under the Dual express lanes (HOV2+) scenario (F1), which can be expected given the available capacity and more attractive HOV occupancy policy. Under all other scenarios, the share of express lane traffic between Wilshire and I-10 is significantly less relative to scenario F1, indicating that some HOV2+ vehicles would rather use congested GP lanes than pay a full or discounted toll for this 2.8 mile stretch.

Table 8-4: 2025 I-405 ExpressLane Traffic Share

Dir/TOD	Segment	Scenario B2/B3		Scenario F1		Scenario F2/F3		Scenario E2	
		Total Volume	EL Share	Total Volume	EL Share	Total Volume	EL Share	Total Volume	EL Share
Mobility Optimization									
SB 6-9 am	US 101 to Wilshire	8,810	15.6%	10,390	30.0%	10,390	25.6%	10,390	26.9%
	Wilshire to I-10	8,260	5.1%	9,560	22.9%	9,560	10.4%	9,560	12.8%
NB 3-7 pm	I-10 to Wilshire	8,320	4.3%	9,490	21.0%	9,490	9.3%	9,490	11.4%
	Wilshire to US 101	10,440	12.0%	12,180	25.3%	12,180	21.6%	12,180	23.2%
Revenue Maximization									
SB 6-9 am	US 101 to Wilshire	8,800	11.3%	10,390	28.1%	10,390	13.8%	10,390	16.7%
	Wilshire to I-10	8,260	5.0%	9,560	22.9%	9,560	9.5%	9,560	10.9%
NB 3-7 pm	I-10 to Wilshire	8,320	4.2%	9,490	20.9%	9,490	8.6%	9,490	9.7%
	Wilshire to US 101	10,440	9.4%	12,180	23.8%	12,180	12.8%	12,180	14.0%

Source: RapidTOM

Table 8-5: 2040 I-405 ExpressLane Traffic Share

Dir	Segment	Scenario B2/B3		Scenario F1		Scenario F2/F3		Scenario E2	
		Total Volume	EL Share	Total Volume	EL Share	Total Volume	EL Share	Total Volume	EL Share
Mobility Optimization									
SB 6-9 am	US 101 to Wilshire	8,450	18.4%	10,300	31.1%	10,300	27.5%	10,300	28.9%
	Wilshire to I-10	9,070	7.1%	9,880	22.9%	9,880	11.7%	9,880	14.9%
NB 3-7 pm	I-10 to Wilshire	8,580	4.9%	9,550	21.4%	9,550	9.6%	9,550	12.3%
	Wilshire to US 101	10,430	13.1%	12,180	25.5%	12,180	21.9%	12,180	24.1%
Revenue Maximization									
SB 6-9 am	US 101 to Wilshire	8,450	12.4%	10,310	28.5%	10,310	14.2%	10,310	17.3%
	Wilshire to I-10	9,070	6.5%	9,880	22.8%	9,880	10.3%	9,880	11.8%
NB 3-7 pm	I-10 to Wilshire	8,580	4.8%	9,560	21.4%	9,550	8.8%	9,550	10.2%
	Wilshire to US 101	10,430	9.8%	12,180	24.1%	12,180	12.9%	12,180	13.8%

Source: RapidTOM

8.2.3 EXPRESS LANE LOS BREACH

Vehicle Level of Service (LOS) breach for each potential express lane scenario is shown in **Table 8-6**, and compared to each baseline scenario. LOS breach represents the amount of time during the peak period that a proposed express lane facility would become degraded (i.e., speeds falling below 45 mph) due to excessive travel demand. Under the baseline No-Build condition using the existing HOV2+ toll policy, the HOV lane is forecasted to be degraded 20-25% of time during the AM peak in the southbound direction, and only 10% in the northbound direction during the PM peak. For the proposed toll scenarios, only the southbound direction in the AM period is expected to see LOS breach, with the Dual express lanes (HOV2+) scenario projected to degraded close to 40% of the time. The Dual express lanes (HOV3+) scenario that assumes a toll discount for HOV2+ vehicles is also expected to have some degradation in the AM, but only 7% of the time. In general, this information indicates that an HOV2+ toll exempt policy would generate moderate to significant express lane degradation.

Table 8-6: Express Lane LOS Breach

Scenarios	Mobility Optimization				Revenue Maximization			
	2025		2040		2025		2040	
	AM SB	PM NB	AM SB	PM NB	AM SB	PM NB	AM SB	PM NB
Baseline No-Build (HOV2+)	25%	--	20%	10%	25%	--	20%	10%
Baseline No-Build (HOV3+)	--	--	--	--	--	--	--	--
B2: Single/HOV3+	--	--	--	--	--	--	--	--
B3: Single/HOV3+ Pk, HOV2+Off Pk	--	--	--	--	--	--	--	--
F1: Dual/HOV2+ Free	44%		39%		44%		39%	
F2: Dual/HOV3+ Free	--	--	--	--	--	--	--	--
E2: Dual/HOV3+ Free, HOV2+ Half Toll	7%	--	--	--	7%			
F3: Dual/HOV3+ Free, HOV2+ Free Off Pk	--	--	--	--	--	--	--	--

Source: RapidTOM

8.2.4 TRAVEL TIME ANALYSIS

The travel time savings offered by express lanes over GP lanes is considered the primary factor that influences a traveler's decision whether or not to pay a toll for express lane access. **Figure 8-9** and **Figure 8-10** present the projected 2040 travel time on I-405 between I-10 and US 101 for both GP lanes and express lanes under the baseline and toll scenarios. As shown in the figures, nearly all projected travel times in the HOV and express lanes range between 9 and 11 minutes under any scenario or policy objective, with HOV3+ scenarios having the shortest times due to the greater access restriction. However, projected GP lane travel times vary significantly, creating a range of different travel times savings offered by the express lanes.

The travel time savings offered by express lanes are greatest under the HOV3+ scenarios, as HOV2+ vehicles are not allowed access, which conversely results in the longest GP lane travel times. In addition, the revenue maximization objective provides a travel time advantage over the mobility optimization objective, as less travelers are willing to pay higher cost to use the express lanes. In the Dual express lanes HOV3+ scenario under the revenue maximization objective, GP travel time is projected as over 60 minutes in the southbound direction during to AM, which results in an express lane travel time savings of over 50 minutes. It is also worth noting that, relative to baseline conditions, all scenarios under the mobility optimization objective are shown to improve southbound general purpose lane travel times by 10 to 20 minutes.

Figure 8-9: 2040 Peak-Hour Travel Times – Single Lane

	Optimize Mobility				*Maximize Revenue*			
	General Purpose		HOV / EL		General Purpose		HOV / EL	
	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)
Baseline (HOV2+) Single HOV	40 MIN	23 MIN	10 MIN	9 MIN	40 MIN	23 MIN	10 MIN	9 MIN
Baseline (HOV3+) Single HOV	46 MIN	26 MIN	9 MIN	9 MIN	46 MIN	26 MIN	9 MIN	9 MIN
Single EL | HOV 3+ Free | No Toll Cap or Discounts (B2)	29 MIN	20 MIN	11 MIN	10 MIN	41 MIN	23 MIN	9 MIN	9 MIN
Single EL | HOV 3+ Free, 2+ Off Pk | No Toll Cap or Discounts (B3)	29 MIN	20 MIN	11 MIN	10 MIN	41 MIN	23 MIN	9 MIN	9 MIN

Source: ECONorthwest/WSP

Figure 8-10: 2040 Peak-Hour Travel Times – Dual Lane

	Optimize Mobility				*Maximize Revenue*			
	General Purpose		HOV / EL		General Purpose		HOV / EL	
	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)
Baseline (HOV2+) Single HOV	40 MIN	23 MIN	10 MIN	9 MIN	40 MIN	23 MIN	10 MIN	9 MIN
Baseline (HOV3+) Single HOV	46 MIN	26 MIN	9 MIN	9 MIN	46 MIN	26 MIN	9 MIN	9 MIN
Dual EL | HOV 2+ Free | No Toll Cap or Discounts (F1)	25 MIN	18 MIN	11 MIN	10 MIN	31 MIN	20 MIN	10 MIN	10 MIN
Dual EL | HOV 3+ Free | No Toll Cap or Discounts (F2)	26 MIN	20 MIN	11 MIN	10 MIN	62 MIN	34 MIN	09 MIN	09 MIN
Dual EL | HOV 3+ Free | Toll Cap, HOV 2+ & CAV Discounts (E2)	27 MIN	18 MIN	11 MIN	10 MIN	46 MIN	30 MIN	09 MIN	09 MIN
Dual EL | HOV 3+ Free, 2+ Off Pk | No Toll Cap or Discounts (F3)	26 MIN	20 MIN	11 MIN	10 MIN	62 MIN	34 MIN	09 MIN	09 MIN

Source: ECONorthwest/WSP

8.2.5 TRAVEL SPEEDS ANALYSIS

Another expected benefit of express lanes is that toll paying drivers would travel at a higher average speed than drivers in adjacent general purpose lanes. **Figure 8-11** and **Figure 8-12** present projected 2040 peak directional travel speeds along the I-405 Sepulveda corridor for each toll scenario, compared to existing (2016) speeds in the existing HOV lanes. In 2016, the average HOV travel speed was only 25 to 35 mph. When the existing HOV 2+ lane is converted to a single express lane (assumed to operate at HOV 3+ at least in the peak periods) or dual express lanes, travel speeds are anticipated to be improved to at least 59 mph under all six toll scenarios. In addition, GP lane travel speeds are also expected to improve or remain consistent, due to the additional capacity and congestion reduction offered by toll paying SOV drivers. As shown in **Figure 8-12**, the greatest express lane travel speeds are offered by the Dual express lanes HOV3+ scenario under the revenue maximization objective (70 mph).

Figure 8-11: 2040 Peak-Hour Travel Speeds – Single Lane

	Optimize Mobility				*Maximize Revenue*			
	General Purpose		HOV / EL		General Purpose		HOV / EL	
	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)
Existing HOV 2016	43 MPH	27 MPH	35 MPH	25 MPH	43 MPH	27 MPH	35 MPH	25 MPH
Single EL | HOV 3+ Free | No Toll Cap or Discounts (B2)	42 MPH	37 MPH	59 MPH	54 MPH	41 MPH	36 MPH	62 MPH	60 MPH
Single EL | HOV 3+ Free, 2+ Off Pk | No Toll Cap or Discounts (B3)	42 MPH	37 MPH	59 MPH	54 MPH	41 MPH	36 MPH	62 MPH	60 MPH

Source: ECONorthwest/WSP

Figure 8-12: 2040 Peak-Hour Travel Speeds – Dual Lane

	Optimize Mobility				Maximize Revenue			
	General Purpose		HOV / EL		General Purpose		HOV / EL	
	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)	SB (AM)	NB (PM)
Existing HOV 2016	43 MPH	27 MPH	35 MPH	25 MPH	43 MPH	27 MPH	35 MPH	25 MPH
Dual EL | HOV 3+ Free, 2+ Off Pk | No Toll Cap or Discounts (F3)	42 MPH	36 MPH	66 MPH	59 MPH	34 MPH	26 MPH	70 MPH	70 MPH
Dual EL | HOV 2+ Free | No Toll Cap or Discounts (F1)	43 MPH	40 MPH	66 MPH	59 MPH	41 MPH	37 MPH	69 MPH	66 MPH
Dual EL | HOV 3+ Free | No Toll Cap or Discounts (F2)	39 MPH	36 MPH	66 MPH	59 MPH	34 MPH	26 MPH	70 MPH	70 MPH
Dual EL | HOV 3+ Free | Toll Cap, HOV 2+ & CAV Discounts (E2)	42 MPH	39 MPH	64 MPH	58 MPH	34 MPH	27 MPH	70 MPH	69 MPH

Source: ECONorthwest/WSP

9.0 ESTIMATED WEEKDAY MODEL RESULTS

This chapter provides weekday modeling outputs for trips, revenues and typical corridor toll rates by time-period and direction. Most of this information is presented in a series of charts covering the six Metro-selected toll scenarios. Revenue and trip volumes are presented for the two, bookend toll operating objectives (i.e., Optimized Mobility and Maximum Revenue). These results are provided for forecast year 2025 as more relevant to current conditions than 2040.

In presenting typical corridor toll rates per mile, data for the in-between, third objective (Balance of Optimized Mobility and Maximum Revenue) is also included.

Results for 2025 only are displayed for the weekday outputs by time-period, as 2025 values are more relevant and comparable to current conditions. Daily revenue projections and volumes for toll and toll-free trips are provided for both 2025 and 2040 forecast years.

9.1 CONTEXT AND FINDINGS FROM THE WEEKDAY MODEL OUTPUTS

The following sections summarize weekday corridor performance and total daily gross toll revenues (in constant 2016 dollars) from the RapidTOM's modeling of the various toll scenarios for I-405. Daily revenues are expressed in constant 2016 dollars because the demand and toll optimization modeling tools incorporate all price inputs in current values. Maintaining these daily amounts in constant 2016 dollars allows for the comparison of forecast years 2025 and 2040 on a real basis absent inflationary effects. As such, higher weekday revenues in 2040 compared to 2025 reflect the real effects of growth in demand levels, greater travel time savings from growing GP lane congestion, and the resultant increased willingness to pay tolls for time savings and reliability — before factoring in general inflation on wages and prices. Later in the report where annual revenue forecasts are provided, those amounts are converted to future, year of collection dollars that capture the above real effects plus the inflationary effects on general prices, including wages and salaries.

Optimized dynamic pricing keeps express lane speeds relatively high in most time periods in both forecast years — especially during off-peak periods. As expected, revenue generation is concentrated in the AM Peak, Midday, and PM Peak periods for all facilities and alternatives.

Under an HOV 3+ toll exemption policy, there are fewer eligible, non-paying users of the express lanes, leaving much more capacity to accommodate paying customers. In addition, because more non-paying two-occupant carpools remain in the GP lanes, the performance of the express lanes is higher relative to the GP lanes. This increases willingness to pay and, hence, yields higher revenues (relative to the HOV 2+ policy) from the combination of greater willingness to pay and a larger pool of feasible toll-paying users (HOV 2's must now buy into the express lanes).

The revenue implications of an express lanes strategy that exempts HOV 2+ vehicles from paying the toll during the off-peak hours and HOV 3+ vehicle during the peak travel hours are shown graphically in charts by toll scenario later in this section and examined in more detail in **Chapter**

9.5 of this report covering the annual T&R forecasts. The analysis of the weekday traffic and revenues across the toll scenarios examined in this study confirmed the expected trade-offs among various carpool policies, agency objectives, and build versus no-build conditions, as summarized in the following observations.

- Revenue is always higher under the toll revenue maximization objective than under the corridor optimized mobility objective that seeks to minimize the total delay costs incurred by users of both the GP and express lane users in the aggregate.
- GP lane speeds are higher under the optimized mobility objective than under the revenue maximization objective.
- Toll revenues are higher, and GP lane speeds can be lower, under the 3+ carpool policy than under the 2+ carpool policy, though the HOV 2+ policy does not effectively manage flows and speeds in the express lanes at peak times and directions.
- Restricting access to the express lanes to a select number of ingress/egress points only modestly reduces toll-paying customers and associated revenue opportunities.
- LOS breaches occur on select segments of the corridor only under HOV 2+ toll exemption operations, and typically but not exclusively during the AM and PM peak periods. The percentage of the time the express lane LOS is breached under the optimized mobility toll objective is higher than under the revenue maximization objective.
- Implementing policies that provide discounts for selected user groups (e.g., clean air vehicles and/or HOV 2 carpools when an HOV 3+ exemption is in effect) somewhat reduces revenue yields.
- Imposing a maximum toll that increases by $0.30 per mile annually in accordance with the Metro ExpressLanes Toll Policy (revised January 20, 2016) does not prove to be a binding constraint, especially in the dual lane scenarios, and therefore has a minimal impact on revenue projections.

As noted earlier, the RapidTOM process implements dynamic tolling informed by five-minute interval volume data from PeMs in order to augment SCAG TDM outputs that are based on average volumes over multiple hour periods. If a facility is prone to hyper-congestion, and the simulation of peak spreading in the SCAG TDM causes spreading to be understated, overestimation of revenues may result.

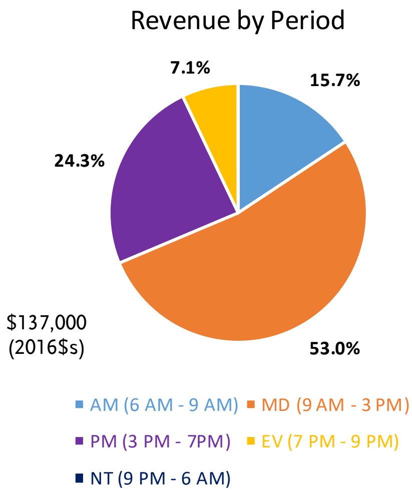
9.2 WEEKDAY REVENUE AND TRIPS BY TIME-PERIOD FOR 2025

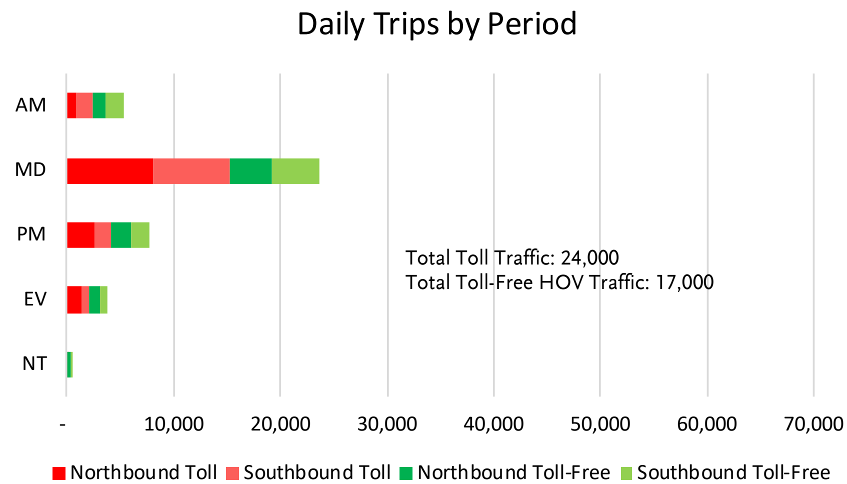
Figure 9-1 through **Figure 9-6** on the following pages display the key weekday model outputs in forecast year 2025 for toll trips and toll-exempt HOV trips by direction and time of day, as well as the revenue distribution by time of day. The twelve figures cover the 6 toll scenarios selected by Metro for detailed T&R forecasts in **Figure 7-6** for the two, bookend toll operating objectives (i.e., Optimized Mobility and Maximum Revenue). The following conclusions can be drawn from these charts:

- For a given lane configuration, revenues are highest when HOV toll exemption is set to 3+ all day (Scenarios B2 and F2), while switching to an HOV 2+ exemption outside of the AM and PM peak periods (Scenarios B3 and F3) tends to maximize the share of revenue generated in the peak periods and maximize the share of toll-exempt HOV trips during midday.
- The distribution of revenue by daily time-period does not vary appreciably between the maximum revenue and optimized mobility toll operating objectives.
- In all cases, toll trips served and revenue generated in the three-hour PM peak period exceed those for the three-hour AM peak period.
- Toll trips are higher in the southbound direction in the AM peak period, and higher northbound in the PM peak period, reflecting current trip OD patterns by time of day.
- The demand for the express lanes by toll-paying customers during the night period from 9 PM to 6 AM is virtually zero due to a lack of congestion in the general purpose lanes. This results in immaterial levels of night period revenue.
- On a per-hour basis, peak period toll trips and toll revenues exceed midday period toll rates. In several cases, especially when the HOV 3+ toll exemption is maintained all day long, midday period trips and revenue exceed the individual peak periods, in part because the midday period is twice as long.
- In addition, demand in the midday period is relatively robust, especially southbound with trips headed into LA, many of which are likely making a northbound return trip later in the day (evening and night periods) when express lane benefits, and thus, demand and toll rates are lower. This contributes to the relatively significant number of trips and revenues generated in the midday period compared to other off-peak periods.

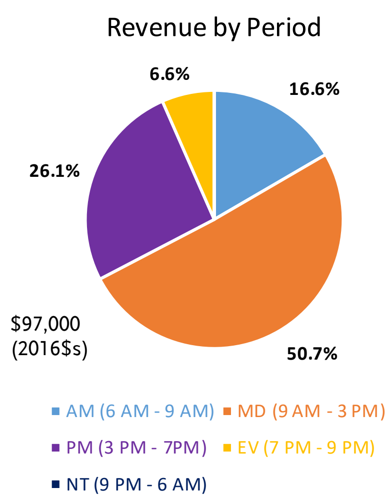
Figure 9-1: Scenario B2 – Weekday Daily Results Summary – 2025

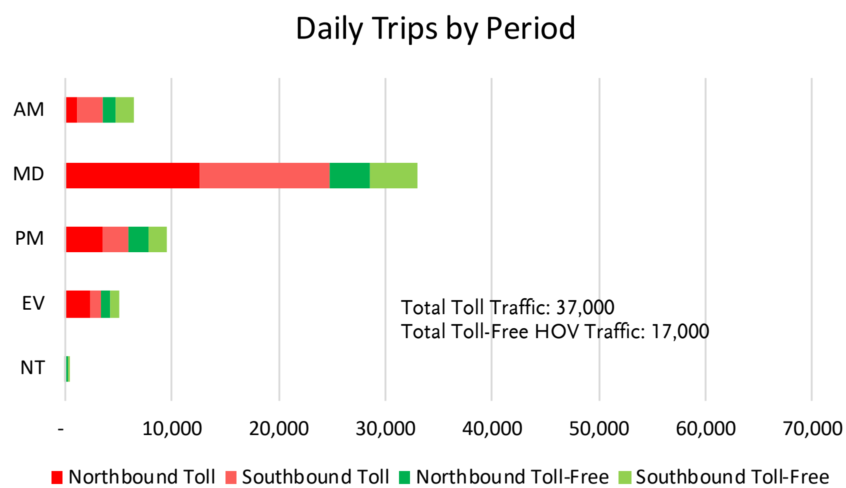
B2-x	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Maximum Revenue





B2-y	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Optimized Mobility

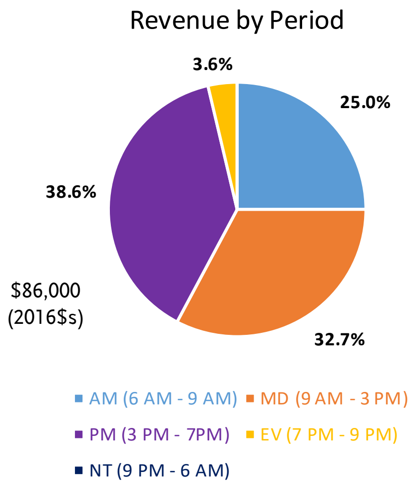


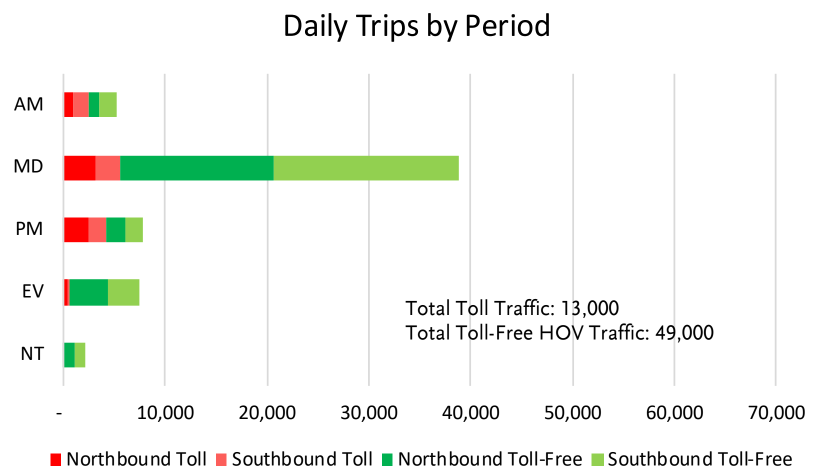


Source: RapidTOM

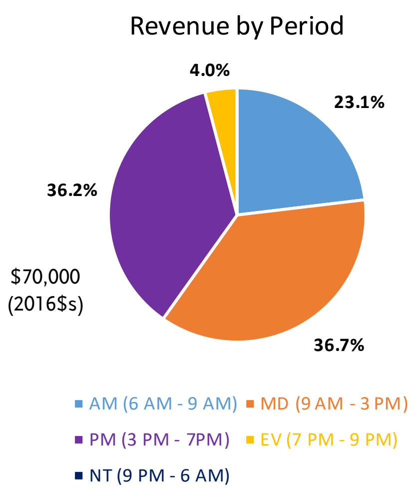
Figure 9-2: Scenario B3 – Weekday Daily Results Summary – 2025

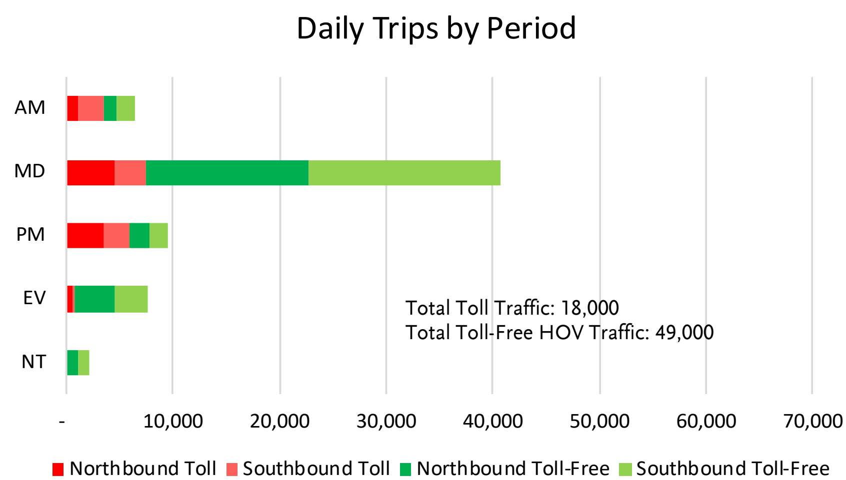
B3-x	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak	Maximum Revenue





B3-y	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak	Optimized Mobility

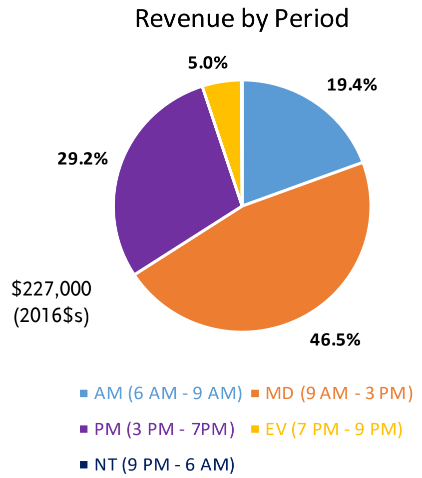


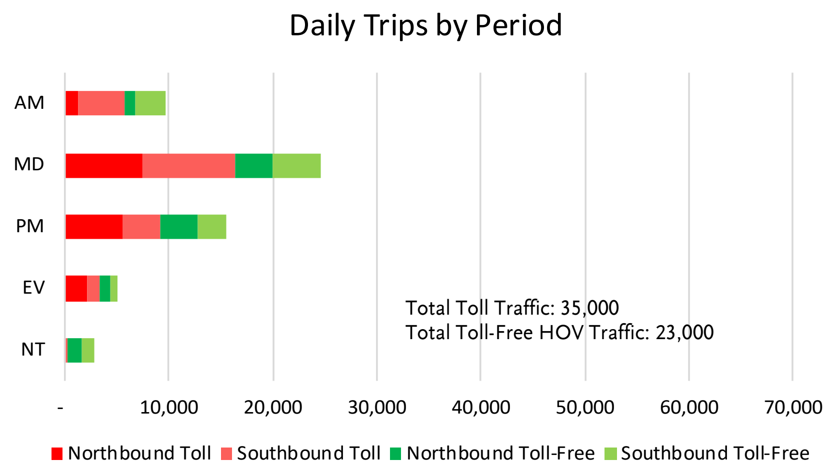


Source: RapidTOM

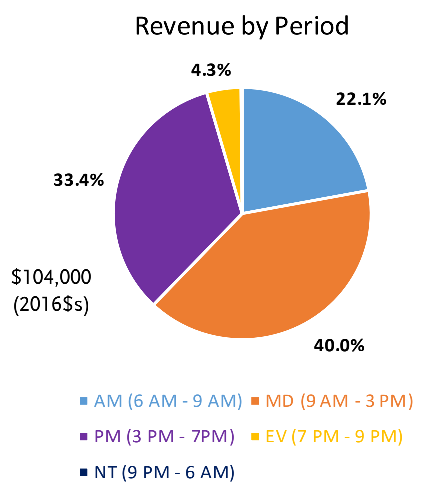
Figure 9-3: Scenario E2 – Weekday Daily Results Summary – 2025

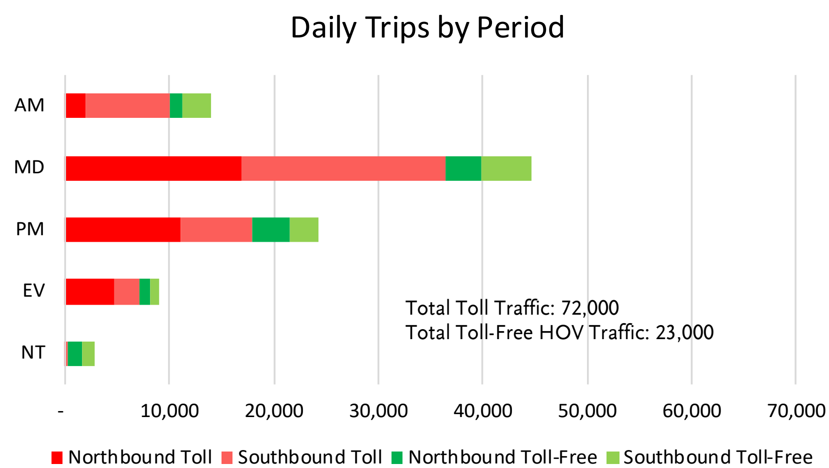
E2-x	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt	Maximum Revenue





