SR-12 Comprehensive Corridor Evaluation and Corridor Management Plan, from SR-29 to I-5

Final Future Conditions Technical (FCT) Report

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Executive Summary

Purpose of Future Conditions Technical Report

The Future Conditions Technical Report is the second analysis element of the SR-12 Comprehensive Corridor Evaluation and presents a forecast of future conditions for the SR-12 Corridor. The Future Conditions Technical Report summarizes the effects of growth and its associated traffic impacts along the SR-12 Corridor. The primary objectives of the future conditions analysis are (1) to prepare traffic forecasts for a short-range (2015) and a long-range year (2035); (2) to prepare a waterborne traffic forecast and assess impacts on bridge openings at the three moveable bridge locations along the corridor; (3) to identify programmed (financially constrained) improvements and other projects included in local transportation plans and studies, and determine their suitability for inclusion in baseline condition; and (4) to identify capacity, congestion and operational issues in the corridor for the short-range and long-range forecasts.

The Future Conditions Technical Report is presented in three sections:

- Section 1 - Introduction: A summary of the basic features of the corridor, including information on programmed improvements that were considered in establishing baseline conditions, including roadway, bridge, public transportation, bicycle, marine and rail improvements; and a statement emphasizing the importance of the risk related to potential sea level rise when assessing mitigation strategies.
- Section 2 - Forecast of Future Conditions: A description of the future roadway conditions in the corridor and a summary of traffic forecasts for the corridor, including expected traffic composition.
- Section 3 - Future Conditions Performance Analysis: An evaluation of the operational performance for future conditions using micro-simulation and macro analysis tools, a forecast of operating speeds and intersection delay, and a summary of forecasted congested areas, bottlenecks and their causes.

Key Issues

Each section of the Future Conditions Technical Report concludes with a summary of key issues. These key issues include:

- *Baseline Conditions*: Substantial roadway improvements have been implemented and further improvements are programmed in the SR-12 Corridor to enhance safety and improve geometry and traffic operations. The baseline conditions for this study include those recently completed and planned projects that are programmed and funded. The programmed roadway improvements considered for this study include the SR-12 Rehabilitation Project, SR-12 Jameson Canyon Project, SR-12 Bouldin Island Project, SR-12 Improvements Project, SR-12 Roadway Rehabilitation Project, SR-12 Church Road Project, I-80 Reliever Route/Jepson Parkway, I-80/I-680/SR-12 Interchange Project, Sacramento County SHOPP Project and the Rio Vista Bridge Replacement Project. These baseline conditions form the basis for analysis of future conditions and will be used to develop potential improvement strategies.

- *Population and Employment Growth Forecast:* Population and employment in San Joaquin County are both projected to grow by about 45% (annual growth rate of 1.5%). Population and employment in the spheres of influence for the cities of Fairfield and Suisun City are projected to grow by 18% and 59% (annual rates of 0.7% and 1.9%), respectively. The City of Rio Vista sphere of influence is expected to grow much faster, increasing its population by 72% and doubling its employment, for annual growth rates of 2.2% and 3%, respectively[1]. Population and employment growth in the Delta area of Sacramento County is projected to be 35% and 8% (annual growth rates of 1.2% and 0.3%), respectively. The future year forecast for Napa County was obtained from The Jameson Canyon Road Widening and SR-12/SR-29 Interchange Project (Jameson Canyon Study) report.
- *Traffic Volume Forecast:* Vehicle traffic along the SR-12 Corridor is expected to increase between 2010 and 2035 to nearly triple current volumes in some segments and double in most others, with average annual growth rates between 2% and 4%. Segments of SR-12 between I-80 and Scally Road are expected to experience volumes that are two to three times higher than those for existing conditions, e.g., from 892 vph to 2,240 vph at Walters Road and from 1,771 vph to 3,975 vph at the I-80 on-ramp in the eastbound PM peak. Remaining segments of SR-12 are projected to experience peak direction volumes that are 50% to 100% higher than those for existing conditions, e.g., from 608 vph to 1,350 vph at Glasscock Road/Tower Parkway in the eastbound PM peak.
- *Travel Mode:* Automobile mode share is expected to be greater than 90% of all commute trips in the SR-12 Corridor, with public transportation accounting for less than 2% of all trips.
- *Truck and Heavy Vehicle Traffic:* While the truck growth rates are forecast to be lower than the passenger vehicle traffic growth rates, the number of trucks on SR-12 is projected to increase substantially by 34% to 71% between 2010 and 2035, depending on location. The absolute number of trucks would increase by 500 to 1,300 per day. Daily truck traffic percentages are projected to be between 5% and 12% in 2035.
- *Moveable Bridges:* In 2010, moveable bridge operations were significantly lower than in the recent past (i.e., 2001-2004) due to economic conditions that affected both shipping and recreational traffic. Based on proposed expansion of the Port of West Sacramento and other potential Marine Highway Corridor improvements, marine traffic is expected to increase significantly by 2035. To account for future increases in waterborne traffic, the frequency of bridge openings was projected to grow at the rate of projected job growth in the three counties (Solano, Sacramento, and San Joaquin), resulting in about 440 and 740 openings in the peak month for the Rio Vista Bridge and the Mokelumne Bridge, respectively, in 2035. These numbers correspond to approximately one opening in the PM peak hour for the Rio Vista Bridge and two openings in the PM peak hour for the Mokelumne Bridge in 2035.
- *General 2015 Performance:* SR-12 is projected to experience a moderate increase in intersection delay and travel time under 2015 conditions. Most of this increase in delay can be attributed to intersections operating at higher levels of saturation, interruptions due to bridge openings, and absence of more passing opportunities along the corridor.
- *General 2035 Performance:* SR-12 is projected to experience very high levels of congestion under 2035 conditions. This increase in congestion is directly related to growth in traffic demand and further compounded by the impact of bridge openings during the peak hour. Exhibit 3-31 identifies the potential causes that may lead to congestion along the corridor. Absence of mitigation will cause the 2035 peak period to extend from the existing 1.5 hours in the AM peak and 2 hours in the PM peak to approximately 2.5 and 4.5 hours, respectively.
- *Corridor Travel Time:* The average time it takes to travel the entire segment of the corridor from I-80 to I-5 in 2035 is projected to be 1 hour and 23 minutes during peak hour—an increase of approximately 30 minutes or 50% as compared to 2010 current conditions.

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[1] A sphere of influence is a planning area usually larger than, although sometimes contiguous with, a city's municipal limits. Spheres of influence are assigned by each county's Local Agency Formation Commission and typically indicate the probable ultimate boundaries of a city (including areas which may eventually be annexed).

- *Intersection Level of Service:* Signalized intersections between I-80 and Walters Road through Suisun City will experience volumes that are two to three times higher than that of existing conditions, exhibit the highest delays, and operate at LOS E or F. Most of the unsignalized intersections are also projected to operate at LOS E or F due to high side street delays. Nearly five out of 10 intersections in the AM peak period and seven out of 10 intersections in the PM peak period are projected to operate at LOS E or F in 2035 without mitigations in addition to those discussed in the committed projects list. Mitigations in addition to those committed projects included in the baseline conditions are required for intersections in the study area to ensure that they operate at LOS D or better under 2035 demand volumes.
- *Mainline Segment Operations:* In 2035, SR-12 is projected to experience volumes that are approximately two to three times the existing volumes. Most of the segments of SR-12 are projected to experience demand volumes that exceed available capacity during the AM and PM peak hours under 2035 volume conditions. Segments of SR-12 between I-80 and Scally Road are projected to experience volumes that are more than twice the available capacity while the other segments are projected to experience volumes that are 50% to 100% more than the available capacity for 2035 conditions. To accommodate anticipated 2035 demand, it is anticipated that currently available capacity will have to be doubled for most segments of SR-12 through the addition of through lanes.
- *Westbound Travel Speeds:* For 2015 conditions, segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 10 mph to 25 mph during the PM peak hour. Segments of SR-12 between Scally Road and I-5 function at an average speed of 40 mph except for the stretch of SR-12 between Hillside Terrace and the River Road intersection which functions at an average speed of 30 mph. SR-12 is projected to experience high levels of congestion under 2035 conditions. Very low average speeds are projected on the west end of the corridor between I-80 and Walters Road through Suisun City. Lower speeds are observed on segments that carry the highest corridor volumes between Chabourne Road and Walters Road. Slower speeds were also observed in the vicinity of Rio Vista and near the I-5 interchange which is also reflected by high intersection delays. Approximately 70% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 42% for year 2035 conditions. Similarly, 72% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 52% for year 2035 conditions.
- *Eastbound Travel Speeds:* For 2015 conditions, the speed profile data indicates that the average speeds for most segments of the corridor are lower than speeds for existing conditions by approximately 10 mph to 15 mph. Segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 30 mph during the AM peak hour and 20 mph during the PM peak hour. Mainline operations in the vicinity of I-5 are similar to those near I-80. Review of individual segment speeds for existing and long-term future year indicates that the average speed of most of the segments decreases which leads to a shift in the speed distribution of the study corridor. Approximately 78% of the eastbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 41% for year 2035 conditions.
- *Impact of Bridge Openings on Travel:* Level of service deficiencies in the vicinity of the Rio Vista Bridge and Mokelumne River Bridge are largely due to bridge operations. It is projected that a 20-minute bridge opening will result in vehicular queues of at least two miles and require at least 30 minutes to dissipate, thereby impacting traffic flow on SR-12 for the entire peak period if not longer. Based on a planning level daily analysis, bridge openings at the Rio Vista and Mokelumne bridges are projected to collectively add no less than 1,735 vehicle hours of daily delay in the corridor during the month with the highest openings by 2035; even with relatively short opening times of 10 minutes. The upper limit estimate of 20- to 25-minute openings yields a maximum projection of 9,130 hours during the peak bridge opening month. These monthly delays translate to an average daily delay per vehicle (daily delay/ADT, including vehicles not encountering a bridge opening) of 82 seconds per vehicle at the Rio Vista Bridge and 133 seconds at the Mokelumne Bridge for 10-minute openings and 572 seconds at the Rio Vista Bridge and 531 seconds at the Mokelumne Bridge for the 20- to 25-minute openings. The likely annual delay in 2035 would be several hundred thousand vehicle hours at each bridge. Replacement of the Rio Vista Bridge and Mokelumne Bridge with a mid-level

or high-level bridge as currently being studied by the Solano Transportation Authority will be necessary to mitigate these forecast conditions.

These key issues will be evaluated during the development of corridor improvement strategies to mitigate corridor safety, congestion, and operational issues along the corridor.

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List of Exhibits

Section 1: Introduction

Future Conditions Technical Report

This Future Conditions Technical Report provides a description of the future roadway conditions of the SR-12 Corridor and defines future baseline conditions for evaluating potential improvement strategies. The Future Conditions Technical Report summarizes the effects of growth and its associated traffic impacts along the SR-12 Corridor as shown in Exhibit 1-1. The primary objectives of the future conditions analysis are 1) to prepare traffic forecasts for a short-range (2015) and a long-range year (2035); 2) to prepare a waterborne traffic forecast and assess impacts on bridge openings at the three moveable bridge locations along the corridor; 3) to identify programmed (financially constrained) improvements and other projects included in local transportation plans and studies, and determine their suitability for inclusion in baseline condition; and (4) to identify capacity, congestion and operational issues in the corridor for the short-range and long-range forecasts.

Exhibit 1-1: SR-12 Corridor Study Area

Programmed Improvements to Establish Baseline Conditions

This subsection describes the programmed transportation improvement projects in the corridor with committed funding within the 2035 time horizon, including the roadway, bridge, public transportation, and marine projects and programs summarized below. These programmed improvements have been incorporated into the existing conditions to establish baseline conditions for determining capacity of the roadway system.

Roadway Improvements

As presented in Section 1 of the *Draft Existing Conditions Technical Report,* Description of the SR-12 Corridor, *(*Draft ECT Report*)*,[2] programmed roadway improvements include one project recently completed on SR-12 between Walters Road and Currie Road in Solano County and five other projects that are close to advertisement or in the project development process. There are also several other projects included below with identified funding that are planned to be implemented prior to the 2035

2 PBS&J. 2011 (January). SR-12 Comprehensive Corridor Evaluation and Corridor Management Plan, from SR-29 to I-5: *Draft Existing Conditions Technical (ECT) Report,* pp. 1-3 – 1-5.

horizon year of this study. These projects address many of the deficiencies and implement some of the improvement elements identified in previous studies. The locations of these projects are shown in Exhibit 1-2.

SR-12 Roadway Rehabilitation Project (Solano EA 04-0T10U) – This recently completed SHOPP project extends from Walters Road to Currie Road and included rehabilitation, reconstruction and some realignment of SR-12. The roadway was rehabilitated between Walters Road and Shiloh/Lambie Road and the median concrete barrier remains with no additional shoulder widening. Between Shiloh/Lambie Road and Currie Road, the work included rehabilitation, widening and full reconstruction. Full reconstruction included sections of realignment to improve the horizontal and vertical alignments. Additional intersection improvements, such as widening and left turn channelization, were included along with drainage improvements. The final configuration between Shiloh/Lambie Road and Currie Road includes full-width outside shoulders with rumble strips and centerline rumble strip with channelizers. This project was completed and opened for traffic in December 2010.

SR-12 Jameson Canyon (and SR-12/SR-29 Intersection) Project (Napa EA 04-264134, Solano EA 04-264144) – This project includes a major reconstruction and widening of SR-12 between SR-29 and Red Top Road to a four-lane conventional highway with a median concrete barrier and full-width shoulders. The reconstruction will include horizontal and vertical alignment changes to meet a 55 mph design speed. This project will widen and improve at-grade intersections at Kelly Road, Kirkland Ranch Road, and Lynch Road. Additionally, an intersection for U-turns will be provided in the middle section of the project. This project is expected to be advertised for construction in the spring of 2011 and be completed in 2014.

The connections to SR-29 and I-80 will not be improved in the first phase of construction. The SR-12/SR-29 intersection was studied and a preferred alternative was identified and cleared in the environmental document. This preferred alternative for SR-12/SR-29 includes reconstructing the existing at-grade intersection to a tight diamond interchange. The SR-12 (West) and I-80 interchange is being studied and developed as part of the I-80/I-680/SR-12 Interchange project discussed below.

SR-12 Bouldin Island Project (San Joaquin EA 10-0G800) – This SHOPP project includes rehabilitation and reconstruction of 4.5 miles of SR-12 between the Mokelumne Bridge and the Potato Slough Bridge to change from a two-lane conventional highway to a two-lane divided highway to improve traffic operations and safety. The scope of the project includes widening to full-width outside shoulders with rumble strips, adding a concrete median barrier and providing six-foot inside shoulders for most of the section adjacent to the concrete barrier. In order to complete the required widening, the entire roadway will be realigned to the south of the existing roadway. A substantial pavement structural section will be used in this difficult geological area to increase the pavement design life. This project is scheduled to advertise for construction in the summer of 2012 and should be completed in 2014.

SR-12 Improvements Project (I-5 to Bouldin Island) (San Joaquin EA 10-0A8404) – This project has two primary purposes—to provide a direct operational improvement by eliminating left turns at the Glascock Road intersection, along with installing left turn pockets and acceleration lanes at other major intersections between Little Potato Slough Bridge and I-5; and to construct a "Smart" Corridor, by the installation of various Intelligent Transportation System (ITS) elements to provide travelers real-time information on the status of SR-12 between I-5 and I-80. The project also includes expanding an existing park and ride lot. The physical limits of the project are from I-5 to the Potato Slough Bridge, but the ITS elements extend all the way from I-5 to Rio Vista. Intersection improvements consist of realignments, left turn channelization, acceleration lanes, and bus turnouts at several locations including Tower Parkway, Glasscock Road, Correia Road, and North Guard Road. The ITS elements include various components, including traffic monitoring stations, changeable message signs, and extinguishable message boards. The intent of the ITS elements are to alert drivers of traffic conditions along SR-12 and these elements include Extinguishable Message Signs (EMS) and Changeable Message Signs (CMS). The intersection improvements and ITS elements are scheduled to advertise for construction in the summer of 2011 and should be completed in 2013. The expansion of the existing park and ride between the I-5 northbound off-ramp and North Thornton Road will be a future phase of construction.

SR-12 Roadway Rehabilitation Project (West of Currie Road to Liberty Island Road) (Solano EA 04-2A6200) - This SHOPP project ties into the current SHOPP project near Currie Road and extends the rehabilitation and widening east to Liberty Island Road. The scope of the project includes rehabilitation of the pavement, widening of shoulders to full eight-foot outside width, and intersection widening and left turn channelization at Currie Road, McCloskey Road, and Azevedo Road. The project also includes improving three non-standard vertical curves to meet a 55 mph design speed. Centerline rumble strips with channelizers and outside shoulder rumble strips are included in the improvements. This project is currently in design with a scheduled construction start in 2012 and completion in 2014.

SR-12 - Church Road Project – This project will improve safety and operational characteristics at the intersection of SR-12 and Church Road/Amerada Road. The four build alternatives presented in the approved Project Study Report (PSR) include the addition of right turn and left turn lanes (deceleration and acceleration lanes) along SR-12 in the east and west directions; the addition of a left turn lane on the Church Road approach; and realignment of the intersection to eliminate the 75-foot offset between Church Road and Amerada Road. This project is expected to finish construction in 2016.

I-80 Reliever Route/Jepson Parkway – While not a project on SR-12, the four-lane Jepson Parkway from SR-12 to Leisure Town Road project is a programmed project and would affect traffic on SR-12 because of its connection between I-80 and the proposed Jepson Parkway. The project is included in the STA model.

I-80/I-680/SR-12 Interchange Project (Solano EA 04-0A5300) – This project, currently in the Project Approval/Environmental Document (PA/ED) phase, analyzes and develops improvement alternatives for the interchange complex of I-80/I-680/SR-12 (east and west along I-80). Two build alternatives were presented in the Draft Environmental Document and both include work along SR-12. Both build alternatives include the reconstruction of the SR-12 (West) and I-80 interchange, but with different configurations. The two build alternatives also include improvements at the SR-12 (East) and I-80 interchange that extend east to near Pennsylvania Avenue with different configurations for each alternative. One alternative proposes a single interchange on SR-12 to access Beck Avenue and Pennsylvania Avenue. The other alternative includes two interchanges to provide access to Beck Avenue and Pennsylvania Avenue and eliminates access to SR-12 from Jackson and Webster streets. This project is still in the PA/ED phase with final design anticipated to start in 2011. While this project would potentially provide an additional eastbound lane on SR-12 from Abernathy Street to Webster Street, this improvement is in the unfunded second phase of the project and is not considered as programmed or part of the baseline condition for this study.

Sacramento County SHOPP Project – This project will rehabilitate the Sacramento County segment of SR-12 (the Rio Vista Bridge to the Mokelumne Bridge) from PM 0.4 to PM 6.10 with a planned construction date of 2017 to 2018. This SHOPP project includes pavement rehabilitation, but does not currently plan capacity enhancements on this segment. This SHOPP project is currently unfunded and, therefore, not considered as part of the baseline condition for this study.

Rio Vista Bridge Replacement Project – The Solano Transportation Authority and the City of Rio Vista have been exploring alternatives for improving long-term transportation mobility on SR-12 through Rio Vista and across the Sacramento River, including investigating replacement and realignment of the Rio Vista Bridge. A recently completed Preliminary Bridge Report[3] investigated potential replacement bridge types, alignment alternatives, environmental constraints, and potential funding strategies. The study evaluated traffic impacts in 2030 for three scenarios: no project, a mid-level bridge on the existing alignment, and a high-level bridge on a bypass alignment. The study concluded that a four-lane bridge and roadway facility with either mid-level or high-level alternative would significantly improve traffic operations in the study area. Intersections in the study area will operate in 2030 at LOS D or better for the mid-level and high-level bridge alternatives compared to LOS F with no improvements.[4] The study includes a preliminary schedule for construction in 2020, but is currently unfunded; therefore, we have

3 AECOM and Solano Transportation Authority. 2010 (September). *Preliminary Bridge Report, SR-12 Realignment/Rio Vista Bridge Preliminary Study.*

4 AECOM and Solano Transportation Authority. 2010. Op cit.

not considered this project in the baseline conditions for this study but will address this issue in development of mitigation strategies in the next phase of this study.

Public Transportation Improvements

Public transportation in the SR-12 Corridor currently provides additional mobility options other than the automobile. Based on travel demand modeling, transit mode share in the corridor is on the order of 2%.[5] While serving important transportation needs in the corridor, public transit does not play a substantial role in the corridor trip making, as indicated by the existing corridor routes and ridership described in the Draft ECT Report.[6] Given its small mode share, the role of public transportation is expected to be similar in the future. While some growth in transit ridership could be expected based on demographic growth, economic and funding issues may limit the ability of the corridor transit providers to expand service in the short run. The Short-Range Transit Plans (STRPs), which address operations and organization over the next five to 10 years, do not indicate any planned changes for the Fairfield/Suisun Transit (FAST) and Rio Vista Delta Breeze routes in the corridor.[7] The STRP for SCT/Link, which operates the Delta Route between Isleton, Lodi, and Galt, is currently being updated by the City of Galt.

Marine Transportation Improvements

Port of West Sacramento Expansion – Based on Caltrans Maintenance and Operations records for 2008/2009, the lift span of the existing Rio Vista Bridge has been recently raised as many as 300 times per month to provide clearance for recreational and commercial boat traffic. Currently, the Port of West Sacramento is receiving approximately 45 ships per year which accounts for 90 bridge openings. In the past, the Port has had as many as 110 ships within a year, and the Port is currently permitted to receive up to 120 ships per year. The number of ships allowed to travel to the Port is expected to increase beyond the currently permitted number of 120 ships per year as future river traffic is expected to increase with planned Port expansion. The size of ships traveling to the Port is also anticipated to increase with the largest ships expected to be auto vessels.[8]

M-580 Marine Highway Corridor – The M-580 Marine Highway Corridor includes the San Joaquin River, Sacramento River, and connecting commercial navigation channels, ports, and harbors from Sacramento to Oakland. By designating this Marine Highway Corridor, the USDOT has identified this as a route where water transportation presents an opportunity to offer relief to landside corridors that suffer from traffic congestion, excessive air emissions or other environmental concerns, and other challenges. The USDOT awarded the Ports of West Sacramento, Oakland, and Stockton a joint $30-million grant through the Transportation Investment to Generate Economic Recovery (TIGER) Grant program. This funding will enable the Ports of West Sacramento, Oakland, and Stockton to begin a Marine Highway, which will take 350 containers on each trip from the Valley to the Port of Oakland, reducing the number of drayage trucks on the already congested highway.

Sacramento River Deep Water Ship Channel Limited Reevaluation Study – This study is being conducted as part of a Congressionally-authorized project being implemented by the U.S. Army Corps of Engineers and the Port of Sacramento who are preparing a joint Supplemental Environmental Impact Statement/Subsequent Environmental Impact Report (SEIS/SEIR) to evaluate the action of resuming construction of navigational improvements to the Sacramento River. The 46.5-mile long ship channel serves the marine terminal facilities at the Port of Sacramento and joins the existing 35-foot deep channel at New York Slough, providing access to the Port of Sacramento from San Francisco Bay area harbors and the Pacific Ocean.

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5 Solano Transportation Authority and Napa County Transportation Planning Agency. 2006 (January). *State Route 12 Corridor Transit Study.* prepared by Urbitran Associates, p. 55.
6 PBS&J. 2011 (January). *op.cit,* pp. 1-23 – 1-25.
7 Fairfield/Suisun Transit. 2008 (January), Short Range Transit Plan FY2007 - FY2016, p. 11-2. Rio Vista Delta Breeze, Short Range Transit Plan FY 2007/08- FY 2017/18. pp. 103-107.
8 AECOM and Solano Transportation Authority. 2010. Op cit.

Summary of Section 1

This section presents a summary of the basic features of the corridor including a description of the previously prepared Existing Conditions Technical Report, and the purpose of this Future Conditions Technical Report. A summary of key issues addressed in this section include:

- *Baseline Conditions*: Substantial roadway improvements have been implemented and further improvements are programmed in the SR-12 Corridor to enhance safety and improve geometry and traffic operations. The baseline conditions for this study include those recently completed and planned projects that are programmed and funded. These baseline conditions form the basis for analysis of future conditions and will be used to develop improvement strategies.

This key issue will be evaluated during the development of corridor improvement strategies to mitigate corridor safety, congestion, and operational issues along the corridor.

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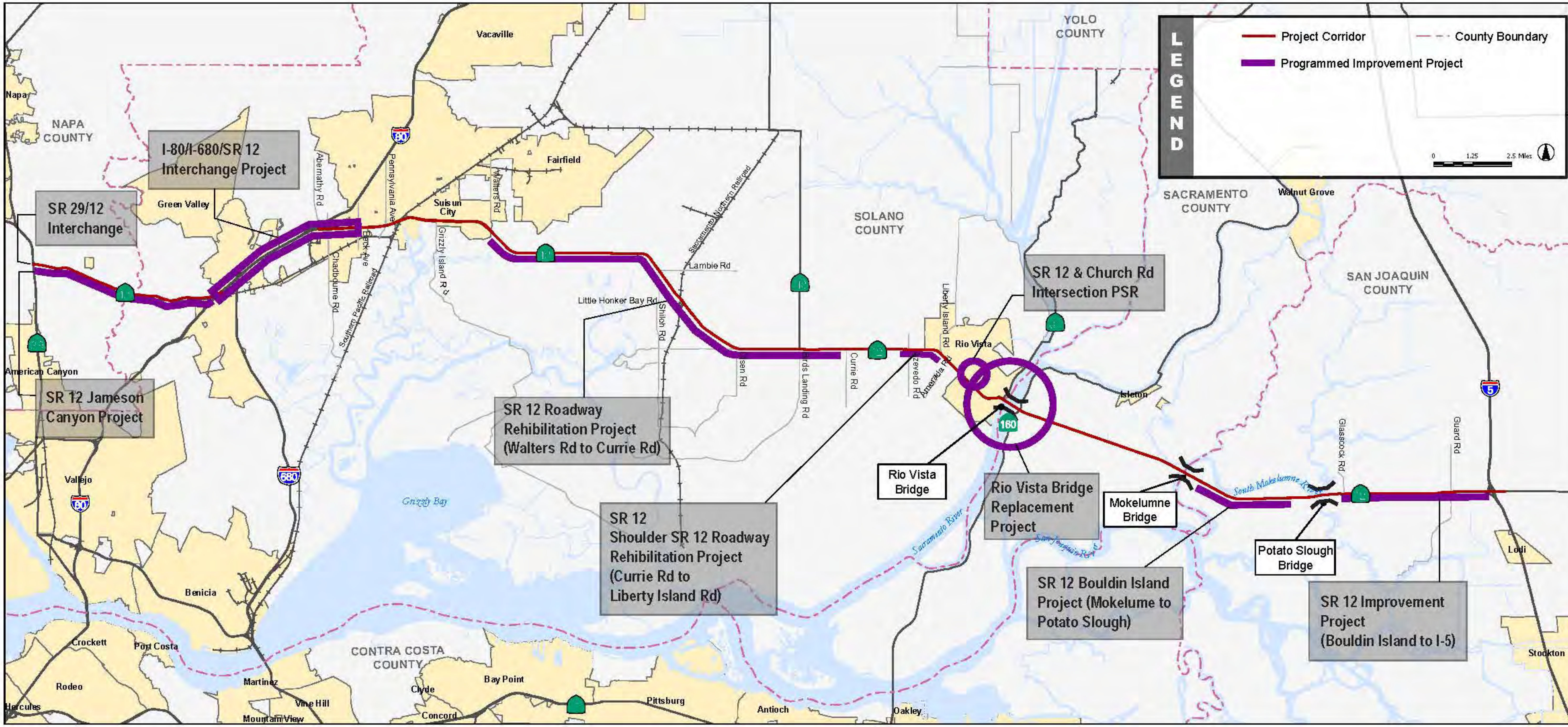
Exhibit 1-2: Programmed Improvements on SR-12



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Section 2: Forecast of Future Conditions

This section provides a description of the future roadway conditions in the SR-12 Corridor and presents traffic forecasts for the corridor, including expected traffic composition.

Forecast of Population and Employment Growth

Urban development, which has been especially rapid in San Joaquin County over the last decade, is projected to continue along the corridor. Because traffic growth rates in developing areas are frequently greater than demographic growth rates, the expected demographic growth rates below are presented as a gauge on the reasonableness of the traffic forecasts presented herein. Population and employment in San Joaquin County are both projected to grow by approximately 45% between 2010 and 2035, which corresponds to an annual growth rate of 1.5%.[9] Substantial growth is also expected along the SR-12 Corridor through Solano and Sacramento counties. The population and employment in the combined spheres of influence for the cities of Fairfield, Suisun City, and Rio Vista are projected to grow by 18% and 59%, respectively, between 2010 and 2035, or annual rates of 0.7% and 1.9%. While these growth rates in the corridor are projected to be slightly higher than for the county as a whole, the City of Rio Vista sphere of influence is expected to grow much faster, increasing its population by 72% and doubling its employment over the same period, for annual growth rates of 2.2% and 3%, respectively[10]. Population and employment growth in the Delta area of Sacramento County through which SR-12 passes is projected to be 35% and 8%, respectively, between 2010 and 2035, corresponding to annual growth rates of 1.2% and 0.3%.[11] Growth overall in Sacramento County is expected to be greater, reaching 44% for population and 31% for jobs between 2010 and 2035[12]. Appendix A presents the detailed population and employment forecasts.

Future Traffic Volume Forecasts

Modeling Methodology

Following evaluation and refinement of the STA travel demand model, this study used the STA model to forecast future year traffic along the 42-mile segment between I-80 and I-5 in Solano, Sacramento, and San Joaquin counties. Forecast data for Napa County was directly obtained from the Jameson Canyon Study report. The STA model (based on census data from ABAG and SACOG) was used by the Jameson Canyon Study to project future year volumes. The resultant future year demand has been reviewed and accepted by Caltrans and other local jurisdictions. A technical modeling committee comprised of representatives from the Metropolitan Transportation Commission (MTC), and Solano, Sacramento, and San Joaquin counties provided oversight and guidance for the modeling and forecasting tasks for this study. The model evaluation found that the model performed acceptably at the regional level without adjustment and was adequate for the study purposes at the county and corridor level with minor model adjustments and post-processor procedures to correct discrepancies on low volume portions of SR-12 east of SR-160. A draft technical memorandum included herein as Appendix B describes the model evaluation and forecasting process and its results in more detail.[13]

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9 San Joaquin Council of Governments. 2009. (November). *Staff Report – Draft Countywide Population/Household/Employment Update.*

10 Association of Bay Area Governments. 2009. *Projections 2009.* The recently *(3-11-11)* released ABAG/MTC *Bay Area Plan, Initial Vision Scenario* envisions a different distribution and amount of growth in Solano County than does *Projections 2009.* For example, the *Initial Vision Scenario* suggests twice as much population growth by 2035 in the SR-12 corridor as does *Projections 2009,* but concentrates it more in Fairfield. Corridor job growth under the *Initial Vision Scenario* would be slightly less than in *Projections 2009.*

11 Sacramento Area Council of Governments. 2008. (February), *Modeling Projections for 2005, 2013, 2018 and 2035.* PBS&J, 2011.

12 SACOG. 2011 (February) http://www.sacog.org/about/advocacy/pdf/fact-sheets/PopulationStats.pdf, http://www.sacog.org/about/advocacy/pdf/fact-sheets/EmploymentStats.pdf.

13 PBS&J. 2010. (February 9). *Draft Technical Memorandum, STA Model Evaluation Summary and Future Forecasts for SR-12*.

Traffic Forecasting Procedure

Other steps in the traffic forecast procedures included the following:

Adjustment of 2010 Counts for Economic Conditions – This study analyzed the magnitude of temporal change in volumes during the recent past and adjusted the 2010 counts accordingly to account for the recent recession and related depressed traffic volumes in the corridor below what is considered a reasonable basis for the 2035 forecasts. Caltrans Average Annual Daily Traffic (AADT) for SR-12 was reviewed for a period extending from 2000 through 2009, and it was found that corridor average AADT in 2009 was 8% lower than during 2005 through 2007. Some locations in Fairfield and Rio Vista were 20% lower. To give a more reasonable basis for a long-range forecast, the 2010 counts were adjusted link by link, corresponding to the AADT changes, to reflect the 2005 through 2007 period rather than the 2009 conditions. Because several links in eastern Fairfield had AADT that increased between 2005-2007 and 2009, these links were not adjusted.

Application of NCHRP Report 255 Procedures – NCHRP Report 255 procedures were applied to the STA 2010 and 2030 model volumes to give a 2030 forecast based on adjusted counts and model growth ratios and volume differences.[14] Traffic volume increments (between existing and future scenarios) derived from the model were then added to the 2010 adjusted counts to project 2030 peak hour volumes. These procedures assume that the model is better at projecting relative growth as compared to absolute growth. That is, the STA model growth rates and incremental volumes are considered more reliable than the total volumes because the eastern portion of SR-12 is a low volume highway on the fringe of the STA model area, a condition that makes calibration of model volumes very difficult. The traffic growth rates, however, reflect regionally adopted land use projections, which are the best available estimates of corridor growth.

Extrapolation to 2035 – Because the STA model has a horizon year of 2030, the 2030 peak hour link volumes were extrapolated to 2035 using Association of Bay Area Governments (ABAG) population and employment data for Solano County, and San Joaquin Council of Governments (SJCOG) data for San Joaquin County. Analysis of the ABAG demographic data found that the projected annual growth rates between 2030 and 2035 for both Solano County as a whole and the SR-12 Corridor (Fairfield, Suisun City, and Rio Vista) were approximately 85% of the average annual growth rates between 2010 and 2030.[15] The comparable ratio for San Joaquin County was 74%,[16] but 85% was used as being more conservative. Comparable demographic data in 5-year increments were not available for the Delta region of Sacramento County, but a similar tapering of growth is expected; given the small size and low projected growth of the Delta compared with the developing areas in adjacent Solano and San Joaquin counties, using the 85% ratio overall is conservative. Year 2035 peak hour link volumes were computed for all links in the corridor using annual growth rates between 2030 and 2035 equal to 85% of their corresponding 2010 to 2030 average annual growth rates (exponential).

Interpolation for 2015 – Because the STA model does not have a 2015 interim year, the 2015 traffic forecast was interpolated between 2010 and 2035 traffic volumes by the ratio of demographic growth within the respective periods. The interpolation ratio for the combined population and jobs of Solano and San Joaquin counties was 21% of the 2010 to 2035 growth between 2010 and 2015. The two counties had almost identical projected growth profiles; relatively constant amounts of growth in each of the five-year periods between 2010 and 2035, with a slight tapering of growth in the last 10 years. The growth statistics for the Delta portion of Sacramento County were not used because they contributed less than 1% of the total.

Historical Trend Analysis and Averaging – Based on Caltrans AADT, the historical growth rates for SR-12 links from 1992 through 2009 were analyzed and compared to the projected growth rates between 2010 and 2035. The projected off-peak

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14 Transportation Research Board. 1982 (December). N*ational Cooperative Highway Research Program (NCHRP) Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design*.

15 ABAG. 2009, *op. cit.*

16 SJCOG, 2009, *op. cit.*

direction growth rates compared very closely to the historical, with differences typically less than 1% per year. The peak direction growth rate had more variation, however, with differences in eastern Fairfield reaching 2% or more. To place a peak hour, peak direction forecast more in line with historical growth trends, the average annual growth rate from the mainline forecast and the historical analysis were averaged, resulting in project peak direction growth rates within 1% or less of the historical average. New 2035 peak hour, peak direction traffic volumes were calculated from the averaged growth rates. The average (exponential) projected traffic growth rates between 2010 and 2035 generally ranged between 2% and 4% which compared well with expected population and job growth rates of 1% to 3%.

