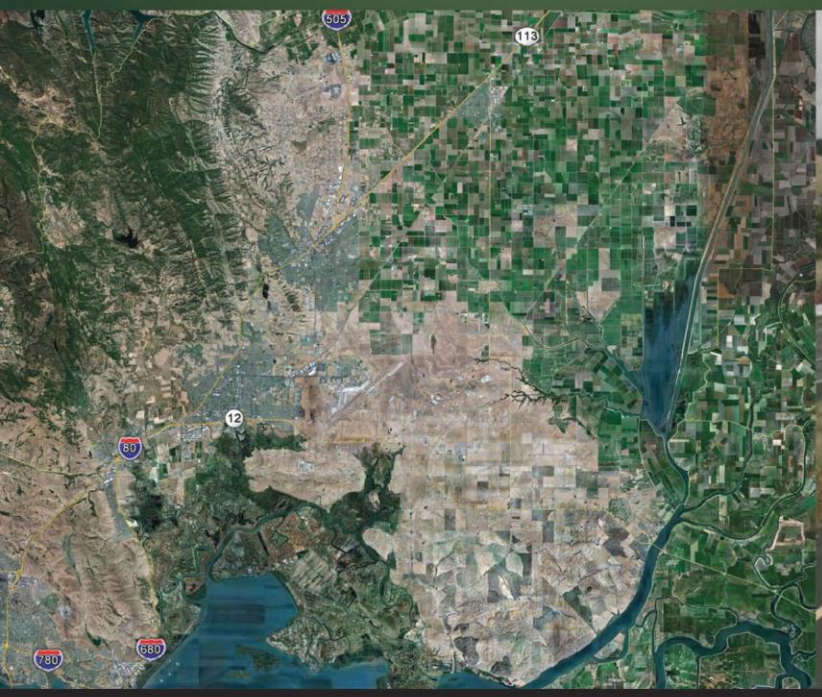
FINAL REPORT

SOLANO COUNTY I-80 RAMP METERING STUDY AND IMPLEMENTATION PLAN

July 2013

Prepared by:

Kittelson & Associates, Inc.
155 Grand Avenue, Suite 900
Oakland, CA 94612
510.839.1742



KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

MOVING**FORWARD**THINKING™

(back of cover page)

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING / PLANNING
155 Grand Avenue, Suite 900, Oakland, CA 94612 P 510.839.1742 F 510.839.0871

July 1, 2013 Project #: 17062.0

Ms. Joy Lee and Ms. Winnie Chung
Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Mr. Alan Chow
Caltrans District 4
Office of Traffic Systems, Mail Station 5F
111 Grand Ave
Oakland, CA 94612

RE: Solano County I-80 Ramp Metering
Deliverable 3.4B –Final Ramp Metering Feasibility and Implementation Plan

Dear Ms. Lee, Ms. Chung, and Mr. Chow:

Kittelson & Associates, Inc. (KAI) is pleased to submit this final report in support of the Solano I-80 ramp metering study. This report is Deliverable 3.4B of the project.

We would like to give credit to the engineers and planners at KAI who contributed greatly to this effort: Allen Huang, Lillian Tsang, Aaron Elias, and Mike Aronson.

Please call me at 510.839.1742 if you have any questions.

Sincerely,
KITTELSON & ASSOCIATES, INC.

Rick Dowling, PhD, PE
Senior Principal Engineer

Kevin Chen, PE
Associate Engineer

ACKNOWLEDGEMENT

Kittelson & Associates would like to thank the contributions made to the preparation of this plan by the following members of the Solano Highways Partnership (SoHIP):
Joe Leach, City of Dixon
George Hicks, City of Fairfield
Steve Hartwig, City of Fairfield
Matt Tuggle, Solano County
Nathan Newell, Solano County
Shawn Cunningham, City of Vacaville
David Kleinschmidt, City of Vallejo
Jill Mercurio, City of Vallejo
Alan Chow, Caltrans District 4
Adrian Levy, Caltrans District 4
Melanie Crotty, MTC
Winnie Chung, MTC
Janet Adams, Solano Transportation Authority
Robert Guerrero, Solano Transportation Authority

We would also like to give special thanks to Sam Shelton and Jeff Knowles for their contributions.

TABLE OF CONTENTS

1. Executive Summary 1
   1.1 Prototype Ramp Metering Plan for 2015 2
   1.2 Metering Staging For Beyond 2015 3
2. Introduction 5
   2.1 Reasons to Activate Ramp Metering on I-80 5
   2.2 How Does Modern Ramp Metering Work? 6
   2.3 Study Area 7
3. Study Approach 9
   3.1 Recommended Analysis Time Periods 9
   3.2 Traffic Operations Analysis Methodologies 10
   3.3 Travel Demand Forecasting Methodologies 10
   3.4 Diversion Analysis 10
   3.5 Future Roadway Network Assumptions 11
4. Existing Conditions 12
   4.1 Existing Freeway Configuration 12
   4.2 Existing Traffic Volumes 13
   4.3 Existing Freeway Operations 15
5. Future Baseline Traffic Forecast and Operations Trends 22
   5.1 Year 2015 Freeway Operations 22
6. Draft Ramp Metering Plan for Year 2015 28
   6.1 Prototype Ramp Metering Plan for 2015 33
   6.2 Ramp Metering effects in Highway Safety 34
   6.3 Effects of the Prototype 2015 Ramp Metering Plan –Eastbound PM Peak Periods 35
   6.4 Effects of the Prototype 2015 Ramp Metering Plan – Eastbound Friday PM Peak Period 36
7. Diversion Analysis 43
   7.1 2015 DTA Results 43
   7.2 2030 DTA Results 48
   7.3 Recommendation 60
8. Implementation Plan 62
   8.1 Next Steps 66

LIST OF EXHIBITS

Exhibit 1: Study Area 8
Exhibit 2: Typical Existing Average Daily Traffic (ADT) 13
Exhibit 3: Monthly and Seasonal Traffic Variations on I-80 East of SR 37 14
Exhibit 4: Monthly and Seasonal Traffic Variations on I-80 at Pena Adobe 14
Exhibit 5: Existing Freeway Bottleneck and Queues Diagram 19
Exhibit 6: Summary Freeway Bottleneck and Queues Summary 23
Exhibit 7: Graphical Illustration of 2015 Freeway Bottleneck and Queue Locations 25
Exhibit 8: Travel Time Comparisons – Eastbound Direction 26
Exhibit 9: Travel Time Comparisons – Westbound Direction 27
Exhibit 10: Eastbound I-80 Metering Equipment for Year 2015 28
Exhibit 11: Westbound I-80 Metering Equipment for Year 2015 29
Exhibit 12: Illustration of 2015 Ramp Equipment 32
Exhibit 13: Ramp Metering Effects on Highway Safety 35
Exhibit 14: Draft Ramp Metering Results for I-80 Eastbound – 2015 Friday PM Peak Period 37
Exhibit 15: I-80 Mainline Freeway Queues and Congested Speeds Comparison (2015) 38
Exhibit 16: I-80 Mainline Travel Time Comparison for 2015 Friday Eastbound 39
Exhibit 17: Peak Hour Travel Time Savings Friday Eastbound PM Metering Schedule (2015) 39
Exhibit 18: Illustration of Peak Hour Travel Time Savings Friday PM Metering Schedule (2015) 40
Exhibit 19: Home Based Work Trip Distribution Between Major Attraction and Production Points 41
Exhibit 20: System-wide Effects of Friday Afternoon Metering Schedule (2015) 42
Exhibit 21: Potential Diversion of Friday Afternoon Metering Schedule (2015) 43
Exhibit 22: Diversion of Friday Eastbound Traffic in Vallejo with Metering (2015) 45
Exhibit 23: Diversion of Friday Eastbound Traffic in Fairfield with Metering (2015) 46
Exhibit 24: Diversion of Friday Eastbound Traffic in Vacaville with Metering (2015) 47
Exhibit 25: Ramp Metering Assumptions for 2030 DTA Analysis – Eastbound I-80 50
Exhibit 26: Ramp Metering Assumptions for 2030 DTA Analysis – Westbound I-80 51
Exhibit 27: Westbound Midweek AM Peak Hour Potential Diversion 52
Exhibit 28: Westbound Sunday PM Peak Hour Potential Diversion 54
Exhibit 29: Eastbound Midweek PM Peak Hour Potential Diversion 56

Exhibit 30: Eastbound Friday PM Peak Hour Potential Diversion 58

Exhibit 31: Percentage of the I-80 Corridor in Congestion by Year 2030 62

Exhibit 32: Implementation Year to Begin Metering at Below Demand Volume Rate 64

Exhibit 33: Solano I-80 Ramp Metering Implementation Staging 65

1. EXECUTIVE SUMMARY

The Metropolitan Transportation Commission (MTC), Caltrans, the Solano Transportation Authority (STA) and the Solano Highways Partnership (SoHIP) have been working and meeting together since January 2010 to determine:

1. Is ramp metering an appropriate strategy to address existing and future congestion on I-80 as Solano County, the Bay Area, and Sacramento continue to grow?
2. What would be the impacts of ramp metering on local streets and how might they be mitigated?
3. If ramp metering is indeed desirable on Solano I-80, what would be an appropriate staging plan?

This report documents the results of this effort and provides a recommended staging plan for implementing ramp metering on the Solano I-80 freeway, along with recommended mitigations and metering policies built into the plan to reduce the impacts on city streets and county roads and assure that Solano County residents experience a net improvement in safety and travel times when using the I-80 freeway.

The study has involved an extensive amount of data collection on I-80 freeway traffic volumes and performance. The STA Solano travel demand model was used to predict future traffic demands for the I-80 freeway and city streets/county roads in the I-80 corridor. A freeway operations analysis model, FREQ (described in more details in Section 3.2), was used to assess freeway operations and suggest initial ramp metering plans. MTC, Caltrans, STA, and SoHIP jointly determined the scope of the analysis and have actively reviewed each of the intermediate products of this study.

This study evaluated two horizon year conditions. The Year 2015 was selected as the base analysis year as that is when ramp metering equipment will be complete and ready for activation for a major portion of the corridor within Solano County. The longer term Year 2030 analysis was conducted to determine the staging of ramp metering on I-80 beyond 2015 conditions and to determine what additional mitigations might be desirable by 2030 to address possible diversions and ramp capacity constraints in the long term.

The initial ramp metering plans produced using the computer models were thoroughly vetted by the project stakeholders (MTC, Caltrans, STA, and SoHIP) to identify an initial implementation segment for ramp metering and to set policies for how metering would be implemented in subsequent stages on the I-80 freeway in Solano County. These policies balance the desire for improved productivity and safety on I-80 with the equally strong desire to minimize delays for Solano County residents using the I-80 freeway. The overarching goal has been to ensure that any metering plan implemented on I-80 would improve safety in the I-80 corridor as well as result in a net savings in travel time for the majority of Solano County residents using the I-80 freeway during peak travel times. In addition, the overarching goal should be accomplished to the extent that there is no significant negative impact to

the local streets and intersections, which might occur if queues from the on-ramp back into the local street. This metering plan avoids that negative effect. Ramp metering could also be implemented to proactively manage traffic congestion before it happens.

This Ramp Metering Study and Implementation Plan is the result of those efforts. The next step of this study, should the study participants choose to proceed, would be to develop a memorandum of understanding with local agencies, monitor traffic conditions following ramp meter activation, and conduct a "before and after" study of the effects of the initial implementation segment.

1.1 PROTOTYPE RAMP METERING PLAN FOR 2015

Based on the results of the traffic operations analysis, it is recommended that ramp meters be installed and activated in the eastbound direction of I-80 in Solano County as soon as possible. Ramp metering on freeway connectors will be evaluated in more details as part of the next step in implementation, conducting before and after studies, which is currently on-going for Stage I between Red Top Road and North Texas Street interchanges in the eastbound direction; Staged II implementation is scheduled on 2014 or later.

The recommended short term (2015) metering plan is:

- Activate ramp meters in the eastbound direction during the Monday–Thursday PM peak period (3 PM to 7 PM);
    - Since recurring peak period congestion on I-80 is currently relatively minor in the eastbound direction, rates would be set at the demand volume rate for each ramp. Metering at demand volume rate indicates that the ramp meter cycle length will be set to serve incoming traffic flow rate. For example, if the existing traffic flow rate is 600 vehicles per hour, the metering rate would be set to serve 600 vehicles per hour. As the I-80 eastbound mainline becomes more congested over time, it will be desirable to re-evaluate these initial metering rates. Based on current demand trends, the initial metering rates should be reevaluated sometime between the Year 2015 and the Year 2018.
- Activate ramp meters in the eastbound direction during the Friday PM peak period (3 PM to 8 PM);
    - Since recurring congestion is significant in the eastbound direction on Fridays, optimal metering rates (in the order of 1% to 3% below demand rate) would be set to optimize system operation. Metering below demand volume rate indicates that the ramp meter cycle length will be set to serve below incoming traffic flow rate. For example, if the existing traffic flow rate is 600 vehicles per hour, the metering rate might be set to serve 98% of that demand or 590 vehicles per hour (metering rates are typically rounded to the nearest tens place). The 2015 analysis suggested that there would be great value to Solano County freeway users, as well as to through traffic, if the eastbound on-ramp meters were to hold back a few vehicles each hour on Friday

afternoons. Barring an incident on the freeway or one of the ramps, all on-ramp queues would be stored within the ramps at all times.

Projected traffic conditions by Year 2015 indicated that activating ramp metering in the westbound direction during weekday AM peak period (5 AM to 10 AM) and Sunday PM peak period (3 PM to 8 PM) would not result in significant operational improvements to the freeway system. Therefore, from a traffic operations standpoint, ramp meters in the westbound direction could be activated later, beyond Year 2015. However, actual freeway mainline conditions should be monitored on a regular basis to determine the exact timing of activating these ramp meters, which could occur by 2015.

Implementation of ramp metering on Friday afternoons in the eastbound direction in 2015 would:

- Reduce vehicle-hours of delay on the freeway by 4% to 5%
- Provide net travel time savings to Solano County residents using I-80 of between 2 to 5 minutes, which takes into account the extra wait time for residents at the ramp meters.

1.2 METERING STAGING FOR BEYOND 2015

Additional analysis was conducted to determine an approximate timeline when ramp meters should be activated in the westbound direction. Based on evaluation of 2030 demand volumes:

- Due to current recurring congestion in the City of Vallejo, both the westbound on-ramps and eastbound on-ramps west of the Redwood Street interchange within Vallejo should be metered as soon as current geometric constraints can be alleviated and the necessary ramp metering equipment can be installed.
- Due to anticipated westbound AM peak and Sunday afternoon recurring congestion along the entire corridor, all on-ramps along the corridor should be metered by the following years:
    - **Westbound Monday through Friday AM Peak Period**: Install and activate ramp meters and set optimal metering rates for the westbound direction by about 2023 or as soon as possible thereafter.
    - **Westbound Sunday PM Peak Period**: Activate ramp meters and set optimal metering rates by about 2019 or as soon as possible thereafter.
- Due to anticipated congestion, on-ramps along the eastbound direction east of I-505 should be metered by the following years:
    - **Eastbound Monday through Thursday PM Peak Period**: Install and activate ramp meters and set demand volume rates as soon as possible after 2015. Based on projected traffic growth, the initial metering rates should be evaluated sometime between 2015 and 2017 as mainline becomes more congested over time.
    - **Eastbound Friday PM Peak Period**: Install and activate ramp meters and set optimal metering rates as soon as possible after 2015.
- Estimated timeline beyond 2015 presented above are based on the evaluation of future forecasting; actual freeway mainline conditions should be monitored on a regular basis to determine the exact timing of implementing ramp meters.

Comprehensive diversion analysis at a county wide level was also conducted for Year 2030 conditions with ramp metering. The analysis found that when metering rates are set appropriately to serve near

demand volume rates and avoid potential queue spillback to arterial streets, ramp metering would not result in any substantial diversion.

2. INTRODUCTION

The Metropolitan Transportation Commission, Caltrans, the Solano Transportation Authority (STA) and the Solano Highways Partnership (SoHIP) have been working and meeting together since January 2010 to determine:

1. Is ramp metering an appropriate strategy to address existing and future congestion on I-80 as Solano County, the Bay Area, and Sacramento continue to grow?
2. What would be the impacts of ramp metering on local streets and how might they be mitigated?
3. If ramp metering is indeed desirable on Solano I-80, what would be an appropriate staging plan?

This report documents the results of this effort and provides a recommended staging plan for implementing ramp metering on the Solano I-80 freeway, along with recommended mitigations and metering policies built into the plan to reduce the impacts on city streets and county roads and assure that Solano County residents experience a net improvement in safety and travel times when using the I-80 freeway.