E2-y	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt	Optimized Mobility

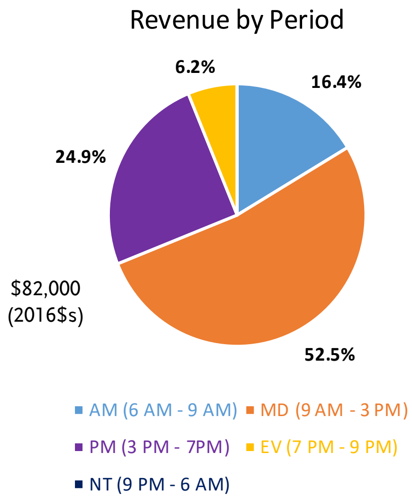


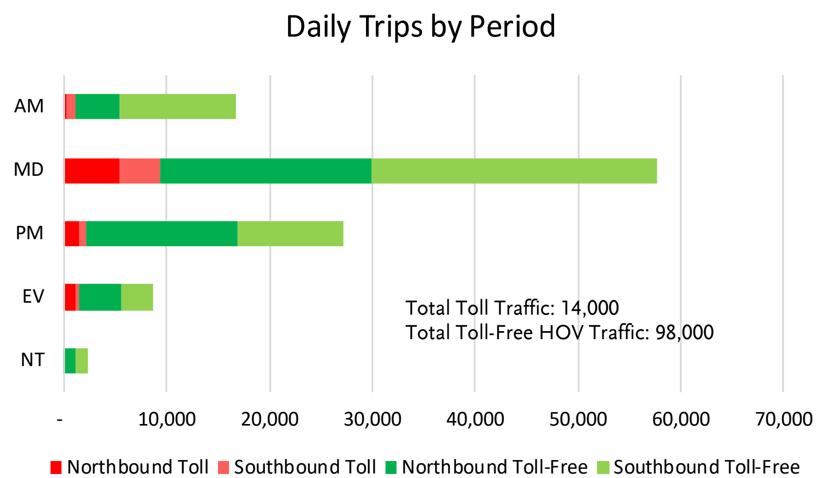


Source: RapidTOM

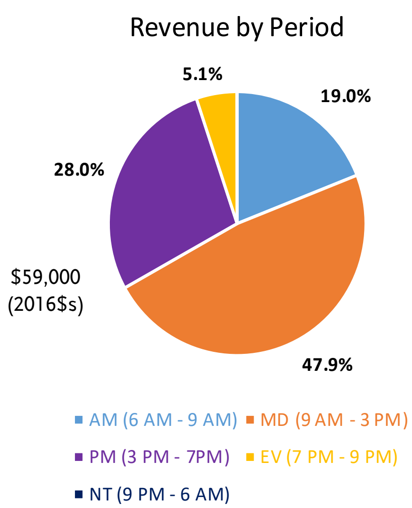
Figure 9-4: Scenario F1 – Weekday Daily Results Summary – 2025

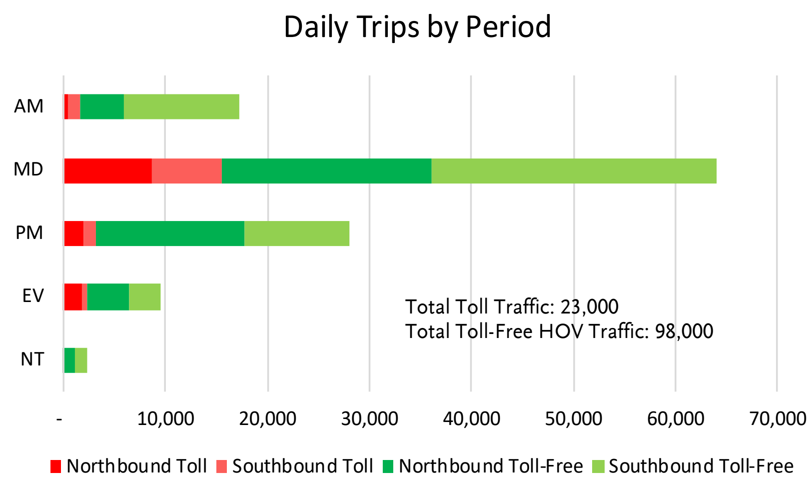
F1-x	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Maximum Revenue





F1-y	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Optimized Mobility

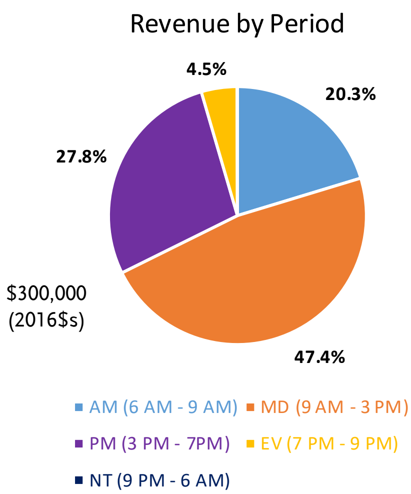


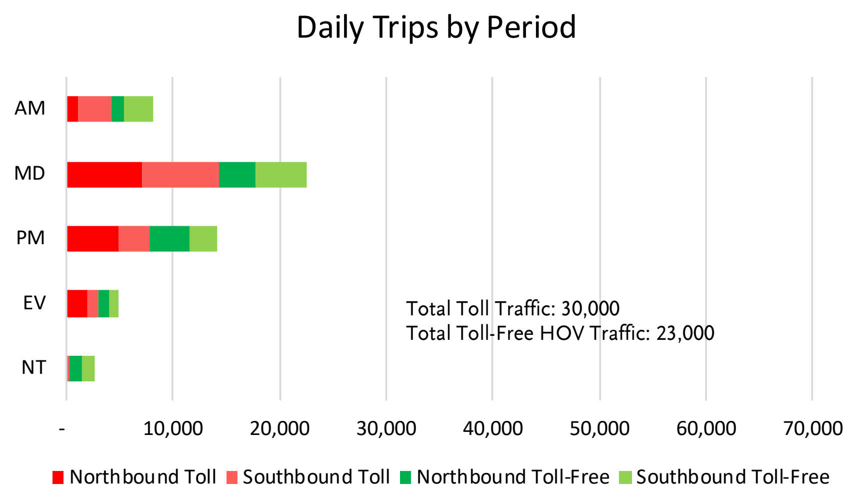


Source: RapidTOM

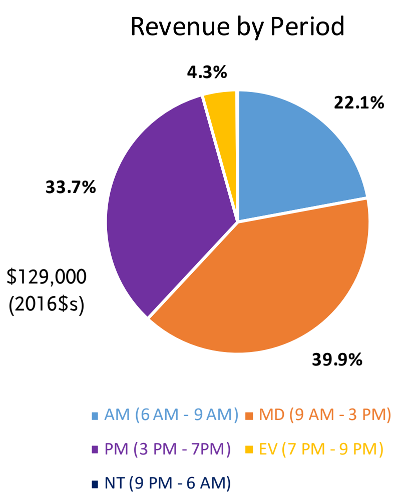
Figure 9-5: Scenario F2 – Weekday Daily Results Summary – 2025

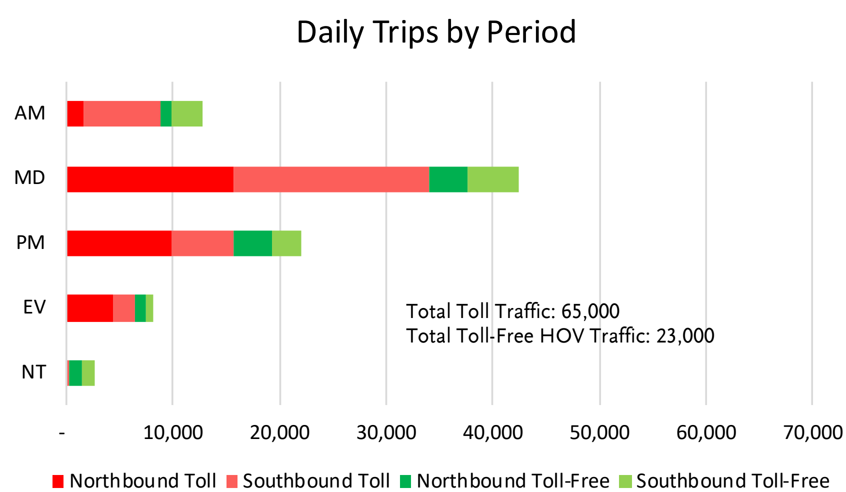
F2-x	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Maximum Revenue





F2-y	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Optimized Mobility

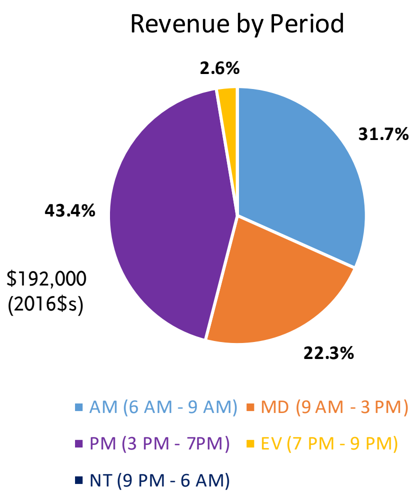


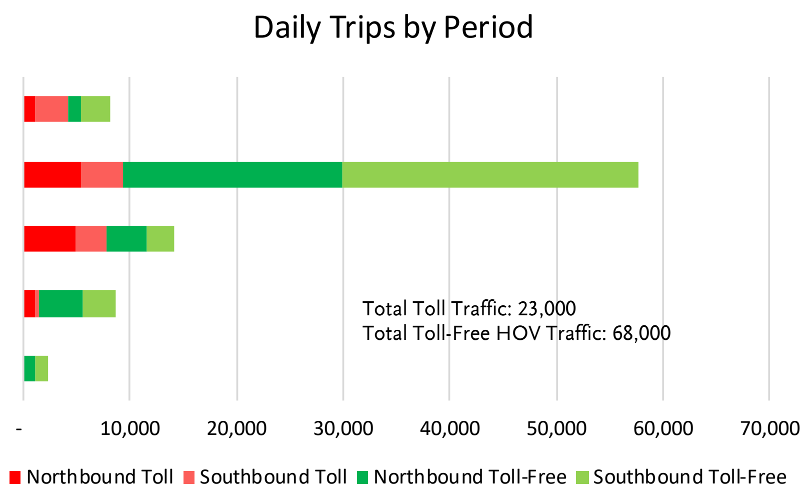


Source: RapidTOM

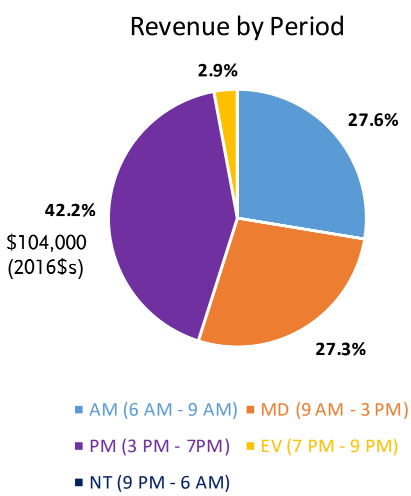
Figure 9-6: Scenario F3 – Weekday Daily Results Summary – 2025

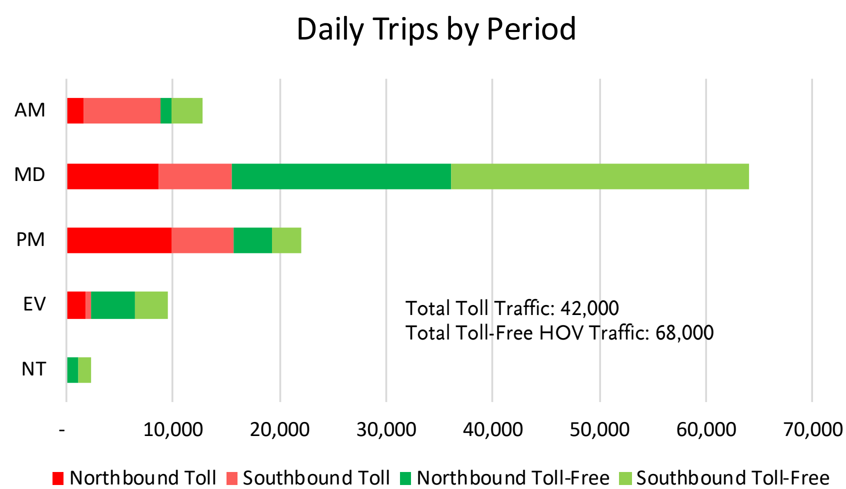
F3-x	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak	Maximum Revenue





F3-y	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak	Optimized Mobility





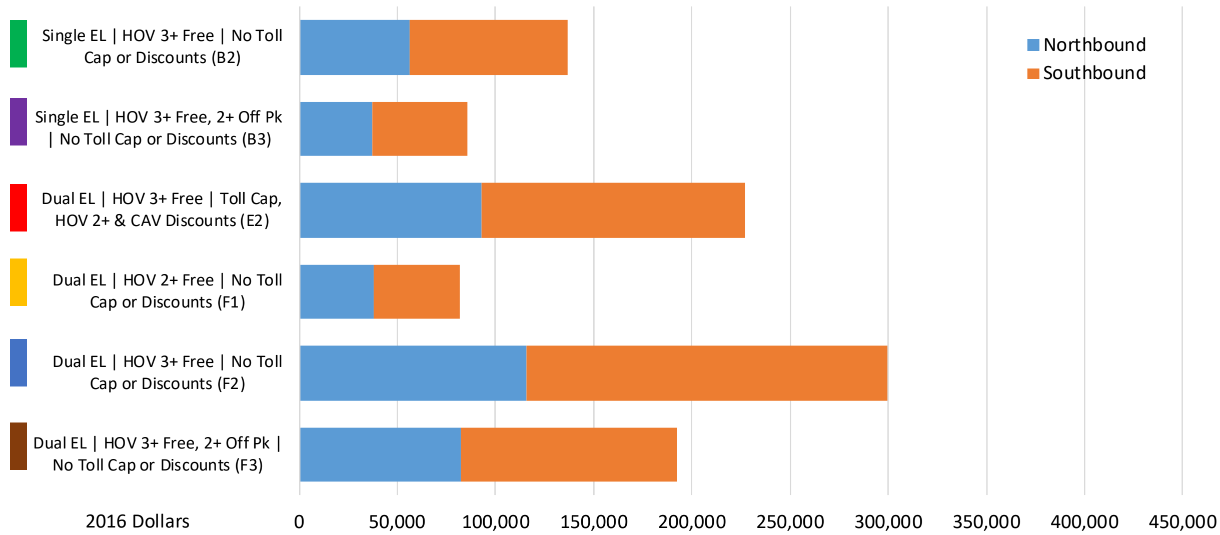
Source: RapidTOM

9.3 WEEKDAY DAILY REVENUE BY SCENARIO AND TOLL OPERATING OBJECTIVE CASE FOR 2025

Figure 9-9 through **Figure 9-14** provide summaries for 2025 and 2040 daily traffic and revenue (in 2016 dollars). The daily revenue charts show the distribution of revenue generated by travel direction across the six selected scenarios for the two bookend toll operating objective cases (maximum revenue and optimized mobility). The daily trip charts combine toll and toll-free trips by travel direction across the same six scenarios and two bookend toll operating objectives. The following conclusions can be drawn from these charts.

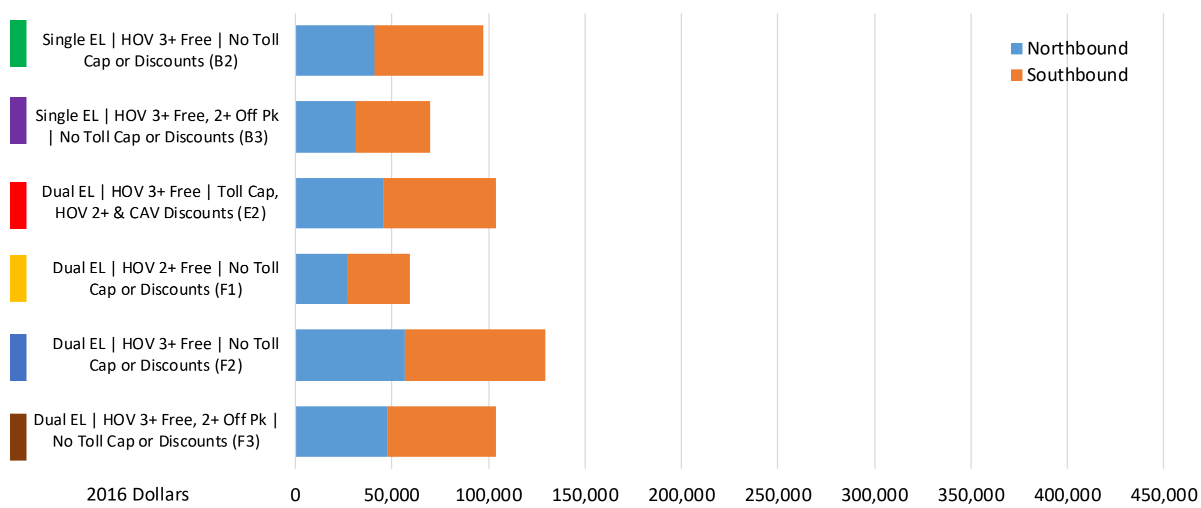
- Daily southbound toll revenues exceed northbound revenues in all of the scenarios and toll operating objective cases.
- Daily toll trips are generally directionally balanced across the six scenarios, with a few exceptions where northbound trips are slightly higher than southbound.
- Over the course of the day, the average revenue per transaction will be higher in the southbound direction than northbound.
- The typical corridor toll rates per mile by time of day and direction in **Table 9-1** and **Table 9-2** also support the finding that willingness to pay tolls, and thus revenues, tend to be higher for southbound travel even when aggregated over the entire weekday.
- The 2+ HOV exemption (Scenario F1) facilitates the highest daily volume of travel by both toll and toll-free customers in the express lanes, though as previously noted, this scenario is significantly more likely to result in degraded performance (speeds less than 45 mph).
- The 3+ HOV exemption (Scenario F2) generates the most revenue regardless of which toll operating objective is selected, but also supports the fewest daily trips compared to the other two toll exemption options.
- The hybrid case with a 3+ HOV toll exemption in peak periods and a 2+ HOV exemption at other times (Scenario F3) tends to balance the revenue with trips served in the express lanes regardless of which toll operating objective is selected.

Figure 9-7: Summary – Daily Revenue 2025 – Maximum Revenue



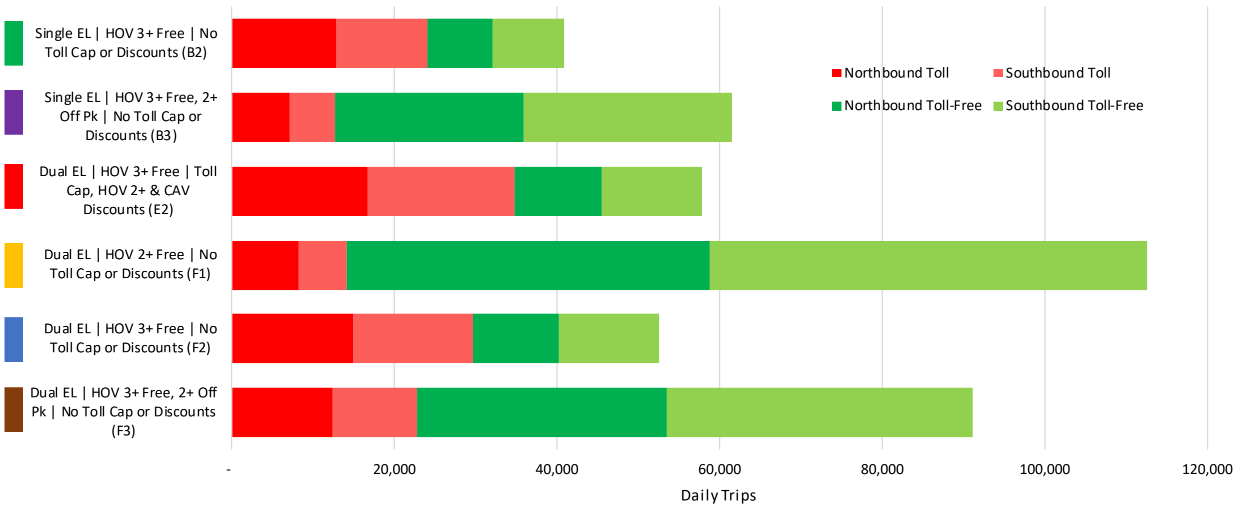
Source: RapidTOM

Figure 9-8: Summary – Daily Revenue 2025 – Optimized Mobility



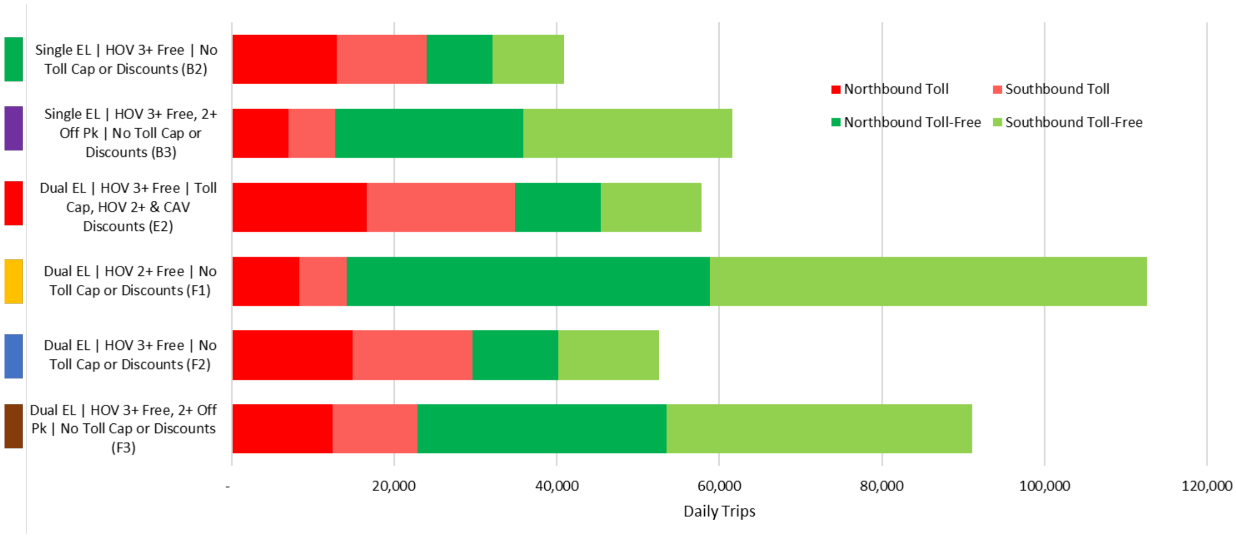
Source: RapidTOM

Figure 9-9: Summary – Daily Trips 2025 – Maximum Revenue



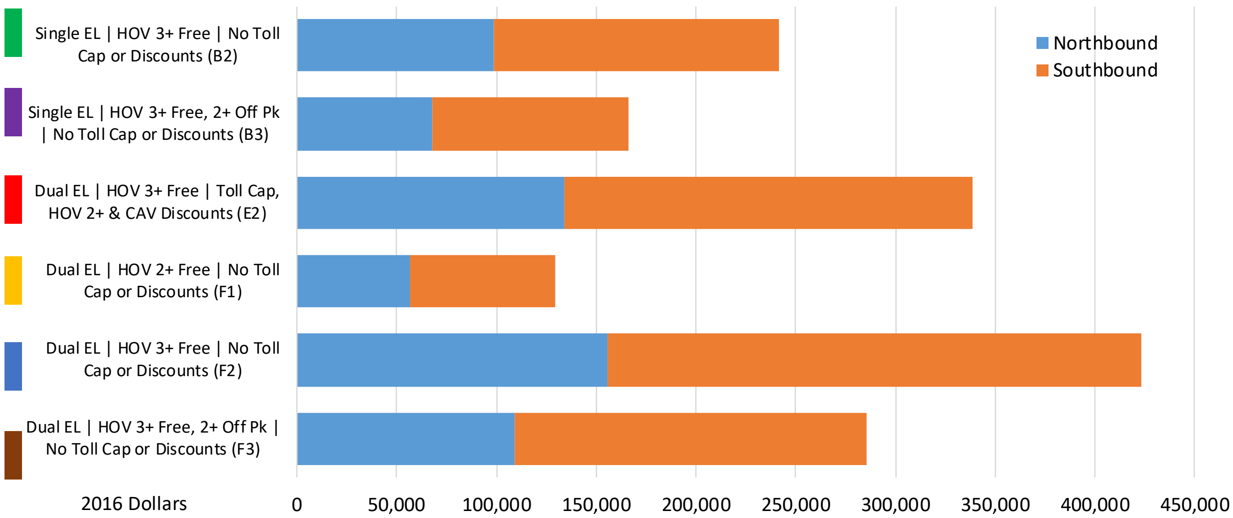
Source: RapidTOM

Figure 9-10: Summary – Daily Trips 2025 – Optimized Mobility



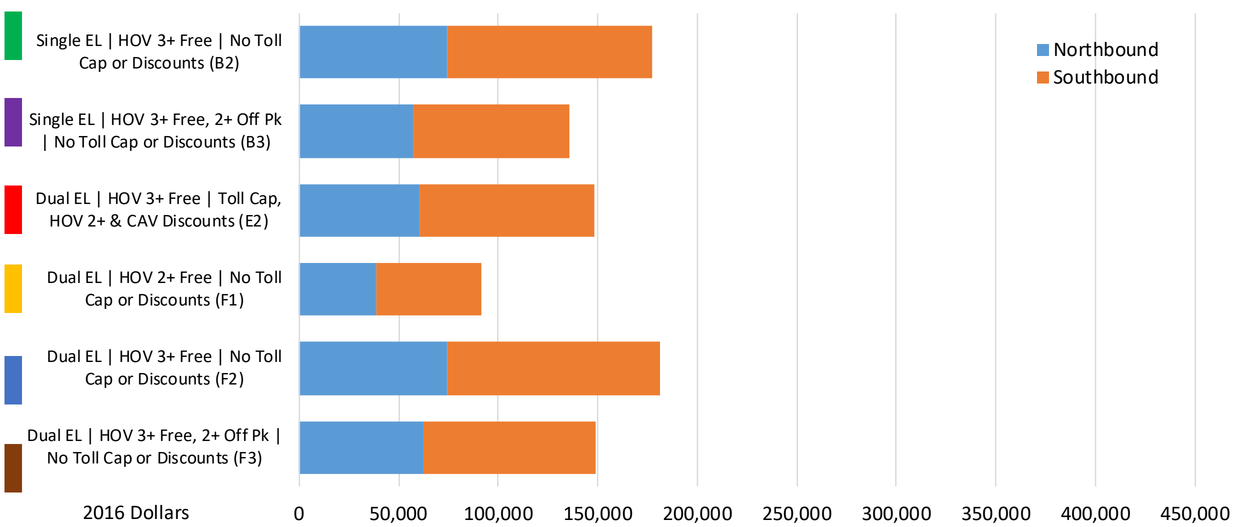
Source: RapidTOM

Figure 9-11: Summary – Daily Revenue 2040 – Maximum Revenue



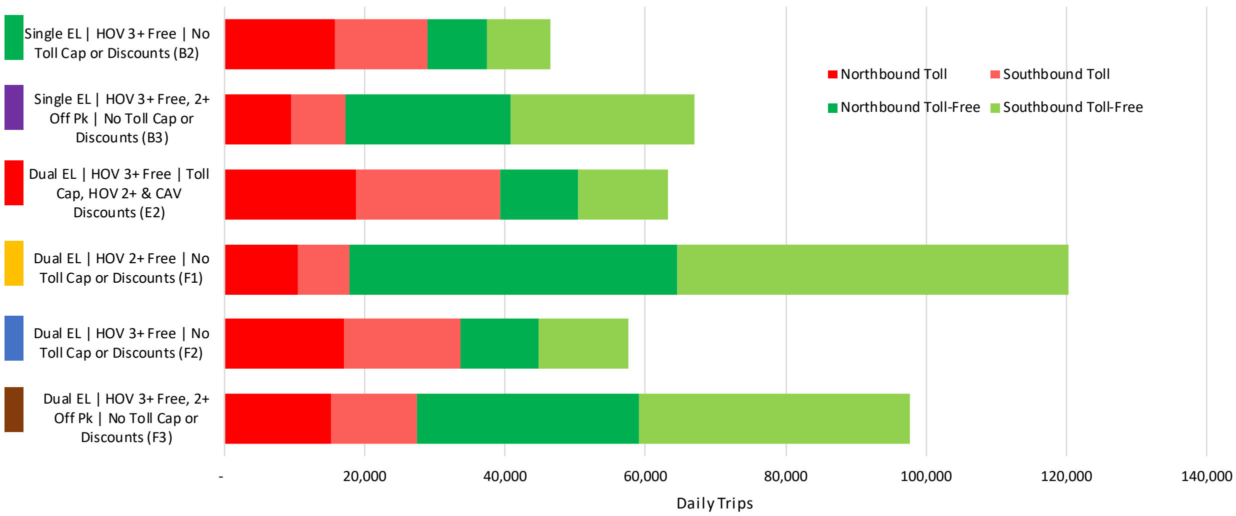
Source: RapidTOM

Figure 9-12: Summary – Daily Revenue 2040 – Optimized Mobility



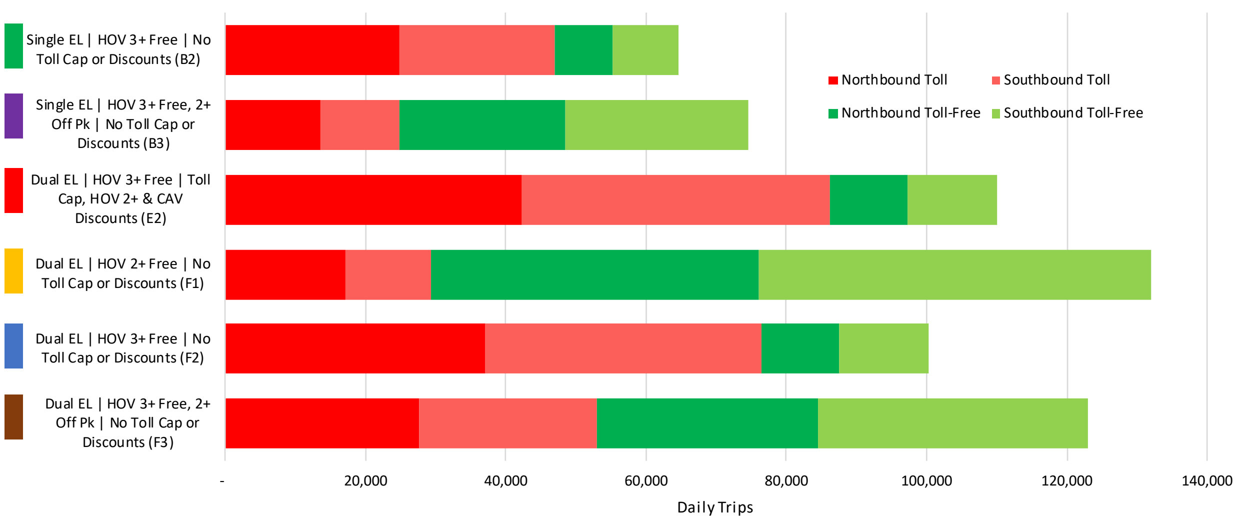
Source: RapidTOM

Figure 9-13: Summary – Daily Trips 2040 – Maximum Revenue



Source: RapidTOM

Figure 9-14: Summary – Daily Trips 2040 – Optimized Mobility



Source: RapidTOM

9.4 TYPICAL TOLL RATES

Table 9-1 and **Table 9-2** below display the estimated average toll rates per mile based upon a full corridor trip for the single and dual lane scenarios, respectively. In both cases, toll rates are provided for both model years 2025 and 2040, expressed in constant 2016 dollars and nominal, year of collection dollars. Estimated toll rates are provided for the balance of mobility and revenue operating objective in addition to the optimized mobility and maximum revenue bookend objectives. For example, under Scenario F2 the typical toll cost for a full corridor trip of 10.21 miles southbound in the AM peak period in the year 2025 would range from $6.53 (Optimized Mobility toll operating objective) to $30.12 (Maximum Revenue toll operating objective) in year of collection dollars. This is equivalent to a range of $5.31 to $24.71 in current (2016) dollars.