Because there is no historical data for most of the intersecting streets, the cross traffic was not subjected to the same historical trend comparison. Intersecting streets can also have substantially more growth than the SR-12 mainline due to the effects of localized development. The growth trends in cross traffic were reviewed and any anomalies were adjusted when link volume growth was applied to turning movement counts at intersections in later future conditions analysis.

Consideration of Seasonal Traffic Variations - Seasonal variation in traffic volumes was also considered to place in perspective the traffic counts performed during May 2010. Caltrans seasonal traffic data was not available for every month except at the very eastern end of the corridor. Based on the Caltrans data, May traffic volumes are typically lower than those during the peak months of June and July, but where data is available to compare month by month, the May traffic is lower by less than 10%. Consequently, we conclude that no seasonal correction is needed for the forecasts.

Forecast Volumes

Exhibit 2-1 through Exhibit 2-4 shows comparative graphs for the base and adjusted 2010 peak hour counts and the 2015 and 2035 forecasts for all links of the SR-12 Corridor by AM/PM peak hour and direction. These final 2015 SR-12 mainline forecast peak hour volumes are also shown on Exhibit 2-5 through Exhibit 2-8. Tables 6 through 9 (included in Appendix B) summarize the base and adjusted 2010 peak hour counts, the 2015 and 2035 forecasts, and the average annual percentage growth (exponential) rate by link between the adjusted 2010 counts and the 2015 and 2035 forecasts. These tables also show the average growth rates between 2010, 2015 and 2035.

Travel by Mode

While corridor level statistics are not available, county-level results of the Census Transportation Planning Products (CTPP) and the related ongoing American Community Survey (ACS) indicate that about 78% of Solano and San Joaquin residents drive alone to work. Data are not available separately for the Delta region of Sacramento County, the portion that has the most influence on SR-12 traffic volumes, so discussion of Census travel data uses only that from Solano and San Joaquin counties. Ridesharing made up 13% to 15% of the work trips in the two counties, with San Joaquin County having the higher value. Public transit made up 1% or less of the total for the counties, although the above text referenced an estimate of a 2% transit mode share in the corridor. Between the 2000 Census and the 2005-2007 follow up ACS, the percentages of residents driving alone increased by 1-2%.[17]

Although gasoline prices generally increased between 2000 and 2005-2007, the rising drive-alone share between 2000 and 2005-2007 may have been a continuation of the decades-long nationwide trend of increasing solo driving as a result of decreasing auto costs, dispersing job locations, and lower housing prices at the fringes of urban areas. Because California housing prices soared between 2000 to 2005-2007, inflated housing costs were probably the major factor in the increasing drive-alone share as commuters searched for affordable housing. The mode share trend for the future is uncertain, but the current

[17] CTPP Part 2 Profile 1: Census 2000 and 2005-2007 ACS for Solano and San Joaquin Counties, http://download.ctpp.transportation.org/profiles_2005-2007/ctpp_profiles.html, 2/2/11. Because mode to work also includes 3-4% "worked at home", the percentages for actual commute travel modes are slightly higher than stated.

automobile mode share of greater than 90% of the commute trips suggests that future trip making in the SR-12 Corridor will likely remain heavily auto-dependent.

Truck and Heavy Vehicle Traffic

The Draft ECT Report discussed current truck and heavy vehicle traffic on SR-12.[18] Exhibit 2-9 and Exhibit 2-10 show comparable projected 2015 and 2035 daily truck volumes and percentages. Future truck volumes and percentages were forecast by developing trend lines from the historical truck volume data on SR-12 as reported by Caltrans in its Annual Average Daily Truck Traffic database for 1992 through 2009.[19] Growth rates from extrapolated trend lines were then averaged with the historical average growth rates between 2000 and 2009 to develop ratios of 2035 to 2010 and 2015 to 2010 truck volumes by location along SR-12. The projected average annual truck growth rates ranged from 1.2% to 2.2% per year, with an average of 1.6% per year for the seven locations shown on Exhibits 2-9 and 2-10.[20] The resulting 2035 daily truck percentages on SR-12 were generally lower than their 2010 counterparts with the exception of segments close to I-5. This exception was influenced by the high historical truck growth rate at the location—truck volumes just west of I-5 grew at a rate of 4% between 2000 and 2009.

While the truck growth rates are forecast to be lower than those for the passenger vehicle traffic, the numbers of trucks on SR-12 are projected to increase substantially by 34% to 71%, depending on location. Exhibits 2-9 and 2-10 show the future numbers of trucks. At the western end of the SR-12 Corridor, just west of Pennsylvania Avenue, 2035 growth is projected to add about 1,300 trucks daily to the 2010 volume of 5,040 trucks per day. While this Fairfield/Suisun section of the corridor is projected to experience the highest absolute growth in trucks, the eastern half of the corridor from SR-160 to I-5 is not far behind and is projected to gain about 900 to 1,300 more trucks per day by 2035 on top of truck volumes that ranged from 1,745 to 2,370 trucks per day in 2010. Growth between 2010 and 2015 is projected to be much more modest, with the addition of about 100 to 200 trucks per day compared with 2010 truck volumes.

Similar truck forecasts were made for peak period traffic to be used in the operations analyses. These forecasts were based on 2010 peak hour truck counts from May and November, which had generally higher percentages than the daily numbers discussed above. While this approach captures the recent trends of truck traffic in the SR-12 Corridor, plans to expand Travis Air Force Base could increase truck and heavy vehicle traffic, as well as auto traffic.

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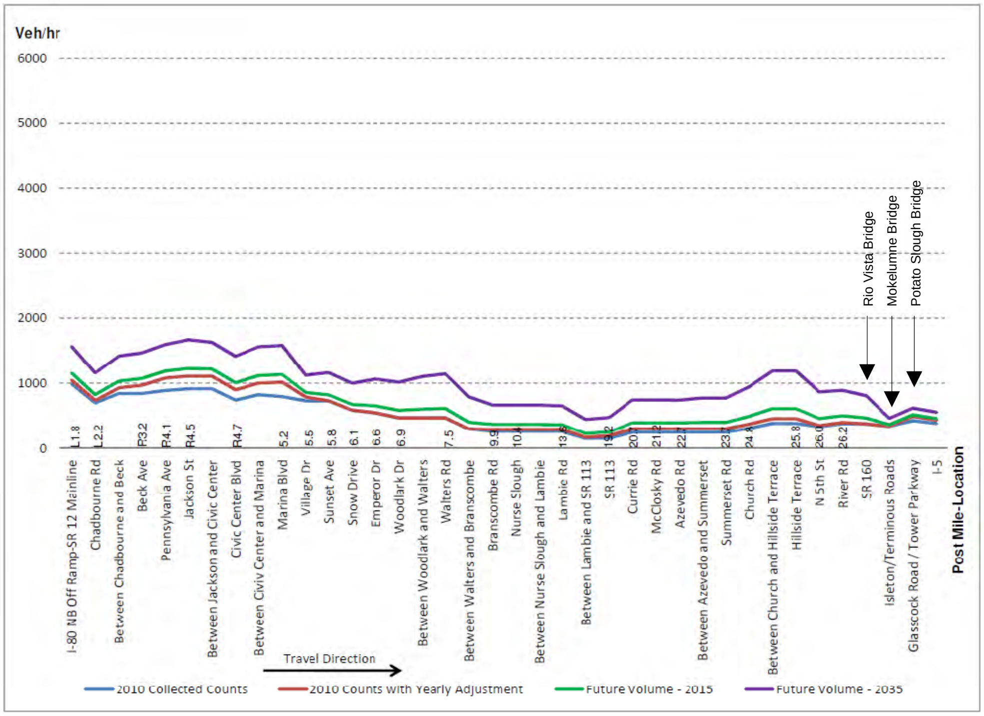
18 PBS&J. 2011. (January). *op. cit.,* p. 3-8.

19 Caltrans. 2009. http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm. 12/20/2010.

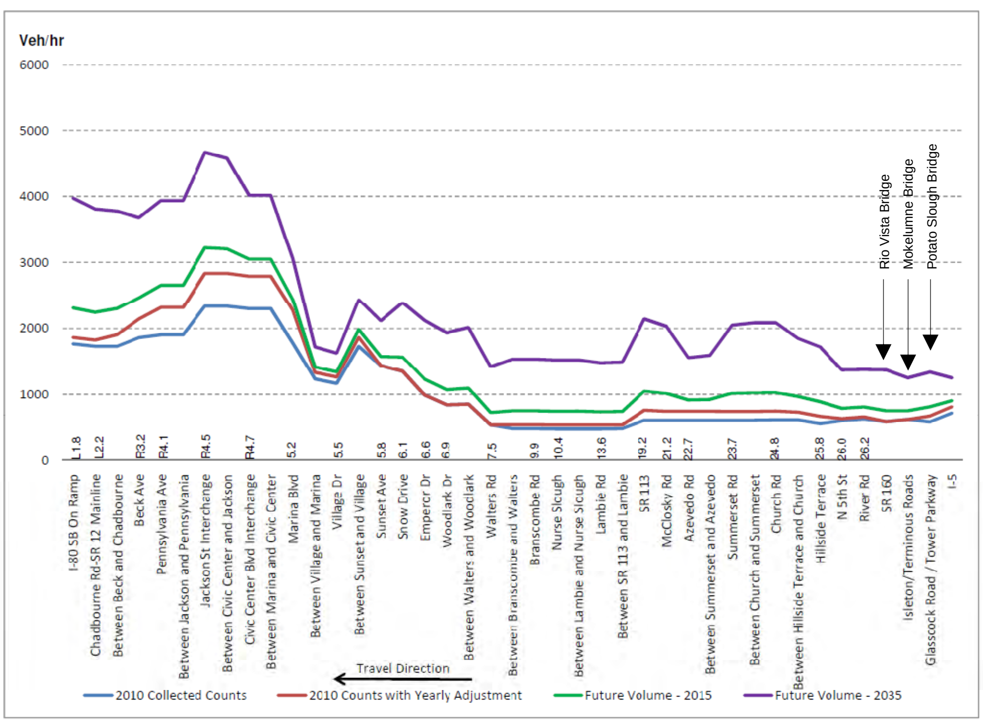
20 PBS&J traffic analysis, 2010.

Exhibit 2-1: AM Peak Hour Volume Trends for Eastbound SR-12



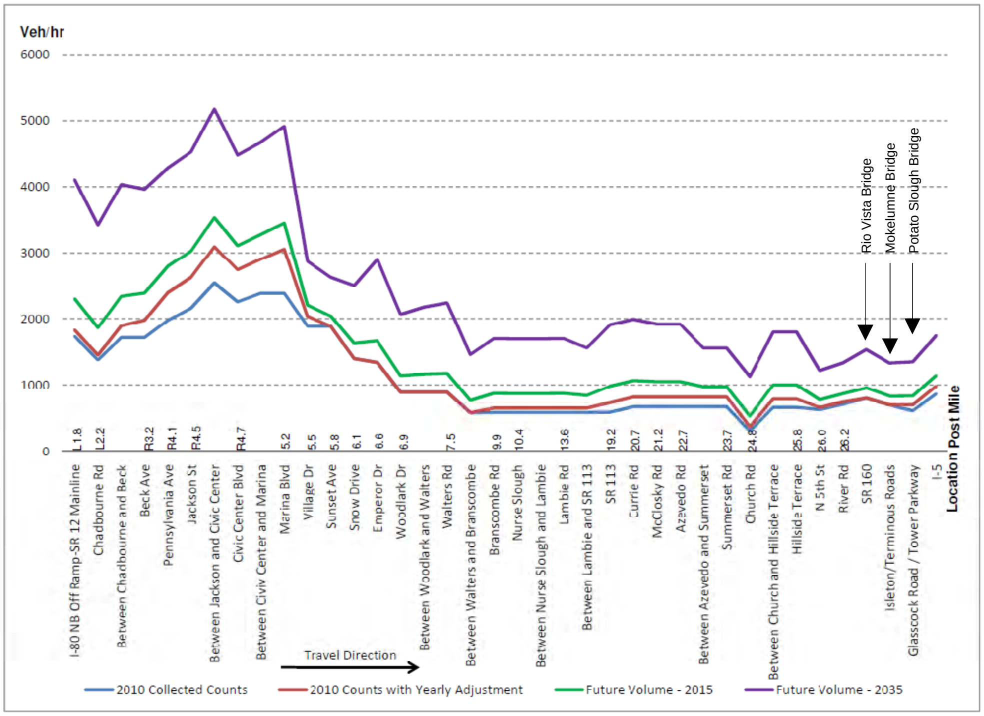
Source: PBS&J traffic analysis, 2011.

Exhibit 2-2: AM Peak Hour Volume Trends for Westbound SR-12



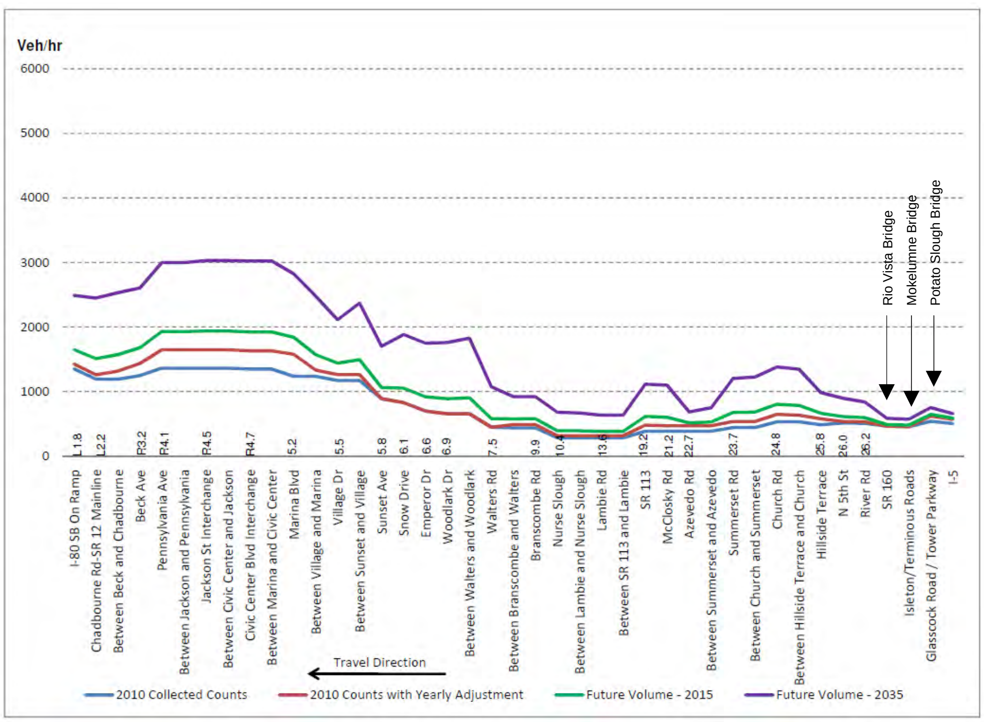
Source: PBS&J traffic analysis, 2011.

Exhibit 2-3: PM Peak Hour Volume Trends for Eastbound SR-12



Source: PBS&J traffic analysis, 2011.

Exhibit 2-4: PM Peak Hour Volume Trends for Westbound SR-12



Source: PBS&J traffic analysis, 2011.

Exhibit 2-5: Future Year (2015) Forecast for the AM Peak Hour

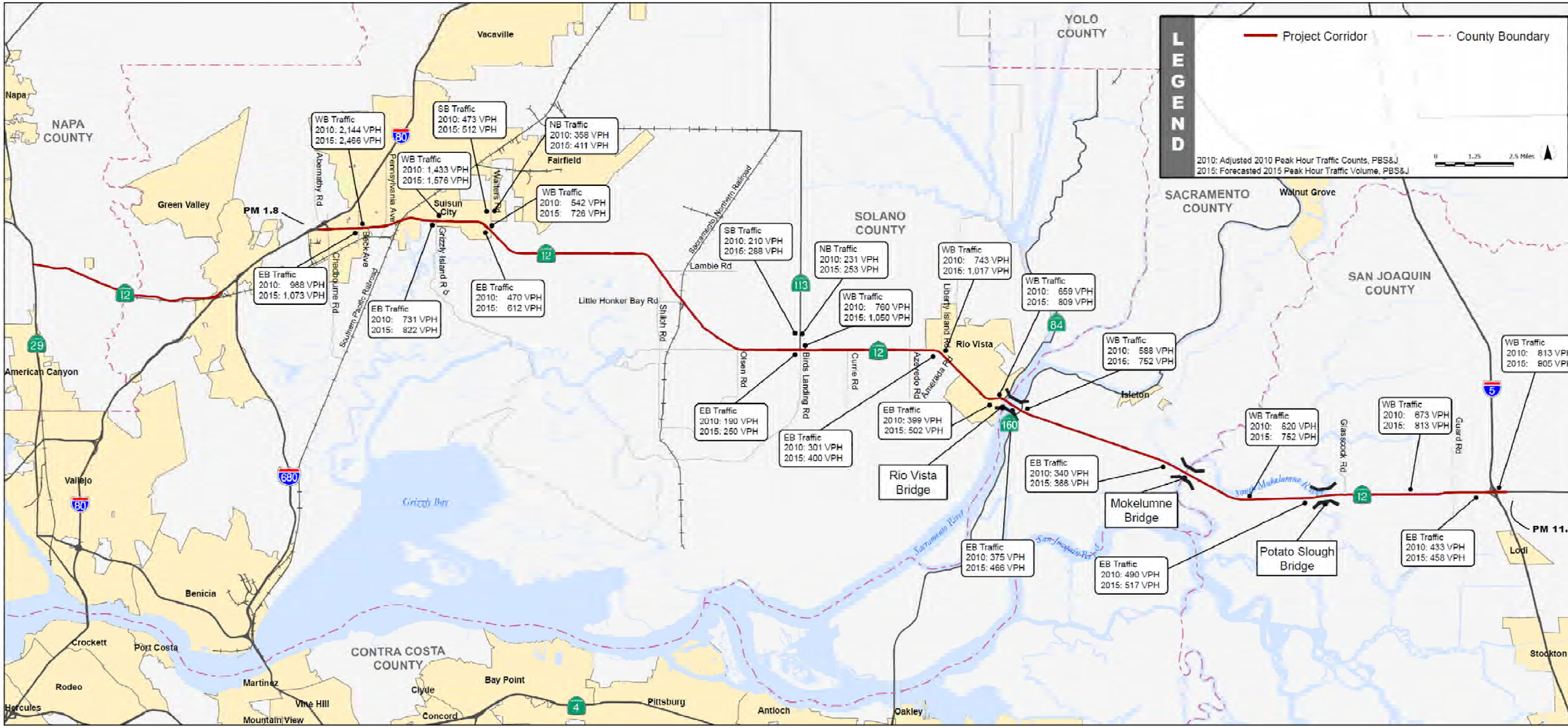


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Exhibit 2-6: Future Year (2015) Forecast for the PM Peak Hour

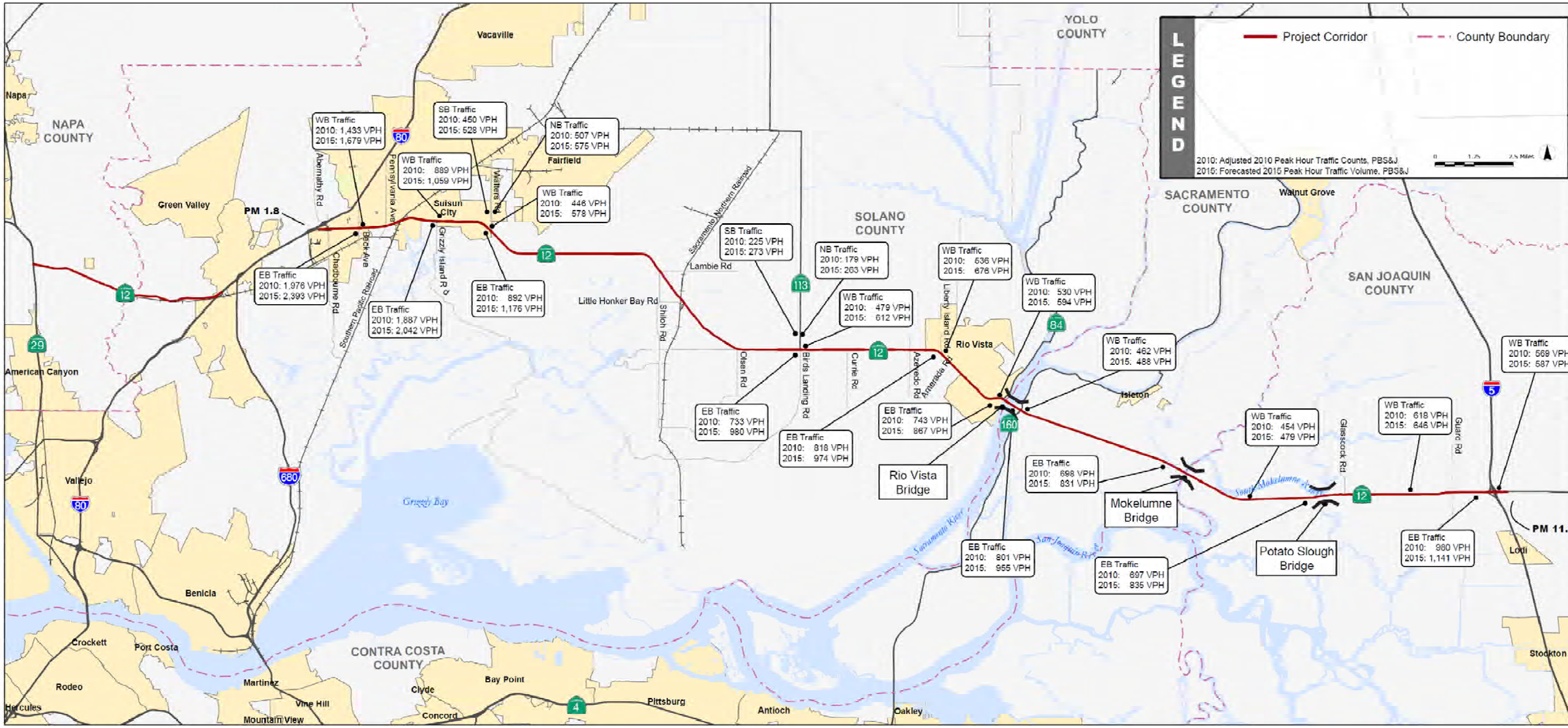

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Exhibit 2-7: Future Year (2035) Forecast for the AM Peak Hour

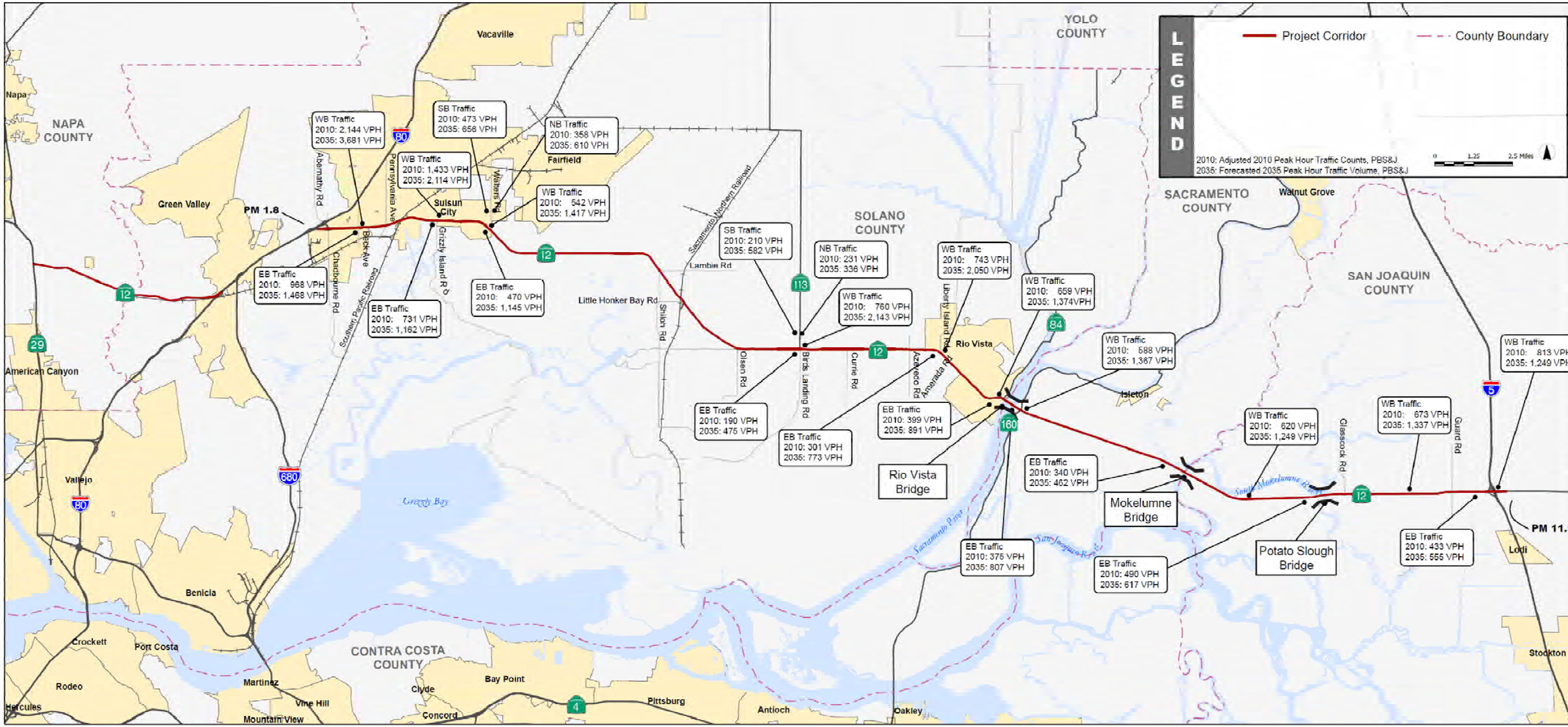

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Exhibit 2-8: Future Year (2035) Forecast for the PM Peak Hour

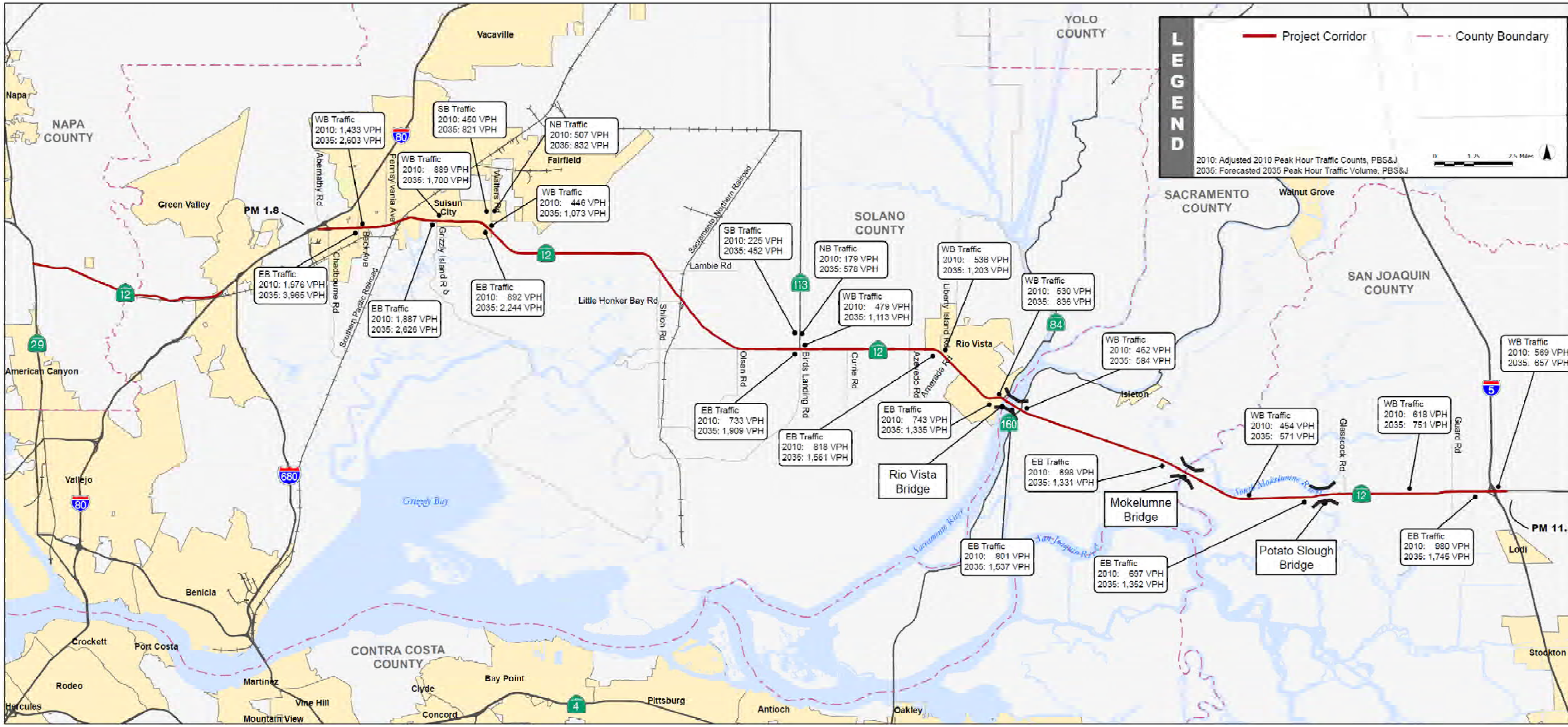

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Exhibit 2-9: Future Year (2015) Forecasts for Average Daily Truck Volumes on SR-12

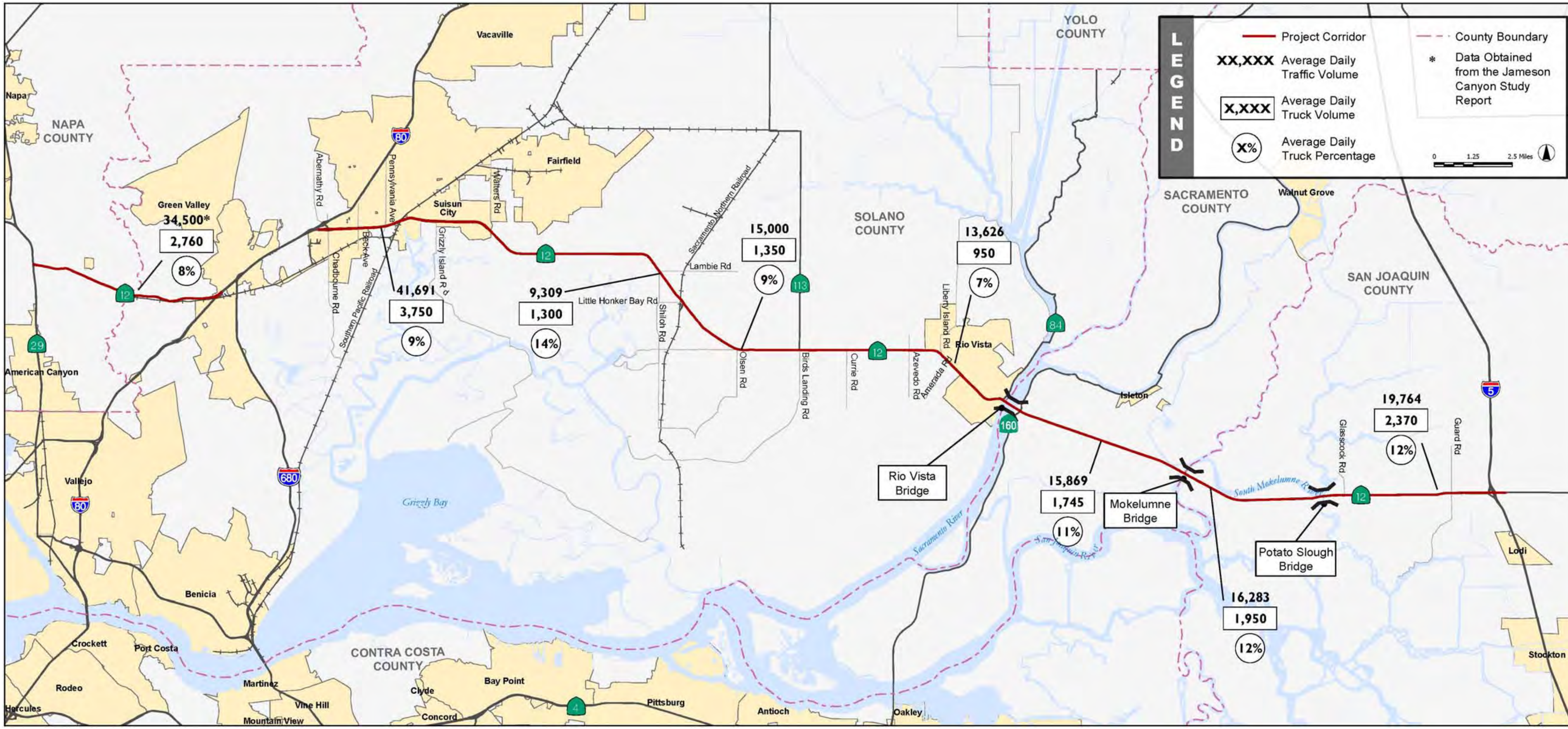

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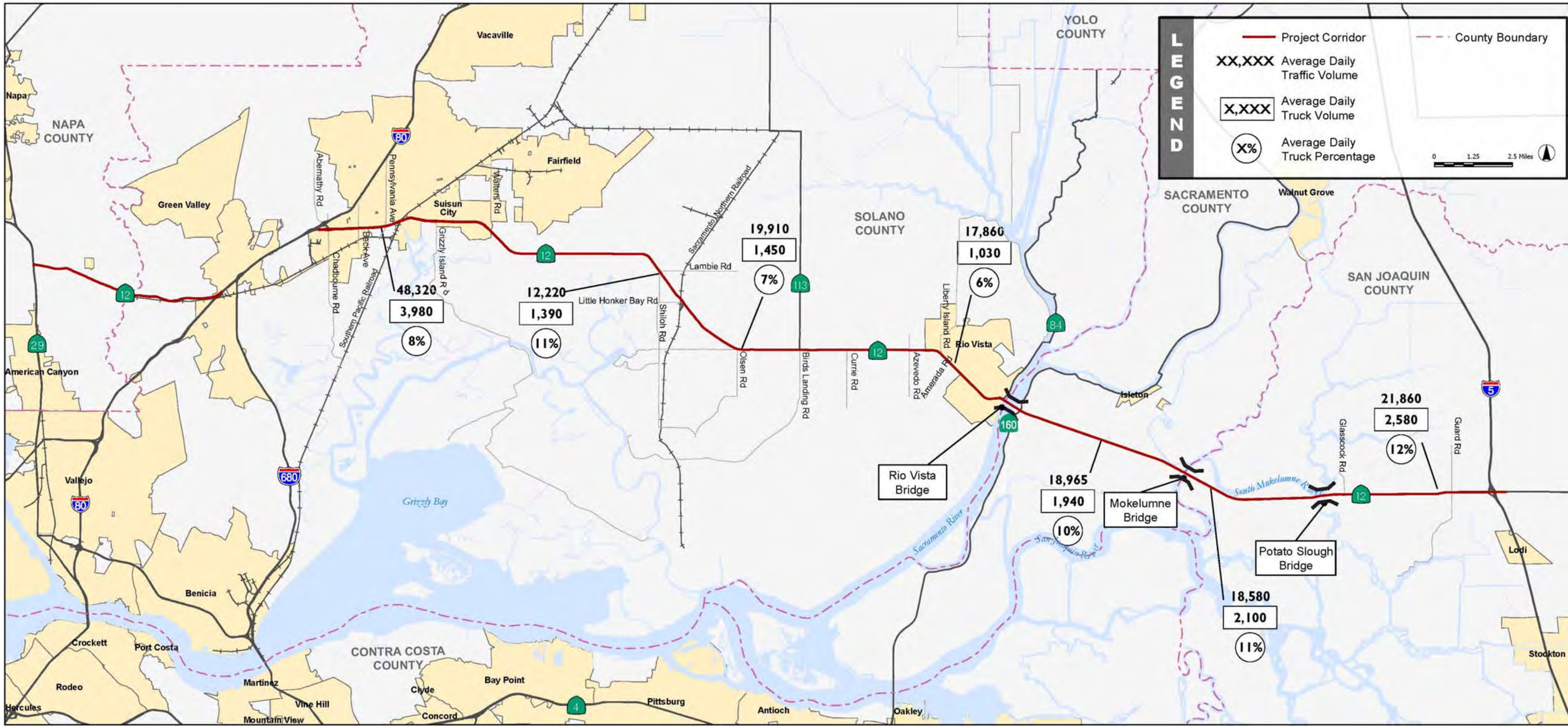
Exhibit 2-10: Future Year (2035) Forecasts for Average Daily Truck Volumes on SR-12



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Recreational Vehicle Traffic

Using three-axle vehicles as a surrogate measure for recreational vehicles in the Draft ECT Report suggested that the upper bound for the percentage of recreational vehicles in average weekday traffic ranged from less than 3% east of SR-160, 5% to 8% between Fairfield and Rio Vista, and about 1% in Fairfield.[21] Because the future growth in traffic is expected to be driven by urban development in the corridor counties, which would contribute disproportionately to the commute and shopping trips in the peak hour, future proportions of recreational vehicles in weekday traffic are expected to be bounded by those experienced currently.

