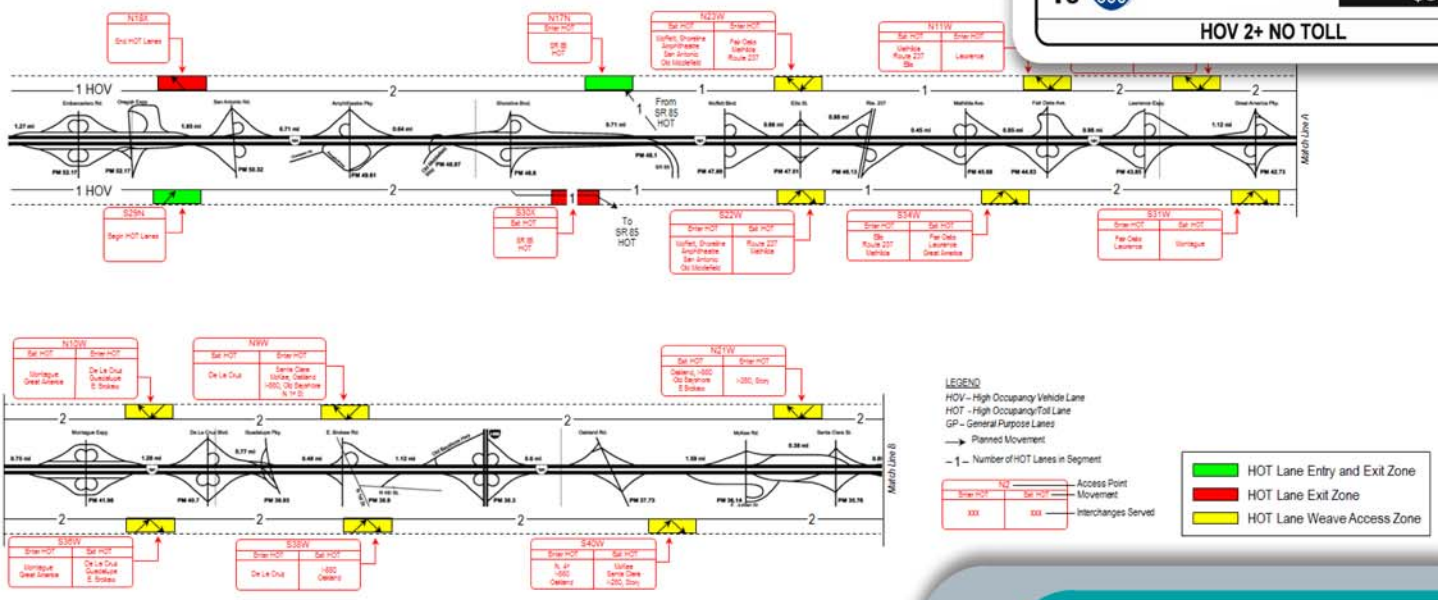
FINAL REPORT



US 101 EXPRESS LANES
EA #04-2G7100
TRAFFIC OPERATIONS ANALYSIS REPORT
FINAL

PREPARED FOR

SANTA CLARA Valley Transportation Authority

Prepared By

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June 3, 2014

US 101 Express Lanes

Traffic Operations Analysis Report

FINAL

Prepared For

Santa Clara Valley Transportation Authority

Prepared By

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(510) 763-2061

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EXECUTIVE SUMMARY

United States Highway 101 (US 101) is a north-south freeway serving local and interregional traffic along the Santa Clara Valley, the Peninsula, and the greater San Francisco Bay Area. Within Santa Clara County, US 101 connect San Benito County to San Mateo County, through the cities of Gilroy, Morgan Hill, San Jose, Santa Clara, Sunnyvale, Mountain View, and Palo Alto. The freeway also connects the San Francisco business district and San Francisco International Airport to San Jose and Silicon Valley to the south. The facility within the project limits typically consists of 3 mixed flow lanes and one high-occupancy vehicle (HOV) lane in each direction, with auxiliary lanes in some locations. It carries up to 256,000 vehicles per day including HOV traffic.

The US 101 Express Lanes Project proposes to convert the existing HOV lanes on US 101 to High Occupancy Toll (HOT) lanes (hereafter known as express lanes) in both directions and widen the freeway to add a second express lane for the majority of the corridor. The project also includes building new express lanes in the northbound direction between East Dunne Avenue and the existing HOV lane at Cochrane Road, and in the southbound direction between Burnett Avenue and East Dunne Avenue. The project also proposes to convert the HOV direct connectors at the northern junction of US 101 and State Route (SR) 85 to express lane operation; restripe the northern 1.1 miles of SR 85 to connect to the buffer constructed by the SR 85 Express Lanes Project; and add auxiliary lanes between the Great America Parkway and Lawrence Expressway interchanges (in both directions), between the Old Bayshore Highway on-ramp and Brokaw Road/1st Street off-ramp (northbound direction), and between the Lawrence Expressway on-ramp and Fair Oaks Avenue off-ramp (northbound direction) to improve future operations in these segments. The overall project limits are from the East Dunne Avenue interchange in Morgan Hill to the Santa Clara/San Mateo County line just north of the Oregon Expressway/Embarcadero Road interchange in Palo Alto. The express lanes facility combines HOV and pricing strategies allowing single occupancy vehicles (SOVs) to gain access to HOV/express lanes by paying a toll.

Assembly Bill 2032 provided legislative authority for Santa Clara Valley Transportation Authority (VTA) to implement and operate two corridors of express lanes within Santa Clara County. The VTA, in coordination with the California Department of Transportation (Caltrans), is implementing the Silicon Valley Express Lanes Program (Program) to provide near-term congestion relief through more effective use of existing roadways, provide a new mobility option, and potentially provide a funding source for transportation improvements within these corridors with any excess revenues.

Work on the development of the US 101 express lanes has been on-going since 2007. Local funds are being used for the Project Approval/Environmental Documentation (PA/ED) phase and final design to progress this important project towards implementation.

Existing Conditions

US 101 between Morgan Hill and Palo Alto exhibits multiple bottlenecks, with significant delays and queuing in both the morning (AM) peak and the afternoon (PM) peak periods. High transportation demand in several segments of the general purpose lanes causes substantial congestion and reduced speeds in these lanes. During the peak periods (6 a.m. to 10 a.m. and 3 p.m. to 7 p.m.), US 101 cannot accommodate all of the traffic demand in the corridor resulting in “bottlenecks” in the general purpose lanes at many freeway segments. High demands also occur in the existing HOV lanes resulting in these lanes also functioning below an acceptable speed.

AM Peak Conditions

During the AM peak period, the following bottleneck locations were observed in the general purpose lanes:

Northbound AM

- Tully Road Loop On-Ramp to Tully Road Diagonal On-Ramp: The queue from this bottleneck forms around 7:10 AM and dissipates by 9:30 AM. It extends back to the Hellyer Avenue On-Ramp (approximately 3.6 miles), overlapping with a secondary bottleneck observed within this queue. The segment between Capitol Expressway On-Ramp and Tully Road Off-Ramp was observed to be a secondary bottleneck.

- Oakland Road On-Ramp to northbound I-880 Off-Ramp: The queue from this bottleneck forms around 7:15 AM and dissipates by 9:30 AM. It extends back to the Alum Rock Ave Off-Ramp (approximately 1.5 miles). At times, the segment between McKee On-Ramp and Old Oakland Rd Off-Ramp was observed to be a secondary bottleneck or even the controlling bottleneck in this area.
- Trimble Road On-Ramp to Montague Expressway Off-Ramp: The queue from this bottleneck forms around 7:10 AM and dissipates by 10:00 AM. It extends back to the Old Bayshore Highway Off-Ramp (approximately 2.5 miles).
- Shoreline Boulevard On-Ramp to northbound Rengstorff Ave Off-Ramp: The queue from this bottleneck forms around 7:00 AM and dissipates by 10:00 AM. It extends back to the Moffett Boulevard Off-Ramp (approximately 1.5 miles).

Southbound AM

- University Avenue On-Ramp and Oregon Expressway Off-Ramp – The queue from this bottleneck forms around 7:45 AM and dissipates by 9:45 AM. It extends beyond the Woodside Road Interchange (approximately 5.0 miles).
- Oregon Expressway On-Ramp to San Antonio Road Off-Ramp: The queue from this minor bottleneck forms around 8:30 AM and dissipates by 9:45 AM and is mainly controlled by the University Avenue to Oregon Expressway bottleneck identified above. It extends approximately 0.5 miles north of the Embarcadero Road Off-Ramp.

High demands also occur in the existing HOV lanes resulting in these lanes also functioning below an acceptable speed which, in turn, diminishes the incentive for drivers to carpool. At the federal level, 23 U.S.C. 166 (d) established a minimum average operating speed that HOV facilities with exempted vehicles must maintain. In the case such as US 101 where the speed limit is 65 mph, the requirement is that the facility operate at a minimum speed of 45 mph during the peak hour no less than 90 percent of the time over a 180-day period. Meanwhile, State AB 2032 (2004) set the requirement that HOV lanes that are converted to express lanes must operate at least at a Level of Service (LOS) C (or LOS D with Caltrans approval), which indicates minimal delays and corresponds to a target threshold of approximately 1,650 vph per HOV lane. The 1,650 vph threshold is intended to provide HOVs with reliable travel time.

Based on tach run data and field investigations, segments of the northbound HOV lane that were observed to be congested during the AM peak include:

- Segment between the Capitol off-ramp and Tully on-ramp;
- Segment between the I-680 On-Ramp and the Old Oakland Off-Ramp;
- Segment between North 1st On-Ramp and the Trimble On-Ramp; and
- Segment between the SR HOV connector and the Rengstorff off-ramp.

These segments generally correspond with the most heavily-congested segments of the general purpose lanes. Field observations indicated that congestion in the HOV lane is due not only to the high demand in the HOV lanes (volumes reach up to 1600-1700 vph), but also due to the friction caused by vehicles moving between the HOV lanes and the heavily-congested general purpose lanes. The merging of HOV's into and out of the HOV lane is reducing the effective capacity of HOV lane in these sections.

Field observations showed no significant congestion in the southbound HOV lane during the AM peak period.

PM Peak Conditions

During the PM peak period the following bottleneck locations were observed in the general purpose lanes:

Northbound PM

- San Antonio Road On-Ramp to Oregon Expressway/Embarcadero Road Off-Ramp: The queue from this bottleneck forms around 3:45 PM and dissipates by 6:45 PM. It extends back to the Ellis Street Off-Ramp (approximately 3.8 miles), overlapping with a secondary bottleneck observed within this queue. The segment between Shoreline Boulevard On-Ramp and northbound Rengstorff Ave Off-Ramp was observed to be a secondary bottleneck.
- Oregon Expressway/Embarcadero Road On-Ramp to University Avenue Off-Ramp: The queue from this bottleneck forms around 3:45 PM and dissipates by 6:30 PM. It extends back through the Oregon Expressway/Embarcadero Road interchange, and is largely controlled by the upstream bottleneck from San Antonio Road to Oregon Expressway described above.

Southbound PM

- Oregon Expressway On-Ramp to San Antonio Road Off-Ramp: The queue from this bottleneck forms around 4:10 PM and dissipates around 7:00 to 7:10 PM. It extends back to between the Marsh Rd and Woodside interchanges (approximately 4.0 mi).
- Rengstorff Avenue On-Ramp to Old Middlefield Way On-Ramp: The queue from this bottleneck forms around 4:10 PM and dissipates around 6:30 to 6:45 PM. It extends beyond the San Antonio Road Off-Ramp (approximately 1.0 mile) where it merges with the queue from Oregon Expressway to San Antonio Road bottleneck identified above.
- De La Cruz Boulevard On-Ramp to State Route 87 Off-Ramp: The queue from this bottleneck forms around 3:15 PM and dissipates by 7:00 PM. It extends back to the Lawrence Expressway Off-Ramp (approximately 3.6 miles) although some data shows the queue extends only to the San Tomas/Montague Expressway interchange.
- Oakland Road On-Ramp to McKee Road Off-Ramp: The queue from this bottleneck forms around 4:10 PM and dissipates by 6:35 PM. It extends beyond the 4th Street on-Ramp (approximately 2.0 miles).
- I-280/I-680 On-Ramp to Tully Off-Ramp – The queue from this bottleneck forms around 3:00 PM and dissipates by 7:00 PM. It extends back to the Santa Clara Street On-Ramp (approximately 2.0 miles).
- Tully Road On-Ramp to Capitol Expressway Off-Ramp– The queue from this bottleneck forms around 4:30 PM and dissipates by 7:00 PM. It extends back to the SB Story Road Off-Ramp (approximately 2.2 miles) where the queue spills over and merges with the queue from the I-280/I/680 bottleneck identified above. A contributing factor to this bottleneck is that the demand for the Capitol/Yerba Buena off-ramp exceeds capacity causing a queue to spillback onto southbound US 101 in the right two lanes.

It was also observed that during the PM peak hour segments of both the northbound and southbound HOV lanes become congested. These segments generally correspond with the most heavily-congested segments of the general purpose lanes. In the northbound direction, congested HOV lane segments include:

- Segment between the Ellis Off-Ramp and the San Antonio On-Ramp; and
- Segment between the Oregon/Embarcadero Off- and On-Ramps.

Southbound, congested HOV lane segments in the PM peak include:

- Segment between the Marsh On-Ramp and the Rengstorff On-Ramp;
- Segment between the Great America Off-Ramp and De La Cruz On-Ramp;
- Segment between the 4th On-Ramp and Old Oakland On-Ramp; and

- Segment between the Santa Clara On-Ramp and Tully On-Ramp.

While HOV lane volumes in the segments listed above approach 1600 vph (with exception of the last southbound segment where the peak is about 1100 vph), field observations indicate that congestion in the northbound and southbound HOV lanes is due primarily to the friction caused by vehicles moving between the HOV lanes and the heavily-congested general purpose lanes. The merging of HOV's into and out of the HOV lane is reducing the effective capacity of HOV lane in these sections.

Projected Travel Demand

Traffic conditions are expected to worsen in the future with continued development in the region and within the US 101 corridor. As noted in VTA's *Valley Transportation Plan 2035*, Santa Clara County is predicted to grow by over 500,000 residents and 400,000 jobs over the next 25 years, increases of 27.5 and 45.6 percent, respectively. Over the same period, the County expects to increase the capacity of the roadway system by 5 to 6 percent.

Traffic on US 101 is also projected to increase in the form of both regional trips going to and from points outside Santa Clara county and local trips to and from locations within the US 101 corridor. The ability to accommodate traffic growth will be constrained by the existing capacity of the freeway. US 101 is bordered by residential, commercial and industrial development throughout most of the project limits. The adjoining land uses limit the potential to expand US 101 to meet existing or future demand without resulting in substantial property acquisitions and residential and business relocations.

Growth in travel demand on US 101 is expected to result in longer periods of time when unacceptable delays persist during both the morning and afternoon peak periods. Congestion will increase in the general purpose lanes, and the HOV lanes will experience delays and no longer provide the travel time benefits intended for the facility. Traffic demand for the northbound HOV lane is expected to increase to about 2,000 vph in 2035 (Caltrans 2011). The resulting delays can reasonably be expected to diminish the public's incentive to carpool or use public transit in the US 101 HOV lanes. The high traffic demand on US 101 and the physical constraints that limit future widening indicate the need to maximize the efficient use of the existing facility to accommodate existing and future traffic levels.

Project Description

The US 101 Express Lanes project consists of converting the existing HOV lane along both northbound and southbound US 101 into an express lane and widening the freeway to add a second express lane for the majority of the corridor. The project also proposes to build new express lanes in the northbound direction between East Dunne Avenue and the existing HOV lane at Cochrane Road, and in the southbound direction from Burnett Avenue to East Dunne Avenue. Furthermore, the project also proposes to convert the HOV direct connectors at the northern junction of US 101 and SR 85 to express lane operation, and add auxiliary lanes between the Great America Parkway and Lawrence Expressway interchanges (in both directions), between the Old Bayshore Highway on-ramp and Brokaw Road/1st Street off-ramp (northbound direction) and between the Lawrence Expressway on-ramp and Fair Oaks Avenue off-ramp (northbound direction) to improve future operations in these segments. At the southern junction between US 101 and SR 85 in south San Jose, the direct connectors from SR 85 to US 101 will be converted to express lane connectors by the SR 85 Express Lanes Project (EA 04-4A7900). The express lanes would allow HOVs to continue to use the lanes without cost and eligible single-occupant vehicles (SOVs) to pay a toll.

The improvements will result in a one- or two-lane limited access express lane facility in both directions extending from the East Dunne Avenue interchange in Morgan Hill to just south of the Oregon Expressway/Embarcadero Road interchange in Palo Alto in both directions. The limits of the single and double express lanes segments are as follows:

Northbound direction:

- Single express lane from East Dunne Avenue to Cochrane Road
- Double express lanes from Cochrane Road to SR 85 in south San Jose
- Single express lane from SR 85 in south San Jose to Blossom Hill Road

- Double express lanes from Blossom Hill Road to North Fair Oaks Avenue
- Single express lane from North Fair Oaks Avenue to SR 85 in Mountain View
- Double express lane from SR 85 in Mountain View to San Antonio Road
- Single express lane from San Antonio Road to Oregon Expressway/Embarcadero Road

Southbound direction

- Single express lane from Oregon Expressway/Embarcadero Road to San Antonio Road
- Double express lanes from San Antonio Road to SR 85 in Mountain View
- Single express lane from SR 85 in Mountain View to North Mathilda Avenue
- Double express lanes from North Mathilda Avenue to Blossom Hill Road
- Single express lane from Blossom Hill Road to SR 85 in south San Jose
- Double express lanes from SR 85 in south San Jose to Cochrane Road
- Single express lane from Cochrane Road to East Dunne Avenue

The overall project limits are from the East Dunne Avenue interchange in Morgan Hill to the Santa Clara/San Mateo County line just north of the Oregon Expressway/Embarcadero Road interchange in Palo Alto. These project limits encompass the majority of the urbanized length of US 101 within Santa Clara County, including the locations where congestion currently occurs and the need for additional capacity or operational improvement exists.

At the south end, a single northbound express lane opens just north of East Dunne Avenue and a second express lane is introduced at the Cochrane Road interchange. In the southbound direction, the second express lane turns into a general purpose lane and the rightmost general purpose lane is dropped at the Cochrane off-ramp. The remaining express lane then turns into a general purpose lane just north of the East Dunne Avenue interchange and the rightmost general purpose lane is dropped at the East Dunne off-ramp. It should be noted that for 2035, it was assumed that US 101 would be widened south of this area to accommodate an extension of the HOV lane; thus, the second express lane would transition to an HOV-only lane rather than a general purpose lane in 2035. The southern project limits near East Dunne Avenue were therefore selected to accommodate installation of signage south of the limits of construction of the express lanes. At the north end of the project within Santa Clara County, US 101 is physically constrained by land use development on both sides, and additional pavement needed to extend the express lanes farther to the north cannot be accommodated without significant additional right-of-way, environmental, and construction costs. The northern limits of construction would be just south of the Oregon Expressway/Embarcadero Road interchange. To allow flexibility for placement of signage, the limits of the project were set just north of the Oregon Expressway/Embarcadero Road interchange.

As described above, both the northbound and southbound HOV direct connectors at the northern junction between US 101 and SR 85 in Mountain View will be converted to express connectors as part of the US 101 Express Lanes project. This will include restriping the northern 1.1 miles of SR 85 between the proposed terminus of the SR 85 Express Lanes project and the SR 85/US 101 Interchange to connect the SR 85 express lanes to the US 101 express lanes.

The express lanes would be adjacent to the center median and separated from the general purpose lanes by a striped buffer zone. The buffer zone would have gaps in multiple locations where vehicles can enter and exit the facility (called “access points”). The design approach being taken for US 101 differs slightly from that currently being applied by Caltrans and MTC to other express lane facilities that together form the Bay Area Express Lane network. For those facilities, the design approach emphasizes an open access system (via continuous access striping) except where access is limited via buffer striping or double white solid striping, as necessary, to enhance or preserve operational efficiency and traffic safety.

The open access system is intended to provide more adequate gaps in traffic stream and easier merging and weaving between the Express Lane and the general purpose lanes for vehicles and transit vehicles, specifically in segments where only a single Express Lane is proposed, or when freeway interchanges are closely spaced. Controlled access will be provided to manage congestion where excessive weaving or conflict is expected with general purpose lanes. Additional benefits to open access include:

- Reduce signage clutter
- Better public acceptance
- Greater driver familiarity
- Eliminate need for 2-foot buffer and associated widening.
- Enhanced maneuverability and easier access, specifically during off-peak hours
- Regional Express Lane consistency

The design approach for US 101, as described in this report, reflects a restrictive access scenario which will be reduced by maintaining as much of the existing continuous access striping scheme during the design phase of this project.

Near-term Benefits

The ultimate goal of the project is to provide congestion relief within the US 101 corridor. This Traffic Operations Analysis Report (TOAR) examines both near-term conditions in the 2015 opening year and 20-year future conditions with a 2035 horizon year. The operating conditions were analyzed using the VISSIM micro-simulation tool with assumptions regarding how dynamic pricing implemented during the AM and PM peak periods would influence demand for the study years.

As noted in the TOAR, the 2015 horizon year analysis shows the following improvement in operations:

AM Peak Period (northbound direction)

- 55% reduction in total hours of delay
- 58% reduction in average delay
- 53% increase in average speed

PM Peak Period (southbound direction)

- 6% reduction in total hours of delay
- 8% reduction in average delay
- 7% increase in average speed

In the offpeak direction in each period, the conditions expected under No Build and Build alternatives are more comparable. This is a reflection of the fact that there is little or no congestion in the offpeak direction and that traffic operates generally at free flow speeds. However, the Build alternative does produce a modest reduction in vehicle hours of delay in the northbound direction during the PM peak period (-121 VHD or -11%). Overall, the proposed US 101 express lanes are expected to produce a reduction of 12,639 vehicle hours of delay combined during the AM and PM peak periods of a typical weekday in 2015.

It is important to recognize that these operational improvements are achieved while serving significantly higher VMT, as well as higher vehicular and person throughput. These increases in VMT and throughput are, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities.

These near-term benefits are achieved by allowing more traffic into the express lanes during the earlier hours of the peak period to minimize the build-up of the congestion in the general purpose lanes. In the peak direction of each period, the proposed project provides travel time savings over the No Build condition for users in both the general purpose and express lanes. For example, the proposed project will result in about an 18 minute reduction in travel time over the length of the corridor within the general purpose lanes and about a 5.5 minute reduction in the HOV/express lane compared to No Build in the AM peak hour (7-8 AM).

In 2015, the express lanes are expected to operate at speeds of 45 mph or higher and LOS D or better in both directions during both peak periods with the exception of the McKee-Santa Clara access zone in the northbound direction which is projected to drop to 40 mph and operate at LOS E during the AM peak period. In addition to the McKee-Santa Clara access zone, the short section immediately downstream of it and the segment from SR 237 on to Ellis off are also forecasted to operate at LOS E. While these operating conditions do not meet standards established in federal and state laws, they are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

For reference, the HOV lane in the peak direction under the No Build alternative is expected to slow to speeds below 50 mph, and degrade to LOS E or F, in several areas in both peak periods.

Long-term Benefits

By 2035, conditions on US 101 are expected to worsen due to increased demand. This is reflected in increased congestion levels and delays. And while the US 101 Express Lanes Project alone will not solve these congestion problems, the analysis shows that proposed project offers significant benefits.

As noted in the TOAR, the 2035 horizon year analysis shows the following improvement in operations:

AM Peak Period (northbound direction)

- 4% reduction in total hours of delay
- 6% reduction in average delay
- 11% increase in average speed

PM Peak Period (southbound direction)

- 13% reduction in total hours of delay
- 18% reduction in average delay
- 23% increase in average speed

In the offpeak direction in each period, the Build alternative also produces a reduction in vehicle hours of delay (-3,501 VHD or -24% in the southbound direction during the AM peak period, and -530 VHD or -16% in the northbound direction during the PM peak period).

It is important to recognize that these delay reductions are achieved while also serving significantly higher VMT and both vehicular and person throughput. The increase in VMT and throughput are, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. Overall, the proposed US 101 express lanes are expected to produce a reduction of 13,546 vehicle hours of delay combined during the AM and PM peak periods of a typical weekday in 2035.

Again, these benefits are achieved by allowing more traffic into the express lanes to minimize the build-up of the congestion in the general purpose lanes. In the peak direction of each period, the proposed project provides travel time savings over the No Build condition for users in both the general purpose and express lanes. For example, the proposed project will result in nearly a 12 minute reduction in travel time over the length of the corridor within both the general purpose lanes and the HOV/express lane compared to No Build in the AM peak hour (7-8 AM). In both cases, the majority of the savings occur within the segment between Bernal road and the I-880 junction.

For 2035, the express lanes between access zones are expected operate at speeds over 45 mph and LOS D or better in both directions during both peak periods, with limited exceptions. In the AM peak, speeds in the northbound express lanes are expected to drop below 45 mph in six access zones plus the short section downstream of the Santa Clara access zone and the one immediately upstream of the Brokaw access zone. In the southbound direction during the PM peak, speeds below 45 mph are expected within the start transition zone, two access zones (Ellis and Mathilda), and the single-lane section just north of the Ellis access zone. Meanwhile, the Montague-De La Cruz and Oakland-Mabury/Taylor access zones are expected to operate at speeds above 45 mph, but at LOS E during the middle two hours. For reference, the HOV lane in the peak direction under the No Build alternative is expected to operate at speeds below 45 mph and at LOS E or worse in numerous locations in both peak periods in 2035.

While these operating conditions do not meet standards established in federal and state laws, they are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

It should also be noted that unlike other freeway improvement projects, express lanes projects have the ability to generate potential revenue from the tolls collected from SOV users. Any excess revenue generated by the project could be used to help fund other potential future improvements.

Successful Deployment

Successful deployment of the US 101 express lanes is highly dependent upon the following components:

- Vehicle detection devices to monitor traffic conditions in both the general purpose lanes and the express lanes. These detectors are being placed at strategic locations at the entrances and exits and at intermediate points.
- A central monitoring system that will use a dynamic pricing algorithm to vary the toll price to use the express lanes based on the measured congestion levels in both the express lanes and adjacent general purpose lanes. Multiple user/operator-adjustable variables are included in the algorithm such as maximum toll rate, minimum toll rate, rate of toll change, hours of operations, and opening/closing the express lanes to SOV traffic. The setting of these variables will directly influence the usage of the express lanes and consequently how the corridor operates.
- Reporting tools to be provided by the central monitoring system that will provide a feedback mechanism to the VTA staff to evaluate how the corridor is operating, to facilitate decisions on the adjustments to implement, and to help determine how to best address future needs within the corridor.

With these possible future changes, the VTA anticipates the ability to manage the US 101 express lanes along with the general purpose lanes successfully, consistent with the goals of the project. As such, it is recommended that the US 101 Express Lanes project move forward in order to accrue the immediate travel time and reliability benefits while additional corridor improvements are evaluated.

1 INTRODUCTION

The United States Highway 101 (US 101) Express Lanes Project consists of converting the existing high-occupancy vehicle (HOV) lane along both northbound and southbound US 101 into an express lane and widening the freeway to add a second express lane for the majority of the corridor. The project also proposes to build new express lanes in the northbound direction between East Dunne Avenue and the existing HOV lane at Cochrane Road, and in the southbound direction from Burnett Avenue to north of East Dunne Avenue. Furthermore, the project also proposes to convert the HOV direct connectors at the northern junction of US 101 and SR 85 to express lane operation, and add auxiliary lanes between the Great America Parkway and Lawrence Expressway interchanges (in both directions), between Old Bayshore Highway on-ramp and Brokaw Road/1st Street off-ramp (northbound direction) and between the Lawrence Expressway on-ramp and Fair Oaks Avenue off-ramp (northbound direction) to improve future operations in these segments. At the southern junction of US 101 and SR 85 in south San Jose, the direct connectors are to be converted to express operation as part of the separate SR 85 Express Lanes project (EA 04-4A7900).

Express lanes are a demand management tool to provide better utilization of HOV lanes capacity by allowing Single Occupant Vehicles (SOVs) to use the express lanes for a fee while still allowing all eligible carpool lane users to use it for free. SOVs would be tolled using FasTrak, the electronic technology that is currently used on the Bay Area Toll Bridges.

Express lanes provide an option to solo drivers to use the facility on an as needed basis. It takes advantage of the underutilized HOV lane capacity while maintaining the overall performance of the lane. As such, express lanes can provide congestion relief through more effectively using the existing freeway mainline capacity by providing a mobility option for commuters, and can provide a potential new funding source for transportation improvements, including public transit.

1.1 Project History

Assembly Bill 2032 (AB 2032) provided legislative authority for Santa Clara Valley Transportation Authority (VTA) to implement and operate two corridors of express lanes within Santa Clara County. These express lanes, a form of roadway pricing, essentially allow solo commuters for a fee to use lanes that ordinarily would have been available for only carpoolers, transit, motorcycles, and vehicles with clean air stickers. The fees would change dynamically in response to existing congestion levels and available capacity in the carpool lanes. VTA has begun efforts as granted by AB 2032 to develop the Silicon Valley Express Lanes Program.

It is important to note mandated performance requirements that must be taken into consideration when designing an express lane project. At the state level, AB 2032 mandated that express lanes operate at a Level of Service (LOS) of "C" or better (LOS "D" may be used if Caltrans and the operator agree). This corresponds to a target threshold of approximately 1,650 vph per HOV lane. The 1,650 vph threshold is intended to provide HOVs with reliable travel time savings. For restricted access express lane facilities, Caltrans' Traffic Operations Policy Directive (TOPD) 11-2 further states that access openings should be located and designed such that they will perform at Level of Service (LOS) "C" or "D", and that the opening should not produce adverse impacts to managed lane and general purpose lane performance.

At the federal level, 23 U.S.C. 166 (d) established a minimum average operating speed that HOV facilities with exempted vehicles must maintain. In the case such as US 101 where the speed limit is 65 mph, the requirement is that a facility operate at a minimum speed of 45 mph during the peak hour no less than 90 percent of the time over a 180-day period. The related federal guidance does not require use of a specific procedure or methodology to use in determining if the operational performance of an HOV facility with exempted vehicles is degraded. In California, Caltrans has agreed with FHWA to monitor degradation by breaking facilities down into approximately 5 mile segments given available PeMS vehicle detection stations.

However, the "5-mile segment" approach for degradation monitoring and reporting is not typically considered as the threshold for traffic operations analyses for future year conditions. At the state level, Section 149.6 of the Streets and Highways Code requires that implementation of the HOT lanes ensure that Level of Service C or D be maintained at all times in the high occupancy vehicle lanes. For this analysis, 45 mph and LOS D are used as performance

standards to identify operational concerns at individual segments or isolated locations of the proposed Express Lanes project. Various improvement measures are identified for locations where express lane operations do not meet federal and state standards.

These performance requirements have been used to guide the design and evaluation of the proposed express lanes on US 101. The provision of two express lanes in each direction for a majority of the corridor was intended to provide capacity for toll-paying users while maintaining adequate operations for HOVs. Adjustments were made to the location and design of the express lane access zones to help minimize potential impacts. And as noted earlier in this report, a series of toll sensitivity assignments were conducted as part of the demand forecasting process to identify the toll rates in each segment that would maximize utilization of the express lanes while limiting the volumes in the express lanes to 1,650 vehicles per hour per lane.

Work on the development of US 101 express lanes has been on-going since 2007. Local funds are being used for the Project Approval/Environmental Documentation (PA/ED) phase and final design to progress this important project towards implementation.

1.2 Study Area

US 101 is a north-south freeway serving local and interregional traffic along the Santa Clara Valley, the Peninsula, and the greater San Francisco Bay Area. Within Santa Clara County, US 101 connect San Benito County to San Mateo County, through the cities of Gilroy, Morgan Hill, San Jose, Santa Clara, Sunnyvale, Mountain View, and Palo Alto. The freeway also connects the San Francisco business district and San Francisco International Airport to San Jose and Silicon Valley to the south.

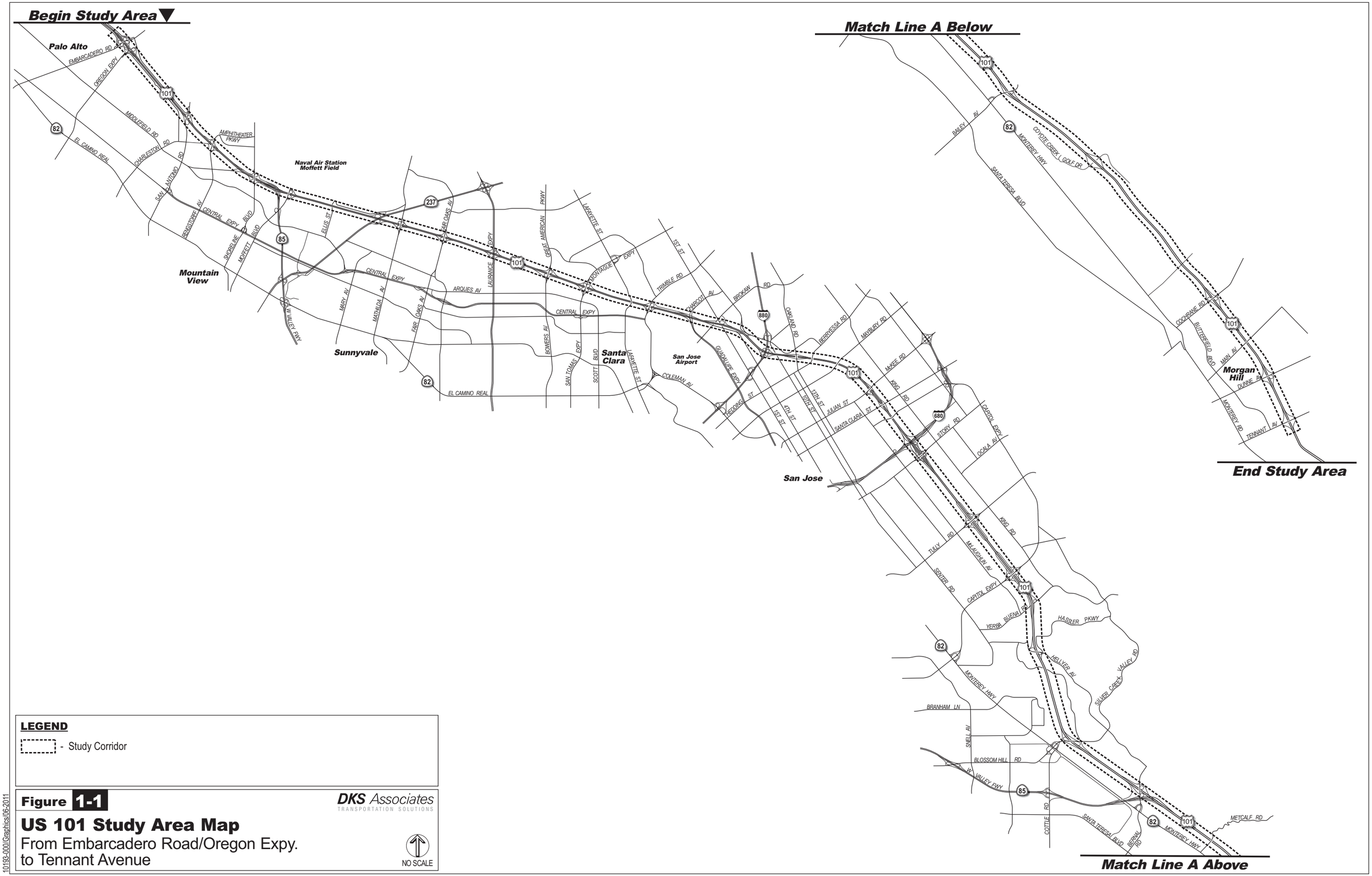
US 101 is a full access-controlled freeway consisting typically of three general purpose lanes and one HOV lane in each direction. Auxiliary lanes exist in several locations along US 101 to facilitate merging and weaving operations between interchanges. Within Santa Clara County, US 101 intersects SR 85 in San Jose and in Mountain View, I-280/I-680, I-880, SR 87, and SR 237. It carries up to 256,000 vehicles per day including HOV traffic.

The US 101 Express Lanes Project consists of converting the existing HOV lane along both northbound and southbound US 101 into an express lane and widening the freeway to add a second express lane for the majority of the corridor. The project also proposes to build new express lanes in the northbound direction between East Dunne Avenue and the existing HOV lane at Cochrane Road, and in the southbound direction from Burnett Avenue to north of East Dunne Avenue. Furthermore, the project also proposes to convert the HOV direct connectors at the northern junction of US 101 and SR 85 to express lane operation, and add auxiliary lanes between the Great America Parkway and Lawrence Expressway interchanges (in both directions), between the Old Bayshore Highway on-ramp and Brokaw Road/1st Street off-ramp (northbound direction) and between the Lawrence Expressway on-ramp and Fair Oaks Avenue off-ramp (northbound direction) to improve future operations in these segments. The overall project limits are from the East Dunne Avenue interchange in Morgan Hill to the Santa Clara/San Mateo County line just north of the Oregon Expressway/Embarcadero Road interchange in Palo Alto. **Figure 1-1** illustrates the corridor and the project limits.

1.3 Report Organization

The remainder of this report is divided into the following chapters:

- Chapter 2 – Analysis Methodology
- Chapter 3 – Existing Conditions (including VISSIM model development and validation)
- Chapter 4 – Alternatives
- Chapter 5 – Travel Demand Forecasts
- Chapter 6 – Near-term (2015) Conditions
- Chapter 7 – Long-term (2035) Conditions
- Chapter 8 – Conclusions



LEGEND

- Study Corridor

Figure 1-1

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US 101 Study Area Map

From Embarcadero Road/Oregon Expy.
to Tennant Avenue

NO SCALE

10193-000/Graphics/06-2011

2 METHODOLOGY

The traffic operations analysis conducted for the US 101 Express Lanes project has the following features:

- included both the four-hour AM (6 to 10 AM) and four-hour PM (3 to 7 PM) peak period;
- was conducted for Existing conditions, plus two future years – near-term (2015) and long-term (2035); and
- considered a No Build and one Build alternative for each future year.

Although the HOV lane restrictions are currently enforced between 5:00 and 9:00 AM, the 6:00 to 10:00 AM analysis period was selected because it better captures when congestion occurs within the corridor.

As noted previously, the overall project limits on US 101 are from the East Dunne Avenue interchange in Morgan Hill to the Santa Clara/San Mateo County line just north of the Oregon Expressway/Embarcadero Road interchange in Palo Alto (see Figure 1-1).

The analysis was comprised of two key components:

1. Forecasting of future year travel demands using VTA's countywide travel demand model; and
2. Detailed operational analysis using a VISSIM micro-simulation model

These components, tools, and the evaluation measures are further described in the following sections.

2.1 Forecast Methodology

This section provides an overview of the tools, methods and procedures used in developing the travel demand forecasts for the US 101 Express Lanes project. Further details related to the forecasting methodology and results are provided in a set of previously-submitted documents including:

- US 101 Express Lanes Study – Base Year Validation Results for US 101 Express Lanes Study, May 3, 2011
- US 101 Express Lanes Forecasted Travel Demand, June 6, 2013

These documents are included as Appendix A to this report.

In general, these forecasts were developed using VTA's countywide travel demand model. The VTA countywide model is a modified version of the Metropolitan Transportation Commission (MTC) regional model, developed to be consistent with methodologies used by MTC. The VTA countywide model includes enhancements to the MTC regional model to provide better detail in Santa Clara County and was designed to more accurately model transit ridership and corridor-level freeway and arterial traffic volumes. The VTA model is a traditional four-step model that includes trip generation, trip distribution, mode choice, and transit and highway assignment. The VTA model was originally calibrated to year 2000 Census Journey-to-work commuter flows to match observed county-to-county trip movements and was also calibrated to year 2000 trips by mode derived from Census and recent transit on-board survey data. The model was subsequently updated and re-validated in 2005.

2.1.1 Model Validation

The base year 2007 model for this project was developed using an existing 2005 countywide model that was validated at the countywide level-of-detail. This model was refined to improve the validation in the US 101 corridor.

The base year model validation was presented to Caltrans previously in the technical memorandum dated May 3, 2011. This memorandum documented what model changes and assumptions were made to develop a 2009 base year model for this project from the existing 2005 validated countywide model. The primary changes included different assumptions regarding link capacities on SR 85 and US 101, as well as adjustments to trip ends in selected fast-growing parts of South San Jose. This memo showed that the auto trip tables originally developed for 2005 would be able to represent observed counts in 2009.

2.1.2 Subarea Window Model

Traffic assignments performed using the VTA regional network were used to establish travel patterns on the network that would be sensitive to changes in land use and highway network assumptions. However, to produce traffic demand volumes for the traffic operations and toll revenue analysis, a subarea model was developed around the US 101 corridor. The extent of the subarea (or windowed) model is shown in **Figure 2-1.** The subarea extraction process was performed for 2009, 2015 No Build and Build, and 2035 No Build and Build scenarios for the AM and PM peak analysis periods. The subarea model is further discussed in the previously submitted memo dated January 31, 2013.

Figure 2-1: Subarea Window Model Network

2.1.3 Development of Demand Forecasts

To develop the traffic demand forecasts for use in the traffic operational analysis, the following steps were undertaken to refine the subarea window models:

1. Split the 2009 peak period extracted subarea trip tables into individual hourly trip tables for AM and PM peak periods. The AM peak period trip tables were divided into three time slices using factors of 0.276, 0.373, and 0.351 and the PM peak period trip tables were divided into four time slices using factors of 0.246, 0.262, 0.266, and 0.226. These factors were developed from an average of the hourly percentages from balanced mainline segments that were estimated from the 2009 traffic counts used to validate the model.

2. Assign 2009 hourly trip tables and compare ramp and mainline demand to target values from the model validation volumes. Since different parts of the corridor, as well as the peak vs. non-peak direction, have different peaking characteristics, adjustments were made to the hourly trip tables using a select-link trip table approach as follows: at specific mainline locations, select-link trip tables of traffic traveling over the link were extracted and factored to better match target volume at the select-link location; these adjusted select-link trip tables were used to replace the original select-link trips in the hourly trip table. Where possible, the adjustments shifted traffic demand from one hour to another within the same peak period, to maintain the original total.

3. Calculate the difference between the final 2009 hourly trip tables and the initial 2009 hourly trip tables to get difference matrices by hour to estimate a net adjustment by zone.
4. Split the extracted 2015 No Build, 2015 Build, 2035 No Build, and 2035 Build trip tables into individual hours using the factors shown in Step 1.
5. Add the net adjustment matrices from Step 3 to each of the trip tables developed in Step 4 to estimate final 2015 and 2035 trip tables for No Build and Build conditions.
6. For the 2015 and 2035 No Build scenarios, run traffic assignments for each of the hourly trip tables developed in Step 5 on a windowed No Build network for each year.
7. For the 2015 and 2035 Build scenarios, using the hourly trip tables developed in Step 5, run a series of toll sensitivity assignments on the windowed Build networks to identify the toll rates in each segment that would maximize utilization of the US 101 express lanes. The volumes presented in the tables in this memo assume that the maximum volume will be limited to 1,650 vehicles per hour per lane on the express lanes.
8. Develop a spreadsheet for post-processing the assignment volumes for No Build and Build conditions. Within this spreadsheet, compare 2009, 2015, and 2035 assignments to estimate net traffic growth from 2009 to 2015 and 2015 to 2035 due to socioeconomic changes, access changes, capacity changes, and SOV access changes. Review and adjust ramp volumes manually and recalculate mainline volumes for AM and PM peak periods; add comments to identify some of the reasoning behind the adjustments. Zero out negative growth unless reason can be identified. Evaluate No Build and Build scenarios independently but compare adjustments to ensure consistency between manual adjustments if possible.
9. Add adjusted net growth through 2015 from Step 8 to actual 2009 traffic volumes from balanced travel demand profile, with peak period growth distributed among the 4 peak hours based on current shares on ramps. (This will result in estimated 2015 traffic volumes reflecting manual adjustments.) Perform same calculation for growth for the period from 2015 to 2035, dividing the adjusted growth among the 4 hours (depending on time period) based on current shares and recalculate total mainline demand.
10. For the Build scenario, estimate the volume in the general purpose lanes and express lanes for each hour, maintaining the original assigned volume by hour for the express lanes from Step 7 (this has the effect of assuming that the manual adjustments from Step 8 are applied to general purpose lane volumes).

2.1.4 Market Share Model

Estimates of traffic demand and revenue potential for the US 101 Express Lanes Project were performed through a market share model applied to the study corridor within the subarea window. The market share model incorporates a variety of information in order to estimate the traffic that would choose the express lane under different operating conditions, and considers such factors as:

- Total existing (global) demand in the corridor;
- Growth of (global) demand in the corridor;
- Project configuration and location of express lane access points;
- Potential time savings offered by the express lane;
- Toll rates to be charged; and
- The value placed on this time savings by drivers in the corridor.