2.1 REASONS TO ACTIVATE RAMP METERING ON I-80

Ramp metering allows for consistent traffic flow on the mainline and more efficient use of freeway capacity. It also improves safety both in the merge area and on the mainline, particularly when mainline congestion is not already present downstream of the ramp. Other benefits of ramp metering include:

- Ability to manage freeway operations and control potential diversion
- Increased freeway capacity, and improved freeway travel times
- More vehicles served on the freeway, which would translate to reduced vehicle trips on parallel surface streets
- Improved highway safety at ramp merge areas and on the mainline by reducing collision rates. Ramp metering the I-580 freeway in the Tri-Valley area of Alameda County (Dublin, Pleasanton, Livermore) resulted in a reduction of 21 and 25 percent in total collisions[1]. Other nation-wide studies indicate that the crash reduction could be as high as 50 percent.[2]

[1] Source: Caltrans District 4 Traffic Accident Surveillance and Analysis Systems (TASAS)

[2] Source: Lee, Chris, Bruce Hellinga, and Kaan Ozbay, "Quantifying Effects of Ramp Metering on Freeway Safety." Paper presented at the 84th Annual Meeting for the Transportation Research Board, Washington, D.C., January 9-13, 2005. Cambridge Systematics, *Twin Cities Ramp Meter Evaluation – Final Report.* Minnesota Department of Transportation, February 1, 2001

Ramp metering is Solano County is also consistent with the on-going I-80 Integrated Corridor Mobility (ICM) Project, which would implement ramp metering and incident management along I-80 from the San Francisco-Oakland Bay Bridge Toll Plaza in Alameda County to the Carquinez Bridge in Contra Costa County.

Recent studies of the Solano I-80 freeway have all recommended ramp metering as near term mitigation to projected congestion on the freeway:

- FPI Solano 80 Corridor Congestion Mitigation Strategies (authored on 4/16/2008)
- I-80/I-680/I-780 Corridors Highway Operations Study and Implementation Plan (7/8/2009) adopted by the STA Board 2/10/10
- Caltrans Interstate 80 East Corridor System Management Plan (authored in 10/2010)

2.2 HOW DOES MODERN RAMP METERING WORK?

The purpose of modern ramp metering is not to keep traffic from using the freeway, but to spread it out so that freeway flows are more evenly apportioned and freeway throughputs are increased throughout peak periods. As opposed to interchange traffic signals that send traffic to the freeway in surges every time the signal turns green, ramp meters work by apportioning out the traffic entering the freeway. When done correctly, ramp meters can actually boost the capacity of the freeway by 2% to 3% without backing up cars onto city streets.

Ramp meters are set to operate during peak traffic periods. The meters start out at a very high rate, allowing a single vehicle to enter the freeway every 4 seconds (900 vehicles per hour). Then, as traffic increases on the freeway, the metering rate (vehicles per lane per hour passing through the ramp meter) will gradually be reduced to its optimum rate; this rate has previously been specified and computed individually for each ramp to maximize freeway throughput without causing the queue of vehicles on the ramp to spill over onto city streets.

QUEUE DETECTOR OPERATION

At each metered on-ramp location, one or more queue detectors are typically installed near the upstream end of the on-ramp where the vehicles first enter the ramp from city streets. On-ramp queues can be detected by either:

- Measuring queue length: using an “in-out” count of vehicles at the queue detector (inbound) and the passage detector (outbound), with the count reset at the start of metering.
- Measuring queue average occupancy: using a 1-minute exponential running average updated every 15 seconds.

If a queue has been detected during metering, the metering rate will be increased by a pre-specified parameter every 15 seconds until either the queue has dissipated, or the maximum metering rate has been reached (typically 900 vehicles per hour per lane). Once the queue has been dissipated, the metering rate will be decreased by the same user entry parameter every 15 seconds until the metering rate is restored to its normal metering rate specified for the time period.

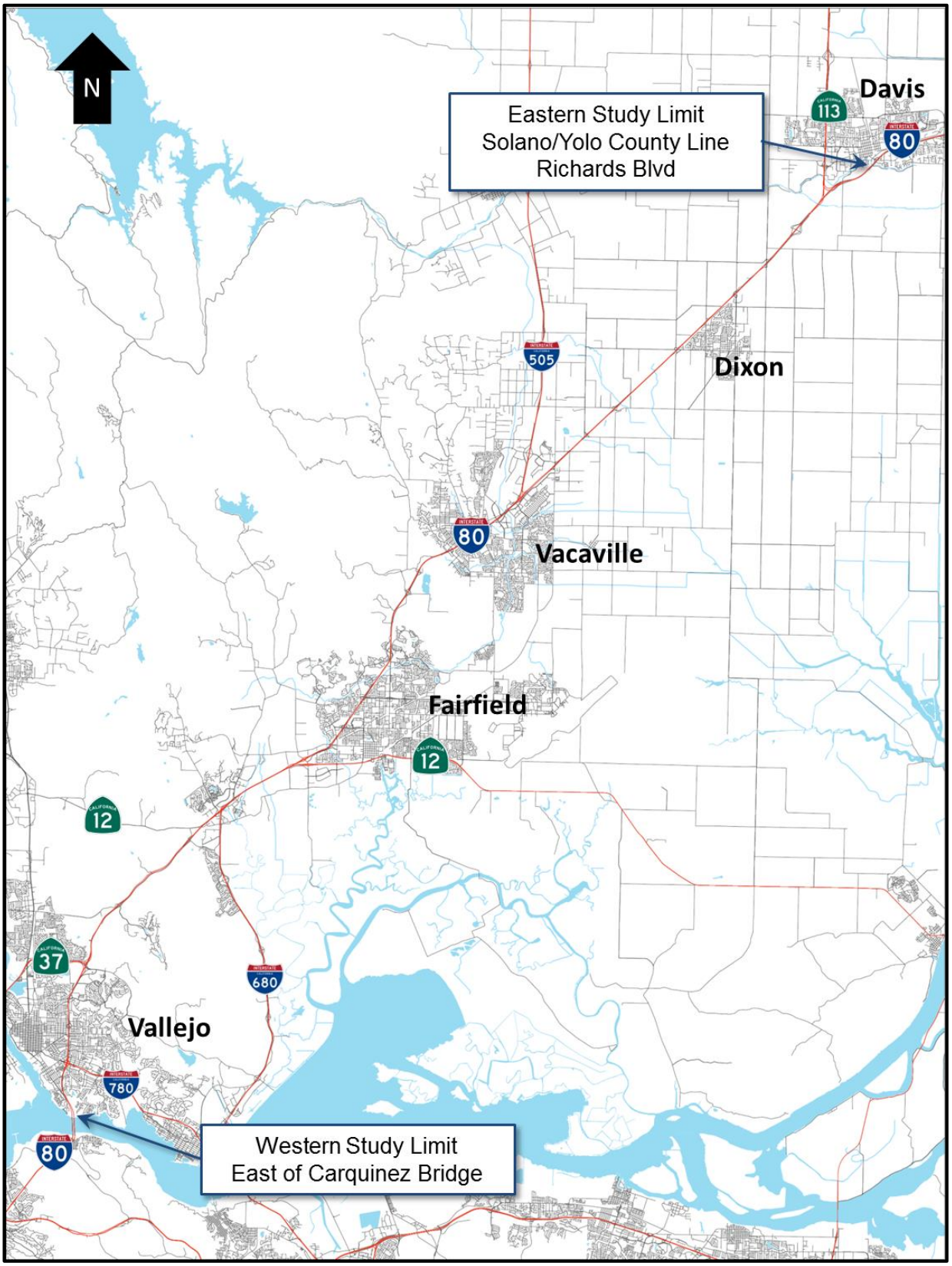
Note that metering rates are specified using the local traffic responsive metering method, based on freeway mainline traffic conditions. The ramp meter will be turned off at the end of the AM and PM peak periods.

2.3 STUDY AREA

The study area consists of two defined areas. The smaller study area applies to the actual stretches of I-80 being evaluated for ramp metering, which includes I-80 from the Solano-Contra Costa county line to the Solano-Yolo county line.

With concentrated input from county and city staff, a larger study area is defined and reflects the impact area of the ramp metering on the local streets. The probability of potential traffic diversion to other local street routes due to ramp metering was assessed at a countywide level, including all potential diversions within the county. Exhibit 1 displays a map of the study corridor and vicinity.

Exhibit 1: Study Area



3. STUDY APPROACH

This chapter provides a summary of traffic operations analysis and travel demand forecasting methodologies that were applied to develop the draft ramp metering plan presented in this report.

The study began with a compilation of traffic data and an evaluation of existing traffic conditions. Detailed near-term conditions (Year 2015) analysis was conducted, as that is the year when metering equipment would be available and ready to activate between Redwood Street in Vallejo and I-505 in Vacaville. Objectives of the Year 2015 analysis were to determine:

- A set of draft metering rates using the FREQ tool.
- The effects of the draft metering plan on the freeway mainline and ramps.
- The peak period(s) when metering rates should be set at or below demand traffic volumes.
- If ramp metering would cause undesirable diversions to local streets in Year 2015 conditions.

This study also included an evaluation of long-term 2030 conditions. The purpose of this evaluation was not to determine a set of metering rates for 2030, but to assess the long-term potential ramp metering effects to local surface streets. Objectives of the Year 2030 analysis were to determine:

- If ramp metering would cause undesirable diversions to local streets in Year 2030 conditions.
- The ramps that may need to be reconstructed in order to enable ramp metering.
- The ramps that need to be widened to continue ramp metering operations due to high demand volumes.
- When ramp meters should be activated along the corridor.

3.1 RECOMMENDED ANALYSIS TIME PERIODS

This facility is heavily used by regular commuters, freight and weekend travelers. Therefore, in addition to studying typical midweek AM and PM peak periods, this analysis also includes Friday eastbound traffic as travelers drive out of the Bay Area towards destinations such as Reno and Lake Tahoe, as well as the Sunday westbound traffic as travelers return to the Bay Area. Based on an examination of available existing traffic data, the following analysis time periods were recommended for evaluation of ramp metering on I-80 in order to fully capture the onset and dissipation of congestion:

- I-80 Westbound Direction:
    - Weekday 5-hour AM peak period: 5:00 AM to 10:00 AM
    - Sunday 5-hour PM peak period: 3:00 PM to 8:00 PM
- I-80 Eastbound Direction:
    - Midweek (Monday – Thursday) 4-hour PM peak period: 3:00 PM to 7:00 PM
    - Friday 5-hour PM peak period: 3:00 PM to 8:00 PM

3.2 TRAFFIC OPERATIONS ANALYSIS METHODOLOGIES

Traffic operations analysis for the I-80 corridor was conducted using the FREQ macroscopic simulation tool, developed by UC Berkeley Professor Emeritus Adolf May. FREQ12 was used to evaluate freeway operations and develop optimized metering rates for the corridor. Caltrans also typically uses this tool for other ramp metering studies.

3.3 TRAVEL DEMAND FORECASTING METHODOLOGIES

The current official version of the Solano Countywide Travel Demand Model (the 2010 Napa-Solano Model) was used to develop travel forecasts for 2015 and 2030 conditions.

Year 2015 and 2030 traffic forecast volumes were obtained using the current official version of the Napa-Solano Travel Demand Model (2010 version). The official model provided socioeconomic datasets for Year 2010 and 2030. The 2015 dataset was developed from a straight-line interpolation of those two datasets.

The 2010 Napa-Solano Model does not include forecasts for Friday evening or Sunday afternoon conditions. The traffic volumes for these time periods were determined by factoring the existing volumes by the ratio of the future years 2015 and 2030 weekday volumes to the existing volumes.

3.4 DIVERSION ANALYSIS

Potential traffic diversions due to ramp metering were evaluated using the CUBE Avenue dynamic traffic assignment (DTA) analysis tool. This is a mesoscopic simulation tool is developed by Citilabs that can effectively measure impacts of upstream traffic congestion, and dynamically re-assign travel path accounting for queuing effects. The process began by extracting a Solano County-only subarea network and trip table from the nine-county 2010 Napa-Solano Model.

Detailed procedures applied for the DTA analysis are summarized as follows:

1. An origin-destination matrix estimation (ODME) process was performed to better match the original countywide travel demand model's ramp and mainline segment volumes to the adjusted forecast ramp volumes. The ODME process creates trip table adjustment factors from the existing traffic counts that are applied to the trip tables during the peak hour assignment process. The trip table adjustment factors indirectly address the peak spreading phenomena in congested areas of the system. A revised subarea trip table was obtained from this process.
2. The revised trip table was then applied as an input and DTA was performed on the subarea. A two-hour simulation period was run, with the first hour to seed the empty network; the second hour results were aggregated for evaluation to represent the peak hour conditions. Intervals of 5 minutes were defined to better assess traffic dynamics, which equates to a total of 24 time intervals for the entire simulation of each study period.

Two DTA runs were performed for each scenario to determine the amount of potential traffic diversion, including a base model run without ramp metering and a second model run with ramp metering.

3.5 FUTURE ROADWAY NETWORK ASSUMPTIONS

Future foreseeable projects were included in the 2015 baseline conditions if those projects are anticipated to have completed construction and be operational by 2015. Based on the information provided by all stakeholders, the following project was included in 2015 baseline conditions:

- Phase 1 of the I-80/I-680/SR-12 Interchange Project

The main features of Phase I incorporated in the FREQ analysis are the construction of braided ramps between the Green Valley Road on-ramp and Route 12 West off-ramp in the westbound direction, and the widening of the Route 12 West off-ramp from one to two lanes.

On-ramp improvement plans provided by Caltrans for 2015 conditions have also been incorporated.

For the long term 2030 analysis, the roadway network was assumed to be consistent with projects that were included in the official Solano countywide model. Additional modifications to the network were made based on input from prior SoHIP meetings, including the I-80/I-680 interchange project described above, and the implementation of express lanes within Solano County:

- Existing HOV lane conversion to express lane from Red Top Road to Air Base Parkway through Fairfield
- Express lane extension from Air Base Parkway in Fairfield to I-505 in Vacaville

4. EXISTING CONDITIONS

This chapter describes existing conditions along the study corridor. I-80 is a national freeway facility connecting California and New Jersey. In Northern California, I-80 connects San Francisco, Alameda, Contra Costa, Solano, Yolo, and Sacramento counties between the cities of San Francisco and Sacramento. Within Solano County, I-80 traverses through the cities of Vallejo, Fairfield, Vacaville, and Dixon, as well as unincorporated Solano County. This facility is heavily used by regular commuters, freight traffic and weekend travelers.

4.1 EXISTING FREEWAY CONFIGURATION

Much of the corridor in the middle portion of the study area includes rolling terrain. There are also some sizeable horizontal curves.

The number of lanes for mixed-flow traffic on I-80 varies from between three and six lanes in both directions, including auxiliary lanes (see Appendix A for detailed existing lane configurations and peak hour volumes). An HOV lane exists between Red Top Road and Air Base Parkway in Fairfield.

In addition, auxiliary lanes exist between ramps at the following locations:

Eastbound:

- Georgia Street on-ramp and Solano Avenue off-ramp
- Solano Avenue on-ramp and Tennessee Street off-ramp
- Jameson Canyon Road (SR 12 West) on-ramp and I-680/Green Valley Road off-ramp
- Abernathy Road on-ramp and W. Texas Street off-ramp
- Beck Avenue on-ramp and Travis Boulevard off-ramp
- Allison Drive southbound on-ramp and I-505 off-ramp
- Kidwell Road on-ramp and SR 113 off-ramp

Westbound:

- SR 113 on-ramp and Kidwell Road off-ramp
- Travis Boulevard westbound on-ramp and W. Texas Street off-ramp
- Truck Rest area on-ramp and SR 37 off-ramp
- Tennessee Street on-ramp and Solano Avenue off-ramp
- Solano Avenue on-ramp and Georgia Street off-ramp

Additionally, there are a number of lane adds (i.e. mainline transitions from 3 to 4 lanes) and lane drops (i.e. mainline transitions from 4 to 3 lanes) throughout the 44-mile study corridor. Detailed freeway lane configurations are included in Appendix A.

4.2 EXISTING TRAFFIC VOLUMES

The existing traffic volumes along the corridor were provided by Caltrans in the form of hourly counts for ramps and select mainline freeway locations[3]. The data varied from 2002–2010, with the vast majority of locations having the more recent traffic data in 2008–2009 (more than 90% of all locations).

Average daily traffic (ADT) on I-80 at a few representative locations throughout the study corridor are presented in Exhibit 2 for typical weekday, Friday, and Sunday conditions.

Exhibit 2: Typical Existing Average Daily Traffic (ADT)

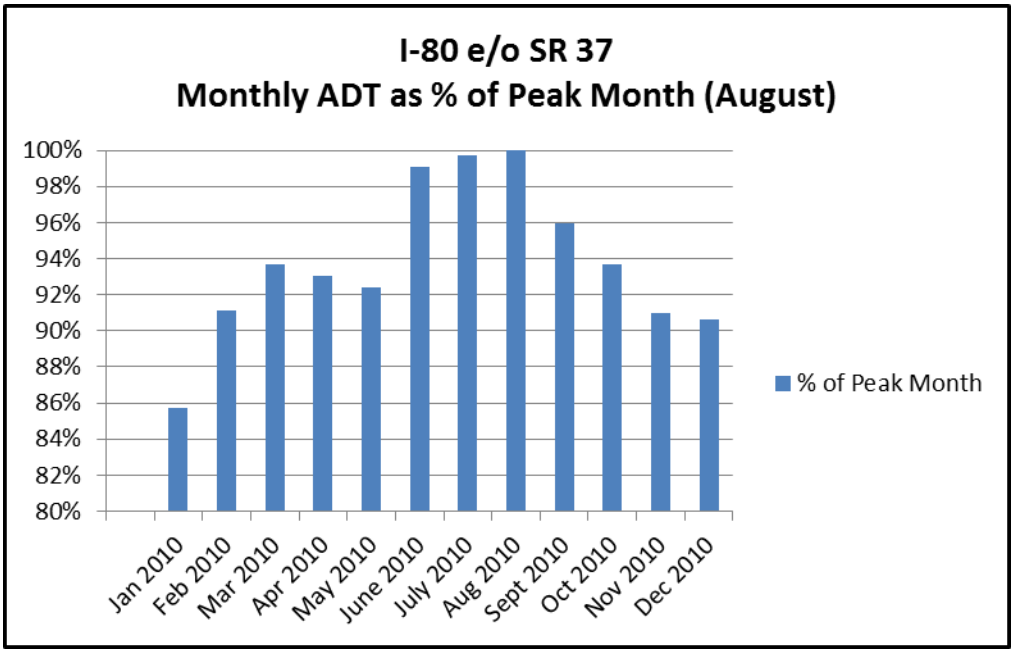
		Vallejo east of SR 29	Vacaville Monte Vista Ave	Yolo County Line
Midweek	**WB**	54,200	73,200	63,800
	EB	51,800	73,500	60,800
	Total	106,000	146,700	124,600
Friday	**WB**	59,900	83,200	69,300
	EB	60,000	88,700	69,900
	Total	119,900	171,900	139,200
Sunday	**WB**	60,800	76,600	66,500
	EB	54,300	74,200	57,600
	Total	115,100	150,800	124,100

Source: Caltrans census count database.