Travel Patterns

Exhibit 2-5 and Exhibit 2-6 illustrate the current pattern and projected future pattern of peak hour traffic flows on SR-12 with AM westbound and PM eastbound peak directions. At the western end of the corridor, this pattern is influenced by Fairfield/Suisun City residents commuting south to jobs in the I-80 and I-680 corridors and using SR-12 for a portion of their trip. In the 2000 Census, 56,000 or 32% of Solano County residents commuted to jobs in counties served by these corridors. The peak direction traffic on SR-12 probably also attracted many of the 459 workers reported as living in San Joaquin County but working in Solano County. Additionally, many of the 322 workers reported living in San Joaquin County could have also driven in the peak direction traffic on SR-12 on their way to reported jobs in Napa, Sonoma, or Marin counties. In the reverse direction, the 2000 Census reported 421 workers living in Solano County but commuting to work in San Joaquin County or adjacent Stanislaus County.[22] In the 2035 forecast, these patterns are projected to continue.

Forecast for Moveable Bridge Operations

The Draft ECT Report described the available data on moveable bridge operations. To summarize, analysis of the 2010 opening data found that the percentages of all openings of the Rio Vista Bridge and Mokelumne Bridge during the PM peak hours of 4 to 6 PM were 11% and 13%, respectively, but bridge openings were down 35% to 56% compared with the 2004 data. The Delta region has abundant recreation opportunities, particularly related to boating activities. The large number of recreational boats in the Delta combined with the low clearance of the Mokelumne and Rio Vista Bridges requires frequent openings during the summer months. Bridge openings from May to September are nearly twice and nearly three times more frequent than other months for the Rio Vista and Mokelumne Bridges, respectively[23]. Please see the referenced Draft ECT Report for further discussion of the existing bridge opening data. PBS&J analysis of additional Caltrans data between 2001 and 2010 showed that this downward trend existed for the entire 10-year period for which data were available. In 2001, there were 173 to 295 openings per month on the Rio Vista Bridge and 325 to 499 openings per month on the Mokelumne Bridge between June and September. In contrast, in 2010 there were 91 to 125 openings per month on the Rio Vista Bridge and 219 to 284 openings per month on the Mokelumne Bridge between June and September[24]. The decline in bridge openings in the peak bridge opening month between 2001 and 2010 was 58% at the Rio Vista Bridge and 43% at the Mokelumne Bridge. The peak bridge opening month for the Rio Vista Bridge is generally August or September, but was as early as May in 2009; the Mokelumne Bridge openings have peaked most consistently in July, but have ranged from June through August in the 10 years of data available. In contrast, June and July are typically the peak highway traffic months on SR-12.

There was one temporary exception to the downward trend for the Rio Vista Bridge when emergency repairs to levees in 2006 almost doubled the June through July bridge openings as compared to the same months in 2005; this jump represented an

21 PBS&J. 2011 (January). *op. cit.,* p. 3-9.
22 U.S. 2000 Census, Residence County to Workplace County Flows for California, 2KRESCO_CA.xls, http://www.census.gov/population/www/cen2000/commuting/index.html, 2/2/11. PBS&J, 2011.
23 PBS&J. 2011 (January). *op.cit,* pp. 4-5 – 4-7.
24 Caltrans District 4 – Division of Maintenance, 2010 and 2011; PBS&J, 2011.

increase of 43% as compared to 2001. Because 2001 data reflect better economic conditions and higher shipping traffic than 2010 conditions, the 2001 data are used to give a conservative base for future bridge operation forecasts. The selected base does not reflect exception conditions such as emergency levee repair. The openings for Potato Slough Bridge are not forecast because the Potato Slough Bridge is opened by appointment only with estimates of less than 10 total openings per year.

While recreation vessels make up the bulk of the waterborne traffic at both the Rio Vista and Mokelumne bridges, there is some freight traffic. Currently, the Port of West Sacramento is receiving approximately 45 ships per year which accounts for 90 Rio Vista Bridge openings. In the past, the Port has had as many as 110 ships within a year, and the Port is currently permitted to receive up to 120 ships per year. The number of ships allowed to travel to the Port is expected to increase beyond the currently permitted number of 120 ships per year as future river traffic is expected to increase with planned Port expansion. The size of ships traveling to the Port is also anticipated to increase with the largest ships expected to be auto vessels. The size of ships is important since larger vessels require a longer opening period, resulting in greater delay at the Rio Vista Bridge.

To account for future increases in waterborne traffic, the frequency of bridge openings was projected to grow at the rate of projected job growth in the three counties (Solano, Sacramento, and San Joaquin). The logic is that the decrease in waterborne traffic for both bridges since 2001 is thought to be primarily the effect of a depressed economy on recreation and freight traffic. Jobs in the three-county area are the best available measure of past and expected future economic conditions that would affect waterborne traffic and resulting bridge openings. A growth rate was developed between historical 2000-2001 jobs and projected 2035 total jobs in the three counties, and then adjusted downward about 22% to reflect the slower growth expected for the manufacturing, wholesale, and transportation sectors.[25] The growth rate of these sectors corresponds more closely to the cargo portion of the waterborne traffic as well as providing a hedge that the Metropolitan Planning Organizations (MPOs) will lower their 2035 jobs forecasts somewhat in the next round of projections as a result of the unemployment lingering longer than expected two years ago.

Exhibit 2-11: Projected Future Year (2035) Forecast Summary for Bridge Openings

	Rio Vista Bridge	Mokelumne Bridge
Monthly Openings	225-440	480-740
Daily Openings	14	24
PM Peak Hour Openings	1	2

The 2035 bridge opening forecast for June through September is summarized in Exhibit 2-11 for the Rio Vista Bridge and the Mokelumne Bridge. The comparable average daily openings in 2015 in the peak bridge opening month would be five for the Rio Vista Bridge and 11 for the Mokelumne Bridge. Bridge opening durations are expected to range from 10 to 25 minutes for the Rio Vista Bridge and 10 to 20 minutes for the Mokelumne Bridge. The longer opening duration for the Rio Vista Bridge allows for the potentially larger vessels on the Sacramento River.

Summary of Section 2

This section presents a description of the future roadway conditions in the corridor and a summary of traffic forecasts for the corridor, including expected traffic composition. A summary of key issues addressed in this section include:

- *Population and Employment Growth Forecast:* Population and employment in San Joaquin County are both projected to grow by about 45% (annual growth rate of 1.5%). Population and employment in the spheres of influence

25 SJCOG 2009 *op. cit.,* ABAG 2009 *op. cit.,* SACOG 2008 *op.cit.*

for the cities of Fairfield, Suisun City, and Rio Vista are projected to grow by 18% and 59% (annual rates of 0.7% and 1.9%), respectively. The City of Rio Vista sphere of influence is expected to grow much faster, increasing its population by 72% and doubling its employment, for annual growth rates of 2.2% and 3%, respectively. Population and employment growth in the Delta area of Sacramento County is projected to be 35% and 8% (annual growth rates of 1.2% and 0.3%), respectively.

- *Traffic Volume Forecast:* Vehicle traffic along the SR-12 Corridor is expected to increase between 2010 and 2035 to nearly triple current volumes in some segments, with average annual growth rates between 2% and 4%. Segments of SR-12 between I-80 and Scally Road are expected to experience volumes that are two to three times higher than those for existing conditions, e.g., from 892 vph to 2,240 vph at Walters Road and from 1,771 vph to 3,975 vph at the I-80 on-ramp in the eastbound PM peak. Remaining segments of SR-12 are projected to experience peak direction volumes that are 50% to 100% higher than those for existing conditions, e.g., from 608 vph to 1,350 vph at Glasscock Road/Tower Parkway in the eastbound PM peak.
- *Travel Mode:* Automobile mode share is expected to be greater than 90% of all commute trips in the SR-12 Corridor, with public transportation accounting for less than 2% of all trips.
- *Truck and Heavy Vehicle Traffic:* While the truck growth rates are forecast to be lower than those for the passenger vehicle traffic, the numbers of trucks on SR-12 are projected to increase substantially by 34% to 71% between 2010 and 2035, depending on location. The absolute numbers of trucks would increase by 500 to 1,300 per day. Daily truck traffic percentages are projected to be between 5% and 12% in 2035.
- *Moveable Bridges:* In 2010, moveable bridge operations were significantly lower than in the recent past due to economic conditions that affected both shipping and recreational traffic. Based on proposed expansion of the Port of West Sacramento, the proposed Sacramento River Deep Water Ship Channel Project, and other potential Marine Highway Corridor improvements, marine traffic is expected to increase significantly by 2035. To account for future increases in waterborne traffic, the frequency of bridge openings was projected to grow at the rate of projected job growth in the three counties (Solano, Sacramento, and San Joaquin), resulting in about 440 and 740 openings in the peak month for the Rio Vista Bridge and the Mokelumne Bridge, respectively, in 2035. These numbers correspond to approximately one opening in the PM peak hour for the Rio Vista Bridge and two openings in the PM peak hour for the Mokelumne Bridge in 2035.

These key issues will be evaluated during the development of corridor improvement strategies to mitigate corridor safety, congestion, and operational issues along the corridor.

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Section 3: Future Conditions Performance Analysis

Performance evaluation for future conditions was conducted using micro-simulation and macro analysis tools. Input volume data for the analysis was derived from the travel demand analysis conducted as a part of this study. Operational performance of the corridor is quantified using operating speeds and intersection delay. This section includes a discussion of the methods and tools used to identify congestion, and it presents an analysis of existing conditions with a focus on identifying congested areas, bottlenecks and the causes of these delays.

Selection and Calibration of the Future Conditions Analysis Tool

Software Selection

The SR-12 Corridor serves both dense urban areas along with rural segments. The west end of the study area is an urban corridor with fairly dense signalization of intersections and serves the Fairfield/Suisun city metro area trips. SR-12 east of the Fairfield/Suisun metro area is a critical east-west link between I-80 and I-5 and functions primarily as a rural highway that includes three moveable bridges and serves regional trips. As such, the traffic analysis software must be suitable for analyzing both the urban and rural highway operation adequately.

Several software packages were considered for use on this study. The SYNCHRO and CORSIM software packages were selected as preferred analysis tools for the SR-12 Study based, among other things, on their suitability for analyzing both the urban and rural highway operation. SYNCHRO is a macroscopic software tool that performs intersection and arterial capacity analysis based on ICU and HCM methodologies. SYNCHRO software is also a powerful signal optimization, timing and modeling tool that can model most urban roadway operations. SimTraffic is companion software to SYNCHRO and performs micro-simulation analysis of all traffic systems including signalized and unsignalized intersections as well as highway segments while accommodating various vehicular modes and pedestrian traffic. SYNCHRO software directly interfaces with CORSIM software such that signal timings can be optimized in SYNCHRO and exported to CORSIM for a more robust micro-simulation analysis of the rural highway segments.

CORSIM is a micro-simulation software developed by FHWA that can analyze all elements of the roadway networks including freeway, urban highway, rural highways and ramps. The CORSIM software yields both microscopic and macroscopic analysis of networks along with a rich set of measures of effectiveness (MOEs) that can be used to quantify operations effectively. Two-lane rural highway and capacity constrained segments including bridge closures can be effectively modeled with CORSIM. In consultation with MTC, the macroscopic simulation model was chosen as the most appropriate analysis tool to be applied to the future conditions analysis of the SR-12 Corridor.

Model Calibration

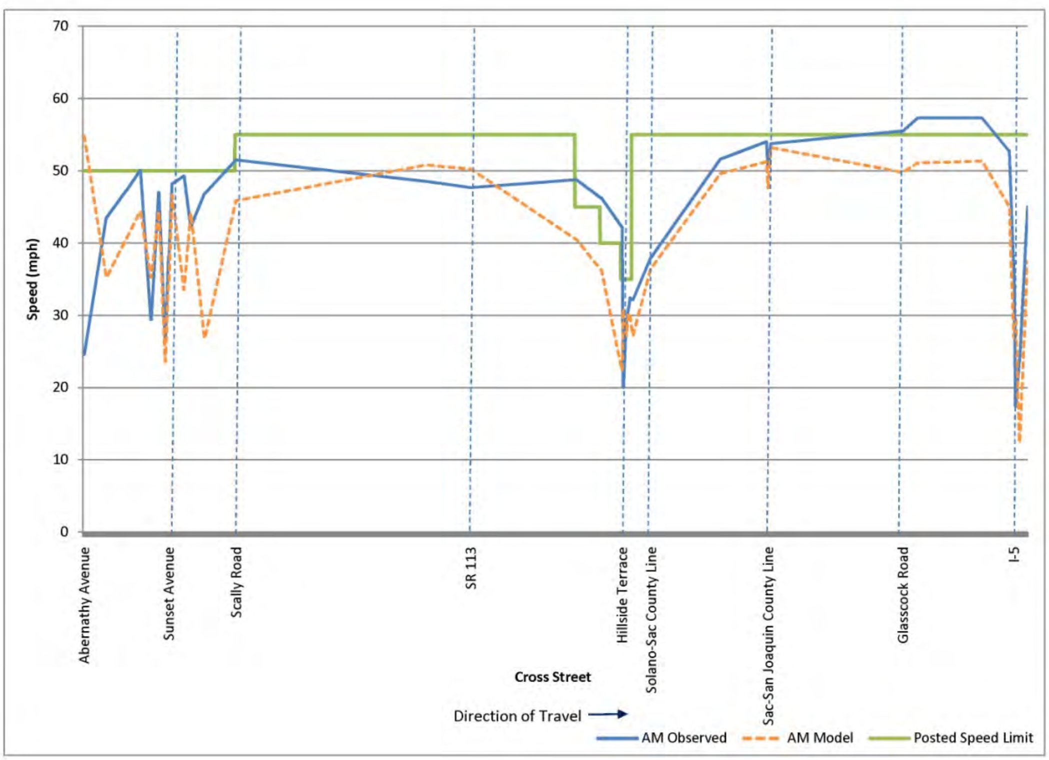
The traffic analysis tools were calibrated to match field observed discharge volumes and average segment travel speeds. Speed distribution, lane change parameters, headway distribution, vehicle arrival distribution, start up lost time, and route familiarity factors were reviewed along with vehicle parameters to ensure that the models were producing reasonable results. The goal of the calibration exercise was to ensure that the model predicted speeds were within 10% of field observed speeds for a majority of the segments. Comparative graphs showing segment travel speeds for AM and PM peak hours are presented in Exhibit 3-1 through Exhibit 3-4.

As can be seen from Exhibit 3-1 and Exhibit 3-3, travel speeds from the model for the eastbound direction are similar to those observed in the field. The eastbound direction is the off-peak direction for the AM peak and experiences lower volumes than the westbound direction. The highest speed variation observed for the eastbound direction is approximately 4 mph for a majority of the corridor segments. Similarly, model travel speeds in the westbound direction follow a trendline that is similar to field observed data with most of the segments being approximately 5 mph lower then observed speeds. These variations were deemed to be acceptable and the AM model was considered to be reasonably calibrated.

As can be seen from Exhibit 3-2 and Exhibit 3-4, model travel speeds in the westbound direction follow a trendline that is similar to field observed data with most of the segments being approximately 5 mph lower than observed speeds. Westbound direction is the peak direction for the AM peak and experiences higher volumes than the eastbound direction. A slightly higher deviation in speed is observed on uninterrupted flow segments of SR-12 in the westbound direction due to the tendency of drivers to drive at or slightly above speed limit. The deviation between model speeds and observed speeds, however, is approximately 12% at the highest point. The model functions acceptably with speeds on most of the westbound segments within 10% of the observed speeds.

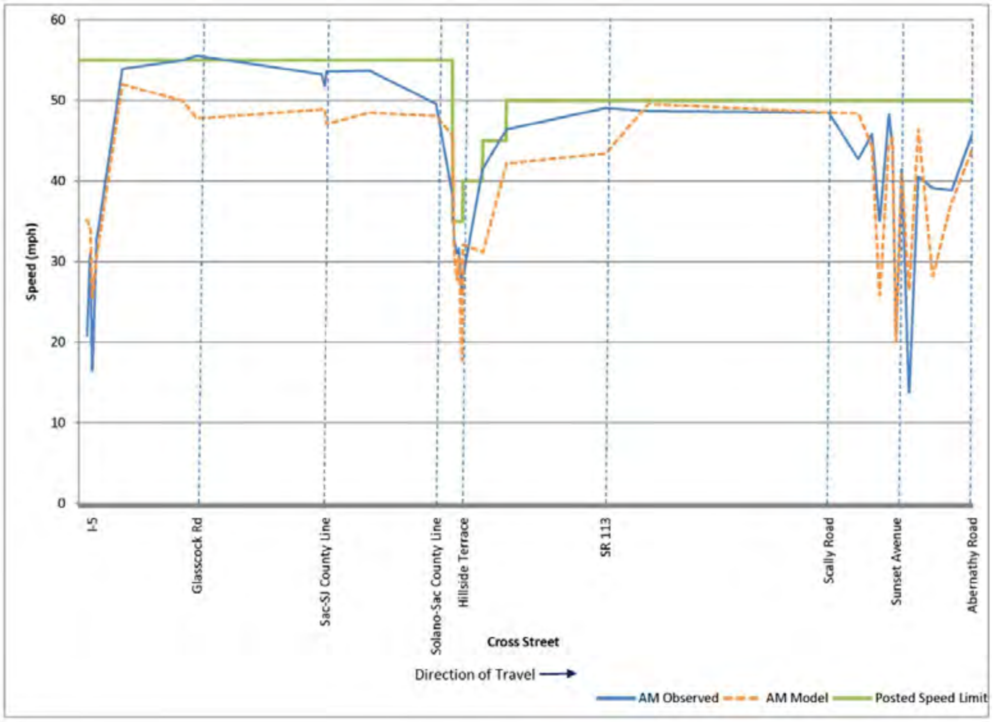
Travel speeds from the model for the PM peak are similar to those observed in the field. Eastbound direction is the peak direction for the PM and experiences higher volumes than the westbound direction. The highest speed variation observed for the eastbound direction was approximately 6 mph for a majority of the free flow segments of the corridor. Deviation in speed observed on uninterrupted flow segments of SR-12 in the eastbound direction may be attributed to the tendency of drivers to drive at or slightly above speed limit. The deviation of speeds for observed speeds, however, is within acceptable limits and the model functions acceptably with speeds on most of the westbound segments within 10% of the observed speeds. Model speeds are identical to those observed for signalized segments of the corridor. These variations were deemed to be acceptable and the PM model was considered to be reasonably calibrated.

Exhibit 3-1: Comparison of Observed and Modeled Speeds for Eastbound SR-12 during the AM Peak hour



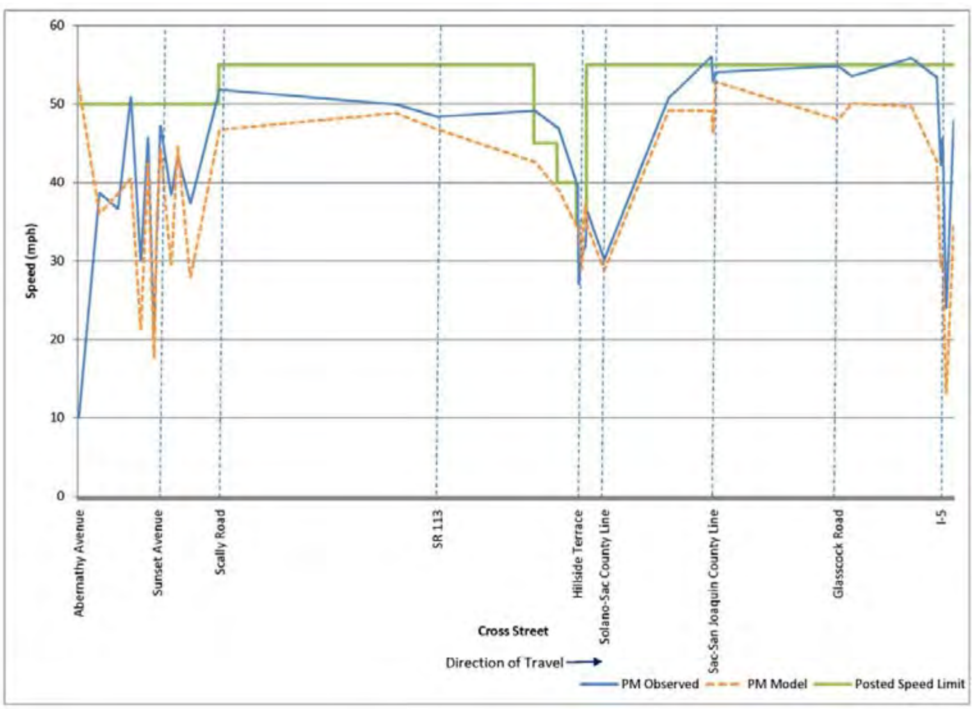
Source: PBS&J traffic analysis, 2011.

Exhibit 3-2: Comparison of Observed and Modeled Speeds for Westbound SR-12 during the AM Peak hour



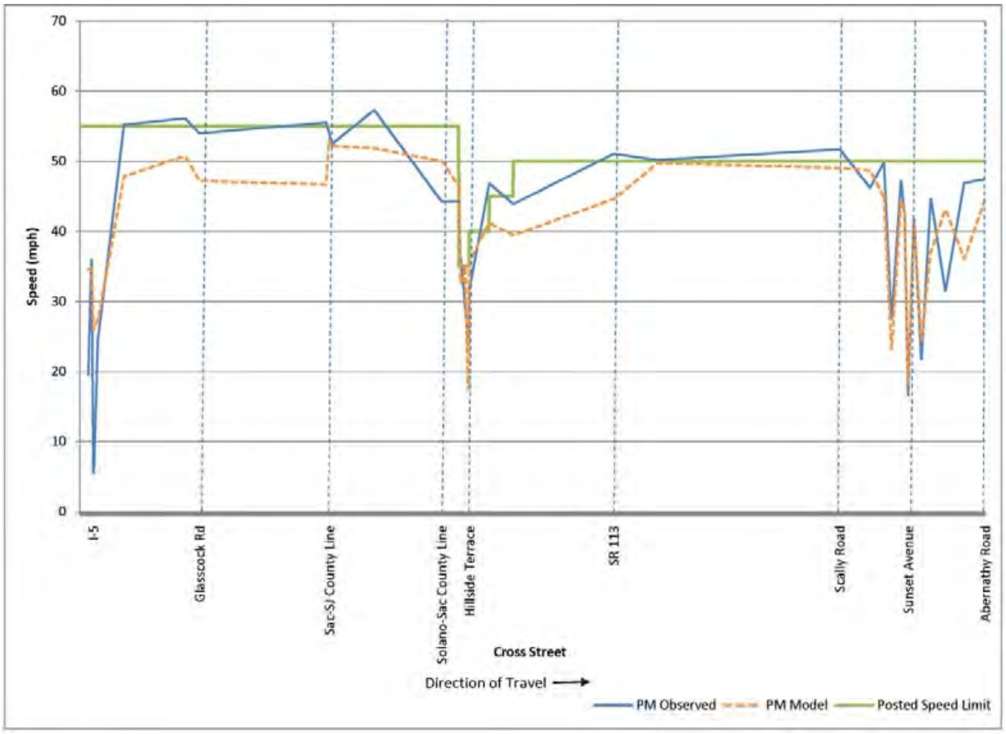
Source: PBS&J traffic analysis, 2011.

Exhibit 3-3: Comparison of Observed and Modeled Speeds for Eastbound SR-12 during the PM Peak hour



Source: PBS&J traffic analysis, 2011.

Exhibit 3-4: Comparison of Observed and Modeled Speeds for Westbound SR-12 during the PM Peak hour



Source: PBS&J traffic analysis, 2011.

Model discharge volumes on various segments of SR-12 were compared to measured volumes to ensure that the model was able to process demand adequately. The GEH statistic[26] was used as a metric to quantify the adequacy of the model. GEH is a statistic used to compare two sets of similar volume entities. The GEH statistic is an empirical formula as opposed to a statistical test but provides a stable form of comparison for data sets that have a wide variation in the population range (ex: corridors that carry heavy and light volumes on different segments). The acceptance criterion for GEH is typically a value of five or less for most segments of a corridor while examining peak hour volumes. Exhibit 3-5 summarizes the GEH values for various segments of SR-12 in both directions for the AM and PM peak.

Results of the comparative analysis of SR-12 segments in the peak direction indicate that more that 85% of the segments have a GEH value of three or lower during the AM peak hour and approximately 86% of the segments have a GEH value of three or lower in the PM peak hour. Approximately 95% of the SR-12 segments in the off peak direction during the AM peak hour, and almost all segments during the PM peak hour, function with a GEH value of three or lower. In summary, the results of the GEH analysis indicate that the GEH value is typically lower than three for most locations and that the model is functioning acceptably under AM and PM peak hour volumes.

26 The GEH Statistic, named after Geoffrey E. Havers, is an empirical formula used in traffic modeling to compare two sets of traffic volumes. Though not a true statistical test, the GEH Value has proven useful for traffic analysis purposes. The formula for the GEH Statistic is $GEH = \sqrt{\frac{2(M-C)^2}{M+C}}$, where M is the hourly traffic volume from the traffic model (or new count) and C is the observed hourly traffic count.

Exhibit 3-5: Comparison of Observed and Modeled Traffic Volumes

Cross Street	AM						PM					
	EB			WB			EB			WB		
	Observed	Model	GEH	Observed	Model	GEH	Observed	Model	GEH	Observed	Model	GEH
Chadbourne Road WB on/off-ramps	842	780	2.18	1771	1694	1.85	1735	1878	3.36	1192	1183	0.26
Beck Avenue	842	866	0.82	1864	1844	0.46	1718	1644	1.80	1246	1294	1.35
Pennsylvania Avenue	889	928	1.29	1908	1765	3.34	1975	2035	1.34	1360	1309	1.40
Civic Center Blvd	914	987	2.37	2299	2216	1.75	2390	2362	0.57	1242	1321	2.21
Marina Blvd	794	832	1.33	1780	1693	2.09	2390	2476	1.74	1234	1254	0.57
Village Drive	731	822	3.27	1730	1667	1.53	1887	1986	2.25	1169	1176	0.20
Sunset Avenue	731	820	3.20	1433	1345	2.36	1887	1972	1.94	889	872	0.57
Lawler Center Drive	586	666	3.20	1427	1339	2.37	1400	1460	1.59	873	823	1.72
Snow Drive	545	614	2.87	1349	1253	2.66	1340	1419	2.13	829	785	1.55
Emperor Drive	545	617	2.99	990	895	3.09	1340	1416	2.05	696	649	1.81
Woodlark Drive	470	533	2.81	853	806	1.63	892	944	1.72	655	605	1.99
Walters Road	470	527	2.55	542	492	2.20	892	932	1.32	446	406	1.94
Scally Road	299	317	1.03	487	392	2.57	580	606	1.07	435	398	1.81
Little Honker Bay Road	150	181	2.41	486	430	2.62	584	605	0.86	283	245	2.34
SR 113	153	154	0.08	611	585	1.06	589	605	0.65	385	378	0.36
Summerset Drive	247	259	0.75	610	608	0.08	672	656	0.62	440	429	0.53
Church Road	306	277	1.70	614	617	0.12	637	572	2.64	531	513	0.79
Hillside Terrace	323	343	1.10	561	613	2.15	590	513	3.28	483	474	0.41
Main Street	383	308	4.03	614	566	1.98	661	574	3.50	531	498	1.45
Gardiner Way	332	323	0.50	553	555	0.08	628	561	2.75	482	502	0.90
N 5th Street	330	318	0.67	605	618	0.53	629	570	2.41	511	521	0.44
Virginia Drive	356	347	0.48	586	579	0.29	660	600	2.39	536	532	0.17
River Road	380	369	0.57	628	605	0.93	708	658	1.91	505	486	0.85
SR 160	375	361	0.73	588	570	0.75	801	764	1.32	462	418	2.10
Jackson Slough Road	427	425	0.10	574	571	0.13	791	800	0.32	448	442	0.28
W. Terminous Road	329	323	0.33	588	597	0.37	711	687	0.91	450	433	0.81
Brannan Island Road	372	352	1.05	592	641	1.97	724	687	1.39	454	491	1.70
E. Terminous Road	371	351	1.05	594	654	2.40	698	659	1.50	481	517	1.61
Glasscock Road	408	364	2.24	619	672	2.09	901	830	2.41	501	539	1.67
Correia Road	402	354	2.47	620	690	2.74	900	803	3.32	502	558	2.43
N. Guard Road	383	342	2.15	587	654	2.69	865	768	3.39	539	589	2.11
I-5 SB on/off-ramps	382	325	3.03	741	817	2.72	600	633	1.33	817	870	1.82
I-5 NB on/off-ramps	312	278	1.98	718	785	2.44	594	524	2.96	736	792	2.03
N. Thornton Road	523	493	1.33	718	788	2.55	895	872	0.77	736	790	1.95
Star Road	476	457	0.88	445	482	1.72	764	759	0.18	502	542	1.75

Source: PBS&J traffic analysis, 2011.

Analysis Methodology

The analysis methods are designed to address mobility, travel times, reliability, and safety in the corridor. Intersection delay and Level of Service (LOS) were extracted from the SYNCHRO software using the Highway Capacity Manual (HCM) prescribed methodologies and travel times/speeds were extracted from the CORSIM model for AM and PM peaks.

The methodology used for the evaluation began with a review of projected travel demand for the study corridor and development of turning movement counts for year 2035 based on projected link volumes. Truck volume was updated to reflect future anticipated truck ratios. Updates were then performed to intersection geometry to match those proposed in the committed projects list. Finally, signal timing was optimized to develop suitable plans for AM and PM peak future conditions. Cycle length for the signals was maintained at a maximum of 120 seconds during the optimization.

The primary measures of mobility are travel time, speed, and delay. As stated previously, this study defines recurrent delay due to congestion as vehicles operating at LOS D, E or F. Level of Service is a measure of performance commonly used to define variations in traffic flow at intersections and on mainline roadways. It is defined in the HCM prepared by the Transportation Research Board and described further hereinafter for both intersections and mainline segments. Intersection and mainline SR-12 operations are quantified using LOS and a corresponding delay and speed value. Generally, LOS relates traffic volume to roadway capacity. It is calculated differently for intersections than for mainline roadway segments and for different classifications of roadways, rural highways, and urban streets, but generally LOS is a function of vehicle delay and travel speed. To identify bottlenecks and congested areas, travel time runs for the analysis period were plotted for the average weekday. Locations with significant delays were identified by evaluating the analysis data from analysis models, travel time data, traffic demand counts and field observations.

Intersection LOS

Intersection operations are quantified using Level of Service (LOS) and a corresponding delay and speed value. Intersection LOS ranges from A (which indicates free flow or excellent conditions with short delays) to F (which indicates congested or overloaded conditions with long delays). The HCM methodology computes the average control delay for each approach to an intersection, expressed in terms of seconds/vehicle (sec/veh). For signalized and all-way stop controlled (AWSC) intersections, the control delay is computed by taking an average of the delay experienced by all vehicles on all approaches to the intersection and reporting an intersection-wide single average value. For two-way stop controlled (TWSC) intersections, the delay is computed for each approach separately and the delay on the worst approach is the value reported for the intersection. The control delay is then used to assign a LOS based on defined ranges in the HCM (Chapters 16 and 17). The HCM methodology of analyzing intersections has some limitations with regards to accounting for presence of upstream and downstream capacity constraints. Micro-simulation analysis was conducted through the use of CORSIM to counter this limitation. As a result, the effect of constrained intersections on adjacent segments and intersections are included in the calculation of bottleneck locations, operating speeds and travel times reported as a part of this study. The analysis of all intersections was performed using Synchro (Version 7). For this analysis, intersection delay at signals is reported as an average delay for all approaches whereas unsignalized delay is the worst delay experienced by the side street. Exhibit 3-6 contains LOS criteria for intersections.

Exhibit 3-6: Delay Thresholds for Intersection LOS

Level of Service	Signalized Intersection Delay (sec/veh)	Unsignalized Intersection Delay (sec/veh)
A	0 – 10	0 – 10
B	>10 - 20	>10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50
Source: Highway Capacity Manual, Transportation Research Board.		

Mainline Segment LOS

Operations for a segment of roadway are typically quantified using LOS ranges similar to that of intersections. LOS for urban street segments is determined by the operating speed of the segment. Intersection operating characteristics are used as input to the mainline segment analysis. LOS for two-lane highways is determined by the amount of time vehicles spend in a platoon following other slower vehicles. The percent time spent following is a quasi measure of operating speeds and the degree of freedom available to vehicles. Exhibit 3-7 shows LOS criteria as defined in the HCM manual for roadway segments.

Operations on SR-12 are quantified based on average travel speed. Segments of SR-12 between I-80 and Scally Road far exceed the available capacity and are projected to experience the most congestion. These delay trends are reflected in slower travel times for these segments.

Exhibit 3-7: LOS Criteria for Roadway Segments

LOS	Two-Lane Highway		Class I Urban Street (45-55 mph)
	Time Spent Following (%)	Average Speed (mph)	Average Speed (mph)
A	≤35	>55	>42
B	>35-50	>50-55	>34-42
C	>50-65	>45-50	>27-34
D	>65-80	>40-45	>21-27
E	>80	≤40	>16-21
F	N/A	N/A	≤16
Source: Highway Capacity Manual, Transportation Research Board.			

Short-Term Future (2015) Analysis

Volumes derived from the forecasting task for year 2015 were used as input to the calibrated existing conditions model to generate the 2015 analysis model. Review of the demand projection indicated that a growth of 15% to 30% is anticipated for mainline SR-12 over the next five years. The additional growth projected for the corridor is anticipated to result in volumes that are very close to the capacity of segments; with the highest volumes occurring on segments in the west and east ends of the corridor.