Market share calculations were performed within an equilibrium traffic assignment process using the windowed model. In this process, the travel time between a path using the tolled express lanes is compared to the travel time on a path using the free general purpose lanes (or parallel arterials within the corridor) for each origin-destination pair (at the traffic analysis zone level) in the model. For each movement, the toll cost per minute of time savings

(cost-per-minute-saved value) is compared to an estimated value-of-time for drivers in the corridor. It is assumed that the value-of-time for drivers is not a single value but a distribution of values that is related to a number of factors, including: income, trip purpose, tardiness, others. The value-of-time for each individual driver will vary day-to-day and trip-by-trip, depending on these factors.

It is assumed that the proportion of motorists with a value-of-time greater than the cost-per-minute-saved would be willing to pay the toll and would likely choose to use the express lanes; those with a value-of-time lower than the cost-per-minute saved would not be willing to pay the toll under the tested conditions and would be assigned to the general purpose lanes. As traffic is assigned to each general purpose lane and express lane link (and others), travel times and speeds on the links are adjusted. An equilibrium assignment approach is used in the modeling process; the market share analysis is conducted for each iteration. Each iteration takes into account the market share shift of SOVs into the express lanes from the previous iteration. The market share express lanes assignment process was conducted for each of the eight individual time periods identified for analysis (three peak and one shoulder hour in the AM peak period, and four hours in the PM peak period).

Additional discussion about the market share model is provided in the forecasted Travel Demand memo dated June 6, 2013.

2.2 Operational Analysis Methodology

This section summarizes the methodology used in conducting the detailed traffic operational analysis for the US 101 Express Lanes project. This methodology is documented in the previously-submitted technical memorandum entitled "US 101 Express Lanes Traffic Operational Analysis Methodology – Revised, September 14, 2011". This document is included as Appendix B to this report.

The operational analysis for the US 101 Express Lanes project was conducted using the VISSIM simulation modeling program. VISSIM is a microscopic simulation modeling software capable of analyzing the vehicle to vehicle interaction along the roadway network.

For this project, a set of directional VISSIM models were developed for both the AM (6 to 10 AM) and PM (3 to 7 PM) peak analysis periods. The US 101 models cover the portion of US 101 from north of the Embarcadero Rd/Oregon Expressway interchange to just south of the Tennant Avenue Interchange.

Initially, Existing Conditions AM and PM peak period models were developed and calibrated to replicate observed conditions. The calibrated Existing Conditions models were then modified to match the forecasted traffic demands and assumed roadway improvements for 2015 and 2035.

There is a certain amount of random variability inherent to a microscopic simulation model such as VISSIM. This is due to the random distribution of vehicle entry time, vehicle type and driver behavior. This is very similar to the random variability from one day to the next observed in the field. Good field data is therefore collected over several days and averaged, as was done with the traffic volumes. Similarly, the simulation model is run multiple times with different random number seeds. The calibration procedure then looks at a statistical comparison between the multiple model runs and the field data. For this study, six runs using different random number seeds were conducted for the weekday AM and PM peak periods.

2.2.1 Measures of Effectiveness

To support the evaluation of the US 101 Express Lanes project, the VISSIM models were used to generate a variety of Measures of Effectiveness (MOEs) for comparing No Build and Build alternative traffic operations. Specific MOEs used in this evaluation included:

- Total model network vehicle miles and hours of travel;
- Total network delay (in terms of vehicle-hours of delay);
- Average delay per vehicle;
- Average speed;
- Flow volumes for the freeway mainline (broken down between the HOV/express and general purpose lanes) and ramps;
- Speed in HOV/express and general purpose lanes;
- Total person throughput at select locations along the freeway; and
- Segment travel time in the HOV/express and general purpose lanes.

These outputs, along with visual inspection of the model animations, were also used to identify and compare the congestion patterns (bottleneck locations and queue lengths) associated with the No Build and Build alternatives. In addition, for the Build alternative, a detailed examination of operations within the express lanes, and specifically at the access zones, was conducted. This included examination of the volumes, densities, level-of-service (LOS) and speeds.

3 EXISTING CONDITIONS

A detailed description of existing conditions in the US 101 corridor, including copies of the relevant traffic data, is provided in the previously-submitted technical report entitled "US 101 Express Lanes Existing Conditions and Model Calibration, June 3, 2013" (see Appendix C). A summary of the existing operating and field conditions is provided in the sections below.

3.1 Freeway Geometry

US 101 is a north-south freeway that runs through Santa Clara County from San Benito County in the south to San Mateo in the north. Within the study area, US 101 passes through the cities of Morgan Hill, San Jose, Santa Clara, Sunnyvale, Mountain View, and Palo Alto.

The existing roadway geometry for US 101 was defined using aerial photographs, as-built drawings and field observations. **Figure 3-1** through **Figure 3-5** illustrate the lane configurations along the freeway mainline and on/off-ramps within the study limits.

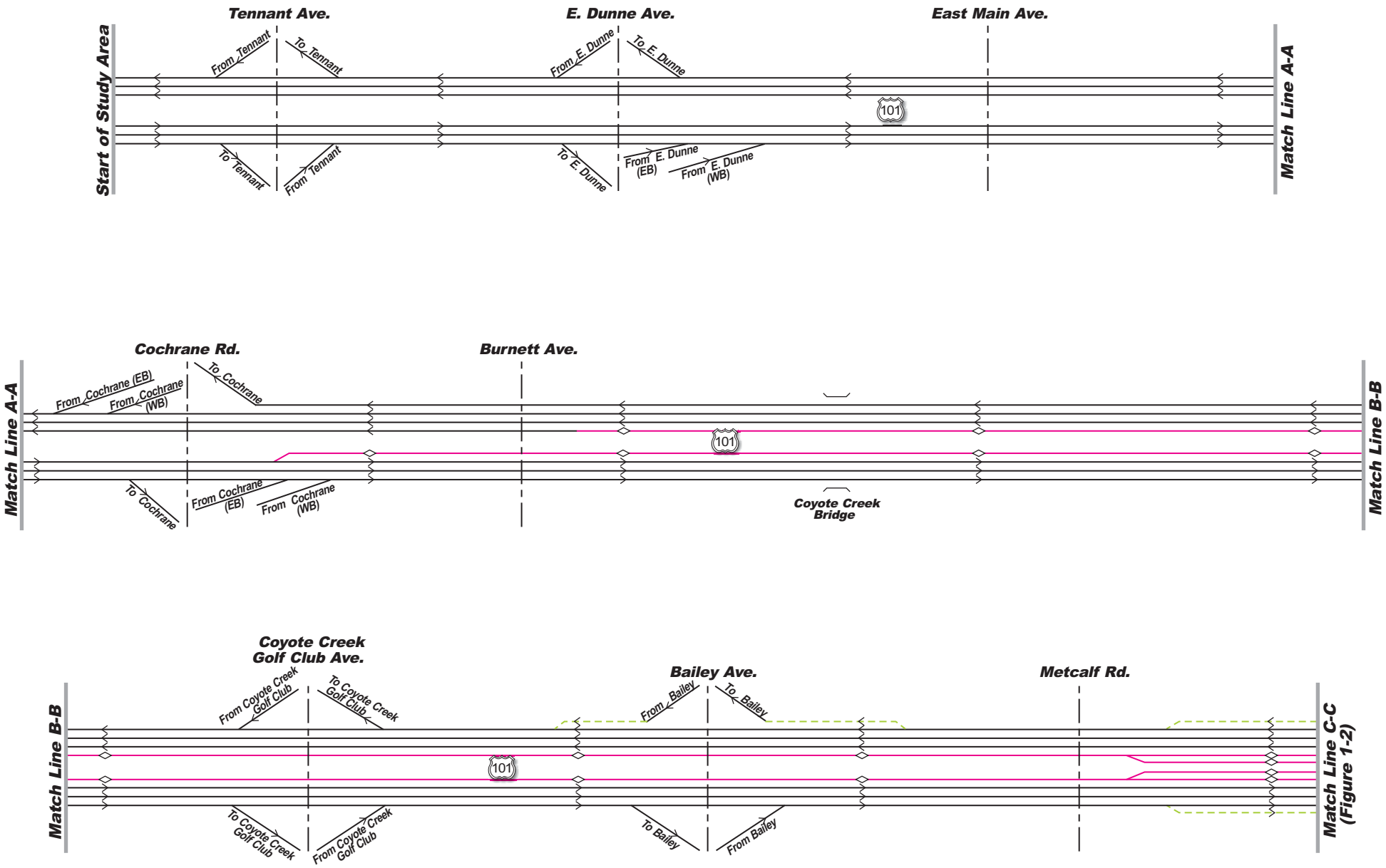
US 101 is a full access-controlled freeway consisting typically of three general purpose lanes and one HOV lane in each direction. Auxiliary lanes exist in various locations along US 101 to facilitate merging and weaving operations between interchanges. There are existing auxiliary lanes between the following interchanges:

Northbound Direction

- Capitol Expressway to Tully Road
- Tully Road to I-280/I-680
- I-280/I-680 to McKee Road/Julian Street
- Old Oakland Road to Old Bayshore Highway
- Brokaw Road to Trimble Road
- Montague/San Tomas Expressway to Bowers Avenue/Great America Parkway
- Moffett Boulevard to Shoreline Boulevard

Southbound Direction

- Charleston Road to Rengstorff Avenue
- Old Middlefield Way to Route 85
- Shoreline Boulevard to Moffett Boulevard
- Route 237 to N. Mathilda Ave
- Bowers Avenue/Great America Parkway to Montague/San Tomas Expressway
- Trimble Road/De La Cruz Boulevard to Route 87
- N. 4th Street to Old Oakland Road
- McKee Road/Julian Street to I-280/I-680
- I-280/I-680 to Tully Road



LEGEND

- HOV Lane
- Auxiliary Lane
- Mixed Use Lane
- Cross Street Centerline

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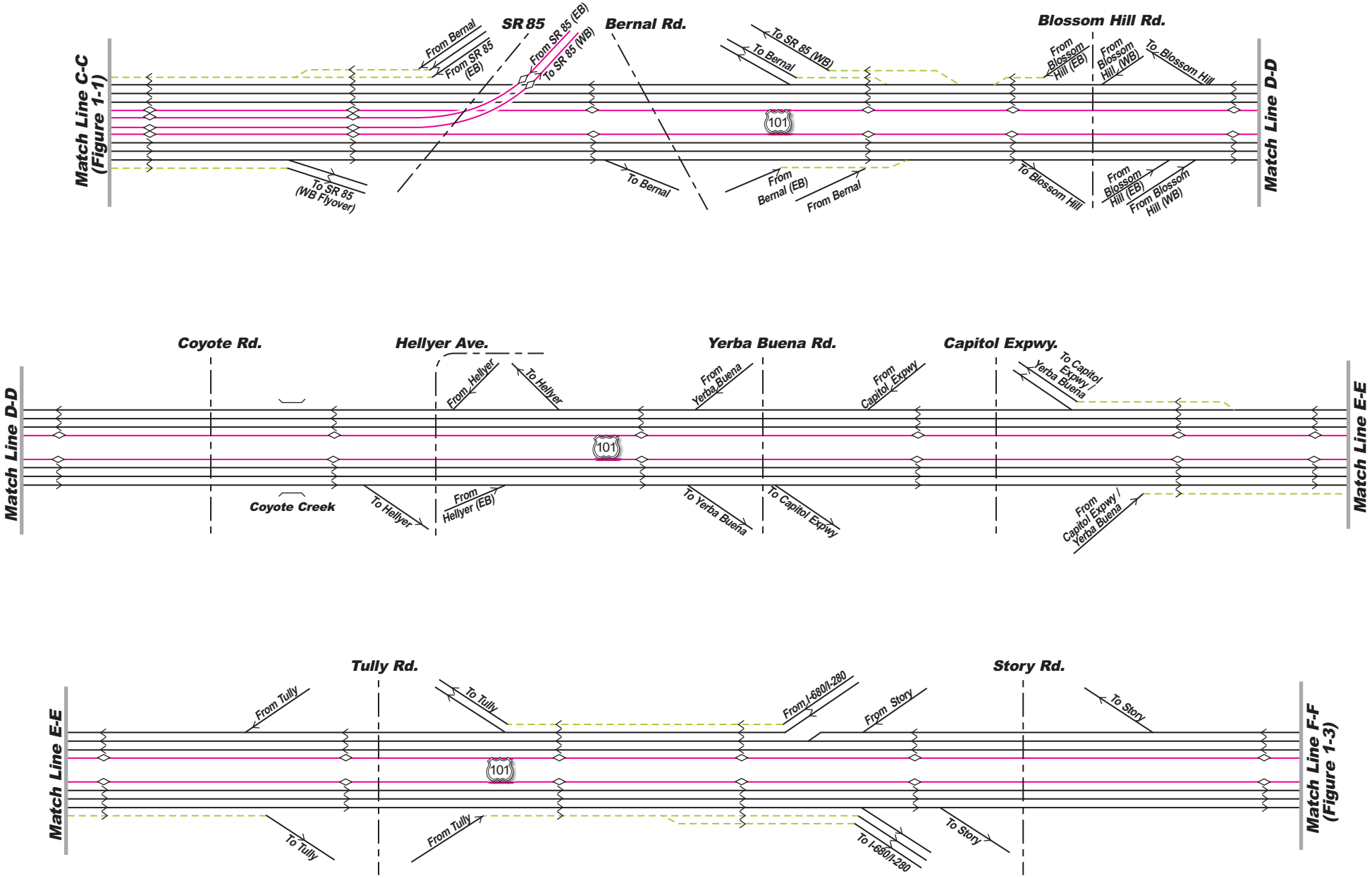
NO SCALE

Figure 3-1

US101 Express Lanes Existing Lane Geometry

P10193-000-003/Graphics/05-2011



LEGEND

- HOV Lane
- Auxiliary Lane
- Mixed Use Lane
- Cross Street Centerline

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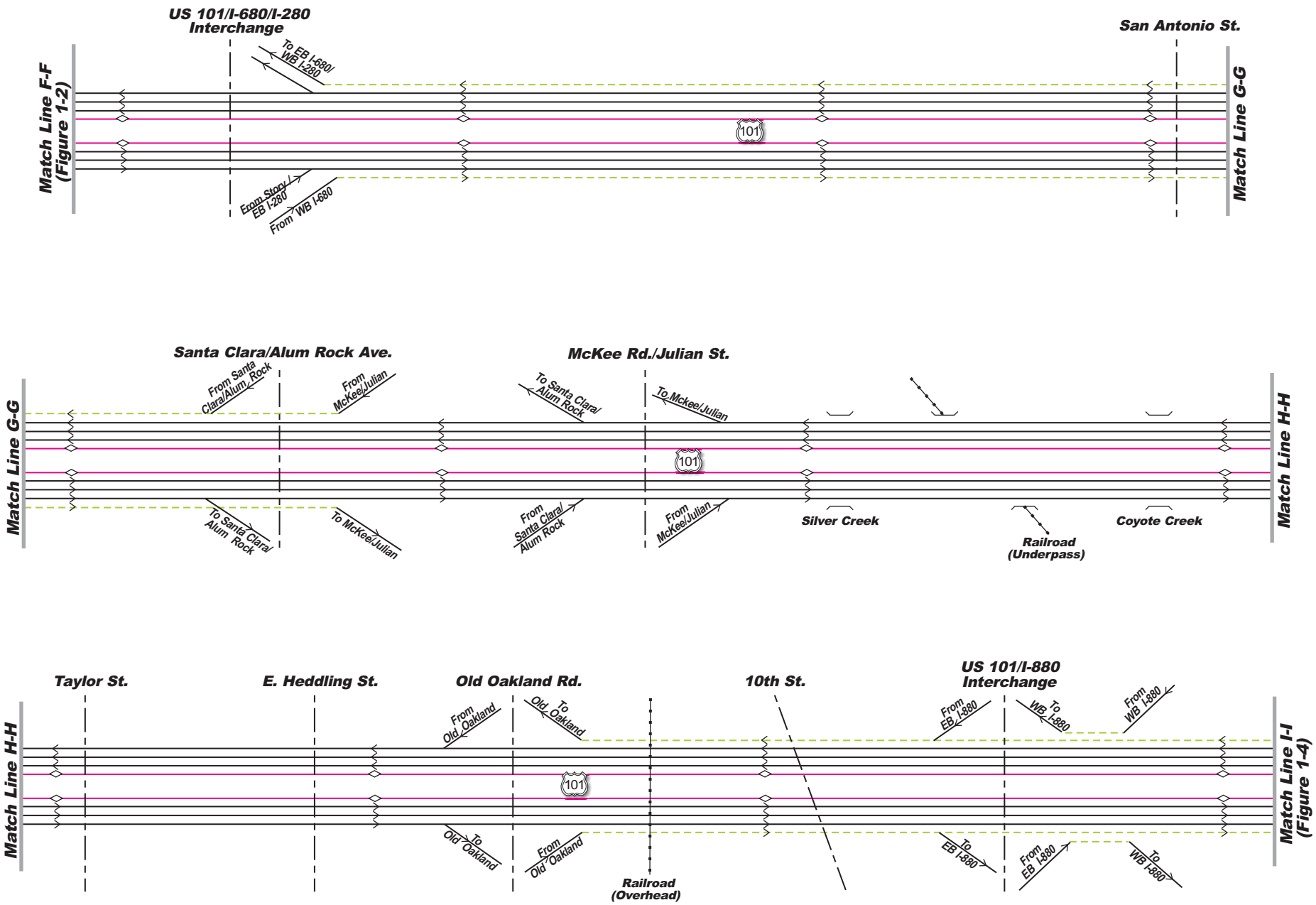
NO SCALE

Figure 3-2

US101 Express Lanes Existing Lane Geometry

P10193-000-003/Graphics/05-2011



LEGEND

- HOV Lane
- Auxiliary Lane
- Mixed Use Lane
- Cross Street Centerline

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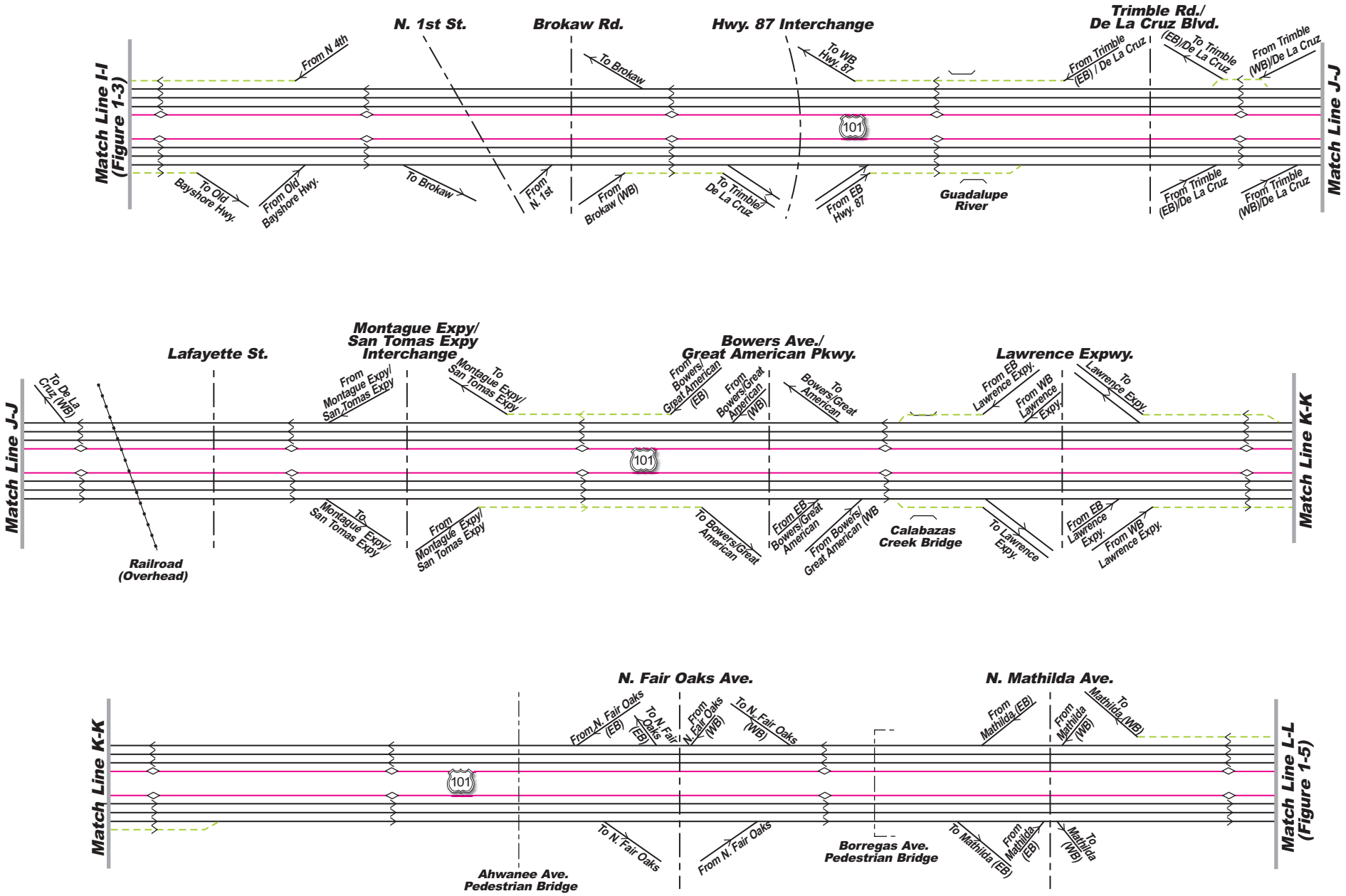
NO SCALE

Figure 3-3

US101 Express Lanes Existing Lane Geometry

P10193-000-003/Graphics/05-2011



LEGEND

- HOV Lane
- Auxiliary Lane
- Mixed Use Lane
- Cross Street Centerline

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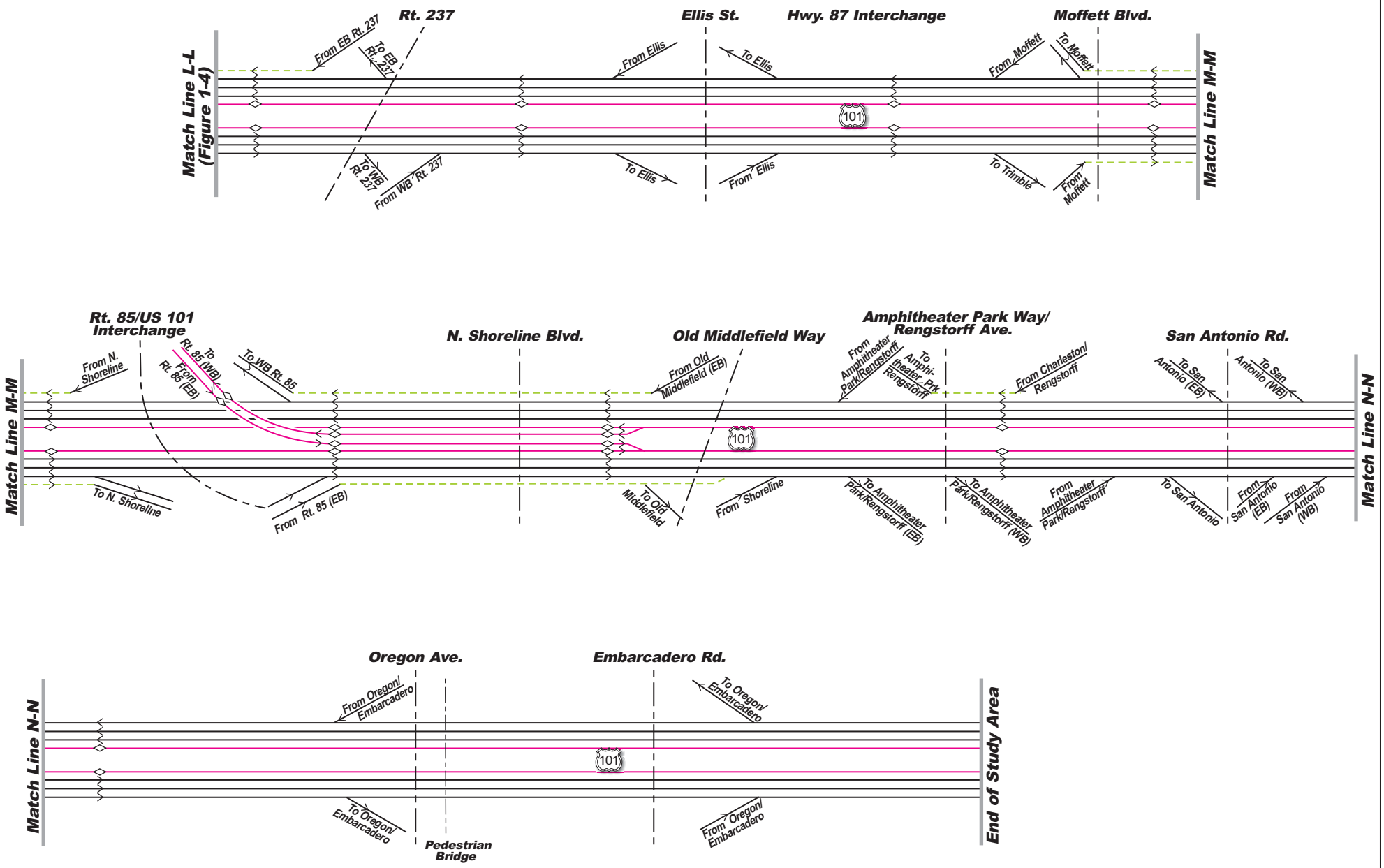
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 3-4

US101 Express Lanes Existing Lane Geometry

P10193-000-003/Graphics/05-2011



LEGEND

- HOV Lane
- Auxiliary Lane
- Mixed Use Lane
- Cross Street Centerline

DKS Associates
TRANSPORTATION SOLUTIONS

NO SCALE

Figure 3-5

US101 Express Lanes Existing Lane Geometry

P10193-000-003/Graphics/05-2011

3.2 Ramp Metering

Ramp metering information for US 101 was provided by Caltrans. During the AM peak period, ramp meters are turned on in the northbound direction only from Bernal Road to Lawrence Expressway. During the PM peak period the southbound on-ramps from Embarcadero Road to Blossom Hill Road are metered. **Table 3-1** and **Table 3-2** present the on-ramps that are metered under existing conditions and the minimum and maximum metering rates for the northbound and southbound directions, respectively.

Table 3-1: Northbound AM Peak Period Ramp Metering Rates and Hours of Operation

NORTHBOUND ON-RAMPS	LANES AT METER LIMIT LINE		HOURS OF OPERATION	MAX. RATE (VPHPL)*	MIN. RATE (VPHPL)*
	MIXED-USE	HOV PRIORITY			
Bernal Road Loop	2		0530-0900	360	330
Bernal Road Diagonal	1	1	0530-0900	520	240
Blossom Hill Road Loop	1		0530-0900	640	480
Blossom Hill Road Diagonal	1	1	0530-0900	600	240
Hellyer Avenue Loop	2		0530-0900	600	290
Capitol Expressway Loop	1		0530-0900	900	480
Capitol Expressway Diagonal	1	1	0530-0900	900	400
Tully Road Loop	1		0530-0900	600	240
Tully Road Diagonal	1		0530-0900	720	330
Story Road/SB I-280 Connector	1		0530-0900	780	360
SB I-680 to NB US 101 Connector	1	1	0530-0900	900	520
Alum Rock Avenue Diagonal	2		0530-0900	450	240
McKee Road Diagonal	2		0530-0900	600	240
Oakland Road Diagonal	2		0530-0900	720	600
North First Street Loop	1		0530-0900	900	300
Brokaw Road Diagonal	1	1	0530-0900	900	400
Guadalupe Pkwy/ Route 87	2	1	0530-0900	600	240
De La Cruz Boulevard Loop	1		0530-0900	800	500
Trimble Road Diagonal	1	1	0530-0900	600	240
San Tomas Expressway Loop	1	1	0530-0900	900	450
Montague Expressway Diagonal	2	1	0530-0900	900	450
Bowers Avenue Loop	1		0530-0900	900	720
Great America Parkway Diagonal	1		0530-0900	900	720
Lawrence Expressway Loop	1	1	0530-0900	900	600
Lawrence Expressway Diagonal	1	1	0530-0900	720	240

Note:
* Refers to metering rates for mixed use lanes. Most on-ramps are metered using a local traffic responsive algorithm based on conditions just upstream of the on-ramp entrance to the freeway. On-ramps could be metered at multiple rates throughout the peak period. The minimum metering rate shown will most likely be in affect when the mainline is congested. The maximum metering rate may go up to 900 vphpl or rest-in-green if conditions on the mainline are very light (low occupancy on the mainline detection). HOV bypass lanes are usually metered at demand rate up to 900 vphpl.
Source: Caltrans, 2011

Table 3-2: Southbound PM Peak Period Ramp Metering Rates and Hours of Operation

SOUTHBOUND ON-RAMPS	LANES AT METER LIMIT LINE		HOURS OF OPERATION	MAX. RATE (VPHPL)*	MIN. RATE (VPHPL)*
	MIXED-USE	HOV PRIORITY			
Embarcadero Road Loop	1	1	1500-1900	400	300
Embarcadero Diagonal	1		1500-1900	600	420
Oregon Expressway Diagonal	1	1	1500-1900	650	500
Rengstorff Avenue Diagonal	1	1	1500-1900	800	450
Old Middlefield Way Diagonal	2		1500-1900	360	270
North Shoreline Boulevard Diagonal	2		1500-1900	520	330
Moffett Boulevard Diagonal	1	1	1500-1900	400	400
Ellis Street Diagonal	1	1	1500-1900	450	240
EB 237 to SB 101 Diagonal	1		1500-1900	660	550
Mathilda Avenue Loop	1	1	1500-1900	720	520
Mathilda Avenue Diagonal	1	1	1500-1900	480	400
Fair Oaks Avenue Loop	1	1	1500-1900	450	300
Fair Oaks Avenue Diagonal	1	1	1500-1900	450	240
Lawrence Expressway Loop	1	1	1500-1900	300	270
Lawrence Expressway Diagonal	2	1	1500-1900	360	300
Great America Parkway Loop	1	1	1500-1900	900	820
Bowers Avenue Diagonal	1	1	1500-1900	520	400
Montague Expressway Loop	1	1	1500-1900	480	420
San Tomas Expressway Diagonal	1	1	1500-1900	400	300
Trimble Road Loop	1	1	1500-1900	720	360
De La Cruz Boulevard Diagonal	2	1	1500-1900	820	650
Tully Road Loop	1		1500-1830	600	400
Tully Road Diagonal	1		1500-1830	600	400
Capitol Expressway Collector	1		1500-1830	900	720
Yerba Buena Road Diagonal	1		1500-1830	720	600
Hellyer Avenue Loop	1		1500-1830	720	600
Blossom Hill Diagonal	1		1500-1830	720	600

Note:
* Refers to metering rates for mixed use lanes. Most on-ramps are metered using a local traffic responsive algorithm based on conditions just upstream of the on-ramp entrance to the freeway. On-ramps could be metered at multiple rates throughout the peak period. The minimum metering rate shown will most likely be in affect when the mainline is congested. The maximum metering rate may go up to 900 vphpl or rest-in-green if conditions on the mainline are very light (low occupancy on the mainline detection). HOV bypass lanes are usually metered at demand rate up to 900 vphpl.
Source: Caltrans, 2011

In addition to those locations listed in the tables above, ramp metering equipment has been installed on several other on-ramps but the meters had not been turned on as of 2011. In the northbound direction, this includes the Fair Oaks, Mathilda, Ellis, Moffett, and Shoreline on-ramps. In the southbound direction, this includes the SB 880, NB 880, Oakland, McKee, and Santa Clara on-ramps. Of note, no metering equipment is currently installed on the Bayshore/4th on-ramp to southbound US 101.

3.3 Traffic Volumes

A critical component of the traffic operational analysis was the traffic volume dataset used for defining existing conditions, developing and calibrating the simulation model, and serving as the basis for the future year demand forecasts. The traffic volume dataset for the US 101 corridor was derived from several sources including:

- Caltrans Traffic Census database (2007-2010);
- 2009 Caltrans Annual Average Daily Truck Traffic Database;
- VTA's 101 Ramp Metering Study;
- The Bay Area 2009 HOV Lanes Report;
- Caltrans Performance Measurement System (PeMS); and
- Project-specific traffic volume counts conducted in April 2011.

3.3.1 Freeway Mainline and Ramp Volumes

Table 3-3 and **Table 3-4** summarize the peak period hourly traffic flow volumes for the on- and off-ramps along US 101 within the study limits in the northbound and southbound directions respectively. The volumes shown in these tables reflect the "raw" average hourly count volumes computed from the sources listed above. Because these data were collected on different days and are subject to variations, it was necessary as part of a subsequent step to make adjustments to the raw counts in order to ensure the balancing of volumes along the corridor. Further adjustments were made in congested areas to define the demand volumes that would in turn generate model flow volumes that match the observed flow or constrained volumes.

Table 3-3: Observed Peak Period On/Off-Ramp Flow Volumes – Northbound[1]

NORTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
Off to Tennant Ave.	269	436	288	239	340	357	351	270
On from Tennant Ave.	576	633	551	497	422	450	481	362
Off to E. Dunne Ave	271	348	399	312	365	389	430	401
On from EB E. Dunne Ave.	453	483	515	356	191	194	203	188
On from WB E. Dunne Ave.[2]	369	668	592	391	204	220	190	176
Off to Cochrane Rd.	444	598	593	403	483	398	444	400
On from EB Cochrane Rd.	428	527	434	368	501	683	710	416
On from WB Cochrane Rd.	203	417	312	195	143	169	170	128
Off to Scheller Ave.	28	28	26	29	23	17	19	15
On from Scheller Ave.	31	34	34	37	56	48	36	29
Off to Bailey Ave.[4]	194	250	150	78	104	106	86	63
On from Bailey Ave.[4]	191	317	309	196	255	289	418	339
Off to HOV Direct Connector Off-Ramp To SR85[3]	480	845	633	1021	390	370	420	390
Off to NB Route 85[4]	1080	733	724	577	923	1129	1354	1063
Off to Bernal Rd.	317	567	517	182	127	131	155	126
On from EB Bernal Rd.	442	643	618	568	759	794	898	662
On from WB/HOV Bernal Rd.[4]	92	241	219	131	113	126	214	169
Off to 82\Blossom Hill	243	508	436	211	239	273	310	244
On from EB Blossom Hill Rd.[4]	912	968	971	1042	1071	1080	1271	1097
On from WB Blossom Hill Rd.	288	545	458	238	234	274	379	304
Off to Hellyer Ave	51	65	62	54	107	122	128	108
On from Hellyer Ave.	779	923	795	559	481	547	658	578
Off to Yerba Buena	80	192	171	155	242	265	395	273
Off to Capitol Expwy.	239	428	441	429	768	851	954	770
On from Capitol Expwy	1735	1762	1780	2756	2183	1959	2088	1961

NORTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
Off to Tully Rd	483	1003	973	550	587	611	638	549
On from EB Tully Rd.	727	986	929	820	664	602	629	544
On from Tully Rd.[4]	748	737	759	1160	1115	1049	1084	995
Off to Route 280 & 680[4]	2402	2917	2950	3235	3090	3070	3372	3000
Off to Story	171	150	181	305	438	437	460	466
On from 280\Story	673	676	541	925	1387	1231	1209	1135
On from SB 680[4]	1007	1121	947	819	644	573	610	574
Off to Route 130\S Cl St.	151	209	276	374	628	619	611	513
Off to Julian\McKee	607	845	627	478	602	622	672	624
On from Route 130[5]	701	693	633	353	402	406	400	323
On from WB McKee	567	536	519	541	541	496	500	383
Off to Oakland Rd/13th [5]	660	561	596	669	674	600	509	450
On from Oakland Rd/13th	1164	1288	1042	868	694	691	600	478
Off to NB Route 880	1458	1428	1698	1731	1295	1238	1490	998
On from NB Route 880	587	716	582	787	658	551	536	451
Off to SB Route 880	476	895	882	752	682	608	548	470
Off to Old Bayshore	191	189	173	200	140	106	72	58
On from Old Bayshore	484	843	982	637	410	364	303	224
Off to N.1st\Brokaw	550	603	619	807	481	416	428	338
On from N.1st St.	135	264	285	175	179	180	220	170
On from Brokaw	312	514	619	651	525	608	832	691
Off to Trimble Rd.[4]	1088	1354	1313	1267	679	588	570	395
On from Guadalupe[4]	1448	1619	1570	2258	1242	1337	1603	1307
On from De La Cruz	169	296	375	277	237	242	220	199
On from SB De La Cruz	126	221	298	283	366	489	641	487
Off to San Tomas	837	897	936	1108	841	831	1119	829
On from San Tomas N\S	800	1445	1635	1429	1003	1140	1551	1313

NORTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
Off to Great America	961	1196	1543	1725	811	716	971	918
On from NB Great America	98	132	151	146	168	182	225	209
On from SB Great America	114	214	257	269	385	436	684	670
Off to NB Lawrence Expwy	815	1030	1188	1214	940	1046	1344	1128
On from NB Lawrence Expwy	308	565	599	627	416	386	428	428
On from SB Lawrence Expwy	242	715	420	265	274	272	322	291
Off to Fair Oaks Ave.	459	748	739	662	538	606	853	705
On from Fair Oaks Ave	514	640	608	515	363	394	402	353
Off to NB Mathilda	524	608	658	711	213	169	188	138
On from NB Mathilda[4]	213	328	314	299	270	289	247	248
Off to SB Mathilda	352	617	621	629	456	477	738	637
Off to WB Route 237	337	702	770	657	570	612	887	783
On from WB Route 237[4]	761	904	746	755	964	1166	944	1149
Off to Ellis St.	283	372	407	376	157	160	268	213
On from Ellis St	44	77	117	127	277	390	492	380
Off to EB Moffett Blvd.	236	221	193	253	201	225	248	257
On from EB Moffett Blvd	150	215	196	202	297	288	278	220
Off to Shoreline/Middlefield	538	807	1066	1022	456	481	575	542
On from NB Route 85	1503	2079	1941	1558	1269	1211	1313	1170
On from NB HOV Route 85[3]	201	504	646	1055	305	312	375	351
Off to Middlefield	347	729	750	641	569	751	1156	1083
On from Shoreline Blvd.	194	584	910	703	519	761	903	767
Off to N. Rengstorff	118	109	180	300	66	58	59	61
Off to SB Rengstorff	221	221	191	257	303	263	240	283
On from Rengstorff	168	400	409	349	480	614	731	625
Off to San Antonio	552	680	684	597	553	489	446	438
On from NB San Antonio [4]	240	522	715	671	794	789	800	610

NORTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
On from SB San Antonio	10	22	30	35	117	162	228	162
Off to Oregon\Embarcadero	928	1337	1216	1266	1157	993	1040	1124
On from Oregon\Embarcadero	324	777	1327	1151	1723	1933	1670	1399

Notes:

1. Based on Caltrans traffic Census data (combination of 2007, 2009 and 2010 data), except where noted.
2. Based on Baymetric count – April 2011
3. VTA Count March 2010
4. Census 2009 only
5. Census 2007 only

Table 3-4: Observed Peak Period On/Off-Ramp Flow Volumes – Southbound[1]

SOUTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
Off to Oregon/Embarcadero[2]	970	1651	1636	1484	1144	1112	1267	1076
On from Oregon/Embarcadero[2]	455	1259	1907	1375	1966	1994	1755	1635
Off to SB San Antonio	169	373	780	786	745	751	766	795
Off to NB San Antonio	66	169	265	245	68	48	44	43
On from Charleston[2]	156	387	932	972	1020	1117	1126	966
Off to Rengstorff	281	554	753	785	389	361	383	416
On from N.Rengstorff[2]	106	176	185	546	526	700	583	437
On from Middlefield Rd[2]	267	523	771	660	496	561	633	522
Off to SB Shoreline	250	436	533	563	425	413	467	518
Off to HOV Connector US 101 SB to SR 85 SB[3]	52	226	212	311	345	397	542	491
Off to SB Route 85[2]	611	1195	1482	1210	2273	2452	2587	2385
On from SB Shoreline[2]	72	105	127	163	359	468	664	578
On from NB Shoreline[2]	173	261	347	318	301	265	305	272
Off to EB Moffett Blvd	122	191	223	243	188	202	222	204

SOUTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
On from EB Moffett Blvd	115	205	257	251	358	330	315	275
Off to Ellis St	254	447	554	549	159	140	146	113
On from Ellis St	91	143	146	162	348	415	400	242
Off to EB Route 237[4]	849	1636	1884	1717	1389	1522	1486	1257
On from EB Route 237	354	826	1200	977	757	781	855	813
Off to SB Mathilda	150	260	337	403	336	376	442	439
On from SB Mathilda[1]	79	111	111	137	810	1003	1059	844
On from NB Mathilda	148	350	554	489	464	439	488	468
Off to Fair Oaks[4]	127	346	246	264	444	527	686	618
On from SB Fair Oaks	84	168	215	205	299	349	430	352
Off to NB Fair Oaks	37	73	126	128	104	127	171	172
On from NB Fair Oaks	232	380	407	413	301	254	253	264
Off to SB Lawrence Expwy	255	610	649	717	925	1135	1347	1127
On from SB Lawrence Expwy[2]	193	322	297	248	314	303	321	330
On from NB Lawrence Expwy	276	606	857	840	640	540	607	616
Off to Great America	268	638	1022	1275	609	614	694	671
On from SB Great America	119	192	239	244	634	702	711	727
On from NB Great America	117	175	216	209	419	458	504	455
Off to San Tomas N\S	391	777	1175	1316	1174	1241	1255	1242
On from San Tomas N/S	315	659	720	681	989	1009	1085	950
Off to SB De La Cruz	171	253	300	298	347	288	262	256
On from SB De La Cruz	145	221	265	293	656	691	599	433
Off to Trimble Road	254	446	614	553	178	115	84	83
On from NB De La Cruz[2]	335	567	721	677	1464	1696	1784	1542
Off to Guadalupe\SR87	724	1348	1525	1447	2246	2289	2243	2189
Off to 1st\Brokaw	334	763	1062	1004	675	586	661	660
On from N.4th St.[4]	240	380	420	460	900	1060	1440	960

SOUTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
Off to SB Route 880	203	395	485	478	568	575	551	538
On from SB Route 880	1016	1036	959	1054	1487	1262	1100	1270
Off to NB Route 880	196	327	364	360	363	299	262	251
On from NB Route 880	379	545	435	473	988	1101	1202	764
Off to N.13th St.	405	644	633	625	1191	1290	1237	1239
On from N.13th St.	372	544	537	534	1087	1216	1218	682
Off to McKee\Julian Rd.	280	434	404	378	731	722	690	549
Off to Route 130\Santa Clara St.	150	252	244	245	578	623	683	652
On from Julian\McKee Rd.	433	714	671	538	793	833	891	800
On from 130\Santa Clara St.	377	554	505	422	671	699	694	541
Off to 280\680[4]	983	1246	1064	1095	1898	1818	1963	1782
Off to Story Rd.	264	453	417	417	1210	1441	1567	1462
On from EB Story[5]	237	425	351	308	358	295	292	291
On from Route 280 & 680 AM[7] PM[8]	1609	2770	2910	2559	3508	3472	3351	3119
Off to Tully Rd.	775	1211	1287	1369	1957	1818	1799	1915
On from Tully Rd	370	597	604	462	711	698	743	614
Off to Capitol Expwy AM[2] PM[9]	788	1662	1734	1459	2589	2453	2568	2464
On from Capitol Expwy[5]	399	785	839	529	817	829	989	856
On from Yerba Buena Rd	218	481	507	288	353	355	421	369
Off to Hellyer Ave.	302	435	452	338	497	532	589	653
On from Hellyer Ave	64	124	126	81	112	126	126	104
Off to Route 82/Blossom	624	1119	1398	1109	1419	1471	1541	1486
On from NB Route 82 (WB)	98	279	249	160	172	194	250	194
On from SB Route 82 (EB)	144	209	233	178	235	232	240	217
Off to NB SR 85 (GP Lanes)[6]	168	443	460	330	273	304	333	306
Off to Bernal Rd.	328	675	855	531	541	564	622	602
On from SB Route 85/Bernal[2]	687	1077	1189	939	1826	1990	2021	1621

SOUTHBOUND ON/OFF-RAMP	FLOW VOLUME (VPH)							
	AM				PM			
	6 TO 7	7 TO 8	8 TO 9	9 TO 10	3 TO 4	4 TO 5	5 TO 6	6 TO 7
On from HOV Direct Connector SB 101 On-Ramp[3]	61	151	176	440	570	639	639	510
Off to Bailey Ave.[2]	181	204	292	377	283	281	289	241
On from Bailey Avenue[2]	55	74	83	82	134	141	167	127
Off to Scheller Ave.	59	62	66	59	51	33	31	14
On from Scheller Ave.	24	24	22	31	33	33	27	26
Off to Cochran Rd.[5]	573	733	838	603	867	985	969	867
On from WB Cochrane Rd	22	72	71	83	156	139	124	108
On from EB Cochrane Rd.	134	229	254	245	514	627	607	449
Off to E. Dunne Ave.	199	358	393	372	797	820	954	925
On from E. Dunne Ave.	185	335	386	340	499	514	534	450
Off to Tennant Ave.	210	381	399	383	679	677	736	696
On from Tennant Ave.	124	252	262	266	387	457	525	369

Notes:

1. Based on Caltrans traffic Census data (combination of 2007, 2009 and 2010 data), except where noted.
2. Census 2010 only
3. Based on VTA Mar-10
4. Census 2007 only
5. Census 2009 only
6. 85 Express Lane study Jul-10
7. 101 Express Land study count by Baymetrics – April 2011
8. Census 2003 only
9. Count Provided by Caltrans Staff.