The tables group toll rate information by the HOV 2+ and HOV 3+ exemption scenarios. In **Table 9-1**, Scenario B1 is included to provide the HOV 2+ toll rates at all times of day. The Scenario B1 midday, evening, and night toll rates can be paired with the HOV 3+ AM and PM peak toll rates from Scenario B2 to assemble the full set of toll rates for the hybrid HOV toll exemption case represented by Scenario B3.

In several cases, the toll rates for the dual lane scenarios are similar to or higher than the comparable single lane scenarios. At first glance, this result seems counterintuitive, given that less capacity to sell in the single lane scenarios should result in those spaces commanding higher prices. However, this result can be attributed to the fact that the SCAG TDM "sees" the additional lane of capacity in each direction and thus assigns a greater number of regional trips to the dual lane scenarios in the toll-free baseline demand assessment. Essentially, the model is reflecting latent demand whereby additional drivers currently using alternate routes or other travel options would be expected to travel on the I-405 through the Sepulveda Pass due to the additional capacity. The higher level of demand with an additional lane in each direction is subsequently distributed between the tolled express lanes and the GP lanes in the toll optimization step.

Section 7.2 in the previous chapter outlines the minimum toll rate per mile assumptions, and where applicable, the maximum toll per mile, and how this Metro policy maximum changes over time in the forecasts.

Additional toll rate details, including average toll rates per mile by analysis segment and times and conditions when the minimum toll is in effect, can be found in **Appendix D**.

Table 9-1: Typical Toll Rates per Mile in 2025 and 2040 – Single Lane Scenario Cases

Note Toll rates shown for scenarios assuming the "Existing/Proposed Metro Toll & Discount Policies" represent blended rates comprised of the posted toll paid by SOVs and the 50% discounted toll paid by 2-person HOVs and Clean Air Vehicles

							2025 Typical Toll Rates per Mile for a Full Corridor Trip										2040 Typical Toll Rates per Mile for a Full Corridor Trip									
							2016 Dollars per Mile					Year of Collection (2025) Dollars per Mile					2016 Dollars per Mile					Year of Collection (2040) Dollars per Mile				
							AM Peak (6-9am)	Midday (9am-3pm)	PM Peak (3-7pm)	Evening (7-9pm)	Night (9pm-6am)	AM Peak (6-9am)	Midday (9am-3pm)	PM Peak (3-7pm)	Evening (7-9pm)	Night (9pm-6am)	AM Peak (6-9am)	Midday (9am-3pm)	PM Peak (3-7pm)	Evening (7-9pm)	Night (9pm-6am)	AM Peak (6-9am)	Midday (9am-3pm)	PM Peak (3-7pm)	Evening (7-9pm)	Night (9pm-6am)
B1-x	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Maximum Revenue	Northbound	$0.49	$0.62	$0.72	$0.57	$0.10	$0.60	$0.76	$0.88	$0.70	$0.12	$0.81	$1.07	$0.82	$0.87	$0.10	$1.39	$1.82	$1.39	$1.48	$0.17
						Southbound	$1.12	$0.95	$0.71	$0.40	$0.10	$1.37	$1.16	$0.87	$0.49	$0.12	$1.67	$1.33	$1.42	$0.85	$0.10	$2.85	$2.27	$2.42	$1.45	$0.17
B1-y	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Optimized Mobility	Northbound	$0.40	$0.38	$0.60	$0.42	$0.10	$0.49	$0.47	$0.73	$0.51	$0.12	$0.61	$0.67	$0.65	$0.65	$0.10	$1.04	$1.14	$1.11	$1.11	$0.17
						Southbound	$1.04	$0.73	$0.53	$0.30	$0.10	$1.27	$0.89	$0.64	$0.37	$0.12	$1.47	$1.04	$1.07	$0.66	$0.10	$2.51	$1.78	$1.82	$1.13	$0.17
B1-z	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Balance of Mobility & Revenue	Northbound	$0.46	$0.54	$0.68	$0.52	$0.10	$0.56	$0.66	$0.83	$0.64	$0.12	$0.75	$0.93	$0.76	$0.80	$0.10	$1.27	$1.59	$1.30	$1.36	$0.17
						Southbound	$1.09	$0.88	$0.65	$0.37	$0.10	$1.34	$1.07	$0.80	$0.45	$0.12	$1.61	$1.24	$1.30	$0.79	$0.10	$2.74	$2.11	$2.22	$1.34	$0.17
B2-x	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Maximum Revenue	Northbound	$0.53	$0.66	$0.77	$0.60	$0.10	$0.64	$0.81	$0.94	$0.74	$0.12	$0.88	$1.13	$0.90	$0.88	$0.10	$1.50	$1.92	$1.54	$1.50	$0.17
						Southbound	$1.08	$1.17	$0.86	$0.34	$0.10	$1.32	$1.43	$1.05	$0.42	$0.12	$1.81	$1.64	$1.50	$0.59	$0.10	$3.09	$2.80	$2.56	$1.01	$0.17
B2-y	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Optimized Mobility	Northbound	$0.37	$0.28	$0.47	$0.25	$0.10	$0.46	$0.34	$0.57	$0.31	$0.12	$0.50	$0.48	$0.52	$0.38	$0.10	$0.86	$0.82	$0.88	$0.64	$0.17
						Southbound	$0.55	$0.42	$0.45	$0.14	$0.10	$0.67	$0.52	$0.55	$0.17	$0.12	$0.85	$0.61	$0.66	$0.20	$0.10	$1.45	$1.05	$1.13	$0.34	$0.17
B2-z	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Balance of Mobility & Revenue	Northbound	$0.48	$0.53	$0.67	$0.49	$0.10	$0.58	$0.65	$0.82	$0.59	$0.12	$0.75	$0.91	$0.78	$0.71	$0.10	$1.29	$1.56	$1.32	$1.22	$0.17
						Southbound	$0.90	$0.92	$0.72	$0.27	$0.10	$1.10	$1.13	$0.88	$0.33	$0.12	$1.49	$1.30	$1.22	$0.46	$0.10	$2.55	$2.22	$2.08	$0.79	$0.17

*Corridor is approximately 10 miles long
Source: ECONorthwest & WSP

Table 9-2: Typical Toll Rates per Mile in 2025 and 2040 – Dual Lane Scenario Cases

Note: Toll rates shown for scenarios assuming the "Existing/Proposed Metro Toll & Discount Policies" represent blended rates comprised of the posted toll paid by SOVs and the 50% discounted toll paid by 2-person HOVs and Clean Air Vehicles

Case	Lanes	Access	Toll Policy	HOV	Objective	Direction	2025: 2016 $/mi AM Peak (6-9am)	2025: 2016 $/mi Midday (9am-3pm)	2025: 2016 $/mi PM Peak (3-7pm)	2025: 2016 $/mi Evening (7-9pm)	2025: 2016 $/mi Night (9pm-6am)	2025: YOC (2025) $/mi AM Peak (6-9am)	2025: YOC (2025) $/mi Midday (9am-3pm)	2025: YOC (2025) $/mi PM Peak (3-7pm)	2025: YOC (2025) $/mi Evening (7-9pm)	2025: YOC (2025) $/mi Night (9pm-6am)	2040: 2016 $/mi AM Peak (6-9am)	2040: 2016 $/mi Midday (9am-3pm)	2040: 2016 $/mi PM Peak (3-7pm)	2040: 2016 $/mi Evening (7-9pm)	2040: 2016 $/mi Night (9pm-6am)	2040: YOC (2040) $/mi AM Peak (6-9am)	2040: YOC (2040) $/mi Midday (9am-3pm)	2040: YOC (2040) $/mi PM Peak (3-7pm)	2040: YOC (2040) $/mi Evening (7-9pm)	2040: YOC (2040) $/mi Night (9pm-6am)
E2-x	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt	Maximum Revenue	Northbound	$0.60	$0.98	$1.69	$0.86	$0.07	$0.73	$1.20	$2.07	$1.05	$0.09	$1.15	$1.44	$1.94	$1.13	$0.07	$1.95	$2.45	$3.32	$1.93	$0.12
						Southbound	$2.24	$2.01	$1.50	$0.54	$0.10	$2.74	$2.46	$1.84	$0.66	$0.12	$2.95	$2.52	$2.35	$0.87	$0.09	$5.03	$4.29	$4.01	$1.48	$0.16
E2-y	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt	Optimized Mobility	Northbound	$0.42	$0.19	$0.53	$0.17	$0.07	$0.52	$0.23	$0.65	$0.20	$0.09	$0.41	$0.23	$0.52	$0.18	$0.07	$0.71	$0.39	$0.88	$0.30	$0.12
						Southbound	$0.74	$0.40	$0.53	$0.17	$0.10	$0.90	$0.49	$0.65	$0.20	$0.12	$0.88	$0.48	$0.64	$0.18	$0.09	$1.50	$0.82	$1.10	$0.31	$0.15
E2-z	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt	Balance of Mobility & Revenue	Northbound	$0.49	$0.51	$1.00	$0.44	$0.07	$0.60	$0.62	$1.22	$0.54	$0.09	$0.71	$0.71	$1.09	$0.56	$0.07	$1.21	$1.21	$1.85	$0.95	$0.12
						Southbound	$1.34	$1.05	$0.92	$0.32	$0.10	$1.64	$1.28	$1.12	$0.39	$0.12	$1.71	$1.29	$1.33	$0.46	$0.09	$2.91	$2.21	$2.26	$0.78	$0.15
F1-x	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Maximum Revenue	Northbound	$0.43	$0.56	$0.85	$0.42	$0.10	$0.53	$0.68	$1.04	$0.51	$0.12	$0.70	$0.81	$0.87	$0.51	$0.10	$1.19	$1.38	$1.48	$0.88	$0.17
						Southbound	$1.24	$1.01	$0.78	$0.36	$0.10	$1.52	$1.23	$0.96	$0.44	$0.12	$1.66	$1.20	$1.36	$0.36	$0.10	$2.83	$2.05	$2.31	$0.62	$0.17
F1-y	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Optimized Mobility	Northbound	$0.35	$0.21	$0.55	$0.17	$0.10	$0.43	$0.26	$0.67	$0.20	$0.12	$0.39	$0.28	$0.57	$0.21	$0.10	$0.67	$0.47	$0.97	$0.36	$0.17
						Southbound	$0.85	$0.48	$0.52	$0.25	$0.10	$1.03	$0.59	$0.63	$0.31	$0.12	$1.05	$0.53	$0.78	$0.16	$0.10	$1.79	$0.91	$1.33	$0.27	$0.17
F1-z	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Balance of Mobility & Revenue	Northbound	$0.38	$0.33	$0.65	$0.25	$0.10	$0.46	$0.40	$0.79	$0.31	$0.12	$0.50	$0.45	$0.67	$0.31	$0.10	$0.85	$0.78	$1.14	$0.53	$0.17
						Southbound	$0.98	$0.65	$0.61	$0.29	$0.10	$1.20	$0.80	$0.74	$0.35	$0.12	$1.25	$0.75	$0.97	$0.23	$0.10	$2.13	$1.29	$1.65	$0.39	$0.17
F2-x	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Maximum Revenue	Northbound	$0.54	$0.94	$1.55	$0.73	$0.10	$0.66	$1.15	$1.89	$0.90	$0.12	$0.99	$1.33	$1.59	$0.89	$0.10	$1.69	$2.27	$2.71	$1.52	$0.17
						Southbound	$2.42	$2.13	$1.24	$0.38	$0.10	$2.95	$2.60	$1.52	$0.46	$0.12	$3.20	$2.57	$2.23	$0.60	$0.10	$5.47	$4.39	$3.81	$1.02	$0.17
F2-y	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Optimized Mobility	Northbound	$0.35	$0.17	$0.45	$0.14	$0.10	$0.43	$0.21	$0.55	$0.17	$0.12	$0.38	$0.23	$0.45	$0.16	$0.10	$0.65	$0.39	$0.77	$0.28	$0.17
						Southbound	$0.52	$0.27	$0.37	$0.11	$0.10	$0.64	$0.33	$0.46	$0.14	$0.12	$0.65	$0.33	$0.48	$0.13	$0.10	$1.10	$0.57	$0.81	$0.23	$0.17
F2-z	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Balance of Mobility & Revenue	Northbound	$0.43	$0.48	$0.89	$0.38	$0.10	$0.52	$0.59	$1.08	$0.46	$0.12	$0.62	$0.67	$0.91	$0.45	$0.10	$1.07	$1.14	$1.55	$0.78	$0.17
						Southbound	$1.28	$1.01	$0.72	$0.22	$0.10	$1.57	$1.24	$0.88	$0.27	$0.12	$1.67	$1.23	$1.18	$0.32	$0.10	$2.85	$2.10	$2.01	$0.55	$0.17

*Corridor is approximately 10 miles long
Source: ECONorthwest & WSP

9.5 COMPARISON TO EXISTING EXPRESSLANES TOLL RATES

Table 9-3 shows average toll rates per mile for the AM and PM peak periods by direction on the existing I-110 ExpressLanes based on weekdays in May 2017, and compares them with the estimated 2025 toll rates per mile (expressed in 2016 dollars) for the I-405 Sepulveda Pass corridor under the balance of mobility and revenue case for Scenario F2 (see **Table 9-2**). The I-110 corridor toll rates were selected over those for I-10 because of the corridor's similarities with I-405. The rates were calculated by dividing the average May 2017 toll for full length trips in each direction and time-period by the corridor's length of 11 miles. I-405 Sepulveda Pass Scenario F1-z was used as the basis of comparison based upon its dual express lanes with existing HOV access locations under an unconstrained dynamic pricing algorithm with HOV 2+ toll-exempt and a toll operating objective that seeks the balance of mobility and revenue. The cells highlighted below indicate the predominant direction of travel for traffic in the respective corridors during each peak period.

Table 9-3: Toll Rate comparison: I-110 ExpressLanes vs. I-405 Sepulveda Pass

Corridor & Time Period	110 NB	405 SB	110 SB	405 NB
AM	$1.16	$0.98	$0.41	$0.38
PM	$0.45	$0.61	$0.78	$0.65

*Toll rates are per mile and expressed in current dollar values.

The expected I-405 Sepulveda Pass toll rates per mile in 2025 for the toll operating objective that balances mobility and revenue, when expressed in constant 2016 dollars, are very similar to those currently being experienced on the I-110. Typical expected toll rates for the other I-405 toll scenarios can be found in **Table 9-1** and **Table 9-2**.

10.0 ANNUAL GROSS TOLL TRAFFIC & REVENUE FORECASTS

10.1 WEEKDAY-TO-ANNUAL FORECAST EXPANSION

The I-405 Sepulveda Pass T&R forecasts for annual trips in the express lanes (both toll and toll-free) plus gross toll revenue potential were prepared for the period extending from 2024 to 2060 for the six toll scenarios selected by Metro. In addition, each of the six scenarios was evaluated over the three toll operating objectives — optimized mobility, maximum revenue, and balance of mobility and revenue — yielding results for a total of 18 different cases.

The preparation of these annual forecast period streams starts with the toll optimization model weekday outputs for model years 2025 and 2040 by direction and time-period for the 18 scenario cases shown in **Figure 7-6**. The annual forecast horizon extends to year 2060 to capture a period sufficient to consider the full amortization of 30-year toll revenue bonds or a 35-year USDOT TIFIA loan.

Existing traffic data by day of week, time of day and direction of travel were analyzed and used to develop separate expansion factors for both traffic (toll and toll-free trips) and toll revenue. This process accounts for the variation between weekday traffic and weekend/holiday traffic for both the express lanes and GP lanes, and the likelihood that over the course of the day, weekend average toll rates will likely be lower than weekday toll rates. Because the SCAG TDM is not designed to for forecasting a weekend day, there were not future demand inputs available for the RapidTOM toll optimization tool to assess weekend toll customer behavior. As such, the forecasts herein apply conservative assumptions that set weekend toll revenue at a fraction of the estimated weekend corridor travel relative to the existing ratio between weekday and weekend traffic on the I-405.

Specifically, the weekend/holiday GP and HOV traffic as a percentage share of weekday traffic was calculated and existing weekend traffic data were analyzed to estimate the percentage share of total HOV and GP weekend/holiday traffic that traveled at times of day when average speeds are typically below 45 mph. These metrics were used to determine the potential weekend/holiday toll payers as percentage shares of the forecasted weekday toll payers. These metrics were then used to develop conservative traffic and revenue expansion factors for both northbound and southbound toll-paying and HOV traffic, and used to generate forecast year annual trips and revenue from the weekday RapidTOM model outputs. The resulting annualized traffic and revenue values account for a year's worth of anticipated weekday and weekend/holiday traffic and revenue in both the 2025 and 2040 forecast years. **Table 10-1** summarizes the traffic and revenue expansion factors used in the analysis by direction. These factors significantly discount weekend travel, assuming only a small share of weekend users would be willing to pay to use the lanes, and, on average, at lower toll rates. Specifically, the northbound traffic expansion factor equates the number weekend toll paying customers at 10% of the typical weekday northbound toll trips, with the northbound weekend revenue expansion factor yielding only 4.5% of a typical weekday's northbound revenue.

Table 10-1: Traffic and Revenue Expansion Factors

Direction	Traffic Expansion Factor	Revenue Expansion Factor
Northbound	266	260
Southbound	292	277

Source: WSP

For the southbound direction, the traffic expansion factor equates the number weekend toll paying customers at about 33% of the typical weekday southbound toll trips, with the southbound weekend revenue expansion factor yielding about 10% of a typical weekday's southbound revenue. The higher expansion factors estimated from existing data in the southbound direction also mirror the weekday T&R forecasts, which as previously described, show a bit more robust demand, revenue and/or average revenue per trip southbound.

Note that for both directions, the "average toll" paid (average revenue per trip) would be one half or less than the toll paid on weekdays, with these outcomes reflecting that weekend daily traffic is both somewhat lower but also more uniformly distributed over the course of the day than weekday traffic.

By way of comparison, data for the existing I-10 and I-110 ExpressLanes for May 2017 were analyzed to assess the weekend use share of typical weekday use and the weekend share of average weekday revenue. The average weekend toll ranges from 22-24% of the average weekday toll on the I-10 and I-110 ExpressLanes.

For the I-110 corridor, which is similar to I-405 Sepulveda Pass in length, directionality and configuration, a typical weekend day has about 45% of the typical number of weekday toll customers, and generates about 11% of the typical weekday revenue. The east-west I-10 corridor exhibits weekend daily traffic of about 40% of a typical weekday, but generates only 4% of typical weekday revenue.

10.2 TRAFFIC AND REVENUE FORECAST HORIZON 2024-60

Using the 2025 and 2040 annual traffic and revenue figures, intermediate year values were interpolated and outside year values were extrapolated using the traffic and revenue compounded annual growth rates (CAGRs) between 2025 and 2040. The extrapolation of toll trips after 2040 used one-half of the traffic CAGR through 2050, and assumed that there would be no growth in toll-paying traffic from 2050 through the end of the forecast period in 2060. This no growth assumption is a conservative assumption, as it is very difficult to accurately predict growth rates over 30 years in the future. The extrapolation from 2025 to the assumed 2024 year of opening discounted the 2024 values by the full 2025|2040 CAGRs.

The preparation of annual revenue forecasts involves two steps — inflation escalation and interpolation/extrapolation from the model forecast years. When preparing toll revenue forecasts, it is important to express the toll rates as the actual prices that will be charged to customers at the future points in time of their travel. For a general toll road, those rates are typically determined by set toll escalation policies. However, for express lanes where the toll is (largely) dynamically determined, this requires building in an inflation component. A customer's willingness to pay a $1.00 toll today for a set amount of time savings and trip reliability benefits will be higher one, ten, or twenty years in the future as their wages or salaries increase over time and the prices of other items, including substitutes for auto travel, such as transit fares, increase with inflation. A toll expressed in constant 2016 dollars within RapidTOM, for example, may be equivalent to the price of a dozen eggs, and needs to be inflated to year of collection dollars in 2025, so that the same toll is equivalent to the price of eggs which will have also inflated in cost over time.

The daily revenues coming out of the RapidTOM modeling process are in constant 2016 dollars, thus reflect 2016 prices. A review of the U.S. Bureau of Labor Statistic's Consumer Price Index for All Urban Consumers (CPI-U) between 1990 and 2016 shows that inflation averaged 2.5% over this period. A slightly more conservative inflation assumption was assumed for the period from 2016 through 2040, with further conservatism applied beyond 2040 to limit the inflationary impacts on revenue growth, as shown in **Table 10-2**.

Table 10-2: Future Inflation Assumptions

Period	Average Annual Inflation Rate
1990-2016	2.50%
2016-2040	2.25%
2040-2060	1.50%

Source: U.S. Bureau of Labor Statistics and WSP

The 2025 and 2040 revenue projections in constant 2016 dollars were escalated to year of collection dollars using inflation factors of 1.222 and 1.706, respectively, based upon the assumed future annual inflation rate in **Table 10-2**. The extrapolation of toll revenue from 2041 through 2050 used one-half of the constant dollar revenue CAGR for 2025|2040 plus the compounded effects of 2.25% inflation through 2040 and a lower 1.5% inflation compounded after 2040. Because toll traffic growth is assumed to be zero after 2050, revenue growth beyond 2050 was limited to inflationary impacts only, at 1.5% per year.

Although some T&R forecasts may assume that people's willingness to pay tolls will grow faster than inflation, due to real (above inflation) growth in wage and salary incomes and/or worsening trip reliability of toll-free alternatives increasing the willingness to pay for the same level of average time savings, no such factors were incorporated here.

Though not directly impacting the T&R forecasts, HOV trips were forecasted to grow by 90% of their respective trip CAGR from 2040 to 2050, with the growth rate reduced to 80% of the CAGR after 2050.

10.3 ANNUAL T&R FORECAST RAMP-UP ADJUSTMENTS

Ramp up factors were applied to the traffic and revenue forecasts in the first three years of the forecast period. Ramp-up adjustments lower the forecasts in the initial years of operation to account for the time it takes travelers to become accustomed to the express lanes, obtain the necessary account and transponder pass to pay for their use, evaluate their best options, and fully understand the travel time savings and reliability benefits that the priced lanes provide. **Table 10-3** below summarizes the ramp-up assumptions applied in this analysis.

Table 10-3: Traffic and Revenue Ramp-Up Factors

Year	Ramp Up Factor	Percentage Reduction in Traffic & Revenue
2024	80%	20%
2025	90%	10%
2026	95%	5%
2027	100%	0%

Source: WSP

10.4 ANNUAL TRAFFIC AND POTENTIAL GROSS TOLL REVENUE

The following pages provide charts for the forecasted annual toll trips, toll-exempt HOV trips, and the potential gross toll revenue for selected toll scenarios. The term "potential" is used to capture the point that the modeling process produces the revenue forecast that would result if every forecasted vehicle had the correct FasTrak Flex transponder and an active, current account with a positive balance so that the correct toll was collected instantaneously. Typically, adjustments need to be made to the potential gross toll revenue values to reflect what might actually be collected — this is done in the following chapter as part of the gross-to-net revenue calculations.

As noted earlier, potential gross toll revenues are expressed in future, year of collection dollars, where nominal toll rates not otherwise set in policy reflect annual inflationary adjustments, consistent with the demand modeling and toll optimization process that assumed that travelers' wages and salaries, and thus their willingness to pay tolls, would keep pace with general inflation to remain constant in real terms. With the increasing willingness to pay comes an equivalent increase in the dynamically optimized toll rates in the corridor.

In addition, comparison charts showing the differences in revenues across the three toll operating objectives (maximum revenue, optimized mobility and balance of mobility and revenue) are shown for the six Metro selected scenario sets "B2", "B3", "E2", "F1", "F2", and "F3", as shown in **Figure 7-6**.

The findings from the annual traffic and revenue forecasts mirror those of the daily results described in **Chapter 9.0**. **Table 10-4** presents the gross toll revenue forecasts by scenario and toll operating objective cases for forecast years 2025 and 2040, expressed in year of collection dollars. For reference, **Table 10-5** presents the same revenue information, but expressed in constant 2016 dollars, which is comparable to what would be generated if the 2025 demand levels were operating on a completed I-405 express lanes corridor at present.

From the tables and **Figure 10-1** through **Figure 10-6** on the following pages, it is clear that the HOV toll exemption policy has the most significant influence on potential revenues. The generally lower revenue, optimized mobility scenarios with HOV 3+ exempt still generate more revenue than the maximum revenue cases for comparable scenarios that are HOV 2+ exempt, reflecting the additional capacity for toll paying customers provided by an HOV 3+ exemption.

In addition, the spread between the optimized mobility and maximum revenue scenarios tends to be larger in both percentage and absolute terms for the dual lane scenarios than for the single lane scenarios.

Table 10-4: 2025 and 2040 Gross Revenues for Selected Scenarios | Year of Collection Dollars

		Access Method		Toll Policy		HOV Toll Exemption			2025 Gross Toll Revenue by Toll Operating Objective (2025 Dollars)			2040 Gross Toll Revenue by Toll Operating Objective (2040 Dollars)		
Scenario Set	Lane Configuration	Existing HOV Access Locations	More Restrictive Access Locations	Existing & Proposed LA Metro Toll & Discount Policies	Unconstrained Dynamic Pricing	HOV 2+ Exempt (1)	HOV 3+ Peak /2+ Off-Peak Exempt (3)	HOV 3+ Exempt (2)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)
B2	Single	X			X			X	$28.8 M	$34.7 M	$40.5 M	$81.5 M	$96.4 M	$111.3 M
B3	Single	X			X		X		$20.7 M	$23.1 M	$25.4 M	$62.6 M	$69.6 M	$76.6 M
E2	Dual	X		X				X	$30.7 M	$49.1 M	$67.4 M	$68.3 M	$112.2 M	$156.1 M
F1	Dual	X			X	X			$17.5 M	$20.8 M	$24.2 M	$42.3 M	$50.9 M	$59.5 M
F2	Dual	X			X			X	$38.4 M	$63.7 M	$89.1 M	$83.6 M	$139.6 M	$195.5 M
F3	Dual	X			X		X		$30.6 M	$43.8 M	$57.0 M	$68.6 M	$100.2 M	$131.7 M

Note: Revenue amounts represent potential gross toll revenues, expressed in year of collection dollars; 2025 amounts are net of ramp-up adjustments.