Monthly and seasonal variations in daily traffic flow on I-80 in the study area can be seen in Exhibit 3 and Exhibit 4. Note that August is the peak month and summer is the peak season.

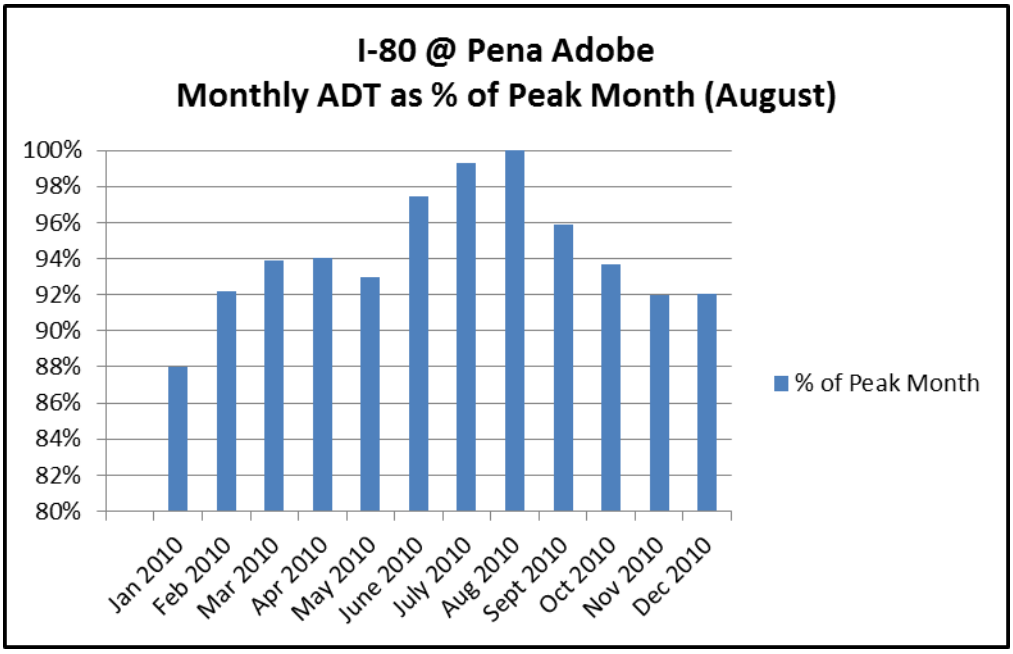
[3] Since Caltrans already had extensive ramp count and select mainline count information from recent years and because up-to-the-minute PeMS data was available for several mainline locations on the freeway, new field counts were deemed unnecessary.

Exhibit 3: Monthly and Seasonal Traffic Variations on I-80 East of SR 37



Source: Caltrans census count database.

Exhibit 4: Monthly and Seasonal Traffic Variations on I-80 at Pena Adobe



Source: Caltrans census count database.

The traffic data were compiled for the periods of analysis which include:

- Typical Weekday (Tuesday/Wednesday/Thursday) 5 AM to 10 AM and 3 PM to 7 PM
- Friday Afternoon Eastbound 3 PM to 8 PM
- Sunday Afternoon Westbound 3 PM to 8 PM

The traffic volumes were processed by first determining the representative hourly traffic volumes for each location (ramps and mainline count stations). This was accomplished by taking the median of the multiple count dates from the most recent count year.

Next, these traffic volumes were examined to determine whether or not any sort of growth factoring or adjustments were needed to create a consistent set of existing 2010 traffic volumes. The traffic volumes were evaluated to determine any trends in growth that may require a factoring of counted volumes when deriving the existing 2010 conditions for this study. It was determined that the traffic volumes did not vary by much in year-on-year comparisons (+/- 5%), and the variances were not consistently higher or lower, but rather a mixture of the two. As a result of that evaluation, the traffic volumes were not factored to reflect specific growth. Rather, the traffic volumes were taken to reflect 2010 conditions, which were then also used as input to the next step in FREQ analysis.

The traffic volumes were then evaluated and normalized to derive a set of volumes that reflected a conservation of traffic flow along the corridor to within a reasonable variance. Since data were collected on different dates, a threshold of +/- 10% was allowed in the variation between the calculated traffic volumes compared to the actual counts for all analysis time periods (mid-week, Friday, and Sunday) to account for the daily traffic variations.

The resulting traffic volumes are presented in Appendix A.

NON-PEAK DIRECTIONS

Traffic counts were examined for the non-peak directions ("reverse commute" or "Sacramento commute" conditions) to assess how the traffic compared to that of the peak directions for the midweek conditions. This included comparing traffic volumes at select locations by travel direction and by peak period (Appendix B). The comparison by travel direction compared the eastbound AM off-peak to the PM peak direction and the westbound AM peak to the PM off-peak direction. The comparison by peak period compared the AM off-peak direction (eastbound) to the AM peak direction (westbound) and the PM off-peak direction (westbound) to the PM peak direction (eastbound). The peak period traffic volumes for all comparisons did show that the traditional peak direction as defined for this study did have greater traffic volumes than the "reverse commute."

4.3 EXISTING FREEWAY OPERATIONS

This section describes existing freeway operating conditions. Existing data—including freeway travel times, speeds, bottleneck locations, length of queues, as well as duration of congestion—were compiled based on several sources of information, as listed below:

- Caltrans tach runs: Caltrans provided tach run (GPS floating car survey) data collected in typical weekday AM and PM peak periods. Data were collected between April and May of 2010.

- KAI field observations made in May 2011, including weekday AM and PM peak periods, Friday PM peak period, and Sunday PM peak period.
- 511.org and other online traffic data monitoring sources, including CHP incident reports monitoring.
- Consultant's monitoring of holiday weekend traffic during Memorial Day weekend and Presidents' Day weekend travel in 2011.
- PEMS travel time data based on available electronic toll collector locations (ETC).

TYPICAL WEEKDAY (MIDWEEK) CONDITIONS

AM Peak Period: 5 AM to 10 AM

Westbound is the peak direction of travel during the AM peak period. There are currently no bottlenecks that cause congestion within the study area. Freeway speeds typically average higher than 65 miles per hour (mph) throughout the entire corridor, and it takes approximately 40 minutes to travel the 44-mile freeway corridor in the westbound direction.

Historically (pre-2008), there were regular and extensive westbound AM queues approaching the I-680 interchange. However, the recently completed HOV lane and prior improvements near the interchange, in addition to reductions in overall traffic volumes due to the economy, have eliminated this historical bottleneck location.

Eastbound was identified as the off-peak direction during typical AM peak period. Evaluation of available data and field observations verified that currently there is not a significant "Sacramento commute" travel pattern. It takes approximately 38 minutes to travel this 44-mile corridor in the eastbound direction. There were no observed bottlenecks or congestion, and traffic volumes are generally lower than in the westbound direction.

PM Peak Period: 3 PM to 7 PM

During the afternoon commute period, eastbound is the peak direction of travel. Based on field observation and available freeway speed data, there was no significant congestion within the study corridor. Through a section within the City of Vallejo, between Georgia Street and Redwood Street, traffic volume was apparently denser compared to other parts of the corridor, as freeway capacity is generally lower due to very-closely spaced interchanges. Based on evaluation of traffic volumes, this section of the freeway could also experience minor congestion on days where traffic volumes fluctuate on the higher side of the range. Traffic volumes are highest between 3 PM to 6 PM. Without traffic congestion (on the day of observation), eastbound travel time is approximately 40 minutes for the entire trip length.

Historically (pre-2008), there were regular eastbound PM peak queues approaching the I-680 interchange. However, the recently completed HOV lane and other improvements in the weigh station area in combination with recent volume drops due to the economy have eliminated this historical bottleneck location.

Westbound was identified as the off-peak direction during typical PM peak period. Evaluation of available data and field observations verified that currently there is not a significant "Sacramento commute" travel pattern. It takes approximately 38½ minutes to travel this 44-mile corridor in the westbound direction. There were no observed bottlenecks or congestion, and traffic volumes are generally lower than in the eastbound direction.

Typical Friday PM Peak Period: 3 PM to 8 PM

Eastbound is the peak direction of travel during Friday afternoons, as weekend travelers are added to typical afternoon commuters. There are several bottlenecks along the corridor:

A. Tennessee Street on-ramp to Redwood Street eastbound off-ramp (Vallejo): Near-capacity mainline volumes combined with moderate on-ramp volumes from Tennessee Street result in over-capacity on the freeway mainline. Queues typically extend to the vicinity between Georgia Street and I-780 interchanges and typically form after 3 PM and dissipate before 7 PM.
B. Three-lane (mixed-flow) segment between signed HOVL end and striped HOVL end (Fairfield, in the vicinity of lane drop west of the North Texas Street off-ramp): The termination of the eastbound HOV lane in combination with a lane drop at right-most mixed-flow traffic lane and high traffic volumes in this section result in a bottleneck. Queues typically extend to the vicinity between Suisun Parkway and West Texas Street and typically form after 3 PM and dissipate before 7 PM.
C. East of study limits (east of the Mace Boulevard interchange in Davis, leading up to the Yolo Causeway): The bottleneck occurs east of study limits. Queues typically extend into the study area in the vicinity of SR 113 (east) and typically form around 3 PM and dissipate before 8 PM.

Depending on the severity of congestion approaching the bottlenecks, travel times vary throughout the peak period. The first bottleneck resulted in delays in the range of one to two minutes. The second bottleneck resulted in delays in the range of 3 to 4 minutes. The third bottleneck located outside of the study area resulted in significant delays. Based on KAI's field observation[4], it took approximately 17 minutes to travel through less than 1½ miles of queue approaching the Richards Boulevard off-ramp in Davis. Delay times in this section vary significantly throughout the peak period. The total time to travel the entire 44-mile trip length was approximately 62 minutes for this particular observation.

No operational constraints were observed in the westbound direction, and the entire trip length was in free flow conditions.

[4] May 20, 2011.

Typical Sunday PM Peak Period: 3 PM to 8 PM

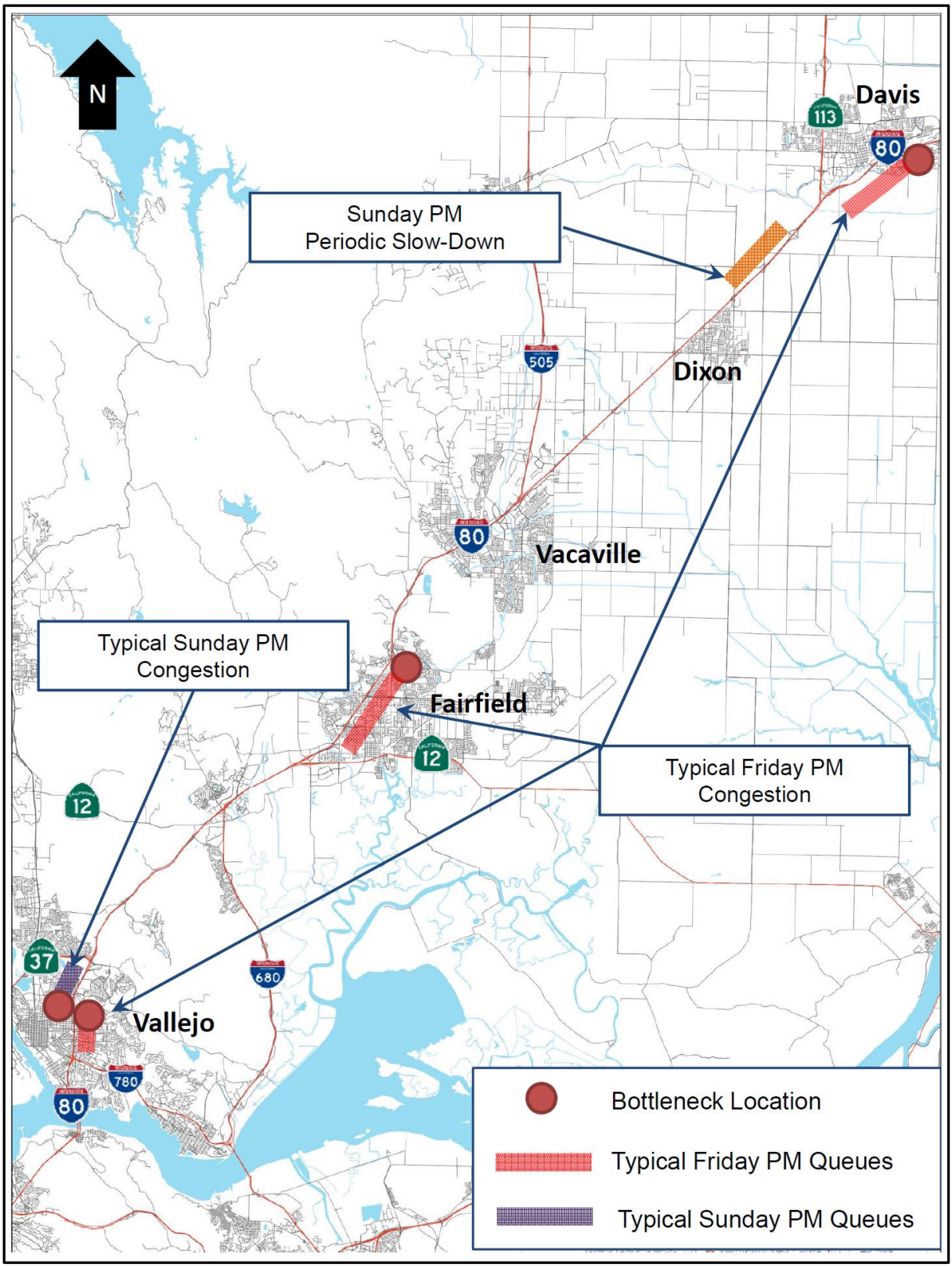
Westbound is the peak direction of travel during Sunday afternoon, as travelers return to the Bay Area at the end of the weekend. Based on field observations, the following operational constraints were found:

A. Bottleneck between Redwood Street on-ramp and Tennessee Street off-ramp (Vallejo): Queues typically extend to the vicinity west of SR 37. Primary factors contributing to this bottleneck include high I-80 and on-ramp volumes from SR 37 for weekend travelers, and the moderately high on-ramp volumes from Redwood Street. Between Tennessee Street and the I-780 off-ramp, the freeway remains at or near capacity due to high mainline volumes and weaving activities caused by the closely spaced interchanges in Vallejo.
B. Periodic slow-downs (minor) were observed between SR 113 west (Davis) and Kidwell Road : The lane drop between Kidwell Road and Pedrick Road results in minor congestion during parts of the peak period; however, travel speeds typically average 60 mph or higher.

It takes approximately 44 minutes to complete the 44-mile corridor, with an average speed of approximately 60 mph.

Typical Friday and Sunday freeway bottleneck and queue locations are illustrated on Exhibit 5.

Exhibit 5: Existing Freeway Bottleneck and Queues Diagram



HOLIDAY WEEKEND CONDITIONS

Memorial Day Weekend

KAI staff also conducted an observation of Memorial Day holiday weekend travel. In general, the freeway operations along the corridor were much more congested compared to typical weekend or weekday peak periods.

On Friday, May 27, 2011, the following congestion was observed for the eastbound direction during PM peak period, as travelers drive away from the Bay Area:

- Congestion between Carquinez Bridge and Redwood Street in Vallejo, starting at or before 3 PM and ending around 6:30 PM.
- Congestion between SR 12 East and North Texas Street in Fairfield starting around or before 3 PM and ending at approximately 6:15 PM.
- Congestion between I-505 and Meridian Road in Vacaville starting around or before 3 PM and ending around 4:15 PM.
- Congestion from SR 113 to east of the study limit starting around or before 3 PM and ending around 8 PM.

On Monday, May 30, 2011, the following operational constraints were observed for the westbound direction during PM peak period, as travelers return to the Bay Area:

- Congestion between SR 113 east and Pedrick Road starting at or before 3 PM and ending at approximately 5 PM.
- Minor slow-down between Dixon Avenue and Midway Road between approximately 3:30 PM to 4:30 PM.
- Congestion between Leisure Town Road and Cherry Glenn Road in Vacaville starting at or before 3 PM and ending at approximately 6:30 PM.
- Congestion between SR 37 and Tennessee Street in Vallejo starting at or before 3 PM and ending at approximately 7:30 PM.