3.3.2 HOV Lane Percentage

HOV lane usage information for the study area was derived from the Bay Area HOV Lane Report 2009 and DKS Traffic counts collected in 2011. The HOV lane percentage illustrates the relative proportion of vehicles using the HOV lanes over the vehicles using all mainline lanes, including the HOV and mixed-flow lanes. **Table 3-5** summarizes the peak HOV lane volumes and percentages for the northbound AM and southbound PM, which are the peak directions of travel along the study corridor.

In the year 2005, the California Vehicle Code (CVC) began allowing qualified single occupancy Low-emission Vehicles to legally use HOV lanes (CVC 5205.5 and 21655.9). Based on the 2009 HOV Lane Report those vehicles accounted for up to 10% of the HOV lane traffic on certain segments of US 101. Beginning on July 1, 2011, the Low-emission Vehicles will no longer be able to use the HOV lanes unless the minimum passenger requirements are met. That can lead to a reduction in the use of the occupancy lane in the short term

Table 3-5: Existing HOV Lane Volumes and Percentages

COUNT LOCATION	NORTHBOUND AM				SOUTHBOUND PM			
	PEAK PERIOD[1]		PEAK HOUR[2]		PEAK PERIOD[1]		PEAK HOUR[2]	
	COUNT	%	COUNT	%	COUNT	%	COUNT	%
1. San Antonio Road I/C[3]	2264	12%	895	13%	2957	16%	1142	18%
2. NB AM - Fair Oaks Avenue I/C SB PM - San Tomas Expressway I/C[3]	2218	14%	967	17%	2117	21%	1021	20%
3. McKee Road I/C	2947	14%	1230	16%	2659	15%	897	15%
4. Hellyer Avenue I/C	1610	11%	734	13%	1953	13%	652	13%
5. Coyote Creek Golf Drive I/C	2058	14%	943	16%	2388	16%	840	15%

Source: Caltrans 2009 HOV Lane Report

Notes:
1. AM peak period defined as 6:00 to 9:00 AM. PM peak period defined as 3:00 to 6:00 PM; except Location 2 which is 4:00 to 6:00 PM.
2. Peak hour varies by location.
3. For these locations, mixed-flow lane counts for the SB direction PM peak hour and PM peak period are in queue. Therefore, the HOV percentage is probably over estimated with respect to total demand for these locations.

3.3.3 Truck Volumes

Truck percentage data for US 101 within the study area were derived from the 2009 Caltrans Annual Average Daily Truck Traffic Database. The data represent the number of trucks as a percentage of the vehicle composition for certain locations. This report listed average daily truck percentage at 10 locations in the study area, as shown in **Table 3-6.**

Table 3-6: Truck Percentages

LOCATIONS	TRUCK PERCENTAGE	YEAR VERIFIED/ESTIMATED
Cochrane Road	8%	2001V
Jct. Rte.85, Bernal Road	9%	2001V
Jct. Rte. 82	8%	2001V
Jct. I-280/I-680	6%	2001E
Jct. Rte. 130	6%	2001V
Jct. Oakland Road	5%	2001V
Jct. I-880	5%	2001E
Jct. Lawrence Expressway	4%	2001V
Jct. Rte. 237	4%	2001V
Jct. Rte. 85	5%	2001V

Source: 2009 Caltrans Annual Average Daily Truck Traffic Database

3.4 Freeway Congestion and Queuing Observations

In addition to the traffic volume data, a combination of travel time tach run data and field observations were used to identify existing bottleneck locations and congestion patterns along US 101. US 101 is typically eight lanes with three general purpose lanes and a single HOV lane in each direction and carries up to 256,000 vehicles per day including HOV traffic. High transportation demand in several segments of the general purpose lanes leads to substantial congestion and reduced speeds during both the AM and PM peak periods. Drivers in the HOV lanes also currently experience delays in some segments of the US 101 corridor.

3.4.1 AM Peak Conditions

During the AM peak period, the following bottleneck locations were observed in the general purpose lanes:

Northbound AM

- Tully Road Loop On-Ramp to Tully Road Diagonal On-Ramp: The queue from this bottleneck forms around 7:10 AM and dissipates by 9:30 AM. It extends back to the Hellyer Avenue On-Ramp (approximately 3.6 miles), overlapping with a secondary bottleneck observed within this queue. The segment between Capitol Expressway On-Ramp and Tully Road Off-Ramp was observed to be a secondary bottleneck.
- McKee On-Ramp and Old Oakland Rd Off-Ramp: The queue from this bottleneck forms around 7:15 AM and dissipates by 9:30 AM. It extends back to the Alum Rock Ave Off-Ramp (approximately 1.5 miles). At times, the segment between Oakland Road On-Ramp to northbound I-880 Off-Ramp was observed to be a secondary bottleneck or even the controlling bottleneck in this area.
- Trimble Road On-Ramp to Montague Expressway Off-Ramp: The queue from this bottleneck forms around 7:10 AM and dissipates by 10:00 AM. It extends back to the Old Bayshore Highway Off-Ramp (approximately 2.5 miles).
- Shoreline Boulevard On-Ramp to northbound Rengstorff Ave Off-Ramp: The queue from this bottleneck forms around 7:00 AM and dissipates by 10:00 AM. It extends back to the Moffett Boulevard Off-Ramp (approximately 1.5 miles).

Southbound AM

- University Avenue On-Ramp and Oregon Expressway Off-Ramp – The queue from this bottleneck forms around 7:45 AM and dissipates by 9:45 AM. It extends beyond the Woodside Road Interchange (approximately 5.0 miles).
- Oregon Expressway On-Ramp to San Antonio Road Off-Ramp: The queue from this minor bottleneck forms around 8:30 AM and dissipates by 9:45 AM and is mainly controlled by the University Avenue to Oregon Expressway bottleneck identified above. It extends approximately 0.5 miles north of the Embarcadero Road Off-Ramp.

High demands also occur in the existing HOV lanes resulting in these lanes also functioning below an acceptable speed which, in turn, diminishes the incentive for drivers to carpool. As described in the Introduction, federal requirements set a minimum average operating speed of 45 mph for HOV lanes that permit use by exempt vehicles and have a speed limit of 50 mph or higher. This generally corresponds to about a Level of Service (LOS) C or D, which indicates minimal delays and corresponds to a target threshold of approximately 1,650 vph per HOV lane. These thresholds are intended to provide HOVs with reliable travel time.

Based on tach run data and field investigations, segments of the northbound HOV lane that were observed to be congested during the AM peak include:

- Segment between the Capitol off-ramp and Tully on-ramp;
- Segment between the I-680 On-Ramp and the Old Oakland Off-Ramp;
- Segment between North 1st On-Ramp and the Trimble On-Ramp; and

- Segment between the SR 85 HOV connector and the Rengstorff off-ramp.

These segments generally correspond with the most heavily-congested segments of the general purpose lanes. Field observations indicated that congestion in the HOV lane is due not only to the high demand in the HOV lanes (volumes reach up to 1600-1700 vph), but also due to the friction caused by vehicles moving between the HOV lanes and the heavily-congested general purpose lanes. The merging of HOV's into and out of the HOV lane is reducing the effective capacity of HOV lane in these sections.

Field observations showed no significant congestion in the southbound HOV lane during the AM peak period.

3.4.2 PM Peak Conditions

During the PM peak period the following bottleneck locations were observed in the general purpose lanes:

Northbound PM

- San Antonio Road On-Ramp to Oregon Expressway/Embarcadero Road Off-Ramp: The queue from this bottleneck forms around 3:45 PM and dissipates by 6:45 PM. It extends back to the Ellis Street Off-Ramp (approximately 3.8 miles), overlapping with a secondary bottleneck observed within this queue. The segment between Shoreline Boulevard On-Ramp and northbound Rengstorff Ave Off-Ramp was observed to be a secondary bottleneck.
- Oregon Expressway/Embarcadero Road On-Ramp to University Avenue Off-Ramp: The queue from this bottleneck forms around 3:45 PM and dissipates by 7:00 PM. It extends back through the Oregon Expressway/Embarcadero Road interchange, and is largely controlled by the upstream bottleneck from San Antonio Road to Oregon Expressway described above.

Southbound PM

- Oregon Expressway On-Ramp to San Antonio Road Off-Ramp: The queue from this bottleneck forms around 4:10 PM and dissipates around 7:00 to 7:10 PM. It extends back to between the Marsh Rd and Woodside interchanges (approximately 4.0 mi).
- Rengstorff Avenue On-Ramp to Old Middlefield Way On-Ramp: The queue from this bottleneck forms around 4:10 PM and dissipates around 6:30 to 6:45 PM. It extends beyond the San Antonio Road Off-Ramp (approximately 1.0 mile) where it merges with the queue from Oregon Expressway to San Antonio Road bottleneck identified above.
- De La Cruz Boulevard On-Ramp to State Route 87 Off-Ramp: The queue from this bottleneck forms around 3:15 PM and dissipates by 7:00 PM. It extends back to the Lawrence Expressway Off-Ramp (approximately 3.6 miles) although some data shows the queue extends only to the San Tomas/Montague Expressway interchange.
- Oakland Road On-Ramp to McKee Road Off-Ramp: The queue from this bottleneck forms around 4:10 PM and dissipates by 6:35 PM. It extends beyond the 4th Street on-Ramp (approximately 2.0 miles).
- I-280/I-680 On-Ramp to Tully Off-Ramp – The queue from this bottleneck forms around 3:00 PM and dissipates by 7:00 PM. It extends back to the Santa Clara Street on-Ramp (approximately 2.0 miles).
- Tully Road on-Ramp to Capitol Expressway off-Ramp– The queue from this bottleneck forms around 4:30 PM and dissipates by 7:00 PM. It extends back to the SB Story Road Off-Ramp (approximately 2.2 miles) where the queue spills over and merges with the queue from the I-280/I/680 bottleneck identified above. A contributing factor to this bottleneck is that the demand for the Capitol/Yerba Buena off-ramp exceeds capacity causing a queue to spillback onto southbound US 101 in the right two lanes.

It was also observed that during the PM peak hour, segments of both the northbound and southbound HOV lanes become congested. These segments generally correspond with the most heavily-congested segments of the general purpose lanes. In the northbound direction, congested HOV lane segments include:

- Segment between the Ellis Off-Ramp and the San Antonio On-Ramp; and

- Segment between the Oregon/Embarcadero Off- and On-Ramps.

Southbound, congested HOV lane segments in the PM peak include:

- Segment between the Marsh On-Ramp and the Rengstorff On-Ramp;
- Segment between the Great America Off-Ramp and De La Cruz On-Ramp;
- Segment between the 4th On-Ramp and Old Oakland On-Ramp; and
- Segment between the Santa Clara On-Ramp and Tully On-Ramp.

While HOV lane volumes in the segments listed above approach 1600 vph (with exception of the last southbound segment where the peak is about 1100 vph), field observations indicate that congestion in the northbound and southbound HOV lanes is due primarily to the friction caused by vehicles moving between the HOV lanes and the heavily-congested general purpose lanes. The merging of HOV's into and out of the HOV lane is reducing the effective capacity of HOV lane in these sections.

3.5 Existing Conditions VISSIM Model

The Existing Conditions VISSIM model development and calibration process involved three main steps: (1) setup, (2) calibration, and (3) validation, which were organized as part of an integrated modeling process. This process was documented in the previously-submitted technical report entitled "US 101 Express Lanes Existing Conditions and Model Calibration, June 3, 2013" (see Appendix C). A summary of these steps and the validation results is provided in the following sections.

3.5.1 Existing Conditions Model Setup

Model setup required the input of geometric and traffic demand data for the study corridor under existing conditions. Geometric features included the locations of on- and off-ramps, number of lanes on the mainline, location of lane drops, curvature of the freeway, auxiliary lanes and merge sections. Additional network features such as the locations of ramp metering lights, loop detectors, and queue detectors were also important. Aerial photographs provided by VTA were used as a background to accurately scale the VISSIM model.

The traffic demand inputs for the model were developed using traffic volume data from various sources. Because these data were collected on different days and are subject to variations, it was necessary to make adjustments to the raw counts in order to ensure the balancing of volumes along the corridor. Further adjustments were made in congested areas to define the demand volumes that would in turn generate model flow volumes that match the observed flow or constrained volumes.

Using the adjusted peak period on-ramp and off-ramp volumes, an origin-destination matrix was developed to assign vehicle trips from each entry point of the network (origin) to specific exit points (destinations). The distribution of trips was consistent with the peak period totals at each on-ramp and off-ramp. The origin-destination matrix was converted to static vehicle routing decisions within VISSIM that were used to fix the traffic distribution patterns and routes throughout the network. The O-D matrix or trip distribution was then adjusted for each hour as part of the calibration process.

3.5.2 Model Calibration Adjustments

Because VISSIM is a micro-simulation tool, the parameters that define driver behavior and performance are critical to the simulation results. The types of parameters that affect driver behavior include distance between stopped vehicles, driver behavior when changing lanes, and driver behavior in congested sections.

Calibration involves modifying the AM and PM peak period models' parameters so that the model accurately represents observed conditions. Criteria, or constraints, in calibrating the model require that all model parameters must fall within the bounds of good professional practice and be reasonable for the general travel conditions for each time period. Unique model components that must be adjusted in the VISSIM model include driver behavior, driver performance, vehicle fleet mix, and vehicle performance.

The model was initialized with the default values given by VISSIM, with adjustment made during the calibration process. The default values in the VISSIM model such as vehicle fleet composition and lane changing behavior were adjusted during the validation step to refine the VISSIM model. The parameters affecting capacity on the freeway links were adjusted so that the observed traffic conditions could be replicated in the VISSIM model. Adjustments to the default values such as average headway, anticipatory lane change distance to prevent last-minute lane changes at freeway off-ramps were made to replicate field conditions.

In addition the model was adjusted to facilitate merging at several on-ramps with high demands. Default driver behavior settings were modified to mimic "zipper merging" during congested conditions. The term "zipper merging" refers to the situation where vehicles from the on-ramp and the rightmost freeway lane merge together in an alternating or "zipperlike" fashion. Finally, an additional feature that allows for cooperative lane changing was used to better replicate cooperation between vehicles at merging areas.

3.5.3 Model Validation

The US 101 VISSIM models were calibrated based on three primary factors: traffic flows or volumes, vehicle travel times, and congestion and queuing patterns. For the first two factors, model generated values were compared to observed traffic flows and travel times. Specific criteria for comparing the simulation output to field data were defined based on that suggested by FHWA and Caltrans (Guidelines for Applying Traffic Micro-simulation Modeling Software, California Department of Transportation, 2002; Volume III – Guidelines for Applying Traffic Micro-simulation Modeling Software, Federal Highway Administration, 2003). In the case of the hourly traffic flows, two "checks" were performed. The first involved a comparison of the observed and model-generated flow volumes at all on- and off-ramp. The second check looked at the output flows at the bottleneck locations, including a breakdown of flows in the mixed-use and HOV lanes. For the last factor, a visual audit of the simulation models was performed. Following consultation with Caltrans District 4 – Highway Operations staff, it was agreed that bottleneck throughput during the peak hour would serve as the primary measure of model validation, and that queuing and travel time would be secondary measures. The results of the Existing Conditions VISSIM model validation is provided in the technical report entitled "US 101 Express Lanes Existing Conditions and Model Calibration, January 16, 2013" (see Appendix C).

4 ALTERNATIVES

This section describes the future year alternatives that were evaluated as part of the traffic operational analysis for the US 101 Express Lanes project. In short, two alternatives are considered in this document: a Build Alternative that would convert the existing HOV lanes on northbound and southbound US 101 to express lane facilities, and the No Build Alternative.

4.1 NO BUILD ALTERNATIVE

The No Build Alternative assumes a number of programmed and planned improvements to the current US 101 corridor. While there are numerous planned or programmed transportation projects within Santa Clara County and the region that can impact future travel patterns (and were therefore incorporated into the travel demand forecasting model), this section focuses only on those future baseline improvements that directly impact the US 101 models. The baseline improvement projects assumed as part of the No Build alternative for 2015 and 2035, as well as the Build alternative, are listed in **Table 4-1**.

Table 4-1: Assumed Baseline Improvements for No Build Alternative

PROJECT TITLE	YEAR	
	2015	2035
SR 85 Express Lanes Project (EA#04-4A7900)	X	X
US 101 Ramp Metering	X	X
US 101 HOV Lanes Extension – Cochrane to SR 25		X
US 101/Tennant Avenue Interchange Improvements	X	X
US 101/East Dunne Avenue Intersection Improvements		X
US 101/Cochrane Road Intersection Improvements		X
US 101/Blossom Hill Road Interchange Improvements		X
US 101/Hellyer Avenue Interchange Improvements		X
US 101/Capitol Expressway I/C Improvements	X	X
US 101/Tully Road Interchange Improvements	X	X
US 101 Southbound Widening from Story Road to Yerba Buena Road	X	X
US 101 SB Auxiliary Lane Widening: Old Oakland to McKee		X
US 101/Mabury Road/Taylor Street Interchange Improvements		X
US 101/Old Oakland Road Interchange Improvements		X
US 101/Zanker Road/Skyport Drive/Fourth Street Interchange Improvements		X
SB US 101 to SB SR 87 Ramp Modifications	X	X
US 101 SB/Trimble Road/De La Cruz Boulevard/Central Expressway Interchange Improvements		X
US 101/Montague Expressway/San Tomas Expressway /Mission College Boulevard I/C Improvements		X
US 101 Southbound Auxiliary Lane: Great America Parkway to Lawrence Expressway		X
SR 237/Mathilda Avenue & US 101/Mathilda Avenue Interchange Improvements		X
SR 237 WB to NB US 101 Ramp Improvements		X
US 101 Southbound Auxiliary Lane Improvement Between Ellis Street and SR 237		X
US 101 Auxiliary Lanes Project (EA#04-4A330) - SR 85 to Embarcadero Road	X	X
US 101 Southbound Improvements: San Antonio Road to Charleston Road/Rengstorff Avenue		X

4.2 Build Alternative

The Build Alternative consists of converting the existing HOV lane along both northbound and southbound US 101 into an express lane and widening the freeway to add a second express lane for the majority of the corridor. The project also proposes to build new express lanes in both directions at the south end; convert the HOV direct connectors at the northern junction of US 101 and SR 85 to express lane operation; and add auxiliary lanes between the Great America Parkway and Lawrence Expressway interchanges (in both directions), between the Old Bayshore on-ramp and the North 1st Street off-ramp (northbound direction), and between the Lawrence Expressway on-ramp and Fair Oaks Avenue off-ramp (northbound direction). The overall project limits are from the East Dunne Avenue interchange in Morgan Hill to the Santa Clara/San Mateo County line just north of the Oregon Expressway/Embarcadero Road interchange in Palo Alto. Conversion of the HOV lanes to express lanes would allow use by SOVs with active FasTrak accounts and transponders.

Previously, VTA prepared an express lanes feasibility study and implementation plan that evaluated several alternatives for US 101. The study evaluated the feasibility of each alternative based on geometrics, traffic, cost, and right-of-way impacts. The screening analysis for the US 101 corridor resulted in the recommended build alternative with two design variations that were discussed in the Project Study Report /Project Development Study (PSR/PDS) that was approved on August 6, 2012.

The two design variations identified for the Build Alternative provided a range of impacts and costs. Design Variation 1 proposed a Rapid Delivery Approach and required justification and approval of several non-standard features. This variation implemented the dual express lane system with some non-standard cross sectional elements that minimized the need for new right-of-way, outside widening, and structure reconstruction. Design Variation 1 maximized the use of the existing pavement cross section with a combination of inside and outside widening to create the additional pavement needed to accommodate the second express lane.

Design Variation 2 was a facility in substantial compliance with the minimum design standards. This variation relied substantially on outside widening of the highway cross-section, including widening of existing structures, replacing overcrossings, right-of-way acquisition, and relocation of residences, businesses, and frontage roads that are adjacent to the existing right-of-way throughout the corridor in order to provide standard width of cross-sectional elements.

Upon further evaluation based on environmental impacts, construction costs, and feasibility, the two design variations discussed in the PSR/PDS were reduced to a single Build Alternative that was carried forward for full analysis during the Project Approval/Environmental Document (PA/ED) phase. The Build Alternative incorporates cross sectional features described in Design Variation 2 for most of the southern segment of the project between East Dunne Avenue and SR 85 in San Jose where a wide median exists. Features described in Design Variation 1 were incorporated into the Build Alternative where physical and environmental constraints exist where US 101 crosses through a more urbanized setting.

The proposed Build alternative consists of a combination of a one and two-lane express lane facility separated from the general purpose lanes by a striped buffer with combined entry and exit points. In the northbound direction, a single express lane begins on US 101 at East Dunne Avenue in Morgan Hill and a second express lane is introduced at Cochrane Road in Morgan Hill where the existing HOV lane begins. The double express lanes extend 8.3 miles north to the SR 85/US 101 interchange in San Jose where the #1 express lane (leftmost express lane) continues onto northbound SR 85 via the express connector, while the #2 express lane (the rightmost express lane) continues on US 101 in a single express lane configuration 3.0 miles north. A second express lane is introduced north of the Blossom Hill Road interchange and continues as a double express lane facility for 16.5 miles through San Jose, Santa Clara, and Sunnyvale until just north of the North Fair Oaks Avenue interchange where the two express lanes merge into a single express lane. The single express lane facility then continues 3.1 miles from just north of the North Fair Oaks Avenue interchange to the SR 85/US 101 interchange in Mountain View. North of the SR 85/US 101 interchange in Mountain View, the project proposes to convert 2.8 miles of existing double HOV lanes (currently under construction by the US 101 Auxiliary Lanes Project EA #04-4A3304) to double express lanes. The buffer terminates about 1 mile south of the Oregon Expressway/Embarcadero Road interchange in Palo Alto, and the double express lanes transition into dual HOV-only lanes that then merge into a single HOV lane just south of the Oregon Expressway/Embarcadero Road off-ramp.

In the southbound direction, the express lane begins 0.5 miles south of the Oregon Expressway/Embarcadero Road interchange in Palo Alto. The project proposes to convert the 2.9 miles of existing double HOV lanes (currently under construction by the US 101 Auxiliary Lanes Project) to express lanes. The express lane buffer begins on US 101, approximately 0.3 miles north of the US 101/Rengstorff Avenue interchange in Mountain View. The #1 express lane (leftmost express lane) continues on SR 85 via the HOV/Express connector while the #2 express lane (rightmost express lane) continues onto US 101 as a single express lane 2.9 miles from SR 85 in Mountain View to just north of the North Fair Oaks Avenue interchange in Sunnyvale. A second express lane is introduced just north of the North Fair Oaks Avenue interchange and continues as a double express lane facility for 16.4 miles through Sunnyvale, Santa Clara, and San Jose until just north of the Blossom Hill Road interchange in San Jose where the second express lane drops into a single express lane. The facility continues as a single express lane for 3.3 miles through SR 85/US 101 interchange in San Jose. A second express lane enters US 101 from the southbound SR 85 express connector. The project then converts the double HOV lanes south of this interchange to double express lanes, and extends the double express lanes facility 7.2 miles to just north of the Cochrane Road interchange in Morgan Hill where the existing HOV lane terminates. The project then constructs a single express lane 1.5 miles south which terminates at the East Dunne Avenue interchange in Morgan Hill.

The Build alternative also includes conversion of the HOV connectors at the northern junction between US 101 and SR 85 in Mountain View to express connectors. This will include restriping the northern 1.1 miles of SR 85 between the proposed terminus of the SR 85 Express Lanes project and the SR 85/US 101 Interchange to connect the SR 85 express lanes to the US 101 express lanes. Furthermore, as part of the currently-defined Build alternative, auxiliary lanes would be added in both directions between the Great America parkway and the Lawrence Expressway interchanges, in the northbound direction between the Old Bayshore Highway on-ramp and Brokaw Road/1st Street off-ramp, and in the northbound direction between the Lawrence Expressway on-ramp and Fair Oaks Avenue off-ramp to improve future operations in these segments.

A separate project, the SR 85 Express Lanes project, will implement express lanes on the SR 85 corridor and convert the HOV connectors at the US 101/SR 85 junction in south San Jose to express connectors in order to complete the express lane network for the two freeways.

The express lanes would be adjacent to the center median and separated from the general purpose lanes by a striped buffer zone. The buffer zone would have gaps in multiple locations where vehicles can enter and exit the facility (called “access points”). As currently-proposed, there would be ten access points in the northbound direction and eleven in the southbound (one of these would egress only) in addition to the start and end points plus the direct connectors to or from SR 85. Consistent with the requirements stated in TOPD 11-2, each access point would be 2000 feet in length, with exception of the following locations which were modified in order to improve operations:

Northbound:

- Story access zone - extended upstream by 1,200’ to provide a 3,200’ opening.
- McKee access zone – extended upstream by approximately 300’, to provide a 2,300’ opening.
- Bayshore access zone – extended by 1,000’, which provides a 3,000’ opening.
- De La Cruz access zone – extended beyond San Tomas/Montague off-ramp, which provides for a 6,000’ opening.
- Great America access zone – extended upstream by 1,000’, which provides for a 3,000’ opening.

Southbound:

- Mathilda-Fair Oaks access zone – extended by 1,000’, which provides for a 3,000’ opening
- Great America access zone – extended upstream by 200’, which provides for a 2,200’ opening.
- De La Cruz access zone – extended beyond diagonal off-ramp, which provides for a 3,000’ opening.
- Oakland-McKee access zone - extended upstream by approximately 2,500’, which provides a 4,500’ opening.

The project would include signage to advise express lane users that entering or exiting the facility anywhere other than designated access zones is a traffic violation.

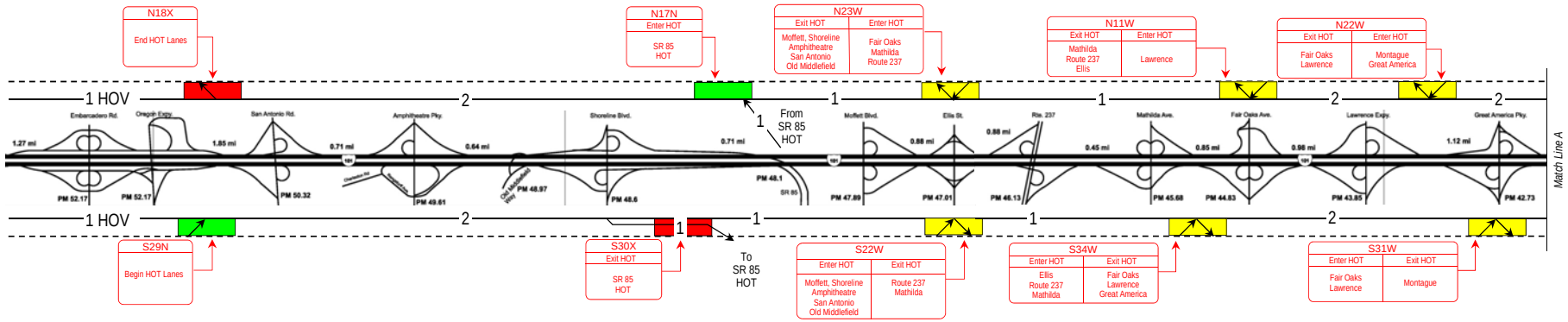
The design approach being taken for US 101 differs slightly from that currently being applied by Caltrans and MTC to other express lane facilities that together form the Bay Area Express Lane network. For those facilities, the design approach emphasizes an open access system (via continuous access striping) except where access is limited via buffer striping or double white solid striping, as necessary, to enhance or preserve operational efficiency and traffic safety.

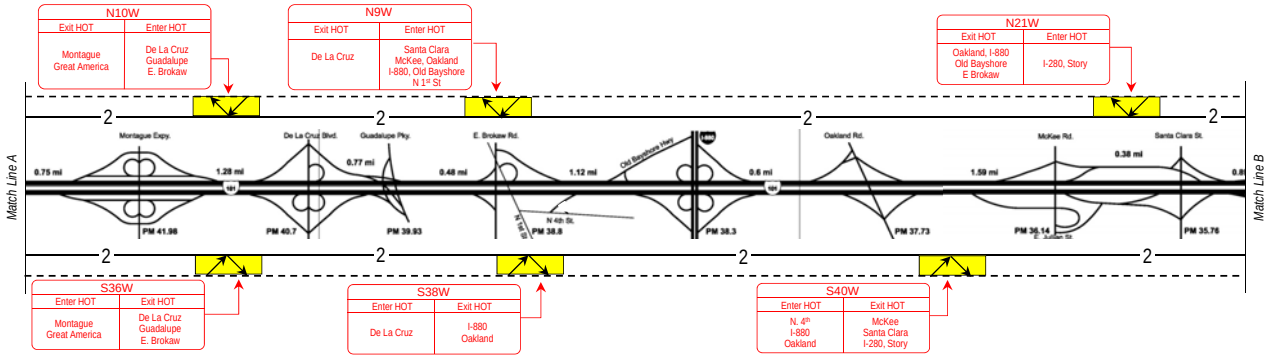
The open access system is intended to provide more adequate gaps in traffic stream and easier merging and weaving between the Express Lane and the general purpose lanes for vehicles and transit vehicles, specifically in segments where only a single Express Lane is proposed, or when freeway interchanges are closely spaced. Controlled access will be provided to manage congestion where excessive weaving or conflict is expected with general purpose lanes. Additional benefits to open access include:

- Reduce signage clutter
- Better public acceptance
- Greater driver familiarity
- Eliminate need for 2-foot buffer and associated widening.
- Enhanced maneuverability and easier access, specifically during off-peak hours
- Regional Express Lane consistency

The design approach for US 101, as described in this report, reflects a restrictive access scenario which will be reduced by maintaining as much of the existing continuous access striping scheme during the design phase of this project.

The proposed Build alternative is illustrated in **Figure 4-1.**





LEGEND

HOV – High Occupancy Vehicle Lane

HOT - High Occupancy/Toll Lane

GP – General Purpose Lanes

→ Planned Movement

–1– Number of HOT Lanes in Segment

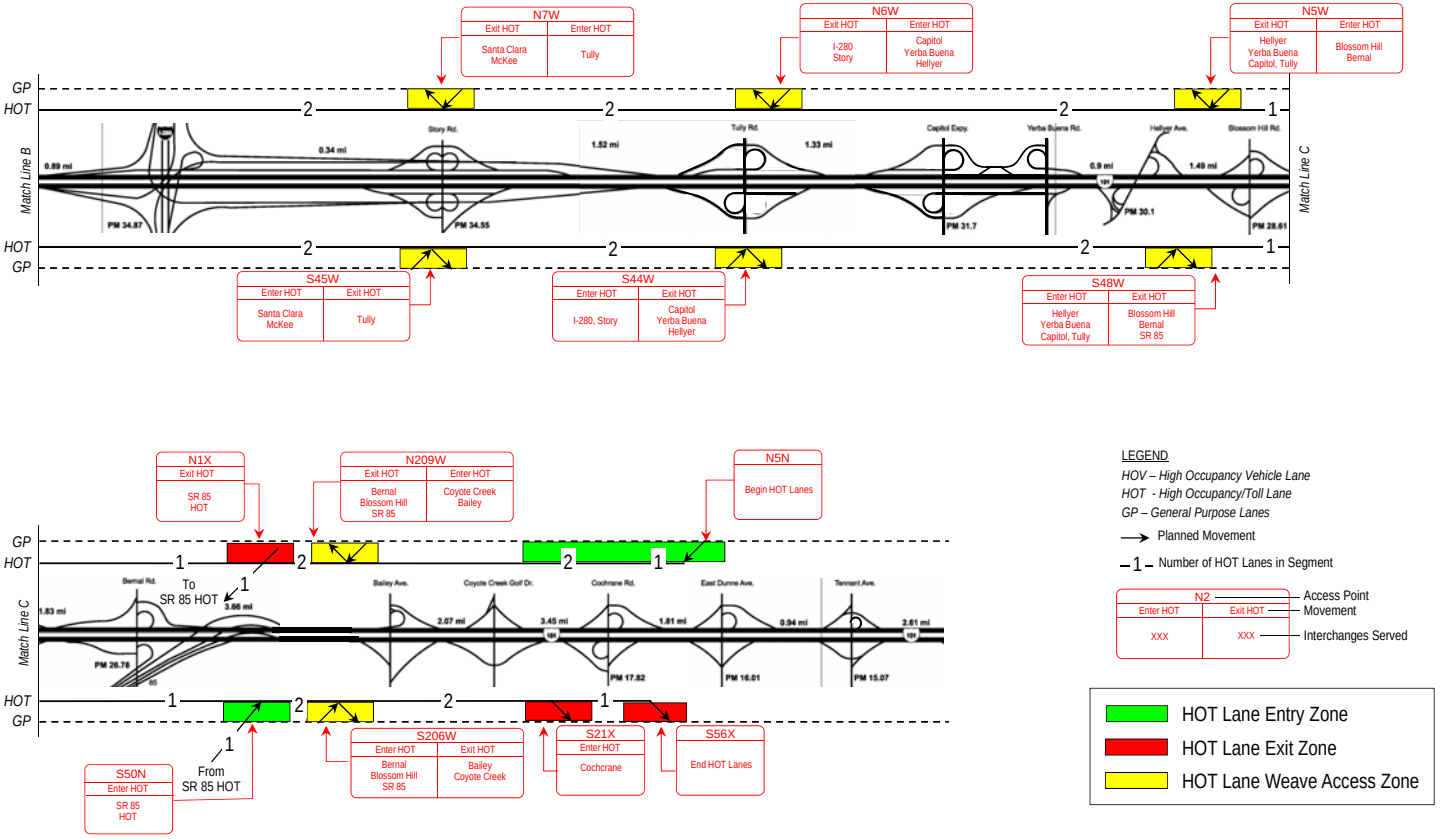
N2	
Enter HOT	Exit HOT
XXX	XXX

Access Point
Movement
Interchanges Served

HOT Lane Entry Zone

HOT Lane Exit Zone

HOT Lane Weave Access Zone



LEGEND

HOV – High Occupancy Vehicle Lane

HOT - High Occupancy/Toll Lane

GP – General Purpose Lanes

→ Planned Movement

–1– Number of HOT Lanes in Segment

N2 — Access Point
Enter HOT: XXX — Movement
Exit HOT: XXX — Interchanges Served

- HOT Lane Entry Zone
- HOT Lane Exit Zone
- HOT Lane Weave Access Zone

5 TRAVEL DEMAND FORECASTS

The 2015 and 2035 traffic demand forecasts used for the US 101 Express Lanes project traffic operational analysis are detailed in the technical memorandum entitled "US 101 Express Lanes Forecasted Travel Demand, June 6, 2013." This memorandum is included as Appendix A of this report. The final results and key findings are summarized below.

Table 5-1 through **Table 5-4** compare the forecasted hourly Build and No Build demand volumes by ramp and mainline segment for the Northbound AM, Southbound AM, Northbound PM, and Southbound PM peak periods respectively. It should be noted that as described in Section 2.1.3 a series of toll sensitivity assignments were conducted for the Build alternative forecasts to identify the toll rates in each segment that would maximize utilization of the express lanes. The volumes presented in the following tables assume that the maximum volume will be limited to 1,650 vehicles per hour per lane on the express lanes.

General observations on the differences between Build and No Build alternatives and differences between 2015 and 2035 include the following:

1. The greatest difference between demands in Build over No Build volumes occurs in the northbound AM and southbound PM peak periods.
2. The additional demand on US 101 in the Build Scenario is a result of the additional (express) lane in each direction, which attracts higher traffic volumes to the highway, as seen in the higher volumes on the entrance ramps over No Build conditions. However, many of the exit ramps are forecasted to experience lower demand when comparing Build vs. No Build conditions because the express lanes and additional capacity encourage longer distance trips on the highway.
3. The greatest increase in demand is forecasted to occur between SR 85 in San Jose and Mathilda Avenue, which corresponds approximately to the area where one additional lane in each direction is being added as part of the express lanes project. (The express lanes become one lane near the SR 85 interchanges; north of SR 85 in San Jose and between Fair Oaks Avenue and SR 85 in Mountain View.)
4. The US 101 express lanes will reduce the volumes on the off-ramp direct connectors to the SR 85 express lanes slightly, since traffic will have the option to use an improved US 101. However, in the northbound SR 85 to northbound US 101 direction, traffic on the express connector may increase during the morning peak period since toll-paying traffic can only use the express connector ramp when the US 101 express lanes are open. In the morning peak period, the connector is an attractive routing by helping toll-paying traffic bypass the ramp meter on the general purpose connector.
5. The northern portion of the study area is forecasted to be extremely congested in the future. The location of access points away from congested areas such as this to allow sufficient weaving distance to exit ramps may reduce the effective time savings of the project for exiting traffic.

SANTA CLARA Valley Transportation Authority

Table 5-1
AM Peak Period - Build and No Build Total Corridor Hourly Demand
Northbound