Source: WSP

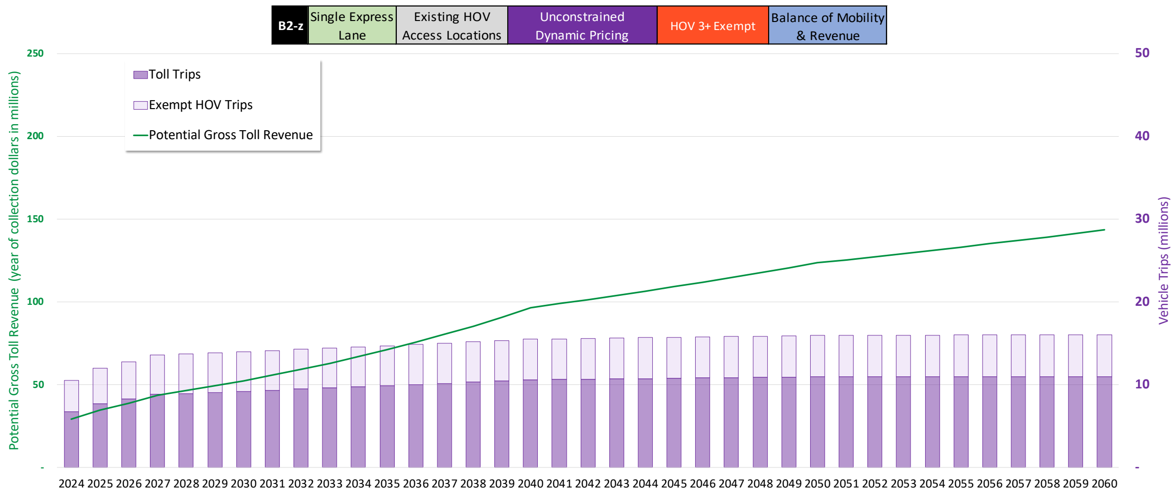
Table 10-5: 2025 and 2040 Gross Revenues for Selected Scenarios | Constant 2016 Dollars

		Access Method		Toll Policy		HOV Toll Exemption			2025 Gross Toll Revenue by Toll Operating Objective (2016 Dollars)			2040 Gross Toll Revenue by Toll Operating Objective (2016 Dollars)		
Scenario Set	Lane Configuration	Existing HOV Access Locations	More Restrictive Access Locations	Existing & Proposed LA Metro Toll & Discount Policies	Uncon-strained Dynamic Pricing	HOV 2+ Exempt (1)	HOV 3+ Peak /2+ Off-Peak Exempt (3)	HOV 3+ Exempt (2)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)
B2	Single	X			X			X	$23.6 M	$28.4 M	$33.2 M	$47.8 M	$56.5 M	$65.3 M
B3	Single	X			X		X		$17.0 M	$18.9 M	$20.8 M	$36.7 M	$40.8 M	$44.9 M
E2	Dual	X		X				X	$25.1 M	$40.2 M	$55.2 M	$40.1 M	$65.8 M	$91.5 M
F1	Dual	X			X	X			$14.3 M	$17.0 M	$19.8 M	$24.8 M	$29.8 M	$34.9 M
F2	Dual	X			X			X	$31.4 M	$52.2 M	$72.9 M	$49.0 M	$81.8 M	$114.6 M
F3	Dual	X			X		X		$25.1 M	$35.9 M	$46.6 M	$40.2 M	$58.7 M	$77.2 M

Note: Revenue amounts represent potential gross toll revenues, expressed in constant 2016 dollars; 2025 amounts are net of ramp-up adjustments.

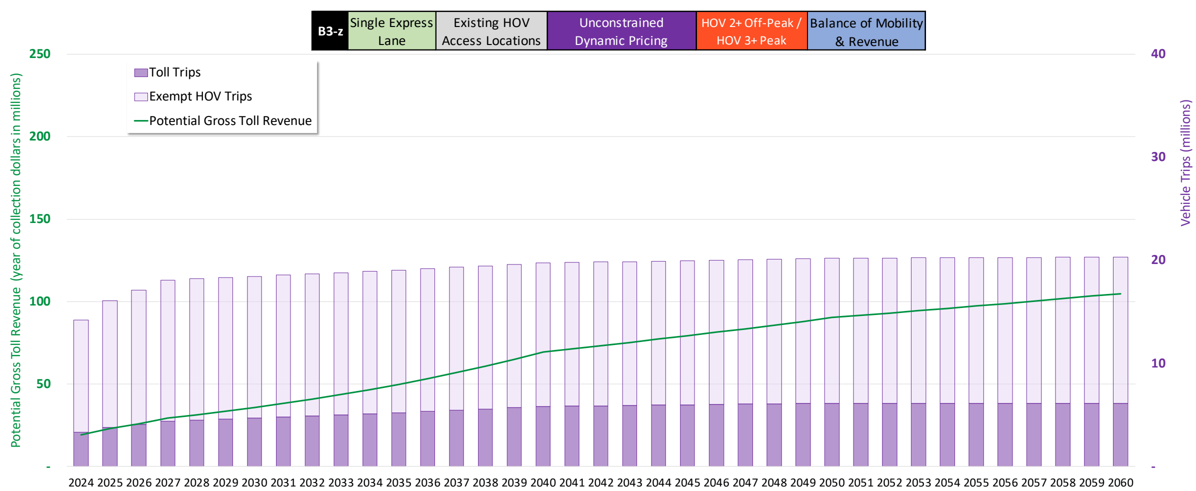
Source: WSP

Figure 10-1: Scenario B2 Toll & Exempt Trips | Gross Toll Revenue Results



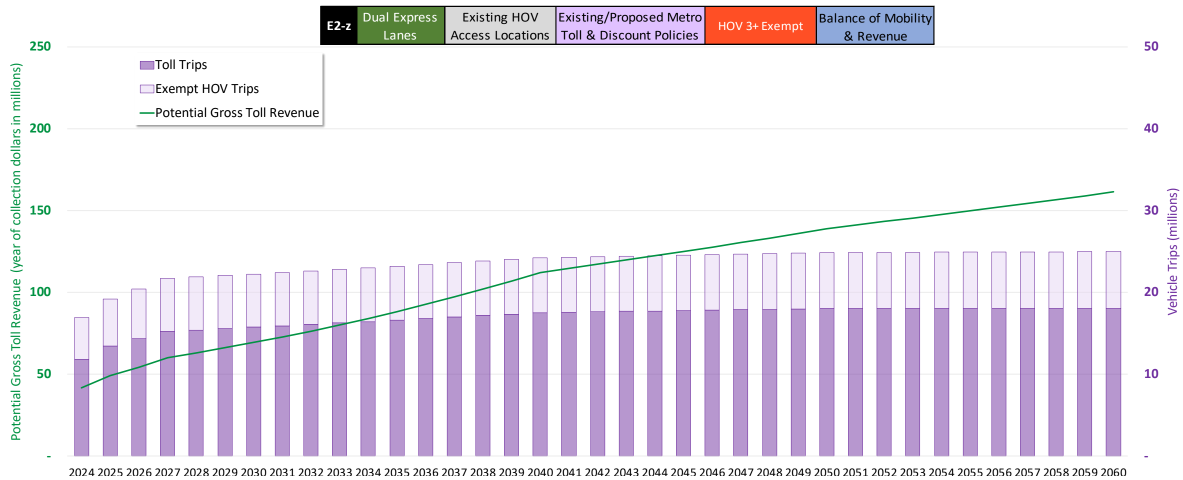
Source: WSP

Figure 10-2: Scenario B3 Toll & Exempt Trips | Gross Toll Revenue Results



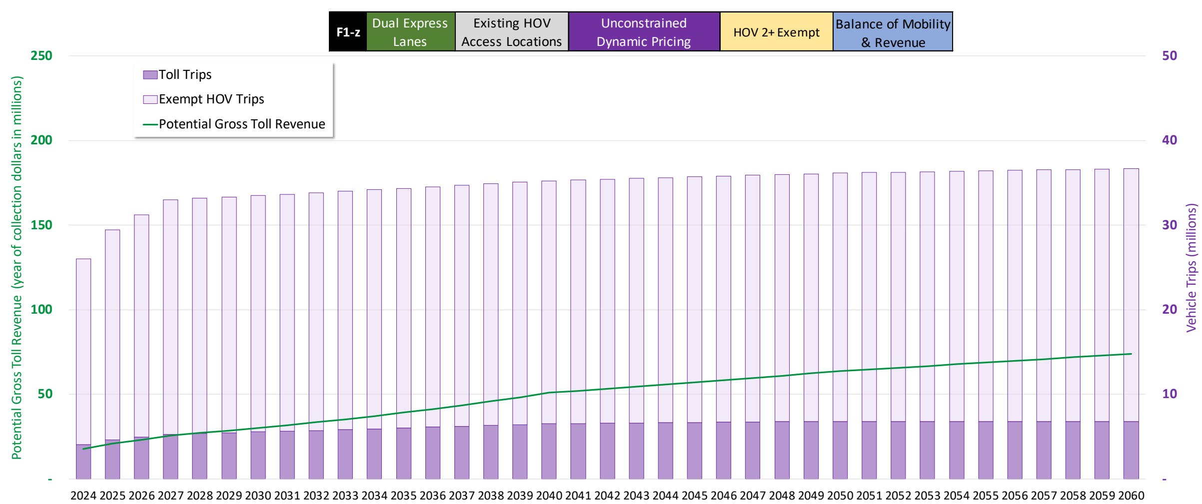
Source: WSP

Figure 10-3: Scenario E2 Toll & Exempt Trips | Gross Toll Revenue Results



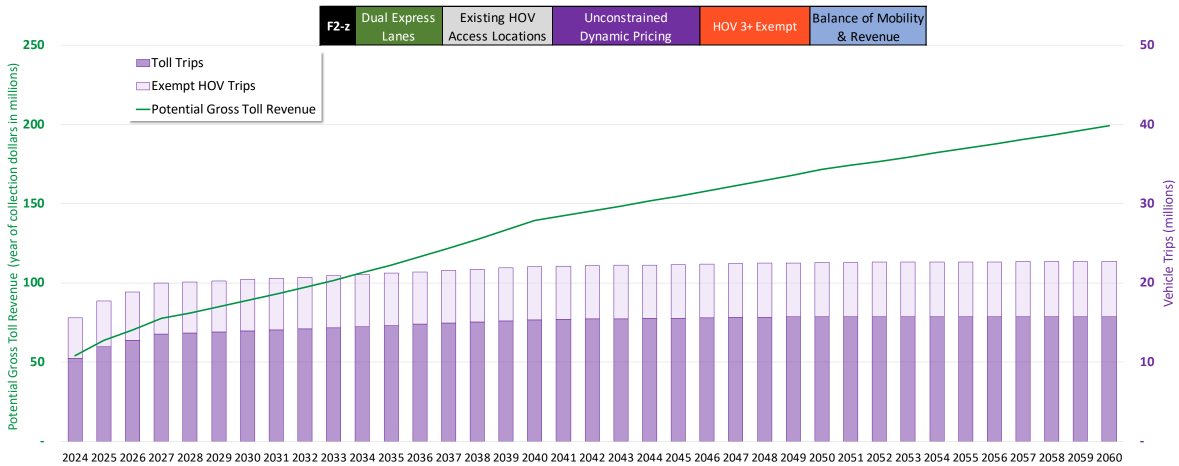
Source: WSP

Figure 10-4: Scenario F1 Toll & Exempt Trips | Gross Toll Revenue Results



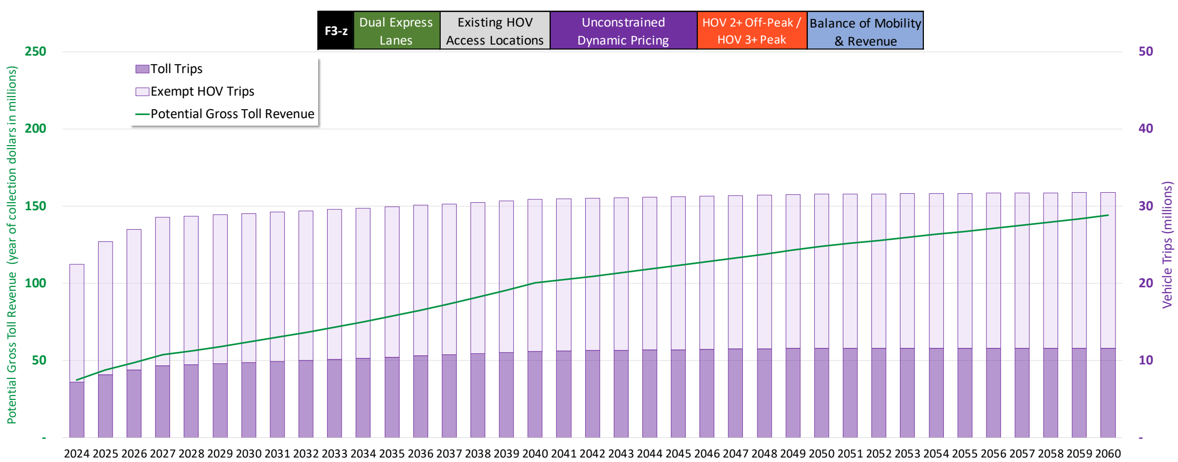
Source: WSP

Figure 10-5: Scenario F2 Toll & Exempt Trips | Gross Toll Revenue Results



Source: WSP

Figure 10-6: Scenario F3 Toll & Exempt Trips | Gross Toll Revenue Results



Source: WSP

11.0 ANNUAL NET TOLL REVENUE FORECASTS

11.1 GROSS-TO-NET TOLL REVENUE PROCESS

Annual toll transactions and potential gross toll revenue serve as the initial inputs in the net revenue forecasts. **Figure 11-1** below illustrates the flow of funds or “waterfall” of revenue adjustments and expenditures that are projected to occur in transitioning from potential gross toll revenue to net revenues. Detailed traffic and revenue tables provided later in this section and in **Appendix E** provide the annual dollar projections for each of the waterfall elements exhibited in **Figure 11-1**, as denoted with numbered columns in the tables. Revenue adjustment and O&M cost assumptions that support the gross-to-net revenue calculations can be found in **Table 11-1** with numbered references to the columns in the tables where the costs can be found.

Violation fees and associated processing costs are not included within the gross-to-net revenue calculations. If not net revenue neutral, then any net violation fees after processing costs are assumed to be diverted elsewhere and not returned to Metro for the benefit of the project.

Figure 11-1: Net Revenue Waterfall

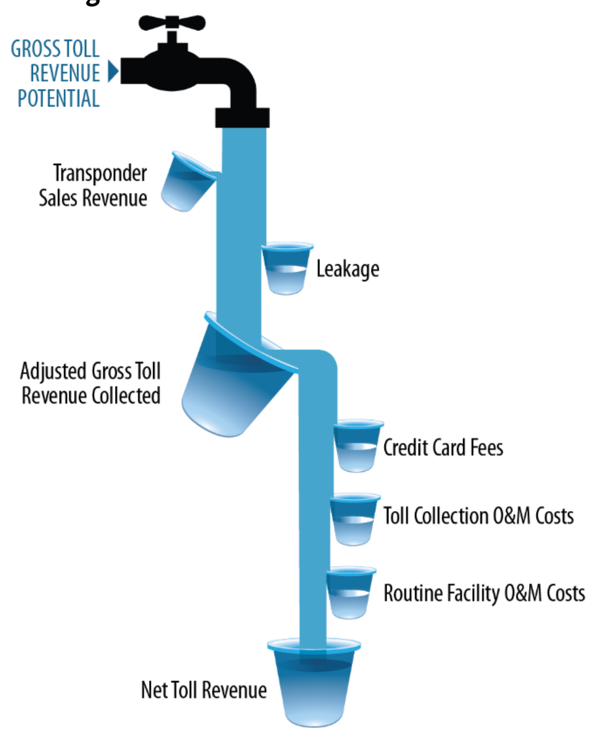


Table 11-1: O&M Cost and Revenue Adjustment

Assumptions (including Additional System Costs)

Category	Variable	Value	Source	Explanation
General Assumptions	O&M Cost Escalation	2.50%	Estimated based on historical U.S. Bureau of Labor Statistics from 1990 to 2016.	Projection based upon historical Consumer Price Index for Urban Consumers
Leakage (Column 6)	Leakage as a % Share of Gross Toll Revenue	10%	WSP Estimate	Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
Credit Card Fees (Column 9)	% Share of Revenue via Credit Card	90%	Estimate based on National Experience	
	Credit Card Fee Rate	2%	Same as LA Metro Strategic Plan Revenue Model	
Toll Collection O&M (Column 10)	Lane Systems: TMO Costs	$11,161/centerline mile (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Lane Systems: DS3	$2,495/centerline mile (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Lane Systems: Earthcam	$5,054/centerline mile (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Base CSC & RTS O&M Contract Cost per Trip	$0.33/trip (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Transponder Pass Average Cost per Unit	$18 (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Marketing - First Year	$200,000 (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Marketing - Steady State	100,000 (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	O&M Oversight	$200,000 (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Metro Staff Costs	$733,333 (2016$)	LA Metro Staff	$2.2 million in total staffing costs divided equally between 405, 110 and 10.
Facility O&M (Column 11)	California Highway Patrol Enforcement Costs	$39,349/lane mile (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	CHP First Year of Operations Additional Cost	$13,441/lane mile (2014$)	LA Metro Strategic Plan Revenue Model	Inflated to 2016$ using CPI at 1.42% in model
	Freeway Service Patrol	$37,667/lane mile (2016$)	LA Metro Staff	Based on I-10/I-110 experience.
	Caltrans Roadway Maintenance	$12,151/lane mile (2016$)	LA Metro Staff	Based on I-10/I-110 experience.

Source: WSP

11.2 REVENUE ADJUSTMENTS AND COSTS ANALYZED

11.2.1 GENERAL ASSUMPTIONS

The operations and maintenance (O&M) future annual cost escalation assumption of 2.5%, compounded annually, is based on the historical U.S. Bureau of Labor Statistics data for the CPI-U from 1990 to 2016. This annual inflation rate is more conservative for estimating costs in year of expenditure dollars than the 2.25% and 1.5% assumed inflation rates for estimating revenues in year of collection dollars for the periods of 2024-2040 and 2041-2060, respectively.

11.2.2 LEAKAGE

It is extremely difficult to measure, let alone forecast, revenue leakage for an express lane facility with open road tolling, especially during the planning phase. Video tolling — where travelers without an account would be billed from owner name and addresses identified from license plate pictures — is not currently offered on the existing I-10 and I-110 ExpressLanes, and thus not assumed as a payment option for the I-405 express lanes. Lacking this payment method helps to eliminate several sources of revenue leakage from unreadable license plates, unidentified vehicle owners, and non-payment of toll bills, but also constrains the universe of potential customers to just those that have FasTrak accounts.

For the I-405 Sepulveda Pass T&R study, leakage is defined as revenue not collected from those traveling in the lane with a FasTrak transponder in their vehicle. Causes of leakage could include:

- Toll collection equipment errors,
- Delinquent accounts (e.g., expired credit cards), and
- False declaration of the required occupancy to travel in exempt (toll-free) carpool status, based upon the FasTrak transponder switch position.

Leakage excludes toll revenue that should have been collected by intentional or unintentional violators that don't have FasTrak accounts and/or don't have a transponder in their vehicle. Such travelers do not have the means to make an electronic payment, and as noted above, any net violation revenues are not assumed to flow back to the express lanes program.

Ultimately, based upon somewhat limited available industry experience and acknowledging the reasonable level of enforcement in place on the I-10 and I-110 ExpressLanes that is assumed to carry over to the I-405, leakage is estimated as 10% of potential gross toll revenue. From the above three assumed causes of leakage, at least half of the 10% can be considered as an allowance for false declaration of carpool status.

11.2.3 CREDIT CARD FEES

Credit card fees are calculated using two assumptions: the share of gross toll revenue that is collected from FasTrak accounts via credit card and the credit card fee rate charged by Metro's bank card processing vendor. The net revenue forecasts assume that 90% of gross toll revenue is paid via credit card, and thus, subject to bank card fees assumed at 2% of the transaction amount. This assumption of bank card fees was developed by WSP based on experience with other toll agencies across the country.

11.2.4 TOLL COLLECTION O&M COSTS

Toll Collection O&M costs incorporate a number of different cost items related to revenue collection that are either estimated as a fixed cost for the express lane facility, vary per transaction, or vary based on the facility's number of center line miles. These include: lane systems, the base customer service center (CSC) and roadside toll system (RTS) vendor O&M contract(s), transponder purchase and inventory, marketing, O&M oversight and Metro staff costs. For the costs that vary by transaction, the per transaction cost applies to both toll-paying customers and toll-free HOV customers, since both types are required to have an account and a FasTrak transponder pass, which is read by the system regardless of occupancy declaration status.

All cost assumptions in this category were provided by Metro staff and based on current unit costs for the I-10 and I-110 ExpressLanes. The assumption for Metro staff costs was calculated based on the addition of two full-time equivalent (FTE) staff to the current nine FTEs. The additional two FTEs would increase Metro's annual staff costs to $2.2 million in current dollars. Metro staff costs are assumed to be shared equally between the I-405 Sepulveda Pass express lane facility and the other two existing express lanes facilities on the I-10 and the I-110, such that 33.3% of the total Metro staff costs would be paid from the I-405 Sepulveda Pass toll revenues.

Additionally, forecasts for FasTrak transponder pass revenues are provided in the T&R tables located in this chapter and in **Appendix E**, with equally offsetting purchase and inventory costs included in the toll collection O&M cost projections. The forecasted revenues should be considered preliminary as details regarding a forthcoming transponder customer purchase model — which is assumed to replace the current customer lease model — are not yet available. However, it is reasonable to assume that the new customer purchase model would be net revenue neutral, and thus, transponder revenues and costs are not assumed to impact the overall net revenue projections documented herein.

11.2.5 FACILITY O&M COSTS

Facility O&M costs include all costs related to the operation of the express lanes as a roadway. These include California Highway Patrol (CHP) enforcement, freeway service patrols (FSP), and Caltrans-provided roadway maintenance activities. These costs are calculated based on a lane mile basis, which leads to significant variation between the single lane and dual lane scenarios. All recurring facility O&M cost assumptions were provided by Metro staff based on current experience on the I-10 and I-110 ExpressLanes, and costs are escalated to year of expenditure dollars using the aforementioned 2.5% annual inflation assumption.

11.2.6 REPAIR AND REPLACEMENT (R&R) COSTS

The net revenue projections provided herein are calculated before consideration of any periodic R&R costs. Periodic facility R&R costs would include items such as repaving/resurfacing roadway lanes and replacing overhead gantries, among other activities. Periodic toll collection R&R costs would include replacement of lane system toll collection equipment at set intervals, replacement of CSC back office software systems, and procurement costs for new CSC systems or operations vendors, among other items. R&R costs are typically a use of net toll revenues rather than a component of them. Specifically, net toll revenues may be used to make annual contributions to one or more reserve accounts that are structured to maintain a balance sufficient to cover the periodic R&R expenses. While this varies by facility, when net toll revenues are used to finance capital improvements, such R&R reserve account contributions are often assumed to be paid downstream of debt service, using excess net toll revenues that serve as debt service coverage.

Estimating facility and toll R&R costs was beyond the scope of this study and would be appropriate once the range of toll scenarios are narrowed to one or two preferred alternatives, and at such time that a detailed financial plan is warranted.

11.3 NET REVENUE FORECAST RESULTS

Table 11-2 provides a bottom line summary of the net revenue forecasts in 2025 and 2040 for the six selected toll scenarios across the three, toll operation objective cases, expressed in future, year of collection dollars.

The following six charts illustrate the annual net toll revenue forecast ranges for the six selected scenarios, comparing each of them across the three toll operating objectives. The optimized mobility (x) operating objective provides the lower bound forecast for net revenues while the maximum revenue (y) objective exhibits the net revenue ceiling in these charts. The balance of mobility (z) case represents the most likely net revenue case, recognizing that Metro would likely implement a toll pricing algorithm that strikes a balance between the two extreme bookends.

Following each chart is a detailed “T&R” table for each scenario under the balance of mobility and revenue (z) toll operating objective. Each table provides the annual values through 2060 for toll trips, toll-free HOV trips, gross toll revenue potential, and the various revenue adjustments and expenditure amounts in the gross-to-net waterfall shown in **Figure 11-1**. The same T&R tables for each scenario under the optimized mobility and maximum revenue objectives can be found in **Appendix E**.

11.3.1 CASES WITH NET REVENUES LESS THAN ZERO

Among the key findings from the net revenue projections, there are two cases under Scenario F1 in which projected net toll revenues are negative in the first year of operations.

- Scenario F1-y, which pairs dual express lanes with an HOV 2+ exemption policy, and operates under the optimized mobility toll operating objective, has negative net revenues of $4.67 million in 2024 and isn't projected to achieve positive net revenues until the ninth year of operations, with $0.18 million of net revenue in 2032.
    - The optimized mobility objective results in more total toll and HOV trips than the other two objectives, which causes the per transaction costs to drive overall toll collection costs above the other cases.
    - Toll-free trips in the opening year outnumber toll trips by a factor of nearly 5:1, which when combined with its low average revenue per toll trip, limits the gross toll revenue potential of Scenario F1-y.
    - The dual lane configuration also has higher facility maintenance costs relative to single lane cases, though that is constant across the three F1 operating objective cases.
- Scenario F1-z, which pairs dual express lanes with an HOV 2+ exemption policy, and operates under the balance of mobility and revenue toll operating objective, has negative net revenues of $1.83 million in 2024, in part due to the downward adjustment in revenues for ramp-up effects in the early years of operations. However, this case is expected to yield $0.17 million in net revenues by the second year, 2025, and remain in the black thereafter.
    - Toll-free trips in the opening year outnumber toll trips by slightly more than 5:1, but the total of the two trip types is lower than for Scenario F1-y, resulting in lower toll collection costs.
    - Higher average revenue per toll trip (average toll rates) allow Scenario F1-z to overcome factors contributing to higher O&M costs early in the forecast period.

11.3.2 EFFECTS OF HOV OCCUPANCY EXEMPTIONS

Other net revenue findings include the following:

- The HOV occupancy exemption policy is the most significant determinant of net revenue among the six selected scenarios.
    - Scenario F2x, which pairs dual express lanes with an HOV 3+ exemption policy, and operates under the maximum revenue objective, is projected to generate net revenues in excess of $154 million in 2040.

- Shifting to the other bookend, the optimized mobility operating objective, Scenario F2y is projected to achieve $48.34 million in net revenues in 2040, with the balance of mobility and revenue objective (Scenario F2z) in the middle at $101.4 million in 2040.
- By comparison, Scenario set of F1-y | F1-z | F1x with an HOV 2+ exemption policy are projected to generate $6.51, $15.10, and $23.70 million, respectively, in 2040, which are orders of magnitude less than their HOV 3+ counterparts.
- The hybrid Scenario set of F3-y | F3-z | F3x, which employ an HOV 2+ exemption at off-peak times and an HOV 3+ exemption during peak periods, yields net revenues that fall in-between the HOV 2+ and HOV 3+ exemption cases, but slightly closer to the higher HOV 3+ exemption case.

Table 11-2: 2025 and 2040 Net Revenues for Selected Scenarios | Year of Collection Dollars

		Access Method		Toll Policy		HOV Toll Exemption			2025 Net Toll Revenue by Toll Operating Objective (2025 Dollars)			2040 Net Toll Revenue by Toll Operating Objective (2040 Dollars)		
Scenario Set	Lane Configuration	Existing HOV Access Locations	More Restrictive Access Locations	Existing & Proposed LA Metro Toll & Discount Policies	Uncon-strained Dynamic Pricing	HOV 2+ Exempt (1)	HOV 3+ Peak /2+ Off-Peak Exempt (3)	HOV 3+ Exempt (2)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)
B2	Single	X			X			X	$16.0 M	$21.9 M	$27.8 M	$55.8 M	$70.5 M	$85.1 M
B3	Single	X			X		X		$7.6 M	$9.9 M	$12.3 M	$37.4 M	$44.2 M	$51.0 M
E2	Dual	X		X				X	$11.2 M	$29.3 M	$47.5 M	$33.2 M	$75.9 M	$118.6 M
F1	Dual	X			X	X			($3.2 M)	$0.2 M	$3.6 M	$6.5 M	$15.1 M	$23.7 M
F2	Dual	X			X			X	$18.7 M	$42.9 M	$67.2 M	$48.3 M	$101.4 M	$154.4 M
F3	Dual	X			X		X		$9.5 M	$22.1 M	$34.8 M	$31.3 M	$61.3 M	$91.3 M

Note: Revenue amounts represent potential net toll revenues, expressed in year of collection dollars; 2025 amounts are net of ramp-up adjustments.

Source: WSP

Table 11-3: 2025 and 2040 Net Revenues for Selected Scenarios | Constant 2016 Dollars

		Access Method		Toll Policy		HOV Toll Exemption			2025 Net Toll Revenue by Toll Operating Objective (2016 Dollars)			2040 Net Toll Revenue by Toll Operating Objective (2016 Dollars)		
Scenario Set	Lane Configuration	Existing HOV Access Locations	More Restrictive Access Locations	Existing & Proposed LA Metro Toll & Discount Policies	Uncon-strained Dynamic Pricing	HOV 2+ Exempt (1)	HOV 3+ Peak /2+ Off-Peak Exempt (3)	HOV 3+ Exempt (2)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)	Optimized Mobility (y)	Balance of Mobility and Revenue (z)	Maximum Revenue (x)
B2	Single	X			X			X	$13.1 M	$17.9 M	$22.7 M	$32.7 M	$41.3 M	$49.9 M
B3	Single	X			X		X		$6.2 M	$8.1 M	$10.0 M	$21.9 M	$25.9 M	$29.9 M
E2	Dual	X		X				X	$9.2 M	$24.0 M	$38.9 M	$19.5 M	$44.5 M	$69.5 M
F1	Dual	X			X	X			($2.6 M)	$0.1 M	$2.9 M	$3.8 M	$8.9 M	$13.9 M
F2	Dual	X			X			X	$15.3 M	$35.1 M	$55.0 M	$28.3 M	$59.4 M	$90.5 M
F3	Dual	X			X		X		$7.8 M	$18.1 M	$28.5 M	$18.3 M	$35.9 M	$53.5 M

Note: Revenue amounts represent potential net toll revenues, expressed in constant 2016 dollars; 2025 amounts are net of ramp-up adjustments.