Note that based on the CHP incident log, there were multiple recorded accidents along the corridor during the hours of traffic monitoring, which added severity to the congestion.

Presidents' Day Weekend

KAI staff also traveled the corridor on Friday, February 18, 2011, which was the Friday of the Presidents' Day weekend, from 4:15 PM to 5:15 PM. Observations included:

- I-80 eastbound bottleneck at Yolo Causeway, backed up traffic through Davis, into Yolo County at SR 113 N interchange.
- I-80 eastbound stop-and-go through Dixon (A Street to SR 113 S).

- I-80 eastbound bottleneck at lane drop east of Leisure Town Interchange in Vacaville, backed up to I-505.
- I-80 eastbound bottleneck at North Texas On-ramp, backed up a few 100 yards.
- I-80 eastbound bottleneck at HOV lane drop, just west of North Texas off ramp. Backed up through Fairfield to weigh station west of SR 12 east off-ramp. Eastbound HOV lane also queued the full length.
- I-80 eastbound bottleneck just east of Tennessee Street on-ramp, backed up through Vallejo to the Carquinez Bridge.
- No westbound bottlenecks or delays. One minor slow up between Vacaville and Fairfield due to fender bender that was then pulled into the median.

The weather conditions included steady to heavy rain, which could have added severity to the congestion. No website (511.org or CHP) monitoring was performed during this time period.

FREEWAY RAMP OPERATIONS

Based on field observations, a vast majority of freeway on-ramps and off-ramps operate at acceptable conditions without notable queues on the ramps under typical weekday and weekend conditions. Exceptions include the following locations:

- I-780 eastbound on-ramp to I-80 Eastbound loop connector: high on-ramp volume results in minor slow down on the connector.
- I-80 westbound off-ramp to Redwood Street: a relatively long queue was observed at this off-ramp due to moderate off-ramp volumes and ramp terminal intersection operations. Queues are typically stored within the available off-ramp storage without extending into the freeway mainline.

5. FUTURE BASELINE TRAFFIC FORECAST AND OPERATIONS TRENDS

This chapter describes results for future baseline travel forecast and trends. A set of calibrated and validated FREQ models were developed for existing conditions (details are included in Appendix C). The validated FREQ12 model was then applied using the projected volumes for 2015 conditions. This section summarizes the performance measures, congestion locations, bottlenecks, and causes along the corridor.

A 2015 land use dataset was obtained based on a straight-line interpolation of 2010 and 2030 datasets, which was then applied as inputs to develop forecast volumes for Year 2015 conditions. The 2015 traffic forecasts used in this operational analysis were determined by adding the raw model volume growth to the existing traffic volumes for the freeway mainline and ramps. For locations where the model forecasted negative growth, the volumes were capped to existing volumes for the purpose of a conservative analysis. Hourly forecasts were expanded to develop the hourly volume profiles throughout the (multi-hour) study periods by applying factors based on existing volume trends throughout the study period.

The Napa-Solano Travel Demand Model does not include forecasts for Friday evening or Sunday afternoon conditions. As such, the traffic volumes for these time periods were determined by factoring the existing volumes by the ratio of the Year 2015 weekday volumes to the existing volumes. The Year 2015 volumes for the Friday evening time period were determined by taking the ratio of the weekday Year 2015 volumes to the existing weekday volumes and multiplying that value by the existing Friday traffic volumes. Similarly, the ratio of the weekday Year 2015 volumes to the existing weekday volumes was multiplied by the existing Sunday afternoon volumes to determine the Sunday afternoon Year 2015 traffic volumes.

Detailed Year 2015 forecast results for the entire corridor are included in Appendix D. As described earlier, Phase I of the I-80/I-680 interchange is assumed to be complete by 2015 conditions. A detailed drawing of this proposed interchange reconstruction is included in Appendix E.

5.1 YEAR 2015 FREEWAY OPERATIONS

This section summarizes 2015 baseline FREQ simulation results. When future FREQ models were initially run, the analysis indicated that with 2015 traffic demand, eastbound freeway queues would extend about 4 miles west beyond the current study limit on the entry link. Based on previous experiences with the FREQ software, coding an unusually long entry link to capture such congestion upstream of the study area would not yield realistic results due to limitations of the software. Therefore, in order to properly evaluate and account for the queues extending beyond the study limit, supplemental computations were performed externally to evaluate queues and delays

associated with the 4-mile entry link in the eastbound direction for both midweek and Friday PM peak periods.

BOTTLENECKS AND QUEUES

Exhibit 6 provides a summary of freeway bottleneck and queues associated with each bottleneck. The approximate duration of congestion is also presented. Freeway congestion in 2015 conditions is also graphically illustrated in Exhibit 7.

Exhibit 6: Summary Freeway Bottleneck and Queues Summary

Bottleneck Location	Queue Length	Duration	
		Start	End
Eastbound Direction - Midweek PM Peak Period			
A - Tennessee Street on-ramp to Redwood Street eastbound off-ramp	Queues would extend as far as approximately 4 miles west beyond the study limit, to east of the Willow Ave interchange. (*)	3:00 PM	7:00 PM
B - Three-lane (mixed-flow) segment between signed HOVL end and striped HOVL end (Fairfield, in the vicinity of lane drop west of the North Texas Street off-ramp)	Queues would extend as far as to east of the Travis Blvd on-ramp	3:00 PM	7:00 PM
C - Lane Drop west of Richards Blvd off-ramp	A short queue would extend less than half mile west of Richards Blvd off-ramp	3:00 PM	5:00 PM
Eastbound Direction - Friday PM Peak Period			
A - Tennessee Street on-ramp to Redwood Street eastbound off-ramp	Queues would extend as far as approximately 2.7 miles west beyond the study limit, to west of the Cummings Skyway interchange	4:00 PM	7:00 PM
B - Three-lane (mixed-flow) segment between signed HOVL end and striped HOVL end (Fairfield, in the vicinity of lane drop west of the North Texas Street off-ramp)	Queues would extend as far as to east of I-680 off-ramp	3:00 PM	7:00 PM
C - Lane Drop west of Weber Road off-ramp	Queues would extend as far as to east of Leisure Town Roadway off-ramp	3:00 PM	6:00 PM
D - Lane Drop west of Richards Boulevard off-ramp	Queues would be overlapped by downstream bottleneck		
E - Yolo County Causeway	Queues would overlap with Richards Blvd bottleneck and extend as far as to east of Kidwell on-ramp	3:00 PM	8:00 PM
Westbound Direction - Midweek AM Peak Period			

Bottleneck Location	Queue Length	Duration	
		Start	End
A - Redwood Street on-ramp and Tennessee Street off-ramp	Queues would be overlapped by downstream bottleneck		
B - Georgia Street on-ramp to I-780 off-ramp	Queues would overlap with Redwood bottleneck and extend as far as east of Route 37 on-ramp	5:00 AM	8:00 AM
C - I-780 on-ramp to Magazine Street off-ramp	Queues would be very short and extend about 200 feet west of I-780 on-ramp	5:00 AM	6:00 AM
Westbound Direction - Sunday PM Peak Period			
A – SR 113 West to Kidwell Road	With projected traffic forecast volume growth, existing observed periodic slow-downs (minor) between SR 113 west (Davis) and Kidwell Road would continue or worsen: The lane drop between Kidwell Road and Pedrick Road results in minor congestion during parts of the peak period.	Periodic	
B - Redwood Street on-ramp and Tennessee Street off-ramp	Queues would extend as far as to west of American Canyon on-ramp	3:00 PM	8:00 PM

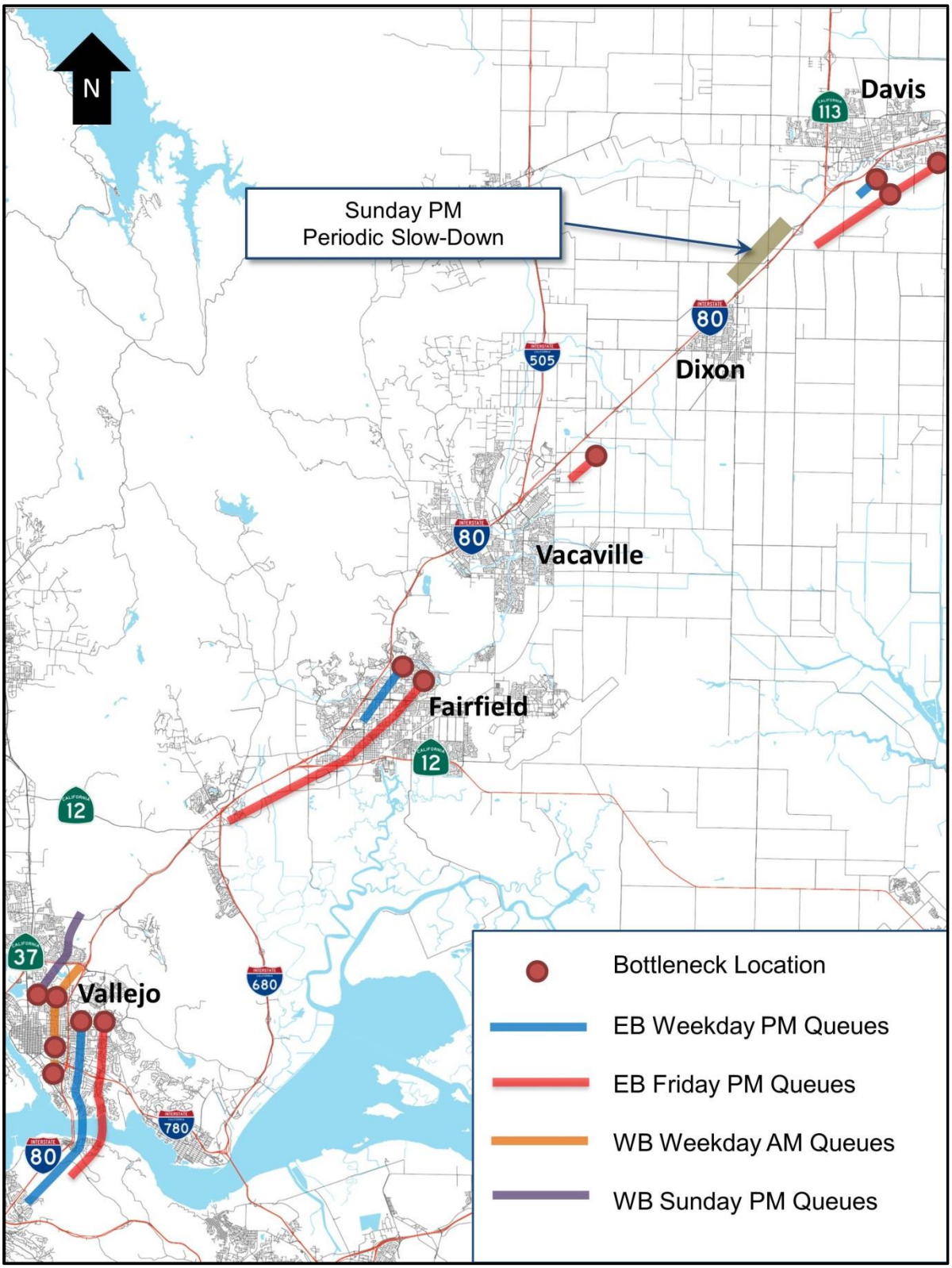
* Note that due to FREQ software limitations, queues extending beyond the study area is computed using an external spreadsheet program.

Compared to existing conditions, the freeway generally would experience more bottlenecks and congestion in both directions in the mixed-flow lanes. The HOV lanes would continue to operate under capacity at free flow conditions.

In the eastbound direction, new bottlenecks would occur at the Tennessee Street on-ramp, at lane drop locations west of Texas Street off-ramp, and west of the Richards Boulevard off-ramp during the midweek PM peak period. During the Friday PM peak period, bottlenecks would occur at the same locations as the existing conditions, except that new bottlenecks would occur west of the Weber Road off-ramp and west of the Richards Boulevard off-ramp. Queue lengths and duration of congestion would also be longer compared to existing conditions due to increased traffic demand.

In the westbound direction, new bottlenecks would occur at Redwood Street on-ramp, Georgia Street on-ramp, and I-780 on-ramp during midweek AM peak period. During Sunday PM peak period, the primary bottleneck would continue to occur at the Redwood Street on-ramp; however, queue length and duration of congestion would be longer compared to existing conditions.

Exhibit 7: Graphical Illustration of 2015 Freeway Bottleneck and Queue Locations



TRAVEL TIMES

Exhibit 8 and Exhibit 9 provide a comparison of travel times between existing conditions and 2015 baseline conditions across the entire corridor for the eastbound and westbound directions, respectively.

Exhibit 8: Travel Time Comparisons – Eastbound Direction

Start Time		Existing (mins)	2015 (mins)	Difference (mins)	% Increase
Eastbound Midweek PM	3:00 PM	45.2	58.5	13.3	30%
	4:00 PM	44.6	67.7	23.1	52%
	5:00 PM	44.9	77.6	32.7	73%
	6:00 PM	43.4	70	26.6	61%
	Average	**44.5**	**68.5**	**24**	**54%**
Eastbound Friday PM	3:00 PM	50.1	57.5	7.4	15%
	4:00 PM	57.3	86.2	28.9	51%
	5:00 PM	69.5	119.5	50	72%
	6:00 PM	56.3	103.9	47.6	84%
	7:00 PM	46.2	65.9	19.7	43%
	Average	**52.3**	**86.6**	**34.3**	**66%**

Note that travel times represent traveling through the entire length of I-80 within Solano County, from east of the Carquinez Bridge in Vallejo to Richards Boulevard off-ramp in Davis, approximately 44 miles in total.

With traffic congestion projected to increase along the corridor, freeway travel times for the eastbound direction during the midweek PM peak period would increase approximately 24 minutes for the entire length of the corridor on average when compared to existing conditions; this represents an increase of approximately 54%. During the Friday PM peak period, the travel time increase compared to existing conditions would average about 34 minutes, or a 66% increase.

Exhibit 9: Travel Time Comparisons – Westbound Direction

Start Time		Existing (mins)	2015 (mins)	Difference (mins)	% Increase
Westbound Midweek AM	5:00 AM	38.7	39.3	0.6	2%
	6:00 AM	38.7	41	2.3	6%
	7:00 AM	38.9	41.5	2.6	7%
	8:00 AM	38.5	40.6	2.1	5%
	9:00 AM	38.4	38.5	0.1	0%
	Average	**38.7**	**40.2**	**1.5**	**4%**
Westbound Sunday PM	3:00 PM	40.5	42.8	2.3	6%
	4:00 PM	44.8	54.4	9.6	22%
	5:00 PM	46.3	59.5	13.2	29%
	6:00 PM	41.6	54.8	13.2	32%
	7:00 PM	38.5	43.9	5.4	14%
	Average	**42.8**	**53.1**	**10.3**	**24%**

Note that travel times represent traveling through the entire length of I-80 within Solano County, from Richards Boulevard on-ramp in Davis to east of the Carquinez Bridge in Vallejo, approximately 44 miles in total.

In the westbound direction, freeway travel times during the midweek AM peak period would be increased slightly by about 2 minutes, on average. During the Sunday PM peak period, the increase would be approximately 10 minutes on average, or approximately 24% longer.

6. DRAFT RAMP METERING PLAN FOR YEAR 2015

The 2015 baseline FREQ model was applied to develop a set of draft metering rates for 2015 conditions. Based on information provided by Caltrans, ramp metering equipment along both directions of the corridor would be completely installed between the Redwood Street interchange in Vallejo and I-505 interchange in Vacaville and could be operational by 2015, except for at the truck weigh station, truck rest area, and I-680 northbound to I-80 westbound connector. As part of the initial assumption for this study, ramp metering on freeway-to-freeway connector ramps (SR 37, SR 12 west, I-680, and I-505) were not assumed for the corridor. However, metering freeway connectors could result in additional operational benefits to the I-80 corridor, and based on recent inputs from SoHIP members, freeway connector metering will be further evaluated during the next phase of the project to implement and activate ramp meters. As part the next step which is currently on-going (Stage I implementation between Red Top Road and North Texas Street on I-80 eastbound), more detailed freeway data are being collected to evaluate the feasibility of metering the freeway connectors.

The status of ramp metering equipment for 2015 conditions is summarized in Exhibit 10 and Exhibit 11, and is illustrated in Exhibit 12.