US 101

SEGMENTS	Model_ID	TOTAL DEMAND, 2-LANE ALT. ON US101								TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD AM Peak Period (6-9 am only)			
		2009				2035				2015				2035				2015				2035				2015		2035	
		AM1 (6-7)	AM2 (7-8)	AM3 (8-9)	AM4 (9-10)	AM1 (6-7)	AM2 (7-8)	AM3 (8-9)	AM4 (9-10)	AM1 (6-7)	AM2 (7-8)	AM3 (8-9)	AM4 (9-10)	AM1 (6-7)	AM2 (7-8)	AM3 (8-9)	AM4 (9-10)	AM1 (6-7)	AM2 (7-8)	AM3 (8-9)	AM4 (9-10)	AM1 (6-7)	AM2 (7-8)	AM3 (8-9)	AM4 (9-10)	AM1 (6-7)	AM2 (7-8)	AM1 (6-7)	AM2 (7-8)
		Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp
MAINLINE GP SOUTH OF TENNANT OFF	1004	4,692	4,578	3,837	3,198	5,433	5,443	4,638	3,665	5,477	5,494	4,685	4,006	5,424	5,432	4,628	3,643	5,468	5,483	4,675	3,984	9	11	10	22	9	11	10	22	30	30
MAINLINE HOV SOUTH OF TENNANT OFF	1004H	0	0	0	0	0	0	0	0	1,231	1,436	1,330	997	0	0	0	0	1,231	1,436	1,330	998	0	0	0	0	0	0	0	0	0	0
MAINLINE SOUTH OF TENNANT-Total	0	4,692	4,578	3,837	3,198	5,433	5,443	4,638	3,665	6,708	6,930	6,015	5,003	5,424	5,432	4,628	3,643	6,699	6,919	6,005	4,982	9	11	10	22	9	11	10	22	30	30
NB OFF TO TENNANT	1005	270	437	288	239	297	480	317	239	429	694	458	283	296	480	317	239	426	691	456	279	1	0	0	0	3	3	2	4	1	8
HOV/Exp ACCESS TO GP	N3X																														
HOV/Exp ACCESS FROM GP	N3N																														
NB ON FROM TENNANT LOOP	2512	0	0	0	0	530	675	507	356	544	693	521	356	516	658	494	356	518	660	496	356	14	17	13	0	26	33	25	0	44	84
HOV/Exp ACCESS TO GP	N4X																														
HOV/Exp ACCESS FROM GP	N4N																														
NB ON FROM TENNANT SLIP	1006	574	731	549	395	59	75	57	39	113	143	108	39	58	73	55	39	58	73	55	39	1	2	2	0	55	70	53	0	5	178
HOV/Exp ACCESS FROM GP	N1N																														
HOV/Exp ACCESS FROM GP	N19N																														
NB OFF TO E.DUNNE	1008	272 4,724	348 4,524	400 3,698	312 3,042	272 5,453	348 5,365	400 4,485	362 3,459	454 6,482	598 6,474	650 5,536	453 4,662	272 5,430	348 5,335	400 4,460	362 3,437	452 6,397	595 6,366	647 5,453	459 4,639	0 23	0 30	0 25	0 22	2 85	3 108	3 83	-6 23	0 78	8 276
NB ON FROM E.DUNNE LOOP	1009	452 5,176	562 5,086	513 4,211	274 3,316	462 5,915	575 5,940	524 5,009	274 3,733	564 7,046	702 7,176	640 6,176	311 4,973	461 5,891	573 5,908	523 4,983	274 3,711	565 6,962	702 7,068	641 6,094	313 4,952	1 24	2 32	1 26	0 22	-1 84	0 108	-1 82	-2 21	4 82	-2 274
NB ON FROM E.DUNNE SLIP	1010	368	745	590	309	368	745	590	309	435	881	698	312	368	745	590	309	380	770	610	313	0	0	0	0	55	111	88	-1	0	254
HOV/Exp ACCESS FROM HOV	2553H																														
HOV/Exp ACCESS TO GP	N5X																														
HOV/Exp ACCESS FROM GP	N5N																														
NB OFF TO COCHRANE	1012	445 5,098	600 5,231	595 4,206	411 3,214	502 5,781	677 6,008	672 4,927	448 3,594	502 6,979	677 7,380	672 6,202	572 4,713	502 5,757	677 5,976	672 4,901	447 3,573	502 6,840	677 7,161	672 6,032	576 4,689	0 24	0 32	0 26	1 21	0 139	0 219	0 170	-4 24	0 82	0 529
NB ON FROM COCHRANE	1014	427	605	433	287	471	668	478	287	607	861	616	417	470	666	477	287	497	705	505	416	1	2	1	0	110	156	111	1	4	377
NB ON FROM COCHRANE	1013	207 5,732	466 6,302	312 4,951	144 3,645	207 6,459	466 7,142	312 5,717	144 4,025	270 7,856	608 8,849	407 7,225	151 5,281	207 6,434	466 7,108	312 5,690	144 4,004	216 7,553	485 8,351	325 6,862	151 5,256	0 25	0 34	0 27	0 21	54 303	123 498	82 363	0 25	0 86	259 1,165
HOV/Exp ACCESS TO GP	N20X																														
HOV/Exp ACCESS FROM GP	N20N																														
NB OFF TO COYOTE	1017	28 5,705	28 6,273	26 4,925	29 3,616	28 6,431	29 7,113	26 5,691	29 3,996	28 7,828	29 8,820	26 7,199	29 5,252	28 6,406	28 7,080	26 5,664	29 3,975	28 7,525	28 8,323	26 6,836	29 5,227	0 25	1 33	0 27	0 21	0 303	1 497	0 363	0 25	1 86	1 1,164
NB ON FROM COYOTE	1018	30 5,735	33 6,307	34 4,960	36 3,652	30 6,461	33 7,146	34 5,725	36 4,032	30 7,858	33 8,853	34 7,233	36 5,288	30 6,436	33 7,113	34 5,698	36 4,011	30 7,555	33 8,356	34 6,870	36 5,263	0 25	0 33	0 27	0 21	0 303	0 497	0 363	0 25	0 86	0 1,164
NB OFF TO BAILEY	1020	194 5,542	250 6,057	151 4,809	78 3,574	146 6,315	189 6,957	114 5,611	78 3,954	265 7,593	343 8,510	206 7,027	78 5,210	145 6,291	188 6,925	113 5,585	78 3,933	264 7,291	342 8,014	206 6,664	78 5,185	1 24	1 32	1 26	0 21	1 302	1 496	0 363	0 25	3 83	2 1,162
NB ON FROM BAILEY	1021	191 5,733	367 6,424	308 5,117	145 3,719	254 6,569	488 7,445	410 6,021	145 4,099	306 7,899	588 9,098	494 7,521	145 5,355	251 6,542	482 7,407	405 5,990	145 4,078	303 7,594	582 8,596	489 7,153	145 5,330	3 27	6 38	5 31	0 21	3 305	6 502	5 368	0 25	14 97	14 1,176
HOV/Exp ACCESS TO GP	209EX																														
HOV/Exp ACCESS FROM GP	209EN																														
NB OFF TO 85-GP	1024	1,086 736	727 580	1,192 808	799 941	1,323 897	887 1,256	1,104 641	1,445 980	968 1,239	88 59	59 300	-122 -83	-81 17	206 -286																
NB OFF TO 85-HOV/EXP	1H	480 4,167	845 4,842	633 3,756	1,021 2,119	724 4,653	1,225 5,412	1,062 4,160	924 2,234	1,234 5,342	1,495 6,706	1,508 5,126	1,399 2,700	1,151 4,287	1,597 5,061	1,524 3,726	1,210 2,227	1,252 4,897	1,665 5,951	1,607 4,578	1,428 2,663	-427 366	-372 351	-462 434	-286 7	-18 445	-170 755	-99 548	-29 37	-1,261 1,153	-287 1,749
NB OFF TO BERNAL	1026	318 3,849	569 4,273	519 3,238	182 1,937	318 4,335	569 4,843	519 3,641	182 2,052	424 4,918	758 5,948	691 4,435	204 2,496	318 3,969	569 4,492	519 3,207	182 2,045	318 4,579	569 5,382	519 4,059	203 2,460	0 366	0 351	0 434	0 7	106 339	189 566	172 376	1 36	0 1,152	467 1,282
NB ON FROM BERNAL	1027	440 4,290	640 4,913	615 3,853	566 2,503	470 4,805	682 5,525	656 4,297	566 2,618	522 5,440	758 6,706	729 5,164	578 3,074	469 4,438	682 5,174	656 3,863	566 2,611	521 5,100	758 6,140	729 4,788	566 3,026	1 367	0 351	0 434	0 7	1 340	0 566	0 376	12 48	1 1,153	1 1,283
NB ON FROM BERNAL	1028																														
NB ON FROM BERNAL-HOV	1029																														
NB ON FROM BERNAL-SLIP/TOTAL	1028/1029	92 4,382	240 5,154	219 4,072	131 2,634	92 4,897	240 5,765	219 4,516	131 2,749	112 5,552	292 6,998	266 5,430	156 3,230	92 4,530	240 5,414	219 4,082	131 2,742	112 5,212	292 6,432	266 5,054	155 3,181	0 367	0 351	0 434	0 7	0 340	0 566	0 376	1 49	0 1,153	0 1,283
NB OFF TO BLOSSOM HILL	1031	244 4,138	509 4,644	437 3,635	211 2,423	244 4,653	509 5,256	437 4,079	211 2,538	496 5,056	924 6,074	868 4,562	268 2,962	244 4,286	509 4,905	437 3,645	211 2,531	506 4,706	939 5,493	884 4,170	268 2,913	0 367	0 351	0 434	0 7	-10 350	-15 581	-16 392	0 49	0 1,153	-41 1,324
NB ON FROM BLOSSOM HILL	1032	906 5,045	1,062 5,706	964 4,599	935 3,358	1,117 5,770	1,309 6,565	1,189 5,268	1,093 3,631	1,190 6,246	1,395 7,469	1,267 5,829	1,256 4,218	1,023 5,309	1,199 6,104	1,089 4,734	1,024 3,555	1,083 5,789	1,269 6,762	1,152 5,322	1,173 4,086	94 461	110 461	100 534	69 76	107 457	126 707	115 507	83 132	304 1,457	348 1,672
NB ON FROM BLOSSOM HILL	1033	286 5,330	593 6,299	457 5,056	188 3,546	308 6,078	639 7,204	493 5,761	197 3,828	311 6,557	644 8,113	497 6,326	233 4,451	289 5,598	600 6,704	462 5,196	197 3,752	289 6,078	600 7,362	462 5,784	232 4,318	19 480	39 500	31 565	0 76	22 479	44 751	35 542	1 133	89 1,546	101 1,773
HOV/Exp ACCESS TO GP	N9W_X																														
HOV/Exp ACCESS FROM GP	N9W_N																														
NB OFF TO HELLYER	1036	51 5,280	65 6,234	62 4,994	54 3,492	51 6,027	65 7,139	62 5,699	54 3,775	166 6,391	214 7,899	202 6,125	78 4,374	51 5,547	65 6,639	62 5,134	54 3,698	145 5,933	186 7,176	176 5,608	78 4,240	0 480	0 500	0 565	0 77	21 458	28 723	26 517	0 134	0 1,546	75 1,698
NB ON FROM HELLYER	1037	775 6,055	1,018 7,252	791 5,785	456 3,948	775 6,802	1,018 8,157	791 6,490	456 4,231	775 7,166	1,018 8,917	791 6,916	480 4,854	775 6,322	1,018 7,657	791 5,925	456 4,154	775 6,708	1,018 8,194	791 6,399	456 4,696	0 480	0 500	0 565	0 77	0 458	0 723	0 517	24 158	0 1,546	0 1,698
NB OFF TO YERBA BUENA	1039	80 5,974	192 7,060	171 5,614	155 3,793	130 6,672	275 7,882	255 6,235	155 4,076	176 6,990	352 8,565	332 6,584	164 4,690	125 6,197	267 7,390	246 5,679	155 3,999	125 6,583	267 7,927	246 6,153	165 4,531	5 475	8 492	9 556	0 77	51 407	85 638	86 431	-1 159	22 1,524	222 1,476
NB OFF TO CAPITOL NB	1043																														
NB OFF TO CAPITOL SB	1045																														
NB OFF TO CAPITOL AUX/TOTAL	1044/1045	240 5,735	429 6,631	442 5,172	430 3,383	240 6,432	429 7,453	442 5,793	430 3,646	284 6,706	509 8,056	524 6,060	447 4,243	240 5,957	429 6,961	442 5,237	430 3,569	321 6,262	573 7,354	591 5,562	446 4,085	0 475	0 492	0 556	0 77	-37 444	-64 702	-67 498	1 158	0 1,524	-168 1,644
NB ON FROM YERBA BUENA	1039A	630	640	495	750	805	818	699	823	872	886	777	823	778	791	668	823	795	808	687	823	27	27	31	0	77	78	90	0	85	245
NB ON FROM CAPITOL NB	2532																														
NB ON FROM CAPITOL NB- HOV	2531																														
NB ON FROM CAPITOL SB	1046																														
NB FROM CAPITOL NB-TOT	2532/2531	1,115 7,480	1,135 8,406	1,300 6,967	2,000 6,113	1,279 8,516	1,302 9,573	1,492 7,984	2,097 6,566	1,397 8,975	1,422 10,364	1,630 8,467	2,153 7,219	1,161 7,896	1,181 8,933	1,353 7,258	2,000 6,392	1,269 8,326	1,291 9,453	1,479 7,728	2,033 6,941	118 620	121 640	139 726	97 174	128 649	131 911	151 739	120 278	378 1,987	410 2,299
NB OFF TO TULLY SLIP	1052																														
NB OFF TO TULLY LOOP	1058																														
NB OFF TO TULLY-TOTAL	1052/1058	483 6,997	1,003 7,402	972 5,995	550 5,563	522 7,994	1,085 8,488	1,051 6,933	610 5,956	522 8,453	1,085 9,279	1,051 7,416	577 6,642	535 7,361	1,112 7,821	1,077 6,181	609 5,783	535 7,791	1,112 8,341	1,077 6,651	629 6,312	-13 633	-27 667	-26 752	1 173	-13 662	-27 938	-26 765	-52 330	-66 2,053	-66 2,365
HOV/Exp ACCESS TO GP	N8W_X																														
HOV/Exp ACCESS FROM GP	N8W_N																														
NB ON FROM TULLY LOOP-GP	1053																														
NB ON FROM TULLY LOOP-HOV	1054																														
NB ON FROM TULLY LOOP-TOTAL	1053/1054	727	956	929	850	1,018	1,339	1,301	906	1,018	1,339	1,301	906	908	1,194	1,160	877	908	1,194	1,160	877	110	145	141	29	110	145	141	29	396	396
NB ON FROM TULLY SLIP	1055	750 8,474	740 9,098	760 7,683	1,160 7,573	825 9,837	814 10,642	836 9,070	1,175 8,037	825 10,297	814 11,433	836 9,553	1,175 8,723	782 9,051	772 9,787	793 8,134	1,160 7,820	782 9,481	772 10,307	793 8,604	1,160 8,349	43 786	42 855	43 936	15 217	43 816	42 1,126	43 949	15 374	128 2,577	128 2,890
NB OFF TO I-680	1061A	2,400 6,074	3,040 6,058	2,920 4,763	3,130 4,443	2,418 7,419	3,061 7,581	2,941 6,129	3,130 4,907	2,533 7,764	3,190 8,243	3,072 6,481	3,130 5,593	2,419 6,632	3,061 6,726	2,941 5,193	3,130 4,690	2,528 6,953	3,183 7,124	3,065 5,539	3,130 5,219	-1 787	0 855	0 936	0 217	5 811	7 1,119	7 942	0 374	-1 2,578	19 2,871
NB OFF TO STORY	1062	170 5,904	180 5,878	170 4,593	290 4,153	170 7,249	180 7,401	170 5,959	290 4,617	204 7,560	216 8,027	204 6,277	497 5,096	170 6,462	180 6,546	170 5,023	290 4,400	201 6,752	213 6,911	201 5,338	497 4,722	0 787	0 855	0 936	0 217	3 808	3 1,116	3 939	0 374	0 2,578	9 2,862
HOV/Exp ACCESS TO GP	N7W_X																														
HOV/Exp ACCESS FROM GP	N7W_N																														
NB OFF TO FAIR OAKS	1125	460 6,564	770 7,218	760 4,993	620 5,383	525 7,229	879 8,189	867 5,824	708 5,802	538 8,057	901 9,682	889 7,136	897 6,930	460 6,982	770 8,033	760 5,592	641 5,769	468 7,670	784 9,107	773 6,765	750 6,580	65 247	109 156	107 232	67 33	70 387	117 575	116 371	147 350	281 635	303 1,334
NB ON FROM FAIR OAKS	1126	510 7,074	640 7,858	610 5,603	510 5,893	523 7,752	656 8,845	626 6,450	521 6,323	540 8,597	678 10,360	647 7,783	576 7,506	510 7,492	640 8,673	610 6,202	525 6,294	510 8,180	640 9,747	610 7,375	576 7,156	13 260	16 172	16 172	16 248	-4 29	30 417	38 613	37 408	0 350	45 680	105 1,439
NB OFF TO MATHILDA	1128	530 6,544	620 7,238	690 4,913	670 5,223	590 7,162	690 8,155	768 5,682	741 5,582	1,059 7,538	1,418 8,942	1,502 6,281	1,407 6,099	577 6,915	675 7,998	751 5,451	743 5,551	1,007 7,173	1,342 8,405	1,424 5,951	1,402 5,754	13 247	15 157	17 231	-2 31	52 365	76 537	78 330	5 345	45 635	206 1,233
NB ON FROM MATHILDA NB	1129	210 6,754	330 7,568	310 5,223	300 5,523	223 7,385	350 8,505	329 6,011	322 5,904	267 7,805	420 9,362	395 6,676	333 6,432	216 7,131	340 8,338	319 5,770	331 5,882	267 7,440	420 8,825	394 6,345	333 6,087	7 254	10 167	10 241	-9 22	0 365	0 537	1 331	0 345	27 662	1 1,234
NB OFF TO MATHILDA	1130	350 6,404	630 6,938	630 4,593	610 4,913	404 6,981	727 7,778	727 5,284	666 5,238	0 7,805	0 9,362	0 6,676	0 6,432	363 6,768	653 7,685	653 5,117	656 5,226	0 7,440	0 8,825	0 6,345	0 6,087	41 213	74 93	74 167	10 12	0 365	0 537	0 331	0 345	189 473	0 1,234
NB ON FROM MATHILDA SB-GP	2519																														
NB ON FROM MATHILDA SB-HOV	2520																														
NB ON FROM MATHILDA SB-TOTAL	2519/2520	0 6,404	0 6,938	0 4,593	0 4,913	0 6,981	0 7,778	0 5,284	0 5,238	257 8,062	405 9,767	380 7,056	133 6,565	0 6,768	0 7,685	0 5,117	0 5,226	257 7,697	403 9,228	379 6,724	137 6,224	0 213	0 93	0 167	0 12	0 365	2 539	1 332	-4 341	0 473	3 1,237
NB OFF TO RTE 237	1133	340 6,064	710 6,228	790 3,803	630 4,283	285 6,696	611 7,167	674 4,610	630 4,508	552 7,510	1,088 8,679	1,233 5,823	1,201 5,364	287 6,481	598 7,087	666 4,451	630 4,596	484 7,213	1,010 8,218	1,124 5,600	890 5,334	-2 215	13 80	8 159	0 12	68 297	78 461	109 223	311 30	19 454	255 982
NB ON FROM RTE 237	1134	760 6,824	900 7,128	740 4,543	750 5,033	760 7,456	900 8,067	740 5,350	998 5,606	1,056 8,561	1,251 9,930	1,029 6,852	1,367 6,731	760 7,241	900 7,987	740 5,191	998 5,594	1,049 8,262	1,243 9,461	1,022 6,622	1,368 6,702	0 215	0 80	0 159	0 12	7 304	8 469	7 230	-1 29	0 454	22 1,004
NB OFF TO ELLIS	1136	280	370	420	370	531	438	497	414	504	666	756	541	313	413	469	415	477	630	716	538	18	25	28	-1	27	36	40	3	71	103
HOV/Exp ACCESS TO GP	N23X																														

SANTA CLARA Valley Transportation Authority

Table 5-1
AM Peak Period - Build and No Build Total Corridor Hourly Demand
Northbound

US 101		TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD			
		2009								2015								2015				2035				2015				2035				AM Peak Period (6-9 am only)			
		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		2015		2035	
SEGMENTS	Model_ID	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp
HOV/Exp ACCESS FROM GP	N23N																																												
NB ON FROM ELLIS	1137	40	6,584	80	6,838	120	4,243	130	4,793	105	7,230	209	7,838	314	5,167	211	5,403	118	8,180	235	9,499	354	6,450	265	6,455	104	7,032	208	7,782	313	5,035	211	5,390	117	7,902	234	9,065	353	6,259	265	6,429	1	198	1	56	1	132	0	13	1	278	1	434	1	191	0	26	3	386	3	904
NB OFF TO MOFFETT	1139	240	6,344	220	6,618	190	4,053	250	4,543	263	6,967	241	7,597	208	4,959	306	5,097	338	7,842	310	9,189	268	6,182	356	6,089	240	6,792	220	7,562	190	4,845	309	5,081	337	7,565	309	8,756	267	5,992	370	6,059	23	175	21	35	18	114	-3	16	1	277	1	433	1	190	-4	30	62	324	3	901
NB ON FROM MOFFETT	1140	150		220		200		200		247		362		329		256		246		360		328		256		238		349		318		262		238		349		318		262		9		13		11		-6		8		11		10		-6		33		29	
NB OFF TO SHORELINE	1180	540	5,954	820	6,018	1,090	3,163	1,000	3,743	581	6,633	882	7,077	1,172	4,116	1,150	4,203	642	7,446	975	8,574	1,296	5,214	1,211	5,134	565	6,465	857	7,054	1,140	4,023	1,153	4,190	623	7,180	946	8,159	1,258	5,052	1,226	5,095	16	168	25	23	32	93	-3	13	19	266	29	415	38	162	-15	39	73	284	86	844
NB ON FROM SR 85	1143A	1,490		2,060		1,930		1,550		1,383		1,882		1,822		1,239		1,294		1,680		1,968		1,637		1,511		2,089		1,957		1,427		1,634		2,251		2,126		1,622		-128		-207		-135		-188		-340		-571		-158		15		-470		-1,069	
HOV/Exp ACCESS FROM SR 85 HOV	N17N	200	7,644	500	8,578	640	5,733	1,050	6,343	674	8,690	1,085	10,044	909	6,846	1,388	6,830	1,226	9,966	1,310	11,564	1,082	8,264	1,250	8,021	362	8,338	658	9,801	675	6,655	1,205	6,822	438	9,252	716	11,126	741	7,919	1,248	7,965	312	352	427	243	233	191	183	8	788	714	594	438	341	345	2	56	972	786	1,723	1,498
NB OFF TO MIDDLEFIELD	1148	350	7,294	770	7,808	860	4,873	490	5,853	350	8,340	770	9,274	860	5,986	512	6,318	458	9,508	1,032	10,532	1,101	7,163	756	7,265	350	7,988	770	9,031	860	5,795	512	6,310	458	8,794	1,032	10,094	1,101	6,818	712	7,253	0	352	0	243	0	191	0	8	0	714	0	438	0	345	44	12	0	786	0	1,498
NB ON FROM SHORELINE	1147	190	7,484	580	8,388	910	5,783	700	6,553	232	8,572	707	9,981	1,109	7,095	774	7,092	313	9,821	956	11,488	1,499	8,662	871	8,136	231	8,219	705	9,736	1,106	6,901	762	7,072	313	9,107	956	11,050	1,499	8,317	808	8,061	1	353	2	245	3	194	12	20	0	714	0	438	0	345	63	75	6	792	0	1,498
NB OFF TO RENGSTROFF NB	1151	120		120		200		270		271		271		451		288		300		300		499		343		235		235		392		288		297		297		496		343		36		36		59		0		3		3		3		0		131		9	
NB OFF TO RENGSTROFF SB	1152	220	7,144	230	8,038	210	5,373	230	6,053	230	8,071	242	9,468	223	6,421	234	6,570	349	9,172	388	10,800	378	7,785	264	7,529	220	7,764	230	9,271	210	6,299	234	6,550	254	8,556	272	10,481	255	7,566	265	7,453	10	307	12	197	13	122	0	20	95	616	116	319	123	219	-1	76	35	626	334	1,155
NB ON FROM RENGSTROFF	1153	170	7,314	400	8,438	410	5,783	350	6,403	211	8,282	497	9,965	509	6,930	408	6,978	223	9,395	525	11,325	538	8,323	458	7,987	211	7,975	496	9,767	508	6,807	407	6,957	222	8,778	523	11,004	536	8,102	457	7,910	0	307	1	198	1	123	1	21	1	617	2	321	2	221	1	77	2	628	5	1,160
NB OFF TO SAN ANTONIO	1155	550	6,764	710	7,728	720	5,063	530	5,873	684	7,598	884	9,081	896	6,034	553	6,425	790	8,605	1,020	10,305	1,034	7,289	658	7,329	653	7,322	843	8,924	855	5,952	553	6,404	784	7,994	1,012	9,992	1,026	7,076	657	7,253	31	276	41	157	41	82	0	21	6	611	8	313	8	213	1	76	113	515	22	1,138
NB ON FROM SAN ANTONIO NB	1156	240		520		720		670		293		634		878		715		332		719		996		790		292		633		876		715		331		717		992		790		1		1		2		0		1		2		4		0		4		7	
NB ON FROM SAN ANTONIO SB	1186	10	7,014	20	8,268	30	5,813	40	6,583	37	7,928	75	9,790	112	7,024	50	7,190	50	8,987	101	11,125	151	8,436	71	8,190	37	7,651	75	9,632	112	6,940	46	7,165	50	8,375	101	10,810	151	8,219	66	8,109	0	277	0	158	0	84	4	25	0	612	0	315	0	217	5	81	0	519	0	1,145
HOV/Exp ACCESS TO GP	N18X																																												
HOV/Exp ACCESS FROM GP	N18N																																												
NB OFF TO OREGON AND EMBARCADERO	1159A	930	6,084	1,390	6,878	1,280	4,533	1,130	5,453	1,014	6,914	1,509	8,281	1,402	5,622	1,138	6,052	1,014	7,973	1,509	9,616	1,402	7,035	1,145	7,046	985	6,666	1,468	8,164	1,360	5,580	1,138	6,027	985	7,390	1,468	9,342	1,360	6,859	1,144	6,985	29	248	41	117	42	42	0	25	29	583	41	274	42	176	1	81	112	407	112	1,033
NB ON FROM EMBARCADERO SB	1167																																												
NB ON FROM OREGON / EMBARCADERO-CD	2528																																												
NB ON FROM OREGON / EMBARCADERO-TO	1167/2528	320	6,404	780	7,658	1,330	5,863	1,150	6,603	374	7,288	912	9,193	1,554	7,176	1,264	7,316	459	8,432	1,119	10,735	1,906	8,941	1,451	8,497	374	7,040	911	9,075	1,553	7,133	1,264	7,291	459	7,849	1,118	10,460	1,907	8,766	1,453	8,418	0	248	1	118	1	43	0	25	0	583	1	275	-1	175	-2	79	2	409	0	1,033

SANTA CLARA Valley Transportation Authority

Table 5-2
AM Peak Period - Build and No Build Total Corridor Hourly Demand
Southbound

US 101

SEGMENTS	Model ID	TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD AM Peak Period (6-9 am only)			
		2009								2015								2015								2015								2015			
		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)	
		Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp
SB SOUTH OF UNIVERSITY-AU	2006A																																				
SB SOUTH OF UNIVERSITY-GP	2006S	4240		7790		7570		6310		4927		9052		8797		7139		6056		11125		10812		8427		4869		8945		8692		7121		6016		11052	
SB SOUTH OF UNIVERSITY-HO	2006H																																				
SB SOUTH OF UNIVERSITY-TO		4240	4240	7790	7790	7570	7570	6310	6310	4927	4927	9052	9052	8797	8797	7139	7139	6056	6056	11125	11125	10812	10812	8427	8427	4869	4869	8945	8945	8692	8692	7121	7121	6016	6016	11052	11052
SB OFF TO EMBARCADERO SB	2009																																				
SB OFF TO EMBARCADERO NB	2011																																				
SB OFF TO OREGON	2013																																				
SB SOUTH OFF OREGON / EMB	2009/11/13	970		1690		1680		1380		1097		1912		1900		1590		1196		2085		2072		1680		1097		1910		1899		1573		1197		2084	
SB ON FROM EMBARCADERO S	2010																																				
SB ON FROM EMBARCADERO N	2012																																				
SB ON FROM OREGON	2015																																				
SB ON OREGON / EMBARCADE	2010/12/15	588	3858	1705	7805	2084	7974	1591	6521	723	4553	2095	9235	2561	9458	1804	7353	779	5639	2257	11297	2759	11499	2271	9018	677	4449	1963	8998	2399	9192	1792	7340	706	5525	2047	11015
HOV/EXP ACCESS FROM HOV	2017H																																				
HOV/EXP ACCESS FROM GP	S29N																																				
SB OFF TO SAN ANTONIO SB	2020	170	3688	380	7425	800	7174	760	5761	228	4325	509	8726	1073	8385	816	6537	330	5309	736	10561	1551	9948	1194	7824	227	4222	508	8490	1070	8122	816	6524	329	5196	736	10279
SB OFF TO SAN ANTONIO NB	2021	70	3618	170	7255	270	6904	230	5531	82	4243	198	8528	315	8070	236	6301	0	5309	0	10561	0	9948	0	7824	81	4141	196	8294	312	7810	241	6283	0	5196	0	10279
SB ON FROM SAN ANTONIO	2521	0	3618	0	7255	0	6904	0	5531	0	4243	0	8528	0	8070	0	6301	50	5359	122	10683	290	10238	169	7993	0	4141	0	8294	0	7810	0	6283	50	5246	122	10401
SB ON FROM CHARLESTON / R	2023	160		390		930		970		171		417		994		1025		227		554		1320		1152		160		390		930		1007		192		468	
SB OFF TO RENGSTROFF	2025	280		570		770		740		373		759		1026		867		424		862		1166		867		373		759		1025		859		423		861	
SB ON FROM RENGSTROFF	2026	110	3608	180	7255	190	7254	550	6311	110	4151	180	8366	190	8228	554	7013	127	5289	208	10583	219	10611	554	8832	110	4038	180	8105	190	7905	550	6981	120	5135	197	10205
SB ON FROM MIDDLEFIELD	2030	270	3878	520	7775	770	8024	660	6971	319	4470	614	8980	910	9138	729	7742	494	5783	951	11534	1409	12020	946	9778	317	4355	610	8715	903	8808	729	7710	494	5629	951	11156
SB OFF TO SHORELINE	2034	250	3628	450	7325	540	7484	540	6431	250	4220	450	8530	540	8598	607	7135	250	5533	450	11084	540	11480	787	8991	250	4105	450	8265	540	8268	607	7103	250	5379	450	10706
SB ON FROM SHORELINE-SB	2037	70		110		130		160		95		149		176		227		115		181		214		282		86		136		160		228		115		181	
SB ON FROM SHORELINE-NB	2036	170		260		350		320		210		321		432		354		255		389		524		435		196		300		404		356		246		377	
SB OFF TO SR 85-GP	2039	610		1220		1510		1150		716		1157		1422		1205		1113		1625		2104		1618		718		1436		1777		1205		1111		2223	
SB OFF TO SR 85-HOV	S30X	50	3208	230	6245	210	6244	310	5451	55	3754	516	7327	557	7227	414	6097	109	4681	1132	8897	1129	8985	587	7503	61	3608	282	6983	258	6797	445	6037	122	4507	561	8480
HOV/EXP ACCESS FROM GP	S32W_N																																				
HOV/EXP ACCESS TO GP	S32W_X																																				
SB OFF TO MOFFETT	2501	120		200		220		230		173		288		317		291		213		355		391		303		173		288		317		291		211		352	
SB ON FROM MOFFETT	2502	120	3208	210	6255	260	6284	250	5471	206	3787	361	7400	447	7357	332	6138	408	4876	714	9256	884	9478	442	7642	205	3640	359	7054	444	6924	332	6078	382	4678	668	8796
SB OFF TO ELLIS	2505	250	2958	460	5795	560	5724	530	4941	278	3509	512	6888	623	6734	605	5533	309	4567	570	8686	693	8785	641	7001	294	3346	540	6514	658	6266	612	5466	332	4346	609	8187
HOV/EXP ACCESS FROM GP	S22N																																				
HOV/EXP ACCESS TO GP	S22X																																				
SB ON FROM ELLIS-GP	2506S																																				
SB ON FROM ELLIS-HOV	2506H																																				
SB ON FROM ELLIS-TOTAL	2506	90	3048	140	5935	150	5874	160	5101	139	3648	217	7105	232	6966	194	5727	202	4769	315	9001	337	9122	306	7307	139	3485	216	6730	232	6498	194	5660	198	4544	307	8494
SB OFF TO RTE 237	2040	850	2198	1670	4265	1910	3964	1640	3461	988	2660	1941	5164	2220	4746	1811	3916	1156	3613	2270	6731	2597	6525	2306	5001	954	2531	1875	4855	2144	4354	1811	3849	1150	3394	2260	6234
SB ON FROM RTE 237	2340	350	2548	830	5095	1200	5164	980	4441	396	3056	940	6104	1359	6105	1021	4937	485	4098	1150	7881	1663	8188	1287	6288	386	2917	916	5771	1324	5678	1021	4870	448	3842	1062	7296
SB OFF TO MATHILDA	2330	150	2398	270	4825	340	4824	390	4051	170	2886	306	5798	386	5719	428	4509	285	3813	513	7368	646	7542	636	5652	162	2755	292	5479	368	5310	428	4442	276	3566	497	6799
SB ON FROM MATHILDA SB	2044	80	2478	110	4935	110	4934	140	4191	116	3002	160	5958	160	5879	180	4689	126	3939	174	7542	174	7716	214	5866	114	2869	157	5636	157	5467	181	4623	122	3688	168	6967
SB ON FROM MATHILDA NB-GP	2045																																				
SB ON FROM MATHILDA NB-HO	2046																																				
SB ON FROM MATHILDA NB-TO	2045/2046	150	2628	350	5285	550	5484	490	4681	173	3175	404	6362	635	6514	523	5212	299	4238	697	8239	1096	8812	753	6619	166	3035	386	6022	607	6074	527	5150	245	3933	570	7537
HOV/EXP ACCESS FROM GP	S34W_N																																				
HOV/EXP ACCESS TO GP	S34W_X																																				
SB OFF TO FAIR OAKS	2048	130	2498	360	4925	250	5234	250	4431	138	3037	383	5979	266	6248	254	4958	138	4100	383	7856	266	8546	298	6322	141	2894	389	5633	270	5804	254	4896	141	3792	389	7148
SB ON FROM FAIR OAKS SB	2049	80	2578	170	5095	220	5454	210	4641	107	3144	226	6205	293	6541	239	5197	151	4251	319	8175	413	8959	297	6619	106	3000	226	5859	292	6096	240	5136	149	3941	316	7464
SB OFF TO FAIR OAKS	2050	40	2538	70	5025	130	5324	130	4511	47	3097	83	6122	153	6388	133	5064	78	4173	138	8037	254	8705	187	6432	47	2953	82	5777	153	5943	132	5004	84	3857	147	7317
SB ON FROM FAIR OAKS NB-GP	2051																																				
SB ON FROM FAIR OAKS NB-HO	2052																																				
SB ON FROM FAIR OAKS NB-TO	2051/2052	230	2768	380	5405	410	5734	410	4921	263	3360	434	6556	468	6856	424	5488	286	4459	471	8508	508	9213	479	6911	250	3203	413	6190	446	6389	411	5415	252	4109	416	7733
SB OFF TO LAWRENCE SB	2055	250	2518	610	4795	650	5084	720	4201	316	3044	770	5786	820	6036	799	4689	369	4090	900	7608	959	8254	941	5970	279	2924	682	5508	727	5662	799	4616	309	3800	756	6977
SB ON FROM LAWRENCE SB	2056	190	2708	320	5115	300	5384	250	4451	227	3271	382	6168	359	6395	292	4981	349	4439	587	8195	552	8806	385	6355	227	3151	382	5890	358	6020	294	4910	307	4107	516	7493
SB ON FROM LAWRENCE NB-G	2057S																																				
SB ON FROM LAWRENCE NB-H	2057H																																				
SB ON FROM LAWRENCE NB-T	2057	280	2988	610	5725	860	6244	840	5291	312	3583	679	6847	957	7352	886	5867	320	4759	697	8892	983	9789	1000	7355	300	3451	654	6544	922	6942	881	5791	316	4423	688	8181
SB OFF TO GREAT AMERICA	2059	270		640		1020		1270		298		706		1125		1301		354		840		1338		1420		278		659		1051		1287		337		799	
HOV/EXP ACCESS FROM GP	S31N																																				
HOV/EXP ACCESS TO GP	S31X																																				
SB ON FROM GREAT AMERICA	2060	120	2838	190	5275	240	5464	240	4261	126	3411	199	6340	252	6479	249	4816	198	4603	313	8365	396	8847	328	6263	125	3298	199	6084	251	6142	249	4753	192	4278	306	7688
SB ON FROM GREAT AMERICA	2061	120	2958	180	5455	220	5684	210	4471	131	3542	197	6537	241	6720	230	5046	184	4787	276	8641	338	9185	292	6555	129	3427	193	6277	236	6378	230	4983	184	4462	276	7964
SB OFF TO SAN TOMAS	2065	390	2568	780	4675	1170	4514	1310	3161	531	3011	1062	5475	1593	5127	1417	3629	794	3993	1588	7053	2382	6803	1690	4865	497	2930	993	5284	1490	4888	1417	3566	713	3749	1425	6539
SB ON FROM MONTAGUE SB	2067																																				
SB ON FROM SAN TOMAS NB	2069																																				
SB ON FROM SAN TOMAS/MON	20672069	320	2888	660	5335	720	5234	680	3841	408	3419	842	6317	918	6045	885	4514	601	4594	1241	8294	1353	8156	1266	6131	408	3338	841	6125	917	5805	885	4451	575	4324	1186	7725
HOV/EXP ACCESS FROM GP	S36W_N																																				
HOV/EXP ACCESS TO GP	S36W_X																																				
SB OFF TO TRIMBLE-SLIP	2073	170	2718	250	5085	300	4934	300	3541	178	3241	262	6055	315	5730	314	4200	699	3895	1028	7267	1234	6923	1134	4997	173	3165	255	5870	306	5499	314	4137	610	3714	897	6828
SB ON FROM TRIMBLE SB	2074	150	2868	220	5305	270	5204	290	3831	186	3427	273	6328	335	6065	369	4569	198	4093	291	7558	357	7280	446	5443	186	3351	273	6143	335	5834	369	4506	186	3900	273	7101
SB OFF TO TRIMBLE-LOOP	2518	250		450		610		550		287		517		700		613		0		0		0		0		280		504		684		614		0		0	
SB ON FROM TRIMBLE NB	2075	340	2958	570	5425	720	5314	680	3961	421	3561	705	6516	891	6256	680	4636	704	4797	1180	8738	1490	8770	888	6331	420	3491	704	6343	889	6039	680	4572	690	4590	1157	8258
SB OFF TO 87	2079	720	2238	1340	4085	1520	3794	1440	2521	876	2685	1630	4886	1849	4407	1704	2932	1066	3731	1983	6755	2249	6521	1956	4375	871	2620	1622	4721	1840	4199	1704	2868	1052	3538	1958	6300
SB OFF TO N1ST	2081	330	1908	760	3325	1060	2734	1000	1521	446	2239	1026	3860	1431	2976	1061	1871	526	3205	1210	5545	1688	4833	1331	3044	437	2183	1006	3715	1404	2795	1063	1805	515	3023	1185	5115
SB ON FROM 1st ST	2082	240	2148	380	3705	420	3154	460	1981	495	2734	783	4643	865	3841	610	2481	0	3205	0	5545	0	4833	0	3044	495	2678	783	4498	865	3660	612	2417	0	3023	0	5115
HOV/EXP ACCESS FROM GP	S38W_X																																				
HOV/EXP ACCESS TO GP	S38W_N																																				
SB OFF TO 4TH	2516	0	2148	0	3705	0	3154	0	1981	0	2734	0	4643	0	3841	0	2481	339	2866	782	4763	1090	3743	592	2452	0	2678	0	4498	0	3660	0	2417	320	2703	737	4378
SB ON FROM 4TH ST	2517	0	2148	0	3705	0	3154	0	1981	0	2734	0	4643	0	3841	0	2481	852	3718	1348	6111	1490	5233	1336	3788	0	2678	0	4498	0	3660	0	2417	848	3551	1342	5720
SB OFF TO I-880	2085	200	1948	390	3315	490	2664	480	1501	200	2534	390	4253	490	3351	521	1960	200	3518	390	5721	490	4743	521	3267	200	2478	390	4108	490	3170	524	1893	219	3332	426	5294
SB ON FROM I-880 SB	2310	1020	2968	1040	4355	960	3624	1050	2551	1110	3644	1131	5384	1044	4395	1191	3151	1381	4899	1407	7128	1299	6042	1556	4823	1110	3588	1131	5239	1044	4214	1191	3084	1351	4683	1377	6671
SB OFF TO I-880 NB	2311	200	2768	330	4025	360	3264	360	2191	443	3201	731	4653	797	3598	536	2615	572	4327	945	6183	1030	5012	756	4067	399	3189	659	4580	719	3495	531	2553	460	4223	760	5911
SB ON FROM I-880 NB	2088	380	3148	550	4575	440	3704	470	2661	380	3581	550	5203	440	4038	503	3118	466	4793	675	6858	540	5552	577	4644	380	3569	550	5130	440	3935	501	3054	443	4666	641	6552
SB OFF TO OAKLAND	2091	410	2738	640	3935	630	3074	620	2041	418	3163	652	4551	642	3396	702	2416	418	4375	652	6206	642	4910	811	3833	410	3159	640	4490	630	3305	706	2348	385	4281	601	5951
SB ON FROM OAKLAND	2092	370	3108	540	4475	540	3614	530	2571	401	3564	586	5137	586	3982	530	2946	490	4865	716	6922	716	5626	643	4476	401	3560	585	5075	585	3890	530	2878	491	4772	716	6667
HOV/EXP ACCESS FROM GP	S40W_N																																				
HOV/EXP ACCESS TO GP	S40W_X																																				
SB OFF TO MABURY	2511	0		0		0		0		0		0		0		0		340		523		486		486		0		0		0		0		340		521	
SB ON FROM MABURY	2510	0	3108	0	4475	0	3614	0	2571	0	3564	0	5137	0	3982	0	2946	259	4784	427	6826	403	5543	363	4353	0	3560	0	5075	0	3890	0	2878	236	4668	390	6536
SB OFF TO MCKEE	2095	280	2828	430	4045	400	3214	380	2191	310	3254	475	4662	442	3540	405	2541	389	4395	596	6230	554	4989	411	3942	310	3250	476	4599	443	3447	409	2469	380	4288	583	5953
SB OFF TO SANTA CLARA	2305	150	2678	250	3795	240	2974	240	1951	162	3092	271	4391	260	3280	244	2297	299	4096	500	5730	480	4509	398	3544	162	3088	271	4328	260	3187	243	2226	305	3983	510	5443
SB ON FROM MCKEE	2096	430	3108	710	4505	670	3644	540	2491	503	3595	831	5222	784	4064	563	2860	727	4823	1201	6931	1133	5642	734	4278	503	3591	831	5159	784	3971	565	2791	693	4676	1145	6588
SB ON FROM SANTA CLARA	2306	380	3488	550	5055	500	4144	420	2911	541	4136	782	6004	711	4775	437	3297	930	5753	1345	8276	1223	6865	710	4988	541	4132	782	5941	711	4682	437	3228	921	5597	1332	7920
SB OFF TO I-680	2106	980	2508	1250	3805	1060	3084	1100	1811	1178	2958	1502	4502	1274	3501	1119	2178	1650	4103	2104	6172	1784	5081	1654	3334	1178	2954	1503	4438	1274	3408	1118	2110	1600	3997	2041	5879
SB OFF TO STORY	2108A	260	2248	450	3355	420	2664	420	1391	269	2689	466	4036	435	3066	420	1758	438	3665	759	5413	709	4372	483	2851	269	2685	466	3972	435	2973	420	1690	456	3541	790	5089
HOV/EXP ACCESS FROM GP	S45W_N																																				
HOV/EXP ACCESS TO GP	S45W_X																																				
SB ON FROM STORY	2113	240	2488	420	3775	350	3014	310	1701	433	3122	757	4793	631	3697	384	2142	686	4351	1199	6612	1000	5372	639	3490	433	3118	757	4729	631	3604	384	2074	652	4193	1140	6229
SB ON FROM I-680	2304	1610	4098	2770	6545	2910	5924	2560	4261	1681	4803	2892	7685	3039	6736	2687	4829	1867	6218	3212	9824	3375	8747	2880	6370	1680	4798	2890	7619	3036	6640	2662	4736	1867	6060	3212	9441
SB OFF TO TULLY-SLIP	2120																																				
SB OFF TO TULLY-LOOP	2119																																				
SB OFF TO TULLY-TOTAL	2119/2120	770	3328	1210	5335	1290	4634	1370	2891	883	3920	1388	6297	1480	5256	1529	3300	1053	5165	1654	8170	1764	6983	1773	4597	883	3915	1388	6231	1480	5160	1511	3225	1045	5015	1643	7798
HOV/EXP ACCESS FROM GP	S44W_N																																				
HOV/EXP ACCESS TO GP	S44W_X																																				
SB ON FROM TULLY-SLIP	2122	176		283		287		219		209		336		341		230		227		365		371		261		209		336		341		228		225		362	
SB ON FROM TULLY-LOOP	2535																																				
SB ON FROM TULLY-LOOP	2534																																				
SB ON FROM TULLY-LOOP TOT	2535/2122	194	3698	314	5932	317	5238	243	3353	206	4335	333	6966	336	5933	304	3834	228	5620	368	8903	371	7725	367	5225	206	4330	333	6900	336	5837	301	3754	228	5468	368	8528
SB OFF TO CAPITOL-SLIP	2126																																				
SB OFF TO CAPITOL-LOOP	2533																																				
SB OFF TO CAPITOL-TOTAL	2126/2533	790		1660		1730		1460		685		1440		1501		1111		948		1992		2077		1373		685		1440		1501		1111		920		1933
SB ON FROM CAPITOL-LOOP	2536																																				
SB ON FROM CAPITOL-LOOP	2537																																				
SB ON FROM CAPITOL-SLIP	2130																																				
SB ON FROM CAPITOL-TOTAL	6/37/2130	400	3308	790	5062	840	4348	530	2423	516	4166	1020	6546	1085	5517	543	3266	673	5345	1330	8241	1415	7063	646	4498	516	4161	1020	6480	1085	5421	543	3186	672	5220	1327	7922
SB OFF TO YERBA BEUNA	2136A	0		0		0		0		263		552		575		433		309		650		677		559		262		551		574		433		298		626
SB ON FROM YERBA BEUNA	2135	220	3528	480	5542	510	4858	290	2713	220	4123	480	6474	510	5452	290	3123	243	5279	530	8121	563	6949	357	4296	220	4119	480	6409	510	5357	290	3043	230	5152	503	7799

SANTA CLARA Valley Transportation Authority

Table 5-2
AM Peak Period - Build and No Build Total Corridor Hourly Demand
Southbound

US 101		TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD	
		2009								2015				2035				2015				2035				2015				2035				AM Peak Period (6-9 am only)	
		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		AM1 (6-7)		AM2 (7-8)		AM3 (8-9)		AM4 (9-10)		2015		2035	
SEGMENTS	Model_ID	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp
SB OFF TO HELLYER	2138	300	3228	440	5102	450	4408	340	2373	300	3823	440	6034	450	5002	345	2778	436	4843	639	7482	653	6296	499	3797	300	3819	440	5969	450	4907	345	2698	424	4728	621	7178	635	5852	433	3698	0	4	0	65	0	95	0	80	12	115	18	304	18	444	66	99	0	165	48	863
SB ON FROM HELLYER	2139	60	3288	120	5222	130	4538	80	2453	70	3893	140	6174	152	5154	80	2858	92	4935	184	7666	200	6496	112	3909	70	3889	141	6110	153	5060	80	2778	92	4820	184	7362	200	6052	112	3810	0	4	-1	64	-1	94	0	80	0	115	0	304	0	444	0	99	-2	163	0	863
HOV/EXP ACCESS FROM GP	S48W_N																																																								
HOV/EXP ACCESS TO GP	S48W_X																																																								
SB OFF TO BLOSSOM HILL	2142	620	2668	1120	4102	1400	3138	1110	1343	656	3237	1185	4989	1482	3673	1202	1656	731	4205	1357	6309	1717	4779	1424	2486	656	3233	1186	4924	1482	3578	1203	1575	726	4094	1312	6050	1639	4413	1422	2388	0	4	-1	65	0	95	-1	81	5	111	45	259	78	366	2	98	-1	164	128	735
SB ON FROM BLOSSOM HILL	2143	100	2768	280	4382	250	3388	160	1503	105	3342	293	5282	262	3935	162	1818	150	4355	420	6729	375	5154	190	2676	105	3338	293	5217	262	3840	162	1737	127	4221	356	6406	318	4731	192	2580	0	4	0	65	0	95	0	81	23	134	64	323	57	423	-2	96	0	164	144	879
SB ON FROM BLOSSOM HILL	2144	140	2908	210	4592	230	3618	180	1683	172	3514	258	5540	282	4217	180	1998	302	4657	452	7181	495	5649	204	2880	170	3508	255	5472	279	4119	180	1917	262	4483	393	6799	430	5161	206	2786	2	6	3	68	3	98	0	81	40	174	59	382	65	488	-2	94	8	172	164	1,043
SB OFF TO SB85-GP	175																																																								
SB OFF TO SB85-HOV	176																																																								
SB OFF TO SB85-TOTAL	175/176	170		440		460		330		172		446		466		330		186		482		503		427		172		445		466		330		182		471		493		427		0		1		0		0		4		11		10		0		1		25	
SB OFF TO BERNAL	2147	330	2408	680	3472	850	2308	530	823	405	2937	834	4260	1043	2708	561	1107	670	3801	1380	5319	1725	3421	797	1656	405	2931	834	4193	1043	2610	562	1025	635	3666	1308	5020	1635	3033	776	1583	0	6	0	67	0	98	-1	82	35	135	72	299	90	388	21	73	0	171	197	821
SB ON FROM 85-GP	173S	690		1080		1190		940		852		1334		1469		1076		1062		1522		1586		1361		865		1353		1491		1075		1097		1716		1891		1361		-13		-19		-22		1		-35		-194		-305		0		-54		-534	
SB ON FROM 85-HOV/EXP	173H	60	3158	150	4702	180	3678	440	2203	120	3909	265	5859	313	4490	488	2671	278	5141	692	7533	808	5815	563	3580	96	3892	241	5787	289	4390	490	2590	246	5009	615	7351	738	5662	563	3507	24	17	24	72	24	100	-2	81	32	132	77	182	70	153	0	73	72	189	179	466
HOV/EXP ACCESS FROM GP	206EN																																																								
HOV/EXP ACCESS TO GP	206EX																																																								
SB OFF TO BAILEY	2150	180	2978	200	4502	290	3388	380	1823	226	3683	251	5608	364	4126	380	2291	326	4815	362	7171	525	5290	380	3200	226	3666	251	5536	364	4026	380	2210	325	4684	361	6990	523	5139	380	3127	0	17	0	72	0	100	0	81	1	131	1	181	2	151	0	73	0	189	4	462
SB ON FROM BAILEY	2151	60	3038	70	4572	80	3468	80	1903	87	3770	102	5710	116	4242	80	2371	119	4934	139	7310	158	5448	94	3294	87	3753	102	5638	117	4143	80	2290	118	4802	139	7129	159	5298	91	3218	0	17	0	72	-1	99	0	81	1	132	0	181	-1	150	3	76	-1	188	0	462
SB OFF TO COYOTE GREEK	2153	60	2978	60	4512	70	3398	60	1843	62	3708	62	5648	72	4170	60	2311	71	4863	71	7239	83	5365	60	3234	62	3691	62	5576	72	4071	60	2230	71	4731	71	7058	83	5215	60	3158	0	17	0	72	0	99	0	81	0	132	0	181	0	150	0	76	0	188	0	462
SB ON FROM COYOTE GREEK	2154	20	2998	20	4532	20	3418	30	1873	20	3728	20	5668	20	4190	30	2341	20	4883	20	7259	20	5385	30	3264	20	3711	20	5596	20	4091	30	2260	20	4751	20	7078	20	5235	30	3188	0	17	0	72	0	99	0	81	0	132	0	181	0	150	0	76	0	188	0	462
HOV/EXP ACCESS TO GP	S21X																																																								
SB OFF TO COCHRANE	2157	570	2428	730	3802	840	2578	600	1273	838	2890	1073	4595	1235	2955	600	1741	1260	3623	1614	5645	1857	3528	600	2664	838	2873	1073	4523	1235	2856	600	1660	1254	3497	1606	5472	1849	3386	600	2588	0	17	0	72	0	99	0	81	6	126	8	173	8	142	0	76	0	188	22	441
SB ON FROM COCHRANE	2158	20	2448	70	3872	70	2648	80	1353	21	2911	74	4669	74	3029	113	1854	26	3649	92	5737	92	3620	133	2797	21	2894	74	4597	74	2930	113	1773	26	3523	92	5564	92	3478	132	2720	0	17	0	72	0	99	0	81	0	126	0	173	0	142	1	77	0	188	0	441
SB ON FROM COCHRANE	2159	130	2578	230	4102	250	2898	240	1593	142	3053	250	4919	272	3301	475	2329	186	3835	327	6064	356	3976	555	3352	141	3035	250	4847	272	3202	475	2248	184	3707	327	5891	356	3834	555	3275	1	18	0	72	0	99	0	81	2	128	0	173	0	142	0	77	1	189	2	443
HOV/EXP ACCESS TO GP	S56X																																																								
SB OFF TO DUNNE	2161	200	2378	360	3742	390	2508	370	1223	348	2705	627	4292	679	2622	701	1628	476	3359	858	5206	929	3047	855	2497	348	2687	626	4221	678	2524	701	1547	476	3231	857	5034	928	2906	857	2418	0	18	1	71	1	98	0	81	0	128	1	172	1	141	-2	79	2	187	2	441
SB ON FROM DUNNE	2162	180	2558	340	4082	390	2898	340	1563	218	2923	412	4704	473	3095	340	1968	268	3627	506	5712	581	3628	340	2837	219	2906	413	4634	474	2998	340	1887	269	3500	508	5542	583	3489	340	2758	-1	17	-1	70	-1	97	0	81	-1	127	-2	170	-2	139	0	79	-3	184	-5	436
SB OFF TO TENNANT	2164	210	2348	380	3702	400	2498	380	1183	248	2675	448	4256	472	2623	402	1566	334	3293	603	5109	635	2993	455	2382	248	2658	448	4186	472	2526	402	1485	334	3166	603	4939	635	2854	456	2302	0	17	0	70	0	97	0	81	0	127	0	170	0	139	-1	80	0	184	0	436
SB ON FROM TENNANT	2165	120	2468	250	3952	260	2758	270	1453	130	2805	271	4527	282	2905	278	1844	150	3443	312	5421	325	3318	318	2700	130	2788	271	4457	281	2807	278	1763	150	3316	313	5252	325	3179	318	2620	0	17	0	70	1	98	0	81	0	127	-1	169	0	139	0	80	1	185	-1	435