Source: WSP

Source: WSP

Figure 11-2: Potential Net Revenues | Balance of Mobility & Revenue Scenarios

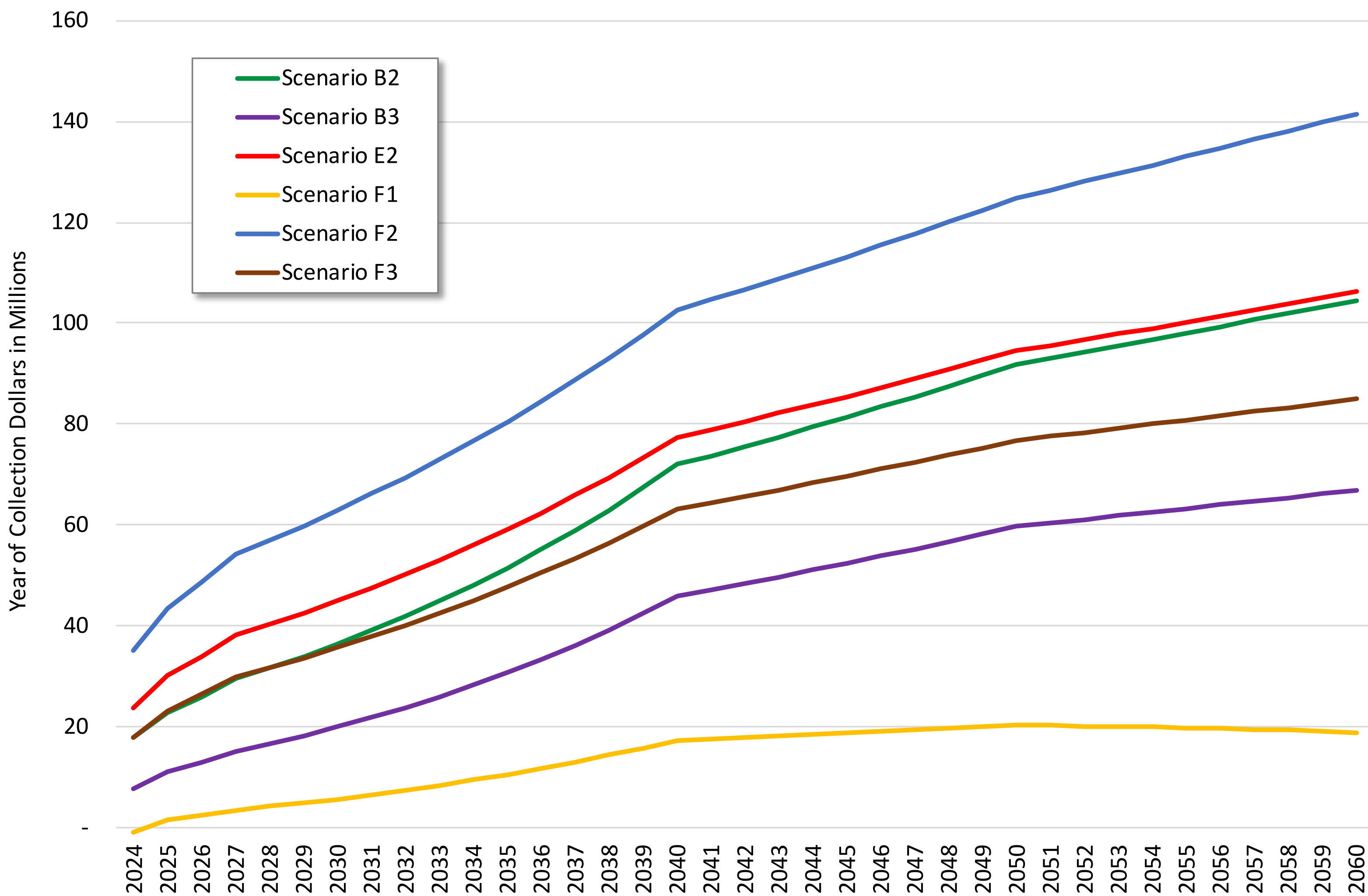


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Figure 11-3: Scenario B2 Net Revenue Results

B2	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt

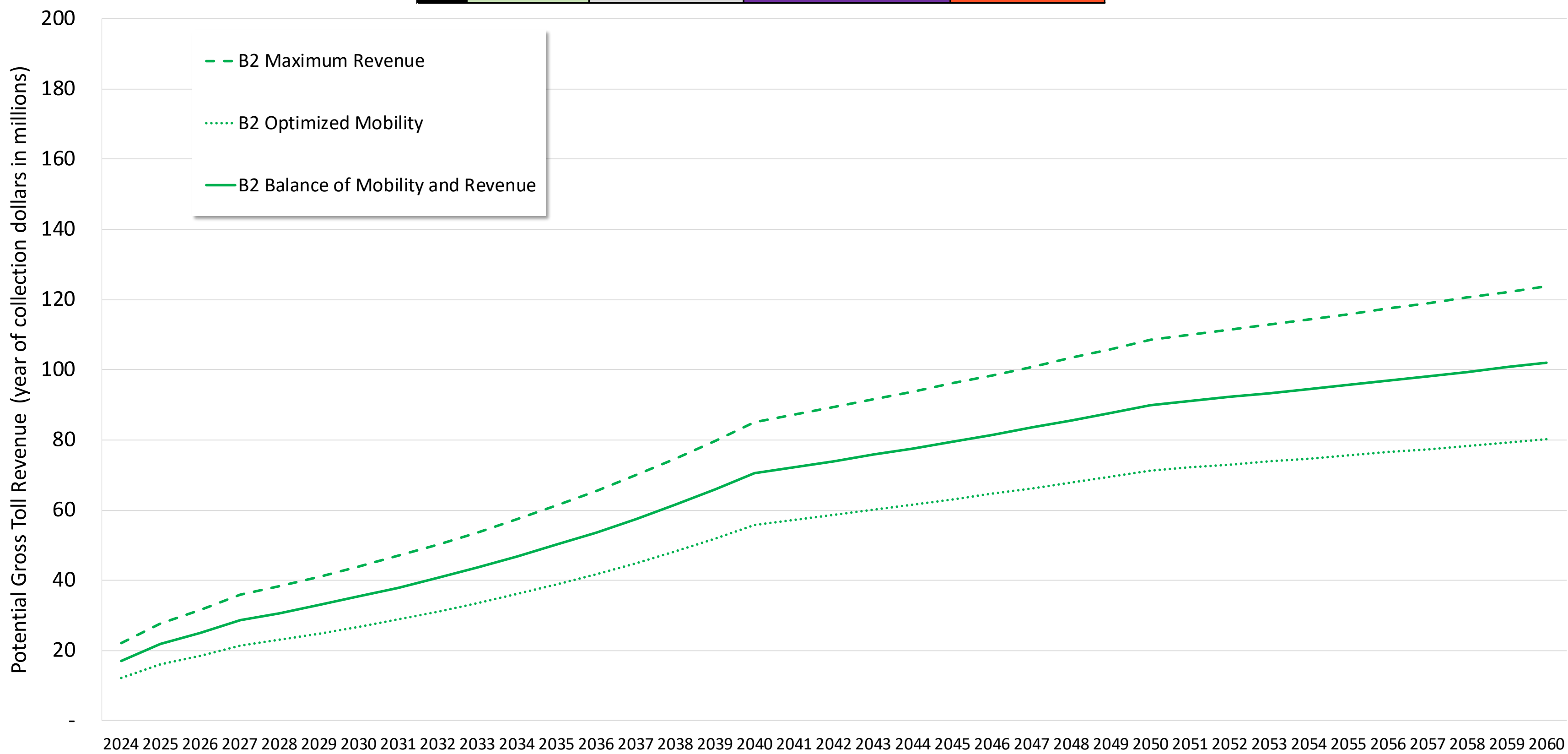


Table 11-4: Scenario B2-z Net Revenue Results

I-405 Sepulveda Pass Express Lanes

Scenario B2-z: Traffic & Revenue Table | Net Revenue Projections *

B2-z	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Balance of Mobility & Revenue

1	2	3	4	5	6	7	8	9	10	11	12
	Traffic Projections				Less:	Plus:	Subtotal:	Less:	Less:	Less:	
Fiscal Year	Annual Exempt HOV Trips (millions)[1]	Annual Toll Trips (millions)[2]	Average Revenue per Trip (one-way)[3]	**Total Potential Gross Toll Revenue ($ millions)[4]**	Leakage ($ millions)[5]	Transponder Sales Revenue ($ millions)[6]	**Adjusted Gross Toll Revenue Collected ($ millions)**	Credit Card Fees ($ millions)[7]	Toll Collection O&M ($ millions)[8]	Facility O&M ($ millions)[9]	**Total Net Toll Revenue Before R&R ($ millions)[10]**
2024	3.78	6.75	4.29	**28.99**	(2.90)	1.56	**27.65**	(0.47)	(7.53)	(2.57)	**17.08**
2025	4.26	7.71	4.50	**34.67**	(3.47)	1.82	**33.02**	(0.56)	(8.28)	(2.29)	**21.89**
2026	4.51	8.25	4.72	**38.90**	(3.89)	1.32	**36.34**	(0.63)	(8.28)	(2.34)	**25.08**
2027	4.75	8.81	4.94	**43.54**	(4.35)	1.44	**40.62**	(0.71)	(8.92)	(2.40)	**28.59**
2028	4.76	8.93	5.18	**46.28**	(4.63)	1.49	**43.15**	(0.75)	(9.22)	(2.46)	**30.71**
2029	4.78	9.06	5.43	**49.20**	(4.92)	1.54	**45.83**	(0.80)	(9.53)	(2.52)	**32.98**
2030	4.79	9.19	5.69	**52.31**	(5.23)	1.60	**48.67**	(0.85)	(9.85)	(2.59)	**35.39**
2031	4.80	9.32	5.97	**55.61**	(5.56)	1.66	**51.70**	(0.90)	(10.18)	(2.65)	**37.97**
2032	4.81	9.45	6.26	**59.11**	(5.91)	1.71	**54.92**	(0.96)	(10.52)	(2.72)	**40.72**
2033	4.82	9.58	6.56	**62.84**	(6.28)	1.78	**58.33**	(1.02)	(10.87)	(2.79)	**43.66**
2034	4.83	9.72	6.87	**66.81**	(6.68)	1.84	**61.97**	(1.08)	(11.24)	(2.86)	**46.79**
2035	4.84	9.86	7.21	**71.02**	(7.10)	1.90	**65.82**	(1.15)	(11.62)	(2.93)	**50.13**
2036	4.85	10.00	7.55	**75.50**	(7.55)	1.97	**69.92**	(1.22)	(12.01)	(3.00)	**53.69**
2037	4.87	10.14	7.92	**80.27**	(8.03)	2.04	**74.28**	(1.30)	(12.42)	(3.08)	**57.49**
2038	4.88	10.28	8.30	**85.33**	(8.53)	2.11	**78.91**	(1.38)	(12.84)	(3.15)	**61.54**
2039	4.89	10.43	8.70	**90.71**	(9.07)	2.19	**83.83**	(1.47)	(13.27)	(3.23)	**65.86**
2040	4.90	10.57	9.12	**96.44**	(9.64)	2.27	**89.06**	(1.56)	(13.72)	(3.31)	**70.47**
2041	4.91	10.61	9.32	**98.86**	(9.89)	2.33	**91.30**	(1.60)	(14.10)	(3.40)	**72.21**
2042	4.92	10.65	9.52	**101.33**	(10.13)	2.40	**93.60**	(1.64)	(14.49)	(3.48)	**73.99**
2043	4.93	10.69	9.72	**103.88**	(10.39)	2.46	**95.95**	(1.68)	(14.89)	(3.57)	**75.81**
2044	4.94	10.72	9.93	**106.48**	(10.65)	2.53	**98.36**	(1.72)	(15.30)	(3.66)	**77.68**
2045	4.95	10.76	10.14	**109.15**	(10.91)	2.60	**100.84**	(1.77)	(15.72)	(3.75)	**79.60**
2046	4.96	10.80	10.36	**111.89**	(11.19)	2.68	**103.37**	(1.81)	(16.15)	(3.84)	**81.57**
2047	4.97	10.84	10.58	**114.69**	(11.47)	2.75	**105.97**	(1.86)	(16.60)	(3.94)	**83.58**
2048	4.98	10.88	10.81	**117.57**	(11.76)	2.83	**108.64**	(1.90)	(17.06)	(4.04)	**85.64**
2049	4.98	10.92	11.04	**120.51**	(12.05)	2.91	**111.37**	(1.95)	(17.53)	(4.14)	**87.75**
2050	4.99	10.95	11.28	**123.54**	(12.35)	2.99	**114.17**	(2.00)	(18.01)	(4.24)	**89.92**
2051	5.00	10.95	11.45	**125.39**	(12.54)	3.07	**115.92**	(2.03)	(18.47)	(4.35)	**91.07**
2052	5.01	10.95	11.62	**127.27**	(12.73)	3.15	**117.69**	(2.06)	(18.94)	(4.46)	**92.23**
2053	5.02	10.95	11.79	**129.18**	(12.92)	3.23	**119.49**	(2.09)	(19.42)	(4.57)	**93.41**
2054	5.02	10.95	11.97	**131.12**	(13.11)	3.31	**121.31**	(2.12)	(19.92)	(4.68)	**94.59**
2055	5.03	10.95	12.15	**133.08**	(13.31)	3.39	**123.17**	(2.16)	(20.42)	(4.80)	**95.79**
2056	5.04	10.95	12.33	**135.08**	(13.51)	3.48	**125.05**	(2.19)	(20.94)	(4.92)	**97.00**
2057	5.05	10.95	12.52	**137.11**	(13.71)	3.57	**126.96**	(2.22)	(21.47)	(5.04)	**98.23**
2058	5.05	10.95	12.70	**139.16**	(13.92)	3.66	**128.90**	(2.25)	(22.02)	(5.17)	**99.46**
2059	5.06	10.95	12.89	**141.25**	(14.13)	3.75	**130.88**	(2.29)	(22.58)	(5.30)	**100.71**
2060	5.07	10.95	13.09	**143.37**	(14.34)	3.85	**132.88**	(2.32)	(23.15)	(5.43)	**101.98**
TOTALS (2024-2060)	**179.98**	**375.40**		**3,487.43**	**(348.74)**	**91.17**	**3,229.86**	**(56.50)**	**(547.46)**	**(133.64)**	**2,492.27**

[1] Includes only those vehicles not paying a toll; excludes transit vehicles (not forecasted).
[2] Includes all vehicles paying a toll, including a discounted toll where applicable.
[3] Equivalent to the overall weighted average toll rate per toll trip.
[4] The gross revenue that would result if the correct toll was immediately collected from every vehicle required to pay a toll.
[5] Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
[6] Transponder costs will be directly offset by customer purchase of transponder.
[7] Credit card fees estimated as a % of adjusted gross toll revenue.
[8] Includes base CSC & lane systems O&M contract, transponder purchase & inventory, traffic management & communications, marketing, O&M oversight and Metro staff costs.
[9] Includes CHP, freeway service patrol and Caltrans maintenance costs.
[10] Periodic capital repair and replacement (R&R) costs associated with roadway and toll collection functions are excluded and assumed to be paid from excess net revenues after debt service or pay-go uses.
* All dollar amounts are in future year of collection/year of expenditure dollars

Source: WSP

Figure 11-4: Scenario B3 Net Revenue Results

B3	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak

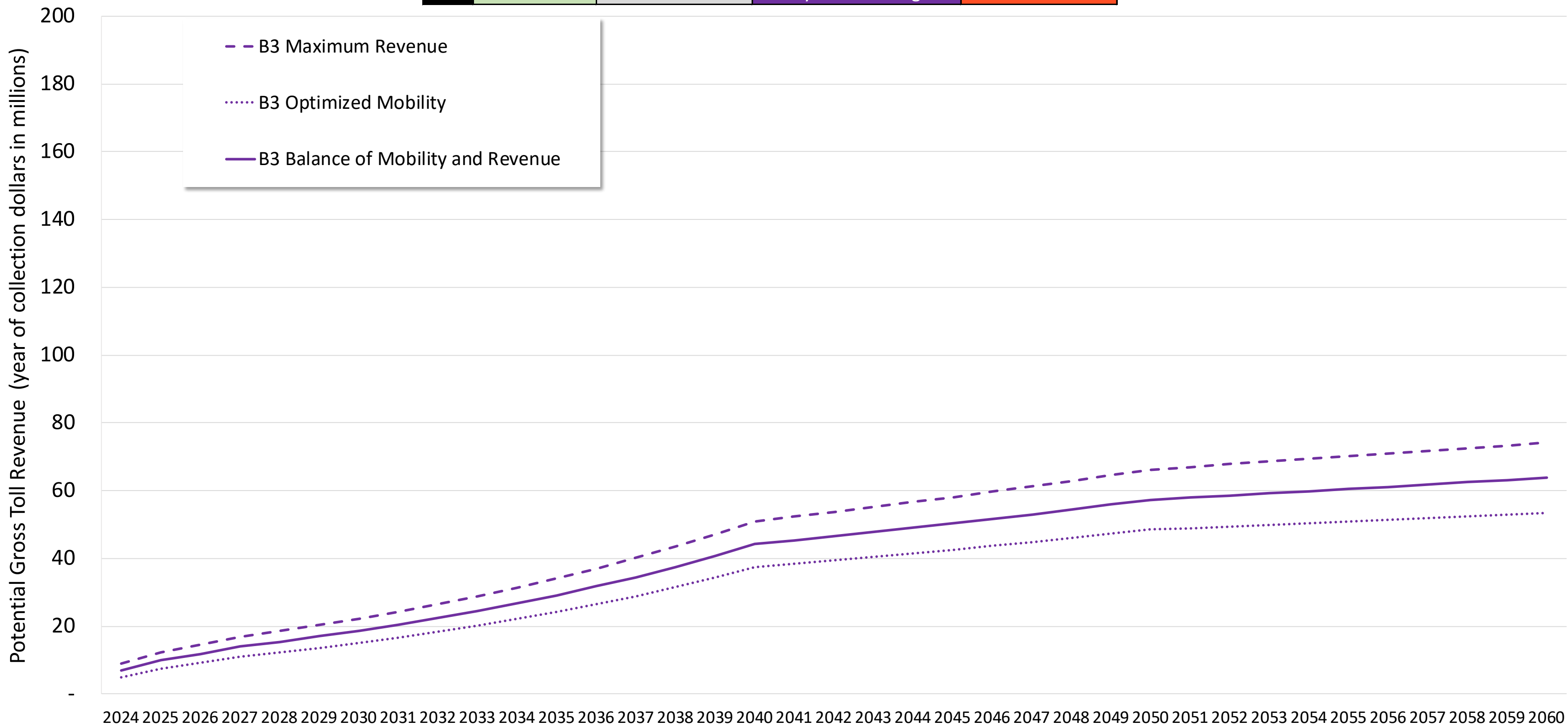


Table 11-5: Scenario B3-z Net Revenue Results

I-405 Sepulveda Pass Express Lanes

Scenario B3-z: Traffic & Revenue Table | Net Revenue Projections *

B3-z	Single Express Lane	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak	Balance of Mobility & Revenue

1	2	3	4	5	6	7	8	9	10	11	12
	Traffic Projections				Less:	Plus:	Subtotal:	Less:	Less:	Less:	Total
Fiscal Year	Annual Exempt HOV Trips (millions)[1]	Annual Toll Trips (millions)[2]	Average Revenue per Trip (one-way)[3]	Total Potential Gross Toll Revenue ($ millions)[4]	Leakage ($ millions)[5]	Transponder Sales Revenue ($ millions)[6]	Adjusted Gross Toll Revenue Collected ($ millions)	Credit Card Fees ($ millions)[7]	Toll Collection O&M ($ millions)[8]	Facility O&M ($ millions)[9]	Net Toll Revenue Before R&R ($ millions)[10]
2024	10.92	3.31	5.80	**19.18**	(1.92)	2.11	**19.37**	(0.31)	(9.56)	(2.57)	**6.92**
2025	12.30	3.80	6.07	**23.06**	(2.31)	2.44	**23.20**	(0.37)	(10.61)	(2.29)	**9.93**
2026	13.00	4.10	6.35	**26.02**	(2.60)	1.77	**25.19**	(0.42)	(10.56)	(2.34)	**11.86**
2027	13.70	4.41	6.64	**29.28**	(2.93)	1.92	**28.27**	(0.47)	(11.37)	(2.40)	**14.02**
2028	13.72	4.50	6.95	**31.29**	(3.13)	1.98	**30.15**	(0.51)	(11.72)	(2.46)	**15.46**
2029	13.73	4.60	7.27	**33.45**	(3.34)	2.05	**32.15**	(0.54)	(12.08)	(2.52)	**17.00**
2030	13.75	4.70	7.60	**35.75**	(3.57)	2.11	**34.29**	(0.58)	(12.45)	(2.59)	**18.67**
2031	13.77	4.80	7.95	**38.21**	(3.82)	2.18	**36.57**	(0.62)	(12.83)	(2.65)	**20.47**
2032	13.78	4.91	8.32	**40.84**	(4.08)	2.25	**39.01**	(0.66)	(13.22)	(2.72)	**22.40**
2033	13.80	5.02	8.70	**43.66**	(4.37)	2.32	**41.61**	(0.71)	(13.63)	(2.79)	**24.48**
2034	13.82	5.12	9.11	**46.66**	(4.67)	2.39	**44.39**	(0.76)	(14.05)	(2.86)	**26.72**
2035	13.84	5.24	9.53	**49.88**	(4.99)	2.47	**47.36**	(0.81)	(14.49)	(2.93)	**29.13**
2036	13.85	5.35	9.97	**53.31**	(5.33)	2.55	**50.53**	(0.86)	(14.94)	(3.00)	**31.72**
2037	13.87	5.47	10.43	**56.98**	(5.70)	2.63	**53.92**	(0.92)	(15.41)	(3.08)	**34.51**
2038	13.89	5.58	10.91	**60.91**	(6.09)	2.72	**57.53**	(0.99)	(15.89)	(3.15)	**37.51**
2039	13.90	5.71	11.41	**65.10**	(6.51)	2.80	**61.40**	(1.05)	(16.38)	(3.23)	**40.72**
2040	13.92	5.83	11.94	**69.59**	(6.96)	2.89	**65.52**	(1.13)	(16.90)	(3.31)	**44.18**
2041	13.94	5.86	12.19	**71.43**	(7.14)	2.97	**67.26**	(1.16)	(17.36)	(3.40)	**45.35**
2042	13.95	5.89	12.44	**73.32**	(7.33)	3.05	**69.05**	(1.19)	(17.83)	(3.48)	**46.55**
2043	13.96	5.92	12.70	**75.27**	(7.53)	3.14	**70.88**	(1.22)	(18.31)	(3.57)	**47.78**
2044	13.98	5.96	12.97	**77.26**	(7.73)	3.22	**72.76**	(1.25)	(18.80)	(3.66)	**49.05**
2045	13.99	5.99	13.24	**79.31**	(7.93)	3.31	**74.69**	(1.28)	(19.31)	(3.75)	**50.35**
2046	14.01	6.02	13.52	**81.41**	(8.14)	3.40	**76.67**	(1.32)	(19.84)	(3.84)	**51.68**
2047	14.02	6.05	13.80	**83.57**	(8.36)	3.50	**78.71**	(1.35)	(20.37)	(3.94)	**53.04**
2048	14.03	6.09	14.09	**85.79**	(8.58)	3.59	**80.80**	(1.39)	(20.93)	(4.04)	**54.45**
2049	14.05	6.12	14.39	**88.06**	(8.81)	3.69	**82.94**	(1.43)	(21.49)	(4.14)	**55.89**
2050	14.06	6.15	14.69	**90.39**	(9.04)	3.79	**85.15**	(1.46)	(22.07)	(4.24)	**57.37**
2051	14.07	6.15	14.91	**91.75**	(9.18)	3.89	**86.46**	(1.49)	(22.64)	(4.35)	**57.99**
2052	14.08	6.15	15.13	**93.13**	(9.31)	3.99	**87.80**	(1.51)	(23.21)	(4.46)	**58.62**
2053	14.10	6.15	15.36	**94.52**	(9.45)	4.09	**89.16**	(1.53)	(23.81)	(4.57)	**59.26**
2054	14.11	6.15	15.59	**95.94**	(9.59)	4.19	**90.54**	(1.55)	(24.41)	(4.68)	**59.89**
2055	14.12	6.15	15.82	**97.38**	(9.74)	4.30	**91.94**	(1.58)	(25.04)	(4.80)	**60.53**
2056	14.13	6.15	16.06	**98.84**	(9.88)	4.41	**93.37**	(1.60)	(25.67)	(4.92)	**61.18**
2057	14.14	6.15	16.30	**100.32**	(10.03)	4.52	**94.82**	(1.63)	(26.33)	(5.04)	**61.82**
2058	14.15	6.15	16.55	**101.83**	(10.18)	4.64	**96.29**	(1.65)	(27.00)	(5.17)	**62.47**
2059	14.16	6.15	16.80	**103.36**	(10.34)	4.76	**97.78**	(1.67)	(27.69)	(5.30)	**63.12**
2060	14.17	6.15	17.05	**104.91**	(10.49)	4.88	**99.30**	(1.70)	(28.39)	(5.43)	**63.77**
TOTALS (2024-2060)	**510.79**	**204.05**		**2,510.97**	**(251.10)**	**116.94**	**2,376.81**	**(40.68)**	**(676.61)**	**(133.64)**	**1,525.89**

[1] Includes only those vehicles not paying a toll; excludes transit vehicles (not forecasted).
[2] Includes all vehicles paying a toll, including a discounted toll where applicable.
[3] Equivalent to the overall weighted average toll rate per toll trip.
[4] The gross revenue that would result if the correct toll was immediately collected from every vehicle required to pay a toll.
[5] Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
[6] Transponder costs will be directly offset by customer purchase of transponder.
[7] Credit card fees estimated as a % of adjusted gross toll revenue.
[8] Includes base CSC & lane systems O&M contract, transponder purchase & inventory, traffic management & communications, marketing, O&M oversight and Metro staff costs.
[9] Includes CHP, freeway service patrol and Caltrans maintenance costs.
[10] Periodic capital repair and replacement (R&R) costs associated with roadway and toll collection functions are excluded and assumed to be paid from excess net revenues after debt service or pay-go uses.
* All dollar amounts are in future year of collection/year of expenditure dollars

Source: WSP

Metro

Figure 11-5: Scenario E2 Net Revenue Results

E2	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt

Table 11-6: Scenario E2-z Net Revenue Results

I-405 Sepulveda Pass Express Lanes

Scenario E2-z: Traffic & Revenue Table | Net Revenue Projections *

E2-z	Dual Express Lanes	Existing HOV Access Locations	Existing/Proposed Metro Toll & Discount Policies	HOV 3+ Exempt	Balance of Mobility & Revenue

1	2	3	4	5	6	7	8	9	10	11	12
	Traffic Projections				Less:	Plus:	**Subtotal:**	Less:	Less:	Less:	**Total**
Fiscal Year	Annual Exempt HOV Trips (millions)[1]	Annual Toll Trips (millions)[2]	Average Revenue per Trip (one-way)[3]	**Total Potential Gross Toll Revenue ($ millions)[4]**	Leakage ($ millions)[5]	Transponder Sales Revenue ($ millions)[6]	**Adjusted Gross Toll Revenue Collected ($ millions)**	Credit Card Fees ($ millions)[7]	Toll Collection O&M ($ millions)[8]	Facility O&M ($ millions)[9]	**Net Toll Revenue Before R&R ($ millions)[10]**
2024	5.13	11.80	3.52	**41.56**	(4.16)	2.51	**39.90**	(0.67)	(11.05)	(5.15)	**23.04**
2025	5.78	13.42	3.66	**49.06**	(4.91)	2.91	**47.06**	(0.79)	(12.36)	(4.57)	**29.34**
2026	6.12	14.32	3.80	**54.33**	(5.43)	2.12	**51.02**	(0.88)	(12.32)	(4.69)	**33.13**
2027	6.46	15.23	3.94	**60.02**	(6.00)	2.31	**56.32**	(0.97)	(13.31)	(4.81)	**37.24**
2028	6.48	15.40	4.09	**62.98**	(6.30)	2.38	**59.06**	(1.02)	(13.74)	(4.93)	**39.38**
2029	6.50	15.57	4.25	**66.08**	(6.61)	2.46	**61.94**	(1.07)	(14.19)	(5.05)	**41.63**
2030	6.51	15.73	4.41	**69.34**	(6.93)	2.55	**64.95**	(1.12)	(14.65)	(5.18)	**44.00**
2031	6.53	15.91	4.57	**72.76**	(7.28)	2.63	**68.12**	(1.18)	(15.13)	(5.31)	**46.50**
2032	6.55	16.08	4.75	**76.35**	(7.64)	2.72	**71.44**	(1.24)	(15.62)	(5.44)	**49.14**
2033	6.57	16.25	4.93	**80.12**	(8.01)	2.81	**74.92**	(1.30)	(16.14)	(5.57)	**51.91**
2034	6.59	16.43	5.12	**84.07**	(8.41)	2.91	**78.57**	(1.36)	(16.66)	(5.71)	**54.83**
2035	6.60	16.61	5.31	**88.22**	(8.82)	3.01	**82.40**	(1.43)	(17.21)	(5.86)	**57.90**
2036	6.62	16.79	5.51	**92.57**	(9.26)	3.11	**86.42**	(1.50)	(17.77)	(6.00)	**61.14**
2037	6.64	16.97	5.72	**97.13**	(9.71)	3.21	**90.63**	(1.57)	(18.36)	(6.15)	**64.55**
2038	6.66	17.16	5.94	**101.92**	(10.19)	3.32	**95.05**	(1.65)	(18.96)	(6.31)	**68.14**
2039	6.68	17.34	6.17	**106.95**	(10.70)	3.43	**99.69**	(1.73)	(19.58)	(6.46)	**71.91**
2040	6.69	17.53	6.40	**112.23**	(11.22)	3.55	**104.55**	(1.82)	(20.23)	(6.63)	**75.88**
2041	6.71	17.58	6.52	**114.66**	(11.47)	3.65	**106.84**	(1.86)	(20.78)	(6.79)	**77.41**
2042	6.72	17.63	6.65	**117.14**	(11.71)	3.75	**109.17**	(1.90)	(21.35)	(6.96)	**78.97**
2043	6.74	17.67	6.77	**119.68**	(11.97)	3.85	**111.56**	(1.94)	(21.93)	(7.13)	**80.56**
2044	6.75	17.72	6.90	**122.27**	(12.23)	3.96	**114.00**	(1.98)	(22.53)	(7.31)	**82.17**
2045	6.77	17.77	7.03	**124.92**	(12.49)	4.07	**116.49**	(2.02)	(23.15)	(7.50)	**83.83**
2046	6.78	17.82	7.16	**127.62**	(12.76)	4.18	**119.04**	(2.07)	(23.78)	(7.68)	**85.51**
2047	6.80	17.87	7.30	**130.39**	(13.04)	4.30	**121.64**	(2.11)	(24.43)	(7.88)	**87.22**
2048	6.82	17.92	7.44	**133.21**	(13.32)	4.41	**124.30**	(2.16)	(25.10)	(8.07)	**88.97**
2049	6.83	17.96	7.58	**136.09**	(13.61)	4.54	**127.02**	(2.20)	(25.79)	(8.27)	**90.76**
2050	6.85	18.01	7.72	**139.04**	(13.90)	4.66	**129.80**	(2.25)	(26.49)	(8.48)	**92.57**
2051	6.86	18.01	7.83	**141.13**	(14.11)	4.78	**131.80**	(2.29)	(27.17)	(8.69)	**93.65**
2052	6.87	18.01	7.95	**143.24**	(14.32)	4.90	**133.82**	(2.32)	(27.86)	(8.91)	**94.73**
2053	6.88	18.01	8.07	**145.39**	(14.54)	5.03	**135.88**	(2.36)	(28.57)	(9.13)	**95.83**
2054	6.89	18.01	8.19	**147.57**	(14.76)	5.16	**137.97**	(2.39)	(29.29)	(9.36)	**96.93**
2055	6.91	18.01	8.32	**149.79**	(14.98)	5.29	**140.10**	(2.43)	(30.04)	(9.60)	**98.03**
2056	6.92	18.01	8.44	**152.03**	(15.20)	5.42	**142.25**	(2.46)	(30.80)	(9.84)	**99.15**
2057	6.93	18.01	8.57	**154.31**	(15.43)	5.56	**144.44**	(2.50)	(31.59)	(10.08)	**100.28**
2058	6.94	18.01	8.70	**156.63**	(15.66)	5.70	**146.67**	(2.54)	(32.39)	(10.33)	**101.41**
2059	6.95	18.01	8.83	**158.98**	(15.90)	5.85	**148.93**	(2.58)	(33.22)	(10.59)	**102.55**
2060	6.97	18.01	8.96	**161.36**	(16.14)	6.00	**151.22**	(2.61)	(34.06)	(10.86)	**103.69**
TOTALS (2024-2060)	**245.99**	**626.60**		**4,091.13**	**(409.11)**	**142.98**	**3,825.00**	**(66.28)**	**(807.58)**	**(267.27)**	**2,683.87**