Short-Term Future Performance Measures

Performance of various elements of the SR-12 Corridor was quantified using the criteria described in the analysis methodology section. Intersection performance is described in terms of LOS which is in turn based on the average delay experienced by vehicles traversing an intersection. Mainline segments are evaluated based on the anticipated average travel speeds on the study segment. Additional corridor-wide measures such as vehicle miles of travel, vehicle hours of travel, total corridor delay and travel time are described in the corridor measures of effectiveness section.

Intersection Analysis

Operations at several intersections are expected to worsen for 2015 volume conditions as compared to existing conditions. Approximately 34% (15 intersections) are projected to operate at LOS E or F under 2015 volume conditions as compared to 10% (four intersections) under existing conditions volumes. Exhibit 3-8 summarizes the intersection operations for the study corridor and Exhibit 3-9 shows the location of congested intersections for 2015.

Exhibit 3-8: Intersection LOS for SR-12 for Future Year (2015)

County	Intersection Name	AM		PM	
		Delay	LOS	Delay	LOS
Solano	I-80 WB on-ramp & Chadbourne Road *	136.6	F	16.1	C
	Auto Mall Pkwy & Chadbourne Road	17.2	B	15.8	B
	SR-12 WB on-ramp & Chadbourne Road	12.4	B	13.2	B
	SR-12 EB off-ramp & Chadbourne Road*	18.7	B	18.1	B
	Busch Drive & Chadbourne Ave	13.8	B	22.3	C
	SR-12 & Beck Avenue	112.6	F	105.9	F
	SR-12 & Pennsylvania Ave	174.8	F	149.8	F
	SR-12 & Parking Lot*	1.0	A	1.0	A
	SR-12 & Marina Boulevard	250.8	F	135.2	F
	SR-12 & Village Blvd*	351.7	F	115.3	F
	SR-12 & Sunset Ave	79.6	E	34.2	C
	SR-12 & Lawler Drive*	21.9	C	15.6	C
	SR-12 & Snow Drive*	30.7	D	14.1	B
	SR-12 & Emperor Drive	48.2	D	36.8	D
	SR-12 & Woodlark Drive*	19.8	C	12.2	B
	SR-12 & Walters Road	30.7	C	26.8	C
	SR-12 & Scally Road*	24.6	C	25.7	D
	SR-12 & Nurse Slough Road*	1.0	A	39.1	E
	SR-12 & Denverton Road*	13.0	B	46.7	E
	SR-12 & Shiloh Road*	1	A	40.0	E
	SR-12 & Little Honker Bay Road*	9.4	A	14.6	B
	SR-12 & SR-113*	23.4	C	126.4	F
	SR-12 & Summerset Drive	10.8	B	10.3	B
	SR-12 & Church Road*	50.8	F	29.4	D
	SR-12 & Hillside Terrace	23.7	C	20.3	C
	SR-12 & Gardiner Way*	25.6	D	28.4	D
	SR-12 & N 5th*	43.5	E	44.8	E
	SR-12 & Virginia Road*	55.9	F	123.1	F
	SR-12 & River Road*	16.8	C	31.3	D
Sacramento	SR-12 & SR-160	44.1	D	61.5	E
	SR-12 & Jackson Slough Road*	33.1	D	92.8	F
	SR-12 & Terminous Road*	29.7	D	1.0	A
	SR-12 & Brannan Island Road*	23.2	C	1.0	A
San Joaquin	SR-12 & Terminous Road*	44.3	E	375	F
	SR-12 & Glasscock Road*	28.0	D	57.4	F
	SR-12 & Correia Road*	12.1	B	27.9	D
	SR-12 & N Guard Road*	49.4	E	32.7	D
	SR-12 & I-5 SB off-ramp	15.4	B	18.5	B
	SR-12 & I-5 NB on-ramp	24.2	C	22.3	C
	SR-12 & N Thornton Road*	10.6	B	12.1	B
	SR-12 & N Thornton Road	36.8	D	35.1	D
	SR-12 & N Flag City Blvd*	22.0	C	43.5	E

Source: PBS&J traffic analysis, 2010.

*Unsignalized intersection; LOS based on worst approach delay.

Bold designates intersections with poor conditions (i.e., LOS E or LOS F). Source: PBS&J traffic analysis, 2010.

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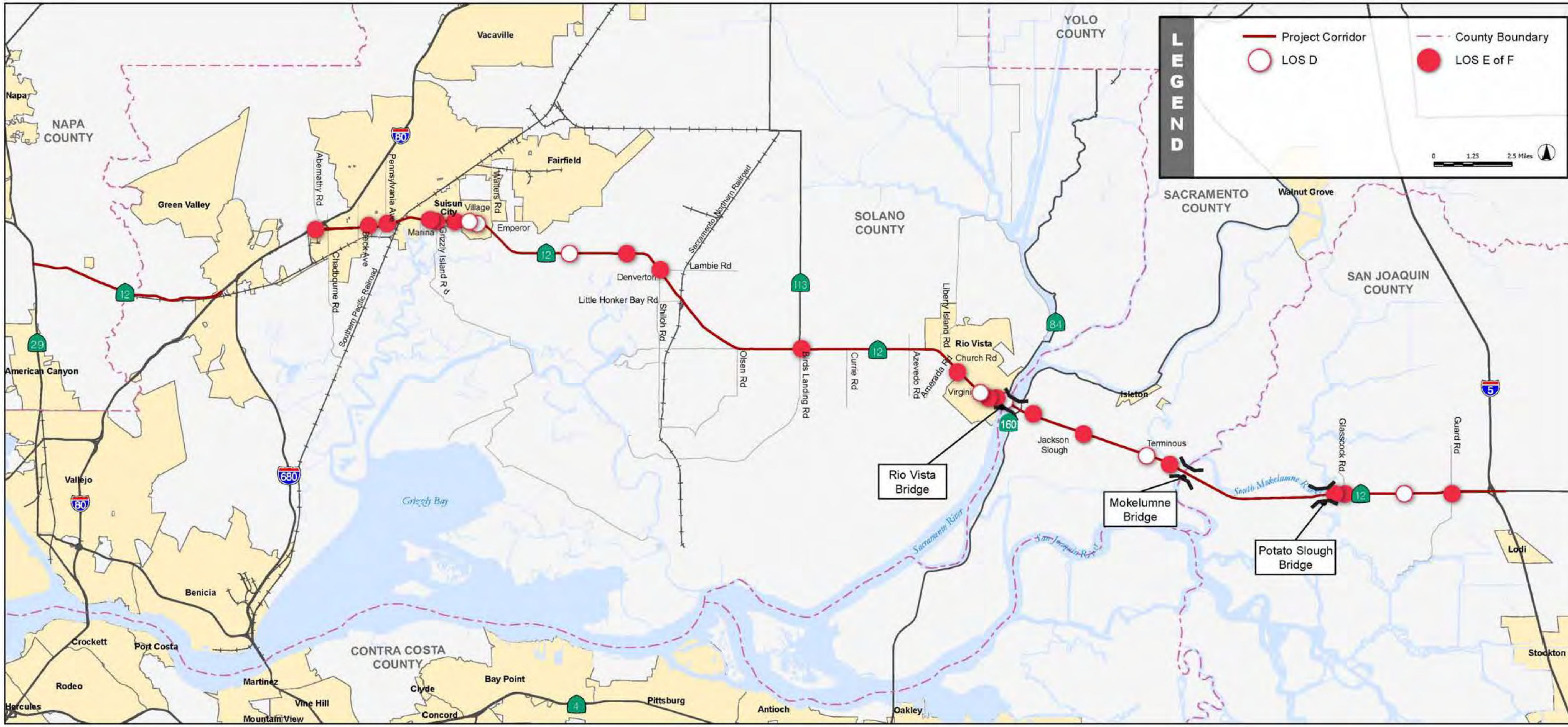
Exhibit 3-9: Intersections where Projected Demand Exceeds Available Capacity for Future Year (2015)



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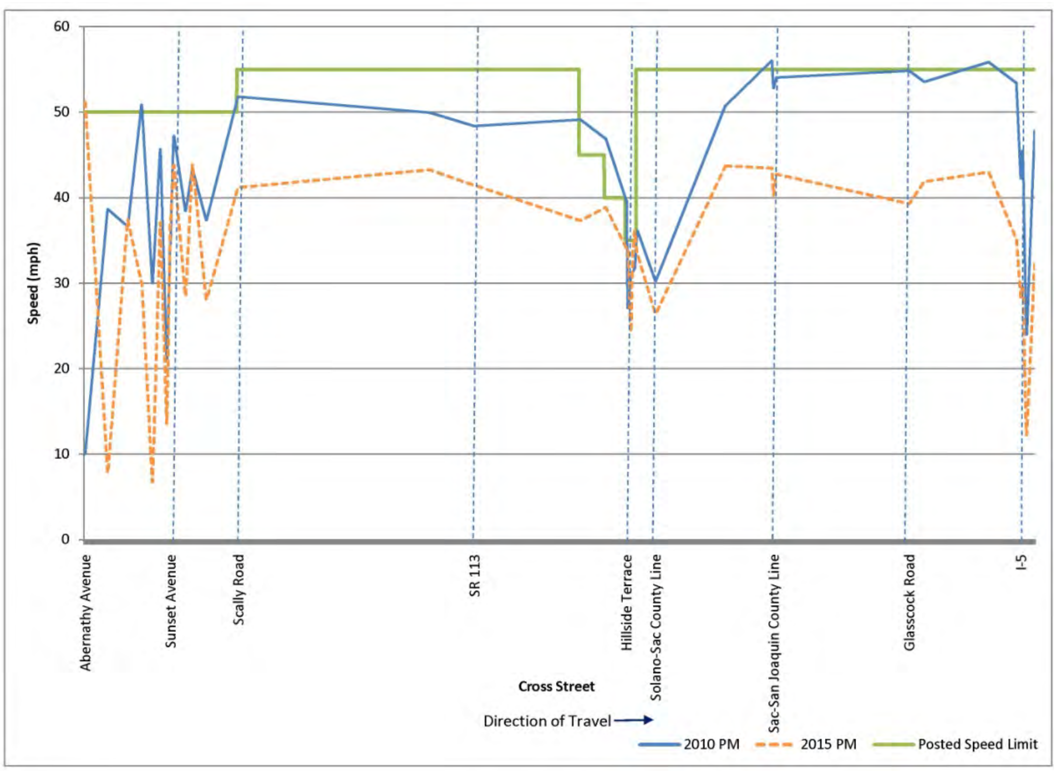
Segment Analysis

Operations on SR-12 are quantified based on average travel speed. Segments of SR-12 between I-80 and Scally Road are projected to experience the most congestion. These delay trends are reflected in slower travel times for these segments. Operational analysis of segments includes operations of the intersections and accounts for bottlenecks at intersections along with any capacity constraints present on other segments. Travel speeds will be used as a key measure of effectiveness for quantifying segment operations; which are discussed by direction in the following sub-sections.

Eastbound SR-12 Travel Speeds

Exhibit 3-10 shows the speed profiles for SR-12 in the eastbound direction of travel. Slower speeds are observed from the SR-12 and I-80 interchange to Pennsylvania Avenue (just west of the Scally Road intersection). Segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 10 mph to 25 mph during the PM peak hour. With the exception of the stretch of SR-12 between Hillside Terrace and the River Road intersection, which functions at an average speed of 30 mph, segments of SR-12 between Scally Road and I-5 function at an average speed of 40 mph. The average operating speeds under existing volume conditions for these segments are in the vicinity of 50 mph to 55 mph. The western segments of SR-12 experience higher levels of congestion under 2015 volume conditions as compared to existing conditions but the anticipated demand does not significantly exceed the capacity of most of the segments. This results in acceptable but longer travel times under 2015 volume conditions.

Exhibit 3-10: Projected Travel Speeds for Eastbound SR-12 during the PM Peak hour

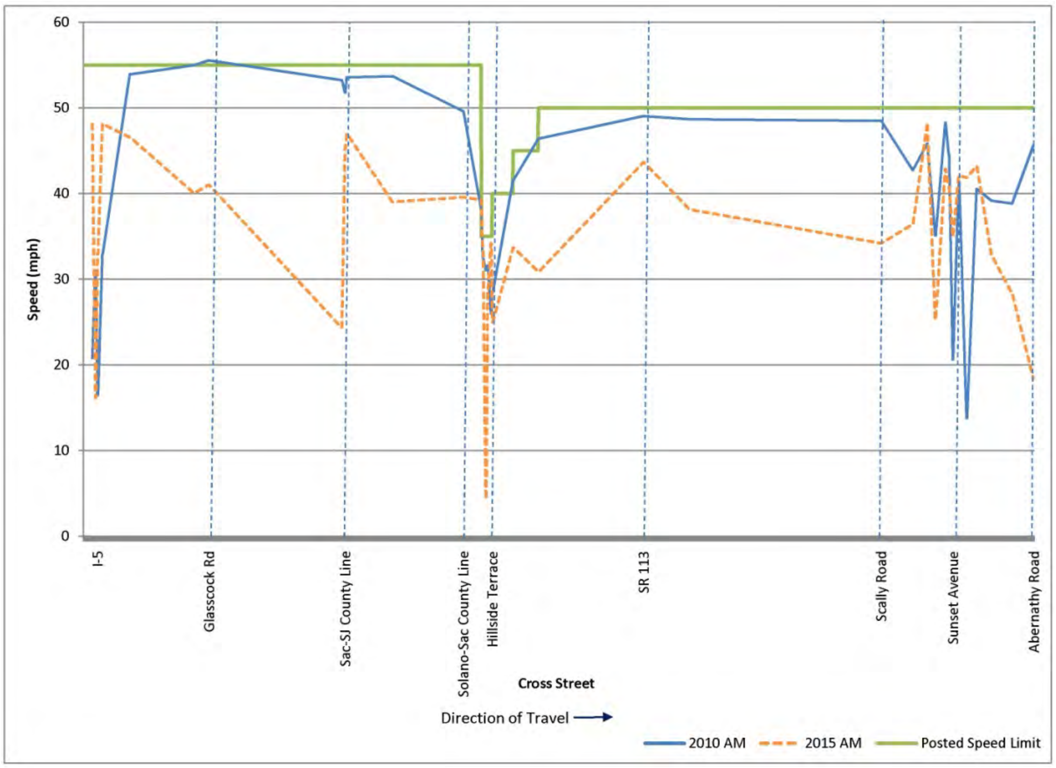


Source: PBS&J traffic analysis, 2011.

Westbound SR-12 Travel Speeds

Exhibit 3-11 illustrates the speed profile in the westbound direction of travel. The coverage shown in the exhibit is from I-80 (Chadbourne Road) in the west to I-5 in the east. Review of the speed profile data indicates that the average speeds for most segments of the corridor are lower than speeds for existing conditions by approximately 10 mph to 15 mph. Segments of SR-12 from Glasscock Road to Brannan Island Road function at approximately 35 mph which is much lower than most of the other study segments. Slower speeds were also observed in the vicinity of Rio Vista near the River Road interchange. Most of the segments of SR-12 are projected to operate at or below 40 mph during the AM peak hour.

Exhibit 3-11: Projected Travel Speeds for Westbound SR-12 during the AM Peak hour



Source: PBS&J traffic analysis, 2011.

Vehicle miles of travel and vehicle hours of travel are projected to increase in proportion to the volume growth at 20% to 22% between years 2010 and 2015. Similarly, corridor travel delays are projected to increase by approximately 33% during 2015 volume conditions. These MOEs are summarized in Exhibit 3-27.

Long-Term Future (2035) Analysis

An initial review of travel demand was conducted and contrasted with available capacity to obtain an estimate of degree of saturation for the various segments of SR-12. Initial analysis of future year conditions indicated that significant portions of the corridor were functioning under capacity by a factor of two. Exhibit 3-13 and Exhibit 3-14 show the relationship for eastbound SR-12 between segment capacity and projected 2035 demand. Results of the comparative analysis indicate that eastbound SR-12 functions well below capacity. However, segments of SR-12 between Chadbourne Road and Scally Road are projected to experience demand in excess of 4000 vph in the PM peak hour which is approximately two times the projected capacity of the these segments. The excess demand translates to approximately two additional lanes for future conditions. Similarly, segments of SR-12 between Hillside Terrace and Glasscock Road are projected to operate well over capacity with demands approaching twice the capacity of the segment. In terms of through capacity, the excess demand equates to approximately one additional lane for future conditions.

Exhibit 3-15 and Exhibit 3-16 show the relationship for westbound SR-12 between segment capacity and projected 2035 demand. Similar to the peak travel direction during the AM peak hour, results of the comparative analysis indicate that westbound SR-12 functions over capacity during the AM peak hour. Segments of SR-12 between Chadbourne Road and Scally Road are projected to carry approximately 4,000 vph which is approximately two times the projected capacity of the these segments. The excess demand translates to approximately two additional lanes for future conditions. Similarly, segments of SR-12 between Glasscock Road and SR 113 are projected to operate well over capacity with demands approaching twice the capacity of the segment. In terms of through capacity, the excess demand equates to approximately one additional lane for future conditions. Peak direction volume intensity is projected to be more pronounced in the PM peak hour as compared to the AM peak hour.

Results of the comparative analysis indicate that westbound SR-12 functions well below capacity during the PM peak hour. However, segments of SR-12 between Chadbourne Road and Scally Road are projected to carry approximately 3,000 vph which is approximately two times the projected capacity of the these segments.

Presence of over saturated conditions during the peak period is projected to extend the peak hour beyond the peak hour and in to the peak hour shoulders preceding and succeeding the peak hour; typically referred to as peak spreading. SR-12 currently experiences peak volumes for one hour during the three hour peak period. It is projected that the peak hour for future conditions will extend to all three periods of the peak period in the peak travel direction. Exhibit 3-12 summarizes the peak spreading of volume for the most congested segments (between Chadbourne Avenue and Scally Road) during the peak period. The percentage values listed in the exhibit are a ratio of the demand to projected maximum capacity of the segment.

Exhibit 3-12: Peak Spreading in the Peak Travel Direction between Chadbourne Avenue and Scally Road

Analysis Year	AM Peak Period – Westbound		
	6 am – 7 am	7 am – 8 am	8 am – 9 am
2010	66%	80%	64%
2035	95%	100%	94%
	PM Peak Period – Eastbound		
	3 pm – 4 pm	4 pm – 5 pm	5 pm – 6 pm
2010	73%	80%	58%
2035	100%	100%	96%
Source: PBS&J Analysis, 2011.			

Review of the revised intra hour share within the peak period indicates that the AM peak will extend from approximately 6 am to 9 am during which SR-12 will function under congested conditions. Similarly, the PM peak period is projected to extend from 3 pm to 6 pm. SR-12 is projected to operate with high intersection delays and slower speeds for the unmitigated 2035 condition. Future year analysis accounts for this spread in peak and includes multiple hours to reflect the expected increase in periods of congestion.

Exhibit 3-13: Comparison of Unconstrained Segment Demand and Capacity for Eastbound SR-12 during the AM Peak Hour

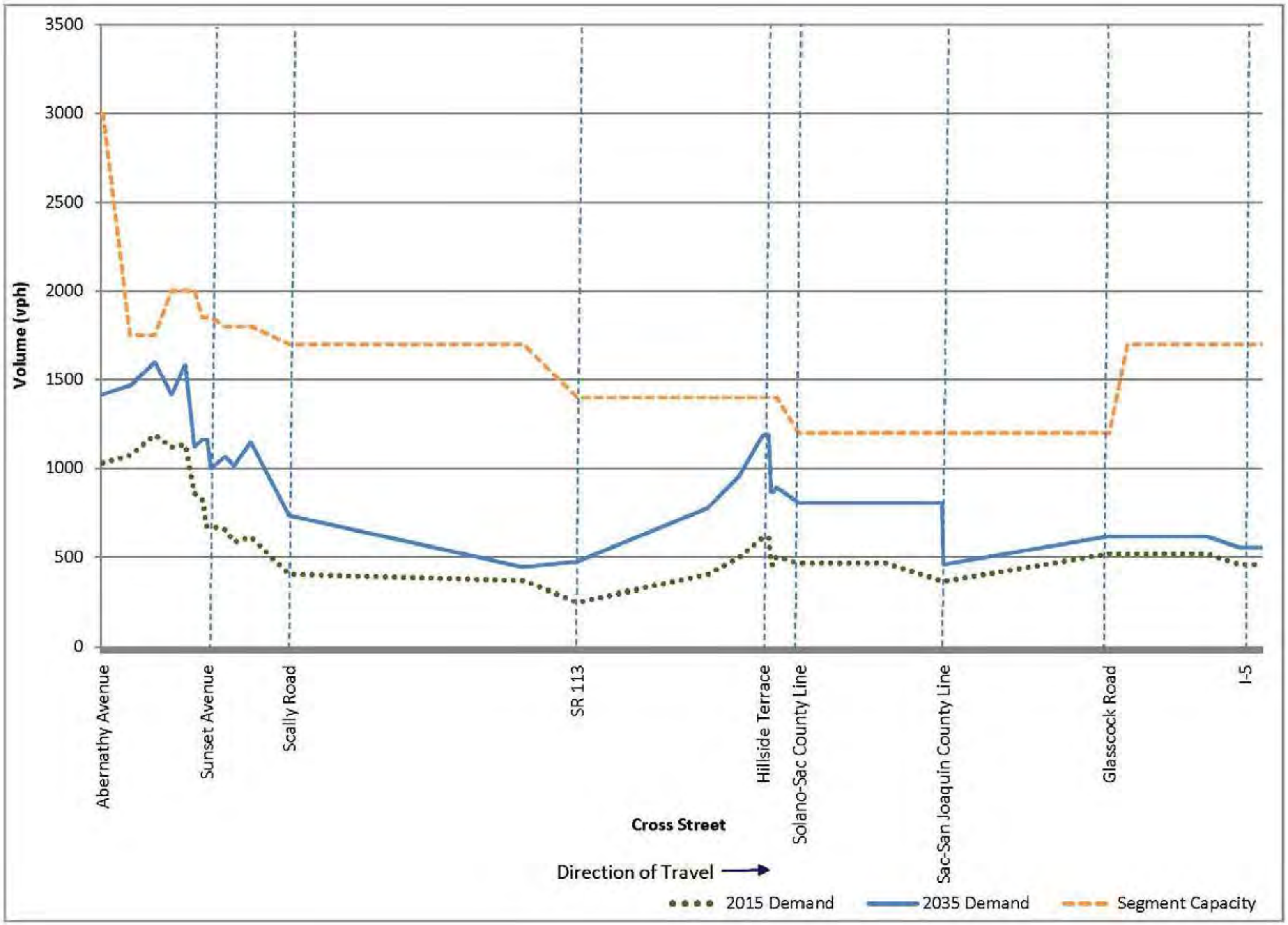


Exhibit 3-14: Comparison of Unconstrained Segment Demand and Capacity for Eastbound SR-12 during the PM Peak Hour

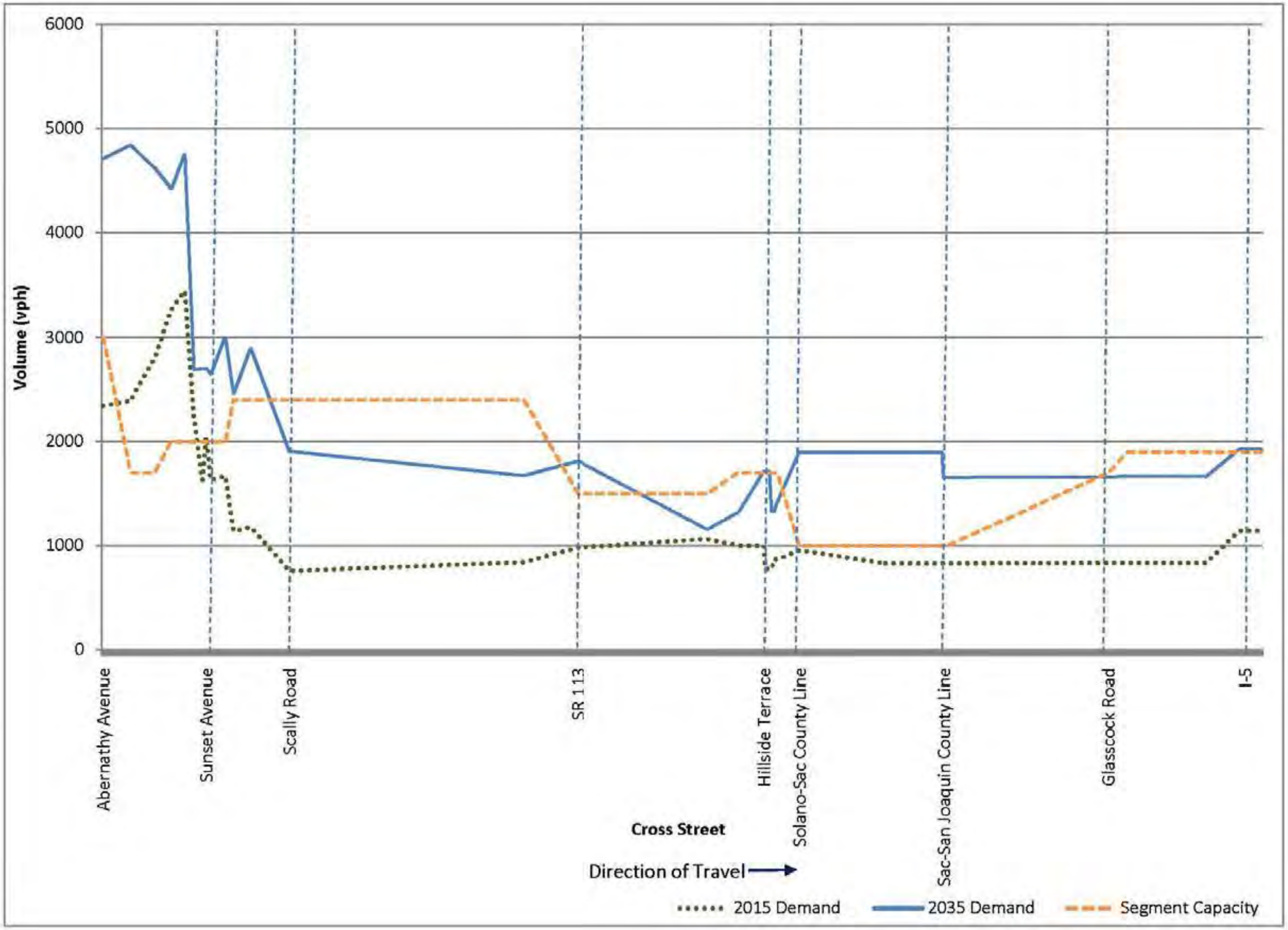


Exhibit 3-15: Comparison of Unconstrained Segment Demand and Capacity for Westbound SR-12 during the AM Peak Hour

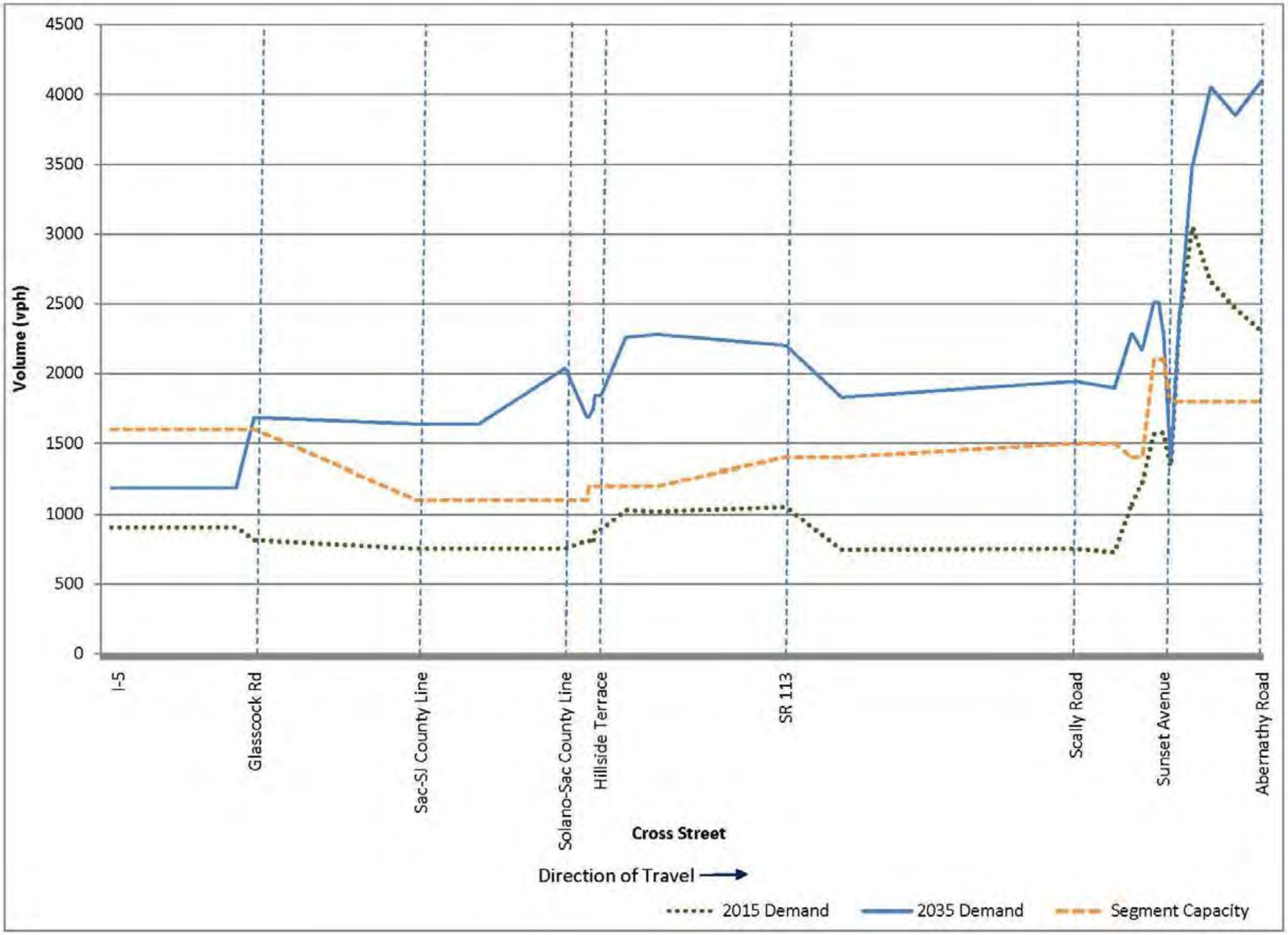
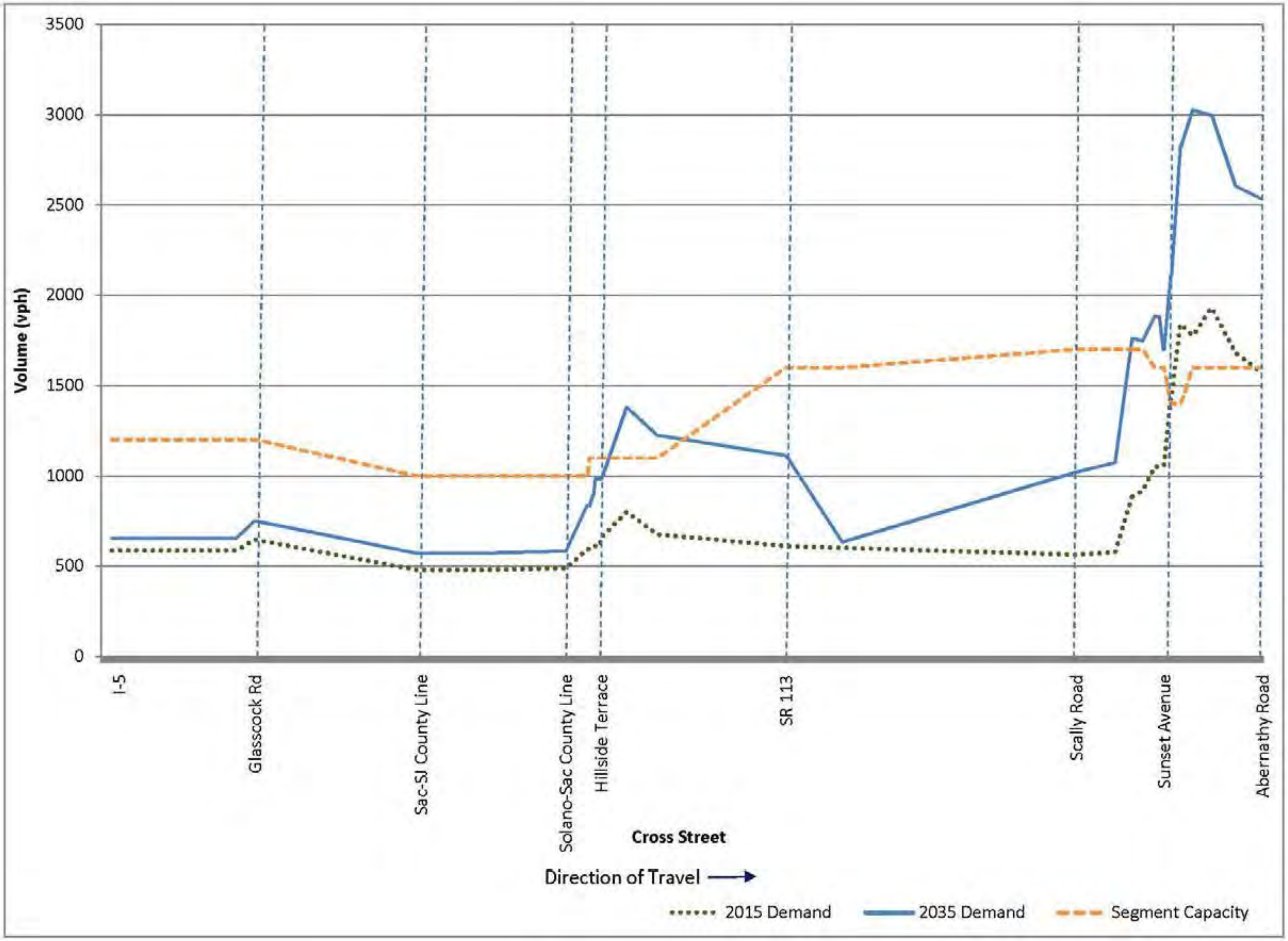


Exhibit 3-16: Comparison of Unconstrained Segment Demand and Capacity for Westbound SR-12 during the PM Peak Hour



Intersection Analysis

Results of the intersection analysis indicate that the signalized intersections on the west end of the corridor between I-80 and Walters Road through Suisun City experience the highest delays and operate at LOS E or F. These intersections experience mainline volumes that are two to three times higher than that of existing conditions which result in higher control delays at intersections.

Most of the unsignalized intersections are also projected to operate at LOS E or F due to high side street delays. While the side street delays are not expected to impact travel on SR-12, mainline SR-12 will operate at slower speeds due to the presence of high demand as compared to existing conditions. Exhibit 3-17 summarizes intersection LOS for the SR-12 Corridor for the morning and evening peak period for Future Year (2035).

Nearly five out of 10 intersections in the AM peak period and seven out of 10 intersections in the PM peak period are projected to operate at LOS E or F in 2035 without mitigations in addition to those discussed in the committed projects list. Only one in 10 intersections during the AM peak hour and less than two in 10 intersections during the PM peak hour function at LOS E or F under existing volume conditions. Note that daily data could not be calculated since the travel demand model used for this study only allows for prediction of peak hour volume data. Congested intersections experiencing noticeable delays are shown on Exhibit 3-18.