SANTA CLARA Valley Transportation Authority

Table 5-3
PM Peak Period - Build and No Build Total Corridor Hourly Demand
Northbound

US 101		TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD	
		2009				2015				2035				2015				2035				2015				2035				PM Peak Period (3-7 pm)	
		PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	2015	2035
SEGMENTS	Model_ID	Ramp / ML after Ramp	Ramp / ML after Ramp	Ramp / ML after Ramp

SANTA CLARA Valley Transportation Authority

Table 5-3
PM Peak Period - Build and No Build Total Corridor Hourly Demand
Northbound

US 101		TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD												DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD			
		2009								2015								2035								2015								2035				PM Peak Period (3-7 pm)			
		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		2015		2035	
SEGMENTS	Model_ ID	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp
NB ON FROM MATHILDA SB-HOV	2520																																								
NB ON FROM MATHILDA SB-TOTAL	2519/2520	0	4,460	0	4,500	0	4,230	0	3,830	0	5,019	0	5,152	0	4,947	0	4,446	123	6,251	132	6,895	114	7,455	114	6,647	0	4,797	0	4,940	0	4,741	0	4,277	123	5,597	132	6,219	113	6,818	113	5,945	0	222	0	212	0	206	0	169	0	654	0	676	1	637	1	702	0	641	1	1,966
NB OFF TO RTE 237	1133	570	3,890	610	3,890	890	3,340	790	3,040	594	4,425	635	4,517	927	4,020	823	3,623	1,145	5,106	1,225	5,670	1,787	5,668	1,586	5,061	570	4,227	610	4,330	890	3,851	790	3,487	991	4,606	1,060	5,159	1,547	5,271	1,373	4,572	24	198	25	187	37	169	33	136	154	500	165	511	240	397	213	489	86	555	559	1,407
NB ON FROM RTE 237	1134	960	4,850	1,160	5,050	940	4,280	1,140	4,180	1,070	5,495	1,293	5,810	1,048	5,068	1,271	4,894	1,442	6,548	1,743	7,413	1,413	7,081	1,713	6,774	1,070	5,297	1,293	5,623	1,048	4,899	1,271	4,758	1,392	5,998	1,682	6,841	1,363	6,634	1,653	6,225	0	198	0	187	0	169	0	136	50	550	61	572	50	447	60	549	0	555	161	1,568
NB OFF TO ELLIS	1136	160		160		270		210		205		205		347		270		415		415		701		545		199		199		336		261		323		323		545		423		6		6		11		9		92		92		156		122		23		340	
HOV/Exp ACCESS TO GP	N23X																																								
HOV/Exp ACCESS FROM GP	N23N		4,690		4,690		4,610		3,970	192	5,299	171	5,606	179	4,723	149	4,424	203	6,113	203	6,968	252	6,539	225	6,225		5,068		5,424		5,543																								
NB ON FROM ELLIS	1137	280	4,970	390	5,280	490	4,500	380	4,350	346	5,636	482	6,087	606	5,327	470	5,094	419	6,552	583	7,581	733	7,113	569	6,798	341	5,439	474	5,898	596	5,159	462	4,959	413	6,088	575	7,093	722	6,811	560	6,362	5	197	8	189	10	168	8	135	6	464	8	488	11	302	9	436	23	555	25	1,254
NB OFF TO MOFFETT	1139	200	4,770	230	5,050	250	4,250	260	4,090	277	5,359	318	5,769	346	4,981	360	4,734	480	6,072	551	7,030	600	6,513	624	6,174	272	5,167	313	5,585	340	4,819	354	4,605	403	5,685	463	6,630	503	6,308	524	5,838	5	192	5	184	6	162	6	129	77	387	88	400	97	205	100	336	16	539	262	992
NB ON FROM MOFFETT	1140	300	-	290	-	280	-	220	-	312	-	302	-	291	-	229	-	545	-	528	-	509	-	400	-	313	-	302	-	292	-	229	-	542	-	524	-	506	-	397	-	-1	-	0	-	-1	-	0	-	3	-	4	-	3	-	3	-	-2	-	10	-
NB OFF TO SHORELINE	1180	460	4,610	480	4,860	580	3,950	540	3,770	558	5,113	583	5,488	704	4,568	656	4,307	646	5,971	674	6,884	814	6,208	759	5,815	560	4,920	584	5,303	706	4,405	657	4,177	612	5,615	639	6,515	772	6,042	719	5,516	-2	193	-1	185	-2	163	-1	130	34	356	35	369	42	166	40	299	-5	542	111	891
NB ON FROM SR 85	1143A	1,260		1,200		1,310		1,160		1,216		1,158		1,265		1,120		1,193		1,136		1,241		1,099		1,307		1,245		1,359		1,204		1,379		1,314		1,434		1,271		-91		-87		-94		-84		-186		-178		-193		-172		-272		-557	
HOV/Exp ACCESS FROM SR 85 HOV	N17N	310	6,180	310	6,370	380	5,640	350	5,280	339	6,668	418	7,064	409	6,242	373	5,800	771	7,935	690	8,710	817	8,266	708	7,622	331	6,558	331	6,879	405	6,169	373	5,754	448	7,442	448	8,277	548	8,024	505	7,292	8	110	87	185	4	73	0	46	323	493	242	433	269	242	203	330	99	369	834	1,168
NB OFF TO MIDDLEFIELD	1148	570	5,610	780	5,590	1,200	4,440	1,030	4,250	570	6,098	780	6,284	1,200	5,042	1,030	4,770	776	7,159	1,062	7,648	1,634	6,632	1,402	6,220	570	5,988	780	6,099	1,200	4,969	1,030	4,724	702	6,740	961	7,316	1,478	6,546	1,269	6,023	0	110	0	185	0	73	0	46	74	419	101	332	156	86	133	197	0	369	331	837
NB ON FROM SHORELINE	1147	520	6,130	760	6,350	900	5,340	760	5,010	538	6,636	787	7,071	932	5,974	787	5,557	597	7,756	874	8,522	1,035	7,667	874	7,094	538	6,526	787	6,886	932	5,901	787	5,511	597	7,337	873	8,189	1,034	7,580	873	6,896	0	110	0	185	0	73	0	46	0	419	1	333	1	87	1	198	0	369	2	839
NB OFF TO RENGSTROFF NB	1151	70		60		60		60		70		60		60		60		121		104		104		104		70		60		60		60		101		86		86		86		0		0		0		0		20		18		18		18		0		56	
NB OFF TO RENGSTROFF SB	1152	300	5,760	270	6,020	250	5,030	260	4,690	300	6,266	270	6,741	250	5,664	260	5,237	523	7,112	471	7,947	436	7,127	454	6,536	300	6,156	270	6,556	250	5,591	260	5,191	399	6,837	360	7,743	333	7,161	346	6,464	0	110	0	185	0	73	0	46	124	275	111	204	103	-34	108	72	0	369	338	445
NB ON FROM RENGSTROFF	1153	480	6,240	610	6,630	730	5,760	620	5,310	591	6,857	751	7,492	899	6,563	763	6,000	716	7,828	910	8,857	1,089	8,216	924	7,460	591	6,747	751	7,307	898	6,489	763	5,954	714	7,551	907	8,650	1,085	8,246	922	7,386	0	110	0	185	1	74	0	46	2	277	3	207	4	-30	2	74	1	370	9	454
NB OFF TO SAN ANTONIO	1155	550	5,690	510	6,120	470	5,290	400	4,910	577	6,280	535	6,957	493	6,070	420	5,580	718	7,110	666	8,191	614	7,602	523	6,937	569	6,178	528	6,779	486	6,003	414	5,540	677	6,874	628	8,022	578	7,668	493	6,893	8	102	7	178	7	67	6	40	41	236	38	169	36	-66	30	44	22	348	115	339
NB ON FROM SAN ANTONIO NB	1156	790	-	790	-	800	-	610	-	859	-	859	-	870	-	663	-	918	-	918	-	929	-	708	-	859	-	859	-	870	-	663	-	914	-	914	-	926	-	706	-	0	-	0	-	0	-	0	-	4	-	4	-	3	-	2	-	0	-	11	-
NB ON FROM SAN ANTONIO SB	1186	120	6,600	160	7,070	230	6,320	160	5,680	132	7,271	176	7,992	253	7,193	176	6,419	150	8,178	200	9,309	288	8,819	200	7,845	132	7,169	176	7,814	253	7,126	176	6,379	148	7,936	197	9,133	283	8,877	197	7,796	0	102	0	178	0	67	0	40	2	242	3	176	5	-58	3	49	0	348	10	360
HOV/Exp ACCESS TO GP	N18X																																								
HOV/Exp ACCESS FROM GP	N18N	4,710	5,710	4,690	5,380	4,610	4,990	3,970	4,610	5,299	6,592	5,606	6,777	4,723	5,892	4,424	5,416	6,113	7,526	6,968	8,176	6,539	7,968	6,225	7,450	5,068	6,236	5,424	6,666	4,543	5,586																												
NB OFF TO OREGON AND EMBARCADE	1159A	1,170	5,430	1,080	5,990	1,140	5,180	960	4,720	1,212	6,059	1,119	6,873	1,181	6,012	994	5,425	1,283	6,895	1,185	8,124	1,250	7,569	1,052	6,793	1,208	5,961	1,115	6,699	1,177	5,949	991	5,388	1,262	6,674	1,165	7,968	1,230	7,647	1,036	6,760	4	98	4	174	4	63	3	37	21	221	20	156	20	-78	16	33	12	336	61	299
NB ON FROM EMBARCADERO SB	1167																																								
NB ON FROM OREGON / EMBARCADER	2528																																								
NB ON FROM OREGON / EMBARCADER	1167/2528	1,720	7,150	1,930	7,920	1,670	6,850	1,400	6,120	1,743	7,802	1,956	8,829	1,692	7,704	1,419	6,844	1,743	8,638	1,956	10,080	1,692	9,261	1,419	8,212	1,743	7,704	1,956	8,655	1,692	7,641	1,419	6,807	1,743	8,417	1,956	9,924	1,692	9,339	1,419	8,179	0	98	0	174	0	63	0	37	0	221	0	156	0	-78	0	33	0	336	0	299

SANTA CLARA Valley Transportation Authority

Table 5-4
PM Peak Period - Build and No Build Total Corridor Hourly Demand
Southbound

US 101

SEGMENTS	Model_ID	TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD	
		2009				2015				2035				2015				2035				2015				2035				PM Peak Period (3-7 pm)	
		PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	PM1 (3-4)	PM2 (4-5)	PM3 (5-6)	PM4 (6-7)	2015	2035
		MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp	MIL after Ramp
SB SOUTH OF UNIVERSITY-AUX	2006A																																		
SB SOUTH OF UNIVERSITY-GP	2006S	6200	6880	6930	5800	7964	8838	8902	7450	9384	10414	10489	8779	7479	8299	8360	6997	8922	9900	9972	8346	485	539	542	453	462	514	517	433	2,019	1,926
SB SOUTH OF UNIVERSITY-HOV/E	2006H																																		
SB SOUTH OF UNIVERSITY-TOTA		6200	6200	6880	6880	6930	6930	5800	5800	7964	7964	8838	8838	8902	8902	7450	7450	9384	9384	10414	10414	10489	10489	8779	8779	7479	7479	8299	8299	8360	8360	6997	6997	8922	8922	9900	9900	9972	9972	8346	485	485	539	539	542	542	453	453	462	462	514	514	517	517	433	433	2,019	2,019	1,926	1,926
SB OFF TO EMBARCADERO SB	2009																																		
SB OFF TO EMBARCADERO NB	2011																																		
SB OFF TO OREGON	2013																																		
SB SOUTH OFF OREGON / EMBAR	09/11/13	1190	1200	1370	1000	1282	1293	1476	1078	1612	1626	1856	1355	1280	1291	1474	1076	1603	1617	1846	1348	2	2	2	2	9	9	10	7	8	35
SB ON FROM EMBARCADERO SB	2010																																		
SB ON FROM EMBARCADERO NB	2012																																		
SB ON FROM OREGON	2015																																		
SB ON OREGON / EMBARCADERO	10/12/15	1970 6980	1990 7670	1700 7260	1420 6220	2171 8853	2193 9738	1874 9300	1565 7937	2171 9943	2193 10981	1874 10507	1565 8989	1970 8169	1990 8998	1700 8586	1420 7341	1970 9289	1990 10273	1700 9826	1420 8418	201 684	203 740	174 714	145 596	201 654	203 708	174 681	145 571	723 2,734	723 2,614
HOV/EXP ACCESS FROM HOV	2017H																																		
HOV/EXP ACCESS FROM GP	S29N																																		
SB OFF TO SAN ANTONIO SB	2020	760 6220	810 6860	810 6450	740 5480	845 8008	901 8837	901 8399	823 7114	1213 8730	1293 9688	1293 9214	1181 7808	839 7330	894 8104	894 7692	817 6524	1210 8079	1290 8983	1290 8536	1178 7240	6 678	7 733	7 707	6 590	3 651	3 705	3 678	3 568	26 2,709	12 2,603
SB OFF TO SAN ANTONIO NB	2021	70 6150	50 6810	40 6410	40 5440	72 7936	52 8785	41 8358	41 7073	0 8730	0 9688	0 9214	0 7808	81 7249	58 8046	46 7646	46 6478	0 8079	0 8983	0 8536	0 7240	-9 687	-6 739	-5 712	-5 595	0 651	0 705	0 678	0 568	-25 2,734	0 2,603
SB ON FROM SAN ANTONIO	2521	0 6150	0 6810	0 6410	0 5440	0 7936	0 8785	0 8358	0 7073	596 9326	651 10339	657 9871	560 8368	0 7249	0 8046	0 7646	0 6478	601 8680	656 9639	662 9198	565 7805	0 687	0 739	0 712	0 595	-5 646	-5 700	-5 673	-5 563	0 2,734	-20 2,583
SB ON FROM CHARLESTON / REN	2023	990	1080	1090	930	1045	1140	1150	981	641	700	705	602	990	1080	1090	930	476	519	524	447	55	60	60	51	165	181	181	155	226	682
SB OFF TO RENGSTROFF	2025	390	400	420	360	450	461	484	415	629	645	677	580	450	461	484	415	629	645	677	580	0	0	0	0	0	0	0	0	0	0
SB ON FROM RENGSTROFF	2026	520 7270	690 8180	570 7650	430 6440	591 9122	785 10249	648 9672	489 8128	735 10073	975 11369	805 10704	608 8998	520 8309	690 9355	570 8822	430 7423	735 9262	975 10488	805 9850	608 8280	71 813	95 894	78 850	59 705	0 811	0 881	0 854	0 718	303 3,263	0 3,265
SB ON FROM MIDDLEFIELD	2030	490 7760	550 8730	620 8270	510 6950	509 9631	571 10820	644 10316	530 8658	859 10932	964 12333	1087 11791	894 9892	509 8818	571 9926	643 9465	529 7952	857 10119	962 11450	1084 10934	891 9171	0 813	0 894	1 851	1 706	2 813	2 883	3 857	3 721	2 3,265	10 3,275
SB OFF TO SHORELINE	2034	430 7330	460 8270	500 7770	460 6490	444 9187	475 10345	517 9799	475 8183	444 10488	475 11858	517 11274	475 9417	444 8374	475 9451	517 8948	475 7477	444 9675	475 10975	517 10417	475 8696	0 813	0 894	0 851	0 706	0 813	0 883	0 857	0 721	0 3,265	0 3,275
SB ON FROM SHORELINE-SB	2037	360	470	670	580	441	576	821	711	457	597	852	737	440	574	818	708	457	597	850	736	1	2	3	3	0	0	2	1	9	3
SB ON FROM SHORELINE-NB	2036	300	270	310	270	300	270	310	270	328	296	339	296	300	270	310	270	327	295	338	295	0	0	0	0	1	1	1	1	0	4
SB OFF TO SR 85-GP	2039	2250	2550	2590	2210	2661	1157	1422	2565	2422	2745	2789	2379	2357	2671	2713	2315	2412	2734	2777	2369	254	288	293	250	10	11	12	10	1,085	43
SB OFF TO SR 85-HOV	S30X	340 5400	400 6060	540 5620	490 4640	874 6443	516 7242	557 6910	666 5933	1260 7591	1373 8633	1585 8111	1355 6716	409 6348	481 7143	650 6713	590 5550	465 7582	547 8586	739 8089	671 6687	465 95	509 99	364 197	76 383	795 9	826 47	826 22	684 29	1,414 775	3,131 108
HOV/EXP ACCESS FROM GP	S32W_N																														
HOV/EXP ACCESS TO GP	S32W_X																														
SB OFF TO MOFFETT	2501	190	210	230	180	260	287	315	246	270	298	327	255	296	327	359	281	304	336	369	289	-36	-40	-44	-35	-34	-38	-42	-34	-155	-148
SB ON FROM MOFFETT	2502	360 5570	330 6180	320 5710	280 4740	424 6607	388 7343	377 6972	329 6016	575 7896	527 8862	511 8295	447 6908	388 6440	356 7172	345 6699	302 5571	540 7818	496 8746	480 8200	421 6819	36 167	32 171	32 273	27 445	35 78	31 116	31 95	26 89	127 1,057	123 379
SB OFF TO ELLIS	2505	160 5410	150 6030	160 5550	90 4650	229 6378	215 7128	229 6743	129 5887	321 7575	302 8560	321 7974	181 6727	379 6061	355 6817	379 6320	213 5358	411 7407	385 8361	411 7789	231 6588	-150 317	-140 311	-150 423	-84 529	-90 168	-83 199	-90 185	-50 139	-524 1,581	-313 692
HOV/EXP ACCESS FROM GP	S22N																														
HOV/EXP ACCESS TO GP	S22X																														
SB ON FROM ELLIS-GP	2506S																														
SB ON FROM ELLIS-HOV	2506H																														
SB ON FROM ELLIS-TOTAL	2506	350 5760	420 6450	400 5950	240 4890	517 6895	620 7748	591 7334	355 6242	772 8347	926 9486	882 8856	530 7257	489 6550	587 7404	559 6879	335 5693	704 8111	846 9207	805 8594	483 7071	28 345	33 344	32 455	20 549	68 236	80 279	77 262	47 186	113 1,694	272 965
SB OFF TO RTE 237	2040	1380 4380	1600 4850	1500 4450	1140 3750	1473 5422	1707 6041	1601 5733	1216 5026	1706 6641	1977 7509	1855 7001	1409 5848	1470 5080	1704 5700	1598 5281	1214 4479	1751 6360	2030 7177	1904 6690	1446 5625	3 342	3 341	3 452	2 547	-45 281	-53 332	-49 311	-37 223	11 1,683	-184 1,149
SB ON FROM RTE 237	2340	760 5140	780 5630	860 5310	810 4560	770 6192	790 6831	872 6605	821 5847	773 7414	793 8302	875 7876	824 6672	763 5843	783 6483	864 6145	814 5293	772 7132	792 7969	874 7564	824 6449	7 349	7 348	8 460	7 554	1 282	1 333	1 312	0 223	29 1,712	3 1,152
SB OFF TO MATHILDA	2330	340 4800	400 5230	450 4860	410 4150	393 5799	463 6368	520 6085	474 5373	469 6945	553 7749	621 7255	566 6106	422 5421	496 5987	558 5587	509 4784	507 6625	597 7372	671 6893	612 5837	-29 378	-33 381	-38 498	-35 589	-38 320	-44 377	-50 362	-46 269	-135 1,847	-178 1,330
SB ON FROM MATHILDA SB	2044	810 5610	1010 6240	1060 5920	850 5000	832 6631	1037 7405	1088 7173	873 6246	948 7893	1182 8931	1240 8495	995 7101	810 6231	1010 6997	1060 6647	850 5634	891 7516	1111 8483	1166 8059	935 6772	22 400	27 408	28 526	23 612	57 377	71 448	74 436	60 329	100 1,947	262 1,592
SB ON FROM MATHILDA NB-GP	2045																														
SB ON FROM MATHILDA NB-HOV	2046																														
SB ON FROM MATHILDA NB-TOTA	45/2046	470 6080	440 6680	490 6410	470 5470	582 7213	545 7950	607 7780	582 6828	867 8760	812 9743	904 9399	867 7968	511 6742	478 7475	532 7179	511 6145	726 8242	679 9162	756 8815	726 7498	71 471	67 475	75 601	71 683	141 518	133 581	148 584	141 470	284 2,231	563 2,155
HOV/EXP ACCESS FROM GP	S34W_N																														
HOV/EXP ACCESS TO GP	S34W_X																														
SB OFF TO FAIR OAKS	2048	440 5640	540 6140	700 5710	600 4870	440 6773	540 7410	700 7080	600 6228	440 8321	540 9204	700 8700	600 7369	447 6295	549 6926	711 6468	609 5536	447 7795	549 8613	711 8104	609 6889	-7 478	-9 484	-11 612	-9 692	-7 526	-9 591	-11 596	-9 480	-36 2,267	-36 2,191
SB ON FROM FAIR OAKS SB	2049	300 5940	350 6490	430 6140	350 5220	381 7154	444 7854	546 7626	444 6672	415 8736	483 9687	594 9294	483 7852	344 6639	401 7327	493 6961	401 5937	344 8139	401 9014	493 8597	401 7290	37 515	43 527	53 665	43 735	71 597	82 673	101 697	82 562	176 2,443	336 2,527
SB OFF TO FAIR OAKS	2050	100 5840	130 6360	170 5970	170 5050	126 7028	163 7691	214 7412	214 6458	157 8579	203 9484	266 9028	266 7586	132 6507	172 7155	224 6737	224 5713	180 7959	234 8780	306 8291	306 6984	-6 521	-9 536	-10 675	-10 745	-23 620	-31 704	-40 737	-40 602	-35 2,478	-134 2,661
SB ON FROM FAIR OAKS NB-GP	2051																														
SB ON FROM FAIR OAKS NB-HOV	2052																														
SB ON FROM FAIR OAKS NB-TOTA	51/2052	300 6140	260 6620	250 6220	260 5310	301 7329	260 7951	250 7662	260 6718	318 8897	275 9759	264 9292	275 7861	300 6807	260 7415	250 6987	260 5973	300 8259	260 9040	250 8541	260 7244	1 522	0 536	0 675	0 745	18 638	15 719	14 751	15 617	1 2,479	62 2,723
SB OFF TO LAWRENCE SB	2055	920 5220	1160 5460	1360 4860	1070 4240	1014 6315	1279 6672	1499 6163	1180 5538	1060 7837	1337 8422	1567 7725	1233 6628	965 5842	1217 6198	1427 5560	1123 4850	985 7274	1242 7798	1456 7085	1146 6098	49 473	62 474	72 603	57 688	75 563	95 624	111 640	87 530	240 2,239	368 2,355
SB ON FROM LAWRENCE SB	2056	310 5530	300 5760	320 5180	330 4570	366 6681	354 7026	378 6541	389 5927	582 8419	563 8985	601 8326	619 7247	329 6171	318 6516	339 5899	350 5200	353 7627	341 8139	364 7449	375 6473	37 510	36 510	39 642	39 727	229 792	222 846	237 877	244 774	151 2,390	932 3,287
SB OFF TO LAWRENCE NB	2057	640 6170	540 6300	610 5790	620 5190	684 7365	577 7603	652 7193	663 6590	723 9142	609 9594	689 9015	700 7947	653 6824	551 7067	623 6522	633 5833	706 8333	596 8735	674 8123	684 7157	31 541	26 536	29 671	30 757	17 809	13 859	15 892	16 790	116 2,506	61 3,348
SB ON FROM LAWRENCE NB-GP	2057S																														
SB ON FROM LAWRENCE NB-HOV	2057H																														
SB ON FROM LAWRENCE NB-TOT	2057	640 6170	540 6300	610 5790	620 5190	684 7365	577 7603	652 7193	663 6590	723 9142	609 9594	689 9015	700 7947	653 6824	551 7067	623 6522	633 5833	706 8333	596 8735	674 8123	684 7157	31 541	26 536	29 671	30 757	17 809	13 859	15 892	16 790	116 2,506	61 3,348
SB OFF TO GREAT AMERICA	2059	610	640	710	620	655	687	762	666	681	714	792	692	617	647	718	627	672	705	782	683	38	40	44	39	9	9	10	9	161	37
HOV/EXP ACCESS FROM GP	S31N																														
HOV/EXP ACCESS TO GP	S31X																														
SB ON FROM GREAT AMERICA SB	2060	640 6200	700 6360	710 5790	730 5300	650 7360	711 7627	721 7152	742 6666	737 9198	806 9686	818 9041	841 8096	650 6857	711 7131	721 6525	742 5948	736 8397	805 8835	817 8158	840 7314	0 503	0 496	0 627	0 718	1 801	1 851	1 883	1 782	0 2,346	4 3,315
SB ON FROM GREAT AMERICA NB	2061	420 6620	460 6820	510 6300	460 5760	489 7849	536 8163	594 7746	536 7202	663 9861	727 10413	806 9847	727 8823	464 7321	508 7639	563 7088	508 6456	636 9033	696 9531	772 8930	696 8010	25 528	28 524	31 658	28 746	27 828	31 882	34 917	31 813	112 2,458	123 3,438
SB OFF TO SAN TOMAS	2065	1180 5440	1300 5520	1270 5030	1150 4610	1407 6442	1550 6613	1515 6231	1372 5830	1849 8012	2037 8376	1991 7856	1803 7020	1379 5942	1519 6120	1484 5604	1344 5112	1797 7236	1979 7552	1934 6996	1751 6259	28 500	31 493	31 627	28 718	52 776	58 824	57 860	52 761	118 2,340	219 3,219
SB ON FROM MONTAGUE SB	2067																														
SB ON FROM SAN TOMAS NB	2069																														
SB ON FROM SAN TOMAS/MONTA	67/2069	990 6430	1010 6530	1090 6120	950 5560	1291 7733	1318 7931	1422 7653	1239 7069	1738 9750	1774 10150	1914 9770	1668 8688	1156 7098	1179 7299	1272 6876	1109 6221	1534 8770	1565 9117	1689 8685	1472 7731	135 635	139 632	150 777	130 848	204 980	209 1033	225 1085	196 957	554 2,894	834 4,053
HOV/EXP ACCESS FROM GP	S36W_N																														
HOV/EXP ACCESS TO GP	S36W_X																														
SB OFF TO TRIMBLE-SLIP	2073	370 6060	310 6220	280 5840	200 5360	511 7223	428 7504	387 7267	276 6793	729 9021	611 9539	552 9218	394 8294	462 6636	387 6912	349 6527	249 5972	641 8129	537 8580	484 8201	346 7385	49 587	41 592	38 740	27 821	88 892	74 959	68 1017	48 909	155 2,739	278 3,776
SB ON FROM TRIMBLE SB	2074	660 6720	690 6910	600 6440	430 5790	900 8123	940 8444	818 8085	586 7379	896 9917	936 10475	815 10033	584 8878	714 7350	747 7659	649 7176	465 6437	753 8882	788 9368	684 8885	490 7875	186 773	193 785	169 909	121 942	143 1035	148 1107	131 1148	94 1003	669 3,408	516 4,292
SB OFF TO TRIMBLE-LOOP	2518	180	130	80	70	280	202	125	109	0	0	0	0	248	179	110	97	1	0	0	1	32	23	15	12	-1	0	0	-1	82	-2
SB ON FROM TRIMBLE NB	2075	1550 8090	1800 8580	1890 8250	1630 7350	1580 9423	1835 10077	1927 9887	1662 8932	1651 11568	1917 12392	2013 12046	1737 10615	1573 8675	1827 9307	1919 8985	1655 7995	1651 10532	1917 11285	2014 10899	1737 9611	7 748	8 770	8 902	7 937	0 1036	0 1107	-1 1147	0 1004	30 3,356	-1 4,293
SB OFF TO 87	2079	2340 5750	2460 6120	2250 6000	1920 5430	2395 7028	2518 7559	2303 7584	1965 6967	2512 9056	2641 9751	2415 9631	2061 8554	2395 6280	2518 6789	2303 6682	1965 6030	2606 7929	2740 8545	2506 8393	2138 7473	0 748	0 770	0 902	0 937	-96 1130	-99 1206	-91 1238	-77 1081	0 3,356	-361 4,654
SB OFF TO NIST	2081	710 5040	640 5480	680 5320	560 4870	925 6103	833 6726	886 6698	729 6238	975 8081	878 8873	934 8697	769 7785	931 5349	839 5950	892 5790	734 5296	1010 6916	910 7635	968 7425	796 6677	-6 754	-6 776	-6 908	-5 942	-35 1165	-32 1238	-34 1272	-27 1108	-23 3,379	-128 4,782
SB ON FROM 1st ST	2082	900 5940	1060 6540	1440 6760	960 5830	911 7014	1072 7798	1457 8155	971 7209	0 8081	0 8873	0 8697	0 7785	910 6259	1072 7022	1457 7247	971 6267	0 6916	0 7635	0 7425	0 6677	1 755	0 776	0 908	0 942	0 1165	0 1238	0 1272	0 1108	1 3,380	0 4,782
HOV/EXP ACCESS FROM GP	S38W_X																														
HOV/EXP ACCESS TO GP	S38W_N																														
SB OFF TO 4TH	2516	0 5940	0 6540	0 6760	0 5830	0 7014	0 7798	0 8155	0 7209	700 7381	631 8242	671 8026	552 7233	0 6259	0 7022	0 7247	0 6267	632 6284	570 7065	606 6819	499 6178	0 755	0 776	0 908	0 942	68 1097	61 1177	65 1207	53 1055	0 3,380	247 4,536
SB ON FROM 4TH ST	2517	0 5940	0 6540	0 6760	0 5830	0 7014	0 7798	0 8155	0 7209	446 7827	525 8767	714 8740	476 7709	0 6259	0 7022	0 7247	0 6267	427 6711	503 7568	683 7502	455 6633	0 755	0 776	0 908	0 942	19 1116	22 1199	31 1238	21 1076	0 3,380	93 4,629
SB OFF TO I-880	2085	570 5370	590 5950	540 6220	490 5340	700 6314	725 7073	663 7492	602 6607	700 7127	725 8042	663 8077	602 7107	674 5585	698 6324	639 6608	579 5688	674 6037	698 6870	639 6863	579 6054	26 729	27 749	24 884	23 919	26 1090	27 1172	24 1214	23 1053	100 3,280	100 4,529
SB ON FROM I-880 SB	2310	1550 6920	1360 7310	1160 7380	1250 6590	1752 8066	1537 8610	1311 8803	1413 8020	2093 9220	1836 9878	1566 9643	1688 8795	1569 7154	1376 7700	1174 7782	1265 6953	2062 8099	1809 8679	1543 8406	1663 7717	183 912	161 910	137 1021	148 1067	31 1121	27 1199	23 1237	25 1078	629 3,909	106 4,635
SB OFF TO I-880 NB	2311	370 6550	310 7000	260 7120	230 6360	555 7511	465 8145	390 8413	345 7675	555 8665	465 9413	390 9253	345 8450	457 6697	383 7317	321 7461	284 6669	457 7642	383 8296	321 8085	284 7433	98 814	82 828	99 952	61 1006	98 1023	82 1117	69 1168	61 1017	310 3,599	310 4,325
SB ON FROM I-880 NB	2088	1010 7560	1130 8130	1230 8350	780 7140	1024 8535	1146 9291	1247 9660	791 8466	1126 9791	1260 10673	1371 10624	870 9320	1010 7707	1130 8447	1230 8691	780 7449	1106 8748	1238 9534	1347 9432	854 8287	14 828	16 844	17 969	11 1017	20 1043	22 1139	24 1192	16 1033	58 3,657	82 4,407
SB OFF TO OAKLAND	2091	1210 6350	1340 6790	1240 7110	1170 5970	1231 7304	1363 7928	1261 8399	1190 7276	1133 8658	1255 9418	1161 9463	1096 8224	1220 6487	1351 7096	1250 7441	1180 6269	1133 7615	1255 8279	1161 8271	1096 7191	11 817	12 832	11 958	10 1007	0 1043	0 1139	0 1192	0 1033	44 3,613	0 4,407
SB ON FROM OAKLAND	2092	1130 7480	1270 8060	1270 8380	710 6680	1130 8434	1270 9198	1270 9669	710 7986	1130 9788	1270 10688	1270 10733	710 8934	1130 7617	1270 8366	1270 8711	710 6979	1130 8745	1270 9549	1270 9541	710 7901	0 817	0 832	0 958	0 1007	0 1043	0 1139	0 1192	0 1033	0 3,613	0 4,407
HOV/EXP ACCESS FROM GP	S40W_N																														
HOV/EXP ACCESS TO GP	S40W_X																														
SB OFF TO MABURY	2511	0	0	0	0	0	0	0	0	485	491	472	314	0	0	0	0	427	432	415	277	0	0	0	0	58	59	57	37	0	211
SB ON FROM MABURY	2510	0 7480	0 8060	0 8380	0 6680	0 8434	0 9198	0 9669	0 7987	527 9830	552 10749	591 10852	527 9147	0 7617	0 8366	0 8711	0 6979	460 8778	483 9600	516 9642	460 8084	0 817	0 832	0 958	0 1008	67 1052	69 1149	75 1210	67 1063	0 3,614	278 4,475
SB OFF TO MCKEE	2095	740 6740	750 7310	720 7660	480 6200	819 7615	830 8368	797 8872	531 7456	1148 8682	1163 9586	1117 9735	744 8403	778 6839	788 7578	757 7954	504 6475	1021 7757	1034 8566	993 8649	662 7422	41 776	42 790	40 918	27 981	127 925	129 1020	124 1086	82 981	150 3,464	462 4,013
SB OFF TO SANTA CLARA	2305	590 6150	640 6670	710 6950	590 5610	613 7002	665 7703	737 8135	613 6843	801 7881	869 8717	964 8771	801 7602	603 6236	654 6924	725 7229	603 5872	823 6934	893 7673	990 7659	823 6599	10 766	11 779	12 906	10 971	-22 947	-24 1044	-26 1112	-22 1003	43 3,421	-94 4,107
SB ON FROM MCKEE	2096	820 6970	860 7530	920 7870	820 6430	1002 8004	1051 8754	1124 9259	1002 7845	1003 8884	1052 9769	1125 9896	1003 8605	976 7212	1024 7948	1095 8324	976 6848	1001 7935	1050 8723	1123 8782	1001 7600	26 792	27 806	29 935	26 997	2 949	2 1046	2 1114	2 1005	108 3,529	8 4,115
SB ON FROM SANTA CLARA	2306	690 7660	720 8250	710 8580	550 6980	1075 9079	1121 9875	1106 10365	857 8702	1398 10282	1458 11227	1439 11335	1115 9720	985 8197	1027 8975	1013 9337	785 7633	1301 9236	1357 10080	1338 10120	1037 8637	90 882	94 900	93 1028	72 1069	97 1046	101 1147	101 1215	78 1083	349 3,878	377 4,492
SB OFF TO I-680	2106	1950 5710	1890 6360	2010 6570	1610 5370	1950 7129	1890 7985	2010 8355	1610 7092	2211 8071	2143 9084	2279 9056	1826 7894	1950 6247	1890 7

Table 5-4
PM Peak Period - Build and No Build Total Corridor Hourly Demand
Southbound

US 101		TOTAL DEMAND, 2-LANE ALT. ON US101																TOTAL DEMAND, NO BUILD								DIFFERENCE, BUILD-NOBUILD								DIFFERENCE, BUILD-NOBUILD	
		2009								2015								2015				2035				2015				2035				PM Peak Period (3-7 pm)	
		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		PM1 (3-4)		PM2 (4-5)		PM3 (5-6)		PM4 (6-7)		2015		2035	
SEGMENTS	Model_ID	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp	Ramp	ML after Ramp
SB ON FROM BLOSSOM HILL	2144	240	4608	230	4911	240	5056	220	3706	284	5512	273	5921	284	6152	261	4692	632	7148	606	7742	632	7690	580	6160	283	4779	271	5175	283	5250	260	3729	616	6162	590	6660	616	6507	565	5097	1	733	2	746	1	902	1	963	16	986	16	1082	16	1183	15	1063	5	3,344	63	4,313
SB OFF TO SB85-GP	175																																																										
SB OFF TO SB85-HOV	176																																																										
SB OFF TO SB85-TOTAL	175/176	270		300		330		310		299		332		365		343		309		343		377		354		274		304		335		314		311		345		380		357		25		28		30		29		-2		-2		-3		-3		112		-10	
SB OFF TO BERNAL	2147	550	3788	580	4031	640	4086	550	2846	670	4543	706	4883	779	5008	670	3679	863	5976	910	6489	1004	6309	863	4943	611	3894	644	4227	711	4204	611	2804	785	5066	827	5488	913	5214	785	3955	59	649	62	656	68	804	59	875	78	910	83	1001	91	1095	78	988	248	2,984	330	3,993
SB ON FROM 85-GP	173S	1860		2030		2060		1650		1808		1974		2003		1604		2505		2734		2775		2222		1864		2034		2064		1653		1968		2147		2179		1745		-56		-60		-61		-49		537		587		596		477		-226		2,197	
SB ON FROM 85-HOV/EXP	173H	570	6218	640	6701	640	6786	510	5006	1029	7380	1201	8058	1200	8211	937	6220	930	9411	1044	10267	1031	10115	800	7965	1073	6831	1205	7466	1205	7473	960	5417	1399	8433	1571	9206	1571	8964	1252	6952	-44	549	-4	592	-5	738	-23	803	-469	978	-527	1061	-540	1151	-452	1013	-76	2,682	-1,988	4,202
HOV/EXP ACCESS FROM GP	206EN																																																										
HOV/EXP ACCESS TO GP	206EX																																																										
SB OFF TO BAILEY	2150	280	5938	280	6421	290	6496	240	4766	558	6822	558	7500	578	7633	478	5742	583	8828	583	9684	604	9511	500	7465	518	6313	518	6948	537	6936	444	4973	521	7912	521	8685	540	8424	447	6505	40	509	40	552	41	697	34	769	62	916	62	999	64	1087	53	960	155	2,527	241	3,961
SB ON FROM BAILEY	2151	130	6068	140	6561	170	6666	130	4896	130	6952	140	7640	170	7803	130	5872	130	8958	140	9824	170	9681	130	7595	130	6443	140	7088	170	7106	130	5103	130	8042	140	8825	170	8594	130	6635	0	509	0	552	0	697	0	769	0	916	0	999	0	1087	0	960	0	2,527	0	3,961
SB OFF TO COYOTE GREEK	2153	50	6018	30	6531	30	6636	10	4886	50	6902	30	7610	30	7773	10	5862	50	8908	30	9794	30	9651	10	7585	50	6393	30	7058	30	7076	10	5093	50	7992	30	8795	30	8564	10	6625	0	509	0	552	0	697	0	769	0	916	0	999	0	1087	0	960	0	2,527	0	3,961
SB ON FROM COYOTE GREEK	2154	30	6048	30	6561	30	6666	30	4916	30	6932	30	7640	30	7803	30	5892	30	8938	30	9824	30	9681	30	7615	30	6423	30	7088	30	7106	30	5123	30	8022	30	8825	30	8594	30	6655	0	509	0	552	0	697	0	769	0	916	0	999	0	1087	0	960	0	2,527	0	3,961
HOV/EXP ACCESS TO GP	S21X																																																										
SB OFF TO COCHRANE	2157	860	5188	980	5581	960	5706	860	4056	995	5937	1134	6506	1111	6692	995	4897	1417	7521	1615	8209	1582	8099	1417	6199	944	5479	1076	6012	1054	6052	944	4179	944	7078	1076	7749	1054	7540	944	5711	51	458	58	494	57	640	51	718	473	443	539	460	528	559	473	488	217	2,311	2,013	1,948
SB ON FROM COCHRANE	2158	160	5348	140	5721	130	5836	110	4166	160	6097	140	6646	130	6822	110	5007	160	7681	140	8349	130	8229	110	6309	160	5639	140	6152	130	6182	110	4289	160	7238	140	7889	130	7670	110	5821	0	458	0	494	0	640	0	718	0	443	0	460	0	559	0	488	0	2,311	0	1,948
SB ON FROM COCHRANE	2159	520	5868	630	6351	610	6446	450	4616	520	6617	630	7276	610	7432	450	5457	575	8256	696	9045	674	8903	497	6806	520	6159	630	6782	610	6792	450	4739	572	7810	694	8583	672	8342	495	6316	0	458	0	494	0	640	0	718	3	446	2	462	2	561	2	490	0	2,311	9	1,957
HOV/EXP ACCESS TO GP	S56X																																																										
SB OFF TO DUNNE	2161	790	5078	810	5541	950	5496	920	3696	802	5815	822	6455	964	6468	934	4523	832	7424	853	8192	1000	7903	969	5837	790	5369	810	5972	950	5842	920	3819	790	7020	810	7773	950	7392	920	5396	12	446	12	483	14	626	14	704	42	404	43	419	50	511	49	441	52	2,259	184	1,774
SB ON FROM DUNNE	2162	500	5578	520	6061	540	6036	450	4146	524	6339	545	7000	566	7034	471	4994	661	8085	688	8880	714	8617	595	6432	522	5891	543	6515	564	6406	470	4289	619	7639	643	8416	668	8060	557	5953	2	448	2	485	2	628	1	705	42	446	45	464	46	557	38	479	7	2,266	171	1,945
SB OFF TO TENNANT	2164	670	4908	670	5391	730	5306	690	3456	780	5559	780	6220	850	6184	804	4190	780	7305	780	8100	850	7767	804	5628	780	5111	780	5735	850	5556	803	3486	780	6859	780	7636	850	7210	803	5150	0	448	0	485	0	628	1	704	0	446	0	464	0	557	1	478	1	2,265	1	1,944
SB ON FROM TENNANT	2165	390	5298	460	5851	530	5836	370	3826	423	5982	498	6718	574	6758	401	4591	423	7728	498	8598	574	8341	401	6029	422	5533	498	6233	574	6130	401	3887	422	7281	498	8134	574	7784	401	5551	1	449	0	485	0	628	0	704	1	447	0	464	0	557	0	478	1	2,266	1	1,945

6 NEAR-TERM (2015) TRAFFIC OPERATIONAL ANALYSIS

Near-term (2015) traffic operating conditions for the US 101 Express Lanes project were analyzed using the VISSIM simulation models. To create the 2015 models, the calibrated Existing Conditions models were modified to reflect the 2015 forecasted demands and network improvements. For the 2015 Build alternative, express lanes were coded into the VISSIM consistent with the design plans for the project.

Consistent with the performance measures described in Section 2.6.2, the data extracted from the model to assess the impact and benefit of the proposed project included:

- Network performance measures – including vehicle miles traveled, VHT, VHD, average speed, and average delay per vehicle;
- Hourly flow volumes or throughput – for mainline (total and with breakdown between general purpose and HOV/express lanes) and ramps;
- Average hourly speeds – reported separately for general purpose and HOV/express lanes;
- Average hourly vehicle density and level-of-service (LOS) – for mainline reported separately for general purpose and HOV/express lanes;
- Segment travel times – average travel time for segments of the corridor; reported separately for general purpose and HOV/express lane travel; and
- Express lane access zone weave volumes, speeds and densities – broken down for individual access zones.