Exhibit 10: Eastbound I-80 Metering Equipment for Year 2015

Eastbound On-Ramp	Jurisdiction	Equipment by 2015	Comment
Magazine St	Vallejo	No	Existing ramp is too short/needs improvement
I-780	Caltrans	No	
Georgia St	Vallejo	No	
Springs Rd	Vallejo	No	Existing ramp is too short/needs improvement
Tennessee St	Vallejo	No	
Redwood St	Vallejo	Yes	
Columbus Pkwy	Vallejo	Yes	
SR 37	Caltrans	Yes	Assume no freeway connector ramp metering by 2015
American Canyon Rd	Solano	Yes	
Red Top Rd	Fairfield	Yes	
SR 12 (West)/Jameson Canyon Rd	Caltrans	Yes	Assume no freeway connector ramp metering by 2015
I-680/Green Valley Rd	Caltrans	Yes	Assume no freeway connector ramp metering by 2015
Suisun Valley Rd	Fairfield	Yes	
Truck weigh station	Caltrans	No	Truck weigh station not metered

Eastbound On-Ramp	Jurisdiction	Equipment by 2015	Comment
Abernathy Rd	Fairfield	Yes	
Auto Mall Pkwy	Fairfield	Yes	
Beck Ave	Fairfield	Yes	
Travis Blvd	Fairfield	Yes	
Air Base Pkwy	Fairfield	Yes	
N Texas St	Fairfield	Yes	
Cherry Glen Rd	Vacaville	Yes	
Pleasants Valley/Rivera Rd	Vacaville	Yes	
Alamo Drive	Vacaville	Yes	
Davis St	Vacaville	Yes	
Mason St/Cliffside Dr	Vacaville	Yes	
Allison Dr Loop	Vacaville	Yes	
Allison Dr Diag	Vacaville	Yes	
I-505	Caltrans	Yes	Assume no freeway connector ramp metering by 2015
Orange Dr	Vacaville	Yes	
Leisure Town Rd Loop	Vacaville	No	
Leisure Town Rd Diag	Vacaville	No	
Meridian Rd	Vacaville	No	
Midway Rd	Solano	No	
Dixon Ave	Dixon	No	
Pitt School Rd	Dixon	No	
SR 113(S)/N 1st St	Dixon	No	
Pedrick Rd	Dixon	No	
Kidwell Rd	Solano	No	
SR 113 SB	Solano	No	
Old Davis Rd	Solano	No	

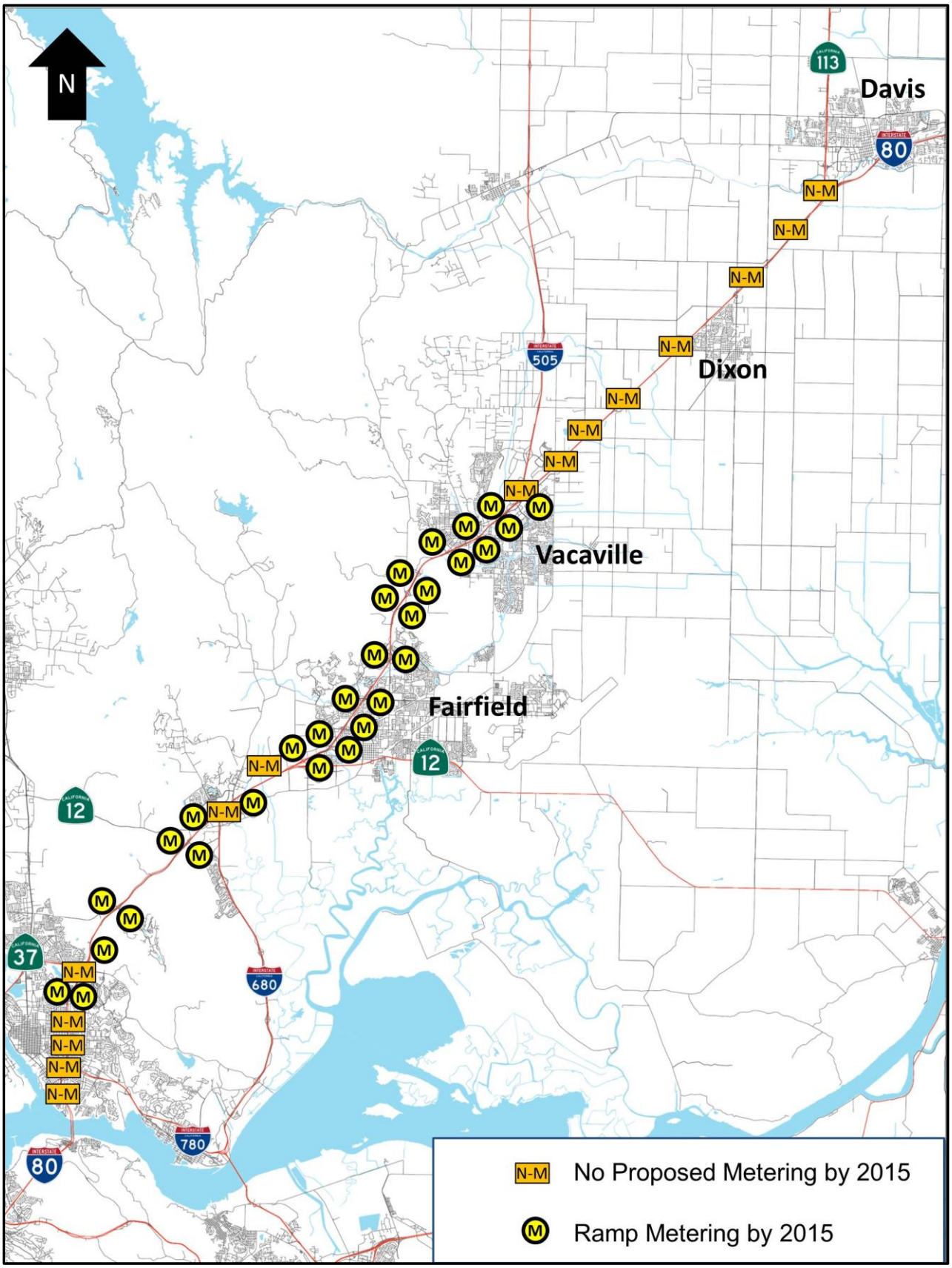
Exhibit 11: Westbound I-80 Metering Equipment for Year 2015

Westbound On-Ramp	Jurisdiction	Equipment by 2015	Comment
Old Davis Rd	Solano	No	
SR 113 SB	Caltrans	No	
Kidwell Rd	Solano	No	
Pedrick Rd	Dixon	No	
SR 113(S)/N 1st St	Dixon	No	
Currey Rd	Dixon	No	

Westbound On-Ramp	Jurisdiction	Equipment by 2015	Comment
Pitt School Rd	Dixon	No	
Dixon Ave	Dixon	No	
Midway Rd	Solano	No	
Meridian Rd	Vacaville	No	
Leisure Town Rd Loop	Vacaville	No	
Leisure Town Rd Diag	Vacaville	No	
I-505	Vacaville	Yes	Assume no freeway connector ramp metering by 2015
Monte Vista Ave (east)	Vacaville	Yes	
Browns Valley/Monte Vista Ave (west)	Vacaville	Yes	
Mason St	Vacaville	Yes	
Davis St	Vacaville	Yes	
Alamo Drive	Vacaville	Yes	
Pleasants Valley/Rivera Rd	Vacaville	Yes	
Cherry Glen Rd	Vacaville	Yes	
N Texas St	Fairfield	Yes	
Air Base Pkwy	Fairfield	Yes	
Travis Blvd Loop	Fairfield	Yes	
Travis Blvd Diag	Fairfield	Yes	
W Texas Rd	Fairfield	Yes	
Abernathy Rd	Fairfield	Yes	
SR 12 (East)	Caltrans	Yes	Assume no freeway connector ramp metering by 2015
Truck weight station	Caltrans	No	Truck Weigh Station not metered
I-680	Caltrans	No	
Green Valley Rd	Fairfield	Yes	
Red Top Rd	Fairfield	Yes	
American Canyon Rd	Solano	Yes	
Truck rest area	Caltrans	No	Rest area not metered
Columbus Pkwy	Vallejo	Yes	
SR 37	Caltrans	Yes	Assume no freeway connector ramp metering by 2015
Redwood St	Vallejo	Yes	
Tennessee St	Vallejo	No	
Springs Rd	Vallejo	No	
Georgia St	Vallejo	No	
I-780	Caltrans	No	

Westbound On-Ramp	Jurisdiction	Equipment by 2015	Comment
Magazine St	Vallejo	No	Existing ramp is too short/needs improvement
Maritime Academy Rd	Vallejo	No	Existing ramp is too short/needs improvement
SR 29	Vallejo	No	

Exhibit 12: Illustration of 2015 Ramp Equipment



6.1 PROTOTYPE RAMP METERING PLAN FOR 2015

Once the ramps between the Redwood Street interchange in Vallejo and the I-505 interchange in Vacaville that could be metered by 2015 were determined, a preliminary analysis was then conducted using the FREQ model to determine which of those ramps should be metered at serving demand rate (meaning that the meters are set at the same hourly rate as the hourly demand rate for the ramp) and which ramps should have metering rates below the hourly demand rate for the ramp. Generally, ramps upstream of a freeway bottleneck were recommended for metering at rates below the hourly demand rate. Ramps downstream of a bottleneck were recommended for metering at the hourly demand rate for each ramp.

The following assumptions were made in the process of developing draft metering rates:

1. Ramp meters would operate with a policy of one car per green for all locations.
2. Preliminary rates were developed based on practical metering operation of 240 vehicles per hour per lane (vphpl) as a minimum limit and 900 vphpl as a maximum limit. Note that in the event that queues exceed the storage capacity of the on-ramp, additional metering plans such as resting in solid green, or metering at 2-cars per green could be developed to serve those high demand traffic volume situations. The current technology does not allow automatic dynamic switch to those special plans, and would need to be predetermined based on observations and pre-programmed into the controller. In addition, the physical permanent sign would need to change from “1 Car Per Green” to “2 Cars Per Green”.
3. Ramp meter rates are based on the FREQ corridor optimization module to maximize vehicle-miles of freeway travel with the constraint that queue lengths would be limited to available storage. On-ramp storage lengths are shown graphically on aerial photos attached in the Appendix F.
4. The ramp metering implementation plan would increase freeway capacity in the metered section by approximately 2.5%. This is a conservative assumption based on capacity increases observed from other Bay Area freeway corridors where ramp meters were implemented.

Based on a review of predicted Year 2015 congestion on the freeway mainline, a recommended ramp metering plan for 2015 conditions has been developed and is described as follows:

1. Activate ramp meters in the eastbound direction during the Monday–Thursday PM peak period (3 PM to 7 PM); Since recurring peak period congestion on I-80 is currently relatively minor in the eastbound direction, rates would be set at the demand volume rate for each ramp. As the I-80 eastbound mainline becomes more congested over time, it will be desirable to re-evaluate these initial metering rates.
2. Activate Ramp meters in the eastbound direction during the Friday PM peak period (3 PM to 8 PM); Since recurring congestion is significant in the eastbound direction on Fridays, optimal metering rates (in the order of 1% to 3% below demand rate) would be set to optimize system operation. The 2015 analysis suggested that there would be great value to Solano County freeway users, as well as to through traffic, if the eastbound on-ramp meters were to hold

back a few vehicles each hour on Friday afternoons. Barring an incident on the freeway or one of the ramps, all on-ramp queues would be stored within the ramps at all times.

3. Projected traffic conditions by Year 2015 indicated that activating ramp metering in the westbound direction during weekday AM peak period (5 AM to 10AM) and Sunday PM peak period (3 PM to 8 PM) would not result in significant operational improvements to the freeway system. Therefore, from a traffic operations standpoint, ramp meters in the westbound direction could be activated later, beyond Year 2015. However, actual freeway mainline conditions should be monitored on a regular basis to determine the exact timing of activating these ramp meters, which could occur by 2015.

DETAILS OF DRAFT 2015 FRIDAY METERING PLAN DEVELOPMENT PROCESS

In order to refine the draft metering plan for the Friday PM peak period in the eastbound direction, several iterations of analysis were performed using the FREQ tool and by evaluation of simulation results.

The iterative process started with the 2015 baseline FREQ model, which provides a basis for freeway bottleneck locations and congestion and identified where ramp metering would be most effective. Input information regarding available ramp metering equipment, ramp storage, number of lanes at the on-ramps, and Caltrans' practical upper and lower metering rate limits were entered into the model. The FREQ model then optimized the system to produce a set of raw metering rates while attempting to maximize system throughput (VMT), with the constraint that queues would not spill beyond the available storage.

Next, raw FREQ rates were evaluated to determine the reasonableness of those rates in terms of potential ramp delays that vehicles would incur prior to entering the freeway, compared against potential travel time savings they would benefit from once they get on the freeway mainline. Consideration was also given to typical on-ramp metering delays that the general public is accustomed to here in the San Francisco Bay Area. Several iterative FREQ model runs were conducted in order to develop the optimal set of metering rates presented in this report, which provides a well-balanced system between expected ramp delays and potential mainline travel time savings.

6.2 RAMP METERING EFFECTS IN HIGHWAY SAFETY

Ramp metering not only allows for consistent traffic flow on the mainline and more efficient use of freeway capacity, it also improves safety both in the merge area and on the mainline, particularly when mainline congestion has not already occurred downstream of the ramp. In the merge area, ramp metering allows a single vehicle or a small platoon (usually two vehicles) to merge onto the mainline into traffic gaps that would result in minimal interference and reduce potential for sideswipe crashes. The speed differential would be reduced between entering vehicles and mainline vehicles because multiple vehicles would not have to compete for the same gaps in mainline traffic; also, queues would be less likely to form at the merge point and the full length of the acceleration distance

could be used. On the mainline, the smoother merging process makes it unnecessary for mainline vehicles to slow down considerably, and sometimes unexpectedly, to let vehicles enter the freeway. Consequently, it is less likely to cause upstream backups, minimizes lane change maneuvers by impatient upstream drivers, and reduces rear-end collisions.

These safety benefits are well documented in a range of studies dating back to 1975, as presented in Exhibit 13. Implementation of ramp metering achieved safety benefits in all the locations. While the measures of effectiveness are different in the studies, the reduction in collisions is substantial in each case. For instance, the two studies along I-580 in the Tri-Valley region (Dublin, Pleasanton, Livermore) of the Bay Area indicated a reduction of 21 and 25 percent in total collisions measured for the same 10- to 12-month period before and after the implementation. Based on the other studies, the safety impact could be as high as 50 percent.

Exhibit 13: Ramp Metering Effects on Highway Safety

Location	Collision Reduction	Year of Evaluation
Pleasanton, CA	21% in total collisions	2004
Livermore, CA	25% in total collisions	2008
Sacramento, CA	50% (*)	1984
Los Angeles, CA	20% (*)	1975
Portland, OR	43% in peak period collisions	1982
Seattle, WA	38% in collision rate	1981–1987
Denver, CO	50% in rear-end & side-swipe collisions	1982
Minneapolis-St. Paul, MN	26% in peak hour collisions	2000
Detroit, MI	50% in total collisions	Not Known
Long Island, NY	15% in collision rate	1987–1991

* Source of data did not indicate whether the reduction was in total collision or collision rate.

6.3 EFFECTS OF THE PROTOTYPE 2015 RAMP METERING PLAN – EASTBOUND PM PEAK PERIODS

For Monday through Thursday PM when metering rates would be set to serve demand volumes in the eastbound direction, meters would be set to allow all vehicles arriving at the on-ramp to enter the freeway within a few seconds (meter at demand rate). Drivers would experience a few seconds of delay as they are stopped at the metering light and spaced out to enter the freeway. The result would be a slight gain in freeway capacity, improved on-ramp merging operations, and improved safety. Delays would not exceed a few seconds and queues would not exceed a few vehicles.

6.4 EFFECTS OF THE PROTOTYPE 2015 RAMP METERING PLAN – EASTBOUND FRIDAY PM PEAK PERIOD

Draft metering rates at each on-ramp, expected ramp delays, and queues are presented in Exhibit 14. As shown in the exhibit, expected queues at each on-ramp due to the draft metering rates would be contained within available storage and would not affect arterial street operations. These draft metering rates are subject to further refinement prior to actual field implementation based on new traffic counts to be collected closer to the activation date. Mean waiting times on eastbound on-ramps in Solano County would range between less than 1 minute to about 5 minutes.

The effects of the Friday PM ramp metering schedule on freeway mainline congestion are shown in Exhibit 15. The metering schedule will have no effect on freeway queues inside Vallejo (because most ramps in Vallejo will not be metered due to lack of metering equipment). It will reduce queue lengths and increase the average speed of traffic through each of the bottlenecks east of Vallejo, including bottlenecks and queues through Fairfield, Vacaville, and in the vicinity of Davis.

In addition to the potential benefits described in the earlier section for setting metering rates to serve traffic demand, additional benefits would be observed for setting optimal metering rates. Freeway mainline travel time comparisons between 2015 baseline and 2015 with ramp metering are shown in Exhibit 16. Travel time savings through the study corridor ranges between approximately 2 to 7 minutes throughout the Friday afternoon peak period, with an average of about 4 minutes, or 5%. Transit travel times would be reduced in a similar order as auto travel times, for buses that also travel along the I-80 freeway corridor.

Exhibit 17 provides a summary of potential travel time savings as a result of implementing these metering rates during the peak hour (within the peak period), while accounting for ramp delays through each interchange. In summary, the Friday afternoon metering schedule would result in travel time savings of generally between 2 and 5 minutes for residents of Solano County using I-80. These travel time savings results are also presented graphically in Exhibit 18. In order to help illustrate these travel time savings with the corresponding proportion of origin-destination (OD) trip pairs, home-based work trip distribution from the Solano countywide model was extracted and presented in Exhibit 19, this represents 2015 Friday PM peak hour conditions.

System-wide effects are shown in Exhibit 20. An approximately 2% system-wide savings in travel time (including ramp delays) would result from this draft metering plan, and a 3% increase in average speed on the freeway itself.