Segment Analysis

Operations on SR-12 are quantified based on average travel speed. Segments of SR-12 between I-80 and Scally Road are projected to experience the most congestion. These delay trends are reflected in slower travel times for these segments. Operational analysis of segments includes operations of the intersections and accounts for bottlenecks at intersections along with any capacity constraints present on other segments. Travel speeds will be used as a key measure of effectiveness for quantifying segment operations, which are discussed by direction in the following sub-sections.

Westbound SR-12 Travel Speeds

Exhibit 3-20 and Exhibit 3-21 illustrate the speed profile in the westbound direction of travel. The coverage shown in the exhibit is from I-80 (Chadbourne Road) in the west to I-5 in the east. Review of the travel time/speed data indicates the presence of very low average speeds on the west end of the corridor between I-80 and Walters Road through Suisun City. Lower speeds are observed on segments that carry the highest corridor volumes between Chadbourne Road and Walters Road. Slower speeds were also observed in the vicinity of Rio Vista and near the I-5 interchange which is also reflected by high intersection delays. SR-12 is projected to experience significant congestion for 2035 volumes in the westbound direction during AM and PM peak hours. Most of the segments of SR-12 are projected to operate at or below 40 mph during the AM and PM peak hours. Segments of SR-12 west of Walters Road are projected to experience the most congestion that will meter traffic entering the I-80 interchange. This conclusion is also supported by the intersection analysis models.

Results of the analysis indicate that several bottlenecks are present on SR-12 in the westbound direction which meter traffic and control the amount of traffic arriving at downstream intersections. Notable bottlenecks were observed at the Beck Avenue, Pennsylvania Avenue, Marina Boulevard and Sunset Avenue intersections on the west end of the corridor. It is anticipated that mitigation of these bottlenecks has to be accompanied by enhancements to through capacity of segments in this area to ensure acceptable operations since the unconstrained demand in this location far exceeds available capacity as indicated by Exhibits 3-15 and 3-16. The Rio Vista and Mokelumne bridges are also projected to create bottlenecks during bridge openings at these locations and the queues resulting from these openings are projected to be at least two miles long. Location of these bottlenecks and resultant queues along with other segments projected to operate at lower speeds are shown in Exhibit 3-19.

Exhibit 3-17: Intersection LOS for SR-12 for Future Year (2015 and 2035)

County	Intersection Name	2010				2015				2035			
		AM		PM		AM		PM		AM		PM	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Napa	SR-12 and SR-29+	115.8	F	67.1	E	NA	NA	NA	NA	25.7	C	37.1	D
	SR-12 and North Kelly Road+	37.4	D	32.8	C	NA	NA	NA	NA	60	E	17.0	B
	SR-12 and Kirkland Ranch Road+	11.4	B	9.0	A	NA	NA	NA	NA	99.0	F	11.0	B
	SR-12 and Red Top Road +	-	F	206.9	F	NA	NA	NA	NA	-	F	206.9	F
	I-80 WB On Ramp & Chadbourne Road *	48.3	E	12.1	B	136.6	F	16.1	C	375.9	F	100.2	F
	Auto Mall Pkwy & Chadbourne Road	29.9	C	22.8	C	17.2	B	15.8	B	24.2	C	21.1	C
	SR-12 WB On Ramp & Chadbourne Road	19.9	B	7.9	A	12.4	B	13.2	B	16.9	B	109.8	F
	SR-12 EB Off Ramp & Chadbourne Road*	13.6	B	130.5	F	18.7	B	18.1	B	19.9	B	103.2	F
	Busch Drive & Chadbourne Ave	25.6	C	37.1	D	13.8	B	22.3	C	16.0	B	106.3	F
	SR-12 & Beck Avenue	33.9	C	45.7	D	112.6	F	105.9	F	409.9	F	428.8	F
	SR-12 & Pennsylvania Ave	54.3	D	41.2	D	174.8	F	149.8	F	473.7	F	>500	F
	SR-12 & Parking Lot*	1.0	A	1.0	A	1.0	A	1.0	A	1.0	A	1.0	A
	SR-12 & Marina Boulevard	54.4	D	45.4	D	250.8	F	135.2	F	467.6	F	>500	F
	SR-12 & Village Blvd*	86.4	F	43.8	E	351.7	F	115.3	F	417.2	F	>500	F
	SR-12 & Sunset Ave	30.3	C	34.2	C	79.6	E	34.2	C	247.4	F	288.4	F
	SR-12 & Lawler Drive*	16.2	C	12.9	B	21.9	C	15.6	C	263.1	F	140.8	F
	SR-12 & Snow Drive*	18.4	C	12.2	B	30.7	D	14.1	B	276.9	F	33.9	D
	SR-12 & Emperor Drive	30.1	C	35.3	D	48.2	D	36.8	D	193.5	F	246.4	F
	SR-12 & Woodlark Drive*	14.2	B	11.0	B	19.8	C	12.2	B	174.7	F	28.1	D
	SR-12 & Walters Road	34.7	C	24.6	C	30.7	C	26.8	C	71.4	E	45.6	C
	SR-12 & Scally Road*	17.0	C	18.7	C	24.6	C	25.7	D	924.4	F	>500	F
	SR-12 & Nurse Slough Road*	1.0	A	23.5	C	1.0	A	39.1	E	1.0	A	>500	F
	SR-12 & Denverton Road*	11.6	B	26.2	D	13.0	B	46.7	E	37.3	E	>500	F
	SR-12 & Shiloh Road*	1	A	24.0	C	1	A	40.0	E	1	A	>500	F
	SR-12 & Little Honker Bay Road*	9.1	A	12.6	B	9.4	A	14.6	B	11.1	B	39.9	E
	SR-12 & SR-113*	16.0	C	33.3	D	23.4	C	126.4	F	>500	F	>500	F
	SR-12 & Summerset Drive	12.8	B	8.1	A	10.8	B	10.3	B	158.8	F	77.4	E
	SR-12 & Church Road*	27.6	D	21.8	C	50.8	F	29.4	D	>500	F	>500	F
	SR-12 & Hillside Terrace	22.0	C	18.7	B	23.7	C	20.3	C	148	F	248.1	F
	SR-12 & Gardiner Way*	17.3	C	16.9	C	25.6	D	28.4	D	>500	F	284.4	F
	SR-12 & N 5th*	21.3	C	20.2	C	43.5	E	44.8	E	>500	F	>500	F
	SR-12 & Virginia Road*	23.7	C	34.2	D	55.9	F	123.1	F	>500	F	>500	F
	SR-12 & River Road*	13.5	B	18.7	C	16.8	C	31.3	D	181.8	F	>500	F
Sacramento	SR-12 & SR-160	33.5	C	37.5	D	44.1	D	61.5	E	184	F	219.5	F
	SR-12 & Jackson Slough Road*	21.3	C	38.0	E	33.1	D	92.8	F	419.5	F	>500	F
	SR-12 & Terminous Road*	24.0	C	256.7	F	29.7	D	1.0	A	125.0	F	1.0	A
	SR-12 & Brannan Island Road*	16.4	C	19.8	C	23.2	C	1.0	A	66.1	E	1.0	A
San Joaquin	SR-12 & Terminous Road*	19.5	C	24.7	C	44.3	E	375	F	>500.0	F	>500	F
	SR-12 & Glasscock Road*	18.9	C	31.9	D	28.0	D	57.4	F	50.1	C	175.2	F
	SR-12 & Correia Road*	10.8	B	19.5	C	12.1	B	27.9	D	12.9	B	109.5	F
	SR-12 & N Guard Road*	26.2	D	21.4	C	49.4	E	32.7	D	248.8	F	>500	F
	SR-12 & I-5 SB Off-Ramp	8.6	A	15.6	B	15.4	B	18.5	B	15.5	B	19.2	B
	SR-12 & I-5 NB On-Ramp	19.6	B	20.6	C	24.2	C	22.3	C	32.1	C	31.6	C
	SR-12 & N Thornton Road*	10.0	B	11.6	B	10.6	B	12.1	B	11.0	B	12.6	B
	SR-12 & N Thornton Road	34.5	C	34.7	C	36.8	D	35.1	D	38.9	C	37.5	C
	SR-12 & N Flag City Blvd*	15.8	C	22.1	C	22.0	C	43.5	E	45.0	E	194.4	F

* Unsignalized intersection; LOS based on worst approach delay.

\+ Obtained from the Jameson Canyon Road Widening and SR-12/SR-29 Interchange Project Report (Final Draft, July 2007).

Bold designates intersections with poor conditions (i.e., LOS E or LOS F). Source: PBS&J traffic analysis, 2010.

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Exhibit 3-18: Intersections where Projected Demand Exceeds Available Capacity for Future Year (2035)

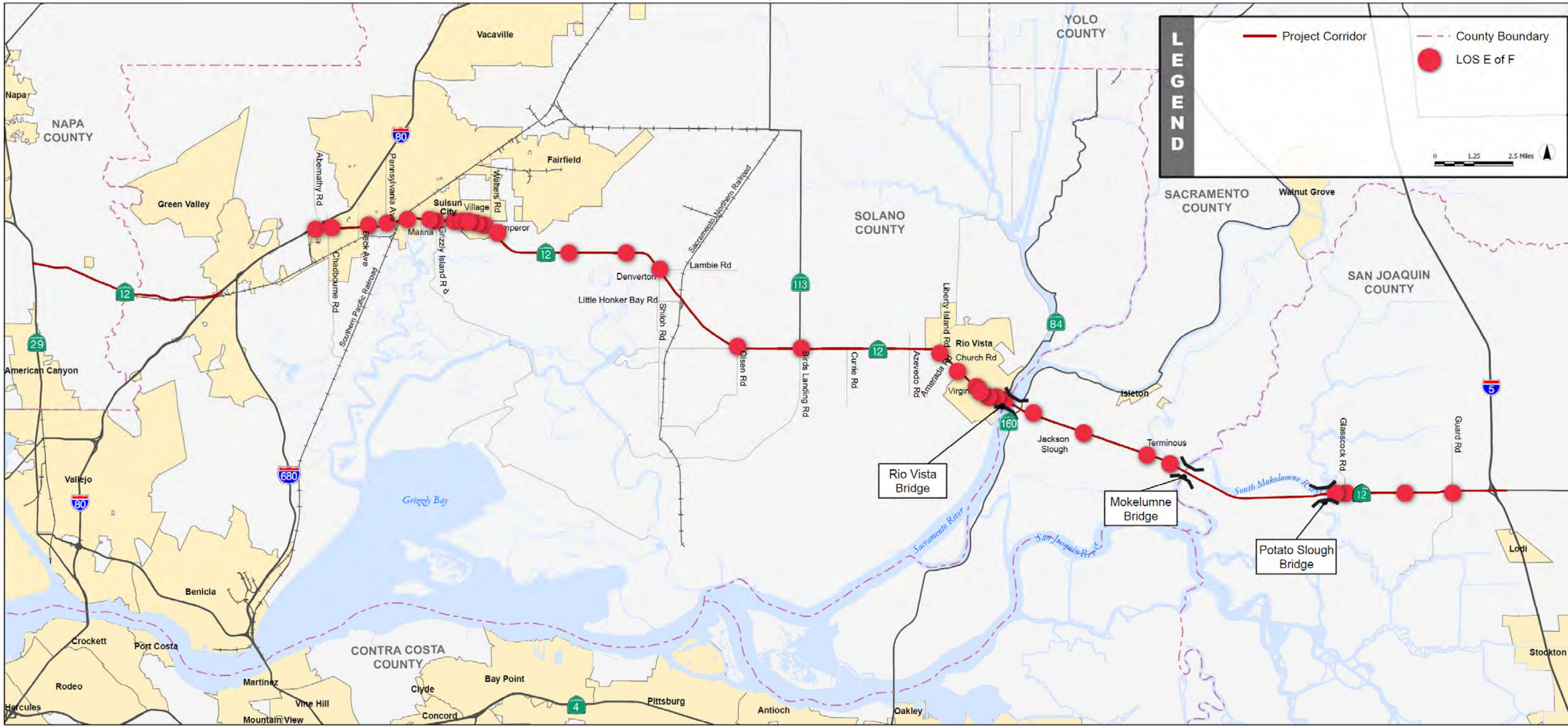

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Exhibit 3-19: Location of Bottlenecks and Queues for Future Year (2015 and 2035)

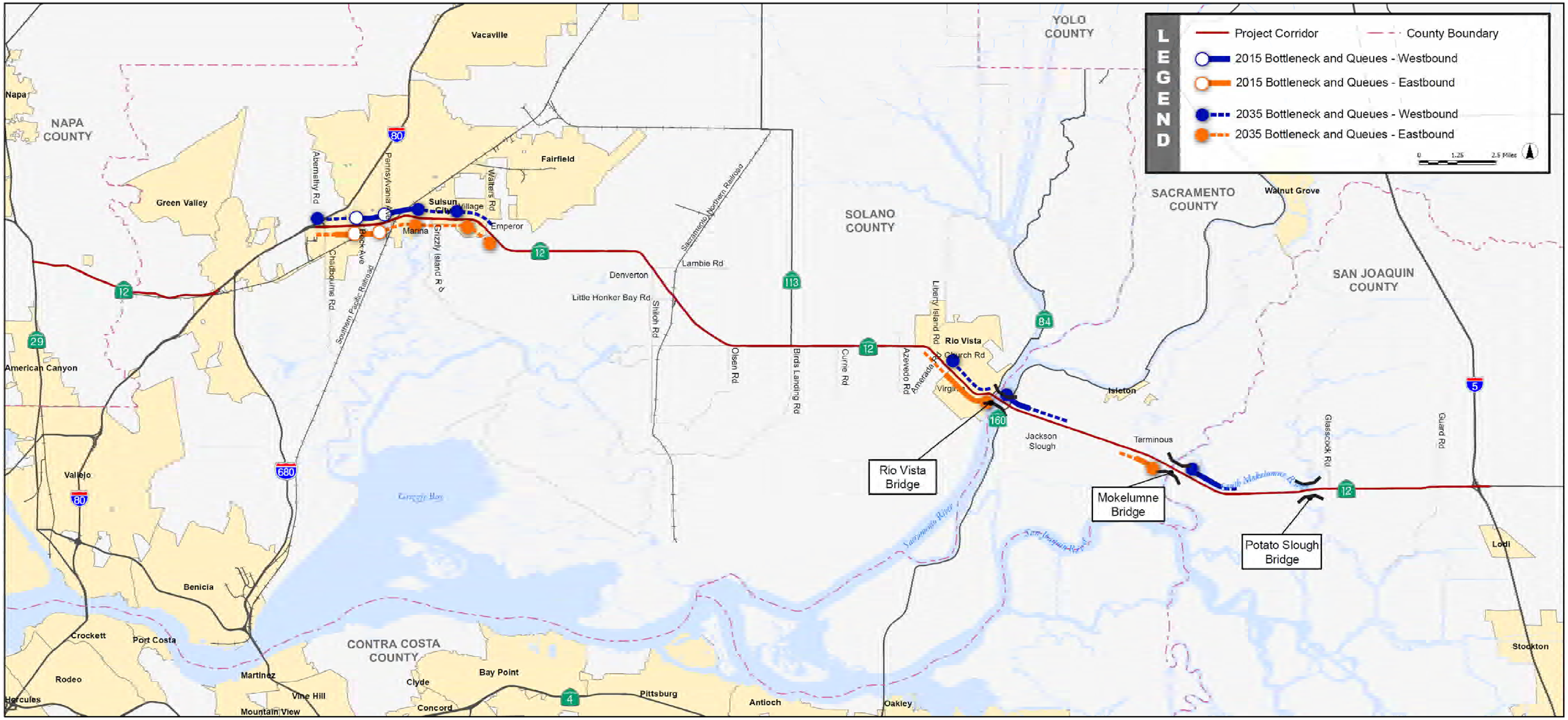

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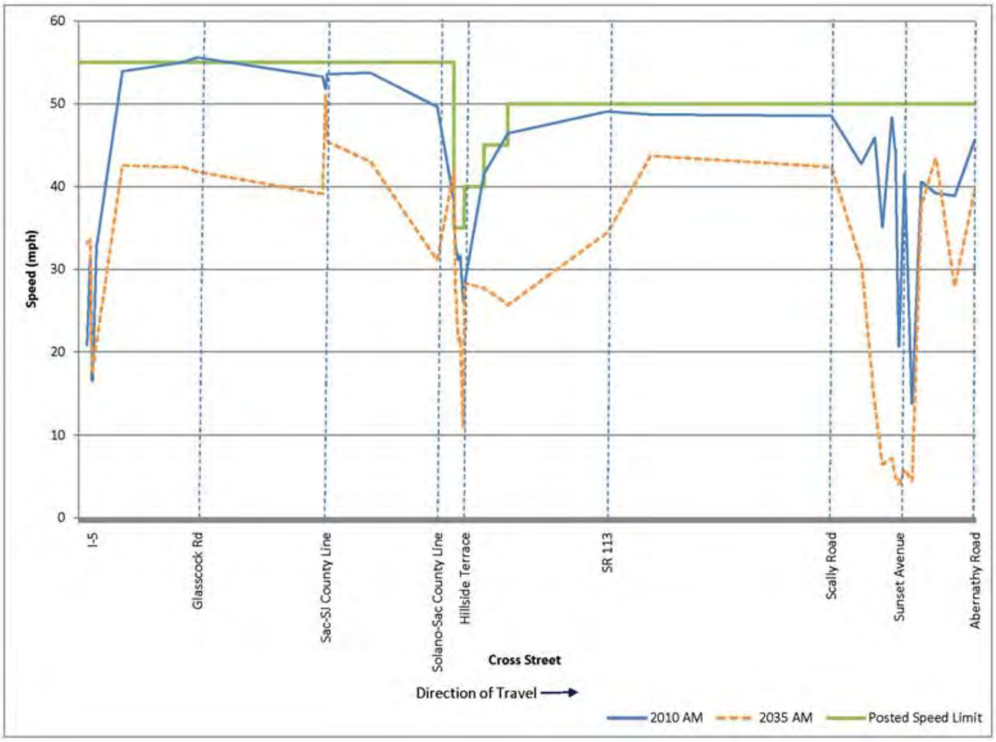
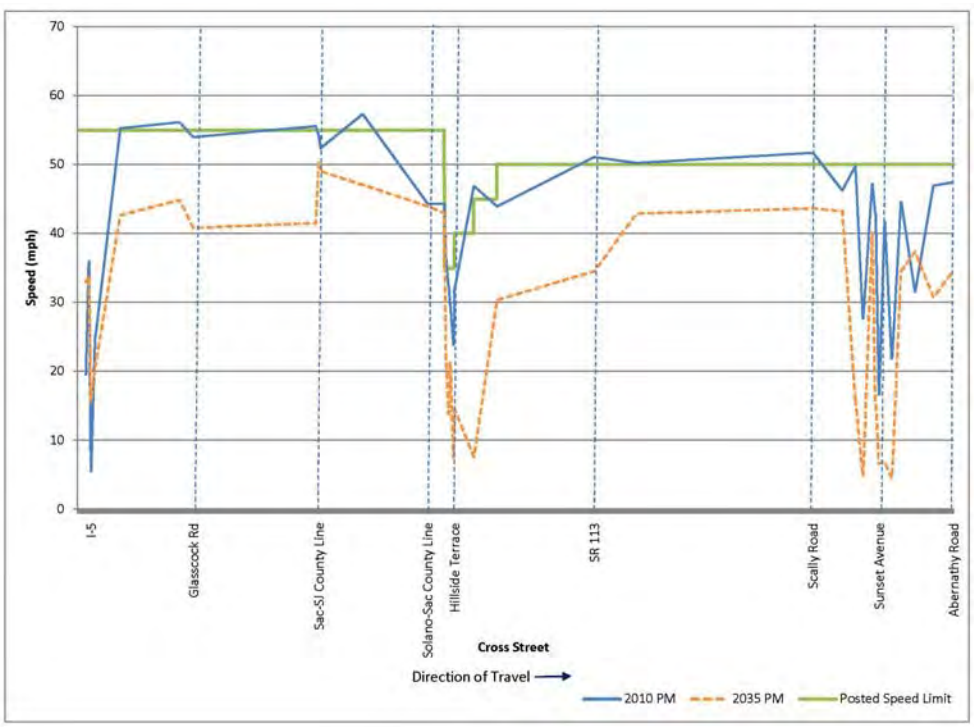
Exhibit 3-20: Projected Travel Speeds for Westbound SR-12 during the AM Peak Hour



Source: PBS&J traffic analysis, 2011.

Exhibit 3-21: Projected Travel Speeds for Westbound SR-12 during the PM Peak Hour

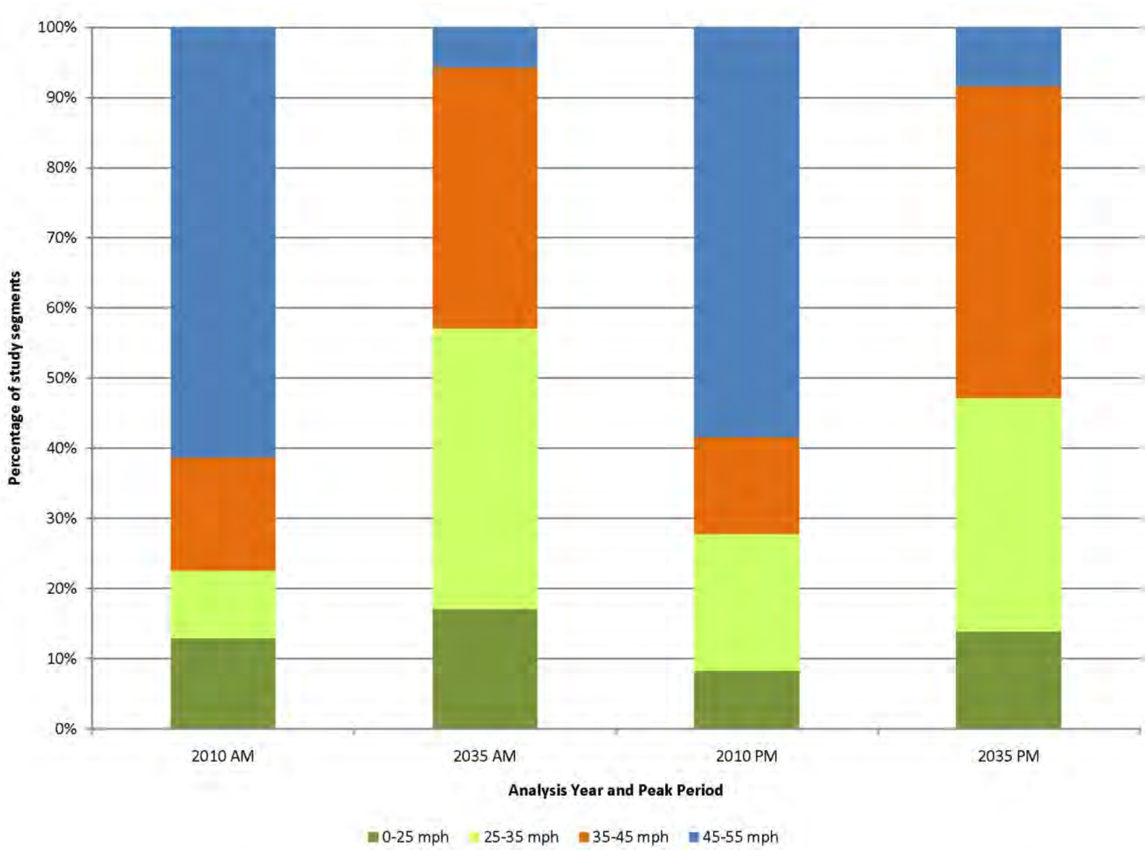


Source: PBS&J traffic analysis, 2011.

Review of individual segment speeds for existing and long-term future year indicates that the average speed of most of the segments decreases which leads to a shift in the speed distribution of the study corridor. Approximately 70% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 42% for year 2035 conditions. Similarly, 72% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 52% for year 2035 conditions.

The shift in speed distribution is consistent with the segment and intersection analysis in that the peak direction experiences a higher intensity of traffic along with higher congestion for future year conditions. The results also indicate that a majority of the segments will experience slower speeds and longer travel times for 2035 conditions. Speed distribution data for westbound SR-12 is shown in Exhibit 3-22.

Exhibit 3-22: Speed Distribution for Westbound SR-12 (Year 2035)



Eastbound SR-12 Travel Speeds

Exhibit 3-24 and Exhibit 3-25 show speed profiles for SR-12 in the eastbound direction of travel. Patterns of congestion observed in the eastbound direction are similar to those observed in the westbound direction. Specifically, slower speeds are observed from the SR-12 and I-80 interchange to Pennsylvania Avenue. Segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 30 mph to 45 mph during the AM peak hour. Travel time analysis results indicate that SR-12 experiences higher levels of congestion under 2035 volume conditions as compared to existing conditions but the anticipated demand does not significantly exceed the capacity of most of the segments. This results in acceptable but longer travel times under 2035 volume conditions.

Segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 30 mph during the AM peak hour and 20 mph during the PM peak hour. Segments of SR-12 downstream of Sunset Avenue exhibit higher operating speeds due to the presence of bottlenecks in the form of congested intersections upstream. Absence of surplus capacity at intersections downstream of Sunset Avenue is demonstrated by high delays as reported in the intersection analysis above. A significant portion of the corridor functions with speeds of 40 mph or less, which equates to LOS E or worse. It is anticipated that mitigation measures to alleviate congestion on the west end of the corridor will likely decrease operating speeds for the central and eastern segments of the study corridor. Mainline operations in the vicinity of I-5 are similar to those near I-80.

Results of the analysis indicate that several bottlenecks are present on SR-12 in the eastbound direction which meter traffic and control the amount of traffic arriving at downstream intersections. Bottlenecks were observed at the Beck Avenue, Pennsylvania Avenue, Marina Boulevard and Sunset Avenue intersections on the west end of the corridor. It is anticipated that mitigation of these bottlenecks has to be accompanied by enhancements to through capacity of segments in this area to ensure acceptable operations since the unconstrained demand in this location far exceeds available capacity as indicated by Exhibits 3-13 and 3-14. The Rio Vista and Mokelumne bridges are also projected to create bottlenecks during bridge openings at these locations and the queues resulting from these openings are projected to be at least two miles long. Location of these bottlenecks and resultant queues along with other segments projected to operate at lower speeds are shown in Exhibit 3-19.

Review of individual segment speeds for existing and long-term future year indicates that the average speed of most of the segments decreases which leads to a shift in the speed distribution of the study corridor. Approximately 78% of the eastbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 41% for year 2035 conditions. Segments functioning with speeds between 25 and 35 mph experience the highest jump in speed share from 10% for existing conditions to 40% for future year conditions indicating the presence of significant congestion on SR-12. Approximately 72% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 52% for year 2035 conditions.

The shift in speed distribution is consistent with the segment and intersection analysis in that the peak direction experiences a higher intensity of traffic along with higher congestion for future year conditions. The results also indicate that a majority of the segments will experience slower speeds and longer travel times for 2035 conditions. Speed distribution data for westbound SR-12 is shown in Exhibit 3-26.

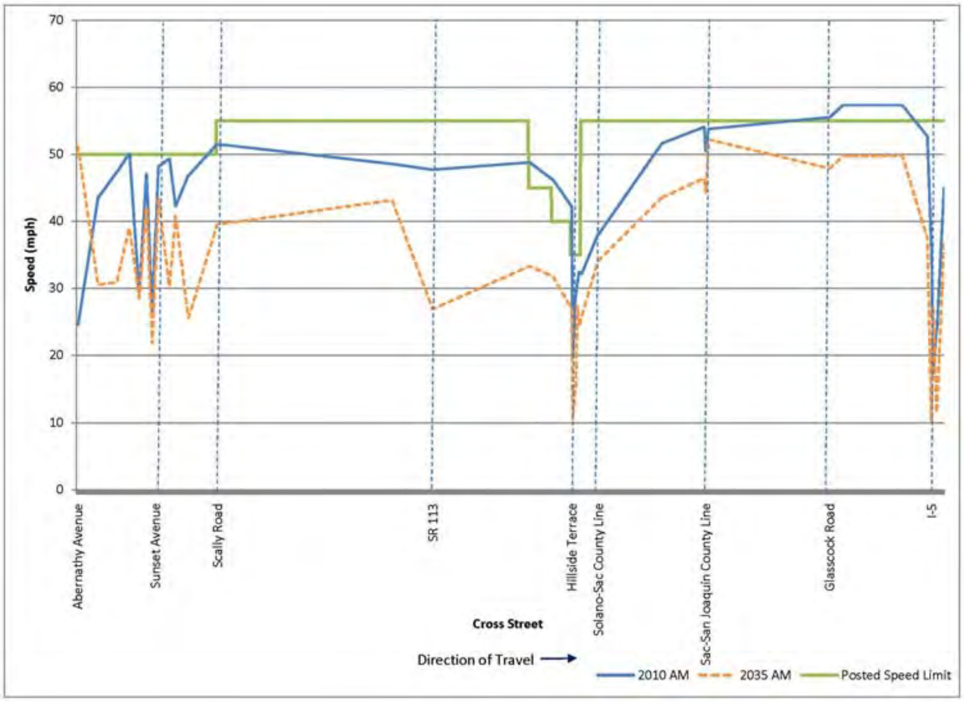
SR-12 Corridor Travel Time

Exhibit 3-23 summarizes the average time it takes to travel the entire segment of the corridor from I-80 to I-5, a distance of approximately 42 miles. These travel times represent an increase of approximately 30 minutes or a 50% increase in total travel time as compared to existing conditions.

Exhibit 3-23: Projected Future Year (2035) Travel Time for the SR-12 Corridor

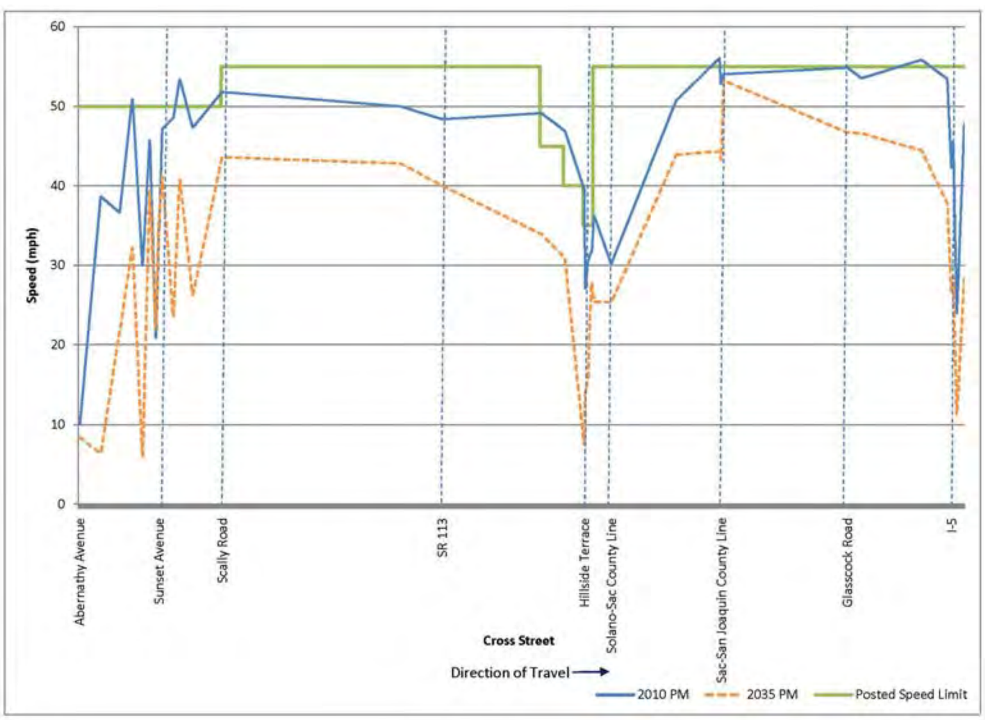
Segment	Peak Direction	Average Travel Time
Between I-80 and I-5	Eastbound (PM)	1 hr 23 mins
	Westbound (AM)	1 hr 25 mins

Exhibit 3-24: Projected Travel Speeds for Eastbound SR-12 during the AM Peak hour



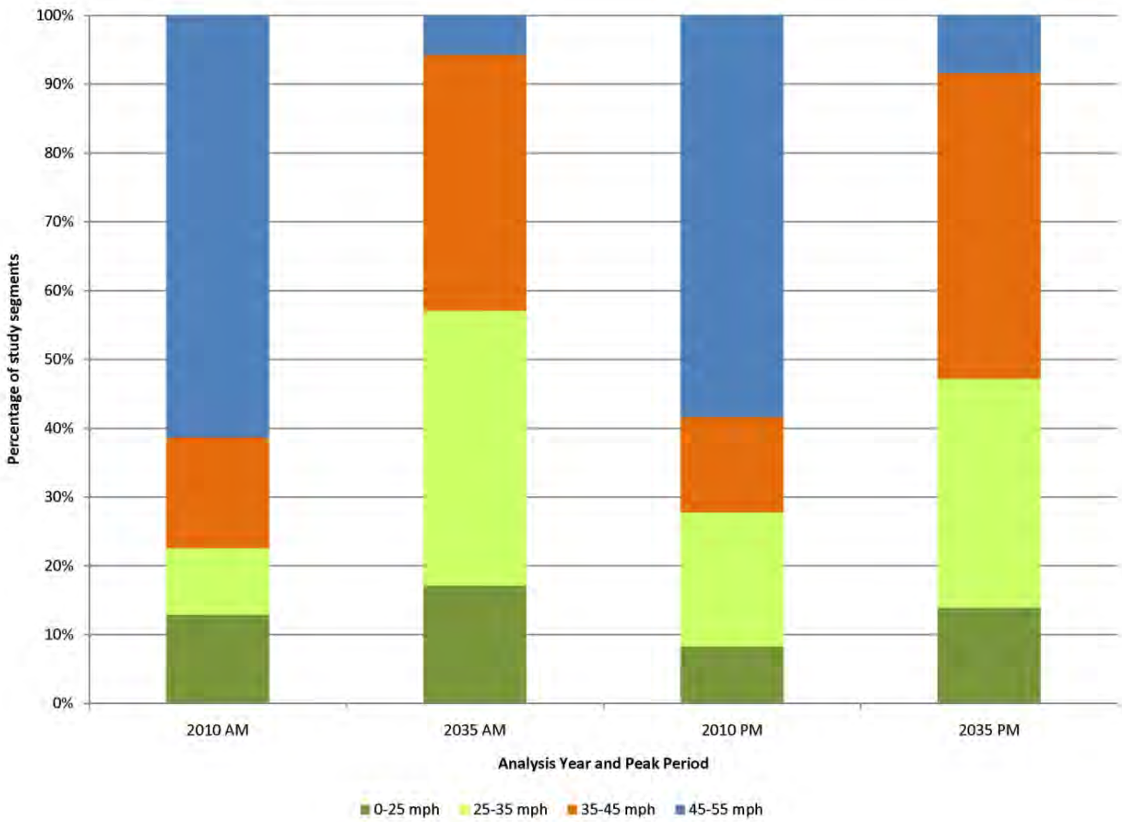
Source: PBS&J traffic analysis, 2011.

Exhibit 3-25: Projected Travel Speeds for Eastbound SR-12 during the PM Peak hour



Source: PBS&J traffic analysis, 2011.

Exhibit 3-26: Speed Distribution for Eastbound SR-12 (Year 2035)



Corridor Measures of Effectiveness (MOEs)

Several MOEs in addition to intersection delay and travel times were evaluated to quantify the impact of anticipated future growth on SR-12. These MOEs include vehicle miles of travel (VMT) expressed in vehicle-miles, vehicle hours of travel (VHT) expressed in vehicle-hours and corridor delay (Delay) expressed in hours. Exhibit 3-27 summarizes the comparative analysis of 2010, 2015 and 2035 conditions on a corridor level.