6.1 2015 AM Peak Period Conditions (6:00 – 10:00AM)

The section summarizes the expected 2015 AM peak period operating conditions focusing on a comparison of the No Build and Build conditions during the AM peak hour (defined as 7:00 to 8:00 AM). Additional detail related to the volume, speed, density, LOS, and express lane access zone weave volume results for the 2015 AM peak period is provided in **Appendix D.**

6.1.1 Network Performance Measures

Table 6-1 summarizes the 2015 AM peak period and peak hour network performance measure results for the No Build and Build alternatives in the northbound direction on US 101. The results for southbound US 101 are presented in **Table 6-2.** In both cases, the network performance measures combine travel on the freeway mainline (both general purpose and HOV/express lanes) and ramps coded within the VISSIM model network.

As **Table 6-1** shows the Build alternative produces significant benefits compared to the No Build in the northbound direction. These benefits include a 12% increase in VMT (+118,971), 27% reduction in total travel time (-9,846 hours), 55% reduction in total delay (-11,415 hours), 58% reduction in average delay (-329 seconds), and 53% increase in average speed (+14 mph) over the peak period. The increase in VMT is a reflection of two factors: 1) with the reduced congestion, vehicles can more easily travel through the network and reach their destination; and 2) under the Build alternative, demand volumes on US 101 increase (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. The VHT, VHD, average delay and speed benefits all reflect the reduced congestion levels achieved under the Build alternative. Similar improvements are achieved during the AM peak hour.

In the southbound direction, there is essentially no difference with respect to the network performance measures between the No Build and Build alternatives during the 2015 AM peak period (see **Table 6-2**). The slight increase in VMT is the result of slightly higher demands for the Build alternative. The changes in the remaining performance measures are essentially negligible and reflect the fact that there is little or no congestion in either alternative. In the AM peak hour, the higher demand served under the Build alternative does produce increases in the total hours of delay (+107 hours) and average delay (+10 seconds), plus a decrease in average speed (-1 mph), but the magnitude of these changes are minor especially relative to the benefits in the peak northbound direction.

Table 6-1: 2015 AM Peak Network Performance Measure Comparison – Northbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	995,813	1,114,783	118,971	12%
Total Travel Time (VHT) (hr)	36,738	26,891	-9,846	-27%
Total Delay (VHD) (hr)	20,742	9,327	-11,415	-55%
Average Delay per Vehicle (sec)	567	238	-329	-58%
Average Speed (mph)	27	42	14	53%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	279,118	314,096	34,978	13%
Total Travel Time (VHT) (hr)	10,180	7,875	-2,305	-23%
Total Delay (VHD) (hr)	5,718	2,955	-2,763	-48%
Average Delay per Vehicle (sec)	474	242	-232	-49%
Average Speed (mph)	27	40	12	45%

Table 6-2: 2015 AM Peak Network Performance Measure Comparison – Southbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	1,148,068	1,194,452	46,384	4%
Total Travel Time (VHT) (hr)	21,490	22,184	693	3%
Total Delay (VHD) (hr)	2,394	2,372	-23	-1%
Average Delay per Vehicle (sec)	73	72	-1	-2%
Average Speed (mph)	53	54	1	1%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	349,490	363,740	14,250	4%
Total Travel Time (VHT) (hr)	6,500	6,835	335	5%
Total Delay (VHD) (hr)	686	793	107	16%
Average Delay per Vehicle (sec)	67	77	10	15%
Average Speed (mph)	54	53	-1	-1%

6.1.2 Congestion Patterns and Bottlenecks

The VISSIM model link flow volume, speed and density results, along with visual inspection of the models, were used to identify congestion patterns, including bottleneck locations and queues for each alternative. These detailed results are contained in Appendix D. The speed results for the 2015 AM peak hour (defined as 7 to 8 AM) are also illustrated **Figure 6-1** and **Figure 6-2** for the northbound and southbound directions respectively. These figures compare the No Build and Build speed profiles for both the general purpose and HOV/express lanes.

During the AM peak period, the peak direction on US 101 is northbound. As shown in **Figure 6-1** considerable congestion is forecasted in the northbound general purpose lanes under the 2015 No Build alternative. In the AM peak hour, bottlenecks occur in several locations including: between the East Dunne on and Cochrane off, Tully off and on, McKee on and Oakland off, De La Cruz on and San Tomas/Montague off, Fair Oak Oaks on and Mathilda off, Rengstorff off and on. These bottlenecks result in significant congestion on northbound US 101, especially through the northern two thirds of the corridor. These conditions persist in the third hour with the queues in the northern half of the corridor merging together. In addition, the bottleneck near Old Oakland shifts downstream to between

the Old Oakland on and northbound I-880 off due, in part, to the high volume exiting to northbound I-880. Under the Build alternative, the level of congestion in the northbound general purpose lanes decreases significantly compared to No Build. Most notably, the bottlenecks between the East Dunne on and Cochrane off, and between the Tully off and on are eliminated under the Build alternative. In addition, the level of congestion associated with a bottleneck between Old Oakland and I-880 is significantly reduced.

Under the No Build alternative, congestion is also forecasted in the northbound HOV lane during the AM peak hour. Speeds within the HOV lane drop below 45 mph in several locations, generally corresponding to bottleneck or congested segments in the general purpose lanes. This HOV lane congestion may be attributed to a combination of high HOV lane volumes and to traffic exiting the HOV lane trying to merge in the general purpose lanes which are congested. Higher speeds and better operations are forecasted for the proposed express lanes, with speeds dropping below 50 mph only at the Santa Clara and Ellis access zones.

As the VISSIM outputs in Appendix D show, higher flow volumes are achieved in the northbound direction under the Build alternative, even at the bottleneck locations, largely as a result of higher flows in the express lanes compared to the HOV lane. Overall, the Build alternative produces higher speeds in both the general purpose and HOV/express lanes, lower densities, and better LOS compared to the No Build alternative.

In the offpeak southbound direction (see **Figure 6-2**) only limited congestion at the north end or start of the corridor is expected in the general purpose lanes under the No Build alternative. Meanwhile, the HOV lanes are expected to operate at free flows speeds. Similar conditions are expected for the Build.

6.1.3 Travel Times

Table 6-3 summarizes the 2015 AM peak hour travel time results in the northbound and southbound directions for both the No Build and Build alternatives. For reference, free flow or uncongested travel times are also provided.

Key findings related to the comparison of the No Build and Build northbound AM peak hour travel times include:

- The Build alternative produces general purpose lane travel time reductions compared to the No Build alternative in all segments, including a reduction of 14.3 minutes in the segment between Bernal Road and I-880.
- The Build alternative produces HOV/express lane travel time reductions compared to the No Build alternative in all four segments, including reductions of 1 to 3 minutes in the two middle segments of the corridor.
- In general, vehicles in the express lane experience little or no delay relative to free flow travel times.
- In the Build alternative, the express lanes offer significant travel time savings compared to the general purpose lanes (16.5 minutes savings over the entire length of the corridor).

The travel time results for the southbound direction reflect the relatively uncongested conditions in a majority of the corridor expected in that direction during the 2015 AM peak hour. For both the general purposes lanes and HOV/express lanes, there is little difference in travel times between the No Build and Build alternatives. HOV/express lane users are expected to experience essentially no travel time delay as average speeds exceed 60 mph.

6.1.4 Person Throughput

Another consideration in the assessment of the express lanes is the total person, rather than vehicle, throughput. A potential concern is that with limited express lane access zones, HOVs may need to use the GP lanes for more of their trips and some shorter HOV trips may not be able to use the express lanes at all because the access points do not correspond well with where they enter and exit the freeway (i.e. there may be an access zone downstream of the on-ramp used, but not another upstream of the desired off-ramp). Conversely, the express lanes would carry a combination of HOVs and toll-paying SOVs unlike the HOV-only lane in the No Build alternative.

To assess the impact of the proposed express lanes on the person-carrying capacity of the corridor, person throughput was measured at four locations along the corridor. These locations were spread throughout the corridor and while a consideration was to select points just downstream of bottlenecks, this was not always possible due to

the length of some queues. The person throughput was determined by applying "average vehicle occupancy" (AVO) factors to the vehicular volumes. Separate factors were applied to the GP and the HOV/express lanes reflecting the different mix of SOVs and HOVs expected to be using these lanes. These AVO factors were derived from observed values on US 101 as reported in the *2010 Bay Area HOV Lanes* report produced by Caltrans. This report provides separate AVO factors for the existing GP and HOV lanes. **Table 6-4** compares the 2015 AM peak hour person throughput at these locations for the No Build and Build alternatives.

As these results show, the Build alternative is expected to produce higher person throughput in the northbound direction at all locations during the 2015 AM peak hour. This includes higher throughput of over 2600 persons per hour through the middle portion of the corridor. In the uncongested southbound direction, the Build alternative is forecasted to serve between 150 and 400 additional persons per hour, with the small differences attributed to the slightly higher forecasted travel demand.

6.1.1 Express Lane Operations

Average speed, density and LOS results for the entire length of the express lanes under 2015 AM peak period conditions are provided in Appendix D. With respect to express lane operations, the most critical locations are generally the access zones where lane-changing maneuvers for vehicles entering and exiting the express lanes are concentrated. For the express lanes, this is where flows may break down and speed can drop. **Table 6-5** summarizes the speed, density, and LOS for the proposed express lane access zones in the Build alternative.

As these results show, the northbound express lanes, with exception of within the McKee-Santa Clara access zone, are expected to operate at speeds of 45 mph or higher and LOS D or better in all segments throughout the 2015 AM peak period, including the last hour (9 to 10 AM) when the express lanes are open to all vehicles. At the McKee-Santa Clara access zone, the express lane speeds are projected to drop to 40 and 41 mph respectively in the second and third hours, and operate at LOS E in both hours. In between access zones, the northbound express lanes are expected to typically operate at speeds greater than 60 mph. Two segments, the McKee access end to Santa Clara on-ramp and SR 237 on-ramp to Ellis off-ramp, are also shown to operate at LOS E but with speeds over 45 mph. Based on these speeds, vehicles in the express lanes are expected to experience very little travel time delay.

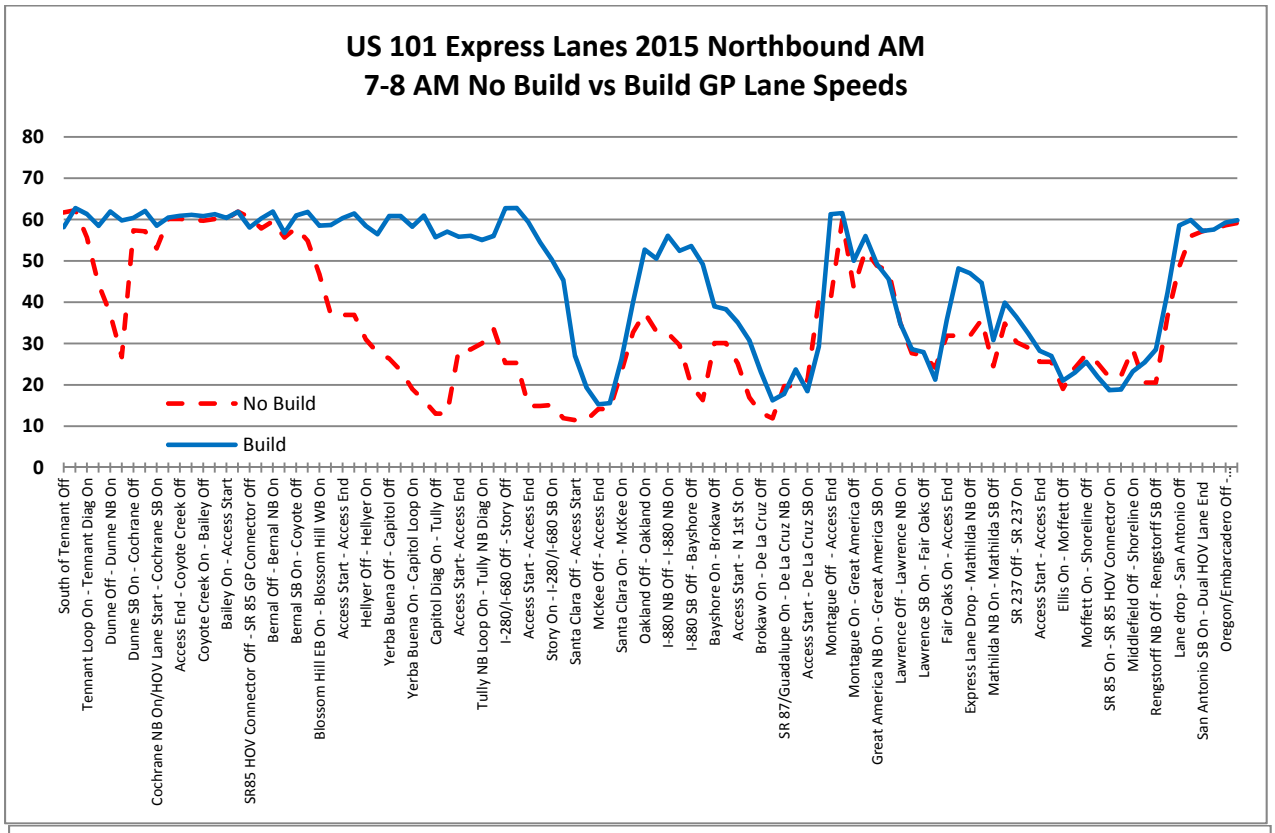
While these operating conditions do not meet standards established in federal and state laws, they are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

For reference, the northbound HOV lane under the No Build alternative is expected to degrade to LOS E or worse in several locations, with speeds dropping to 30 mph or lower in both the second and third hours of the 2015 AM peak period.

In the southbound direction, the express lanes are forecasted to operate at speeds of 58 mph or higher and LOS C or better during the hours of express operations (6 to 9 AM). During the last hour (9 to 10 AM) of the 2015 AM peak period, when the express lanes are open to all vehicles, conditions degrade slightly at the start and at the Ellis access zone but still remain at LOS C or better. This is similar to the HOV lane operations under the No Build alternative.



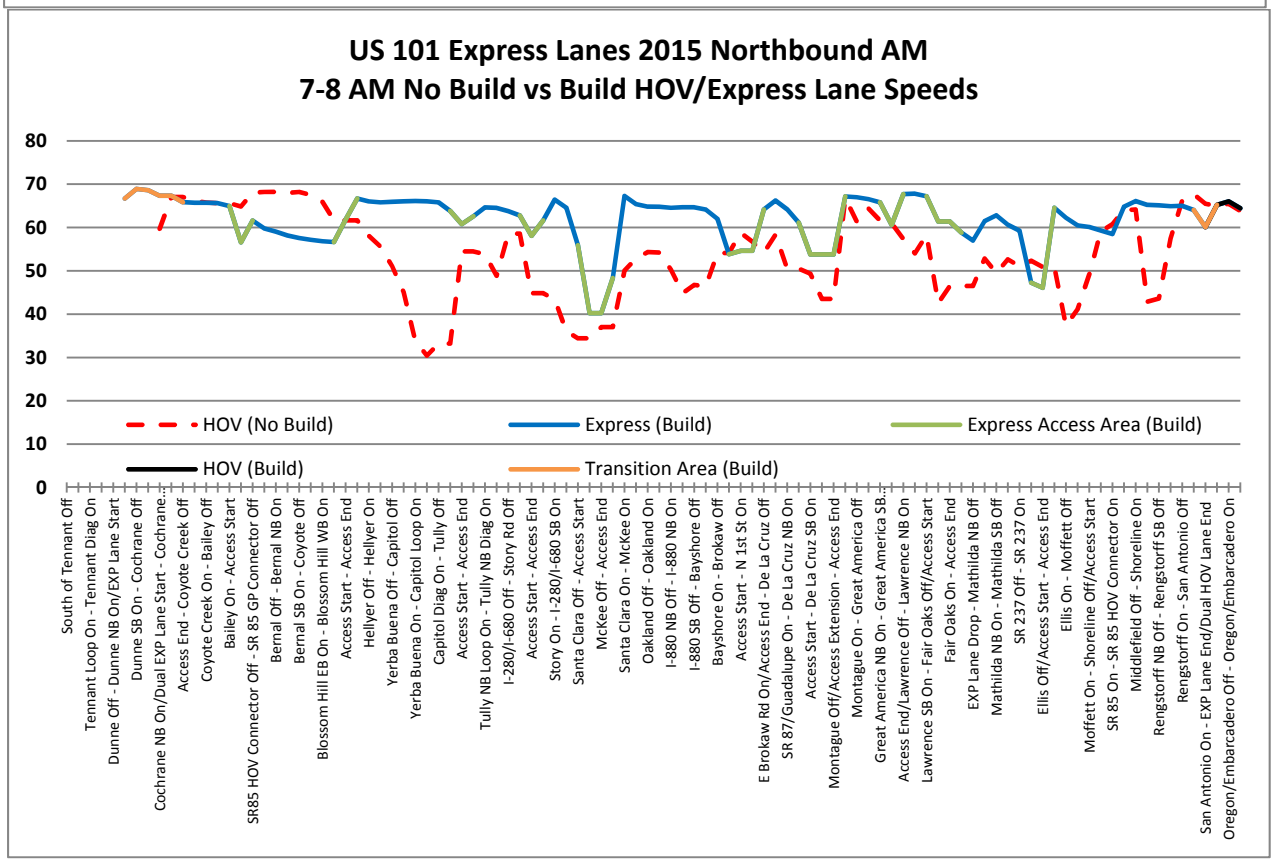
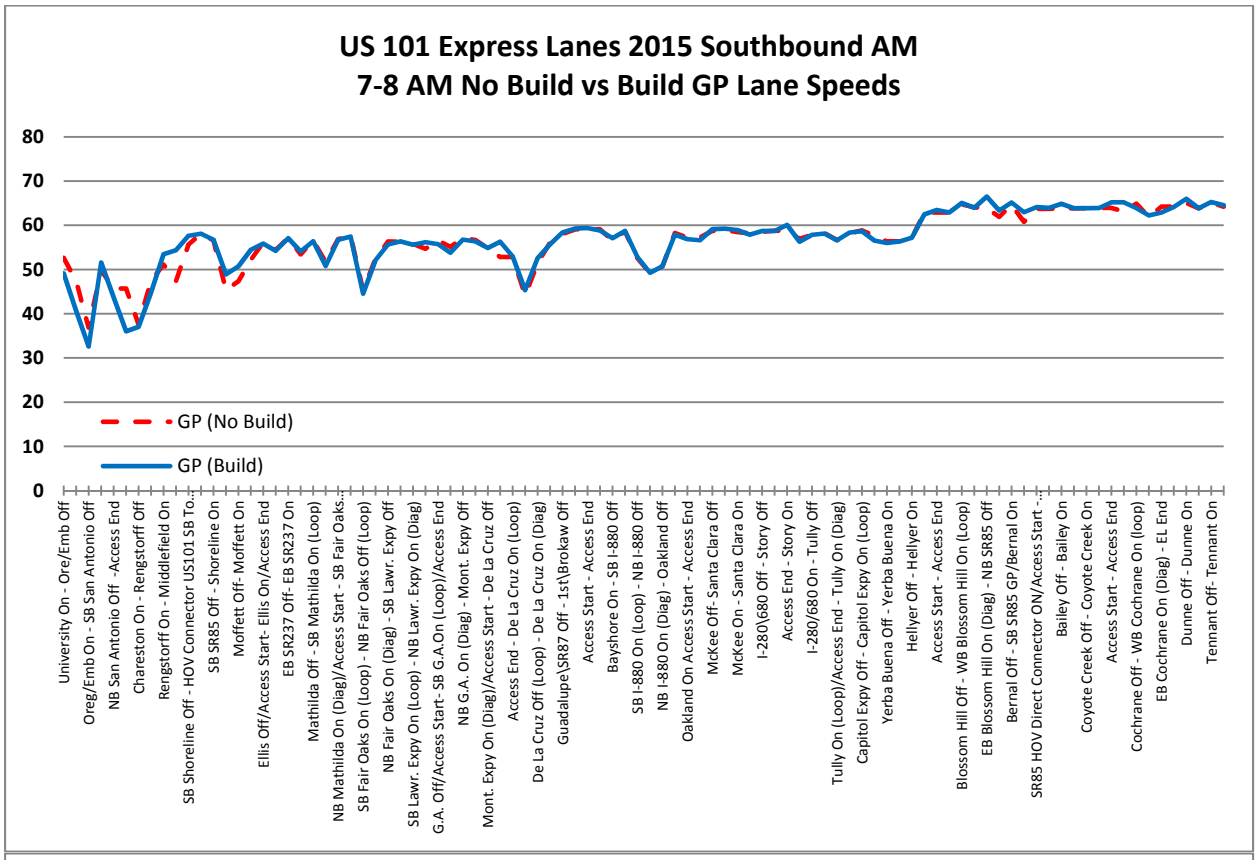


Figure 6-1: 2015 AM Peak Hour Speed Profiles – Northbound



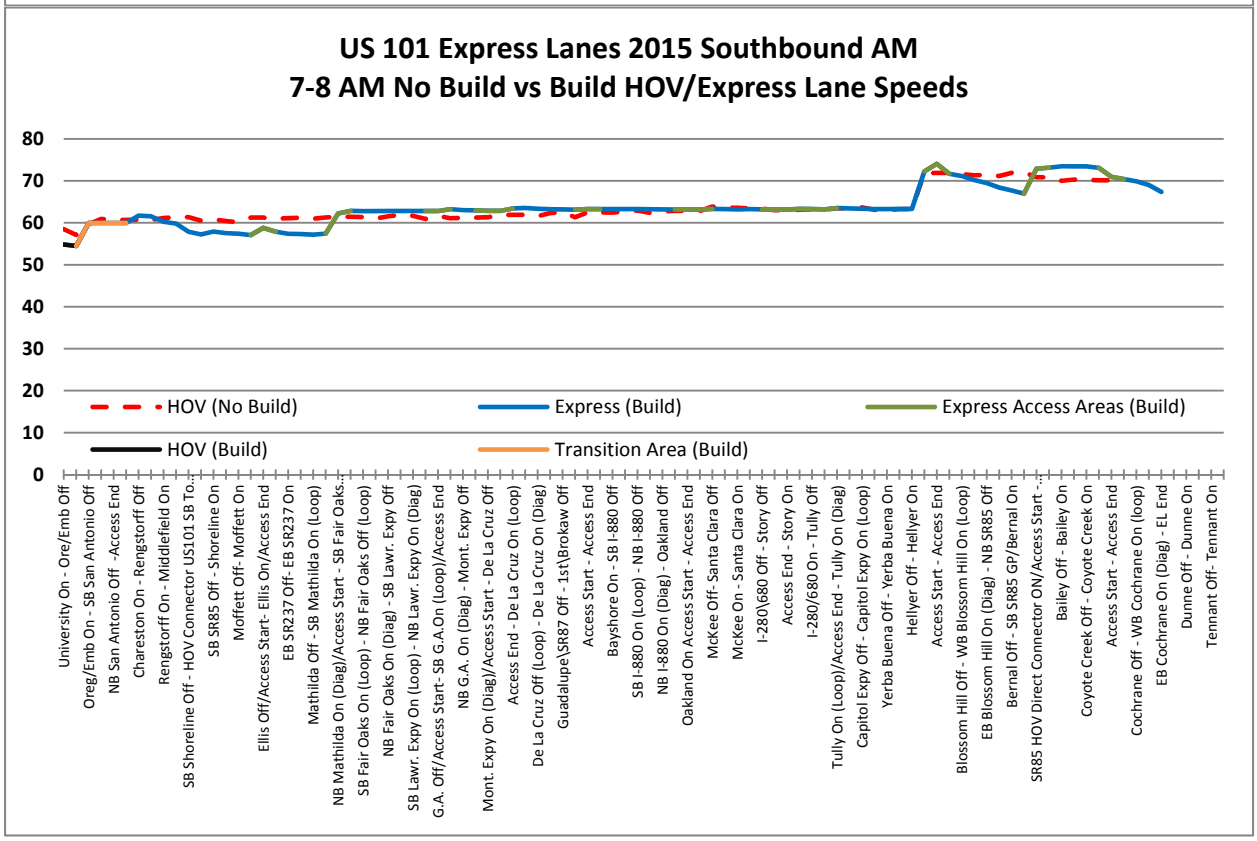


Figure 6-2: 2015 AM Peak Hour Speed Profiles - Southbound

Table 6-3: 2015 AM Peak Hour[1] Travel Time Comparison (minutes)

LANE TYPE	SEGMENT	FREE FLOW[2]	NO BUILD	BUILD	BUILD – NO BUILD DIFFERENCE
NORTHBOUND					
General Purpose	1. Dunne Ave On - Bernal Rd On	10.1	11.7	10.9	-0.8
	2. Bernal Rd On - Rt 880 Jct	10.6	28.6	14.3	-14.3
	3. Rt 880 Jct - Rt 237 On	7.3	18.1	15.2	-2.8
	4. Rt 237 On - Embarcadero On	5.4	11.0	10.7	-0.3
HOV/Express	1. Dunne Ave On - Bernal Rd On	10.1	10.8	10.0	-0.9
	2. Bernal Rd On - Rt 880 Jct	10.6	14.0	11.1	-2.9
	3. Rt 880 Jct - Rt 237 On	7.3	9.0	7.6	-1.4
	4. Rt 237 On - Embarcadero On	5.4	6.2	5.9	-0.3
SOUTHBOUND					
General Purpose	1. San Antonio Off to Rt 237 Jct	3.9	5.4	5.8	0.4
	2. Rt 237 Jct to McKee Rd Off	8.9	10.4	11.0	0.5
	3. McKee Rd Off to Rt 85 Jct	9.2	9.9	9.9	0.0
	4. Rt 85 Jct to Cochrane Rd Off	7.7	7.9	7.9	0.0
HOV/Express	1. San Antonio Off to Rt 237 Jct	3.9	4.2	4.4	0.2
	2. Rt 237 Jct to McKee Rd Off	8.9	9.4	9.7	0.3
	3. McKee Rd Off to Rt 85 Jct	9.2	8.9	9.0	0.1
	4. Rt 85 Jct to Cochrane Rd Off	7.7	7.1	6.9	-0.2

Note: 1. AM peak hour defined as 7:00 to 8:00AM
2. Free flow travel time is based on an assumed speed of 65 mph. In some cases, model speeds may exceed 65 mph producing travel times that are less than free flow.

Table 6-4: 2015 AM Peak Hour[1] Person Throughput

LOCATION	ALTERNATIVE	GP LANES		HOV/EXPRESS LANES		TOTAL	
		VEHICLES	**PERSONS**	**VEHICLES**	**PERSONS**	**VEHICLES**	**PERSONS**
Northbound							
1. Coyote Creek On-Bailey Off	No Build	5,274	5,801	1,598	3,356	6,872	9,157
	Build	4,413	5,296	2,754	3,966	7,167	9,261
2. Old Oakland on-NB I-880 off	No Build	6,096	6,706	1,502	3,154	7,598	9,860
	Build	6,641	7,637	3,139	4,865	9,780	12,503
3. San Tomas/Montague on-Great America off	No Build	6,936	7,630	1,290	2,709	8,226	10,339
	Build	6,494	7,468	2,370	3,934	8,864	11,402
4. Rengstorff on-San Antonio off	No Build	6,391	7,030	1,544	3,242	7,935	10,273
	Build	6,130	6,866	2,462	4,358	8,592	11,223
Southbound							
1. Rengstorff on-Middlefield on	No Build	5,983	6,581	1,502	3,154	7,485	9,736
	Build	5,859	6,796	1,746	3,090	7,605	9,887
2. De La Cruz on-SR 87 off	No Build	5,117	5,629	787	1,653	5,904	7,281
	Build	5,499	6,159	761	1,514	6,260	7,673
3. McKee/Julian off-Santa Clara off	No Build	3,623	3,985	689	1,447	4,312	5,432
	Build	3,869	4,333	746	1,485	4,615	5,818
4. Coyote Creek on-Cochrane off	No Build	4,290	4,719	890	1,869	5,180	6,588
	Build	4,498	5,173	940	1,643	5,438	6,816

Note: 1. AM peak hour defined as 7:00 to 8:00AM

Table 6-5: 2015 AM Peak Period Express Lane Access Zone Speed, Density, and LOS

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]
NORTHBOUND													
1	Between Dunne NB on/Exp Lane start and start of buffer (Cochrane SB On to Coyote Creek Off)	68	67	68	69	12	17	12	15	B	B	B	B
2	Between Bailey On and SR 85 Connector Off	62	57	61	61	15	23	17	17	B	C	B	B
3	Between Blossom Hill On and Hellyer Off	62	62	63	63	13	18	13	15	B	C	B	B
4	Between Tully Off and On	63	61	63	64	19	26	19	18	C	C	C	C
5	Between Story Off and On	60	58	59	60	22	27	22	22	C	D	C	C
6	Between McKee Off and Santa Clara On	58	40	41	55	25	44	37	24	C	E	E	C
7	Between Brokaw Off and Brokaw On	59	55	57	60	23	27	22	20	C	D	C	C
8	Between De La Cruz NB On and San Tomas/Montague Off	59	54	54	54	22	26	23	25	C	C	C	C
9	Between Great America On and Lawrence Off	62	61	58	64	16	17	17	14	B	B	B	B
10	Between Fair Oaks Off and Mathilda Off	65	61	61	63	13	14	15	11	B	B	B	A
11	Between Ellis Off and On	55	46	47	58	25	32	32	20	C	D	D	C
12	North of San Antonio to end express lane (transition to HOV-only)	61	60	62	61	11	14	13	14	A	B	B	B
SOUTHBOUND													
1	Between Oreg\Emb On and Start of Buffer (transition from HOV-only)	63	60	59	57	4	16	19	24	A	B	C	C
2	Between Ellis Off and On	62	59	58	58	4	18	23	27	A	C	C	D
3	Between Mathilda Diag On and Fair Oaks Diag Off	63	62	62	62	2	8	10	14	A	A	A	B
4	Between Great America Off and On	64	63	63	61	3	7	9	17	A	A	A	B
5	Between San Tomas/Montague On and De La Cruz Loop On	64	63	63	61	2	6	6	18	A	A	A	B
6	Between 1st/Brokaw Off and Bayshore On	64	63	63	62	2	5	5	13	A	A	A	B
7	Between Old Oakland On and McKee Off	64	63	63	62	3	6	5	12	A	A	A	B

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]
8	Between Story Off and On	64	63	63	62	2	6	5	10	A	A	A	A
9	Between Tully Off and On	64	63	64	62	2	6	5	10	A	A	A	A
10	Between Hellyer On and Blossom Hill Off	75	74	74	73	2	5	4	8	A	A	A	A
11	Between SR85 HOV Connector On and Bailey Off	74	73	73	72	3	7	6	11	A	A	A	A
12	Between Coyote On and Cochrane Off	73	71	71	68	2	8	7	14	A	A	A	B

Note: 1. During the last hour (9 to 10 AM) of the AM peak period, the express lanes are open to all vehicles.

6.2 2015 PM Peak Period Conditions (3:00 – 7:00PM)

The section summarizes the expected 2015 PM peak period operating conditions focusing on a comparison of the No Build and Build conditions during the PM peak hour (defined as 5:00 to 6:00 PM). Additional detail related to the volume, speed, density, LOS, and express lane access zone weave volume results for the 2015 PM peak period is provided in Appendix E.

6.2.1 Network Performance Measures

Table 6-6 summarizes the 2015 PM peak period and peak hour network performance measure results for the No Build and Build alternatives in the northbound direction on US 101. The results for southbound US 101 are presented in **Table 6-7**. In both cases, the network performance measures combine travel on the freeway mainline (both general purpose and HOV/express lanes) and ramps coded within the VISSIM model network.

As these results show, the proposed project provides network benefits in both directions during the 2015 PM peak period by opening up the express lanes to toll-paying SOVs thus maximizing the use of these lanes and providing a second express lane in each direction through the middle portion of the corridor. These benefits include reductions in total hours of travel, hours of delay and average delay, plus an increase in average travel speed.

In the offpeak northbound direction, little congestion is expected under either alternative during the PM peak period as reflected in the average speeds above 50 mph. However, the Build alternative does produce an increase of nearly 6,500 VMT (+1%) along with reductions in vehicle hours of delay (-121 hours or -1%) and average delay (-4 sec/vehicle or -13%). A similar pattern of improvement is expected in the PM peak hour.

In the peak southbound direction, the Build alternative produces improvements in vehicle hours of delay (-1,080 hours or -6%), average delay (-33 seconds or -8%) and average speed (+2 mph or +7%) over the PM peak period. While the delay and speed improvements appear modest, it is important to recognize that this is achieved while serving significantly higher VMT (+133,723 miles or +9%). The increase in VMT is, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. These benefits were not quantified as part of this analysis. A similar pattern of improvement is expected in the PM peak hour.

Table 6-6: 2015 PM Peak Network Performance Measure Comparison – Northbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	784,861	791,382	6,521	1%
Total Travel Time (VHT) (hr)	13,921	13,801	-121	-1%
Total Delay (VHD) (hr)	1,057	937	-121	-11%
Average Delay per Vehicle (sec)	29	26	-4	-13%
Average Speed (mph)	56	57	1	2%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	203,241	206,939	3,697	2%
Total Travel Time (VHT) (hr)	3,679	3,669	-10	0%
Total Delay (VHD) (hr)	342	298	-44	-13%
Average Delay per Vehicle (sec)	33	28	-5	-15%
Average Speed (mph)	55	56	1	2%

Table 6-7: 2015 PM Peak Network Performance Measure Comparison – Southbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	% DIFFERENCE
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	1,473,565	1,607,288	133,723	9%
Total Travel Time (VHT) (hr)	43,442	44,280	837	2%
Total Delay (VHD) (hr)	18,661	17,581	-1,080	-6%
Average Delay per Vehicle (sec)	397	365	-33	-8%
Average Speed (mph)	34	36	2	7%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	377,559	418,588	41,028	11%
Total Travel Time (VHT) (hr)	12,522	13,078	556	4%
Total Delay (VHD) (hr)	6,171	6,114	-57	-1%
Average Delay per Vehicle (sec)	411	394	-16	-4%
Average Speed (mph)	30	32	2	6%

6.2.2 Congestion Patterns and Bottlenecks

The VISSIM model flow volume, speed and density results, along with visual inspection of the models, were used to identify congestion patterns, including bottleneck locations and queues for each alternative. These detailed results are contained in Appendix E. The speed results for the 2015 PM peak hour (defined as 5 to 6 PM) are also illustrated in **Figure 6-3** and **Figure 6-4** for the northbound and southbound directions respectively. These figures compare the No Build and Build speed profiles for both the general purpose and HOV/express lanes.

In the northbound direction (**Figure 6-3**) the general purpose lanes on US 101 are expected to be largely uncongested during the PM peak period under 2015 No Build conditions. In most areas, average hourly speeds in the general purpose lanes are expected to be around 60 mph. Isolated slowdowns with speeds dropping below 55 mph are projected at the following locations: Capitol-Tully, Tully-I-280, De La Cruz-San Tomas, San Tomas-Great America, and at Mathilda. Similar conditions for the northbound US 101 general purpose lanes are expected under the Build alternative, with slowdowns in the same locations. No congestion is forecasted in the northbound HOV/express lanes during the 2015 PM peak period under either the No Build or Build alternative.

In the PM peak period, the peak direction on US 101 is southbound. As shown in **Figure 6-4** major bottlenecks forecasted in the southbound general purpose lanes under 2015 No Build conditions include those between the Rengstorff on-ramp and Middlefield on-ramp, between the De La Cruz diagonal on-ramp and SR 87 off-ramp, and between the Old Oakland on and McKee off. During the PM peak hour, the queue from the Rengstorff-Middlefield bottleneck extends well upstream into San Mateo County. It should be noted that the queue associated with the De La Cruz-SR 87 bottleneck is projected to be significantly shorter than that observed under Existing conditions. This reduction may be attributed to the assumed modification of the off-ramp to SR 87, specifically the addition of a second lane to the exit ramp. This modification reduces the weaving in this segment by eliminating the need for vehicles on US 101 to change lanes to exit at SR 87.

Under the Build alternative, these same general purpose lane bottleneck locations remain. While the total throughput at these bottlenecks (general purpose plus HOV/express lanes) increases under the Build alternative, the level of congestion and queuing is similar to the No Build due to the increased demand on US 101 under the Build alternative. At the Rengstorff-Middlefield and De La Cruz-SR 87 bottlenecks, the general purpose lane throughput is

slightly lower in the Build alternative. This may be attributed to a number of factors. One of these is the fact that of those vehicles in the general purpose lanes, a higher percentage are preparing to exit just downstream of the bottleneck (to SR 85 for the Rengstorff-Middlefield bottleneck, and to SR 87 for the De La Cruz bottleneck) under the Build alternative creating more weaving and right-lane overload compared to the No Build (in the Build more of the "through" vehicles are in the express lanes). A second factor that may contribute to this condition is the difference in ramp demands (i.e. at De La Cruz, demands for the loop on and off ramps are higher under the Build resulting in more weaving). A third factor is the presence of the buffer between the express and general purpose lanes which may affect the capacity of this segment. With respect to the buffer separation, this study reflects a restrictive access scenario for the proposed Express lane which will be reduced by maintaining as much of the existing continuous access striping scheme during the design phase of the project. It should be noted, however, that like all bottleneck locations, the total volume of traffic served under the Build alternative increases at both of these bottlenecks. In addition, a new bottleneck emerges between Dunne on and Tennant off. This new bottleneck occurs because the volume of traffic reaching this point is much higher under the Build alternative compared to the No Build alternative.

In the southbound HOV lane, speeds drop below 50 mph in a number of locations through the middle portion of the corridor during the 2015 PM peak hour under the No Build alternative. These locations generally coincide with the areas of congestion in the general purpose lanes. As such, congestion in the HOV lane is not due to the demand exceeding the capacity in these segments, but it is due to traffic exiting the HOV lane trying to merge in the general purpose lanes that are congested.

Under the Build alternative, the southbound express lanes operate without congestion.

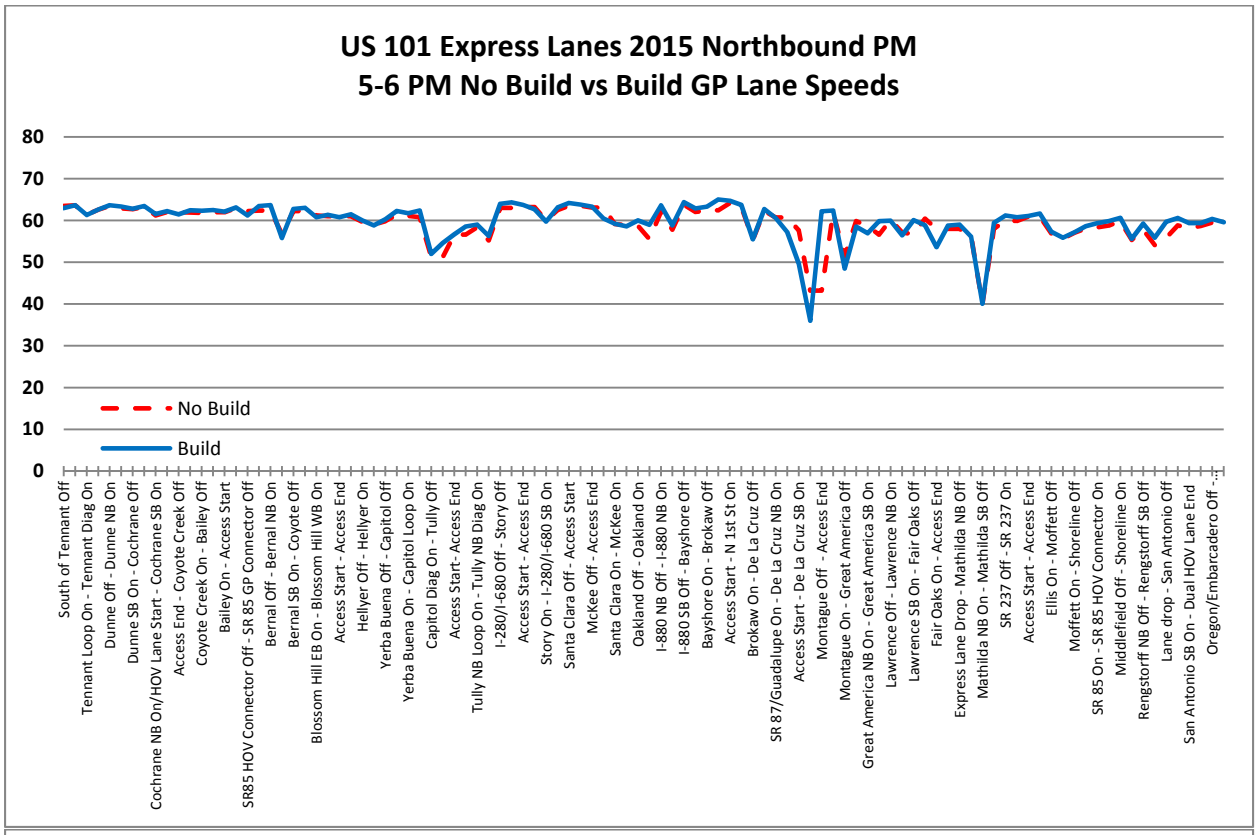
6.2.3 Travel Times

Table 6-8 summarizes the 2015 PM peak hour northbound and southbound segment travel time results for both the No Build and Build alternatives. For reference, free flow or uncongested travel times are also provided.

The travel time results for the northbound direction reflect the relatively uncongested conditions expected in that direction during the 2015 PM peak hour. Over the length of the corridor, northbound travel times in both the general purpose and HOV/express lanes are approximately the same for both the No Build and Build alternatives. HOV/express lane users are expected to experience no travel time delay, while those in the general purpose lanes experience only minor delay.

For the southbound direction, key findings related to the comparison of the No Build and Build 2015 PM peak hour travel times include:

- In the general purpose lanes, travel times between the No Build and Build alternatives vary by less than 1 minute, with exception of the segment from SR 237 to McKee Road where the average travel time increases by about 2 minutes under the Build alternative.
- In the HOV/express lane, the differences in travel time between the two alternatives are negligible.
- With exception of the segment between SR 237 and McKee, vehicles in the HOV/express lane experience little or no delay relative to free flow travel times in either alternative.
- In the Build alternative, the express lanes offer significant travel time savings compared to the general purpose lanes (a reduction of 11.4 minutes over the entire length of the corridor), most notably in the two northern segments.