Exhibit 14: Draft Ramp Metering Results for I-80 Eastbound – 2015 Friday PM Peak Period

Eastbound On-Ramp	No. of Lanes		Available Storage (veh.)	3-4 PM				4-5 PM				5-6 PM				6-7 PM				7-8 PM			
	Mixed-Flow	HOV		Demand	Metering Rate	Ramp Queue *	Avg Ramp Delay**	Demand	Metering Rate	Ramp Queue *	Avg Ramp Delay**	Demand	Metering Rate	Ramp Queue *	Avg Ramp Delay**	Demand	Metering Rate	Ramp Queue *	Avg Ramp Delay**	Demand	Metering Rate	Ramp Queue *	Avg Ramp Delay**
Redwood St	1	0	8	284	280	7	0.7	284	290	6	1.3	294	300	5	1.1	309	310	4	0.9	247	250	6	1.2
Columbus Pkwy	1	0	40	450	440	14	0.9	443	430	26	2.6	483	470	38	3.8	408	410	35	4.9	343	360	18	4.2
American Canyon Rd	1	0	24	388	380	8	0.6	393	380	22	2.2	348	350	20	3.4	317	320	22	3.7	226	240	11	3.9
Red Top Rd	1	0	13	587	580	12	0.6	545	550	9	1.1	737	740	6	0.6	266	270	6	1.3	235	240	4	1.2
Suisun Valley Rd (2-Ln)	2	1	38	869	370	17	0.7	880	380	22	1.5	914	400	15	1.4	580	250	23	2.2	440	240	0	1.5
Abernathy Rd	1	1	15	687	600	10	0.5	698	620	8	0.9	600	530	5	0.7	345	300	9	1.4	279	250	4	1.5
Auto Mall Pkwy	1	0	23	737	720	23	1.2	735	740	19	2.0	710	720	11	1.4	394	400	3	1.2	287	290	1	0.5
Beck Rd (2-Ln)	2	0	23	911	450	18	0.7	1063	530	14	1.0	1049	530	10	0.8	761	380	2	0.5	482	250	0	0.0
Travis Blvd (2-Ln)	2	0	47	1121	550	20	0.5	1178	580	38	1.5	1177	590	33	1.8	1014	510	28	1.8	963	480	31	1.8
Air Base Pkwy	1	1	25	713	700	13	0.6	752	750	17	1.2	820	820	16	1.2	556	560	12	1.5	357	360	10	1.8
N Texas St	1	1	17	662	540	16	0.9	666	560	15	1.6	689	580	13	1.4	555	470	8	1.3	402	420	0	0.2
Lagoon Valley Rd	1	0	21	130	900	0	0.0	160	900	0	0.0	166	900	0	0.0	84	900	0	0.0	43	900	0	0.0
Pena Adobe Rd	1	0	16	49	900	0	0.0	56	900	0	0.0	60	900	0	0.0	41	900	0	0.0	32	900	0	0.0
Alamo Drive	1	0	29	716	700	22	1.1	651	650	12	1.8	601	600	16	1.7	462	460	12	2.1	387	410	0	0.2
Davis St	1	0	12	369	360	11	1.0	361	360	3	1.3	341	350	9	1.3	291	300	4	1.5	220	240	0	0.1
Mason St (2-Ln)	2	0	16	555	280	0	0.0	521	270	0	0.0	423	240	0	0.0	361	240	0	0.0	281	240	0	0.0
Allison Dr SB	1	1	26	265	263	0	0.0	223	240	0	0.0	236	240	0	0.0	219	240	0	0.0	142	240	0	0.0
Allison Dr NB	1	1	31	238	240	0	0.0	233	240	0	0.0	228	240	0	0.0	174	240	0	0.0	162	240	0	0.0
Orange Dr	1	1	22	403	900	0	0.0	369	900	0	0.0	339	900	0	0.0	291	900	0	0.0	283	900	0	0.0

* Ramp queues in vehicles reported are based on the FREQ analysis, which reflects unserved demand at the end of each simulation hour and would accumulate into the next hour. Note that the queues shown in this and subsequent exhibits are steady state at the end of the hour, which compares the total hourly flow rate versus hourly metering rate. Ramps with zero steady state queues at the end of the hour would have transient short queues within the hour, which would vary throughout the hour when platoons of vehicles arrive from an upstream signal; however, the queues are expected to be of short duration (persisting for only a few signal cycles during the hour) and length. Monitoring of metering operation after initial activation would verify that the transient queues do not exceed the available storage. If they do, the metering rate could be adjusted accordingly.

** Average ramp delays in minutes reported based on FREQ analysis. This is the average delay for all on-ramp vehicles.

Exhibit 15: I-80 Mainline Freeway Queues and Congested Speeds Comparison (2015)

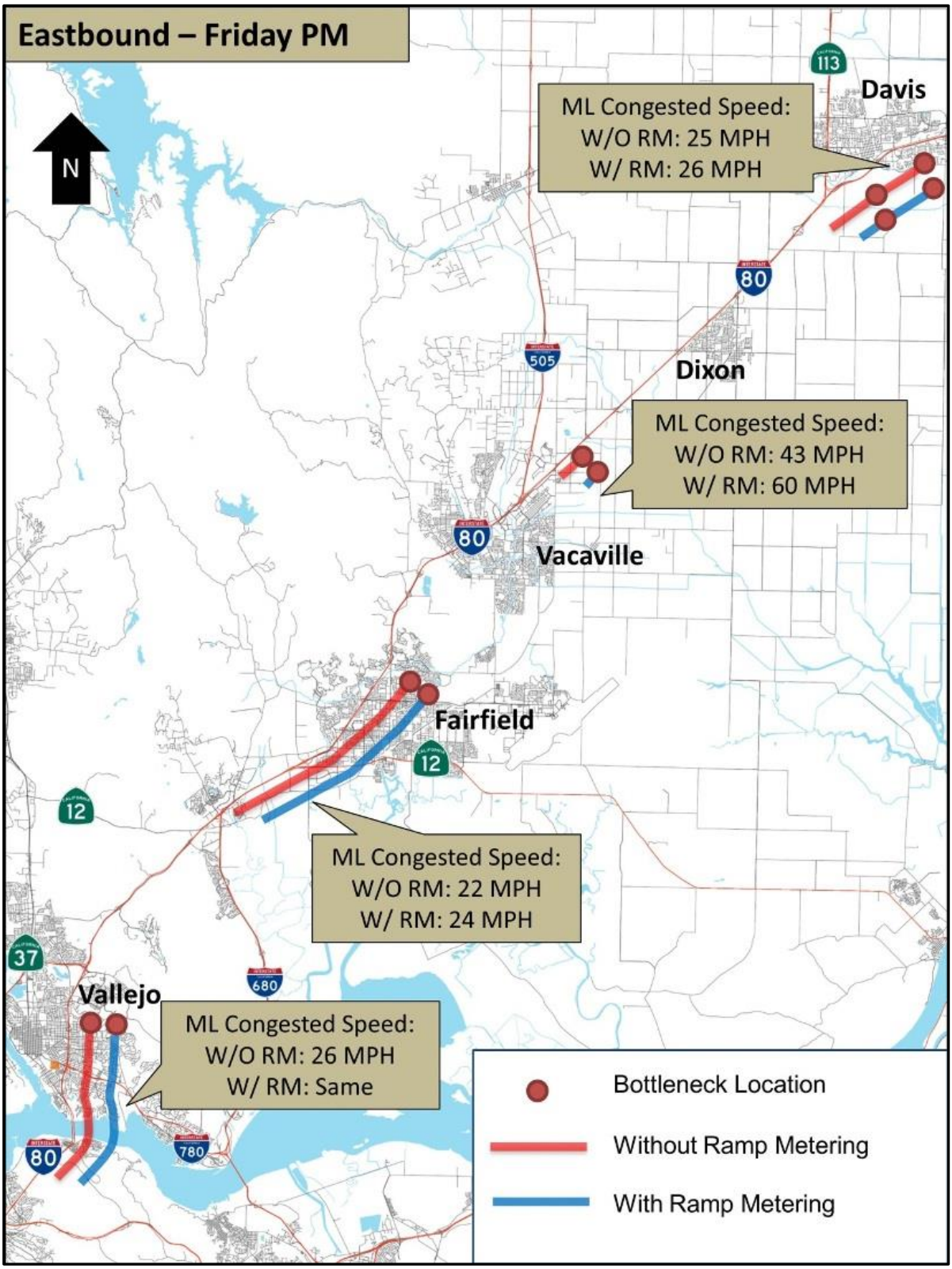


Exhibit 16: I-80 Mainline Travel Time Comparison for 2015 Friday Eastbound

Start Time	End Time	Baseline (minutes)	With Ramp Metering (minutes)	Difference	
				(minutes)	(%)
3:00 PM	4:00 PM	55.3	52.6	2.8	5%
4:00 PM	5:00 PM	78.8	72.4	6.5	8%
5:00 PM	6:00 PM	106.3	101.1	5.2	5%
6:00 PM	7:00 PM	88.1	84.7	3.5	4%
7:00 PM	8:00 PM	55.2	53.5	1.6	3%
Average		**76.7**	**72.9**	**3.9**	**5%**

Note that travel times represent traveling through the entire length of I-80 within Solano County, from east of the Carquinez Bridge in Vallejo to Richards Boulevard off-ramp in Davis, approximately 44 miles in total.

Exhibit 17: Peak Hour Travel Time Savings Friday Eastbound PM Metering Schedule (2015)

	Destination				
Origin	**SF/ALA/CC**	**Vallejo**	**Fairfield**	**Vacaville**	**Yolo/Sac**
SF/ALA/CC	N/A	N/A	3/57 minutes (4%)	3/75 minutes (3%)	5/106 minutes (5%)
Vallejo	N/A	Negligible	2/33 minutes (6%)	2/51 minutes (4%)	5/82 minutes (6%)
Fairfield	N/A	N/A	Negligible	-1/18 minutes (-5%)	2/50 minutes (3%)
Vacaville	N/A	N/A	N/A	Negligible	2/31 minutes (8%)
Yolo/Sac	N/A	N/A	N/A	N/A	Negligible

Note that travel times represent traveling through the entire length of I-80 within Solano County, from east of the Carquinez Bridge in Vallejo to Richards Boulevard off-ramp in Davis, approximately 44 miles in total. x/xx denotes number of minutes in travel time savings/total travel times.

Exhibit 18: Illustration of Peak Hour Travel Time Savings Friday PM Metering Schedule (2015)

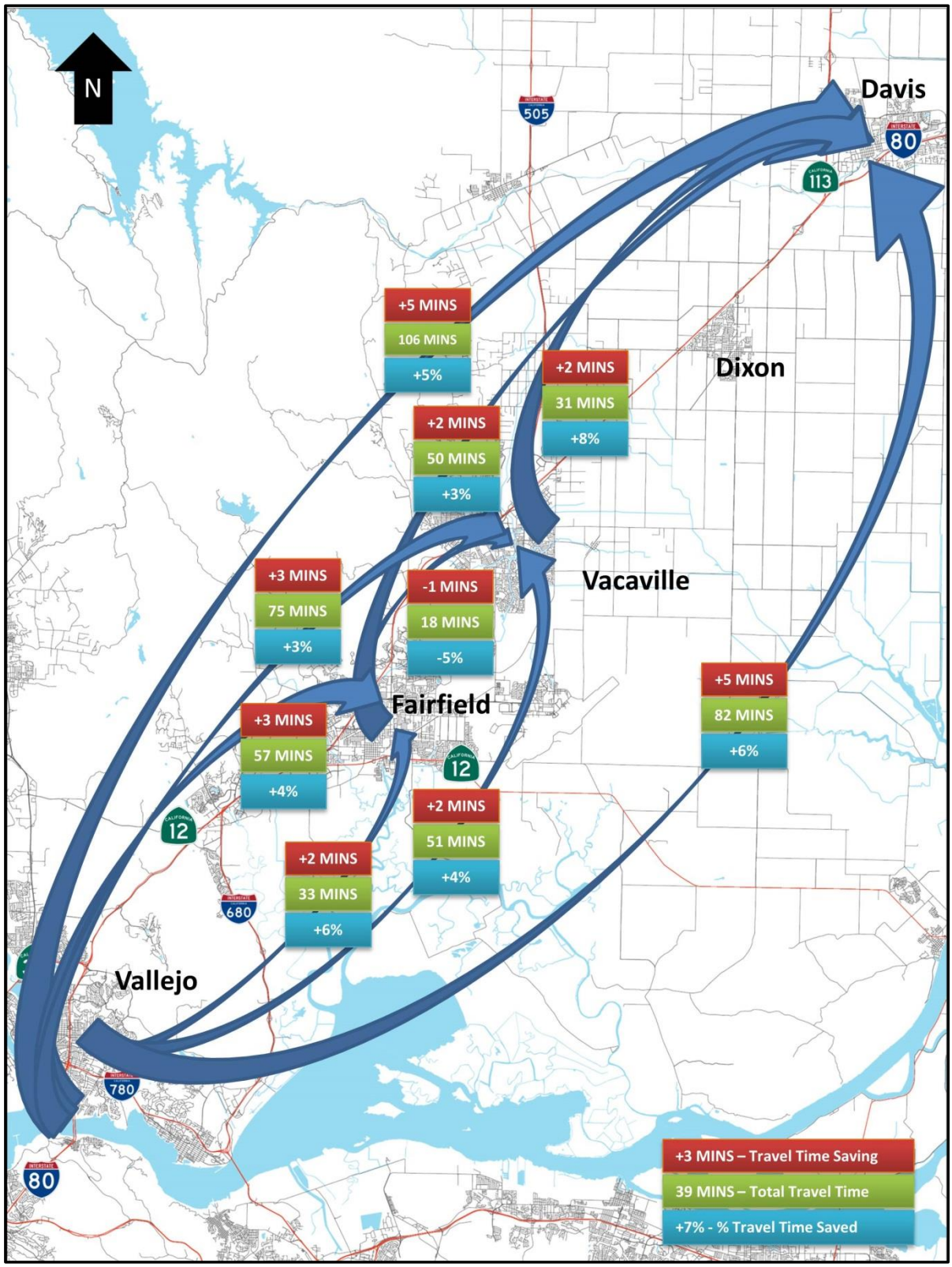


Exhibit 19: Home Based Work Trip Distribution Between Major Attraction and Production Points

Exhibit 20: System-wide Effects of Friday Afternoon Metering Schedule (2015)

Performance Measures	VHT (ML only)	VHT (System)	VMT (System)	Avg. ML Speed (MPH)
Without Ramp Metering	39,977	41,218	1,430,469	36
With Ramp Metering	38,178	40,228	1,427,289	37
Difference	-1,799	-990	-3,180	1
% Diff	-4.5%	-2.4%	-0.2%	2.8%

Note: System performance measures include both mainline and ramps.

VHT (ML only) = vehicle hours traveled on freeway mainline only

VHT (System) = vehicle hours traveled on freeway plus ramps, including ramp delays

VMT = vehicle miles traveled

7. DIVERSION ANALYSIS

Potential diversions due to ramp metering were evaluated using the CUBE Avenue dynamic traffic assignment (DTA) analysis tool. The analysis evaluated potential diversions for the entire Solano County.

7.1 2015 DTA RESULTS

Diversion effects of the prototype ramp metering plan developed for Friday PM peak period in the eastbound direction are summarized in Exhibit 21. For Monday through Thursday PM peak period, setting meter rates to serve demand volumes would not result in significant diversion traffic.

Exhibit 21: Potential Diversion of Friday Afternoon Metering Schedule (2015)

Eastbound On-Ramp	Peak Hour Demand (5-6 PM)	RM Rate/ Demands Ratio*	Diversion	
			Veh. Diverted**	% Change in Ramp Vol
Redwood St	294	99%	-3	-1.0%
Columbus Pkwy	483	97%	-15	-3.1%
SR 37 (2-Ln)	1308	N/A	+18	1.4%
American Canyon Rd	348	97%	Neg.	Neg.
Red Top Rd	737	99%	-9	-1.2%
SR 12 (W) (2-Ln)	1281	N/A	+9	0.7%
Green Valley/I-680 (3-Ln)	3329	N/A	Neg.	Neg.
Suisun Valley Rd (2-Ln)	914	98%	-4	-0.4%
Abernathy Rd	600	99%	+4	0.7%
Auto Mall Pkwy	710	97%	-3	-0.4%
Beck Rd (2-Ln)	1049	99%	-2	-0.2%
Travis Blvd (2-Ln)	1177	97%	-30	-2.5%
Air Base Pkwy	820	98%	-3	-0.4%
N Texas St	689	97%	Neg.	Neg.
Lagoon Valley Rd	166	100%	Neg.	Neg.
Pena Adobe Rd	60	100%	Neg.	Neg.
Alamo Drive	601	98%	-5	-0.8%
Davis St	341	98%	+5	1.5%
Mason St (2-Ln)	423	100%	Neg.	Neg.
Allison Dr SB	236	100%	Neg.	Neg.
Allison Dr NB	228	100%	Neg.	Neg.
I-505	286	N/A	Neg.	Neg.
Orange Dr	339	100%	Neg.	Neg.
Stay on Local Roads	N/A	N/A	+38	N/A
Net			0	

* This ratio reflects the worst case condition (lowest %) throughout the peak period, to conservatively assess potential diversions.
** Note: '+' means vehicles were diverted to this location from adjacent ramp(s).

As shown in the exhibit, ramp metering rates would be set to serve demand traffic volumes ranging from 97% to 100%. As a result, potential diversion at all on-ramps along the corridor would range from negligible (zero vehicles) to a maximum of 30 vehicles. Note that some short trips would elect to avoid using the freeway system and take local streets to reach their destinations.