Exhibit 3-27: Projected Future Year (2035) Performance Measures for the SR-12 Corridor

Daily Values	VMT	VHT	Delay
	veh-mile	veh-hrs	hrs
2010	455994.4	12225.75	3245.892
2015	520862.6	14419.28	4345.054
2035	1025693	36753.23	16317.24
Percentage Change for 2015	14.2%	17.9%	33.8%
Percentage Change for 2035	224%	300%	500%

Vehicle miles of travel are expected to increase by approximately 15% on an average which is accompanied by an 18% increase in vehicle hours of travel and a 34% increase in delay. The disproportionate growth of corridor delay in relation to vehicle miles of travel and the lower rate of growth of vehicle miles of travel as compared to anticipated growth in demand (18% against 21%)

indicates that presence of congestion on certain segments of the corridor that maybe causing some metering of demand on the west end of the corridor.

The effect of volume metering and the impact of congestion on operations of SR-12 are more pronounced in 2035. Traffic volumes are projected to grow by a factor of 2 to 2.5 between 2010 and 2035 on some of the western segments of SR-12 which is reflected in the percentage change of VMTs for 2035. Vehicular hours of travel and corridor delays are projected to grow at a higher rate when compared to volume growth. Absence of capacity on SR-12, especially in the western and eastern most segments, results in very high delays and lower speeds at intersections and on segments. The intersections on the west end of the corridor act as a bottleneck and meter traffic entering and exiting SR-12 to and from the west. It is anticipated that mitigation measures to alleviate congestion on the west end of the corridor will likely decrease operating speeds for the central and eastern segments of the study corridor.

Impact of Bridge Openings

Peak Hour Impact

Traffic analysis was performed using both roadway and waterborne traffic forecast volumes (described in Section 2) and bridge operational characteristics (described in the Draft ECT Report) to quantify the projected impact of bridge operations on SR-12. It is to be noted that the machinery used for bridge openings for both the Rio Vista and Mokelumne bridges is old and outdated. This has led to breakdowns in operations and disruption to traffic flow for as long as a week in the recent past. These incidents are non-recurrent in nature and typically result in very high delays and road closures when they do occur.

Recurrent delay due to bridge openings for future conditions was quantified for 2015 and 2035 conditions. Bridge opening durations for existing year (2010) conditions vary from as few as eight minutes to as long as 25 minutes. To project future year (2015 and 2035) vehicle queuing, a traffic analysis was performed for the longest opening durations (25 minutes and 20 minutes for the Rio Vista Bridge and the Mokelumne Bridge, respectively), in each direction during the AM and PM peak hours at each bridge, and is summarized in Exhibit 3-28.

Exhibit 3-28: Projected Queues Due to Bridge Openings

Bridge	Peak Hour	Queues (vehicles)					
		2010		2015		2035	
		EB	WB	EB	WB	EB	WB
Rio Vista Bridge	AM	136	258	186	401	340	685
	PM	141	224	426	390	736	621
Mokelumne Bridge	AM	116	155	167	301	320	701
	PM	169	125	408	287	710	520
Source: PBS&J analysis, 2010.							

The queues projected for a 20-minute bridge opening would typically extend past the upstream intersections for the Rio Vista Bridge with the highest queues occurring in the westbound direction and slightly higher during the AM peak hour. Similarly, Mokelumne Bridge is projected to experience significant queues in excess of 700 vehicles during the PM peak hour for the 20-minute opening. Dispersion of queues resulting from the bridge openings is estimated to take between 30 and 45 minutes. The cumulative impact of bridge opening time and dispersion time increases the total corridor travel duration by approximately 60%. In addition, each 20-minute bridge opening is projected to impact operations on SR-12 for the entire peak hour since the dissipation of vehicular queues will take more than 30 minutes and the impact of these queues are expected to be felt at other adjacent intersections.

Daily and Annual Impact

A planning level analysis was conducted to estimate the daily and annual vehicle delay that would result from the bridge openings and vehicular traffic forecast for 2015 and 2035 as discussed in Section 2. These data were analyzed with standard queuing equations and a weighted distribution of bridge openings over the day. To bind the range of probable events, Exhibit 3-29 presents the results for opening durations of 10 and 25 minutes for the Rio Vista Bridge and Exhibit 3-30 presents the comparable results for opening durations of 10 and 20 minutes for the Mokelumne Bridge. The exhibits display the average hours of daily vehicle delay for the peak and average bridge opening months as well as an average delay time for all vehicles using the bridges. For comparison, the exhibits present estimated 2010 delay results for the same opening duration ranges.

Exhibit 3-29 and Exhibit 3-30 show that for bridge opening durations of 10 minutes, vehicular traffic on SR-12 will be subjected to extreme delays in the peak waterborne traffic month by 2035, with the traffic delay per daily vehicle averaging over 80 seconds on the Rio Vista Bridge and over 130 seconds on the Mokelumne Bridge. Annual vehicle delays would be 700 to 1,000 hours per day in the peak month and would approach 200,000 hours per year at each bridge. With bridge opening durations greater than 10 minutes, delays would increase dramatically and would reach 4,000 to 5,000 vehicle hours per day in the peak bridge opening month for the maximum 20 and 25 minute times analyzed. Annual delays would reach over 760,000 vehicle hours of delay for the Mokelumne Bridge and 1.2 million vehicle hours of delay for the Rio Vista Bridge.

Exhibit 3-29: Projected Total and Average Vehicle Delay at Rio Vista Bridge, 2010 - 2035

	Delay by Average Bridge Opening Duration and Year					
	2010		2015		2035	
	10 Minutes	25 Minutes	10 Minutes	25 Minutes	10 Minutes	25 Minutes
Daily Delay in Peak Bridge Opening Month						
Vehicle Hours	65	405	150	920	730	5,120
Seconds per Vehicle	16	99	29	179	82	572
Daily Delay in Average Month						
Vehicle Hours	50	340	90	590	520	3,290
Seconds per Vehicle	13	82	18	115	58	368
Total Annual Delay*						
Vehicle Hours	18,250	124,100	32,850	215,350	189,800	1,200,850
Seconds per Vehicle	13	82	18	115	58	368

*Total annual delay is estimated as 365 x daily delay in average month.
Source: PBS&J traffic analysis, 2011.

Exhibit 3-30: Projected Total and Average Vehicle Delay at Mokelumne Bridge, 2010 - 2035

	Delay by Average Bridge Opening Duration and Year					
	2010		2015		2035	
	10 Minutes	20 Minutes	10 Minutes	20 Minutes	10 Minutes	20 Minutes
Daily Delay in Peak Bridge Opening Month						
Vehicle Hours	150	615	250	995	1,005	4,010
Seconds per Vehicle	34	136	48	193	133	531
Daily Delay in Average Bridge Opening Month						
Vehicle Hours	90	360	130	520	500	2,090
Seconds per Vehicle	20	79	25	101	69	277
Total Annual Delay*						
Vehicle Hours	32,850	131,400	47,450	189,800	182,500	762,850
Seconds per Vehicle	20	79	25	101	69	277

*Total annual delay is estimated as 365 x daily delay in average bridge opening month.
Source: PBS&J traffic analysis, 2011.

Summary of Section 3

This section presents a summary of an evaluation of the operational performance for future conditions using micro-simulation and macro analysis tools, a forecast of operating speeds and intersection delay, and a summary of forecasted congested areas, bottlenecks and their causes. A summary of key issues addressed in this section include:

- *General 2015 Performance:* SR-12 is projected to experience a moderate increase in intersection delay and travel time under 2015 conditions. Most of this increase in delay can be attributed to intersections operating at higher levels of saturation, interruptions due to bridge openings, and absence of more passing opportunities along the corridor.
- *General 2035 Performance:* SR-12 is projected to experience very high levels of congestion under 2035 conditions. This increase in congestion is directly related to growth in traffic demand and further compounded by the impact of bridge openings during the peak hour. Exhibit 3-31 identifies the potential causes that may lead to congestion along the corridor. Absence of mitigation will cause the peak period to extend from the existing 1.5 hours in the AM peak and 2 hours in the PM peak to approximately 2.5 and 4.5 hours, respectively. This growth in demand may require doubling of the mainline capacity in most locations along with intersection optimization and mitigation of the impact of bridge openings to ensure acceptable operations along SR-12 in the future.
- *Corridor Travel Time:* The average time it takes to travel the entire segment of the corridor from I-80 to I-5 in 2035 is projected to be 1 hour and 25 minutes during peak hour—an increase of approximately 30 minutes or 50% as compared to current conditions.
- *Intersection Level of Service:* Signalized intersections on the west end of the corridor between I-80 and Walters Road through Suisun City experience volumes that are two to three times higher than that of existing conditions, exhibit the highest delays, and operate at LOS E or F. Most of the unsignalized intersections are also projected to operate at LOS E or F due to high side street delays. Nearly five out of 10 intersections in the AM peak period and seven out of 10 intersections in the PM peak period are projected to operate at LOS E or F in 2035 without mitigations in addition to those discussed in the committed projects list. Mitigations, in addition to those committed projects included in the baseline conditions, are required for intersections in the study area to ensure that they operate at LOS D or better under 2035 demand volumes.

- *Mainline Segment Operations:* In 2035, SR-12 is projected to experience volumes that are approximately two to three times the existing volumes. Most of the segments of SR-12 are projected to experience demand volumes that exceed available capacity during the AM and PM peak hours under 2035 volume conditions. Segments of SR-12 between I-80 and Scally Road are projected to experience volumes that are more than twice the available capacity while the other segments are projected to experience volumes that are 50% to 100% more than the available capacity for 2035 conditions. It is anticipated that currently available capacity will have to be doubled for most segments of SR-12 through the addition of through lanes to accommodate anticipated 2035 demand.
- *Westbound Travel Speeds:* For 2015 conditions, segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 10 mph to 25 mph during the PM peak hour. Segments of SR-12 between Scally Road and I-5 function at an average speed of 40 mph except for the stretch of SR-12 between Hillside Terrace and the River Road intersection which functions at an average speed of 30 mph. SR-12 is projected to experience high levels of congestion under 2035 conditions. Very low average speeds are projected on the west end of the corridor between I-80 and Walters Road through Suisun City. Lower speeds are observed on segments that carry the highest corridor volumes between Chadbourne Road and Walters Road. Slower speeds were also observed in the vicinity of Rio Vista and near the I-5 interchange which is also reflected by high intersection delays. Approximately 70% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 42% for year 2035 conditions. Similarly, 72% of the westbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 52% for year 2035 conditions.
- *Eastbound Travel Speeds:* For 2015 conditions, the speed profile data indicates that the average speeds for most segments of the corridor are lower than speeds for existing conditions by approximately 10 mph to 15 mph. Segments of SR-12 between I-80 and Sunset Avenue experience the most congestion with average operating speeds of approximately 30 mph during the AM peak hour and 20 mph during the PM peak hour. Mainline operations in the vicinity of I-5 are similar to those near I-80. Review of individual segment speeds for existing and long-term future year indicates that the average speed of most of the segments decreases which leads to a shift in the speed distribution of the study corridor. Approximately 78% of the eastbound study segments operate with speeds of 35 mph or more for existing conditions as compared to 41% for year 2035 conditions.
- *Impact of Bridge Openings on Travel:* Level of service deficiencies in the vicinity of the Rio Vista Bridge and Mokelumne River Bridge are largely due to bridge operations. It is projected that a 20-minute bridge opening will result in vehicular queues of at least two miles and require at least 30 minutes to dissipate, thereby impacting traffic flow on SR-12 for the entire peak period if not longer. Based on a planning level daily analysis, bridge openings at the Rio Vista and Mokelumne bridges are projected to collectively add 1,700 vehicle hours of delay daily in the corridor during the peak bridge opening month by 2035; even with relatively short opening times of 10 minutes. The average delay per daily vehicle (daily delay/ADT) would be 80 seconds per vehicle at the Rio Vista Bridge and 130 seconds at the Mokelumne Bridge under these conditions. Longer bridge openings would add substantially to these delays. The likely annual delay in 2035 would be several hundred thousand vehicle hours of delay at each bridge. Replacement of the Rio Vista Bridge with a mid-level or high-level bridge as currently being studied by the Solano Transportation Authority will be necessary to mitigate these forecast conditions.

These key issues will be evaluated during the development of corridor improvement strategies to mitigate corridor safety, congestion, and operational issues along the corridor.

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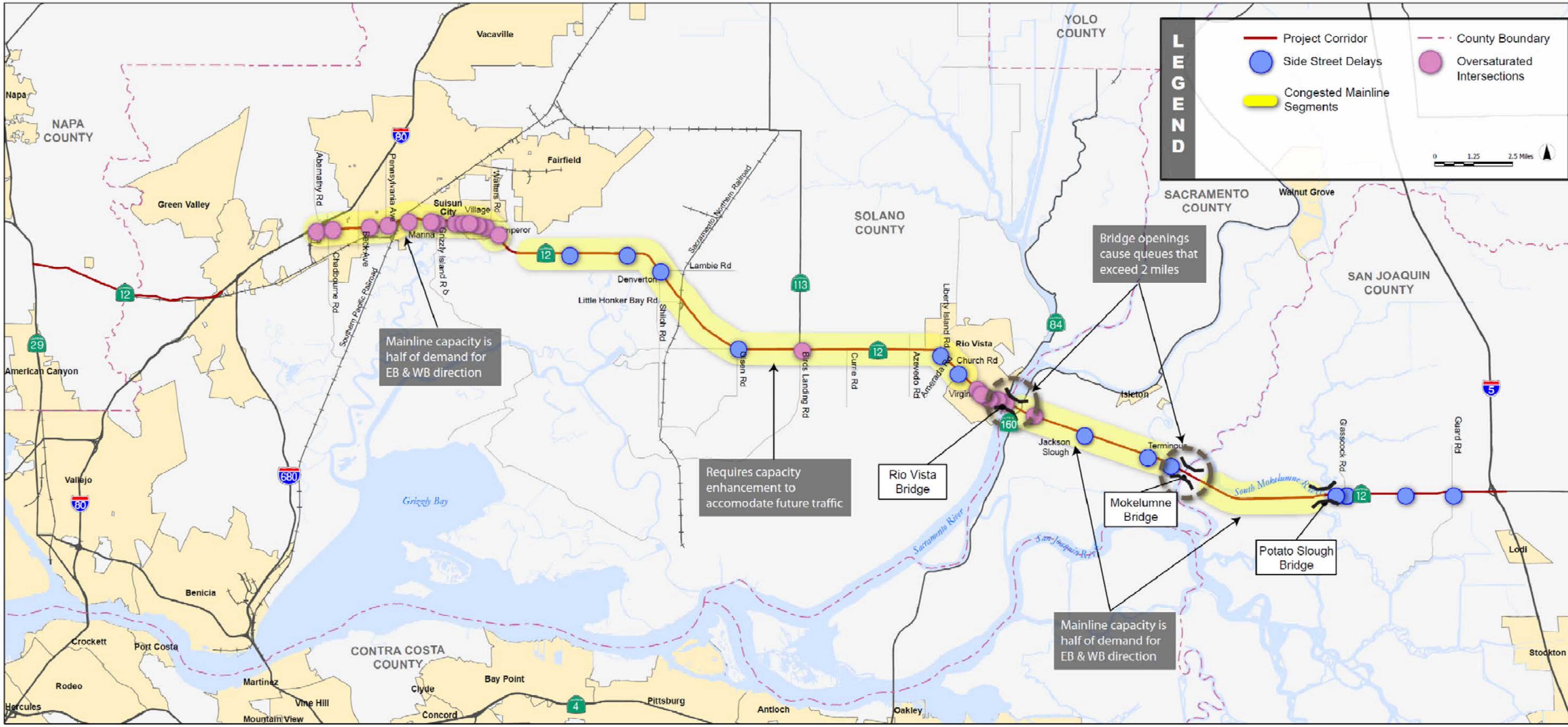
Exhibit 3-31: Summary of Operational Deficiency for Future Year (2035)



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Appendix A: Demographic Forecasts for Solano, San Joaquin, and Sacramento Counties

11/2009
SJCOG Board

STAFF REPORT

SUBJECT: Draft Countywide Population / Household / Employment Update

RECOMMENDED ACTION: Approval of the updated Population / Housing / Employment Forecast Base Year 2006 to 2035

DISCUSSION:

SJCOG has undertaken an update of population, household, and employment estimates for a baseline year of 2006, with forecasts of future years to 2035. These estimates and forecasts were developed by the Business Forecasting Center at University of the Pacific (UOP) under contract with SJCOG.

The forecasts may be used for a wide variety of planning activities by both SJCOG and its member agencies. They also are a critical component of the Regional Transportation Plan (RTP) as they form the basis of the land-use element in the RTP. SJCOG is currently updating the RTP, with expected publication in 2010. Federal Highways Administration RTP guidelines specify that the RTP be based on "latest planning assumptions," "including estimates of current and future population, employment…most recently developed by the MPO…" Additionally, "land use, population, employment, and other network-based travel model assumptions must be documented and based on the best available information." Recent shifts in the housing and employment sectors would indicate a departure from previous trends. The forecasts provided by UOP incorporate the latest available data on current population, household, and employment trends. A report on forecast methodology, as well as additional information on population and housing trends as reported in the most recent *Regional Analyst* publication, is attached.

UOP's forecasts are lower than current California Department of Finance forecasts (vintage 2007). The proposed SJCOG/UOP forecast and its comparison to the 2007 DOF forecasts is presented below. DOF estimates for current and previous years are revised annually; the last forecast of future-year population was provided in July 2007.

	2000	2006	2010	2015	2020	2025	2030	2035
SJCOG/UOP Forecast	568,023	662,395	682,523	744,459	809,685	872,960	934,503	989,774
DOF Projections*	568,991	670,159	741,417	N/A	965,094	N/A	1,205,198	N/A

*2000 & 2006 are July 1 estimates from *State of California, Department of Finance, Population Estimates and Components of Change by County, July 1, 2000-2008. Sacramento, California, December 2008* (Table E-6). Forecasts from 2010 to 2030 are from *State of California, Department of Finance, Population Projections for California and Its Counties 2000-2050, by Age, Gender and Race/Ethnicity, Sacramento, California, July 2007*(Table P-3).

The 2030 projections from UOP are approximately 12.5% lower than the population assumptions utilized in the 2007 RTP, which were, in turn, approximately 11% lower than the DOF projections. Ultimately, the current population numbers reflect a continuing trend from those adopted as part of the last RTP update. In addition to the comparison of DOF forecasts, it is helpful to look backward at DOF's population estimates since the 2000 Census.

04/01/2000	01/01/2001	01/01/2002	01/01/2003	01/01/2004	01/01/2005	01/01/2006	01/01/2007	01/01/2008	01/01/2009
563,598	580,057	599,317	616,737	635,252	652,248	664,889	674,331	682,316	689,480
		3.32%	2.91%	3.00%	2.68%	1.94%	1.42%	1.18%	1.05%

State of California, Department of Finance, E-4 Population Estimates for Cities, Counties and the State, 2001–2009, with 2000 Benchmark. Sacramento, California, May 2009.

Of particular interest in the data is the revised January 2008 estimated population for San Joaquin County of 682,316 and the January 2009 estimate of 689,480 (a 1.05% increase), as compared to the 2010 DOF forecast of 741,417. The average annual growth over the eight-year period is 2.36%, with a decline in the rate of growth in every year since 2004. The difference between the January 2009 estimate of 689,480 and the 2010 forecast of 741,417 as shown in the previous table is 7.5% (5% annual growth), a rate well above historical population growth rates in San Joaquin County and certainly above the most recent trends. Historical population trends in San Joaquin County between 1970 and 2005 indicate an average annual growth rate of 2% per year, including two particularly strong growth periods in the 1980s and between 2000 and 2005. This growth is almost one and one-half times the state and over two times the national growth rate over the same period.

The major factor driving the recent slowed growth trend is domestic migration (migration to/from other areas of California or other states). While natural population increase and international migration have held relatively steady over the last two decades, net domestic migration has been more volatile and has shown a more substantial drop in the last two years, turning negative in 2006. This negative domestic migration stems somewhat from more people leaving San Joaquin County for other areas; however, the largest contributor is the drop in the number of people coming to San Joaquin County from other areas of the State and/or Country. Unemployment and the poor real estate market are two major factors affecting domestic migration as San Joaquin County follows a wider national trend of decreasing population mobility. The current population projections by UOP are based on an "average" domestic migration scenario that takes into account an average over the 1995-2000 time frame (the 2000-2005 time period represents an above-average growth period; the 2005 through 2010 period represents a below-average growth period). The UOP population model is calibrated to 2008 census estimates and assumes that the migration levels between 2008 and 2010 remain at the 2007-2008 level. During the 2010 to 2015 time period, population growth gradually returns to about 1.7% annually as net domestic migration returns to pre-recession average levels, still well above the projected state and national growth rates of 1.1%. Please see the attached *Regional Analyst* for additional information.

Household projections are a function of population forecasts and will show similar variations assuming no dramatic shifts in the variables underlying household formation. According to historical DOF numbers, persons per household in San Joaquin County rose slightly in the decade from 1990 to 2000, increasing from 2.94 to 3.00; then rising again from 2000 to 2009, from 3.00 to 3.06. The current forecasts from UOP indicate a persons per household number ranging from 2.97 in 2010 to 3.00 in 2020 and beyond in keeping with historical data. This occurs even as the population overall in San Joaquin County ages, following national trends. While the aging population trends towards more, smaller households, higher fertility rates overall in San Joaquin County as compared to the remainder of the state trends toward fewer, larger households with more children. Thus, total households trends proportionally with population growth even as population within the age ranges shifts gradually - with the over 60-year old group growing at the fastest pace. Again, the attached *Regional Analyst* provides more detail on these demographics.

It is clear from DOF's own estimates that a revision to the growth forecasts will be necessary; however, new forecasts will not be completed until after the 2010 census. In the interim, representatives from DOF have conducted meetings throughout the state in order to understand the magnitude and likely persistence of the downward trend in recent population growth estimates. One such meeting occurred with the City of Stockton, DOF representatives, and representatives of the California Department of Housing and Community Development. SJCOG and UOP representatives also attended this meeting. SJCOG has undertaken this update with UOP in large part due the substantial lag time between DOF's 2007 forecast and a likely update scenario of at least 2011 for new DOF forecasts.

Where population growth projections have shown downward revisions that are expected to persist over time, job growth in the county has represented a less volatile trend. This, of course, is due in part to the fact that in-migration to the county has not primarily been due to increasing employment opportunities in San Joaquin County, but the lack of affordable housing in the Bay Area. Thus, even as population growth trends decrease, job growth remains relatively stable. The differences in the most recent jobs forecasts for San Joaquin County and the previous assumptions from the 2007 RTP is shown below:

	Base (2006)	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
2007 RTP Jobs	N/A	216,076	225,468	234,897	262,076	288,737	N/A
UOPJobs Forecast*	223,292	213,956	240,150	258,497	275,785	294,359	312,799

Note: This is a measure of the number of jobs physically located within San Joaquin County and is not a measure of the number of employed persons.

***** The base year job number is from the U.S. Census Bureau's 2006 Longitudinal Employer-Household Dynamics (LEHD) data; forecasts are projected through 2035 by the Business Forecasting Center at University of the Pacific.

While San Joaquin County has not been immune to the downturn in the economy in general, as reflected in the drop of the number of jobs between the 2006 base year and 2010 of approximately 9,300 jobs, the job outlook has improved by the next analysis year in 2015. While recent forecasts have indicated that the overall unemployment rate in San Joaquin County, the State, and the Nation may remain higher than historic averages, job formation within the County will improve over the long-term. According to data presented in the June 2009 *Regional Analyst*, job growth in the county over the 2000 to 2008 time period is led by Transportation, Warehousing, and Utilities sector reflecting a shift of these jobs from the Bay Area; growth in Professional & Business Services sector reflecting growth in temporary staffing agencies; and growth in Educational & Health Services following national trends and carrying over from population growth.

Recommendation:

Staff recommends that the SJCOG Board approve the following population, household, and jobs forecasts for the purpose of meeting the latest planning assumptions requirement for the Regional Transportation Plan (RTP) update.

The following base year (2006) and future year forecasts for San Joaquin County are submitted for your review and action:

	Base (2006)	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**
Population	662,395	682,523	744,459	809,685	872,960	934,503	989,774
Households	224,754	229,674	249,057	269,845	290,743	311,358	330,105
Jobs	223,292	213,956	240,150	258,497	275,785	294,359	312,799

The recommendations of the Technical Advisory Committee (TAC), the Executive Committee, the Citizens Advisory Committee (CAC), and the Management & Finance Committee will be reported as part of the staff presentation. Should the totals be adopted, the population, housing and employment forecasts will be disaggregated to the jurisdictional and Traffic Analysis Zone (TAZ) level; these sub-county forecasts are expected to be brought before the SJCOG Policy Board at a future meeting.

Prepared By: Kim Anderson, Associate Regional Planner
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Total Population

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	26,928	27,200	28,900	29,100	29,400	29,700	29,900	30,200
DIXON**	16,180	17,500	18,400	20,000	21,300	22,500	23,400	24,600
FAIRFIELD**	96,545	106,900	113,900	118,000	121,200	124,200	126,700	129,400
RIO VISTA**	4,715	7,500	9,200	10,500	11,900	13,300	14,600	15,800
SUISUN CITY**	26,640	28,200	29,800	30,800	31,800	33,000	34,000	35,000
VACAVILLE**	89,304	97,200	101,300	104,400	106,900	109,200	111,400	113,100
VALLEJO**	119,917	122,900	127,200	131,100	134,800	137,700	140,700	143,200
REMAINDER	14,313	14,200	14,400	14,600	14,800	15,000	15,100	15,200
SOLANO COUNTY	**394,542**	**421,600**	**443,100**	**458,500**	**472,100**	**484,600**	**495,800**	**506,500**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Household Population

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	26,874	27,100	28,800	29,000	29,300	29,600	29,800	30,100
DIXON**	16,139	17,500	18,400	20,000	21,300	22,500	23,400	24,600
FAIRFIELD**	92,255	102,400	109,400	113,500	116,700	119,700	122,200	124,900
RIO VISTA**	4,713	7,500	9,200	10,500	11,800	13,200	14,500	15,700
SUISUN CITY**	26,546	28,100	29,700	30,700	31,700	32,900	33,900	34,900
VACAVILLE**	80,086	87,800	91,900	95,000	97,400	99,700	101,900	103,600
VALLEJO**	118,119	121,100	125,400	129,300	133,000	135,900	138,900	141,400
REMAINDER	13,836	13,700	13,900	14,100	14,300	14,500	14,600	14,700
SOLANO COUNTY	**378,568**	**405,200**	**426,700**	**442,100**	**455,500**	**468,000**	**479,200**	**489,900**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Households

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	10,352	10,670	11,200	11,300	11,400	11,520	11,630	11,710
DIXON**	5,102	5,640	5,870	6,440	6,920	7,350	7,690	8,100
FAIRFIELD**	30,995	35,000	36,970	38,030	38,930	39,940	41,020	42,230
RIO VISTA**	1,940	3,120	3,800	4,350	4,900	5,450	5,960	6,470
SUISUN CITY**	8,158	8,770	9,170	9,500	9,850	10,220	10,590	10,990
VACAVILLE**	28,351	31,590	32,720	33,600	34,550	35,540	36,480	37,410
VALLEJO**	40,608	42,330	43,480	44,540	45,720	46,890	48,080	49,330
REMAINDER	4,897	4,920	4,950	4,970	5,010	5,030	5,040	5,050
SOLANO COUNTY	**130,403**	**142,040**	**148,160**	**152,730**	**157,280**	**161,940**	**166,490**	**171,290**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Persons Per Household

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	2.60	2.54	2.57	2.57	2.57	2.57	2.56	2.57
DIXON**	3.16	3.10	3.13	3.11	3.08	3.06	3.04	3.04
FAIRFIELD**	2.98	2.93	2.96	2.98	3.00	3.00	2.98	2.96
RIO VISTA**	2.43	2.40	2.42	2.41	2.41	2.42	2.43	2.43
SUISUN CITY**	3.25	3.20	3.24	3.23	3.22	3.22	3.20	3.18
VACAVILLE**	2.82	2.78	2.81	2.83	2.82	2.81	2.79	2.77
VALLEJO**	2.91	2.86	2.88	2.90	2.91	2.90	2.89	2.87
REMAINDER	2.83	2.78	2.81	2.84	2.85	2.88	2.90	2.91
SOLANO COUNTY	**2.90**	**2.85**	**2.88**	**2.89**	**2.90**	**2.89**	**2.88**	**2.86**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Employed Residents

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	14,455	14,590	15,530	15,810	16,050	16,270	16,570	16,810
DIXON**	7,697	8,340	8,750	10,320	11,470	12,250	13,180	14,420
FAIRFIELD**	44,883	49,570	53,050	55,970	58,130	59,970	62,940	66,600
RIO VISTA**	2,051	3,260	4,460	5,980	7,300	8,300	9,700	11,240
SUISUN CITY**	12,804	13,520	14,230	15,140	15,980	16,650	17,670	18,880
VACAVILLE**	40,246	43,650	45,640	48,070	50,350	52,160	54,740	57,550
VALLEJO**	54,308	55,520	57,540	60,450	63,260	65,400	68,670	72,440
REMAINDER	6,520	6,450	6,500	6,560	6,660	6,700	6,730	6,760
SOLANO COUNTY	**182,964**	**194,900**	**205,700**	**218,300**	**229,200**	**237,700**	**250,200**	**264,700**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Total Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	14,560	15,530	13,820	15,350	16,730	17,510	18,260	19,010
DIXON**	4,980	5,840	5,490	6,290	8,070	8,770	9,730	10,650
FAIRFIELD**	46,500	50,740	45,990	51,440	56,580	61,750	66,840	71,640
RIO VISTA**	2,290	2,450	2,930	3,330	3,750	4,490	5,260	6,120
SUISUN CITY**	3,670	4,080	4,190	4,310	4,840	5,290	5,680	6,460
VACAVILLE**	27,060	30,710	29,940	31,100	32,470	36,090	40,300	43,920
VALLEJO**	32,480	35,720	33,590	36,140	39,520	42,500	44,930	47,870
REMAINDER	5,200	5,450	4,170	4,570	5,100	5,450	5,730	6,210
SOLANO COUNTY	**136,740**	**150,520**	**140,120**	**152,530**	**167,060**	**181,850**	**196,730**	**211,880**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Agriculture and Natural Resources Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	100	110	110	120	120	120	110	100
DIXON**	210	280	330	350	430	440	460	450
FAIRFIELD**	230	270	260	280	290	290	290	290
RIO VISTA**	180	240	290	300	310	350	380	410
SUISUN CITY**	40	40	50	50	50	40	40	40
VACAVILLE**	110	80	110	100	80	90	90	90
VALLEJO**	370	350	350	330	310	300	300	310
REMAINDER	820	640	510	480	420	380	340	320
SOLANO COUNTY	**2,060**	**2,010**	**2,010**	**2,010**	**2,010**	**2,010**	**2,010**	**2,010**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Manufacturing, Wholesale and Transportation Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	5,240	5,300	4,960	5,430	5,830	6,140	6,320	6,430
DIXON**	1,030	1,180	1,140	1,330	1,730	1,750	1,990	2,150
FAIRFIELD**	6,190	6,300	6,400	6,650	7,080	7,360	7,950	8,950
RIO VISTA**	380	430	580	540	680	820	920	930
SUISUN CITY**	470	720	730	690	760	900	820	1,000
VACAVILLE**	4,310	4,540	4,700	4,820	4,940	5,620	6,310	6,740
VALLEJO**	3,040	3,040	2,830	3,240	3,420	3,610	3,780	3,680
REMAINDER	1,380	1,120	800	870	980	1,110	1,110	1,210
SOLANO COUNTY	**22,040**	**22,630**	**22,140**	**23,570**	**25,420**	**27,310**	**29,200**	**31,090**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Retail Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	1,340	1,400	1,330	1,390	1,400	1,430	1,590	1,550
DIXON**	850	970	880	750	1,270	1,350	1,600	1,690
FAIRFIELD**	5,730	6,120	5,630	6,730	6,460	7,170	7,400	8,590
RIO VISTA**	370	320	300	300	510	640	770	980
SUISUN CITY**	510	530	490	540	590	740	760	800
VACAVILLE**	4,360	4,840	4,720	4,850	4,900	5,760	6,480	6,710
VALLEJO**	4,120	4,420	3,800	3,960	4,780	5,110	5,320	5,330
REMAINDER	320	450	320	410	580	720	740	840
SOLANO COUNTY	**17,600**	**19,050**	**17,470**	**18,930**	**20,490**	**22,920**	**24,660**	**26,490**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Financial and Professional Service Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	2,150	2,450	1,810	1,980	2,430	2,560	2,460	2,680
DIXON**	630	770	600	890	900	1,150	1,060	1,240
FAIRFIELD**	6,340	6,830	6,280	6,650	7,470	7,680	9,190	9,010
RIO VISTA**	290	330	420	620	580	600	590	600
SUISUN CITY**	510	560	530	530	650	740	860	870
VACAVILLE**	3,830	4,620	4,450	4,430	4,700	5,550	6,190	7,440
VALLEJO**	4,160	4,850	4,010	4,620	4,960	5,660	5,610	6,140
REMAINDER	440	1,100	800	990	1,080	1,090	1,200	1,410
SOLANO COUNTY	**18,350**	**21,510**	**18,900**	**20,710**	**22,770**	**25,030**	**27,160**	**29,390**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Health, Educational and Recreational Service Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	3,400	3,800	3,480	3,940	4,240	4,410	4,830	5,140
DIXON**	1,360	1,610	1,610	1,840	2,290	2,510	2,860	3,190
FAIRFIELD**	13,570	15,710	14,290	16,300	18,150	20,250	21,460	22,740
RIO VISTA**	620	670	840	990	1,050	1,230	1,530	1,880
SUISUN CITY**	1,500	1,510	1,590	1,680	1,940	1,990	2,190	2,610
VACAVILLE**	9,020	10,540	10,140	11,000	11,630	12,280	13,870	15,110
VALLEJO**	16,130	18,020	17,640	18,820	20,420	21,830	23,520	25,420
REMAINDER	1,410	1,220	940	1,060	1,260	1,380	1,540	1,610
SOLANO COUNTY	**47,010**	**53,080**	**50,530**	**55,630**	**60,980**	**65,880**	**71,800**	**77,700**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Other Jobs

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	2,330	2,470	2,130	2,490	2,710	2,850	2,950	3,110
DIXON**	900	1,030	930	1,130	1,450	1,570	1,760	1,930
FAIRFIELD**	14,440	15,510	13,130	14,830	17,130	19,000	20,550	22,060
RIO VISTA**	450	460	500	580	620	850	1,070	1,320
SUISUN CITY**	640	720	800	820	850	880	1,010	1,140
VACAVILLE**	5,430	6,090	5,820	5,900	6,220	6,790	7,360	7,830
VALLEJO**	4,660	5,040	4,960	5,170	5,630	5,990	6,400	6,990
REMAINDER	830	920	800	760	780	770	800	820
SOLANO COUNTY	**29,680**	**32,240**	**29,070**	**31,680**	**35,390**	**38,700**	**41,900**	**45,200**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Mean Household Income (In Constant 2005 Dollars)

Subregional Study Area

	2000	2005	2010	2015	2020	2025	2030	2035
BENICIA**	98,000	96,500	100,000	103,900	108,800	114,300	119,000	123,700
DIXON**	75,400	77,400	81,500	86,700	93,000	98,900	103,900	109,300
FAIRFIELD**	74,800	72,300	76,700	81,200	88,500	96,300	103,400	109,300
RIO VISTA**	70,200	67,700	73,900	80,900	86,200	92,800	97,000	101,600
SUISUN CITY**	80,400	77,700	82,000	87,000	92,300	97,900	102,300	107,000
VACAVILLE**	79,800	77,300	80,500	88,600	97,100	103,100	109,000	114,800
VALLEJO**	72,000	72,300	79,100	84,500	89,400	94,600	100,600	106,500
REMAINDER	130,500	126,100	133,500	141,500	151,700	160,000	166,300	172,800
SOLANO COUNTY	**78,000**	**84,400**	**85,600**	**90,100**	**94,600**	**99,300**	**104,300**	**109,400**

*CITY **CITY SPHERE OF INFLUENCE ***OTHER SUBREGIONAL AREA

Sacramento - Delta Population and Employment Projections

SACOG Modeling Projections for 2005, 2013, 2018 and 2035; February 2008

Regional Analysis District Name 2006	Regional Analysis District Number 2006	Total Household Population 2005	Total Household Population 2013	Total Household Population 2018	Total Household Population 2035		Total Employment 2005	Total Employment 2013	Total Employment 2018	Total Employment 2035
Delta	20	5,941	6,141	6,365	8,205		3,205	3,206	3,213	3,477

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Appendix B: Draft Technical Memorandum STA Model Evaluation Summary and Future Forecasts for SR-12

DRAFT MEMORANDUM

To: Caltrans Districts 4, 3, and 10

From: Mohan Garakhalli and Guillaume Shearin – PBS&J

Date: April 15, 2011

Subject: STA Model Evaluation Summary and Future Forecasts for the SR 12 Comprehensive Corridor Evaluation and Corridor Management Plan

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The memo presents an evaluation of the updated STA travel demand forecasting model. PBS&J received the updated model from STA in June of 2010. PBS&J used the STA model to forecast future year volumes along a 42-mile stretch of the SR 12 corridor in Solano, Sacramento, and San Joaquin counties as part of the SR-12 Comprehensive Corridor Evaluation and Corridor Management Plan.