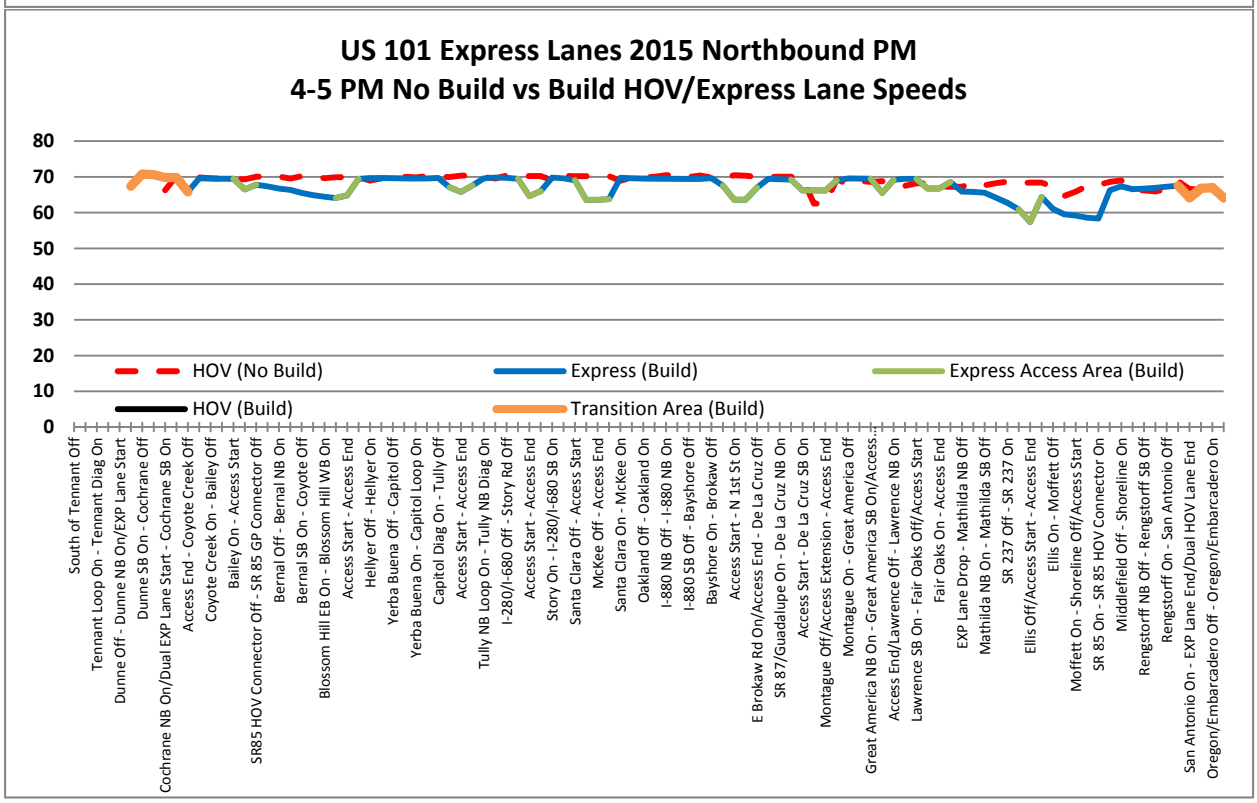
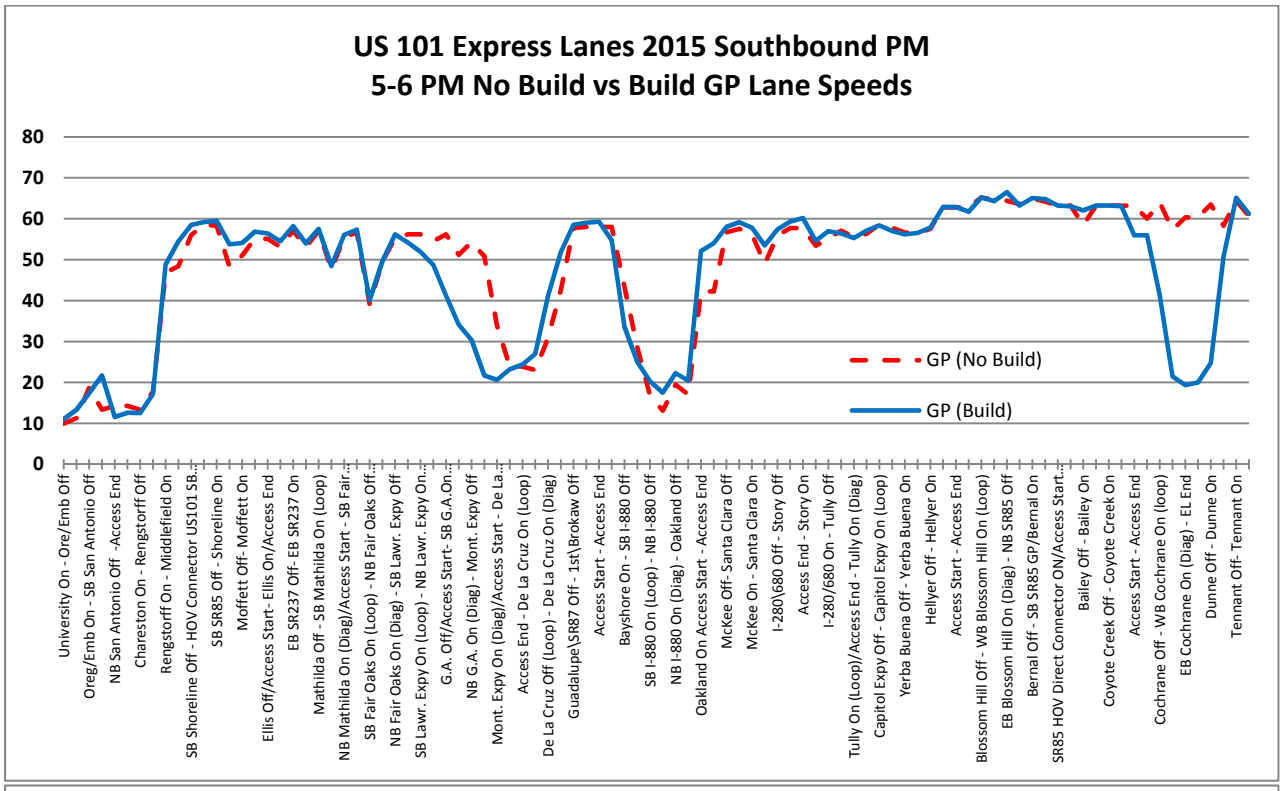


Figure 6-3: 2015 PM Peak Hour Speed Profiles – Northbound



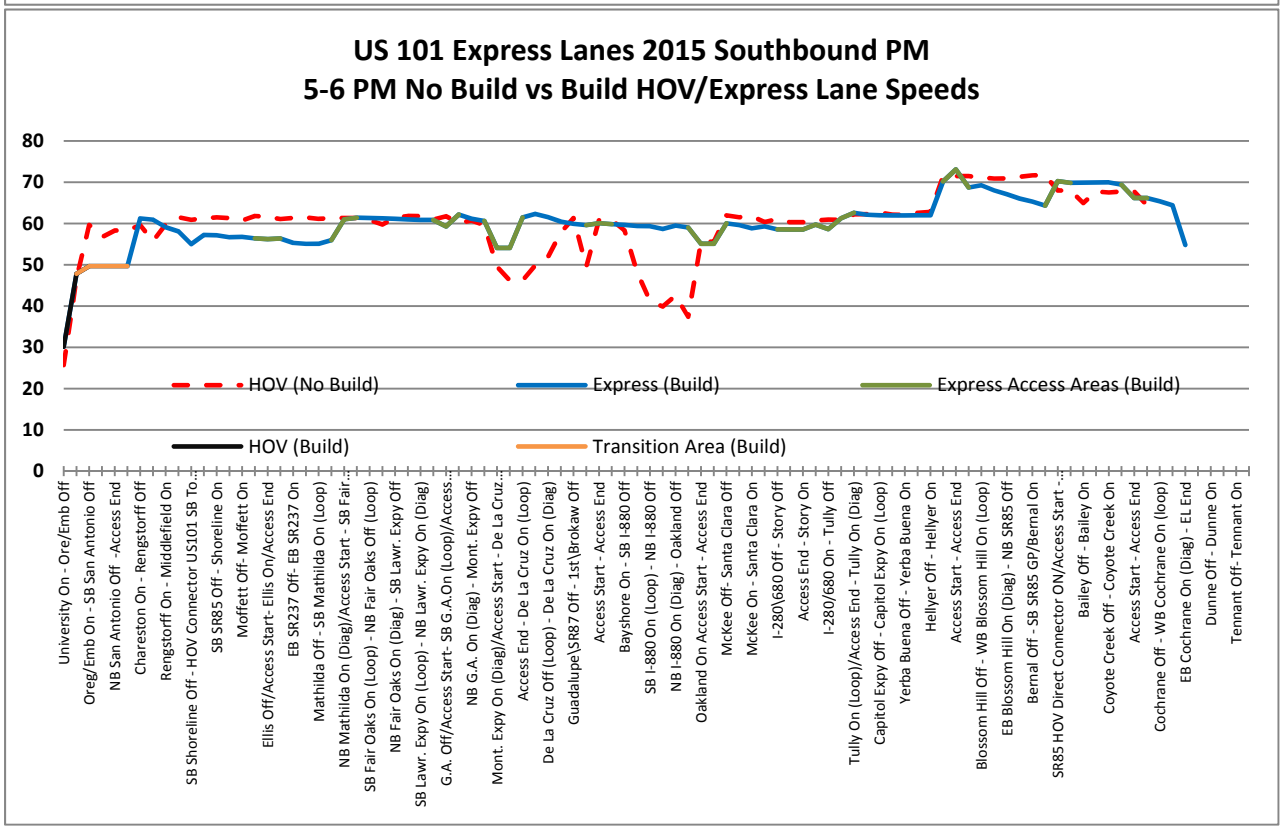


Figure 6-4: 2015 PM Peak Hour Speed Profiles – Southbound

Table 6-8: 2015 PM Peak Hour Segment Travel Time Comparison (minutes)

LANE TYPE	SEGMENT	FREE FLOW[2]	NO BUILD	BUILD	BUILD – NO BUILD DIFFERENCE
NORTHBOUND					
General Purpose	1. Dunne Ave On - Bernal Rd On	10.1	10.7	10.6	-0.1
	2. Bernal Rd On - Rt 880 Jct	10.6	11.6	11.3	-0.3
	3. Rt 880 Jct - Rt 237 On	7.3	8.3	8.3	0.0
	4. Rt 237 On - Embarcadero On	5.4	6.0	5.9	-0.1
HOV/Express	1. Dunne Ave On - Bernal Rd On	10.1	10.0	9.4	-0.6
	2. Bernal Rd On - Rt 880 Jct	10.6	9.9	10.1	0.2
	3. Rt 880 Jct - Rt 237 On	7.3	7.2	7.0	-0.2
	4. Rt 237 On - Embarcadero On	5.4	5.1	5.4	0.3
SOUTHBOUND					
General Purpose	1. San Antonio Off to Rt 237 Jct	3.9	7.9	8.2	0.2
	2. Rt 237 Jct to McKee Rd Off	8.9	14.5	16.6	2.1
	3. McKee Rd Off to Rt 85 Jct	9.2	10.2	10.1	-0.1
	4. Rt 85 Jct to Cochrane Rd Off	7.7	8.0	8.1	0.1
HOV/Express	1. San Antonio Off to Rt 237 Jct	3.9	4.3	4.5	0.2
	2. Rt 237 Jct to McKee Rd Off	8.9	10.4	10.3	-0.1
	3. McKee Rd Off to Rt 85 Jct	9.2	9.2	9.5	0.3
	4. Rt 85 Jct to Cochrane Rd Off	7.7	7.4	7.3	-0.1

Note: 1. PM peak hour defined as 5:00 to 6:00 PM
2. Free flow travel time is based on an assumed speed of 65 mph. In some cases, model speeds may exceed 65 mph producing travel times that are less than free flow.

6.2.4 Person Throughput

To assess the impact of the proposed express lanes on the person-carrying capacity of the corridor, person throughput was measured at four locations along the corridor**. Table 6-9** compares the 2015 PM peak hour person throughput at these locations for the No Build and Build alternatives.

As these results show, during the 2015 PM peak hour the Build alternative is expected to produce higher person throughput in the northbound direction through the mid-northern portion of the corridor. Within the other portions of the corridor, there is little difference between the person throughput under the No Build and Build alternatives. In the peak southbound direction, the Build alternative is expected to produce higher person throughput at all locations, with nearly 800 additional persons per hour at the De La Cruz/SR 87 location, and nearly 1300 additional persons per hour at the McKee/Santa Clara location.

Table 6-9: 2015 PM Peak Hour[1] Person Throughput

LOCATION	ALTERNATIVE	GP LANES		HOV/EXPRESS LANES		TOTAL	
		VEHICLES	PERSONS	VEHICLES	PERSONS	VEHICLES	PERSONS
Northbound							
1. Coyote Creek On-Bailey Off	No Build	3,277	3,605	792	1,663	4,069	5,268
	Build	3,343	4,012	650	1,222	3,993	5,234
2. Old Oakland on-NB I-880 off	No Build	4,259	4,685	768	1,613	5,027	6,298
	Build	4,658	5,590	442	782	5,100	6,372
3. San Tomas/Montague on-Great America off	No Build	5,607	6,168	1,075	2,258	6,682	8,425
	Build	6,416	7,699	707	1,213	7,123	8,912
4. Rengstorff on-San Antonio off	No Build	5,683	6,251	1,109	2,440	6,792	8,691
	Build	5,685	6,822	1,073	1,846	6,758	8,668
Southbound							
1. Rengstorff on-Middlefield on	No Build	5,747	6,322	1,634	3,431	7,381	9,753
	Build	5,474	6,295	2,684	4,013	8,158	10,308
2. De La Cruz on-SR 87 off	No Build	7,341	8,075	1,461	3,068	8,802	11,143
	Build	7,030	8,085	3,033	3,867	10,063	11,952
3. McKee/Julian off-Santa Clara off	No Build	5,716	6,288	1,268	2,663	6,984	8,950
	Build	5,096	5,860	3,178	4,402	8,274	10,262
4. Coyote Creek on-Cochrane off	No Build	5,459	6,005	1,379	2,896	6,838	8,901
	Build	5,206	6,247	2,300	3,059	7,506	9,306

Note: 1. PM peak hour defined as 5:00 to 6:00PM

6.2.5 Express Lane Operations

Average speed, density and LOS results for the entire length of the express lanes under 2015 PM peak period conditions are provided in Appendix E. These results for each proposed express lane access zone are also presented in **Table 6-10**.

As these results show, speeds in the northbound express lanes remain quite high (57 mph or higher) throughout the corridor during the PM peak period, including in all access zones. Based on density, the northbound express lanes are expected to operate at LOS A or B.

The southbound express lanes, including the start transition and all access zones, are expected to operate with speeds of 50 mph or higher throughout the PM peak period. Based on density, the southbound express lanes are expected to operate at LOS D or better throughout the 2015 PM peak period. There is no transition zone at the south end of the corridor because once the buffer ends, the lane immediately becomes a general purpose lane.

Table 6-10: 2015 PM Peak Period Express Lane Access Zone Speed, Density and LOS

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4
NORTHBOUND													
1	Between Dunne NB on/Exp Lane start and start of buffer (Cochrane SB On to Coyote Creek Off)	70	70	70	70	3	4	4	2	A	A	A	A
2	Between Bailey On and SR 85 Connector Off	67	67	66	67	3	4	5	3	A	A	A	A
3	Between Blossom Hill On and Hellyer Off	65	65	65	66	3	4	4	2	A	A	A	A
4	Between Tully Off and On	66	66	65	66	4	5	5	3	A	A	A	A
5	Between Story Off and On	65	65	64	64	5	6	4	3	A	A	A	A
6	Between McKee Off and Santa Clara On	64	64	64	64	4	5	4	3	A	A	A	A
7	Between Brokaw Off and Brokaw On	64	64	64	64	5	6	5	4	A	A	A	A
8	Between De La Cruz NB On and San Tomas/Montague Off	66	66	65	66	5	6	5	4	A	A	A	A
9	Between Great America On and Lawrence Off	66	65	66	66	4	6	5	4	A	A	A	A
10	Between Fair Oaks Off and Mathilda Off	67	67	67	67	4	7	5	4	A	A	A	A
11	Between Ellis Off and On	60	57	59	61	10	16	11	8	A	B	B	A
12	North of San Antonio to end express lane (transition to HOV-only)	68	64	67	67	6	9	8	8	A	A	A	A
SOUTHBOUND													
1	Between Oreg\Emb On and Start of Buffer (transition from HOV-only)	51	50	50	53	24	27	28	21	C	D	D	C
2	Between Ellis Off and On	57	57	56	57	27	28	30	25	D	D	D	C
3	Between Mathilda Diag On and Fair Oaks Diag Off	61	61	61	61	13	14	16	13	B	B	B	B
4	Between Great America Off and SB On	61	61	59	60	17	17	22	21	B	B	C	C
5	Between San Tomas/Montague On and De La Cruz Loop On	59	55	54	58	20	24	28	25	C	C	D	C
6	Between 1st/Brokaw Off and Bayshore On	61	61	60	60	22	23	25	24	C	C	C	C
7	Between Old Oakland On and McKee Off	57	56	55	55	28	29	29	29	D	D	D	D

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4
8	Between Story Off and On	58	58	59	58	25	25	24	24	C	C	C	C
9	Between Tully Off and On	61	61	61	61	16	15	14	16	B	B	B	B
10	Between Hellyer On and Blossom Hill Off	72	72	73	72	10	9	7	9	A	A	A	A
11	Between SR85 Express Connector On and Bailey Off	70	69	70	71	17	20	16	15	B	C	B	B
12	Between Coyote Creek On and Cochrane Off	64	66	66	66	22	20	19	20	C	C	C	C

6.3 Summary of 2015 Conditions

In the peak direction of each period (northbound AM and southbound PM), the proposed Project produces significant benefits along the US 101 corridor. These benefits include increases in VMT, throughput and average speed, along with reductions in total delay, and average delay. The increase in VMT is a reflection of two factors: 1) with the reduced congestion, vehicles can more easily travel through the network and reach their destination; and 2) under the Build alternative, demand volumes on US 101 increase (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. The VHD, average delay and speed benefits all reflect the reduced congestion levels achieved under the Build alternative. The proposed Project reduces total delay by 11,415 hours (-55%) in the northbound direction during the AM peak period, and by 1,080 hours (-6%) in the southbound direction during the PM peak period.

In the offpeak direction in each period, the conditions expected under No Build and Build alternatives are more comparable. This is a reflection of the fact that there is little or no congestion in the offpeak direction and that traffic operates generally at free flow speeds. However, the Build alternative does produce a modest reduction in vehicle hours of delay in the northbound direction during the PM peak period (-121 VHD or -11%). Overall, the proposed US 101 express lanes are expected to produce a reduction of 12,639 vehicle hours of delay combined during the AM and PM peak periods of a typical weekday in 2015.

Under the Build alternative, the express lanes are expected to operate at speeds of 45 mph or higher and at LOS D or better in all segments in both directions throughout both peak periods with the exception of the McKee-Santa Clara access zone in the northbound direction which is expected to operate at LOS E with speeds as low as 40 mph during the AM peak period. Two additional segments, the McKee access end to Santa Clara on-ramp and SR 237 on-ramp to Ellis off-ramp, are also shown to operate at LOS E but with speeds over 45 mph.

While these operating conditions do not meet standards established in federal and state laws, they are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

For reference, the HOV lane in the peak direction under the No Build alternative is expected to degrade to LOS E or F, with speeds below 50 mph, in several locations in both peak periods.

7 LONG-TERM (2035) TRAFFIC OPERATIONAL ANAYSIS

Long-term (2035) traffic operating conditions for the US 101 Express Lanes project were analyzed using the VISSIM simulation models. To create the 2035 models, the 2015 models were modified to reflect the 2035 forecasted demands and network improvements.

Consistent with the performance measures described in Section 2.6.2, the data extracted from the model to assess the impact and benefit of the proposed project included:

- Network performance measures – including vehicle miles traveled, VHT, VHD, average speed, and average delay per vehicle;
- Hourly flow volumes or throughput – for mainline (total and with breakdown between general purpose and HOV/express lanes) and ramps;
- Average hourly speeds –reported separately for general purpose and HOV/express lanes;
- Average hourly vehicle density and level-of-service (LOS) – for mainline reported separately for general purpose and HOV/express lanes;
- Segment travel times – average travel time for segments of the corridor; reported separately for general purpose and HOV/express lane travel; and
- Express lane access zone weave volumes, speeds and densities – broken down for individual access zones.

7.1 2035 AM Peak Period Conditions (6:00 – 10:00AM)

The section summarizes the expected 2035 AM peak period operating conditions focusing on a comparison of the No Build and Build conditions during the AM peak hour (defined as 7:00 to 8:00 AM). Additional detail related to the volume, speed, density, LOS, and express lane access zone weave volume results for the 2035 AM peak period is provided in Appendix F.

7.1.1 Network Performance Measures

Table 7-1 summarizes the 2035 AM peak period and peak hour network performance measure results for the No Build and Build alternatives in the northbound direction on US 101. The results for southbound US 101 are presented in **Table 7-2**. In both cases, the network performance measures combine travel on the freeway mainline (both general purpose and HOV/express lanes) and ramps within the VISSIM model network.

As **Table 7-1** shows, the Build alternative produces significant benefits compared to the No Build in the northbound direction. These benefits include a 9% increase in VMT (+84,093 miles), 2% reduction in total travel time (-1,407 hours), 4% reduction in total delay (-2,314 hours), 6% reduction in average delay (-84 seconds), and 11% increase in average speed (+2 mph) over the peak period. During the AM peak hour, the No Build and Build alternatives perform similarly, although the Build alternative does serve 6% more VMT.

The Build alternative also shows benefits in the southbound direction during the 2035 AM peak period (**Table 7-2**). These benefits include a 4% increase in VMT (+60,629), 7% reduction in total travel time (-2,728 hours), 24% reduction in total delay (-3,501 hours), 25% reduction in average delay (-88 seconds), and 13% increase in average speed (+5 mph) over the peak period. A similar pattern of benefits occurs in the AM peak hour as well.

It should also be recognized that the increase in VMT is, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities.

Table 7-1: 2035 AM Peak Network Performance Measure Comparison – Northbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	949,052	1,033,145	84,093	9%
Total Travel Time (VHT) (hr)	71,167	69,760	-1,407	-2%
Total Delay (VHD) (hr)	55,893	53,580	-2,314	-4%
Average Delay per Vehicle (sec)	1,397	1,314	-84	-6%
Average Speed (mph)	13	15	2	11%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	212,156	224,648	12,492	6%
Total Travel Time (VHT) (hr)	22,623	22,814	190	1%
Total Delay (VHD) (hr)	19,229	19,323	94	0%
Average Delay per Vehicle (sec)	1,241	1,282	40	3%
Average Speed (mph)	9	10	1	5%

Table 7-2: 2035 AM Peak Network Performance Measure Comparison – Southbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	1,374,606	1,435,235	60,629	4%
Total Travel Time (VHT) (hr)	37,846	35,118	-2,728	-7%
Total Delay (VHD) (hr)	14,786	11,285	-3,501	-24%
Average Delay per Vehicle (sec)	357	269	-88	-25%
Average Speed (mph)	36	41	5	13%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	411,289	422,808	11,519	3%
Total Travel Time (VHT) (hr)	9,044	8,806	-239	-3%
Total Delay (VHD) (hr)	2,140	1,775	-364	-17%
Average Delay per Vehicle (sec)	165	136	-29	-18%
Average Speed (mph)	45	48	3	6%

7.1.2 Congestion Patterns and Bottlenecks

The VISSIM model flow volume, speed and density results, along with visual inspection of the models, were used to identify congestion patterns, including bottleneck locations and queues for each alternative. The speed results for the 2035 AM peak hour (defined as 7 to 8 AM) are also illustrated in **Figure 7-1** and **Figure 7-2** for the northbound and southbound directions respectively. These figures compare the No Build and Build speed profiles for both the general purpose and HOV/express lanes.

As shown in **Figure 7-1**, considerable congestion is forecasted in the northbound general purpose lanes during the AM peak hour under 2035 No Build conditions. The primary bottlenecks are those between De La Cruz and San Tomas/Montague, and between Rengstorff and San Antonio. In the first hour, there is significant congestion through the middle portion of the corridor between De La Cruz and Hellyer. In the peak hour (see Figure 7-1), the queue from the De La Cruz bottleneck extends upstream as far as Bailey Road. At the same time, conditions worsen in the northern portion of the corridor due to the Rengstorff bottleneck. By the third hour, the area of congestion extends from Rengstorff to Dunne. In the fourth hour, when the HOV lane restriction is no longer in effect, conditions improve considerably; however, a queue still exists from I-880 to south of Tennant Avenue.

In addition, congestion is forecasted in areas of the northbound HOV lane during all hours of the AM peak period. In the peak hour (see **Figure 7-1**) significant congestion in the northbound HOV lane, with speeds below 45 mph, occurs in several locations notably around Mathilda-Fair Oaks and through the middle of the corridor (between 1st and Hellyer). These areas generally correspond with the same segments where congestion in the general purpose lanes is heaviest. This HOV lane congestion may be attributed to a combination of high HOV lane volumes and to traffic exiting the HOV lane trying to merge into the general purpose lanes which are congested.

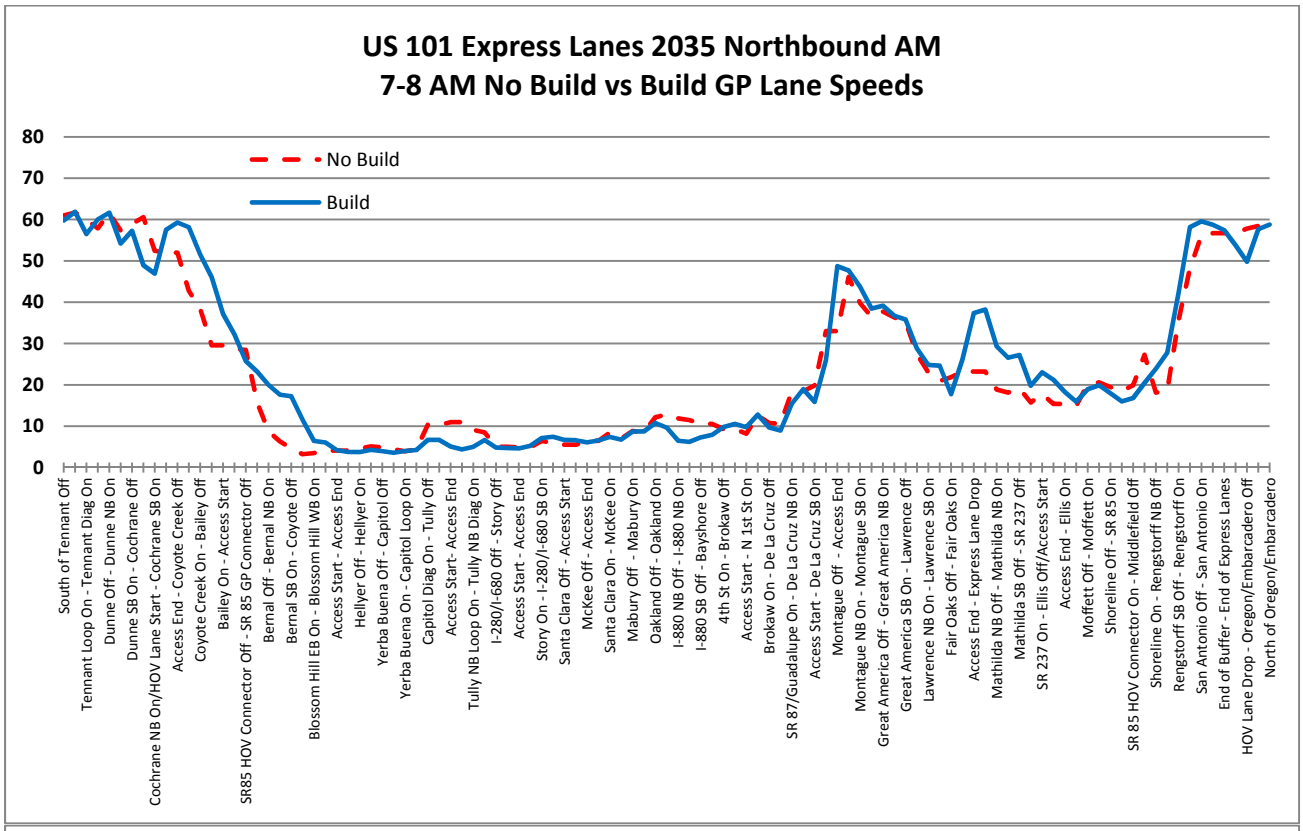
Under the Build alternative, the same primary bottlenecks are expected in the northbound general purpose lanes. However, the extent of the congestion in the south part of the corridor decreases in each hour compared to No Build. In the northern portion of the corridor, the level of congestion in the general purpose lanes is lower in the first hour, similar in the middle two hours, and slightly greater in the last hour.

In the express lanes, conditions are expected to be considerably better than those in the HOV lane under the No Build alternative. In the express lanes, speeds drop below 45 mph for one or more hours within several access zones but, with a few exceptions, remain above 55 mph between access zones. Between 9 and 10 AM, when the express/HOV lane restrictions are no longer in effect, significant congestion appears at the south end of the corridor before the introduction of the first buffer-separated segment. The access zone locations where speeds drop generally correspond with the same segments where congestion in the general purpose lanes is heaviest (express lane operations are further discussed in section 7.1.4).

Higher volumes are achieved under the Build alternative, even at the bottleneck locations, largely as a result of higher flows in the express lane compared to the No Build HOV lane. Overall, the Build alternative produces higher speeds in both the general purpose and HOV/express lanes, lower densities, and better LOS compared to the No Build alternative.

One consequence of the higher flows achieved under the Build alternative is that higher volumes are delivered to the north end of the study corridor beyond the end of the express lane. For example, in the segment south of the Oregon/Embarcadero off-ramp, the express/HOV lanes transition from express operation to HOV only and from two lanes to one lane. Just south of the Oregon/Embarcadero off-ramp, the single HOV lane is projected to carry 1700-1800 vph and the general purpose lanes operate near capacity. While the current analysis shows speeds in this area dropping to about 50 mph, with flows being near capacity minor fluctuations could result in a new bottleneck forming and breakdown of both the general purpose and HOV lanes. If this condition were to occur, pricing for the Express lane could be adjusted to reduce the volumes reaching this point.

In the offpeak southbound direction (see **Figure 7-2**), a major bottleneck is expected to occur between the Oregon/Embarcadero on-ramp and San Antonio off-ramp under the No Build alternative starting around 7:00 AM. The queue from this bottleneck is expected to extend well back into San Mateo County. In the last two hours of the period, a bottleneck also forms around the off-ramp to SR 237, with the queue spilling back to and merging with that from the Oregon/Embarcadero-San Antonio bottleneck. Through the remainder of Santa Clara County, only isolated slowing with speeds dropping below 50 mph is expected in the general purpose lanes. Under the No Build alternative, the southbound HOV lane is expected to operate at essentially free flow speeds, with exception of a few locations in the northern portion of the corridor during the last two hours of the peak period. These locations generally correspond with the same segments where congestion in the general purpose lanes is heaviest. For both the general purpose and express lanes, similar conditions are expected under the Build alternative.



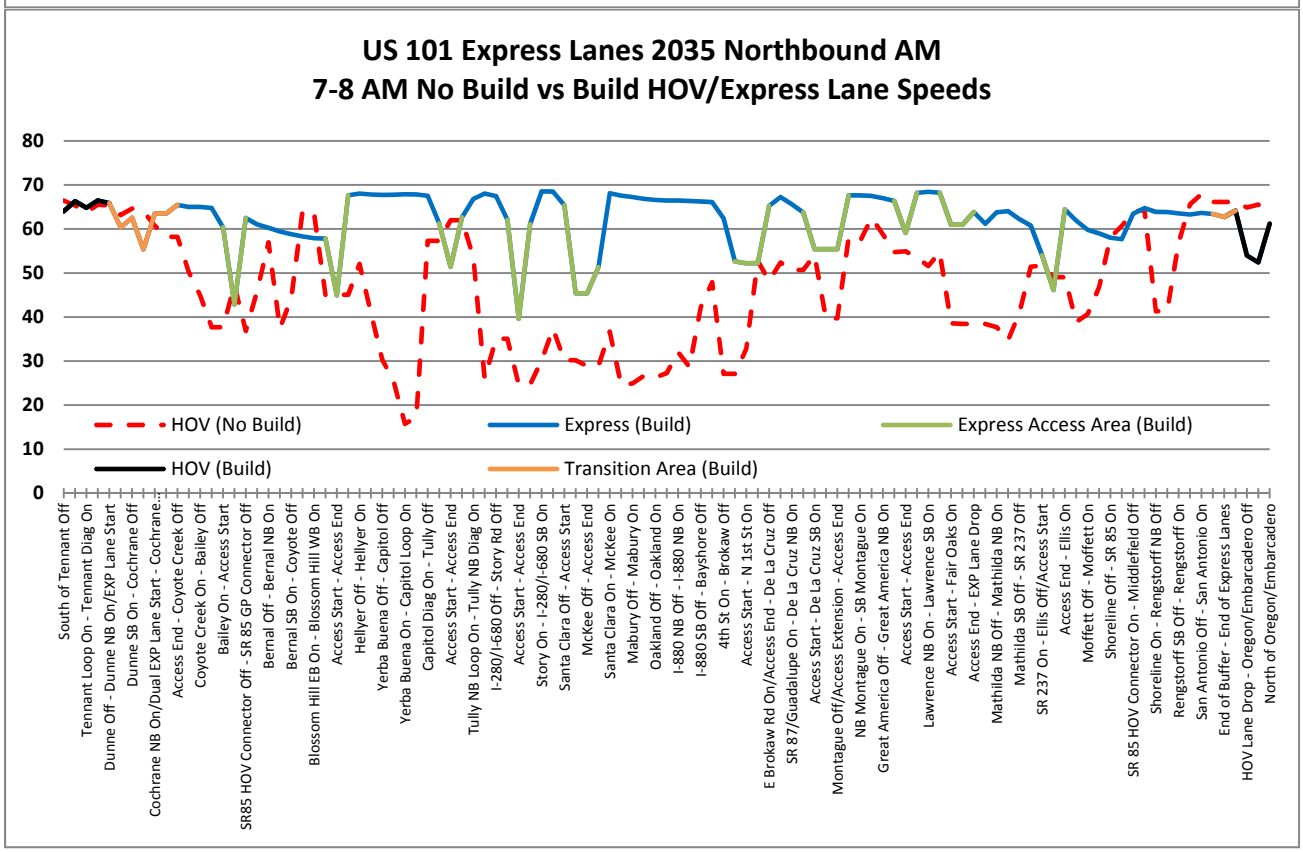
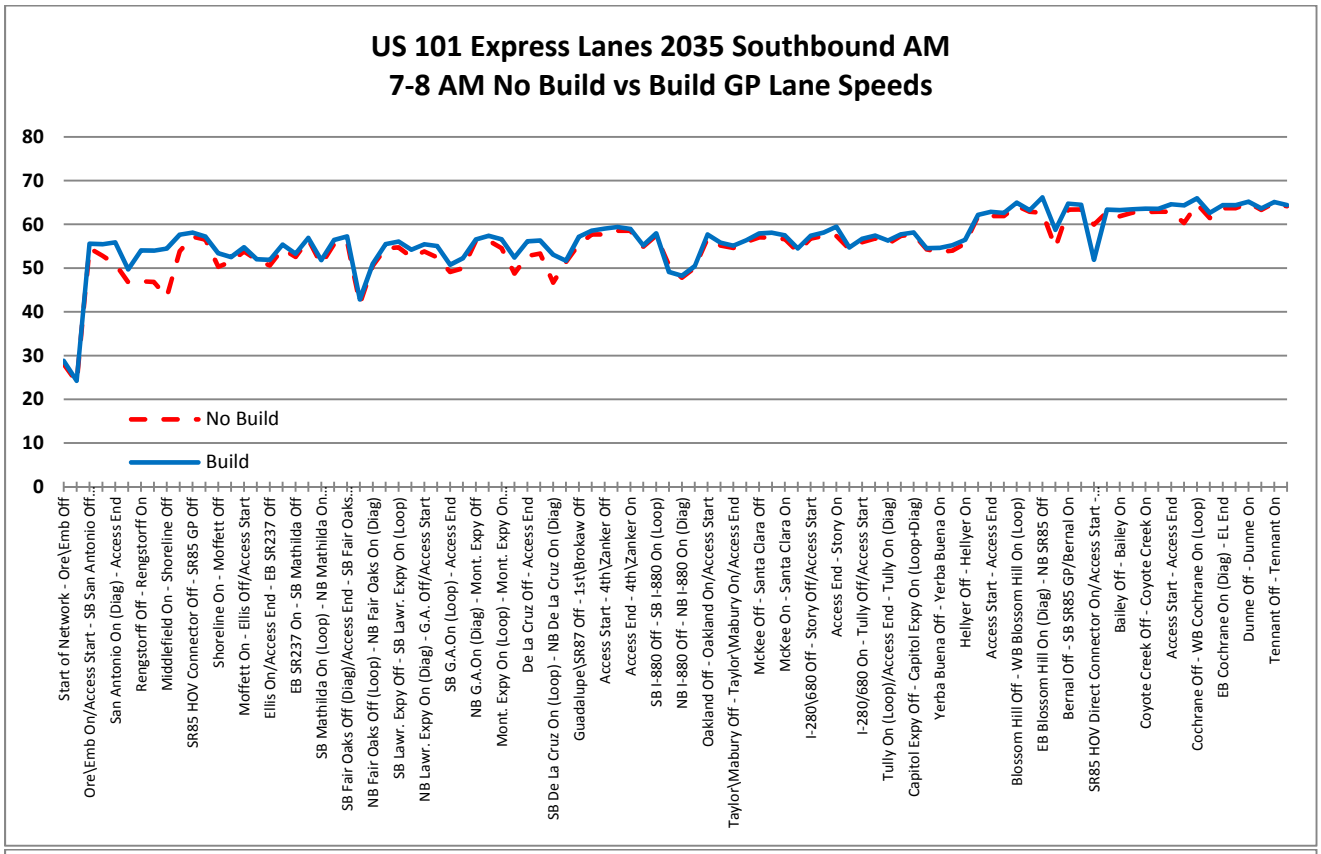


Figure 7-1: 2035 AM Peak Hour Speed Profiles - Northbound



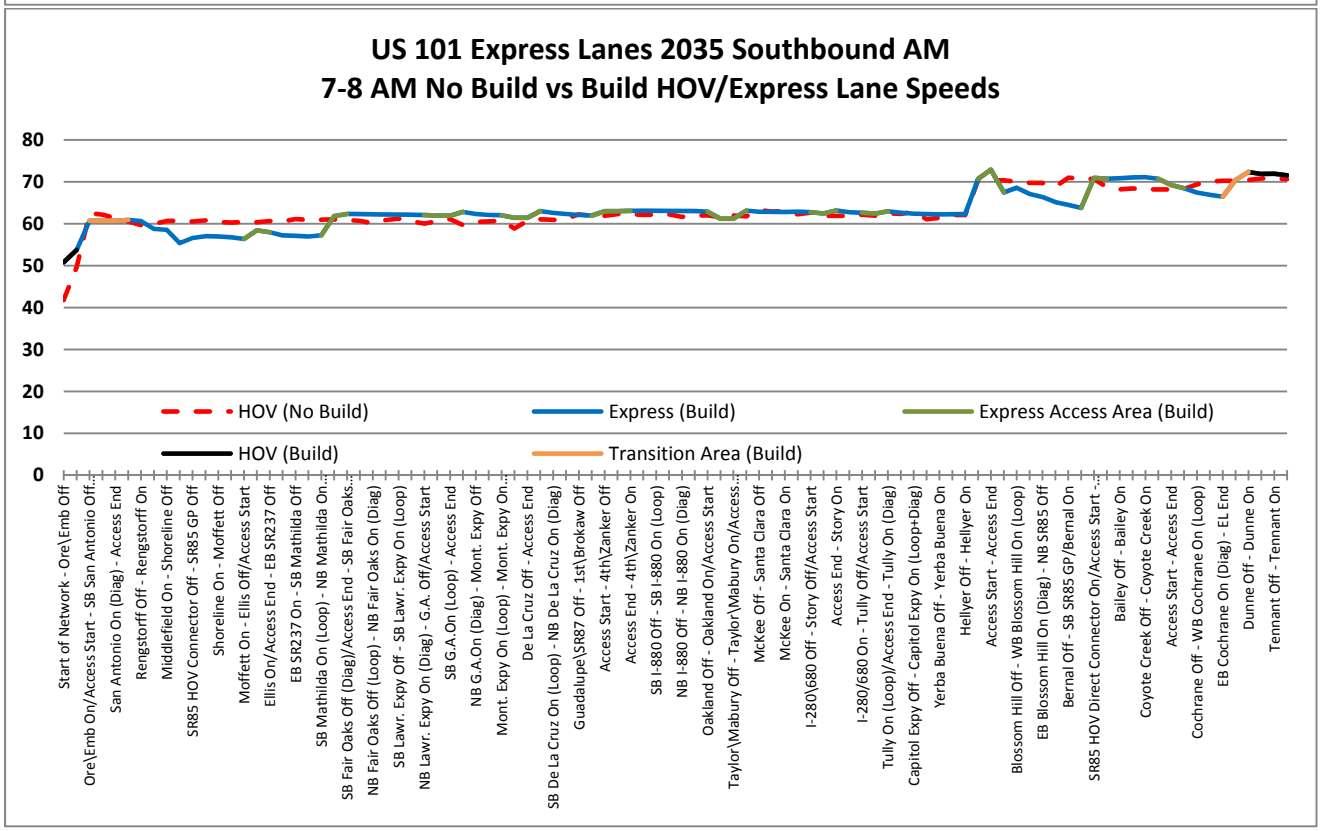


Figure 7-2: 2035 AM Peak Hour Speed Profiles - Southbound

7.1.3 Travel Times

Table 7-3 summarizes the 2035 AM peak hour northbound and southbound segment travel time results for both the No Build and Build alternatives. For reference, free flow or uncongested travel times are also provided.

Key findings related to the comparison of the No Build and Build AM peak hour travel times in the northbound direction include:

- The Build alternative produces significant reductions (approximately 9 minutes) in both general purpose and HOV/express lane travel times compared to the No Build alternative in the segment between Bernal Road and I-880.
- The Build alternative also produces moderate reductions in general purpose lane travel time in the segment from Dunne to Bernal (-4.7 minutes), and in HOV/express lane travel time in the segment from I-880 to SR 237 (-2.9 minutes).
- In general, vehicles in the express lane experience only slight delay relative to free flow travel times.
- In the Build alternative, the express lanes offer a travel time savings for the entire corridor of over 2 hours compared to the general purpose lanes.

Table 7-3: 2035 AM Peak Hour[1] Segment Travel Time Comparison (minutes)

LANE TYPE	SEGMENT	FREE FLOW[2]	NO BUILD	BUILD	BUILD – NO BUILD DIFFERENCE
NORTHBOUND					
General Purpose	1. Dunne Ave On - Bernal Rd On	10.1	19.8	15.1	-4.7
	2. Bernal Rd On - Rt 880 Jct	10.6	125.4	116.7	-8.6
	3. Rt 880 Jct - Rt 237 On	7.3	24.7	26.6	1.8
	4. Rt 237 On - Embarcadero On	5.4	13.6	12.8	-0.8
HOV/Express	1. Dunne Ave On - Bernal Rd On	10.1	10.1	10.5	0.4
	2. Bernal Rd On - Rt 880 Jct	10.6	20.4	11.3	-9.1
	3. Rt 880 Jct - Rt 237 On	7.3	10.4	7.5	-2.9
	4. Rt 237 On - Embarcadero On	5.4	6.3	6.0	-0.3
SOUTHBOUND					
General Purpose	1. San Antonio Off to Rt 237 Jct	3.9	10.1	9.6	-0.6
	2. Rt 237 Jct to McKee Rd Off	8.9	10.8	10.7	0.0
	3. McKee Rd Off to Rt 85 Jct	9.2	10.1	10.0	-0.1
	4. Rt 85 Jct to Dunne Ave Off	9.5	9.8	9.1	-0.7
HOV/Express	1. San Antonio Off to Rt 237 Jct	3.9	5.0	4.6	-0.4
	2. Rt 237 Jct to McKee Rd Off	8.9	9.5	9.5	0.0
	3. McKee Rd Off to Rt 85 Jct	9.2	9.0	9.3	0.3
	4. Rt 85 Jct to Dunne Ave Off	9.5	8.9	8.4	-0.5

Note: 1. AM peak hour defined as 7:00 to 8:00AM
2. Free flow travel time is based on an assumed speed of 65 mph. In some cases, model speeds may exceed 65 mph producing travel times that are less than free flow.

With exception of the first segment, the travel time results for the southbound direction (see **Table 7-3**) reflect the relatively uncongested conditions expected in that direction during the 2035 AM peak hour. For both the general

purpose and HOV/express lanes, the No Build and Build alternative travel times vary by less than 1 minute in all segments.

7.1.4 Person Throughput

To assess the impact of the proposed express lanes on the person-carrying capacity of the corridor, person throughput was measured at four locations along the corridor. **Table 7-4** compares the 2035 AM peak hour person throughput at these locations for the No Build and Build alternatives.

As these results show, the Build alternative is expected to produce higher person throughput in the northbound direction at all locations during the 2015 AM peak hour. This includes higher throughput of about 1600 persons per hour in the southern and northern portions of the corridor, and about 1000 persons per hour through the middle portion of the corridor.

In the uncongested southbound direction, the Build alternative is expected to serve higher person throughput in the higher-volume northern segments of the corridor. For the southern portion the person throughput is essentially the same between the No Build and Build alternatives.

Table 7-4: 2035 AM Peak Hour[1] Person Throughput

LOCATION	ALTERNATIVE	GP LANES		HOV/EXPRESS LANES		TOTAL	
		VEHICLES	PERSONS	VEHICLES	PERSONS	VEHICLES	PERSONS
Northbound							
1. Coyote Creek On-Bailey Off	No Build	5,397	5,937	1,757	3,690	7,154	9,626
	Build	5,615	6,233	2,987	4,860	8,602	11,092
2. Old Oakland on-NB I-880 off	No Build	4,827	5,310	1,373	2,883	6,200	8,193
	Build	4,403	4,887	2,342	4,171	6,745	9,058
3. San Tomas/Montague on-Great America off	No Build	5,853	6,438	1,033	2,169	6,886	8,608
	Build	5,338	5,925	1,939	3,667	7,277	9,592
4. Rengstorff on-San Antonio off	No Build	6,364	7,000	1,477	3,102	7,841	10,102
	Build	6,169	6,848	2,627	4,794	8,796	11,642
Southbound							
1. Rengstorff on-Middlefield on	No Build	6,173	6,790	1,650	3,465	7,823	10,255
	Build	5,509	6,335	2,738	4,696	8,247	11,031
2. De La Cruz on-SR 87 off	No Build	6,452	7,097	909	1,909	7,361	9,006
	Build	6,327	7,339	1,541	2,304	7,868	9,643
3. McKee/Julian off-Santa Clara off	No Build	4,588	5,047	863	1,812	5,451	6,859
	Build	4,728	5,484	1,096	1,699	5,824	7,183
4. Coyote Creek on-Cochrane off	No Build	5,284	5,812	1,213	2,547	6,497	8,360
	Build	4,813	5,583	1,888	2,656	6,701	8,239

Note: 1. AM peak hour defined as 7:00 to 8:00AM

7.1.5 Express Lane Operations

Average speed, density and LOS results for the entire length of the express lanes under 2035 AM peak period conditions are provided in Appendix F. These results for each proposed express lane access zone are also presented in **Table 7-5.**

As these results show, speeds in the northbound express lanes remain quite high (45 mph or higher) in the buffer-separated segments between access zones during all hours of the 2035 AM peak period with exception of the short section immediately downstream of the Santa Clara access zone and the one immediately upstream of the Brokaw access zone. Consistent with this, the buffered express lane segments are expected to operate at LOS D or better with exception of these same short sections. However, speeds and service levels are forecasted to degrade within several of the access zones in 2035. Six of the access zones are expected to operate at speeds less than 45 mph, with four of these also degrading to LOS E or worse during at least one hour of the 2035 AM peak period when the express lane restrictions are in effect (between 6 and 9 AM). The single-lane portion of the transition zone at the start of the express lane (between the Dunne diagonal on-ramp and Cochrane loop on-ramp) also degrades to LOS E or worse.