Exhibit 22, Exhibit 23, and Exhibit 24 illustrate the diversion of traffic between ramps for the Friday PM ramp metering schedule. The amount of diverted traffic is small compared to existing volumes at the on-ramps and on city streets.

Exhibit 22: Diversion of Friday Eastbound Traffic in Vallejo with Metering (2015)

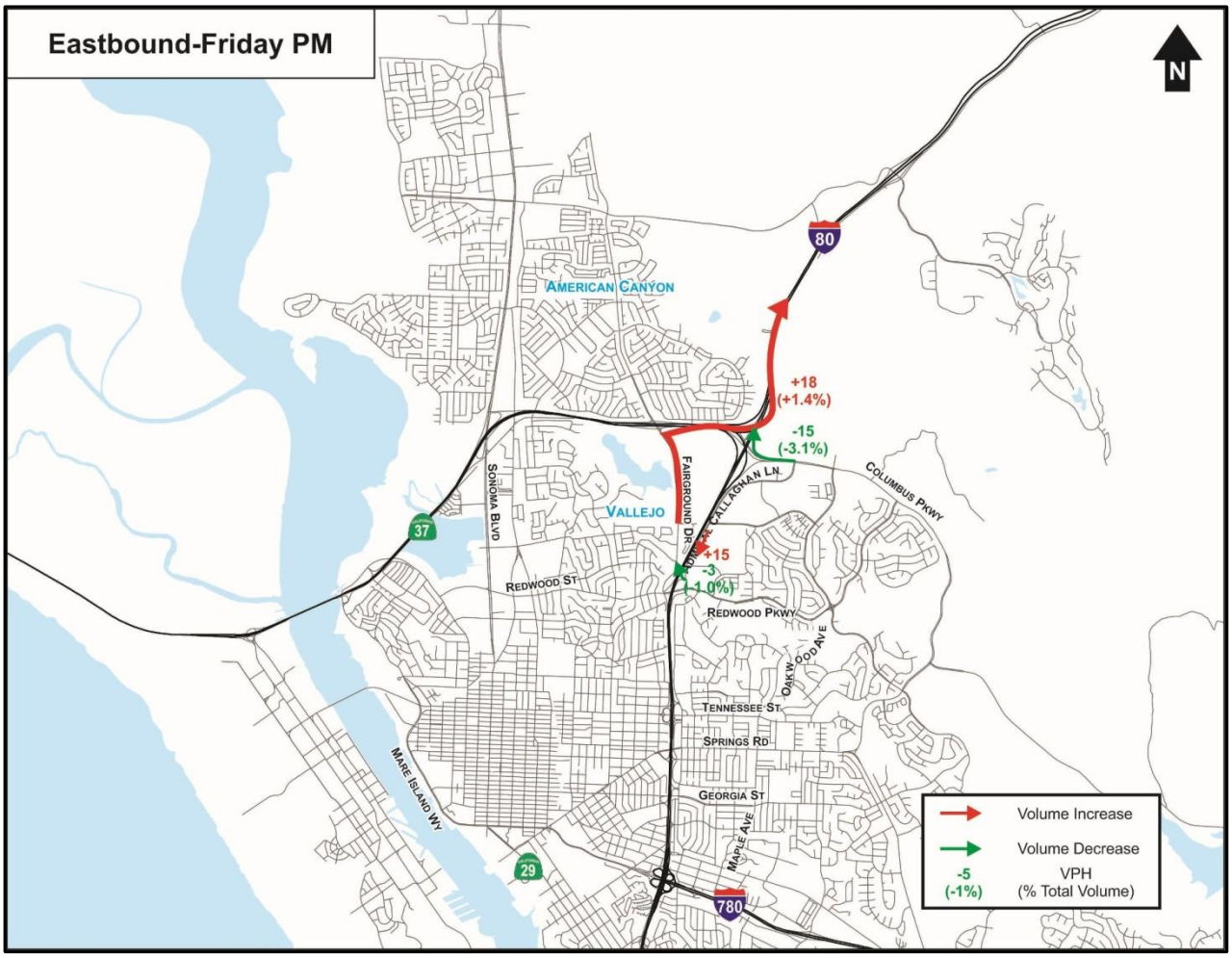


Exhibit 23: Diversion of Friday Eastbound Traffic in Fairfield with Metering (2015)

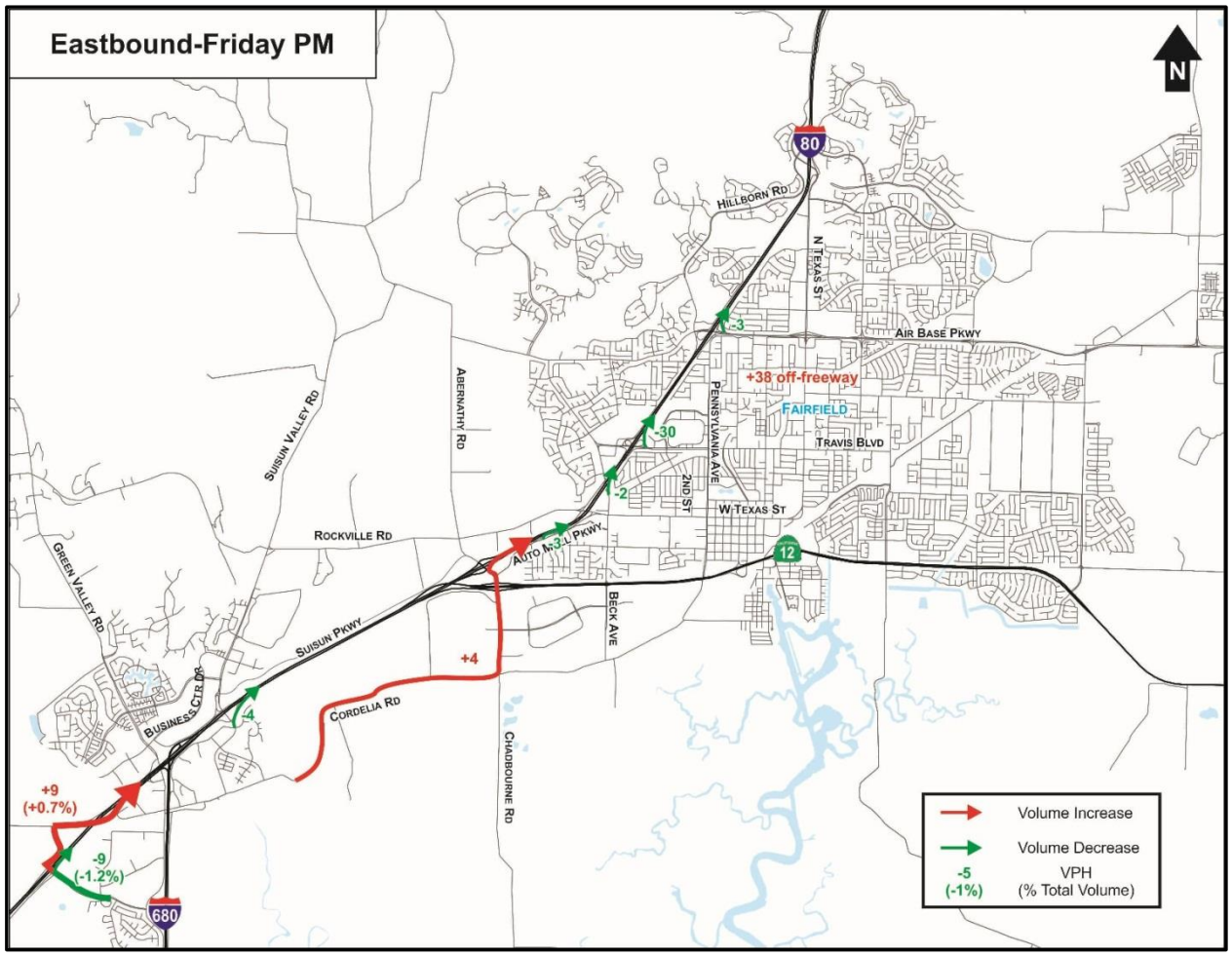
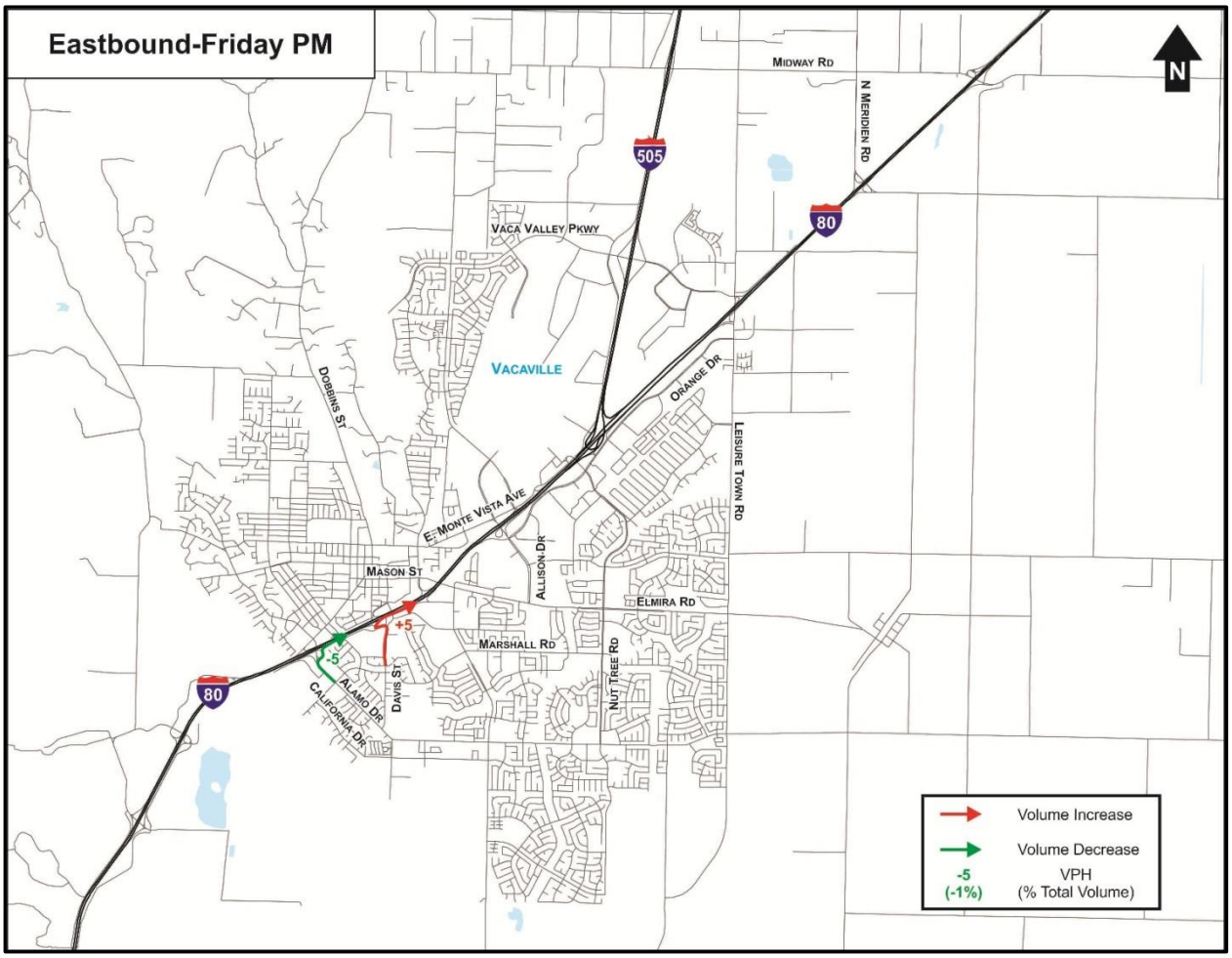


Exhibit 24: Diversion of Friday Eastbound Traffic in Vacaville with Metering (2015)



7.2 2030 DTA RESULTS

For the long term 2030 conditions, an evaluation of future travel demand volumes indicates that the I-80 corridor would experience congestion in all four study periods in the peak direction of travel; therefore, metering at below demand rates throughout the corridor would help manage freeway system efficiency. Input metering rates for the DTA model were set to maximize the use of available storage at each on-ramp, without spillback beyond on-ramps that would interfere with arterial traffic operations.

The purpose of conducting the 2030 DTA analysis was not to determine a specific set of metering rates for the Year 2030 conditions, but to assess potential ramp metering effects to local surface streets in the long term. The three primary objectives of the Year 2030 analysis were to determine:

- If ramp metering would cause undesirable diversions to local streets in Year 2030 conditions.
- Ramps that may need to be reconstructed in order to enable ramp metering and ramps that may need to be widened to continue ramp metering operations due to high demand volumes.
- Ramp metering implementation timing for the corridor.

Detailed specific on-ramp assumptions for ramp metering in Year 2030 are listed under Exhibit 25 and Exhibit 26.

A set of freeway mainline and ramp volume forecasts were computed for the study corridor. These forecasts were based on model growth estimated from the Solano countywide travel demand model and added onto the 2015 adjusted forecast volume set. Although ramp metering equipment was assumed to be available by 2030, projected 2030 on-ramp volumes were also evaluated to determine if metering is feasible in the event that ramp volumes are higher than maximum typical metering rates (i.e., greater than 900 vehicles per hour per lane). A conservative assumption was made that the freeway-to-freeway connectors would not be metered for the purpose of diversion evaluation. In practice, even when freeway connectors are not metered, the freeway system would still realize operational benefits from other surface street ramp meters along the corridor. Furthermore, a few on-ramps within the City of Vallejo currently have substandard design with very limited storage; ramp metering is assumed to be infeasible at these locations until further improvement plans are identified, which could be part of future express lane or other projects. There are also other locations in that may require modifications to accommodate future travel demand, as identified in Exhibit 25 and Exhibit 26.

The DTA model analysis procedures are similar to those described previously for the 2015 conditions analysis. CUBE Avenue was selected as the DTA tool for this evaluation. The process began with the Solano countywide travel demand model. A Solano county-only subarea network and trip table was then extracted from the nine-county model.

The roadway network for the DTA analysis was assumed to be consistent with projects that were included in the official Solano countywide model. Additional modifications to the network were made based on input from prior SoHIP meetings:

- Phase 1 of the I-80/I-680/SR 12 Interchange Project
- Express lane limits extended from Air Base Parkway to I-505

Detailed specific on-ramp assumptions for ramp metering in Year 2030 are listed under Exhibit 25 and Exhibit 26.

Exhibit 25: Ramp Metering Assumptions for 2030 DTA Analysis – Eastbound I-80

Eastbound On-Ramp	2030 Assumption	Comment
Magazine St	No Meter	Existing ramp is too short/needs improvement
I-780	No Meter	Freeway Connector. Further modifications to this ramp may need to be considered.
Georgia St	Meter	Further modifications to this ramp may need to be considered.
Springs Rd	No Meter	Existing ramp is too short/needs improvement
Tennessee St	Meter	Further modifications to this ramp may need to be considered for the northern ramp.
Redwood St	Meter	
Columbus Pkwy	Meter	
SR 37	No Meter	Freeway Connector
American Canyon Rd	Meter	
Red Top Rd	No Meter	On-ramp demand volume too high (Friday)
SR 12 (West)/Jameson Canyon Rd	No Meter	Freeway Connector
I-680/Green Valley Rd	No Meter	Freeway Connector
Suisun Valley Rd	Meter	
Abernathy Rd	Meter	
Auto Mall Pkwy	No Meter	On-ramp demand volume too high
Beck Ave	Meter	
Travis Blvd	Meter	
Air Base Pkwy	Meter	
N Texas St	No Meter	On-ramp demand volume too high
Cherry Glen Rd	Meter	
Pleasants Valley/Rivera Rd	Meter	
Alamo Drive	Meter	
Davis St	Meter	
Mason St/Cliffside Dr	Meter	
Allison Dr Loop	Meter	
Allison Dr Diag	Meter	
I-505	No Meter	Freeway Connector
Orange Dr	Meter	
Leisure Town Rd Loop	Meter	
Leisure Town Rd Diag	Meter	
Meridian Rd	Meter	
Midway Rd	Meter	
Dixon Ave	Meter	
Pitt School Rd	Meter	
SR 113(S)/N 1st St	Meter	
Pedrick Rd	Meter	
Kidwell Rd	Meter	

Eastbound On-Ramp	2030 Assumption	Comment
SR 113 SB	No Meter	Freeway Connector
Old Davis Rd	Meter	

Exhibit 26: Ramp Metering Assumptions for 2030 DTA Analysis – Westbound I-80

Westbound On-Ramp	2030 Assumption	Comment
Old Davis Rd	Meter	
SR 113 SB	No Meter	Freeway Connector
Kidwell Rd	Meter	
Pedrick Rd	Meter	
SR 113(S)/N 1st St	Meter	
Currey Rd	Meter	
Pitt School Rd	Meter	
Dixon Ave	Meter	
Midway Rd	Meter	
Meridian Rd	Meter	
Leisure Town Rd Loop	Meter	
Leisure Town Rd Diag	Meter	
I-505	No Meter	Freeway Connector
Monte Vista Ave (east)	Meter	
Browns Valley/Monte Vista Ave (west)	Meter	
Mason St	Meter	
Davis St	Meter	
Alamo Drive	Meter	
Pleasants Valley/Rivera Rd	Meter	
Cherry Glen Rd	Meter	
N Texas St	Meter	
Air Base Pkwy	Meter	
Travis Blvd Loop	Meter	
Travis Blvd Diag	Meter	
W Texas Rd	Meter	
Abernathy Rd	Meter	
SR 12 (East)	No Meter	Freeway Connector
I-680	No Meter	Freeway Connector
Green Valley Rd	Meter	
Red Top Rd	Meter	
American Canyon Rd	Meter	
Columbus Pkwy	Meter	
SR 37	No Meter	Freeway Connector
Redwood St	Meter	
Tennessee St	Meter	Further modifications to this ramp may need to be considered.