[1] Includes only those vehicles not paying a toll; excludes transit vehicles (not forecasted).
[2] Includes all vehicles paying a toll, including a discounted toll where applicable.
[3] Equivalent to the overall weighted average toll rate per toll trip.
[4] The gross revenue that would result if the correct toll was immediately collected from every vehicle required to pay a toll.
[5] Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
[6] Transponder costs will be directly offset by customer purchase of transponder.
[7] Credit card fees estimated as a % of adjusted gross toll revenue.
[8] Includes base CSC & lane systems O&M contract, transponder purchase & inventory, traffic management & communications, marketing, O&M oversight and Metro staff costs.
[9] Includes CHP, freeway service patrol and Caltrans maintenance costs.
[10] Periodic capital repair and replacement (R&R) costs associated with roadway and toll collection functions are excluded and assumed to be paid from excess net revenues after debt service or pay-go uses.
* All dollar amounts are in future year of collection/year of expenditure dollars

Source: WSP

Metro

Figure 11-6: Scenario F1 Net Revenue Results

F1	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt

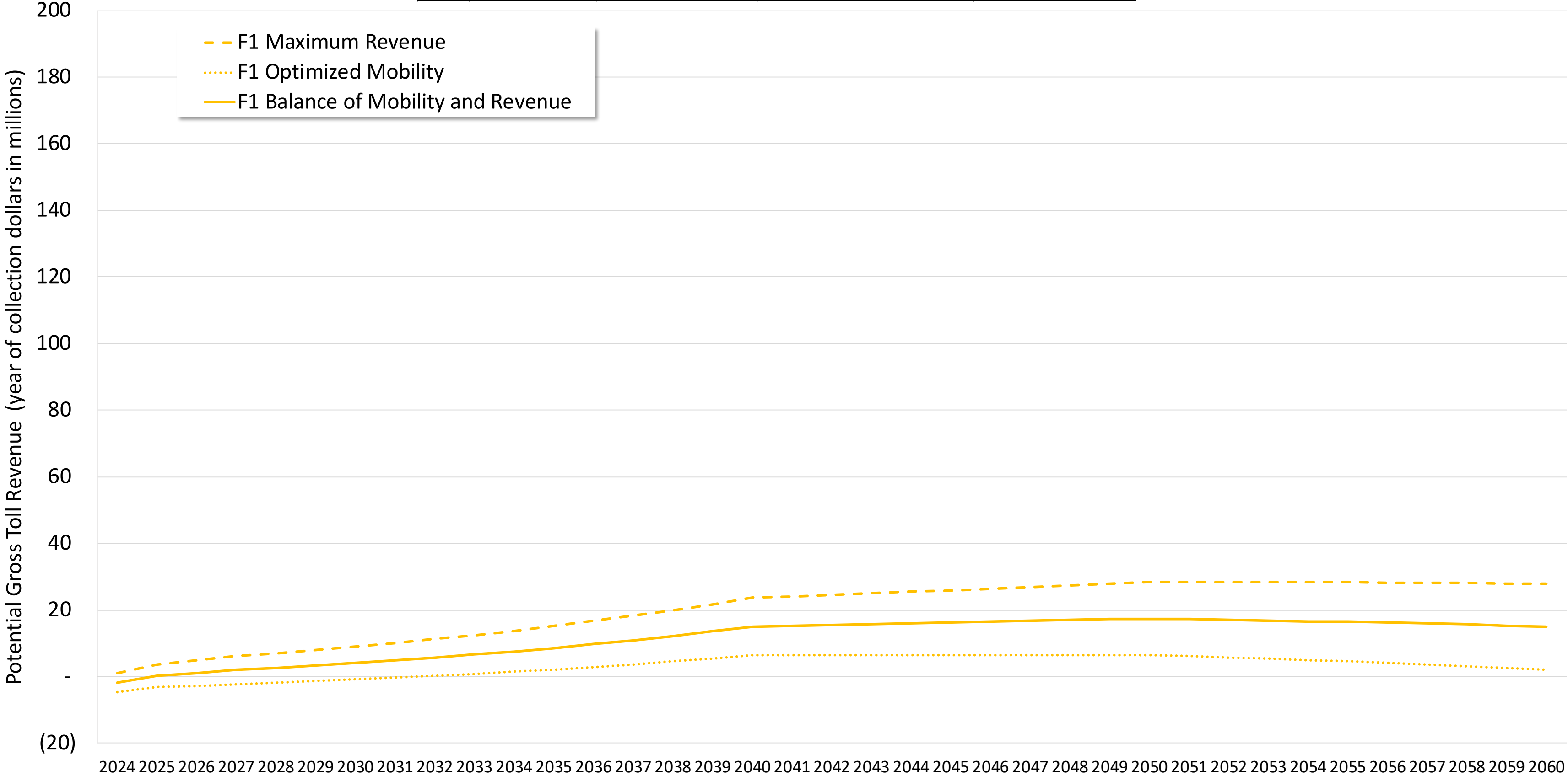


Table 11-7: Scenario F1-z Net Revenue Results

I-405 Sepulveda Pass Express Lanes

Scenario F1-z: Traffic & Revenue Table | Net Revenue Projections *

F1-z	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Exempt	Balance of Mobility & Revenue

1	2	3	4	5	6	7	8	9	10	11	12
	Traffic Projections				Less:	Plus:	Subtotal:	Less:	Less:	Less:	Total
Fiscal Year	Annual Exempt HOV Trips (millions)[1]	Annual Toll Trips (millions)[2]	Average Revenue per Trip (one-way)[3]	**Total Potential Gross Toll Revenue ($ millions)[4]**	Leakage ($ millions)[5]	Transponder Sales Revenue ($ millions)[6]	**Adjusted Gross Toll Revenue Collected ($ millions)**	Credit Card Fees ($ millions)[7]	Toll Collection O&M ($ millions)[8]	Facility O&M ($ millions)[9]	**Net Toll Revenue Before R&R ($ millions)[10]**
2024	22.01	4.02	4.37	**17.56**	(1.76)	3.85	**19.66**	(0.28)	(16.05)	(5.15)	**(1.83)**
2025	24.82	4.59	4.53	**20.82**	(2.08)	4.46	**23.20**	(0.34)	(18.12)	(4.57)	**0.17**
2026	26.28	4.93	4.70	**23.16**	(2.32)	3.24	**24.08**	(0.38)	(17.98)	(4.69)	**1.03**
2027	27.73	5.27	4.87	**25.70**	(2.57)	3.51	**26.64**	(0.42)	(19.41)	(4.81)	**2.01**
2028	27.81	5.36	5.05	**27.09**	(2.71)	3.61	**27.99**	(0.44)	(19.98)	(4.93)	**2.64**
2029	27.88	5.45	5.24	**28.55**	(2.85)	3.72	**29.42**	(0.46)	(20.57)	(5.05)	**3.33**
2030	27.96	5.54	5.43	**30.09**	(3.01)	3.83	**30.91**	(0.49)	(21.19)	(5.18)	**4.07**
2031	28.04	5.63	5.63	**31.71**	(3.17)	3.95	**32.49**	(0.51)	(21.81)	(5.31)	**4.86**
2032	28.11	5.72	5.84	**33.43**	(3.34)	4.07	**34.15**	(0.54)	(22.46)	(5.44)	**5.71**
2033	28.19	5.82	6.06	**35.23**	(3.52)	4.19	**35.90**	(0.57)	(23.13)	(5.57)	**6.62**
2034	28.27	5.91	6.28	**37.13**	(3.71)	4.32	**37.74**	(0.60)	(23.82)	(5.71)	**7.60**
2035	28.34	6.01	6.51	**39.14**	(3.91)	4.45	**39.67**	(0.63)	(24.53)	(5.86)	**8.65**
2036	28.42	6.11	6.75	**41.25**	(4.12)	4.58	**41.71**	(0.67)	(25.26)	(6.00)	**9.77**
2037	28.50	6.21	7.00	**43.48**	(4.35)	4.72	**43.85**	(0.70)	(26.02)	(6.15)	**10.98**
2038	28.57	6.31	7.26	**45.82**	(4.58)	4.87	**46.11**	(0.74)	(26.80)	(6.31)	**12.26**
2039	28.65	6.42	7.52	**48.30**	(4.83)	5.01	**48.48**	(0.78)	(27.60)	(6.46)	**13.64**
2040	28.73	6.53	7.80	**50.90**	(5.09)	5.17	**50.98**	(0.82)	(28.43)	(6.63)	**15.10**
2041	28.79	6.55	7.95	**52.06**	(5.21)	5.31	**52.17**	(0.84)	(29.20)	(6.79)	**15.33**
2042	28.86	6.58	8.09	**53.25**	(5.33)	5.45	**53.38**	(0.86)	(30.01)	(6.96)	**15.55**
2043	28.92	6.61	8.24	**54.47**	(5.45)	5.61	**54.63**	(0.88)	(30.83)	(7.13)	**15.78**
2044	28.98	6.63	8.40	**55.71**	(5.57)	5.76	**55.90**	(0.90)	(31.67)	(7.31)	**16.01**
2045	29.05	6.66	8.55	**56.98**	(5.70)	5.92	**57.20**	(0.92)	(32.54)	(7.50)	**16.24**
2046	29.11	6.69	8.71	**58.28**	(5.83)	6.08	**58.54**	(0.94)	(33.44)	(7.68)	**16.47**
2047	29.18	6.72	8.88	**59.61**	(5.96)	6.25	**59.90**	(0.97)	(34.35)	(7.88)	**16.71**
2048	29.24	6.74	9.04	**60.97**	(6.10)	6.42	**61.30**	(0.99)	(35.29)	(8.07)	**16.94**
2049	29.31	6.77	9.21	**62.36**	(6.24)	6.60	**62.73**	(1.01)	(36.26)	(8.27)	**17.18**
2050	29.37	6.80	9.38	**63.78**	(6.38)	6.78	**64.19**	(1.03)	(37.26)	(8.48)	**17.42**
2051	29.42	6.80	9.52	**64.74**	(6.47)	6.96	**65.23**	(1.05)	(38.24)	(8.69)	**17.25**
2052	29.47	6.80	9.66	**65.71**	(6.57)	7.15	**66.29**	(1.06)	(39.25)	(8.91)	**17.07**
2053	29.52	6.80	9.81	**66.70**	(6.67)	7.34	**67.36**	(1.08)	(40.28)	(9.13)	**16.87**
2054	29.58	6.80	9.96	**67.70**	(6.77)	7.53	**68.46**	(1.10)	(41.34)	(9.36)	**16.66**
2055	29.63	6.80	10.10	**68.71**	(6.87)	7.73	**69.57**	(1.11)	(42.43)	(9.60)	**16.43**
2056	29.68	6.80	10.26	**69.74**	(6.97)	7.93	**70.70**	(1.13)	(43.55)	(9.84)	**16.19**
2057	29.73	6.80	10.41	**70.79**	(7.08)	8.14	**71.85**	(1.15)	(44.69)	(10.08)	**15.93**
2058	29.78	6.80	10.57	**71.85**	(7.19)	8.36	**73.03**	(1.16)	(45.87)	(10.33)	**15.66**
2059	29.83	6.80	10.72	**72.93**	(7.29)	8.58	**74.22**	(1.18)	(47.08)	(10.59)	**15.36**
2060	29.89	6.80	10.89	**74.02**	(7.40)	8.81	**75.43**	(1.20)	(48.32)	(10.86)	**15.05**
TOTALS (2024-2060)	**1,055.66**	**230.59**		**1,849.74**	**(184.97)**	**210.27**	**1,875.04**	**(29.97)**	**(1,145.07)**	**(267.27)**	**432.73**

[1] Includes only those vehicles not paying a toll; excludes transit vehicles (not forecasted).
[2] Includes all vehicles paying a toll, including a discounted toll where applicable.
[3] Equivalent to the overall weighted average toll rate per toll trip.
[4] The gross revenue that would result if the correct toll was immediately collected from every vehicle required to pay a toll.
[5] Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
[6] Transponder costs will be directly offset by customer purchase of transponder.
[7] Credit card fees estimated as a % of adjusted gross toll revenue.
[8] Includes base CSC & lane systems O&M contract, transponder purchase & inventory, traffic management & communications, marketing, O&M oversight and Metro staff costs.
[9] Includes CHP, freeway service patrol and Caltrans maintenance costs.
[10] Periodic capital repair and replacement (R&R) costs associated with roadway and toll collection functions are excluded and assumed to be paid from excess net revenues after debt service or pay-go uses.
* All dollar amounts are in future year of collection/year of expenditure dollars

Source: WSP

Figure 11-7: Scenario F2 Net Revenue Results

F2	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt

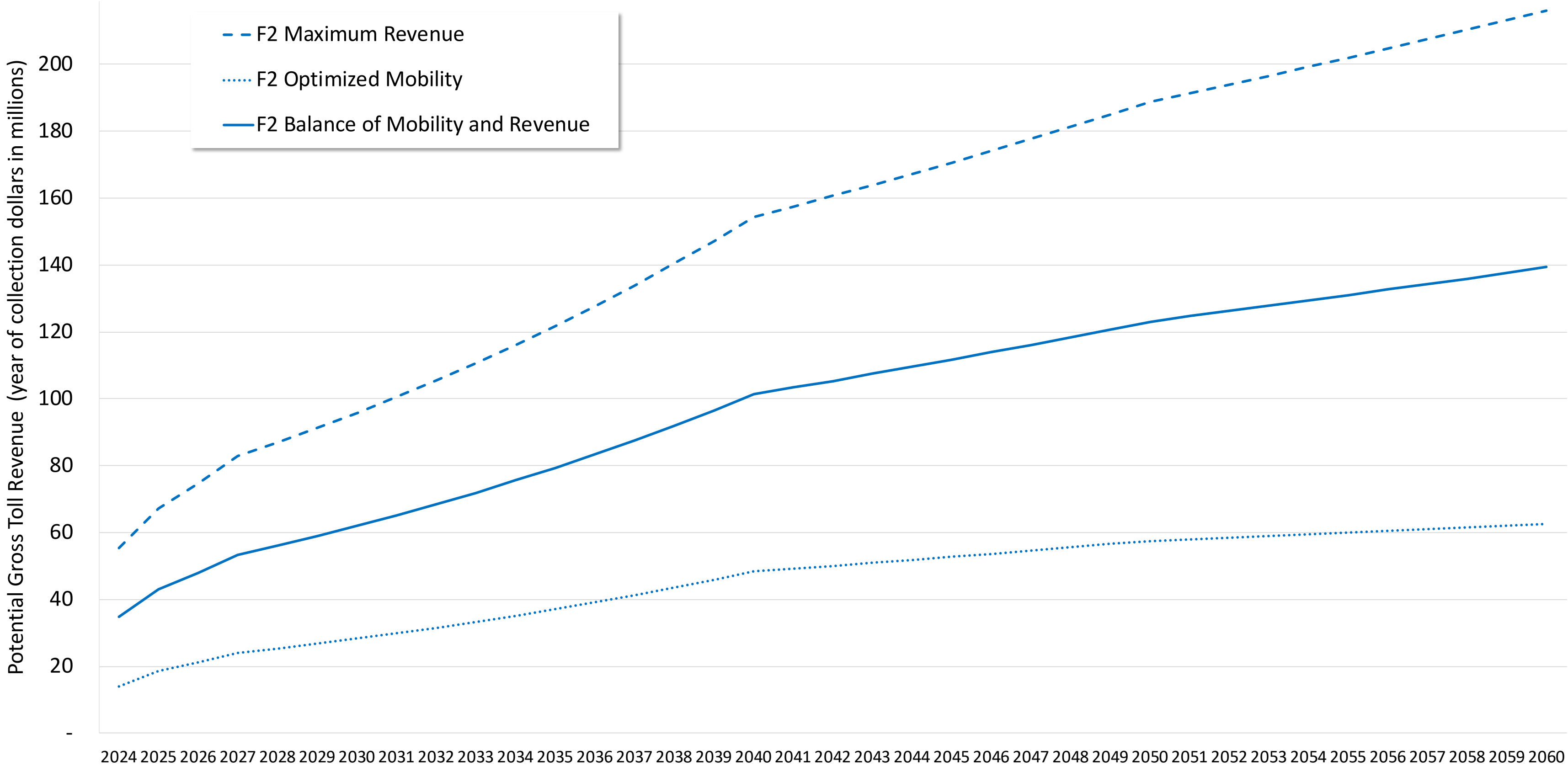


Table 11-8: Scenario F2-z Net Revenue Results

I-405 Sepulveda Pass Express Lanes

Scenario F2-z: Traffic & Revenue Table | Net Revenue Projections *

F2-z	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 3+ Exempt	Balance of Mobility & Revenue

1	2	3	4	5	6	7	8	9	10	11	12
	Traffic Projections				Less:	Plus:	Subtotal:	Less:	Less:	Less:	Total
Fiscal Year	Annual Exempt HOV Trips (millions)[1]	Annual Toll Trips (millions)[2]	Average Revenue per Trip (one-way)[3]	**Total Potential Gross Toll Revenue ($ millions)[4]**	Leakage ($ millions)[5]	Transponder Sales Revenue ($ millions)[6]	**Adjusted Gross Toll Revenue Collected ($ millions)**	Credit Card Fees ($ millions)[7]	Toll Collection O&M ($ millions)[8]	Facility O&M ($ millions)[9]	**Net Toll Revenue Before R&R ($ millions)[10]**
2024	5.13	10.49	5.16	**54.15**	(5.41)	2.31	**51.05**	(0.88)	(10.33)	(5.15)	**34.70**
2025	5.78	11.92	5.35	**63.74**	(6.37)	2.69	**60.05**	(1.03)	(11.51)	(4.57)	**42.93**
2026	6.12	12.70	5.54	**70.39**	(7.04)	1.95	**65.30**	(1.14)	(11.47)	(4.69)	**48.00**
2027	6.46	13.50	5.74	**77.52**	(7.75)	2.12	**71.89**	(1.26)	(12.37)	(4.81)	**53.46**
2028	6.48	13.64	5.95	**81.11**	(8.11)	2.19	**75.19**	(1.31)	(12.77)	(4.93)	**56.18**
2029	6.50	13.77	6.16	**84.86**	(8.49)	2.26	**78.64**	(1.37)	(13.17)	(5.05)	**59.04**
2030	6.51	13.91	6.38	**88.79**	(8.88)	2.34	**82.25**	(1.44)	(13.59)	(5.18)	**62.04**
2031	6.53	14.05	6.61	**92.90**	(9.29)	2.41	**86.02**	(1.50)	(14.03)	(5.31)	**65.19**
2032	6.55	14.19	6.85	**97.20**	(9.72)	2.49	**89.97**	(1.57)	(14.47)	(5.44)	**68.49**
2033	6.57	14.33	7.10	**101.70**	(10.17)	2.58	**94.10**	(1.65)	(14.93)	(5.57)	**71.95**
2034	6.59	14.47	7.35	**106.40**	(10.64)	2.66	**98.42**	(1.72)	(15.41)	(5.71)	**75.57**
2035	6.60	14.62	7.62	**111.32**	(11.13)	2.75	**102.94**	(1.80)	(15.90)	(5.86)	**79.38**
2036	6.62	14.76	7.89	**116.48**	(11.65)	2.84	**107.67**	(1.89)	(16.41)	(6.00)	**83.37**
2037	6.64	14.91	8.17	**121.86**	(12.19)	2.93	**112.61**	(1.97)	(16.93)	(6.15)	**87.55**
2038	6.66	15.06	8.47	**127.50**	(12.75)	3.03	**117.78**	(2.07)	(17.48)	(6.31)	**91.93**
2039	6.68	15.21	8.77	**133.40**	(13.34)	3.13	**123.19**	(2.16)	(18.03)	(6.46)	**96.53**
2040	6.69	15.36	9.09	**139.58**	(13.96)	3.23	**128.85**	(2.26)	(18.61)	(6.63)	**101.35**
2041	6.71	15.40	9.25	**142.49**	(14.25)	3.32	**131.56**	(2.31)	(19.12)	(6.79)	**103.35**
2042	6.72	15.44	9.42	**145.47**	(14.55)	3.41	**134.33**	(2.36)	(19.64)	(6.96)	**105.38**
2043	6.74	15.48	9.60	**148.51**	(14.85)	3.50	**137.16**	(2.41)	(20.17)	(7.13)	**107.45**
2044	6.75	15.51	9.77	**151.61**	(15.16)	3.60	**140.05**	(2.46)	(20.72)	(7.31)	**109.57**
2045	6.77	15.55	9.95	**154.78**	(15.48)	3.70	**143.00**	(2.51)	(21.28)	(7.50)	**111.72**
2046	6.78	15.59	10.14	**158.02**	(15.80)	3.80	**146.02**	(2.56)	(21.86)	(7.68)	**113.91**
2047	6.80	15.63	10.32	**161.32**	(16.13)	3.91	**149.09**	(2.61)	(22.45)	(7.88)	**116.15**
2048	6.82	15.67	10.51	**164.69**	(16.47)	4.01	**152.24**	(2.67)	(23.07)	(8.07)	**118.43**
2049	6.83	15.71	10.70	**168.13**	(16.81)	4.12	**155.44**	(2.72)	(23.69)	(8.27)	**120.75**
2050	6.85	15.75	10.90	**171.65**	(17.16)	4.24	**158.72**	(2.78)	(24.34)	(8.48)	**123.12**
2051	6.86	15.75	11.06	**174.22**	(17.42)	4.35	**161.14**	(2.82)	(24.96)	(8.69)	**124.67**
2052	6.87	15.75	11.23	**176.84**	(17.68)	4.46	**163.61**	(2.86)	(25.59)	(8.91)	**126.24**
2053	6.88	15.75	11.40	**179.49**	(17.95)	4.57	**166.11**	(2.91)	(26.24)	(9.13)	**127.82**
2054	6.89	15.75	11.57	**182.18**	(18.22)	4.69	**168.65**	(2.95)	(26.91)	(9.36)	**129.42**
2055	6.91	15.75	11.74	**184.91**	(18.49)	4.81	**171.23**	(3.00)	(27.60)	(9.60)	**131.04**
2056	6.92	15.75	11.92	**187.69**	(18.77)	4.93	**173.85**	(3.04)	(28.30)	(9.84)	**132.67**
2057	6.93	15.75	12.10	**190.50**	(19.05)	5.06	**176.51**	(3.09)	(29.02)	(10.08)	**134.32**
2058	6.94	15.75	12.28	**193.36**	(19.34)	5.18	**179.21**	(3.13)	(29.76)	(10.33)	**135.98**
2059	6.95	15.75	12.46	**196.26**	(19.63)	5.32	**181.95**	(3.18)	(30.52)	(10.59)	**137.66**
2060	6.97	15.75	12.65	**199.20**	(19.92)	5.45	**184.74**	(3.23)	(31.30)	(10.86)	**139.35**
TOTALS (2024-2060)	**245.99**	**550.09**		**5,100.24**	**(510.02)**	**130.34**	**4,720.55**	**(82.62)**	**(743.98)**	**(267.27)**	**3,626.67**

[1] Includes only those vehicles not paying a toll; excludes transit vehicles (not forecasted).
[2] Includes all vehicles paying a toll, including a discounted toll where applicable.
[3] Equivalent to the overall weighted average toll rate per toll trip.
[4] The gross revenue that would result if the correct toll was immediately collected from every vehicle required to pay a toll.
[5] Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
[6] Transponder costs will be directly offset by customer purchase of transponder.
[7] Credit card fees estimated as a % of adjusted gross toll revenue.
[8] Includes base CSC & lane systems O&M contract, transponder purchase & inventory, traffic management & communications, marketing, O&M oversight and Metro staff costs.
[9] Includes CHP, freeway service patrol and Caltrans maintenance costs.
[10] Periodic capital repair and replacement (R&R) costs associated with roadway and toll collection functions are excluded and assumed to be paid from excess net revenues after debt service or pay-go uses.
* All dollar amounts are in future year of collection/year of expenditure dollars

Source: WSP

Figure 11-8: Scenario F3 Net Revenue Results

F3	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak

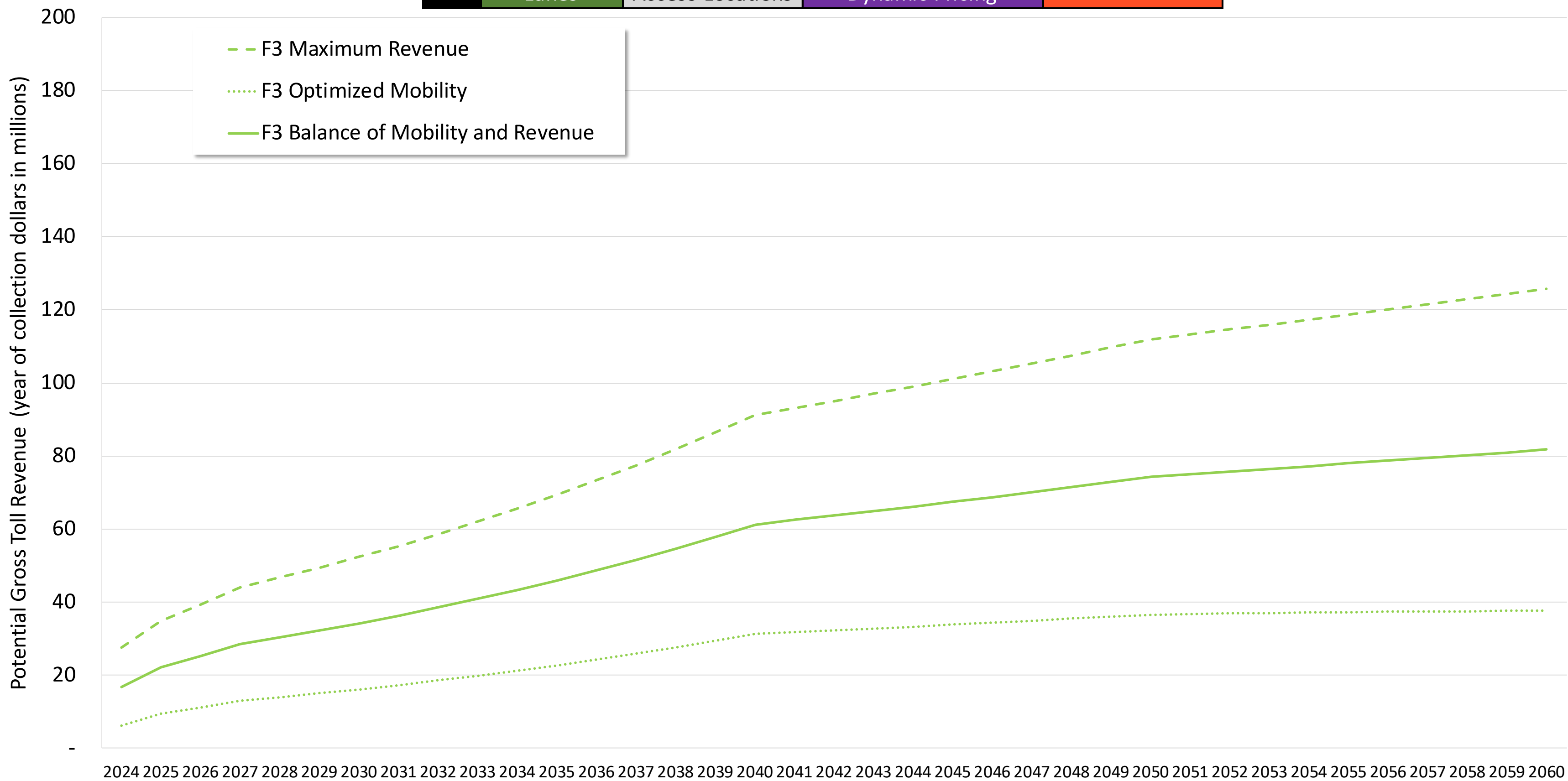


Table 11-9: Scenario F2-z Net Revenue Results

I-405 Sepulveda Pass Express Lanes

Scenario F3-z: Traffic & Revenue Table | Net Revenue Projections *

F3-z	Dual Express Lanes	Existing HOV Access Locations	Unconstrained Dynamic Pricing	HOV 2+ Off-Peak / HOV 3+ Peak	Balance of Mobility & Revenue