While these operating conditions do not meet standards established in federal and state laws, they are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

For reference, the northbound HOV lane under the No Build alternative is expected to operate at speeds below 45 mph and at LOS E or worse through a significant portion of the corridor during the AM peak period.

In the southbound direction, the express lanes are expected to operate at speeds above 45 mph and LOS D or better throughout the corridor during the hours of express operations (6 to 9 AM). During the last hour (9 to 10 AM) of the 2035 AM peak period, when the express lanes are open to all vehicles, conditions degrade at the start transition area and at Ellis access zone.

Table 7-5: 2035 AM Peak Period Express Lane Access Zone Speed, Density and LOS

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]
NORTHBOUND													
1	Between Dunne NB on/Exp Lane start and start of buffer north of Cochrane SB On (transition from HOV-only)	66	64	59	32	18	20	22	33	C	C	C	D
2	Between Bailey On and SR 85 Connector Off	56	43	24	36	25	41	72	41	C	E	F	E
3	Between Blossom Hill On and Hellyer Off	62	45	47	44	17	19	21	17	B	C	C	B
4	Between Tully Off and On	46	51	48	45	34	19	26	37	D	C	D	E
5	Between Story Off and On	44	40	37	49	34	28	38	26	D	D	E	D
6	Between McKee Off and Santa Clara On	35	45	34	36	47	26	45	42	F	C	E	E
7	Between Brokaw Off and Brokaw On	49	52	38	52	32	24	35	33	D	C	D	D
8	Between De La Cruz NB On and San Tomas/Montague Off	56	55	38	51	25	21	44	34	C	C	E	D
9	Between Great America On and Lawrence Off	62	59	55	55	17	13	16	23	B	B	B	C
10	Between Fair Oaks Off and Mathilda Off	65	61	56	57	12	11	12	16	B	A	B	B
11	Between Ellis Off and On	54	46	43	51	26	29	24	32	C	D	C	D
12	North of San Antonio to end express lane (transition to HOV-only)	66	64	67	65	17	18	14	21	B	B	B	C
SOUTHBOUND													
1	Between Oreg\Emb On and Start of Buffer (transition from HOV-only)	62	61	58	43	9	21	23	36	A	C	C	E
2	Between Ellis Off and On	60	58	48	43	15	25	34	44	B	C	D	E
3	Between Mathilda Diag On and Fair Oaks Diag Off	62	62	61	61	7	12	16	17	A	B	B	B
4	Between Great America Off and SB On	63	62	60	60	7	14	20	20	A	B	C	C
5	Between San Tomas/Montague On and De La Cruz Loop On	63	61	60	60	6	13	17	20	A	B	B	C
6	Between 1st/Brokaw Off and Bayshore On	63	63	63	62	5	8	10	15	A	A	A	B

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]	HR1	HR2	HR3	HR4[1]
7	Between Old Oakland On and Mabury/Taylor On	62	61	61	61	10	14	13	17	A	B	B	B
8	Between Story Off and On	63	62	62	60	6	10	11	18	A	A	B	C
9	Between Tully Off and On	63	62	62	61	7	12	12	16	A	B	B	B
10	Between Hellyer On and Blossom Hill Off	74	73	73	73	6	9	8	9	A	A	A	A
11	Between SR85 Express Connector On and Bailey Off	73	71	71	72	8	14	14	12	A	B	B	B
12	Between Coyote Creek On and Cochrane Off	71	69	68	71	8	12	15	9	A	B	B	A
13	Between Cochrane On and Dunne Off to end of express lane (transition to HOV-only)	72	70	70	73	9	14	13	8	A	B	B	A

Note: 1. During the last hour (9 to 10 AM) of the AM peak period, the express lanes are open to all vehicles.

7.2 2035 PM Peak Period Conditions (3:00 – 7:00PM)

The section summarizes the expected 2035 PM peak period operating conditions focusing on a comparison of the No Build and Build conditions during the PM peak hour (defined as 5:00 to 6:00 PM). Additional detail related to the volume, speed, density, LOS, and express lane access zone weave volume results for the 2035 PM peak period is provided in Appendix G.

7.2.1 Network Performance Measures

Table 7-6 summarizes the 2035 PM peak period and peak hour network performance measure results for the No Build and Build alternatives in the northbound direction on US 101. The results for southbound US 101 are presented in **Table 7-7**. In both cases, the network performance measures combine travel on the freeway mainline (both general purpose and HOV/express lanes) and ramps within the VISSIM model network.

In the offpeak northbound direction, little congestion is expected under either alternative during the PM peak period as reflected in the average speeds above 50 mph. However, the Build alternative does produce a 10% increase in VMT (+88,850) along with a 16% reduction in vehicle hours of delay (-530 hours) and 13% reduction in average delay (-9 sec/vehicle). A similar pattern of benefits occurs in the PM peak hour.

In the southbound direction, the proposed Project produces significant benefits. Over the 2035 PM peak period, the Build alternative results in a 17% increase in VMT (+257,549), with a 13% reduction in vehicle hours of delay (-7,201 hours), an 18% reduction in average delay per vehicle (-205 seconds), and a 23% increase in average speed (+4 mph). The increase in VMT is, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. A similar pattern of benefits occurs in the PM peak hour.

Table 7-6: 2035 PM Peak Network Performance Measure Comparison – Northbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	917,408	1,005,987	88,580	10%
Total Travel Time (VHT) (hr)	19,330	17,774	-1,556	-8%
Total Delay (VHD) (hr)	3,211	2,681	-530	-16%
Average Delay per Vehicle (sec)	71	62	-9	-13%
Average Speed (mph)	52	52	0	1%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	243,928	263,980	20,052	8%
Total Travel Time (VHT) (hr)	5,421	5,023	-398	-7%
Total Delay (VHD) (hr)	1,190	1,012	-178	-15%
Average Delay per Vehicle (sec)	90	79	-10	-11%
Average Speed (mph)	49	49	0	0%

Table 7-7: 2035 PM Peak Network Performance Measure Comparison – Southbound US 101

PERFORMANCE MEASURE	NO BUILD	BUILD	BUILD – NO BUILD	
			DIFFERENCE	**% DIFFERENCE**
PEAK PERIOD				
Total Distance Traveled (VMT) (mi)	1,472,285	1,729,834	257,549	17%
Total Travel Time (VHT) (hr)	81,346	77,929	-3,417	-4%
Total Delay (VHD) (hr)	56,599	49,398	-7,201	-13%
Average Delay per Vehicle (sec)	1,119	914	-205	-18%
Average Speed (mph)	18	22	4	23%
PEAK HOUR				
Total Distance Traveled (VMT) (mi)	342,708	421,945	79,237	23%
Total Travel Time (VHT) (hr)	25,361	23,946	-1,416	-6%
Total Delay (VHD) (hr)	19,595	16,996	-2,599	-13%
Average Delay per Vehicle (sec)	1,064	885	-179	-17%
Average Speed (mph)	14	18	4	31%

7.2.2 Congestion Patterns and Bottlenecks

The VISSIM model flow volume, speed and density results, along with visual inspection of the models, were used to identify congestion patterns, including bottleneck locations, and queues for each alternative. These detailed results are contained in Appendix G. The speed results for the 2035 PM peak hour (defined as 5 to 6 PM) are also illustrated in **Figure 7-3** and **Figure 7-4** for the northbound and southbound directions respectively. These figures compare the No Build and Build speed profiles for both the general purpose and HOV/express lanes.

The northbound general purpose lanes on US 101 are expected to be uncongested through a majority of the corridor during the PM peak period under 2035 No Build conditions. In most areas, average hourly speeds in the general purpose lanes are expected to be above 55 mph. However, some congestion is forecasted in the northern portion of the corridor with bottlenecks around De La Cruz, Moffett, and Rengstorff. Average hourly speeds in these areas are expected to drop below 30 mph.

Under the Build alternative, the level of congestion in the general purpose lanes associated with the Moffett and Rengstorff bottlenecks is lessened; however, the level increases at the De La Cruz bottleneck and a new bottleneck appears around Tully. These changes occur as a result of increased demand at these locations under the Build alterative.

The northbound HOV lane in the No Build alternative is expected to operate at speeds over 60 mph, with exception of the segments where congestion occurs in the general purpose lanes (around De La Cruz, Moffett, and Rengstorff). In these areas, HOV lane speeds drop to between 40 and 50 mph. Under the Build alternative, the northbound express lane is expected to operate at speeds of 50 mph or higher throughout the corridor.

In the southbound peak direction alternative, significant congestion is expected throughout the northern portion of the corridor under the No Build alternative. In the first hour, major bottlenecks include those between the Rengstorff on-ramp and Middlefield on-ramp, and between the De La Cruz diagonal on-ramp and SR 87 off-ramp. In the PM peak hour (**Figure 7-4**), the queue from the De La Cruz bottleneck merges with that from the Rengstorff bottleneck and extends well upstream into San Mateo County. In addition, a minor bottleneck appears between the Taylor-Mabury off and on, with a further slowdown between the Story on and I-280/I-680 on. In the HOV lane, congestion occurs in pockets between the start of the corridor and De La Cruz.

Under the Build alternative, a similar congestion patterns occurs. In this alternative, bottlenecks occur at several of the same locations as the No Build (Rengstorff-Middlefield, De La Cruz-SR 87, and Taylor-Mabury off-on), while new bottlenecks emerge between SR 85 and Bailey off, and between Dunne on and Tennant off. These new bottlenecks occur because the volume of traffic reaching these points is much higher under the Build alternative compared to the No Build alternative.

At the De La Cruz-SR 87 bottleneck, the general purpose lane throughput is slightly lower in the Build alternative. This may be attributed to the fact that of those vehicles in the general purpose lanes, a higher percentage are preparing to exit just downstream of the bottleneck to SR 87 under the Build alternative creating more weaving and right-lane overload compared to the No Build (in the Build more of the "through" vehicles are in the express lanes). Other factors that may contribute to this condition include differences in ramp demands (i.e. at De La Cruz, demands for the loop on are higher under the Build) and the presence of the buffer. With respect to this latter factor, this study reflects a restrictive access scenario for the proposed Express lane which will be reduced by maintaining as much of the existing continuous access striping scheme during the design phase of the project. It should be noted, however, that like all bottleneck locations, the total volume of traffic served under the Build alternative increases at both of these bottlenecks.

Within the southbound express lanes, isolated slowing is shown at several access zones in the northern portion of the corridor. In addition, significant congestion is expected in the buffer-separated section between the start of the express lanes and the Ellis access zone. This entire section is expected to operate at LOS F with speeds below 50 mph between 5 and 6 PM. However, the overall level of congestion within the express lanes is less than that projected for the HOV lane in the No Build.

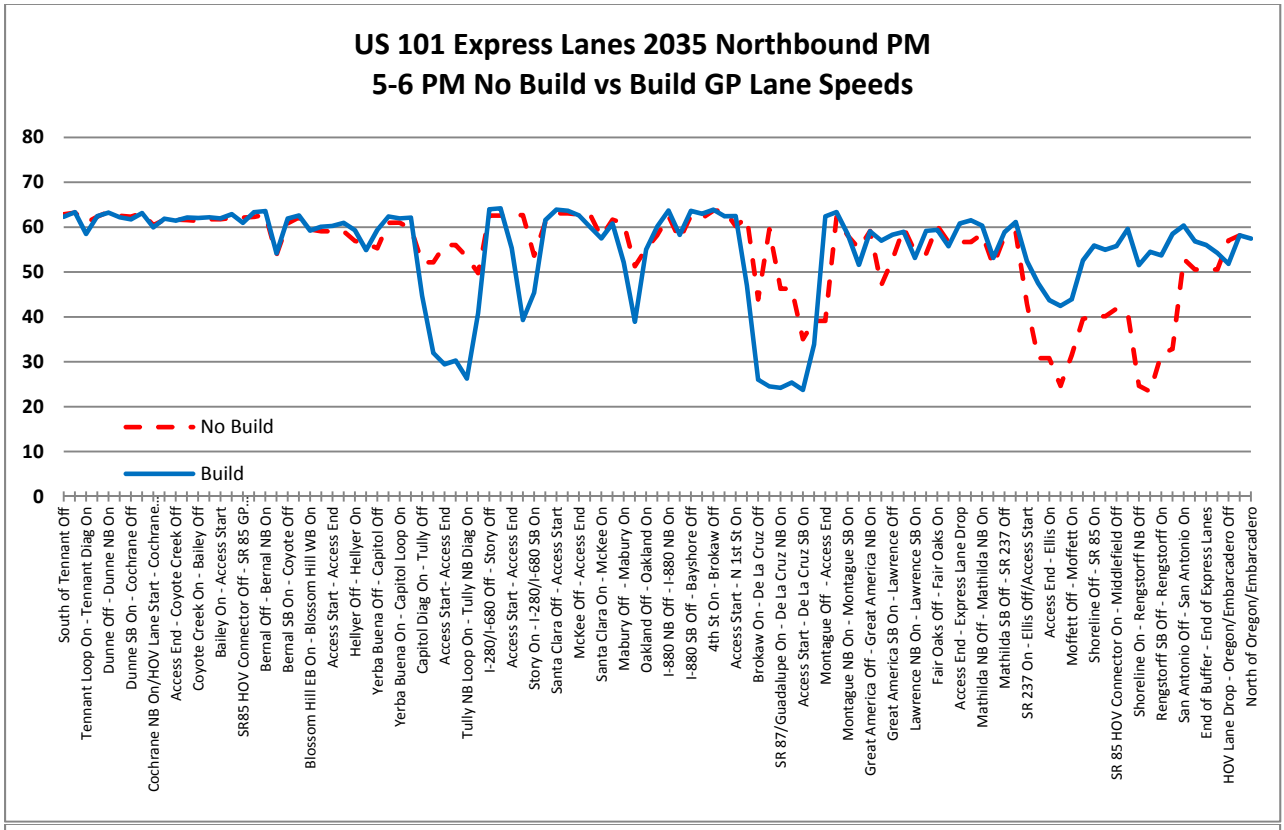
7.2.3 Travel Times

Table 7-8 summarizes the 2035 PM peak hour northbound and southbound segment travel time results for both the No Build and Build alternatives. For reference, free flow or uncongested travel times are also provided.

In the northbound direction, the Build alternative produces slightly higher general purpose lane travel times compared to the No Build alternative through the middle of the corridor, but lower times in the northern segment. Over the entire length of the corridor, the total travel time is essentially the same (less than 0.1 minutes difference) between the two alternatives. For both the No Build and Build alternatives, HOV/express lane users are expected to experience little travel time delay.

For the southbound direction, key findings related to the comparison of the No Build and Build 2035 PM peak hour travel times include:

- The Build alternative produces an increase in the general purpose lane travel times, notably in the segment between San Antonio and SR 237 compared to the No Build alternative. This increase is a result of the higher demands on US 101 under the Build alternative.
- In the HOV/express lane, the Build alternative produces a moderate reduction in travel time compared to the No Build alternative through the northern portion of the corridor (-3.2 minutes).
- In the southern half of the corridor, HOV/express lane users experience little or no delay relative to free flow travel times under either alternative.
- Over the length of the corridor, the express lanes offer a travel time savings of nearly 72 minutes compared to the general purpose lanes under the Build alternative.



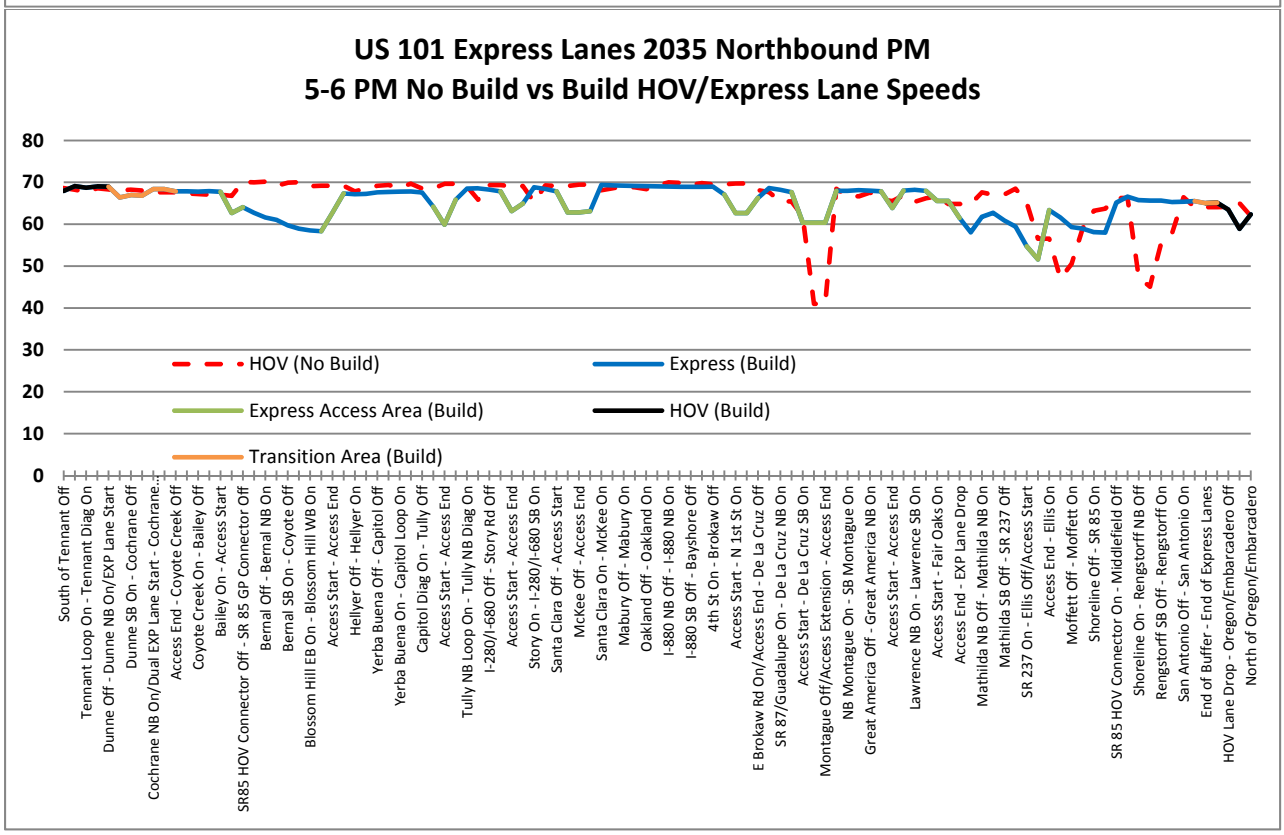
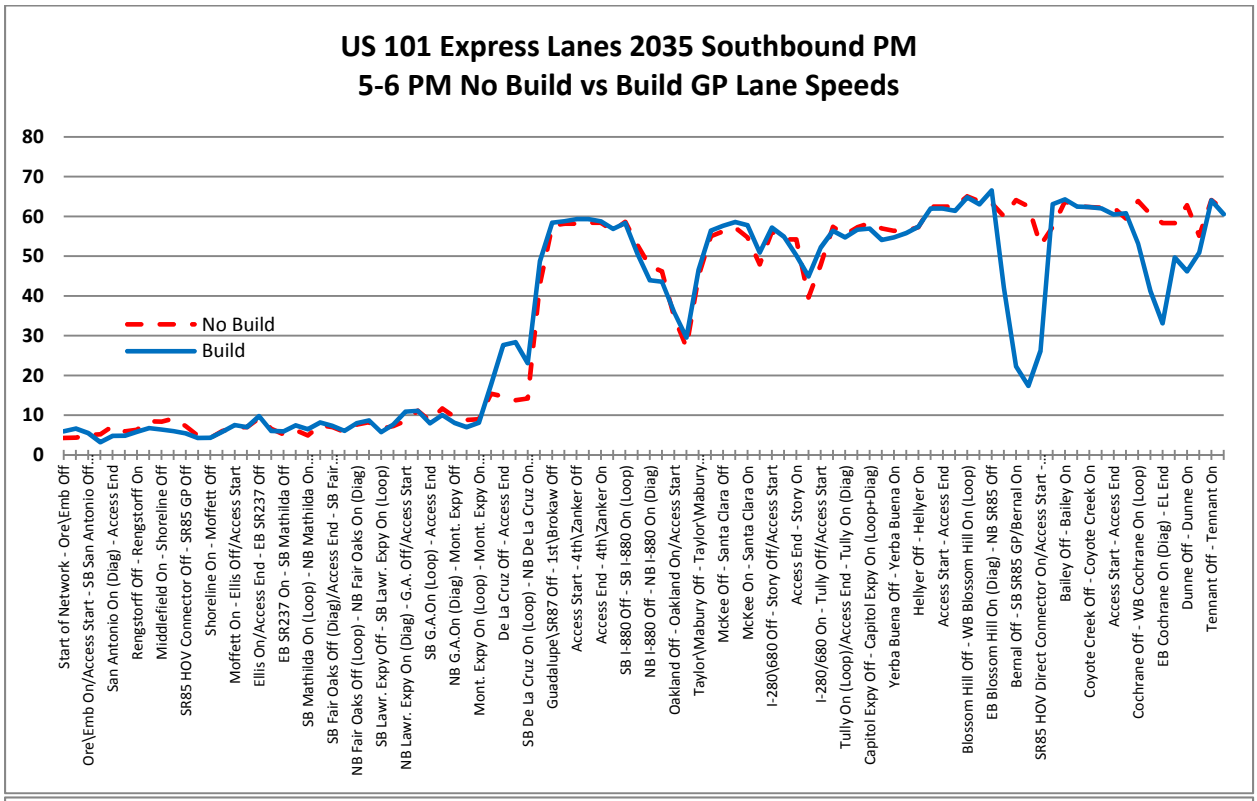


Figure 7-3: 2035 PM Peak Hour Speed Profiles – Northbound



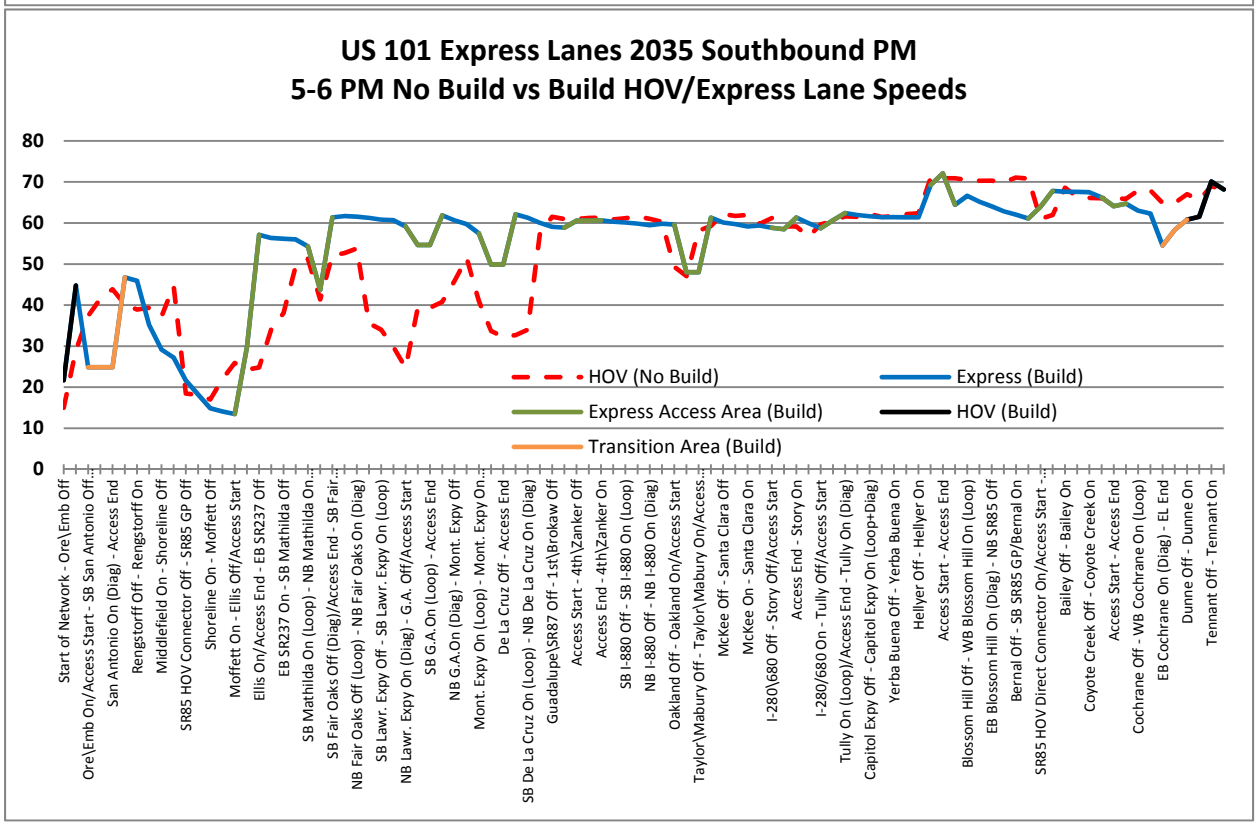


Figure 7-4: 2035 PM Peak Hour Speed Profiles – Southbound

Table 7-8: 2035 PM Peak Hour[1] Travel Time Comparison (minutes)

LANE TYPE	SEGMENT	FREE FLOW2	NO BUILD	BUILD	BUILD – NO BUILD DIFFERENCE
NORTHBOUND					
General Purpose	1. Dunne Ave On - Bernal Rd On	10.1	10.8	10.6	-0.1
	2. Bernal Rd On - Rt 880 Jct	10.6	12.0	13.0	1.0
	3. Rt 880 Jct - Rt 237 On	7.3	8.6	10.2	1.6
	4. Rt 237 On - Embarcadero On	5.4	9.1	6.6	-2.5
HOV/Express	1. Dunne Ave On - Bernal Rd On	10.1	9.8	9.7	-0.1
	2. Bernal Rd On - Rt 880 Jct	10.6	10.0	10.5	0.5
	3. Rt 880 Jct - Rt 237 On	7.3	7.2	7.2	0.1
	4. Rt 237 On - Embarcadero On	5.4	5.9	5.7	-0.2
SOUTHBOUND					
General Purpose	1.San Antonio Off to Rt 237 Jct	3.9	37.6	44.3	6.7
	2. Rt 237 Jct to McKee Rd Off	8.9	42.1	41.0	-1.2
	3. McKee Rd Off to Rt 85 Jct	9.2	10.5	11.8	1.3
	4. Rt 85 Jct to Dunne Ave Off	9.5	10.3	12.6	2.0
HOV/Express	1. San Antonio Off to Rt 237 Jct	3.9	9.3	8.9	-0.4
	2. Rt 237 Jct to McKee Rd Off	8.9	13.2	10.4	-2.8
	3. McKee Rd Off to Rt 85 Jct	9.2	9.3	9.6	0.3
	4. Rt 85 Jct to Dunne Ave Off	9.5	9.5	8.8	-0.7

Note: 1. PM peak hour defined as 5:00 to 6:00 PM
2. Free flow travel time is based on an assumed speed of 65 mph. In some cases, model speeds may exceed 65 mph producing travel times that are less than free flow.

7.2.4 Person Throughput

To assess the impact of the proposed express lanes on the person-carrying capacity of the corridor, person throughput was measured at four locations along the corridor. **Table 7-9** compares the 2035 PM peak hour person throughput at these locations for the No Build and Build alternatives.

As these results show, during the 2035 PM peak hour the Build alternative is expected to produce higher person throughput in the northbound direction at all locations, most notably through the middle of the corridor. The Build alternative is also expected to produce significantly higher person throughput in the southbound direction, with increases of about 700 persons per hour or more at all locations.

Table 7-9: 2035 PM Peak Hour[1] Person Throughput

LOCATION	ALTERNATIVE	GP LANES		HOV/EXPRESS LANES		TOTAL	
		VEHICLES	PERSONS	VEHICLES	PERSONS	VEHICLES	PERSONS
Northbound							
1. Coyote Creek On-Bailey Off	No Build	4,141	4,555	1,035	2,174	5,176	6,729
	Build	3,541	4,426	1,807	2,622	5,348	7,048
2. Old Oakland on-NB I-880 off	No Build	5,152	5,667	1,060	2,226	6,212	7,893
	Build	5,783	7,229	1,140	1,654	6,923	8,883
3. San Tomas/Montague on-Great America off	No Build	6,373	7,010	1,282	2,692	7,655	9,703
	Build	6,796	8,155	1,872	2,675	8,668	10,830
4. Rengstorff on-San Antonio off	No Build	6,287	6,916	1,681	3,530	7,968	10,446
	Build	6,007	7,208	2,299	3,412	8,306	10,620
Southbound							
1. Rengstorff on-Middlefield on	No Build	3,218	3,540	1,666	3,499	4,884	7,038
	Build	2,631	3,157	2,845	4,566	5,476	7,723
2. De La Cruz on-SR 87 off	No Build	7,224	8,669	1,303	2,791	8,527	11,460
	Build	6,774	8,264	3,255	4,329	10,029	12,593
3. McKee/Julian off-Santa Clara off	No Build	6,021	6,623	1,204	2,528	7,225	9,152
	Build	5,424	6,075	3,180	4,579	8,604	10,654
4. Coyote Creek on-Cochrane off	No Build	6,289	6,918	1,651	3,467	7,940	10,385
	Build	6,088	7,001	3,081	4,437	9,169	11,438

Note: 1. PM peak hour defined as 5:00 to 6:00PM

7.2.5 Express Lane Operations

As noted, AB 2032, the enabling legislation for the express lanes in Santa Clara County, mandated that express lanes operate at a Level of Service (LOS) of "C" or better (LOS "D" may be used if Caltrans and the operator agree). This corresponds to a target threshold of approximately 1,650 vph per HOV lane. For restricted access express lane facilities such as that proposed for US 101, Caltrans' Traffic Operations Policy Directive (TOPD) 11-2 further states that access openings should be located and designed such that they will perform at Level of Service (LOS) "C" or "D". Meanwhile, federal law mandates that express lanes and HOV lanes that are used by non-carpool vehicles operate at a minimum speed of 45 miles per hour during the peak hour no less than 90 percent of the time over a 180-day period. These performance requirements have been used to guide the design and evaluation of the proposed express lanes on US 101.

Average speed, density and LOS results for the entire length of the express lanes under 2035 PM peak period conditions are provided in Appendix G. These results for each proposed express lane access zone are also summarized in **Table 7-10**.

As these results show, speeds in the northbound express lanes remain above 50 mph in all access zones during the peak period. Based on density, the northbound express lanes are expected to operate at LOS D or better in all access zones throughout the 2035 PM peak period. Between access zones, the northbound express lanes are also expected to operate with speeds over 50 mph and at LOS D or better.

In the southbound direction, express lane speeds are forecasted to remain above 45 mph throughout the PM peak period with the exception of the start transition zone, two access zones (Ellis and Mathilda), and the buffered segment between the start of the express lanes and the Ellis access zone. At the start, the express lanes are expected to operate at speeds below 45 mph and at LOS F in three of four hours during the PM peak period. This slowing is due to a combination of factors including high demands, congestion in the general purpose lanes, and the high volume of weaving as SOVs enter the express lane and HOVs with destinations within the first buffered segment exit. At the Ellis access zone, the low speeds are a function of high demand, but more importantly the heavy

congestion in the general purpose lanes that makes maneuvering into and out of the express lanes difficult and a single-lane design that does not allow through vehicles in the express lane to bypass weaving vehicles. The congestion at this access zone, along with high demand, also results in the significant congestion expected within the buffer-separated section between the start of the express lanes and the Ellis access zone. Most links within this section are expected to operate at LOS F with speeds below 50 mph between 4 and 6 PM.

Speeds at the Mathilda access zone are expected to drop just below the 45 mph threshold (to 44 mph) in only one hour. Heavy congestion in the general purpose lanes also is major contributing factor to the slow speeds at this location. Despite the lower speed, this access zone is expected to operate at LOS C or better. Conversely, the Montague-De La Cruz and Oakland-Mabury/Taylor access zones are expected to operate at speeds above 45 mph, but at LOS E during the middle two hours. Again, it is important to recognize that this shift in volumes to US 101 can also lessen demand and improve conditions on other facilities. These benefits were not quantified as part of this analysis.

While operating conditions at speeds below 45 mph or at LOS E do not meet standards established in federal and state laws, these results are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

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For reference, the southbound HOV lane under the No Build alternative is expected to operate at speeds below 45 mph and at LOS E or worse through significant portions of the corridor during the PM peak period.

Table 7-10: 2035 PM Peak Period Express Lane Access Zone Speed, Density, and LOS

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4
NORTHBOUND													
1	Between Dunne NB on/Exp Lane start and start of buffer north of Cochrane SB On (transition from HOV-only)	69	69	68	69	9	10	11	7	A	A	B	A
2	Between Bailey On and SR 85 Connector Off	64	64	63	65	11	12	14	9	B	B	B	A
3	Between Blossom Hill On and Hellyer Off	63	63	63	64	12	12	12	8	B	B	B	A
4	Between Tully Off and On	64	64	60	63	13	13	14	9	B	B	B	A
5	Between Story Off and On	63	63	63	64	13	13	11	9	B	B	B	A
6	Between McKee Off and Santa Clara On	63	63	63	63	12	12	10	8	B	B	A	A
7	Between Brokaw Off and Brokaw On	62	62	63	63	14	15	13	11	B	B	B	A
8	Between De La Cruz NB On and San Tomas/Montague Off	64	63	61	60	13	15	16	14	B	B	B	B
9	Between Great America On and Lawrence Off	64	64	64	64	12	13	13	11	B	B	B	B
10	Between Fair Oaks Off and Mathilda Off	65	66	66	66	13	12	13	12	B	B	B	B
11	Between Ellis Off and On	52	51	52	54	31	29	29	26	D	D	D	D
12	North of San Antonio to end express lane (transition to HOV-only)	66	66	65	67	15	15	17	15	B	B	B	B
SOUTHBOUND													
1	Between Oreg\Emb On and Start of Buffer (transition from HOV-only)	52	40	25	30	27	46	63	52	D	F	F	F
2	Between Ellis Off and On	51	33	30	36	34	54	58	44	D	F	F	E
3	Between Mathilda Diag On and Fair Oaks Diag Off	55	48	44	50	19	23	26	18	C	C	C	C
4	Between Great America Off and On	56	55	55	59	26	27	28	20	C	D	D	C
5	Between San Tomas/Montague On and De La Cruz Loop On	50	49	50	54	35	37	35	27	D	E	E	D
6	Between Brokaw Off and Bayshore On	61	60	61	61	24	25	23	22	C	C	C	C

ACCESS NO.	LOCATION	EXPRESS LANES											
		SPEED				DENSITY				LOS			
		HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4	HR1	HR2	HR3	HR4
7	Between Oakland On and Mabury/Taylor On	55	51	48	54	32	35	38	31	D	E	E	D
8	Between Story Off and On	57	57	58	59	28	27	25	25	D	D	C	C
9	Between Tully Off and On	60	60	61	61	19	19	17	18	C	C	B	C
10	Between Hellyer On and Blossom Hill Off	72	72	72	72	12	12	11	10	B	B	A	A
11	Between SR85 HOV On and Bailey Off	69	66	64	66	22	23	23	20	C	C	C	C
12	Between Coyote On and Cochrane Off	64	64	64	67	24	24	23	18	C	C	C	B
13	Between Cochrane On and Dunne Off to end of express lane (transition to HOV only)	62	60	58	63	28	30	32	26	D	D	D	D

7.3 Summary of 2035 Conditions

Overall, the proposed Project produces significant benefits along the US 101 corridor in 2035. These benefits include increases in VMT and average speed, along with reductions in total travel time, total delay, and average delay. The increase in VMT is a reflection of two factors: 1) with the reduced congestion, vehicles can more easily travel through the network and reach their destination; and 2) under the Build alternative, demand volumes on US 101 increase (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. The VHT, VHD, average delay and speed benefits all reflect the reduced congestion levels achieved under the Build alternative.

During the AM peak period, the proposed Project reduces total delay by 2,314 hours (-4%) in the northbound direction and 3,501 hours (-24%) in the southbound direction. Significant delay reductions are also achieved in the PM peak period (-530 hours northbound and -7,201 hours southbound). It is important to recognize that these results are achieved while serving significantly higher VMT, as well as higher vehicular and person throughput. These increases in VMT and throughput are, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. Overall, the proposed US 101 express lanes are expected to produce a reduction of 13,546 vehicle hours of delay combined during the AM and PM peak periods of a typical weekday in 2035.

For 2035, the express lanes are generally expected operate at speeds over 45 mph and LOS D or better between access zones in both directions during both peak periods with limited exceptions. In the AM peak when the express lane restrictions are in effect, speeds in the northbound express lanes are expected to drop below 45 mph in six access zones plus the short sections downstream of the Santa Clara access zone and immediately upstream of the Brokaw access zone. In the southbound direction during the PM peak, speeds below 45 mph are expected within the start transition zone, two access zones (Ellis, Mathilda), and most of the buffer-separated section between the start of the express lanes and the Ellis access zone. Meanwhile, the Montague-De La Cruz and Oakland-Mabury/Taylor access zones are expected to operate at speeds above 45 mph, but at LOS E during the middle two hours. In the offpeak direction, the express lanes are expected operate at speeds over 45 mph and LOS D or better during both peak periods.

While operating conditions at speeds below 45 mph or at LOS E do not meet standards established in federal and state laws, these results are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

For reference, the HOV lane in the peak direction under the No Build alternative is expected to operate at speeds below 45 mph and at LOS E or worse in the peak direction through significant portions of the corridor in both peak periods in 2035.

8 CONCLUSIONS

8.1 Project Benefits

The ultimate goal of the project is to provide congestion relief within the US 101 corridor. This Traffic Operations Analysis Report (TOAR) examines both near-term conditions in the 2015 opening year and 20-year future conditions with a 2035 horizon year. The operating conditions were analyzed using the VISSIM micro-simulation tool with assumptions regarding how dynamic pricing implemented during the AM and PM peak periods would influence demand for the study years.

The 2015 horizon year analysis shows the following improvement in operations:

AM Peak Period (northbound direction)

- 55% reduction in total hours of delay
- 58% reduction in average delay
- 53% increase in average speed

PM Peak Period (southbound direction)

- 2% reduction in total hours of delay
- 5% reduction in average delay
- 5% increase in average speed

It is important to recognize that these operational improvements are achieved while serving significantly higher VMT, as well as higher vehicular and person throughput. These increases in VMT and throughput are, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities.

These near-term benefits are achieved by allowing more traffic into the express lanes during the earlier hours of the peak period to minimize the build-up of the congestion in the general purpose lanes. In the peak northbound direction during the AM peak hour, the proposed project provides travel time savings over the No Build condition for users in both the general purpose and express lanes. For example, the proposed project will result in about an 18 minute reduction in travel time within the general purpose lanes and about a 5 minute reduction in the HOV/express lane compared to No Build in the AM peak hour (7-8 AM).

Within the express lanes themselves, speeds are expected remain quite high (45 mph or higher) in both directions during both peak periods with the exception of the McKee-Santa Clara access zone in the northbound direction during the AM peak period. The express lanes are also expected to operate at LOS D or better in all segments in both directions throughout both peak periods with the exception of this access zone plus the short section immediately downstream of it, and the segment from SR 237 on to Ellis off. These locations are forecasted to operate at LOS E.

While these operating conditions with speeds below 45 mph or at LOS E do not meet standards established in federal and state laws, these results are based on forecasts of future traffic demands. Management strategies or physical design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

For reference, the HOV lane in the peak direction under the No Build alternative is expected to degrade to LOS E or F in several locations in both peak periods.

By 2035, conditions on US 101 are expected to worsen due to increased demand. This is reflected in increased congestion levels and delays. And while the US 101 Express Lanes Project alone will not solve these congestion problems, the analysis shows that proposed project offers significant benefits.

The 2035 horizon year analysis shows the following improvement in operations:

AM Peak Period (northbound direction)

- 4% reduction in total hours of delay
- 6% reduction in average delay
- 11% increase in average speed

PM Peak Period (southbound direction)

- 13% reduction in total hours of delay
- 18% reduction in average delay
- 23% increase in average speed

In the offpeak direction in each period, the Build alternative also produces a significant reduction in vehicle hours of delay (-3,501 VHD or -24% in the southbound direction during the AM peak period, and -530 VHD or -16% in the northbound direction during the PM peak period).

It is important to recognize that these delay reductions are achieved while also serving significantly higher VMT and both vehicular and person throughput. The increases in VMT and throughput are, in part, a result of the increased demand volumes on US 101 under the Build alternative (more vehicles want to use US 101) which can lessen demand and improve conditions on other facilities. Overall, the proposed US 101 express lanes are expected to produce a reduction of 13,546 vehicle hours of delay combined during the AM and PM peak periods of a typical weekday in 2035.

Again, these benefits are achieved by allowing more traffic into the express lanes to minimize the build-up of the congestion in the general purpose lanes. In the peak direction of each period, the proposed project provides travel time savings over the No Build condition for users in both the general purpose and express lanes. For example, the proposed project will result in about a 12 minute reduction in travel time over the length of the corridor within both the general purpose lanes and in the HOV/express lane compared to No Build in the AM peak hour (7-8 AM). In both cases, the majority of the savings occur within the segment between Bernal Road and the I-880 junction.

For 2035, the express lanes are expected operate at speeds over 45 mph and LOS D or better in both directions during both peak periods, with limited exceptions. In the AM peak, speeds in the northbound express lanes are expected to drop below 45 mph in six access zones plus the short section immediately downstream of the Santa Clara access zone and the one immediately upstream of the Brokaw access zone. In the southbound direction during the PM peak, speeds below 45 mph are expected within the start transition zone, two access zones (Ellis and Mathilda), and most of the buffer-separated section between the start of the express lanes and the Ellis access zone. Meanwhile, the Montague-De La Cruz and Oakland-Mabury/Taylor access zones are expected to operate at speeds above 45 mph, but at LOS E during the middle two hours. For reference, the HOV lane in the peak direction under the No Build alternative is expected to operate at speeds below 44 mph and at LOS E or worse in numerous locations in both peak periods in 2035.

While these operating conditions with speeds below 45 mph or at LOS E do not meet standards established in federal and state laws, these results are based on forecasts of future traffic demands. Management strategies or physical

design alterations should be employed to improve express lane traffic operating speed when it drops below federal and state standards.

The proposed project includes a centralized express lane monitoring system and corresponding management strategy that will be used to regulate express lane demand in order to avoid any operational issues that violate federal and state standards for express lanes. The express lane management strategy includes dynamic toll pricing to regulate the number of toll-paying SOVs using the express lanes, even to the extent of restricting the express lanes to HOVs only. Physical design alterations such as conversion to continuous-access design, lengthening the access zones or reducing buffer areas, relocation of access zones, addition of a merge or weave lane at access zones, addition of general purpose auxiliary lanes, and construction of direct connector ramps, can be implemented to mitigate potential deficiencies.

The express lane operator will regularly monitor and report on the performance of the US 101 Express Lanes, measuring it against the speed and LOS standards established in federal and state laws. The express lane operator is required to take one or more management or design adjustment actions described above to restore express lane speeds and LOS to meet the applicable standards.

8.2 Successful Deployment

Successful deployment of the US 101 express lanes is highly dependent upon the following components:

- Vehicle detection devices to monitor traffic conditions in both the general purpose lanes and the express lanes. These detectors are being placed at strategic locations at the entrances and exits and at intermediate points.
- A central monitoring system that will use a dynamic pricing algorithm to vary the toll price to use the express lanes based on the measured congestion levels in both the express lanes and adjacent general purpose lanes. Multiple user/operator-adjustable variables are included in the algorithm such as maximum toll rate, minimum toll rate, rate of toll change, hours of operations, and opening/closing the express lanes to SOV traffic. The setting of these variables will directly influence the usage of the express lanes and consequently how the corridor operates.
- Reporting tools to be provided by the central monitoring system that will provide a feedback mechanism to the VTA Express Lane staff to evaluate how the corridor is operating, to facilitate decisions on the adjustments to implement, and to help determine how to best address future needs within the corridor.

With these possible future changes, the VTA anticipates the ability to manage the US 101 express lanes along with the general purpose lanes successfully, consistent with the goals of the project. As such, it is recommended that the US 101 Express Lanes project move forward in order to accrue the immediate travel time and reliability benefits while additional corridor improvements are evaluated.