A technical modeling committee was formed to guide the modeling and forecasting tasks of the study. The committee provided crucial review and guidance throughout the process to ensure that the modeling methodology was sound and the data being used for forecasting travel demand matched long range projections of the various agencies through which SR 12 traverses. The committee was comprised of representatives from Metropolitan Transportation Commission (MTC), Solano, Sacramento and San Joaquin counties. Review of study tasks was conducted for existing and future conditions analysis. Comments from the review were incorporated into the analysis and the final approved numbers were summarized and will be used as input to the various analysis tasks. A discussion of each of the modeling tasks follows.

1 Review of the Solano Transportation Authority (STA) Travel Demand Model

The purpose of this study was to evaluate how well the model is currently performing, and assess whether it is ready to be used for its intended purpose. The model was evaluated at a regional, county and study corridor level. A discussion of the comparative analyses conducted for each level is provided below and followed by a summary of conclusions and recommendations. As explained below, the model review concluded that the STA model is adequate for use in the SR 12 corridor evaluation.

2.1 Regional Level Validation

STA's on-call modeling consultant in the spring of 2010 (Fehr & Peers) made several improvements to the model. These improvements are described in a technical memo[1], dated April 19, 2010 and addressed to STA. Table 1 shows the results of the Base year (2010) model validation for the updated/improved model.

Table 1: Results of Calibrated 2010 STA Model Validation

Validation Item	Criterion for Acceptance	AM Model Results	PM Model Results
Model to Count Ratio	Between 0.9 and 1.1	1.03	0.96
% of Links within Caltrans Standard Deviations	At least 75%	80%	84%
Correlation Coefficient	Greater than 88%	96%	98%
%RMSE	30% or less	**36%**	25%

Source: Fehr & Peers, 2010
Note: Figures in bold indicate criteria are not met

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1 Fehr & Peers. Solano-Napa Model Update – 2010 Validation Summary. April 19, 2010.

Model volumes were compared to count data at various links located throughout Solano, Sacramento and San Joaquin counties. Only those roadway segments with a peak hour count of at least 100 vehicles were included. Eighty percent of the model's link volumes are within Caltrans' defined acceptable range when compared to counts in the AM peak hour, and 84 percent in the PM peak hour. During the AM peak hour, three of the four validation tests meet the specified criteria. During the PM peak hour, all four validation tests meet the criteria. These results represent a significant improvement in the model's performance, and the model was considered to be performing acceptably at the regional level.

2.2 County Level Validation

Comparative analysis was performed for both socio-economic input data and resultant volume assignment data. Socio-economic data for Solano County and adjacent San Joaquin County used in the STA model were compared to the assumptions contained in the fiscally constrained San Joaquin Council of Governments (SJCOG) travel demand model, which has been recently updated. Results of the comparative analysis for the two counties are listed in Table 2 and Table 3, which have different formats because of different data available for the two counties. The comparison did not include Sacramento County because its mostly rural land use was not expected to influence traffic volumes on SR 12 substantially. For Solano County, the total dwelling units in the STA model are slightly higher than those SJCOG model (1%) but the jobs are lower (16%). Since the land use in the STA model has been recently updated for Solano County, the relatively lower jobs are probably an accurate reflection of the changing economic conditions. For San Joaquin County, results indicate that the land use assumptions in the STA model are close to those in the SJCOG model for trip productions (less than 10% variation) whereas the attraction totals for San Joaquin County are higher in the SJCOG model as compared to the STA model.

Table 2: Land Use Comparison between the STA 2010 and SJCOG Model for Solano County

Jurisdiction	HOUSING		EMPLOYMENT		
	Single Family	Multi Family	Retail	Service	Other
Solano County (Total) from STA Model 2010[1]	108,638	40,859	31,252	33,998	52,374
Solano County (Total) from San Joaquin County 2010[2]	109,174	38,987	26,683	34,273	79,164
Difference (STA model-San Joaquin)	-536	1,872	4,569	-275	-26,790
Difference % ((STA Model-San Joaquin)/STA Model)	-0.5%	4.8%	17.1%	-0.8%	-33.8%

1. Data from STA model 2010
2. Data from San Joaquin County

Table 3: Land Use Comparison between the STA 2010 and SJCOG Model for San Joaquin County

Jurisdiction	Production	Attraction
San Joaquin County (Total) from STA Model 2010 [1]	1,455,456	1,200,958
San Joaquin County (Total) from San Joaquin County 2010 [2]	1,609,094	1,582,409
Difference (STA model-San Joaquin)	-153,638	-381,452
Difference % ((STA Model-San Joaquin)/STA Model)	-9.5%	-24.1%

1. Data from STA model 2010
2. Data from San Joaquin County

Similar to the regional level validation, traffic volumes on state routes including SR 160, I-5, SR 12, SR 113 and I-80 were compared to counts obtained from the PeMS database for years 2008 through 2010. Only those links that experienced more than 100 vehicles during the peak hour were included in the analysis. Also, it should be noted that limited availability of count data on various state routes did not allow for an extensive comparative analysis. Results of the comparative analysis at a county level for Solano County indicates trends that are similar to those observed on a regional level. The statistics indicate that the model is performing well with model volumes being close to existing conditions ground counts. Table 4 summarizes the results of this analysis.

Table 4: County Level Volume Comparison between the STA 2010 Model and Existing Counts

County	RMSE	Model to Count Ratio	Correlation Coefficient
Solano	30%	1.01	0.96
Sacramento	63%	1.42	0.91
San Joaquin	50%	1.43	0.93

Larger variations in Sacramento and San Joaquin Counties can be attributed to lower volumes on non-interstate routes such that minor variations in volumes will lead to larger ratios or percentage changes. The deviation is also attributed to the fact that these areas constitute the fringe areas of the STA model, including portions of Sacramento and San Joaquin Counties along SR 12. The majority of the STA model (contained in Solano County) meets all criteria and was found to be operating acceptably such that results of the model can be used to reasonably predict future travel demand with some minor offline volume adjustments.

2.3 Corridor Level Validation

The initial evaluation included a detailed check of the 2010 model network in the study corridor, and a review of the model's ability to match available count data for mainline segments. A comparative analysis was conducted to try and gain a more complete picture of the how the model is performing specifically along SR 12, and to gain insight into where any further improvements or adjustments may be needed. The 2010 model volumes were compared to available count data from several sources (Caltrans, PeMS, and PBS&J on-site data collection). Comparison of model and count data for key study links are shown on Figures 1 and 2.

Figure 1: Comparison of AM Peak Hour Volume on SR 12 between the STA 2010 Model and Existing Counts

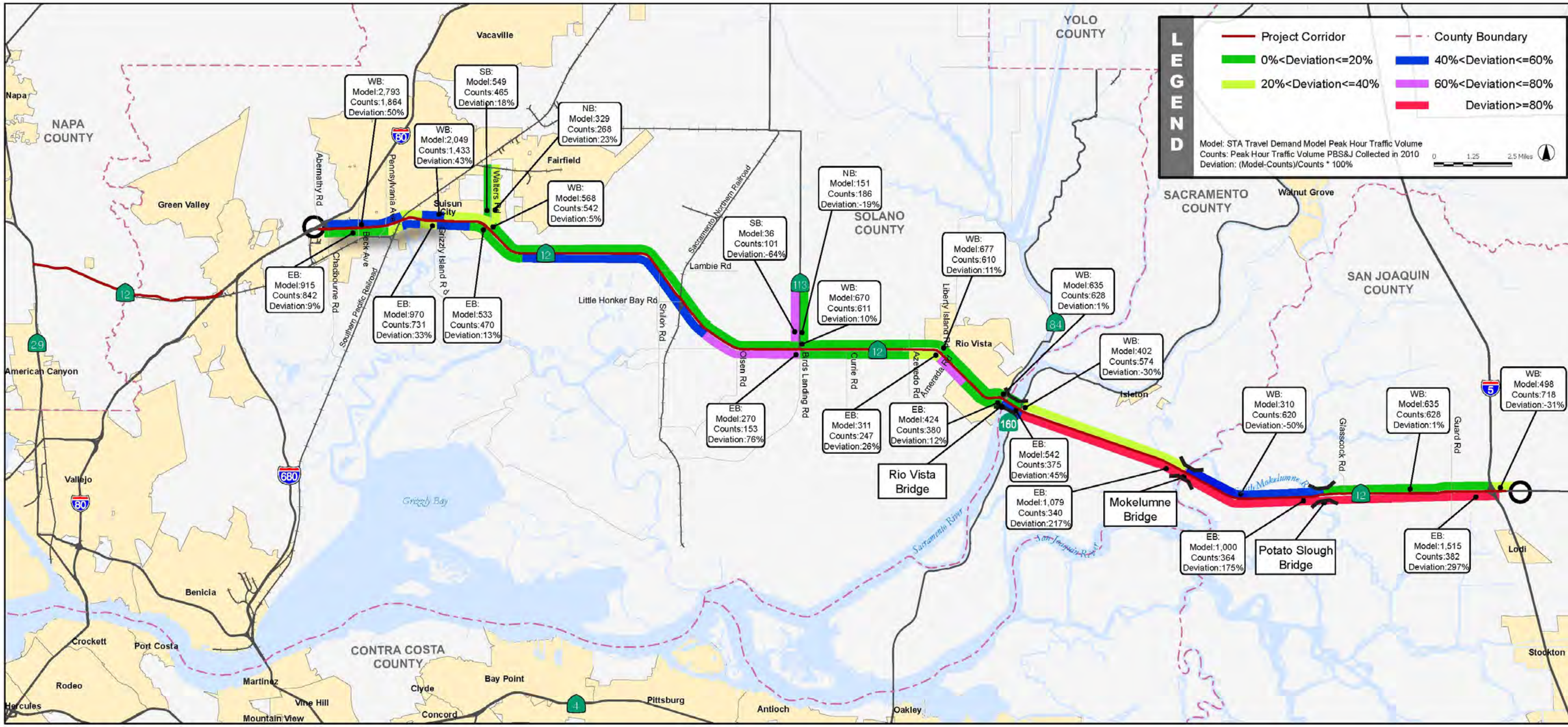
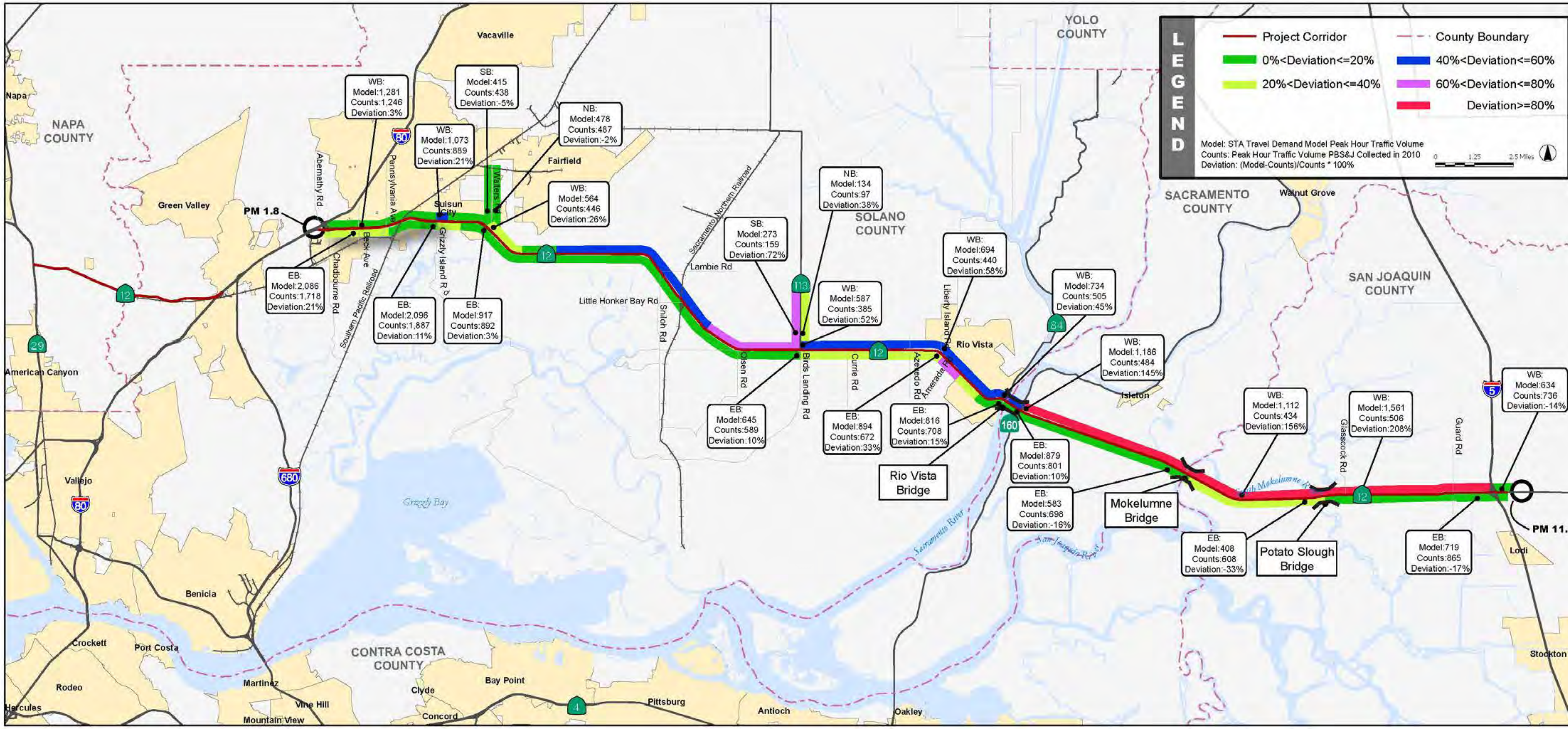


Figure 2: Comparison of PM Peak Hour Volume on SR 12 between the STA 2010 Model and Existing Counts



Results of the analysis indicate that the STA model is performing acceptably for the SR 12 corridor except for over predicting 2010 EB AM trips and the converse PM movement on SR 12 east of SR 160. Because this is a fringe area of the model covering portions of Sacramento and San Joaquin counties along SR 12, the model would typically have less detail and accuracy here than in more central areas. This over-prediction is also more noticeable because SR 12 east of SR 160 has relatively low volumes that are difficult to predict accurately in any model. The San Joaquin model has similar results in this area, except that the San Joaquin model over predicts both travel directions on SR 12.

Since comparison of the production/attraction totals indicated that the STA model totals were slightly below the San Joaquin totals, it was concluded that the difference in trips for SR 12 east of SR 160 was not a function of land use totals. Further investigation in the form of select link analyses and review of desire lines indicated that some out of direction trips were utilizing SR 12 to travel from Antioch and Brentwood to Lodi and Stockton. It was also found that the centroid connector for a major TAZ (1691) had to be reconfigured to better match the TAZ access point with the concentration of land use for this TAZ. In addition, links on SR-4 and SR 160 were revised to better reflect actual operations and to create a more desirable logical path for the out of way trips. These revisions to the network significantly improved volumes on SR 12 east of SR 160.

Review of the results of the improved STA model indicates that all of the out of way trips on SR 12 were eliminated and that the resultant volumes on SR 12 were reduced by approximately 800 trips in the peak direction. While the resulting assignments are still further off than those for some of the other segments of SR 12, they are improved enough that future traffic can be predicted reasonably by percentage change in link volumes along SR 12.

2.4 Summary of Model Review and Forecasting Approach

These results of the comparative analyses are not unexpected. As with most regional models, the STA model was designed to forecast traffic at a regional or county-wide level and it appears to be producing reasonable results at that level. The STA model is functioning acceptably for all links of SR 12 except those east of SR 160. The links east of SR 160 are experiencing off-peak direction volumes significantly higher than those obtained during volume counts. This over-prediction is pronounced because SR 12 east of SR 160 has relatively low volumes that are difficult to predict accurately in any model.

Very few regional models are able to perform within widely accepted validation targets at the sub-area or corridor level, without additional work and refinement. Investigation of and adjustments to the STA model improved the performance of the model on SR 12 east of SR 160 sufficiently that future traffic can be predicted reasonably by applying percentage change in link volumes along SR 12. Correction of the remaining over-prediction stated above and the minor findings related to correlation between the STA and SJ model would require refinements to the Sacramento and San Joaquin county portions of the STA model and would not materially improve the study results.

Several methods and techniques have been developed especially for this situation, where a regional model is being used for a corridor level analysis. The most widely used procedure is the adjustment process described in National Cooperative Highway Research Program (NCHRP) Report 255[2]. This adjustment process was specifically developed to analyze corridor traffic movements, and basically uses the model to estimate the growth in traffic between a base and future year, and then adds the growth from the model to a base year traffic count. This procedure was applied to the improved STA model to obtain growth factors for each segment. These factors were used to calculate volumes for 2030 conditions. Post processed 2030 volumes were extrapolated to obtain 2035 volumes. Extrapolation of volumes was conducted based on growth trends between 2010 and 2030 which were obtained from the STA travel demand model as well as MTC and SJCOG projections for 2010 through 2035. The resultant volumes were cross-checked against historical growth data from past years to ensure that the projected growth is representative of the anticipated changes in land use intensity for the study area.

2 Transportation Research Board. National Cooperative Highway Research Program (NCHRP) Report 255: Highway Traffic Data for Urbanized Area Project Planning and Design. December 1982.

In addition to determination of future volumes, truck percentages were also calculated based on past traffic volume counts. Vehicle classification data on SR 12 was reviewed for previous years to determine the variation in truck percentage over time. Results of the analysis are listed in Table 5.

Table 5: Comparison of Truck Percentages on SR-12 for Past Years

Segment	Years					
	2000	2002	2004	2006	2008	2010
Jct. Rte. 80	5.09	5.09	5.09	5.09	5.09	5.09
Scandia road	9.4	9.66	9.66	9.66	9.50	9.50
Scally road	12.27	17.56	17.56	17.56	17.56	17.56
Jct. Rte. 113N	13.7	15.18	15.18	9.54	8.75	8.75
Jct. Rte. 84 N	11.1	10.12	10.12	8.94	9.11	9.11
Solano/Sacramento county line	13.6	13.6	13.6	13.6	13.6	13.6
Jct. Rte. 160	14.5	14.5	14.5	14.5	14.5	14.5
Sacramento/San Joaquin county line	14.1	14.1	14.1	14.1	14.1	14.1
Jct. Rte. 5	15.3	13.9	15.3	15.3	18.9	18.9
Average	12.3	13.2	13.2	12.1	12.1	12.1
Source: Caltrans Average Annual Truck Traffic database, 2009. http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/index.htm on 12/20/2010 and PBS&J traffic analysis, 2010.						

Review of historic data indicates that the percentage of truck traffic has largely remained constant for most segments. Segments of SR 12 in the vicinity of I-5 show noticeable variation. Existing truck classification data were compared and modified to match historic trends while calculating future year peak-hour truck traffic percentages, which are presented at the end of this memorandum.

2 Travel Demand Forecast for Year 2035

This section summarizes the methodology employed to forecast 2035 volumes and displays the results in graphical and tabular form. The forecast procedures used the following six steps, each of which are further discussed in the following sections:

- STA model 2030 forecast with network and centroid corrections to minimize anomalies
- 2010 counts adjusted for economic conditions
- NCHRP Report 255 procedures applied to STA model volumes and adjusted 2010 counts
- Extrapolation to 2035
- Historical trend analysis and averaging
- Consideration of seasonal traffic variations

2.5 Modification of the Existing Conditions Network

Network and centroid adjustments were performed to correct volume anomalies observed during the initial review of the model. Network modifications adjusted a few link connections and the centroid modifications revised the centroid connection location to better match access points that exist in the field. These minor network refinements resulted in volume assignments that were similar to field counts and addressed the volume anomalies adequately. The same refinements were conducted for the 2030 network and the refined STA model was used to forecast 2030 link volumes for the SR 12 corridor. The adjustments minimized out-of-direction travel on SR 12 that was not supported by the traffic counts and gave a reasonable forecast that was further refined and extrapolated in the next steps.

2.6 Year 2010 Counts Adjusted for Economic Conditions

This study analyzed the magnitude of temporal change in volumes during the recent past and adjusted the 2010 counts accordingly to address concerns that the recent recession had depressed traffic volumes in the corridor below what could be considered a reasonable basis for the 2035 forecasts. Caltrans Average Annual Daily Traffic (AADT) for SR 12 was reviewed for a period extending from 2000 through 2009 and it was found that corridor average AADT in 2009 was 8% lower than during 2005 through 2007, but some locations in Fairfield and Rio Vista were 20% lower. To give a more reasonable basis for a long-range forecast, the 2010 counts were adjusted link by link corresponding to the AADT changes to reflect the 2005 through 2007 period rather than the 2009 conditions. Because a few links in eastern Fairfield had AADT that increased between 2005-2007 and 2009, these links were not adjusted.

2.7 NCHRP Report 255 Procedures

NCHRP Report 255 procedures were applied to the STA 2010 and 2030 model volumes to give a 2030 forecast based on adjusted counts and model growth ratios and volume differences. These procedures assume that the model is better at projecting relative growth as compared to absolute growth and compute traffic volume increments that were added to the 2010 adjusted counts to project 2030 peak-hour volumes. Tables 6 through 9 summarize the base and adjusted 2010 peak-hour counts, the 2035 forecasts, and the average annual percentage growth (exponential) by link between the adjusted 2010 counts and the 2035 forecasts and are included in the appendix of this memorandum.

2.8 Extrapolation to 2035

Because the STA model has a horizon year of 2030, 2030 peak-hour link volumes were extrapolated to 2035 using Association of Bay Area Governments (ABAG) population and employment data for Solano County. Analysis of the ABAG demographic data found that the projected annual growth rates between 2030 and 2035 for both Solano County as a whole and the SR 12 corridor (Fairfield, Suisun City, and Rio Vista) were approximately 85% of the average annual growth rates between 2010 and 2030. A comparable analysis of SJCOG demographic data found that the San Joaquin County growth rates between 2030 and 2035 were approximately 74% of the average annual growth rates between 2010 and 2030. Year 2035 peak-hour link volumes were computed for all links in the corridor using annual growth rates between 2035 and 2030 equal to 85% of their corresponding 2010 to 2030 average annual growth rates (exponential).

2.9 Historical Trend Analysis and Averaging

Based on Caltrans historical AADT, the historical growth rates for SR 12 links from 1992 through 2009 were analyzed and compared to the projected growth rates between 2010 and 2035. The off-peak direction growth rates compared very closely to the historical, with differences typically less than 1% per year. The peak-direction growth rate had more variation, however, with differences in eastern Fairfield reaching 2% or more. To give a peak-hour, peak-direction forecast more in line with historical growth trends, the average annual growth rate from the mainline forecast and the historical analysis were averaged, resulting in project peak-direction growth rates within 1% or less of the historical average. New 2035 peak-hour, peak-direction traffic volumes were calculated from the averaged growth rates.

Because there is no historical data for most of the intersecting streets, the cross traffic was not subjected to the same historical trend comparison. Intersecting streets can also have substantially more growth than the SR 12 mainline due to the effects of localized development. The growth trends in cross traffic were reviewed and any anomalies were adjusted when link volume growth was applied to turning movement counts at intersections in later future conditions analysis. Figures 3 through 6 show comparative graphs for the base and adjusted 2010 peak-hour counts and the 2035 forecasts for all links of the SR 12 corridor by AM/PM peak hour and direction. These final 2035 SR 12 mainline forecast peak-hour volumes are shown on Figures 7 and 8. Tables 6 through 9 (included in the appendix) also show the average growth rate between 2010 and 2035, which generally ranges between 2% and 4%.

Figure 3: AM Peak Hour Volume Trends for Eastbound SR 12

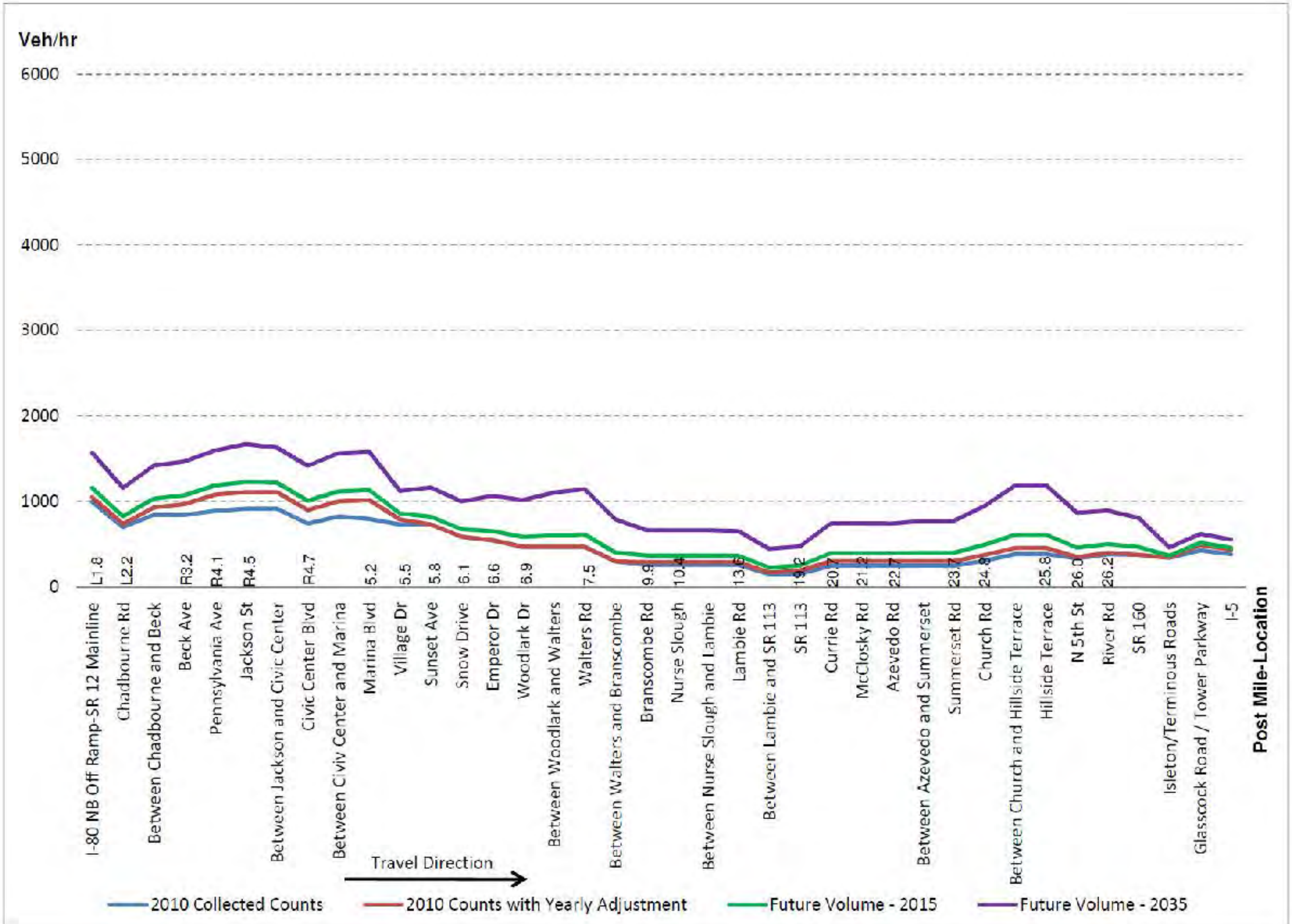


Figure 4: AM Peak Hour Volume Trends for Westbound SR 12

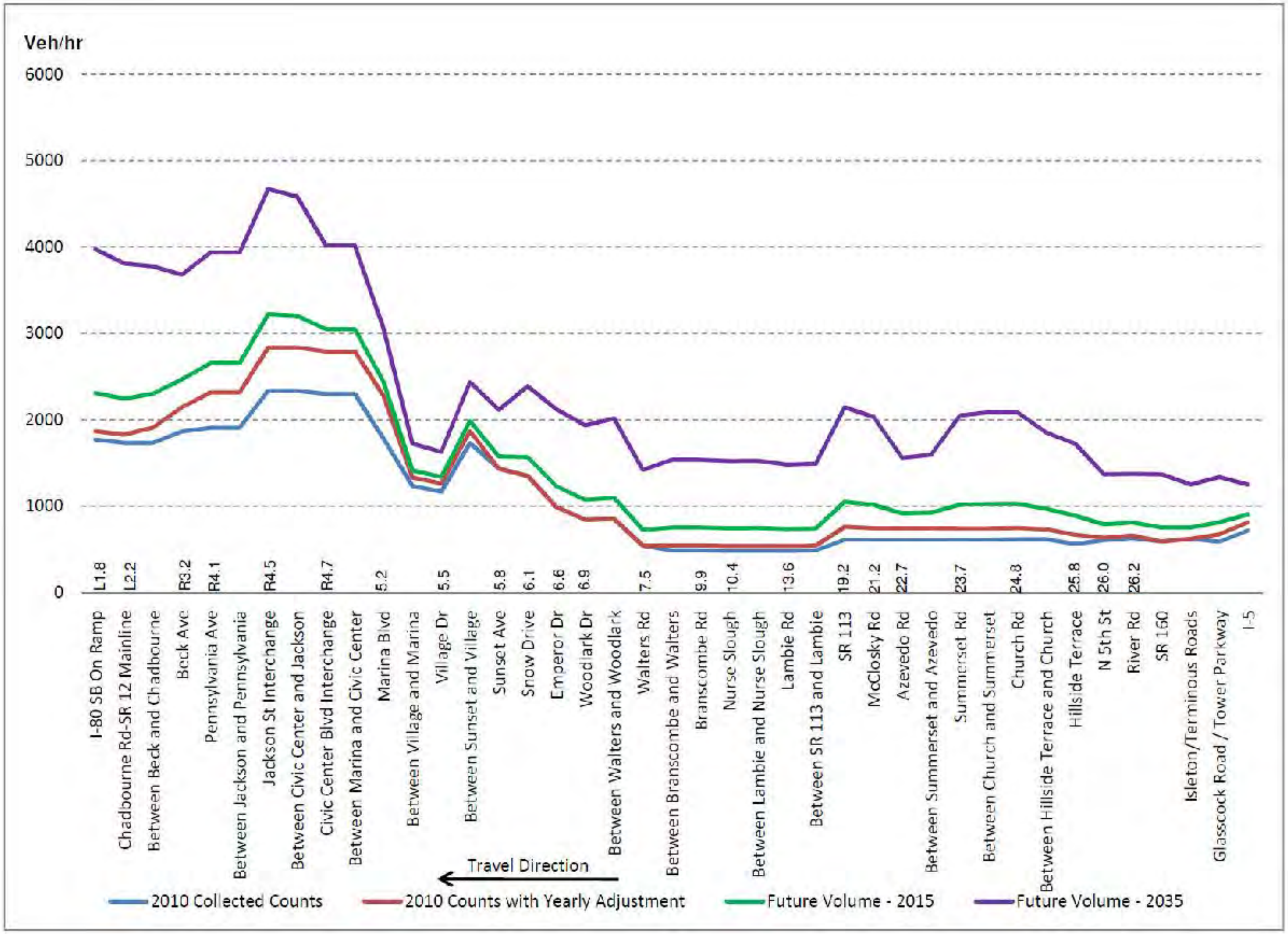


Figure 5: PM Peak Hour Volume Trends for Eastbound SR 12

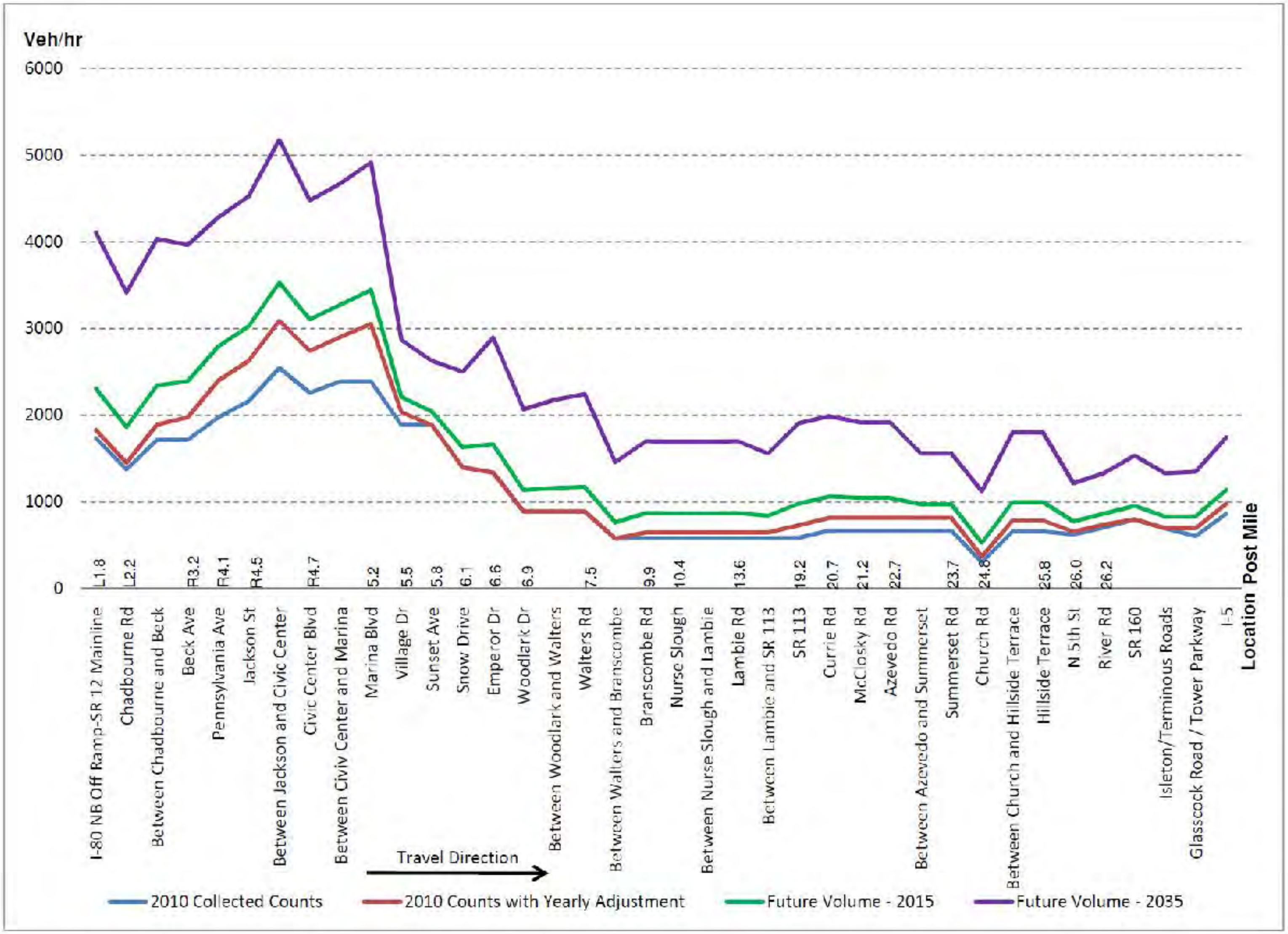
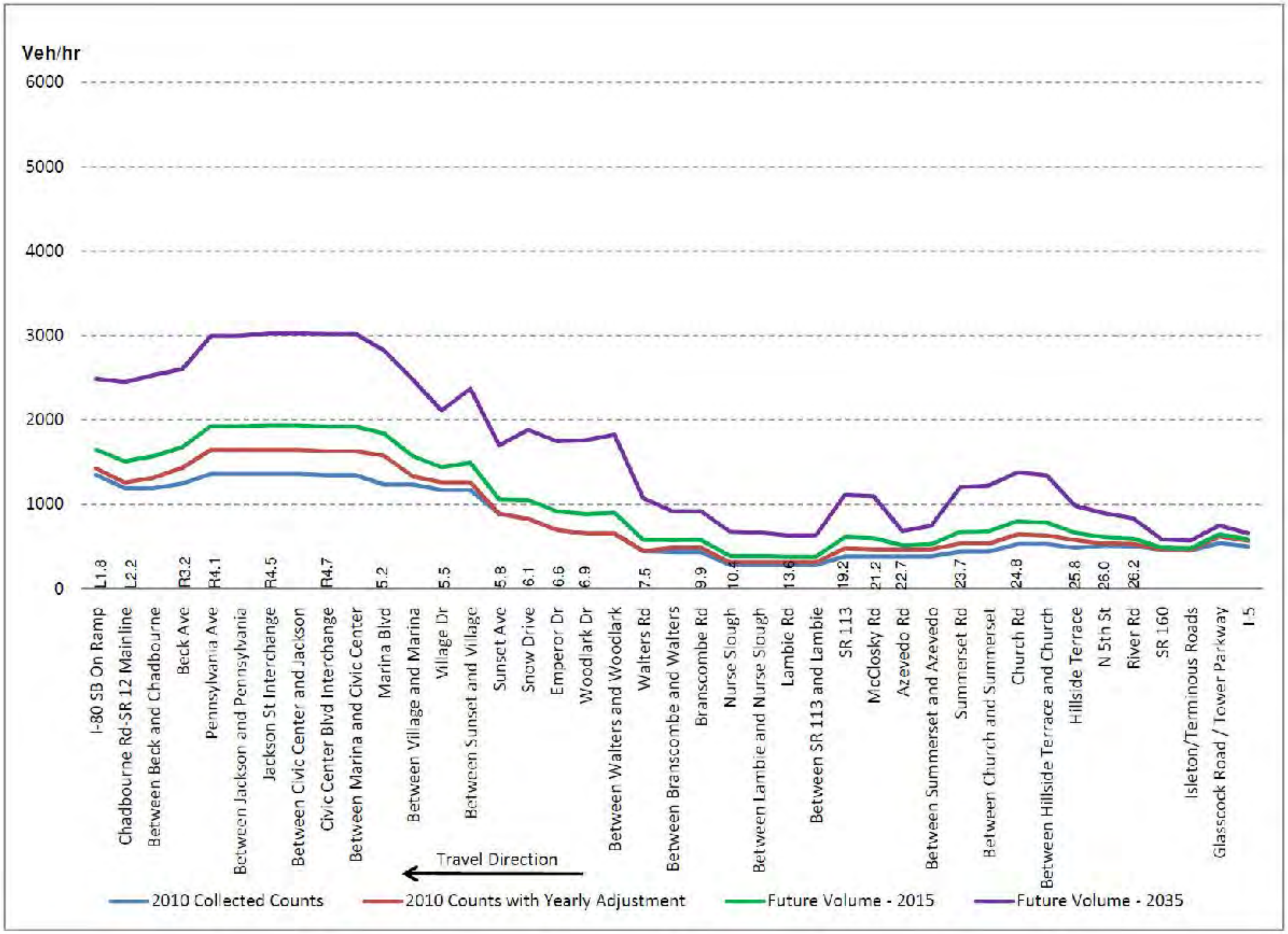