1	2	3	4	5	6	7	8	9	10	11	12
	Traffic Projections				Less:	Plus:	Subtotal:	Less:	Less:	Less:	Total
Fiscal Year	Annual Exempt HOV Trips (millions)[1]	Annual Toll Trips (millions)[2]	Average Revenue per Trip (one-way)[3]	**Total Potential Gross Toll Revenue ($ millions)[4]**	Leakage ($ millions)[5]	Transponder Sales Revenue ($ millions)[6]	**Adjusted Gross Toll Revenue Collected ($ millions)**	Credit Card Fees ($ millions)[7]	Toll Collection O&M ($ millions)[8]	Facility O&M ($ millions)[9]	**Net Toll Revenue Before R&R ($ millions)[10]**
2024	15.29	7.16	5.18	**37.11**	(3.71)	3.32	**36.72**	(0.60)	(14.09)	(5.15)	**16.89**
2025	17.24	8.17	5.36	**43.81**	(4.38)	3.86	**43.28**	(0.71)	(15.86)	(4.57)	**22.14**
2026	18.23	8.75	5.55	**48.52**	(4.85)	2.80	**46.46**	(0.79)	(15.76)	(4.69)	**25.23**
2027	19.22	9.33	5.74	**53.59**	(5.36)	3.03	**51.27**	(0.87)	(17.01)	(4.81)	**28.59**
2028	19.26	9.47	5.94	**56.23**	(5.62)	3.13	**53.74**	(0.91)	(17.52)	(4.93)	**30.38**
2029	19.29	9.60	6.15	**59.00**	(5.90)	3.23	**56.33**	(0.96)	(18.06)	(5.05)	**32.27**
2030	19.32	9.73	6.36	**61.91**	(6.19)	3.33	**59.05**	(1.00)	(18.61)	(5.18)	**34.26**
2031	19.36	9.87	6.58	**64.96**	(6.50)	3.43	**61.89**	(1.05)	(19.17)	(5.31)	**36.36**
2032	19.39	10.01	6.81	**68.16**	(6.82)	3.54	**64.88**	(1.10)	(19.76)	(5.44)	**38.58**
2033	19.43	10.15	7.05	**71.52**	(7.15)	3.65	**68.02**	(1.16)	(20.36)	(5.57)	**40.92**
2034	19.46	10.29	7.29	**75.05**	(7.50)	3.76	**71.30**	(1.22)	(20.98)	(5.71)	**43.39**
2035	19.50	10.43	7.55	**78.75**	(7.87)	3.88	**74.75**	(1.28)	(21.63)	(5.86)	**45.99**
2036	19.53	10.58	7.81	**82.63**	(8.26)	4.00	**78.36**	(1.34)	(22.29)	(6.00)	**48.73**
2037	19.57	10.73	8.08	**86.70**	(8.67)	4.12	**82.15**	(1.40)	(22.97)	(6.15)	**51.62**
2038	19.60	10.88	8.36	**90.97**	(9.10)	4.25	**86.13**	(1.47)	(23.68)	(6.31)	**54.67**
2039	19.64	11.03	8.65	**95.46**	(9.55)	4.38	**90.30**	(1.55)	(24.41)	(6.46)	**57.88**
2040	19.67	11.19	8.95	**100.16**	(10.02)	4.52	**94.67**	(1.62)	(25.16)	(6.63)	**61.26**
2041	19.70	11.22	9.12	**102.33**	(10.23)	4.64	**96.74**	(1.66)	(25.84)	(6.79)	**62.46**
2042	19.73	11.26	9.28	**104.55**	(10.45)	4.77	**98.86**	(1.69)	(26.54)	(6.96)	**63.67**
2043	19.76	11.30	9.45	**106.81**	(10.68)	4.90	**101.03**	(1.73)	(27.25)	(7.13)	**64.91**
2044	19.79	11.34	9.62	**109.12**	(10.91)	5.03	**103.24**	(1.77)	(27.99)	(7.31)	**66.17**
2045	19.82	11.38	9.79	**111.48**	(11.15)	5.17	**105.51**	(1.81)	(28.75)	(7.50)	**67.46**
2046	19.85	11.42	9.97	**113.90**	(11.39)	5.31	**107.82**	(1.85)	(29.53)	(7.68)	**68.76**
2047	19.87	11.46	10.15	**116.36**	(11.64)	5.46	**110.18**	(1.89)	(30.33)	(7.88)	**70.10**
2048	19.90	11.50	10.34	**118.88**	(11.89)	5.61	**112.60**	(1.93)	(31.15)	(8.07)	**71.45**
2049	19.93	11.54	10.52	**121.45**	(12.15)	5.76	**115.07**	(1.97)	(31.99)	(8.27)	**72.84**
2050	19.96	11.58	10.71	**124.08**	(12.41)	5.92	**117.59**	(2.01)	(32.86)	(8.48)	**74.24**
2051	19.98	11.58	10.87	**125.94**	(12.59)	6.07	**119.42**	(2.04)	(33.70)	(8.69)	**74.99**
2052	20.01	11.58	11.04	**127.83**	(12.78)	6.22	**121.27**	(2.07)	(34.56)	(8.91)	**75.73**
2053	20.03	11.58	11.20	**129.75**	(12.98)	6.38	**123.16**	(2.10)	(35.45)	(9.13)	**76.47**
2054	20.05	11.58	11.37	**131.70**	(13.17)	6.55	**125.08**	(2.13)	(36.36)	(9.36)	**77.22**
2055	20.08	11.58	11.54	**133.67**	(13.37)	6.72	**127.02**	(2.17)	(37.30)	(9.60)	**77.97**
2056	20.10	11.58	11.71	**135.68**	(13.57)	6.89	**129.00**	(2.20)	(38.25)	(9.84)	**78.71**
2057	20.12	11.58	11.89	**137.71**	(13.77)	7.07	**131.01**	(2.23)	(39.24)	(10.08)	**79.46**
2058	20.15	11.58	12.07	**139.78**	(13.98)	7.25	**133.05**	(2.26)	(40.24)	(10.33)	**80.21**
2059	20.17	11.58	12.25	**141.88**	(14.19)	7.44	**135.12**	(2.30)	(41.28)	(10.59)	**80.96**
2060	20.19	11.58	12.43	**144.00**	(14.40)	7.63	**137.23**	(2.33)	(42.34)	(10.86)	**81.70**
TOTALS (2024-2060)	**722.20**	**397.22**		**3,651.46**	**(365.15)**	**183.00**	**3,469.31**	**(59.15)**	**(1,008.23)**	**(267.27)**	**2,134.65**

[1] Includes only those vehicles not paying a toll; excludes transit vehicles (not forecasted).
[2] Includes all vehicles paying a toll, including a discounted toll where applicable.
[3] Equivalent to the overall weighted average toll rate per toll trip.
[4] The gross revenue that would result if the correct toll was immediately collected from every vehicle required to pay a toll.
[5] Revenue leakage assumed to be 10 % of gross toll revenue for delinquent accounts, equipment errors, and an allowance for false declaration of carpool status.
[6] Transponder costs will be directly offset by customer purchase of transponder.
[7] Credit card fees estimated as a % of adjusted gross toll revenue.
[8] Includes base CSC & lane systems O&M contract, transponder purchase & inventory, traffic management & communications, marketing, O&M oversight and Metro staff costs.
[9] Includes CHP, freeway service patrol and Caltrans maintenance costs.
[10] Periodic capital repair and replacement (R&R) costs associated with roadway and toll collection functions are excluded and assumed to be paid from excess net revenues after debt service or pay-go uses.
* All dollar amounts are in future year of collection/year of expenditure dollars

Source: WSP

12.0 TOLL SCENARIO VARIABLE SENSITIVITY TESTS

12.1 SENSITIVITY TEST RESULTS

Based on the scenarios selected by Metro staff, two scenarios were identified as affording the ability to conduct sensitivity tests for the most scenario combinations. The two scenarios selected as baselines for sensitivity testing are:

- F2-z: Dual Express Lanes | Existing Access | Unconstrained Dynamic Pricing | HOV 3+ Exempt | Balance of Mobility and Revenue
- B2-z: Single Express Lane | Existing Access | Unconstrained Dynamic Pricing | HOV 3+ Exempt | Balance of Mobility and Revenue

Additional scenarios are included in the comparison beyond the 18 detailed in this study to provide a comparison for all scenario variables.

12.1.1 SENSITIVITY TEST RESULTS FOR SCENARIO F2-Z | DUAL LANE

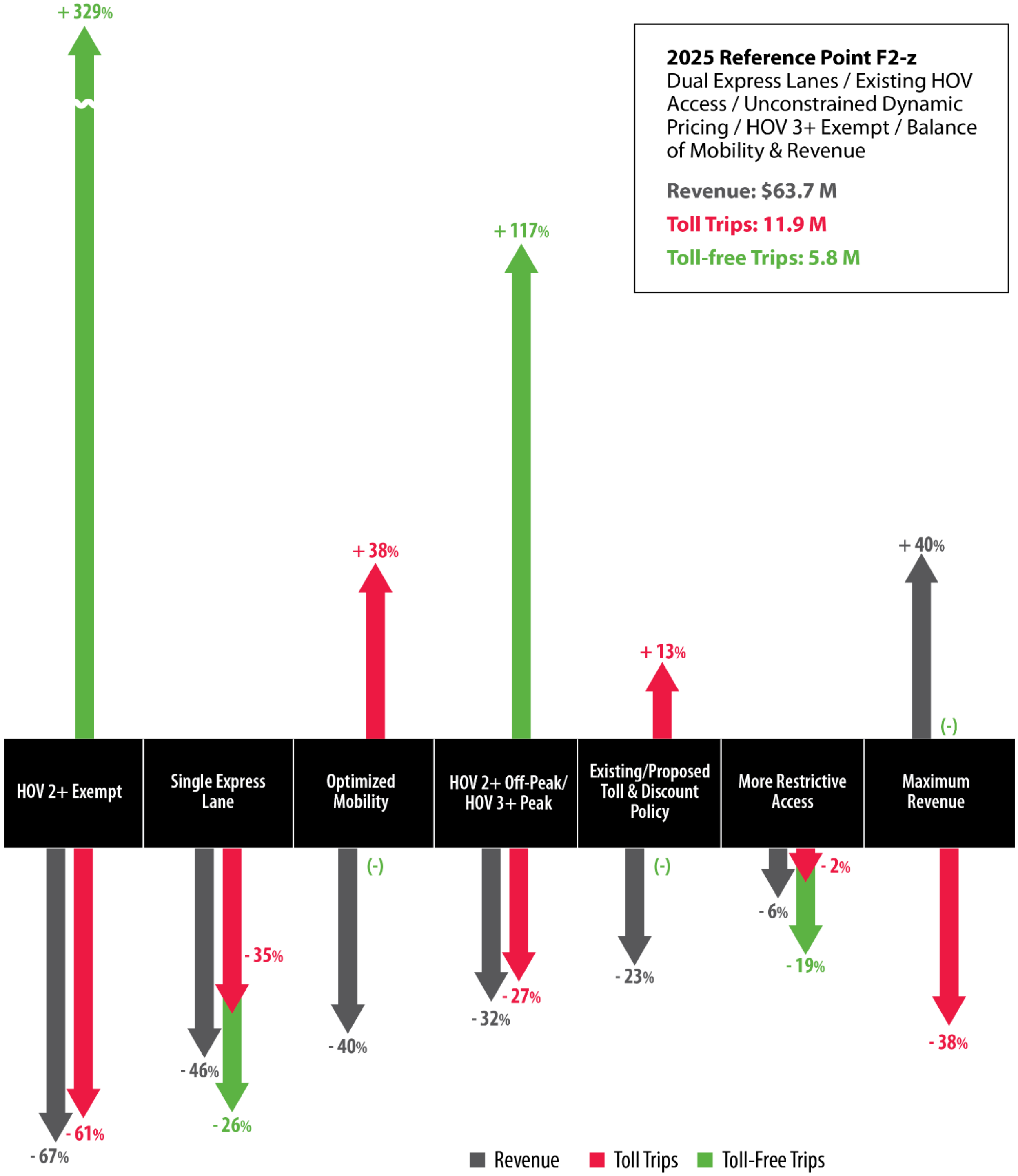
The effects of toll policy variables relative to Dual Lane Scenario F2 with the Balance of Mobility and Revenue Toll Operating Objective (F2-z) are displayed in the following figures. The effects are measured by changing:

- Lane Configuration
- Access Method
- Toll Policy
- HOV Toll Exemption
- Toll Operating Objective

Notes:

- The “Existing / Proposed Toll and Discount Policy” imposes maximum and minimum toll rates per mile plus a 50% discount for clean air vehicles and 2-person HOVs at time HOV 3+ are required for a toll exemption, whereas “Unconstrained Dynamic Pricing” excludes any discounts and only imposes a minimum toll.
- In the hybrid toll exemption case of “HOV 2+ Off-Peak / HOV 3+ Peak”, the peak hours are defined as 6-9 AM and 3-7 PM.
- The “Maximum Revenue” toll operating objective results in higher average toll rates, whereas the “Optimized Mobility” objective results in lower average toll rates designed to attract more express lane paying customers, thereby minimizing the overall corridor travel times in both the toll and GP lanes. A third, “Balanced” case is created from blending the results of the other two bookend objectives.

Figure 12-1: Reference Point F2-z 2025 Scenario Variable Comparison

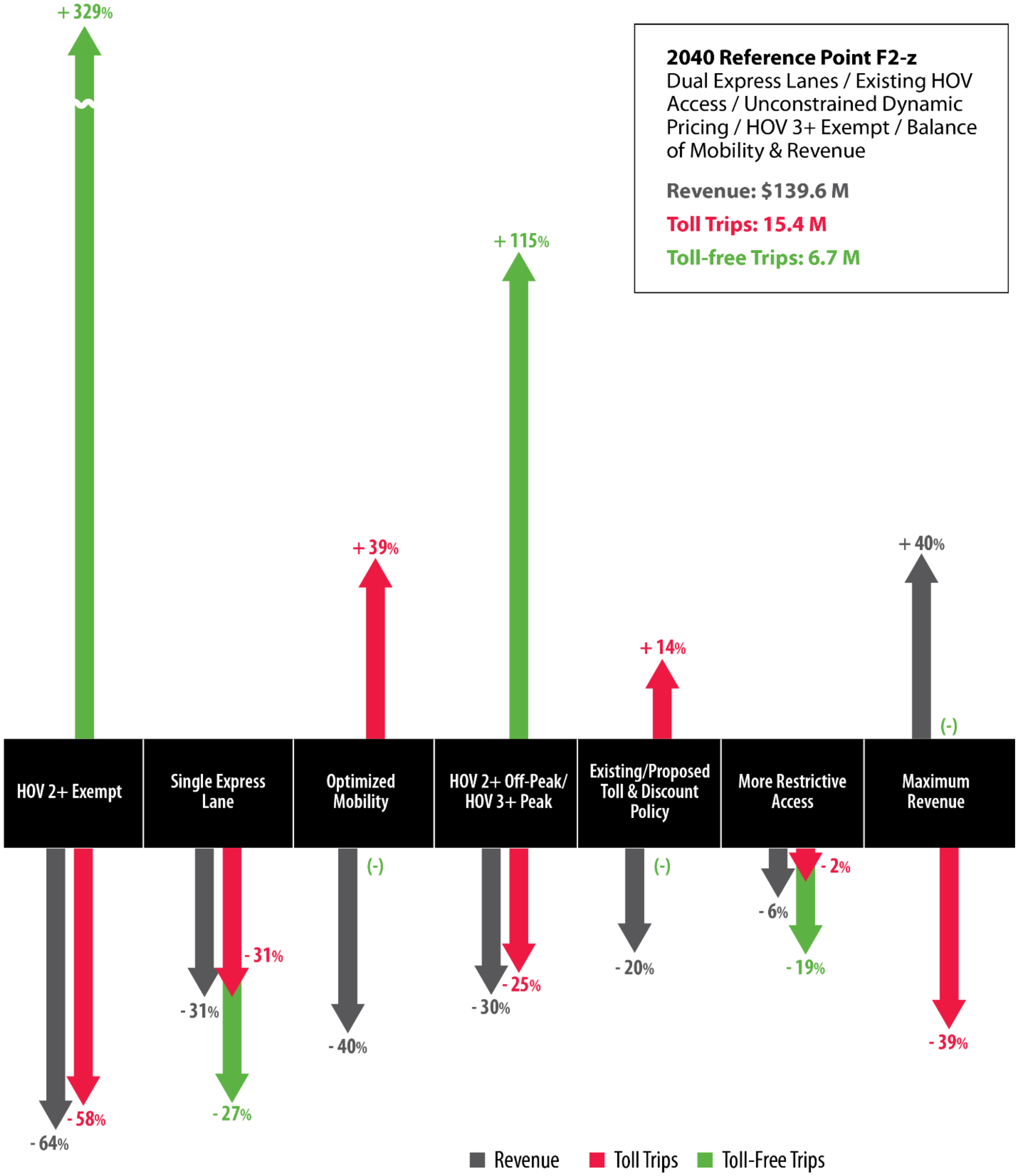


Source: WSP

Observations on Dual Lane Scenario F2 with the Balance of Mobility and Revenue Toll Operating Objective (F2-z) - 2025:

- Reducing occupancy requirements from HOV 3+ to HOV 2+ in the dual lane scenario F1-z leads to a significant reduction in toll trips and toll revenues, 61% and 67% respectively. However, toll-free trips increase by 329%.
- Restricting access to the express lanes has a minor impact on toll trips and toll revenues with a 6% reduction in revenue and a 2% reduction in toll trips. Access restrictions have a more significant impact on toll-free trips, reducing them by 19%.
- Permitting HOV2+ toll-free access during off-peak periods while maintaining the HOV3+ toll exempt requirement during peak periods increases toll-free trips by 117% while reducing toll-paying trips by 27% and toll revenues by 32%.
- Maintaining the Existing/Proposed Toll & Discount Policy instead of shifting to an unconstrained dynamic pricing policy leads to a 13% increase in toll trips and a 23% reduction in toll revenues. This discrepancy between an increase in toll traffic and a decrease in toll revenues can be attributed to the toll rate cap being reached under the Existing/Proposed Toll & Discount Policy and customers not being dissuaded from using the lanes. The higher revenues in the unconstrained dynamic pricing scenario highlight customers' willingness to pay for a fast and reliable trip. Toll-free trips do not change despite the change in toll policy, as toll-free travelers are assumed to be insensitive to toll pricing policies.
- Reducing the number of express lanes from two (2) to one (1) reduces toll revenue by 46%, while reducing toll trips and toll-free trips by 35% and 26% respectively.

Figure 12-2: Reference Point F2-z 2040 Scenario Variable Comparison



Source: WSP

Observations on Dual Lane Scenario F2 with the Balance of Mobility and Revenue Toll Operating Objective (F2-z) - 2040:

- The most significant change relative to dual lane scenario F2-z between 2025 and 2040 is the difference in toll revenues between the dual and single lane (B2-z) scenarios. In 2025, single lane revenues are 46% lower than the comparable dual lane scenario. By 2040, single lane revenues are only 31% lower than comparable dual lane scenario. The increase in revenues for the single lane scenario relative to the dual lane scenario can be attributed to the increasing value of the space in the single lane. As the single express lane becomes more congested, tolls must rise to maintain travel speeds and customers are willing to pay more for that faster trip. The dual lanes have more capacity and thus do not see toll rates grow at as rapid of a pace as the single lane cases do.

12.1.2 SENSITIVITY TEST RESULTS FOR SCENARIO B2-Z | SINGLE LANE

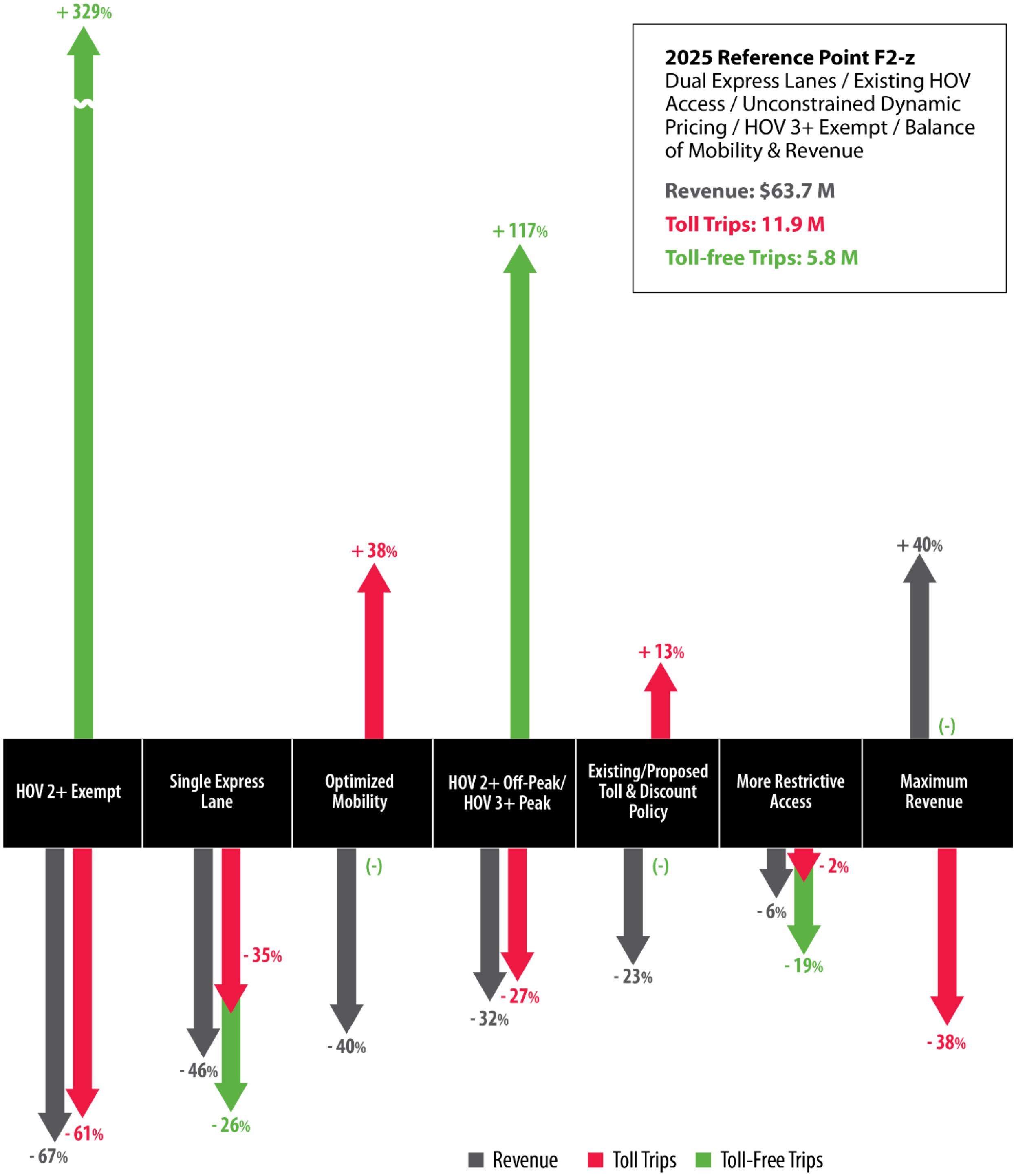
The effects of toll policy variables relative to Single Lane Scenario B2 with the Balance of Mobility and Revenue Toll Operating Objective (B2-z) are displayed in the following figures. The effects are measured by changing:

- Lane configuration
- Access Method
- Toll Policy
- HOV Toll Exemption
- Toll Operating Objective

Notes:

- The "Existing / Proposed Toll and Discount Policy" imposes maximum and minimum toll rates per mile plus a 50% discount for clean air vehicles and 2-person HOVs at time HOV 3+ are required for a toll exemption, whereas "Unconstrained Dynamic Pricing" excludes any discounts and only imposes a minimum toll.
- In the hybrid toll exemption case of "HOV 2+ Off-Peak / HOV 3+ Peak", the peak hours are defined as 6-9 AM and 3-7 PM.
- The "Maximum Revenue" toll operating objective results in higher average toll rates, whereas the "Optimized Mobility" objective results in lower average toll rates designed to attract more express lane paying customers, thereby minimizing the overall corridor travel times in both the toll and GP lanes. A third, "Balanced" case is created from blending the results of the other two bookend objectives.

Figure 12-3: Reference Point B2-z 2025 Scenario Variable Comparison

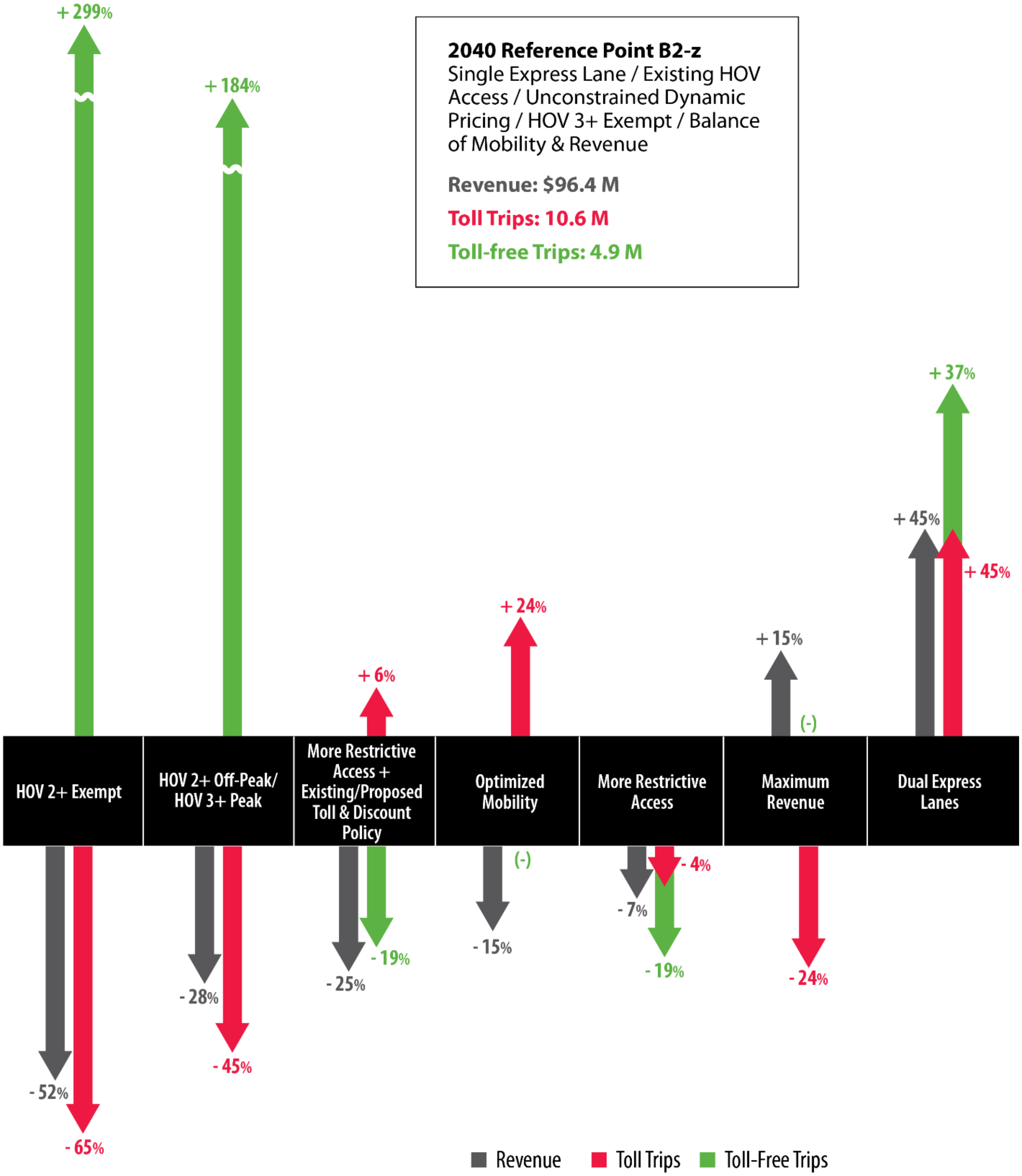


Source: WSP

Observations on Dual Lane Scenario B2 with the Balance of Mobility and Revenue Toll Operating Objective (B2-z) - 2025:

- Adopting the maximum revenue operating objective is the only way to generate more toll revenues (17%) than the reference point B2-z when considering only single lane cases.
- The optimized mobility operating objective increases the number of toll trips by 22%, but results in a 17% decrease in toll revenues due to the scenario's lower toll rates.
- Restricting access to the express lane results in minor reductions in toll trips and toll revenue, 3% and 5% respectively, with a significant decrease in toll-free trips of 20%, which can be attributed to toll-free customers that would otherwise use that lanes for shorter trips if they had access.
- Moving from a full-time HOV3+ exempt policy to an HOV 3+ Peak / HOV 2+ Off-Peak results in a 189% increase in toll-free trips, while toll paying trips decrease by 51% and toll revenues decrease by 33%.
- Reducing occupancy requirements from HOV3+ exempt to HOV2+ exempt full-time results in a 301% increase in toll-free trips, while toll-paying trips decrease by 69% and toll revenues decrease by 60%.