Figure 6: PM Peak Hour Volume Trends for Westbound SR 12



2.10 Seasonal Traffic Variations

Seasonal variation in traffic volumes was also considered to place in perspective the traffic counts performed during May 2010. Caltrans seasonal traffic data was not available for every month except at the very eastern end of the corridor. Based on the Caltrans data, May traffic volumes are typically lower than those during the peak months of June and July, but where data is available to compare month by month, the May traffic is lower by less than 10%. Consequently, we concluded that no seasonal correction was needed for the forecasts.

2.11 Summary of Anticipated Growth

Urban development, which has been especially rapid in San Joaquin County over the last decade, is projected to continue along the corridor. Because traffic growth rates in developing areas are frequently greater than demographic growth rates, the expected demographic growth rates are a reality check on the reasonableness of the traffic forecasts presented later in this section. Population and employment in San Joaquin County are both projected to grow by about 45% between 2010 and 2035, which corresponds to an annual growth rate of 1.5%[3]. Substantial growth is also expected along the SR 12 corridor through Solano and Sacramento counties. The population and employment in the spheres of influence for the cities of Fairfield, Suisun City, and Rio Vista are projected to grow by 18% and 59%, respectively, between 2010 and 2035, or annual rates of 0.7% and 1.9%. While these growth rates in the corridor are projected to be slightly higher than for the county as a whole, the City of Rio Vista sphere of influence is expected to grow much faster, increasing its population by 72% and doubling its employment over the same period, for annual growth rates of 2.2% and 3%, respectively[4]. Population and employment growth in the Delta area of Sacramento County through which SR 12 passes is projected to be 35% and 8%, respectively, between 2010 and 2035, corresponding to annual growth rates of 1.2% and 0.3%[5]. Growth in Sacramento County is expected to be greater, reaching 44% for population and 31% for jobs between 2010 and 2035[6]. These growth rates of 1% to 3% compare relatively well with the higher projected traffic growth rates of 2% to 4% per year and the truck growth rates of 1% to 2% per year for the corridor.

The results of using the STA travel demand model and supplementary procedures are shown on Figures 7 and 8. The figures show adjusted 2010 peak-hour counts and 2035 peak-hour forecast by time, location, and direction. The average annual growth rate of traffic from 2010 to 2035 is also indicated by the SR 12 line color.

2.12 Extrapolation of Peak-Hour Truck Volumes to 2035

Figure 9 shows the projected 2035 average daily truck volumes and percentages on SR-12. Future truck volumes and percentages were forecast by developing trend lines from the historical truck volume data on SR-12 reported by Caltrans in its on-line Annual Average Daily Truck Traffic database for 1992 through 2009. Growth rates from extrapolated trend lines were then averaged with the historical average growth rates between 2000 and 2009 to develop ratios of 2035 to 2010 truck volumes by location along SR 12. The projected average annual truck growth rates ranged from 1.2% to 2.2% per year, with an average of 1.6% per year for the seven locations for which peak-hour traffic counts were collected. This rate compares well with an average rate of 1.9% growth per year between 2000 and 2009 for all SR-12 locations between I-80 and I-5 reported in the Caltrans database. Using existing 2010 average daily truck volumes from counts, the growth rates were used to project 2035 average daily truck volumes. 2035 Average Daily Traffic (ADT) was projected by assuming that ADT would grow in the same proportion to the peak-hour traffic volumes illustrated on Figures 7 and 8. The resulting 2035 daily truck percentages on SR 12 were generally lower than their 2010 counterparts with the exception of just west of I-5. This exception was influenced by the high historical truck growth rate at the location—truck volumes just west of I-5 grew at a rate of 4% between 2000 and 2009.

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3 San Joaquin Council of Governments (SJCOG). 2009 (November). Staff Report - Draft Countywide Population / Household / Employment Update.

4 Association of Bay Area Governments (ABAG). 2009. *Projections 2009.*

5 Sacramento Area Council of Governments (SACOG). 2008 (February), SACOG Modeling Projections for 2005, 2013, 2018 and 2035. PBS&J, 2011.

6 SACOG. 2011 (February) http://www.sacog.org/about/advocacy/pdf/fact-sheets/PopulationStats.pdf, http://www.sacog.org/about/advocacy/pdf/fact-sheets/EmploymentStats.pdf

Figure 7: Future Year (2035) forecasts for the AM Peak Hour

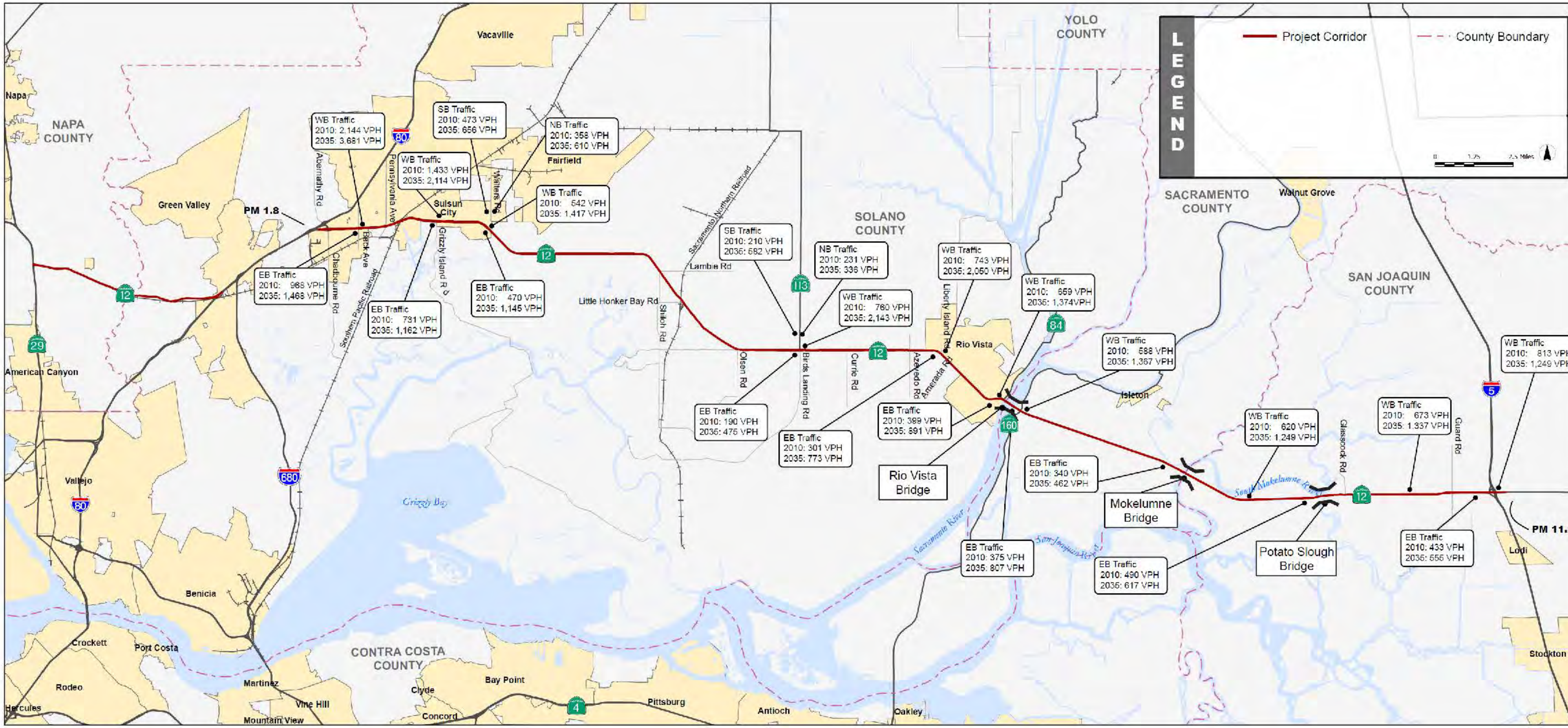

Figure 8: Future Year (2035) forecasts for the PM Peak Hour

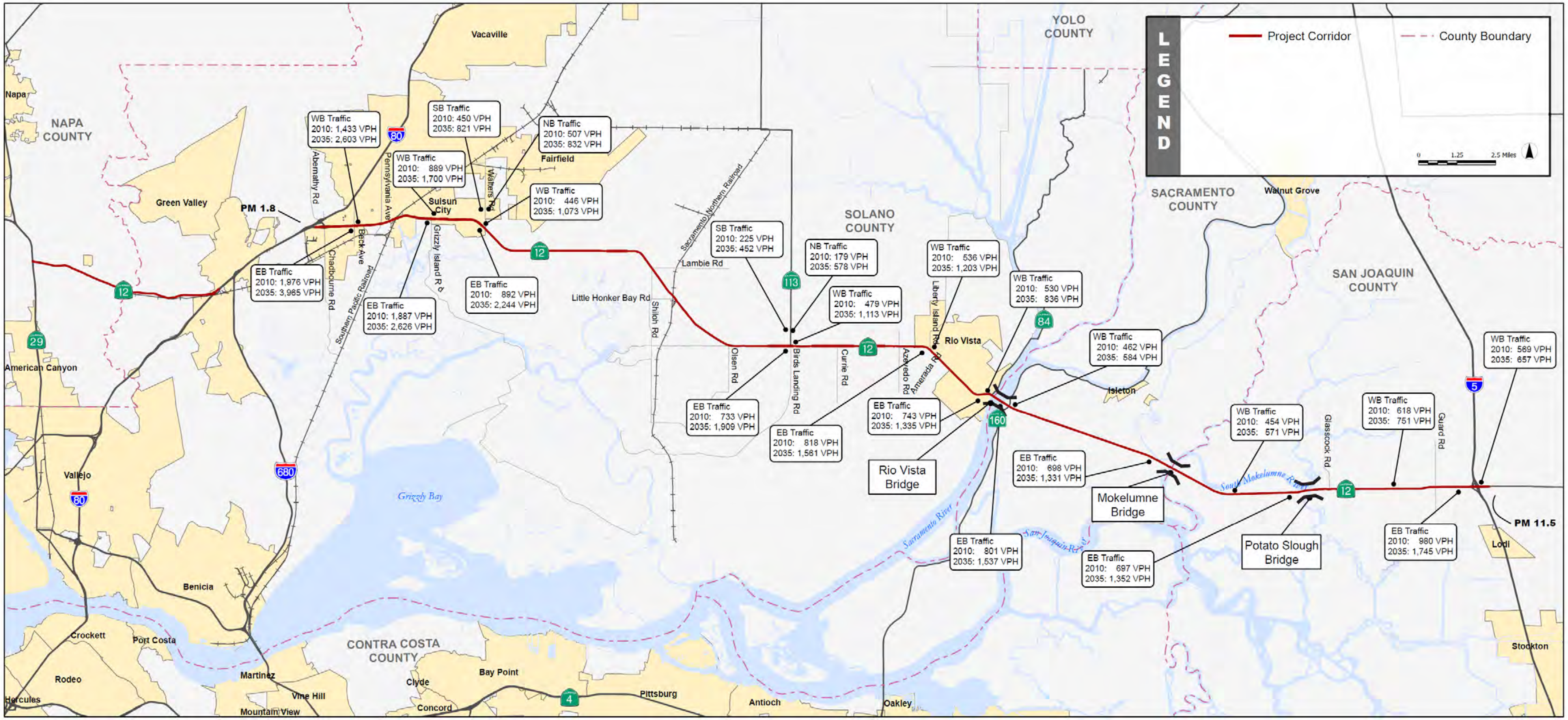

Figure 9: Future Year (2035) Forecasts for Average Daily Truck Volumes on SR-12

APPENDIX

Table 1 - EB Model Volume - AM Peak Hour

#	Intersection Name	2010 Collected Counts				2010 Counts with Yearly Adjustment				Future Volume - 2035				Growth Ratio - 2035			
		NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
Study Area																	
1	I-80 Off Ramp-SR 12 Mainline			994				1049				1569				1.6%	
2	I-80 Off Ramp-SR 12 Mainline			994				1049				1569				1.6%	
3	I-80 Off Ramp-SR 12 Mainline			994				1049				1569				1.6%	
4	Chadbourne Rd-SR 12 Mainline			698				736				1158				1.8%	
5	Chadbourne Rd-SR 12 Mainline			698				736				1158				1.8%	
8	East of Chadbourn Rd			842				928				1418				1.7%	
9	Beck Ave Intersection	76	340	842	1864	87	391	968	2144	244	1204	1468	3852	4.2%	4.6%	1.7%	2.4%
10	Pennsylvania Ave Intersection	32	230	889	1908	39	279	1079	2316	182	742	1596	4049	6.4%	4.0%	1.6%	2.3%
11	Jackson St Interchange			914				1110				1670				1.6%	
12	Jackson St Interchange			914				1110				1679				1.7%	
13	Main St			914				1110				1629				1.5%	
14	Civic Center Blvd			740				898				1417				1.8%	
17	East of Civic Blvd			824				1000				1563				1.8%	
18	East of Civic Blvd			824				1000				1563				1.8%	
19	Marina Blvd Intersection	126	620	794	1780	161	792	1015	2275	268	1596	1581	2460	2.1%	2.8%	1.8%	0.3%
20	Village Dr			731				789				1124				1.4%	
21	Village Dr			731				789				1124				1.4%	
22	Sunset Ave Intersection	197	447	731	1433	197	447	731	1433	368	222	1162	2303	2.5%	-2.8%	1.9%	1.9%
23	Snow Drive Intersection	20	92	586	1349	20	92	586	1349	8	72	1000	2511	-3.8%	-1.0%	2.2%	2.5%
24	Emperor Dr Intersection	225	229	545	990	225	229	545	990	260	485	1065	2173	0.6%	3.0%	2.7%	3.2%
25	WoodLark Dr		148	470	842		148	470	842		55	1015	2286		-3.9%	3.1%	4.1%
26	East of WoodLark Dr			470				470				1105				3.5%	
27	East of WoodLark Dr			470				470				1145				3.6%	
28	East of WoodLark Dr			470				470				1145				3.6%	
29	Walters Rd Intersection	155	473	470	542	155	473	470	542	521	656	1145	1598	5.0%	1.3%	3.6%	4.4%
30	East of Walters Rd			299				299				788				4.0%	
31	East of Walters Rd			299				299				788				4.0%	
32	East of Walters Rd			299				299				732				3.6%	
33	East of Walters Rd			299				299				732				3.6%	
34	Bransombe Rd Intersection			259	487			289	487			664	1514			3.4%	4.6%
35	East of Bransombe Rd			259				289				664				3.4%	
36	East of Bransombe Rd			259				289				664				3.4%	
37	Lambie Rd Intersection			259	482			289	482			653	1436			3.3%	4.5%
38	East of Lambie Rd			150				167				444				4.0%	
39	East of Lambie Rd			150				167				444				4.0%	
40	East of Lambie Rd			150				167				444				4.0%	
41	East of Lambie Rd			150				167				444				4.0%	
42	SR 113 Intersection	17	169	153	611	21	210	190	760	31	582	475	2202	1.5%	4.2%	3.7%	4.3%
43	Currie Rd Intersection			247				301				745				3.7%	
44	MaClosky Rd Intersection			247				301				745				3.7%	
45	Azevedo Rd Intersection			247				301				742				3.7%	
46	East of Azevedo Rd			247				301				773				3.8%	
47	Liberty Island Rd Intersection		137	247	610	0	167	301	743		346	773	1908		3.0%	3.8%	3.8%
48	Church Rd Intersection	45	59	306	614	55	72	373	748	331	161	946	1954	7.5%	3.3%	3.8%	3.9%
49	East of Church Rd			383				456				1187				3.9%	
50	Hillside Terminal Intersection	87	121	383	561	104	144	456	668	54	194	1187	1842	-2.5%	1.2%	3.9%	4.1%
51	5th St Intersection	76	44	332	605	80	46	348	635	113	41	867	1739	1.4%	-0.5%	3.7%	4.1%
52	River Rd Intersection	79	54	380	628	83	57	399	659		86	891	1748		1.7%	3.3%	4.0%
53	SR 160 Intersection	363	283	375	588	363	283	375	588			807	1596			3.1%	4.1%
54	Isleton/Terminous Roads			340				340				462				1.2%	
55	Glassroak Road / Tower Parkway			427				490				617				0.9%	
56	I-5			382	718			433	813			555	1292			1.0%	1.9%

Table 2 - EB Model Volume - PM Peak Hour																	
		2010 Collected Counts				2010 Counts with Yearly Adjustment				Future Volume - 2035				2035 - Growth Precentage Yearly Adjustmen			
#	Intersection Name	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
Study Area																	
1	I-80 Off Ramp-SR 12 Mainline			1735				1830				4106				3.3%	
2	I-80 Off Ramp-SR 12 Mainline			1735				1830				4106				3.3%	
3	I-80 Off Ramp-SR 12 Mainline			1735				1830				4106				3.3%	
4	Chadbourne Rd-SR 12 Mainline			1376				1452				3416				3.5%	
5	Chadbourne Rd-SR 12 Mainline			1376				1452				3416				3.5%	
8	East of Chadbourn Rd			1718				1894				4034				3.1%	
9	Beck Ave Intersection	363	391	1718	1246	417	450	1976	1433	518	407	3965	2875	0.9%	-0.4%	2.8%	2.8%
10	Pennsylvania Ave Intersection	100	444	1975	1360	121	539	2398	1651	1313	1085	4281	2948	10.0%	2.8%	2.3%	2.3%
11	Jackson St Interchange			2164				2627				4525				2.2%	
12	Jackson St Interchange			2164				2627				4495				2.2%	
13	Main St			2546				3091				5177				2.1%	
14	Civic Center Blvd			2259				2742				4476				2.0%	
17	East of Civic Blvd			2390				2901				4672				1.9%	
18	East of Civic Blvd			2390				2901				4672				1.9%	
19	Marina Blvd Intersection	150	415	2390	1234	192	530	3054	1577	487	836	4915	2537	3.8%	1.8%	1.9%	1.9%
20	Village Dr			1887				2036				2869				1.4%	
21	Village Dr			1887				2036				2869				1.4%	
22	Sunset Ave Intersection	215	657	1887	889	215	657	1887	889	403	1427	2626	1237	2.5%	3.2%	1.3%	1.3%
23	Snow Drive Intersection	65	54	1400	829	65	54	1400	829	107	40	2500	1481	2.0%	-1.2%	2.3%	2.3%
24	Emperor Dr Intersection	165	103	1340	696	165	103	1340	696	397	133	2897	1505	3.6%	1.0%	3.1%	3.1%
25	WoodLark Dr		41	892	655		41	892	655		41	2069	1520		0.0%	3.4%	3.4%
26	East of WoodLark Dr			892				892				2180				3.6%	
27	East of WoodLark Dr			892				892				2244				3.8%	
28	East of WoodLark Dr			892				892				2244				3.8%	
29	Walters Rd Intersection	96	450	892	446	96	450	892	446	279	821	2244	1122	4.4%	2.4%	3.8%	3.8%
30	East of Walters Rd			580				580				1460				3.8%	
31	East of Walters Rd			580				580				1460				3.8%	
32	East of Walters Rd			580				580				1469				3.8%	
33	East of Walters Rd			580				580				1418				3.6%	
34	Bransombe Rd Intersection			584	435			651	435			1703	1137			3.9%	3.9%
35	East of Bransombe Rd			584				651				1696				3.9%	
36	East of Bransombe Rd			584				651				1696				3.9%	
37	Lambie Rd Intersection	50	0	584	282	56	0	651	315			1703	822			3.9%	3.9%
38	East of Lambie Rd			584				651				1560				3.6%	
39	East of Lambie Rd			584				651				1560				3.6%	
40	East of Lambie Rd			584				651				1560				3.6%	
41	East of Lambie Rd			584				651				1560				3.6%	
42	SR 113 Intersection	15	181	589	385	19	225	733	479	14	452	1909	1248	-1.0%	2.8%	3.9%	3.9%
43	Currie Rd Intersection			672				818				1989				3.6%	
44	MaClosky Rd Intersection			672				818				1920				3.5%	
45	Azevedo Rd Intersection			672				818				1919				3.5%	
46	East of Azevedo Rd			672				818				1561				2.6%	
47	Liberty Island Rd Intersection		82	672	440		100	818	536		941	1561	1022		9.4%	2.6%	2.6%
48	Church Rd Intersection	45	59	306	614	55	72	373	748	405	435	1124	2256	8.3%	7.5%	4.5%	4.5%
49	East of Church Rd			661				787				1801				3.4%	
50	Hillside Terminal Intersection	137	44	661	483	163	52	787	575	70	142	1801	1316	-3.3%	4.1%	3.4%	3.4%
51	5th St Intersection	49	38	628	511	51	40	659	536	64	60	1216	989	0.9%	1.7%	2.5%	2.5%
52	River Rd Intersection		102	708	505		107	743	530			1335				2.4%	
53	SR 160 Intersection	562	134	801	462	562	134	801	462			1537				2.6%	
54	Isleton/Terminous Roads			698				698				1331				2.6%	
55	Glassroak Road / Tower Parkway			608				697				1352				2.7%	
56	I-5			865	502			980	569			1745	1013			2.3%	2.3%

Table 3 - WB Model Volume - AM Peak Hour																	
		2010 Collected Counts				2010 Counts with Yearly Adjustment				Future Volume - 2035				Growth Ratio - 2035			
#	Intersection Name	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
Study Area																	
1	I-5 Intersection			382	718			433	813			664	1249			1.7%	1.7%
2	Glassroak Road / Tower Parkway				587				673				1337				2.8%
3	Isleton/Terminous Roads				620				620				1249				2.8%
4	SR 160 Intersection	363	283	375	588	363	283	375	588	312		872	1367	-0.6%		3.4%	3.4%
5	River Rd Intersection	79	54	380	628	83	57	399	659		89	831	1374		1.8%	3.0%	3.0%
6	5th St Intersection	76	44	332	605	80	46	348	635	113	40	751	1369	1.4%	-0.6%	3.1%	3.1%
7	Hillside Terminal Intersection	87	121	383	561	104	144	456	668	104	194	1176	1722		1.2%	3.9%	3.9%
8	West of Hillside				614				731				1853				3.8%
9	West of Hillside				614				731				1853				3.8%
10	Church Rd Intersection	45	59	306	614	55	72	373	748	458	182	1039	2085	8.9%	3.8%	4.2%	4.2%
11	West of Church				610				743				2087				4.2%
12	Liberty Island Rd Intersection		137	247	610		167	301	743		346	830	2050		3.0%	4.1%	4.1%
13	West of Liberty Island Rd				611				744				1594				3.1%
14	Azevedo Rd Intersection				611				744				1559				3.0%
15	MaClosky Rd Intersection				611				744				2032				4.1%
16	SR 113 Intersection	17	169	153	611	21	210	190	760				2143				4.2%
17	West of SR 113				486				543				1492				4.1%
18	West of SR 113				486				543				1491				4.1%
19	West of SR 113				486				543				1491				4.1%
20	West of SR 113				486				543				1491				4.1%
21	West of SR 113				486				543				1491				4.1%
22	Lambie Rd Intersection			259	482			289	538			796	1481			4.1%	4.1%
23	West of Lambie				482				538				1527				4.3%
24	West of Lambie				482				538				1523				4.2%
25	West of Lambie				482				538				1523				4.2%
26	Bransombe Rd Intersection			259	487			289	544			816	1535			4.2%	4.2%
27	West of Bransombe Rd				487				544				1535				4.2%
28	West of Bransombe Rd				487				544				1538				4.2%
29	West of Bransombe Rd				487				544				1538				4.2%
30	West of Bransombe Rd				487				544				1521				4.2%
31	West of Bransombe Rd				487				487				1259				3.9%
32	Walters Rd Intersection	155	473	470	542	155	473	470	542	636	656	1229	1417	5.8%	1.3%	3.9%	3.9%
33	West of Walterd Rd				853				853				2015				3.5%
34	West of Walterd Rd				853				853				2015				3.5%
35	West of Walterd Rd				853				853				2015				3.5%
36	WoodLark Dr		148	470	842		148	470	842			1081	1937			3.4%	3.4%
37	Emperor Dr Intersection	225	229	545	990	225	229	545	990			1167	2120			3.1%	3.1%
38	Snow Drive Intersection	20	92	586	1349	20	92	586	1349	6	65	1037	2388	-4.8%	-1.4%	2.3%	2.3%
39	Sunset Ave Intersection	197	447	731	1433	197	447	731	1433			1079	2114			1.6%	1.6%
40	West of Sunset Ave				1730				1867				2435				1.1%
41	Village Dr		128	1887	1169		138	2036	1261		81		1628		-2.1%		1.0%
42	West of Village				1234				1331				1723				1.0%
43	Marina Blvd Intersection	126	620	794	1780	161	792	1015	2275	268	1596	1363	3055	2.1%	2.8%	1.2%	1.2%
44	West of Marina				2299				2791				4016				1.5%
45	Civic Center Blvd Interchange				2299				2791				4016				1.5%
46	Civic Center Blvd Interchange				2231				2708				3933				1.5%
47	Civic Center Blvd Interchange				2231				2708				3933				1.5%
50	West of Civic Center Blvd				2336				2836				4586				1.9%
51	Jackson St Interchange				2336				2836				4672				2.0%
52	West of Jackson				1908				2316				3937				2.1%
53	Pennsylvania Ave Intersection	32	230	889	1908	39	279	1079	2316			1834	3937			2.1%	2.1%
54	Beck Ave Intersection	76	340	842	1864	87	391	968	2144	161	1443	1663	3681	2.5%	5.4%	2.2%	2.2%
55	West of Beck Ave				1733				1911				3778				2.8%
56	Chadbourne Rd-SR 12 Mainline				1733				1828				3809				3.0%
57	Chadbourne Rd-SR 12 Mainline				1575				1662				3461				3.0%
60	I-80 On Ramp				1771				1868				3973				3.1%

Table 4 - WB Model Volume - PM Peak Hour																	
		2010 Collected Counts				2010 Counts with Yearly Adjustment				Future Volume - 2035				Growth Ratio - 2035			
#	Intersection Name	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB	NB	SB	EB	WB
Study Area																	
1	I-5 Intersection			865	502			980	569			2744	657			4%	0.58%
2	Glassroak Road / Tower Parkway				539				618				751				0.78%
3	Isleton/Terminous Roads				454				454				571				0.92%
4	SR 160 Intersection	562	134	801	462	562	134	801	462	1244		1897	584	3%		4%	0.94%
5	River Rd Intersection	141	102	708	505	148	107	743	530		168	1416	836		2%	3%	1.84%
6	5th St Intersection	49	38	628	511	51	40	659	536	84	60	1325	895	2%	2%	3%	2.07%
7	Hillside Terminal Intersection	137	44	661	483	163	52	787	575		142	1711	982		4%	3%	2.16%
8	West of Hillside				531				632				1344				3.06%
9	West of Hillside				531				632				1344				3.06%
10	Church Rd Intersection	18	26	637	531	22	32	776	646	425	411	1963	1379	13%	11%	4%	3.08%
11	West of Church				440				536				1225				3.36%
12	Liberty Island Rd Intersection		82	672	440		100	818	536			1155	1203			1%	3.29%
13	West of Liberty Island Rd				385				469				747				1.88%
14	Azevedo Rd Intersection				385				469				683				1.52%
15	MaClosky Rd Intersection				385				469				1097				3.46%
16	SR 113 Intersection	15	181	589	385	19	225	733	479	14	452	1813	1113	-1.04%	2.83%	3.69%	3.43%
17	West of SR 113				283				316				634				2.82%
18	West of SR 113				283				316				633				2.82%
19	West of SR 113				283				316				633				2.82%
20	West of SR 113				283				316				633				2.82%
21	West of SR 113				283				316				633				2.82%
22	Lambie Rd Intersection			584	282			652	315			1993	632			5%	2.82%
23	West of Lambie				282				315				667				3.05%
24	West of Lambie				282				315				678				3.11%
25	West of Lambie				282				315				678				3.11%
26	Bransombe Rd Intersection			584	435			652	486			1993	920			5%	2.59%
27	West of Bransombe Rd				435				486				920				2.59%
28	West of Bransombe Rd				435				486				1021				3.02%
29	West of Bransombe Rd				435				486				1021				3.02%
30	West of Bransombe Rd				435				486				1135				3.45%
31	West of Bransombe Rd				435				435				1056				3.61%
32	Walters Rd Intersection	96	450	892	446	96	450	892	446			2892	1073			5%	3.57%
33	West of Walterd Rd				655				655				1825				4.18%
34	West of Walterd Rd				655				655				1825				4.18%
35	West of Walterd Rd				655				655				1825				4.18%
36	WoodLark Dr		41	892	655		41	892	655			2463	1760			4%	4.03%
37	Emperor Dr Intersection	165	103	1340	696	165	103	1340	696			2999	1748			3%	3.75%
38	Snow Drive Intersection	65	54	1400	829	65	54	1400	829	107	40	2653	1884	2%	-1%	3%	3.34%
39	Sunset Ave Intersection	215	657	1887	889	215	657	1887	889			2699	1700			1%	2.63%
40	West of Sunset Ave				1169				1261				2369				2.55%
41	Village Dr		128	1887	1169		138	2036	1261		224		2112		2%		2.08%
42	West of Village				1234				1331				2477				2.51%
43	Marina Blvd Intersection	150	415	2390	1234	192	530	3054	1577	487	836	4749	2824	4%	2%	2%	2.36%
44	West of Marina				1348				1631				3024				2.50%
45	Civic Center Blvd Interchange				1348				1631				3024				2.50%
46	Civic Center Blvd Interchange				1242				1503				2811				2.54%
47	Civic Center Blvd Interchange				1242				1503				2811				2.54%
50	West of Civic Center Blvd				1360				1646				3030				2.47%
51	Jackson St Interchange				1360				1646				3030				2.47%
52	West of Jackson				1360				1646				2997				2.43%
53	Pennsylvania Ave Intersection	100	444	1975	1360	121	537	2390	1646	1313	1083	4613	2997	10%	3%	3%	2.43%
54	Beck Ave Intersection	363	391	1718	1246	417	450	1976	1433	518	407	4841	2603	1%	0%	4%	2.42%
55	West of Beck Ave				1192				1314				2532				2.66%
56	Chadbourne Rd-SR 12 Mainline				1192				1258				2449				2.70%
57	Chadbourne Rd-SR 12 Mainline				953				1005				1869				2.51%
60	I-80 On Ramp				1351				1425				2488				2.25%

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