Figure 12-4: Reference Point B2-z 2040 Scenario Variable Comparison



Source: WSP

Observations on Dual Lane Scenario B2 with the Balance of Mobility and Revenue Toll Operating Objective (B2-z) - 2040:

- The difference between B2-z and the HOV2+ exempt scenario (B1-z) decreases in 2040 with toll revenues 52% lower than B2-z compared to 60% in 2025. The reduction in difference between the two scenarios can be attributed to the increase in toll rates B1-z, as toll rates must rise to manage congestion in the lanes, thereby increasing toll revenues.
- The difference between B2-z and the HOV 3+ Peak / HOV 2+ Off-Peak (B3-z) decreases in 2040 as toll trips and toll revenues are only 45% and 28% lower than B2-z compared to 51% and 33% lower in 2025. The increase in tolled trips can be attributed to increasing congestion in the corridor, with the express lane providing a value that customers are willing to pay for.

12.1.3 SENSITIVITY TEST RESULTS - ADDITIONAL ANALYSIS

Additional tables displaying the effects of changing individual variables between toll scenarios are provided on the following pages.

Figure 12-5: Dual Lane Scenario Sensitivity Analysis – 2025 Summary Table

2025 | Changing Variable Impacts on Dual Lane Scenarios | I-405 Sepulveda Pass Express Lane Toll T&R Study

Scenario	Lane Configur-ation	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objective	Revenue *% variance / F2z*	Toll Trips *% variance / F2z*	Toll-Free Trips *% variance / F2z*	Average Revenue / Trip *% variance / F2z*
F1-z				HOV 2+ Exempt		$20.8 M *– 67%*	4.6 M *– 61%*	24.8 M *+ 329%*	$4.53 *– 15%*
B2-z	Single Express Lane					$34.7 M *– 46%*	7.7 M *– 35%*	4.3 M *– 26%*	$4.50 *– 16%*
F2-y					Optimized Mobility	$38.4 M *– 40%*	16.4 M *+ 38%*	5.8 M —	$2.13 *– 60%*
H3-z				HOV 2+ Off-Peak / HOV 3+ Peak		$43.4 M *– 32%*	8.7 M *– 27%*	12.5 M *+ 117%*	$5.00 *– 7%*
E2-z			Existing / Proposed Toll & Discount Policy			$49.1 M *– 23%*	13.4 M *+ 13%*	5.8 M —	$3.66 *– 32%*
H2-z		More Restrictive Access				$60.2 M *– 6%*	11.7 M *– 2%*	4.7 M *– 19%*	$5.16 *– 4%*
F2-z	**Dual Express Lanes**	Existing HOV Access	**Unconstrained Dynamic Pricing**	**HOV 3+ Exempt**	**Balance of Mobility & Revenue**	**$63.7 M**	**11.9 M**	**5.8 M**	**$5.35**
F2-x					Maximum Revenue	$89.1 M *+ 40%*	7.4 M *– 38%*	5.8 M —	$11.98 *+ 124%*

Source: WSP

Figure 12-6: Single Lane Scenario Sensitivity Analysis – 2025 Summary Table

2025 | Changing Variable Impacts on Single Lane Scenarios

Scenario	Lane Configur-ation	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objective	Revenue *% variance / B2z*	Toll Trips *% variance / B2z*	Toll-Free Trips *% variance / B2z*	Average Revenue / Trip *% variance / B2z*
B1-z				HOV 2+ Exempt		$13.8 M *– 60%*	2.4 M *– 69%*	17.1 M *+ 301%*	$5.87 *+ 30%*
B3-z				HOV 2+ Off-Peak / HOV 3+ Peak		$23.1 M *– 33%*	3.8 M *– 51%*	12.3 M *+ 189%*	$6.07 *+ 35%*
C2-z		More Restrictive Access	Existing / Proposed Toll & Discount Policy			$26.8 M *– 23%*	8.2 M *+ 6%*	3.4 M *– 20%*	$3.27 *– 27%*
B2-y					Optimized Mobility	$28.8 M *– 17%*	9.4 M *+ 22%*	4.3 M *—*	$3.06 *– 32%*
D2-z		More Restrictive Access				$32.8 M *– 5%*	7.4 M *– 3%*	3.4 M *– 20%*	$4.41 *– 2%*
B2-z	**Single Express Lane**	Existing HOV Access	**Unconstrained Dynamic Pricing**	**HOV 3+ Exempt**	**Balance of Mobility & Revenue**	**$34.7 M**	**7.7 M**	**4.3 M**	**$4.50**
B2-x					Maximum Revenue	$40.5 M *+ 17%*	6.0 M *– 22%*	4.3 M *—*	$6.74 *+ 50%*
F2-z	Dual Express Lanes					$63.7 M *+ 84%*	11.9 M *+ 55%*	5.8 M *+ 36%*	$5.35 *+ 19%*

Source: WSP

Figure 12-7: Dual Lane Scenario Sensitivity Analysis – 2040 Summary Table

2040 | Changing Variable Impacts on Dual Lane Scenarios | I-405 Sepulveda Pass Express Lane Toll T&R Study

Scenario	Lane Configur-ation	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objective	Revenue *% variance / F2z*	Toll Trips *% variance / F2z*	Toll-Free Trips *% variance / F2z*	Average Revenue / Trip *% variance / F2z*
F1-z				HOV 2+ Exempt		$50.9 M *– 64%*	6.5 M *– 58%*	28.7 M *+ 329%*	$7.80 *– 14%*
B2-z	Single Express Lane					$96.4 M *– 31%*	10.6 M *– 31%*	4.9 M *– 27%*	$9.12 *+ 0%*
F2-y					Optimized Mobility	$83.6 M *– 40%*	21.3 M *+ 39%*	6.7 M —	$3.92 *– 57%*
H3-z				HOV 2+ Off-Peak / HOV 3+ Peak		$97.4 M *– 30%*	11.5 M *– 25%*	14.4 M *+ 115%*	$8.44 *– 7%*
E2-z			Existing / Proposed Toll & Discount Policy			$112.2 M *– 20%*	17.5 M *+ 14%*	6.7 M —	$6.40 *– 30%*
H2-z		More Restrictive Access				$130.5 M *– 6%*	15.1 M *– 2%*	5.4 M *– 19%*	$8.67 *– 5%*
F2-z	**Dual Express Lanes**	Existing HOV Access	**Unconstrained Dynamic Pricing**	**HOV 3+ Exempt**	**Balance of Mobility & Revenue**	**$139.6 M**	**15.4 M**	**6.7 M**	**$9.09**
F2-x					Maximum Revenue	$195.5 M *+ 40%*	9.4 M *– 39%*	6.7 M —	$20.83 *+ 129%*

Source: WSP

Figure 12-8: Single Lane Scenario Sensitivity Analysis – 2040 Summary Table

2040 | Changing Variable Impacts on Single Lane Scenarios | I-405 Sepulveda Pass Express Lane Toll T&R Study

Scenario	Lane Configur-ation	Access Method	Toll Policy	HOV Toll Exemption	Toll Operating Objective	Revenue *% variance / B2z*	Toll Trips *% variance / B2z*	Toll-Free Trips *% variance / B2z*	Average Revenue / Trip *% variance / B2z*
B1-z				HOV 2+ Exempt		$46.2 M *– 52%*	3.8 M *– 65%*	19.5 M *+ 299%*	$12.30 *+ 35%*
B3-z				HOV 2+ Off-Peak / HOV 3+ Peak		$69.6 M *– 28%*	5.8 M *– 45%*	13.9 M *+ 184%*	$11.94 *+ 31%*
C2-z		More Restrictive Access	Existing / Proposed Toll & Discount Policy			$72.6 M *– 25%*	11.2 M *+ 6%*	3.9 M *– 19%*	$6.49 *– 29%*
B2-y					Optimized Mobility	$81.5 M *– 15%*	13.1 M *+ 24%*	4.9 M *—*	$6.23 *– 32%*
D2-z		More Restrictive Access				$90.0 M *– 7%*	10.2 M *– 4%*	3.9 M *– 19%*	$8.85 *– 3%*
B2-z	**Single Express Lane**	Existing HOV Access	**Unconstrained Dynamic Pricing**	**HOV 3+ Exempt**	**Balance of Mobility & Revenue**	**$96.4 M**	**10.6 M**	**4.9 M**	**$9.12**
B2-x					Maximum Revenue	$111.3 M *+ 15%*	8.1 M *– 24%*	4.9 M *—*	$13.80 *+ 51%*
F2-z	Dual Express Lanes					$139.6 M *+ 45%*	15.4 M *+ 45%*	6.7 M *+ 37%*	$9.09 *– 0%*

Source: WSP

13.0 KEY TRAFFIC & REVENUE FINDINGS

As described in the preceding sections, the travel demand and toll optimization modeling yielded a wide range of traffic operations and revenue related performance measures. These performance measures provided the basis for the detailed evaluation of the selected toll scenarios, as described previously, for the differing tolling objectives, as well as the sensitivity analysis. The results of the detailed evaluation were quantified in the preceding sections for each of the primary evaluation techniques and analysis objectives. This section consolidates the analysis results and summarizes key findings based on the range of traffic and revenue performance measures considered as part of the detailed evaluation.

13.1 LEVEL OF SERVICE

- Under the baseline No-Build condition with the existing HOV2+ toll policy, the I-405 HOV lanes are forecasted to have degraded level of service (LOS) 20-25% of the time during the AM peak period in the southbound direction, and 10% of the time during the PM peak period in the northbound direction.
- The southbound direction in the AM peak period would continue to exhibit LOS degradation under Scenario F1 with dual express lanes operating with an HOV 2+ toll exemption, or any other case with single or dual express lanes operating with a peak period HOV 2+ exemption. For Scenario F1, this expected to be close to 40% of the time during the AM peak period. While this scenario has more capacity than the baseline No-Build condition, the additional space would be filled by both toll exempt HOV 2+ vehicles and tolled SOVs.
- Scenario E2 with dual express lanes operating with an HOV3+ toll exemption and employing a policy whereby HOV 2 vehicles and clean air vehicles would receive a 50% toll discount during peak periods is also expected to have some LOS degradation in the AM peak period, roughly 7% of the time.
- LOS degradation / breaches occur on select segments of the corridor only under HOV 2+ toll exemption operations, and typically, but not exclusively, during the AM and PM peak periods. The percentage of the time the express lane LOS is breached under the optimized mobility toll objective is higher than under the revenue maximization objective.
- In general, an HOV2+ toll exemption policy during peak periods would generate moderate to significant express lane LOS degradation.

13.2 TRAVEL TIMES

- The travel time savings offered by express lanes are greatest under the HOV 3+ scenarios where HOV 2 vehicles are not allowed free access, which conversely results in the longest GP lane travel times.

- In addition, the revenue maximization toll objective provides a travel time advantage over the mobility optimization objective, with the higher tolls of the former objective causing fewer travelers to pay, thereby easing demand and improving flow in the express lanes.
- In the dual express lane, peak period HOV3+ exempt scenarios (E2, F2, and F3), the revenue maximization tolling objective bookend yields GP lane travel times reaching over 60 minutes in the AM peak period southbound, thereby providing express lane travel time savings of over 50 minutes. Express lane travel times are higher, GP travel times lower, and the time savings of the former smaller under the mobility optimized and balanced tolling objectives.
- When the express lanes are simulated under the mobility optimized tolling objective, the AM peak southbound GP lane travel times show 10-20 minutes of improvement (reduction) relative to the baseline conditions.

13.3 TRAVEL SPEEDS

- In 2016, the average HOV lane travel speed was only 25 to 35 mph in the peak period and direction.
- When the existing HOV 2+ lane is converted to a single express lane (assumed to operate at HOV 3+ at least in the peak periods) or widened to include dual express lanes, travel speeds are anticipated to be improved to at least 59 mph under all six toll scenarios.
- In addition, GP lane travel speeds are also expected to improve or remain consistent, due to the additional capacity and congestion reduction offered by toll paying SOV drivers. As shown in the **Figure 8-12**, the greatest express lane travel speeds are offered by the Dual express lanes HOV3+ scenario under the revenue maximization objective (70 mph).

13.4 WEEKDAY TOLL RATES, TRAFFIC AND REVENUE

- Revenue is always higher under the toll revenue maximization objective than under the corridor optimized mobility objective that seeks to minimize the total delay costs incurred by users of both the GP and express lane users in the aggregate.
- GP lane speeds are higher under the optimized mobility objective than under the revenue maximization objective.
- Toll revenues are higher, and GP lane speeds are typically lower, when operated with the HOV 3+ carpool exemption policy, compared to the HOV 2+ carpool policy. However, the HOV 2+ exemption policy does not effectively manage demand, traffic flow and travel speeds in the express lanes at peak times and directions.
- Further restricting access to the express lanes from the existing HOV access locations to a subset selection of ingress/egress points only modestly reduces toll-paying customers and associated revenue opportunities by excluding certain shorter segment trips.

- Implementing policies that provide discounts for selected user groups (e.g., clean air vehicles and/or HOV 2 carpools when an HOV 3+ exemption is in effect) increases express lane demand; the increase in demand causes the base toll rates to increase while the discounts offered to certain user groups somewhat reduces overall revenue yields.
- Imposing a maximum toll that increases annually by $0.30 per mile in accordance with the Metro ExpressLanes Toll Policy (revised January 20, 2016) does not prove to be a binding constraint, especially in the dual lane scenarios, and therefore has a minimal impact on revenue projections. Rather, it is the discounts that are combined with the maximum toll in the "Existing/Proposed Metro Toll & Discount Policies" case that causes Scenario E2 to have lower revenue than the unconstrained pricing cases.
- The distribution of revenue by daily time-period does not vary appreciably between the maximum revenue and optimized mobility toll operating objectives.
- Toll trips are higher in the southbound direction in the AM peak period, and higher northbound in the PM peak period, reflecting the current trip origin-destination patterns and peaking characteristics by time of day.
- Despite higher peak direction toll rates and demand during the three-hour AM peak period, more toll trips are served and toll revenues are generated in the three-hour PM peak period than in the morning period due to more evenly spread peak conditions over the evening three hours and greater directional balance (higher afternoon/evening demand levels in the "non-peak" southbound direction than in the morning northbound).
- While daily toll trips are generally directionally balanced across the six scenarios, southbound toll revenues exceed northbound revenues in all of the scenarios and toll operating objective cases, consistent with the above peak period findings.
- For forecast year 2025, average toll rates per mile in the AM and PM peak periods by direction — when expressed in constant 2016 dollars — do not vary materially from the comparable average toll rates in the AM and PM peak periods that are observed on the I-110 ExpressLanes today.
- Under dual express lane Scenario F2, the typical toll cost for a full corridor trip of 10.21 miles southbound in the AM peak period in the year 2025 — in year of collection dollars — would range from $6.53 (Optimized Mobility toll operating objective) to $30.12 (Maximum Revenue toll operating objective), with the Balance of Mobility and Revenue case averaging about $16.00 or $1.57 per mile.
    - This is equivalent to a range of $5.31 to $24.71 in current (2016) dollars, with the balanced case at about $13.00, or $1.28 per mile.

- Under dual express lane Scenario F2, the typical toll cost for a full corridor trip of 10.21 miles southbound in the AM peak period in the year 2040 — in year of collection dollars — would range from $11.23 (Optimized Mobility toll operating objective) to $55.85 (Maximum Revenue toll operating objective), with the Balance of Mobility and Revenue case averaging about $29.10 or $2.85 per mile.

  - This is equivalent to a range of $6.64 to $32.67 in current (2016) dollars, with the balanced case at about $17.05, or $1.67 per mile.

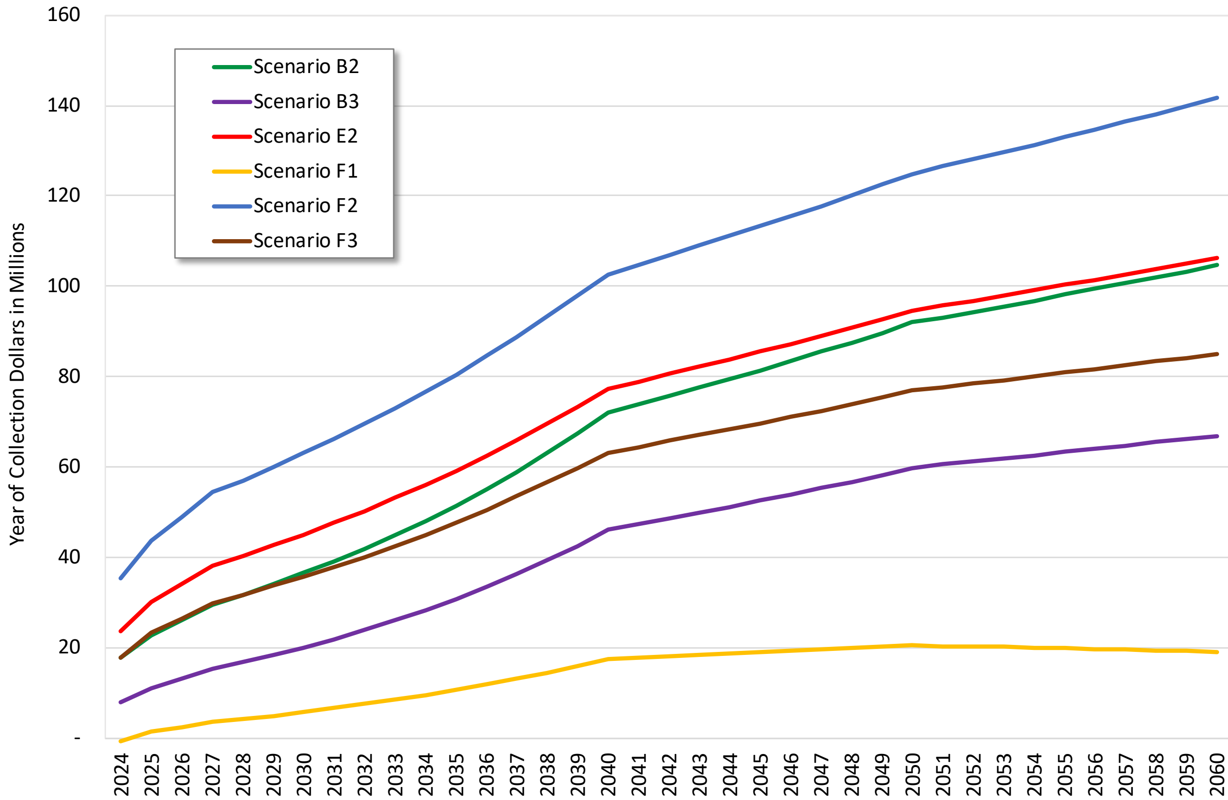
13.5 ANNUAL POTENTIAL GROSS TOLL REVENUES

- Annual potential gross toll revenues were forecasted out through 2060 in year of collection dollars, with both traffic growth rates and general price inflation forecasts dampened substantially after 2040.
- Potential gross toll revenues in year 2025 (in year of collection dollars inclusive of ramp-up adjustments) range from about $21 M under the mobility optimization tolling objective to $25 M under the maximum revenue tolling objective for the lowest single express lane case, Scenario B3, and from about $38 M under the mobility optimization tolling objective to $89 M under the maximum revenue tolling objective for the highest dual lane case, Scenario F2
  - The 2025 gross revenues for Scenarios B3 and F2 under the balance of mobility and revenue objective are $23 M and $64 M, respectively.
- By 2040, the year of collection dollar revenue ranges across the tolling operating objectives for Scenarios B3 and F2 range from about $63 M to $ 77 M and from about $84 M to $196 M, respectively.
  - The 2040 gross revenues for Scenarios B3 and F2 under the balance of mobility and revenue objective are about $70 M and $140 M, respectively.

13.6 ANNUAL NET REVENUE PROJECTIONS

- Revenue adjustments associated with estimated costs of facility operations and maintenance, toll collection, ramp-up, enforcement, leakage, and violations were accounted for in each of the six scenarios for each of the three toll operating objectives.
  - Toll collection and facility O&M costs were based on the existing I-10 and I-110 ExpressLane operations and industry benchmarks, with some adjustments for economies of scale from adding I-405 to the existing LA Metro express lane network.
  - Detailed gross-to-net revenue tables for all 18 cases are provided in **Appendix E**.
  - **Figure 13-1** illustrates the net revenue projections for the six toll scenarios under the balance of mobility and revenue toll operating objective.

Figure 13-1: Net Revenue Projections by Scenario



- There are two cases in which net toll revenues after adjustments and operating costs are negative in the first year of operations. Both occur under Scenario F1 which pairs dual express lanes with an HOV 2+ exemption policy for the mobility optimized and maximum revenue toll operating objectives.
  - Scenario F1 with mobility optimized tolls has negative net revenues of $4.67 million in 2024 and isn't projected to achieve positive net revenues until the ninth year of operations, with $0.18 million of net revenue in 2032.
  - The optimized mobility objective results in more total toll and HOV trips than the other two objectives, which causes the per transaction costs to drive overall toll collection costs above the other cases, especially with dual lanes and HOV 2+ toll exempt.
  - Toll-free trips in the opening year outnumber toll trips by a factor of nearly 5:1, which when combined with its low average revenue per toll trip, limits the gross toll revenue potential this case.
  - The dual lane configuration also has higher facility maintenance costs relative to single lane cases, though that is constant across the three F1 operating objective cases.

  - Scenario F1 with the balance of mobility and revenue tolls has negative net revenues of $1.83 million in 2024, in part due to the downward adjustment in revenues for ramp-up effects in the early years of operations. However, this case is expected to yield $0.17 million in net revenues by the second year, 2025, and remain in the black thereafter.
  - Higher average revenue per toll trip (average toll rates) allow Scenario F1 with the balanced tolls to overcome factors contributing to higher O&M costs early in the forecast period.
- The HOV occupancy exemption policy is the most significant determinant of net revenue among the six selected scenarios.
  - Scenario F2, which pairs dual express lanes with an HOV 3+ exemption policy, when operating under the maximum revenue objective, is projected to generate net revenues in excess of $154 million in 2040.
  - Shifting to the other bookend, the optimized mobility operating objective, Scenario F2 is projected to achieve $48 million in net revenues in 2040, with the balance of mobility and revenue objective (Scenario F2z) in the middle at about $101 million in 2040.
  - By comparison, Scenario F1 under the same three toll operating objectives but with an HOV 2+ exemption policy, generates $6.5 M, $15 M, and $24 M, for the mobility optimized, balanced, and maximum revenue cases, respectively, in 2040, which are orders of magnitude less than their HOV 3+ counterparts.
- The hybrid Scenario set of F3, which employs an HOV 2+ exemption at off-peak times and an HOV 3+ exemption during peak periods, yields net revenues that fall in-between the HOV 2+ and HOV 3+ exemption cases, but slightly closer to the higher HOV 3+ exemption case.
- Compared to dual lane Scenario F2 under the balanced objective:
  - Reducing occupancy requirements for a toll exemption from HOV 3+ to HOV 2+ in Scenario F1 leads to a significant reduction in toll trips and toll revenues, 61% and 67% respectively. However, toll-free trips increase by 329%.
  - Restricting access to the express lanes has a minor impact on toll trips and toll revenues with a 6% reduction in revenue and a 2% reduction in toll trips. Access restrictions have a more significant impact on toll-free trips, reducing them by 19%.
  - Permitting HOV2+ toll-free access during off-peak periods while maintaining the HOV3+ toll exempt requirement during peak periods increases toll-free trips by 117% while reducing toll-paying trips by 27% and toll revenues by 32%.
  - Maintaining the Existing/Proposed Toll & Discount Policy instead of shifting to an unconstrained dynamic pricing policy leads to a 13% increase in toll trips and a 23% reduction in toll revenues. This discrepancy between an increase in toll traffic and a decrease in toll revenues can be attributed to the toll rate cap being reached under the Existing/Proposed Toll & Discount Policy and customers not being dissuaded from using the lanes. The higher revenues in the unconstrained dynamic pricing scenario

highlight customers' willingness to pay for a fast and reliable trip. Toll-free trips do not change despite the change in toll policy, as toll-free travelers are assumed to be insensitive to toll pricing policies.

- Reducing the number of express lanes from two (2) to one (1) reduces toll revenue by 46%, while reducing toll trips and toll-free trips by 35% and 26% respectively.

- The most significant change relative to dual lane Scenario F2 with the balanced toll operating objective between 2025 and 2040 is the difference in toll revenues between the dual and single lane (B2-z) scenarios.
  - In 2025, single lane revenues are 46% lower than the comparable dual lane scenario.
  - By 2040, single lane revenues are only 31% lower than comparable dual lane scenario.
  - The increase in revenues for the single lane scenario relative to the dual lane scenario can be attributed to the increasing value of the space in the single lane. As the single express lane becomes more congested, tolls must rise to maintain travel speeds and customers are willing to pay more for that faster trip. The dual lanes have more capacity and thus do not see toll rates grow at as rapid of a pace as the single lane cases do.
- Compared to single lane Scenario B2 under the balanced objective:
  - Adopting the maximum revenue operating objective is the only way to generate more toll revenues (17%) than the reference point B2-z when considering only single lane cases.
  - The optimized mobility operating objective increases the number of toll trips by 22%, but results in a 17% decrease in toll revenues due to the scenario's lower toll rates.
  - Restricting access to the express lane results in minor reductions in toll trips and toll revenue, 3% and 5% respectively, with a significant, decrease in toll-free trips of 20%, which can be attributed to toll-free customers that would use that lanes for shorter trips if they had access.
  - Moving from a full-time HOV3+ exempt policy to an HOV 3+ Peak / HOV 2+ Off-Peak results in a 189% increase in toll-free trips, while toll paying trips decrease by 51% and toll revenues decrease by 33%.
  - Reducing occupancy requirements from HOV3+ exempt to HOV2+ exempt full-time results in a 301% increase in toll-free trips, while toll-paying trips decrease by 69% and toll revenues decrease by 60%.
  - The difference between HOV 3+ exemption in Scenario B2 and the HOV2+ exempt scenario (B1) decreases in 2040 with toll revenues 52% lower than B2 compared to 60% in 2025. The reduction in difference between the two scenarios can be attributed to the increase in toll rates B1, as toll rates must rise to manage congestion in the lanes, thereby increasing toll revenues.

- The difference between B2 and the HOV 3+ Peak / HOV 2+ Off-Peak (B3-z) decreases in 2040 as toll trips and toll revenues are only 45% and 28% lower than B2-z compared to

51% and 33% lower in 2025. The increase in tolled trips can be attributed to increasing congestion in the corridor, with the express lane providing a value that customers are willing to pay for.

14.0 NEXT STEPS

The I-405 Sepulveda Pass ExpressLanes Intermediate (Level 2) Traffic & Revenue Study provides preliminary information on the feasibility of an express lane solution through the I-405 Sepulveda Pass. Although the study provides important information and key findings allowing decision makers to gauge the viability of express lanes on the I-405, more detailed investigations, technical analysis, and design is required as part of a project development process. The project development process for the I-405 express lanes would include several phases and major work efforts prior to project deployment. As part of a future project development process, multiple methods for project delivery and phasing may be considered.

14.1 PROJECT DEVELOPMENT PROCESS

Any future project development process for express lanes on the I-405 will be dictated by a standard progression of formal steps regulated by Caltrans, to guide the project from feasibility analysis to operation. Highlights of a potential Caltrans project development process for I-405 express lanes are listed below.

1. Project Study Report (PSR)
2. Concept of Operations
3. Project Approval and Environmental Document (PAED)
4. Final Design / PS&E
5. Right-of-Way Acquisition
6. Construction Procurement
7. Construction & Installation
8. System Testing & Launch

The next phase in the development of I-405 express lanes, following completion of the Level 2 T&R Study, would include the preparation of a Project Study Report (PSR) and the development of a Concept of Operations (ConOps) document. A PSR would include analyzing and defining project purpose and need, performing a detailed investigation of a full range of various project alternatives, better analyzing and defining logical project termini, and calculating traffic performance impacts. A PSR would also include the scoping of physical work, and creating an associated budget and project delivery schedule.

As any express lane project would involve a tolling system and associated ITS infrastructure, a ConOps document would be necessary as part of the project Systems Engineering Analysis (SEA) process outlined by FHWA. The preparation of a ConOps would also provide an opportunity to define desired express lane system parameters and toll policies that could be used to better inform the physical design of the express lane system.

The next step in project development would be the preparation of the Draft Project Report (PR), which is a technical engineering report that describes the project scope of work and further considers design alternatives. A PR involves a greater level of detail than the PSR, which provides a greater understanding of potential issues and impacts. The preparation of the PR would occur concurrently with the Project Acceptance and Environmental Document (PAED) process. The PAED process would entail detailed environmental analysis to determine potential environmental impacts, and identify the least impactful alternative that meets the project purpose and need. Once technical environmental analysis is complete, the Draft PR would be finalized and approved, and the draft PAED document would be circulated and presented publicly at a public hearing. Once public comments are addressed, a preferred alternative would be selected, and the PAED process completed.

Through the selection of a preferred alternative, the completion of the PR would authorize project approval. However, The National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) require the review of environmental impacts caused by infrastructure projects. This would likely trigger the need to prepare an Environmental Impact Statement (EIS) and Environmental Impact Report (EIR), respectively. The environmentally preferred alternative would be identified in a Record of Decision published in the Federal Register.

The PAED process may also indicate the need for an investment grade traffic and revenue study (Level 3) to be completed. A Level 3 T&R analysis may be necessary, depending on the project funding package proposed by the project sponsor. Specifically, the award of a TIFIA loan, bonding mechanisms, or private financing would all require a more detailed traffic and revenue analysis.

Once a locally preferred alternative is selected and approved, the project would enter a Final Design phase, including the preparation of detailed design plans, specifications, and estimates necessary for construction (PS&E). If necessary, right-of-way acquisition, legal agreements, and permitting would also take place concurrent to final design. An investment grade study may include, but not be limited to, the following additional, project-specific efforts:

- Updated, more in-depth state preference survey / value of time study
- Additional trip origin-destination survey / data collection
- Independent, detailed socio-economic (population and employment) forecasts
- Additional traffic data collection on volumes and travel times by time of day, direction and vehicle class
- Updated travel demand modeling, augmented with more refined operational analysis (microsimulation) and toll simulation/optimization/diversion analysis