Westbound On-Ramp	2030 Assumption	Comment
Springs Rd	Meter	Further modifications to this ramp may need to be considered.
Georgia St	Meter	Further modifications to this ramp may need to be considered.
I-780	No Meter	Freeway Connector. Further modifications to this ramp may need to be considered.
Magazine St	No Meter	Existing ramp is too short/needs improvement
Maritime Academy Rd	No Meter	Existing ramp is too short/needs improvement
SR 29	No Meter	On-ramp demand volume too high

MIDWEEK WESTBOUND AM PEAK HOUR RESULTS

DTA analysis was conducted to evaluate potential diversion associated with on-ramp delays due to ramp metering. Note that as a result of the diverted traffic, background arterial traffic would also shift between different paths away from the freeway mainline. Potential diversion results are summarized in Exhibit 27. In addition, these potential traffic diversions are illustrated graphically in the Appendix G. Potential diversion at each on-ramp along the corridor ranges from negligible to a maximum of 58 vehicles, or approximately 4% of peak hour demand volume.

Exhibit 27: Westbound Midweek AM Peak Hour Potential Diversion

Westbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Old Davis Rd	66	100%	Neglig.	Neglig.
SR 113 SB	1145	NM	Neglig.	Neglig.
Kidwell Rd	80	100%	Neglig.	Neglig.
Pedrick Rd	143	100%	Neglig.	Neglig.
SR 113(S)/N 1st St	135	100%	10	7%
Currey Rd	7	100%	Neglig.	Neglig.
Pitt School Rd	355	96%	6	2%
Dixon Ave	849	96%	-35	-4%
Midway Rd	224	100%	14	6%
Meridian Rd	79	100%	6	7%
Leisure Town Rd Loop	151	100%	Neglig.	Neglig.
Leisure Town Rd Diag	335	90%	-17	-5%
I-505	1687	NM	17	1%
Monte Vista Ave (east)	67	100%	8	12%
Browns Valley/Monte Vista Ave (west)	1206	99%	-8	-1%
Mason St	742	96%	Neglig.	Neglig.
Davis St	507	96%	17	3%
Alamo Drive	1387	97%	-42	-3%

Westbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Pleasants Valley/Rivera Rd	193	100%	6	3%
Cherry Glen Rd	678	97%	19	3%
W Texas St	520	95%	-18	-3%
Air Base Pkwy	1500	96%	-58	-4%
Travis Blvd Loop	480	95%	-13	-3%
Travis Blvd Diag	390	97%	-12	-3%
W Texas Rd	446	97%	-9	-2%
Abernathy Rd	706	98%	-4	-1%
SR 12	3750	NM	Neglig.	Neglig.
I-680	421	NM	Neglig.	Neglig.
Green Valley Rd	765	97%	Neglig.	Neglig.
Red Top Rd	873	97%	Neglig.	Neglig.
American Canyon Rd	730	98%	Neglig.	Neglig.
Columbus Pkwy	91	100%	Neglig.	Neglig.
SR 37	1559	NM	16	1%
Redwood St	814	98%	-16	-2%
Tennessee St	719	93%	Neglig.	Neglig.
Springs Rd	266	95%	-13	-5%
Georgia St	549	98%	-10	-2%
I-780	1187	NM	23	2%
Magazine St	410	NM	Neglig.	Neglig.
Maritime Academy Rd	427	NM	Neglig.	Neglig.
SR 29	964	NM	Neglig.	Neglig.

Note: NM – No Metering. "+" indicates more vehicles as a result of ramp metering, and "-" indicates fewer vehicles. Negligible is where diversion is not anticipated.

As shown in Exhibit 27, setting ramp metering rates at below demand volume rate would result in potential diversions through the study area. Route choice for certain trips would elect to use adjacent on-ramps to reach their corresponding destinations, while a portion of the short trips would elect to use local streets and avoid using the freeway. Potential diversion routes in each major city are listed below for trips that are anticipated to divert away from their original route choice. This information, along with numerical results presented in the exhibit, provide an assessment of the order of magnitude and route choice pattern for these diversion trips in the long term conditions.

- Dixon
  - N First Street
  - Pitt School Road
  - Midway Road
  - Weber Road

- Vacaville
  - Vaca Valley Parkway
  - I-505 southbound
  - E Monte Vista Avenue
  - Davis Street
  - California Drive
  - Pleasants Valley Road/Cherry Glen Road
- Fairfield
  - N Texas Street
  - Pennsylvania Avenue
  - W Texas Street
  - Rockville Road
  - Cordelia Road
  - Suisun Parkway
- Vallejo
  - Route 37 eastbound
  - Springs Road
  - Georgia Street
  - Maple Avenue
  - Oakwood Avenue
  - I-780

SUNDAY WESTBOUND PM PEAK HOUR RESULTS

Potential diversion results for the Year 2030 Sunday PM peak hour are summarized in Exhibit 28. These are also illustrated graphically in Appendix G. Potential diversion at each on-ramp along the corridor ranges from negligible to a maximum of 46 vehicles, or approximately 18% of peak hour demand volume.

Exhibit 28: Westbound Sunday PM Peak Hour Potential Diversion

Westbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Old Davis Rd	118	100%	Neglig.	Neglig.
SR 113 SB	1023	NM	Neglig.	Neglig.
Kidwell Rd	55	100%	Neglig.	Neglig.
Pedrick Rd	206	100%	Neglig.	Neglig.
SR 113(S)/N 1st St	175	100%	Neglig.	Neglig.
Currey Rd	20	100%	Neglig.	Neglig.
Pitt School Rd	268	96%	Neglig.	Neglig.
Dixon Ave	358	96%	Neglig.	Neglig.
Midway Rd	103	100%	Neglig.	Neglig.

Westbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Meridian Rd	60	100%	Neglig.	Neglig.
Leisure Town Rd Loop	95	100%	Neglig.	Neglig.
Leisure Town Rd Diag	383	90%	-34	-9%
I-505	1986	NM	Neglig.	Neglig.
Monte Vista Ave (east)	309	100%	Neglig.	Neglig.
Browns Valley/Monte Vista Ave (west)	1098	99%	-11	-1%
Mason St	476	96%	-33	-7%
Davis St	534	96%	7	1%
Alamo Drive	548	97%	26	5%
Pleasants Valley/Rivera Rd	211	100%	Neglig.	Neglig.
Cherry Glen Rd	363	97%	23	6%
W Texas St	327	95%	-17	-5%
Air Base Pkwy	892	96%	12	1%
Travis Blvd Loop	924	95%	-27	-3%
Travis Blvd Diag	344	97%	Neglig.	Neglig.
W Texas Rd	305	97%	-15	-5%
Abernathy Rd	281	98%	Neglig.	Neglig.
SR 12	1866	NM	29	2%
I-680	311	NM	Neglig.	Neglig.
Green Valley Rd	462	97%	-4	-1%
Red Top Rd	302	97%	4	1%
American Canyon Rd	477	98%	Neglig.	Neglig.
Columbus Pkwy	253	100%	-46	-18%
SR 37	1943	NM	39	2%
Redwood St	892	98%	-18	-2%
Tennessee St	405	93%	13	3%
Springs Rd	247	95%	3	1%
Georgia St	465	98%	Neglig.	Neglig.
I-780	522	NM	Neglig.	Neglig.
Magazine St	213	NM	Neglig.	Neglig.
Maritime Academy Rd	590	NM	Neglig.	Neglig.
SR 29	963	NM	Neglig.	Neglig.

Note: NM – No Metering. "+" indicates more vehicles as a result of ramp metering, and "-" indicates fewer vehicles. Negligible is where diversion is not anticipated.

Potential diversion routes in each major city are listed as follows:

- Dixon
  - No diversion anticipated

- Vacaville
  - Vaca Valley Parkway
  - I-505 southbound
  - Dobbins Street
  - E Monte Vista Avenue
  - Mason Street
  - Davis Street
  - Merchant Street
  - Pleasants Valley Road/Cherry Glen Road
- Fairfield
  - N Texas Street
  - Hiborn Road
  - Pennsylvania Avenue
  - Beck Avenue
  - Route 12 westbound
  - Business Center Drive
- Vallejo
  - Route 37 eastbound
  - Redwood Parkway
  - Tennessee Street
  - Springs Road

MIDWEEK EASTBOUND PM PEAK HOUR RESULTS

Potential diversion results for the Year 2030 midweek PM peak hour are summarized in Exhibit 29. These are also illustrated graphically in Appendix G. Potential diversion at each on-ramp along the corridor ranges from negligible to a maximum of 46 vehicles, or approximately 17% of peak hour demand volume.

Exhibit 29: Eastbound Midweek PM Peak Hour Potential Diversion

Eastbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Magazine St	522	NM	Neglig.	Neglig.
I-780	1950	NM	Neglig.	Neglig.
Georgia St	428	98%	-9	-2%
Springs Rd	219	NM	9	4%
Tennessee St	1039	97%	Neglig.	Neglig.
Redwood St	547	98%	-11	-2%
Columbus Pkwy	825	95%	11	1%
SR 37	2310	NM	Neglig.	Neglig.
American Canyon Rd	639	96%	Neglig.	Neglig.

Eastbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Red Top Rd	593	NM	Neglig.	Neglig.
SR 12	1931	NM	Neglig.	Neglig.
I-680/Green Valley Rd	3960	NM	Neglig.	Neglig.
Suisun Valley Rd	892	96%	-35	-4%
Abernathy Rd	781	98%	4	1%
Auto Mall Pkwy	1501	NM	Neglig.	Neglig.
Beck Ave	1548	98%	-31	-2%
Travis Blvd	1450	96%	-16	-1%
Air Base Pkwy	978	97%	16	2%
N Texas St	1148	NM	16	1%
Cherry Glen Rd	623	97%	Neglig.	Neglig.
Pleasants Valley/Rivera Rd	225	95%	Neglig.	Neglig.
Alamo Drive	722	96%	-16	-2%
Davis St	410	97%	-12	-3%
Mason St/Cliffside Dr	485	100%	23	5%
Allison Dr Loop	223	100%	5	2%
Allison Dr Diag	401	93%	-8	-2%
I-505	278	NM	46	17%
Orange Dr	490	95%	-3	-1%
Leisure Town Rd Loop	572	95%	-11	-2%
Leisure Town Rd Diag	491	92%	-24	-5%
Meridian Rd	120	100%	Neglig.	Neglig.
Midway Rd	170	100%	Neglig.	Neglig.
Dixon Ave	137	100%	Neglig.	Neglig.
Pitt School Rd	333	96%	-13	-4%
SR 113(S)/N 1st St	419	94%	-17	-4%
Pedrick Rd	449	96%	2	0.4%
Kidwell Rd	292	90%	6	2%
SR 113 SB	1069	NM	Neglig.	Neglig.
Old Davis Rd	298	100%	Neglig.	Neglig.

Note: NM – No Metering. "+" indicates more vehicles as a result of ramp metering, and "-" indicates fewer vehicles. Negligible is where diversion is not anticipated.

Potential diversion routes in each major city are listed as follows:

- Vallejo
  - Admiral Callaghan Lane
  - Oakwood Avenue
  - Springs Road
- Fairfield

  - Cordelia Road
  - Suisun Parkway
  - Chadbourne Road
  - West Texas Street
  - 2nd Street
  - Travis Boulevard
  - Pennsylvania Avenue
  - Air Base Parkway
- Vacaville
  - Alamo Drive
  - Marshall Road
  - Peabody Road
  - Nut Tree Road
  - E Monte Vista Avenue
  - I-505
- Dixon
  - Lincoln Street
  - Dorset Drive

FRIDAY EASTBOUND PM PEAK HOUR RESULTS

Potential diversion results for the Year 2030 Friday PM peak hour are summarized in Exhibit 30. These are also illustrated graphically Appendix G. Potential diversion at each on-ramp along the corridor ranges from negligible to a maximum of 41 vehicles, or approximately 13% of peak hour demand volume.

Exhibit 30: Eastbound Friday PM Peak Hour Potential Diversion

Eastbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Magazine St	542	NM	Neglig.	Neglig.
I-780	1824	NM	Neglig.	Neglig.
Georgia St	503	98%	Neglig.	Neglig.
Springs Rd	202	NM	Neglig.	Neglig.
Tennessee St	1082	97%	-32	-3%
Redwood St	453	98%	14	3%
Columbus Pkwy	881	95%	Neglig.	Neglig.
SR 37	2187	NM	Neglig.	Neglig.
American Canyon Rd	659	96%	Neglig.	Neglig.
Red Top Rd	1225	NM	Neglig.	Neglig.
SR 12	1871	NM	Neglig.	Neglig.
I-680/Green Valley Rd	3960	NM	17	0.4%

Eastbound On-Ramp Locations	Peak Hour Demand Volume	RM Rate/Demand Ratio	Potential Diversion	
			vph	% Total Vol.
Suisun Valley Rd	986	96%	-20	-2%
Abernathy Rd	687	98%	3	0.4%
Auto Mall Pkwy	1383	NM	27	2%
Beck Ave	1329	98%	-27	-2%
Travis Blvd	1274	96%	-25	-2%
Air Base Pkwy	981	97%	-10	-1%
N Texas St	1273	NM	14	1%
Cherry Glen Rd	722	97%	Neglig.	Neglig.
Pleasants Valley/Rivera Rd	327	95%	Neglig.	Neglig.
Alamo Drive	679	96%	-5	-1%
Davis St	367	97%	-7	-2%
Mason St/Cliffside Dr	478	100%	12	3%
Allison Dr Loop	267	100%	Neglig.	Neglig.
Allison Dr Diag	414	93%	-17	-4%
I-505	315	NM	41	13%
Orange Dr	475	95%	-24	-5%
Leisure Town Rd Loop	563	95%	-28	-5%
Leisure Town Rd Diag	482	92%	-24	-5%
Meridian Rd	64	100%	Neglig.	Neglig.
Midway Rd	132	100%	Neglig.	Neglig.
Dixon Ave	180	100%	Neglig.	Neglig.
Pitt School Rd	356	96%	-14	-4%
SR 113(S)/N 1st St	458	94%	Neglig.	Neglig.
Pedrick Rd	419	96%	14	3%
Kidwell Rd	402	90%	Neglig.	Neglig.
SR 113 SB	829	NM	Neglig.	Neglig.
Old Davis Rd	233	100%	Neglig.	Neglig.

Note: NM – No Metering. "+" indicates more vehicles as a result of ramp metering, and "-" indicates fewer vehicles. Negligible is where diversion is not anticipated.

Potential diversion routes in each major city are listed as follows:

- Vallejo
  - Tennessee Street
  - Tuolumne Street
  - Redwood Parkway
  - Broadway Street
  - Sonoma Boulevard
- Fairfield
  - I-680 northbound

    - Cordelia Road
    - Chadbourne Road
    - Auto Mall Parkway
    - Pennsylvania Avenue
    - North Texas Street
    - Dover Avenue
    - Vanden Road
- Vacaville
    - Hume Way
    - Peabody Road
    - Nut Tree Road
    - E Monte Vista Avenue
    - I-505
    - Fry Road
- Dixon
    - A Street
    - Pedrick Road

The DTA analysis results presented in this report demonstrated that when metering rates are set appropriately potential diversions resulting from operating ramp meters along the I-80 corridor would not be substantial and would range from negligible to a maximum of less than 60 vehicles per hour.

7.3 RECOMMENDATION

It is recommended that the short ramps in Vallejo and other on-ramps that are projected to have high demand volumes be reconstructed or widened as listed below, so that they can be metered in the long term and to improve the effectiveness of the overall ramp metering system. These include:

- Reconstruction of Short Non-Standard On-Ramps
    - Eastbound on-ramp from Magazine Street
    - Eastbound on-ramp from Springs Road
    - Westbound on-ramp from Magazine Street
    - Westbound on-ramp from Maritime Academy Drive
- Widening of On-Ramps with High Demand Volumes (>900 vphpl)
    - Eastbound on-ramp from Red Top Road
    - Eastbound on-ramp from Green Valley Road
    - Eastbound on-ramp from N. Texas Street
    - Westbound on-ramp from Route 29/Sonoma Boulevard
- Further modifications to these ramp may need to be considered
    - Eastbound and westbound on-ramps from I-780
    - Eastbound and westbound on-ramps from Georgia Street

- Eastbound and westbound on-ramps from Tennessee Street
  Westbound on-ramp from Springs Road

8. IMPLEMENTATION PLAN

Ramp metering equipment will be installed and ready for activation on I-80 between the Redwood Street interchange in Vallejo and I-505/Orange Drive in Vacaville by 2015. To take maximum advantage of the operational and safety benefits offered by ramp metering, these ramp meters should be activated as soon as feasible prior to 2015 in the eastbound direction. Based on the projected freeway mainline conditions by 2015, it is recommended that the ramp metering rates in the eastbound direction be set to serve demand volumes Monday through Thursday PM peak period. For Friday PM peak period in the eastbound direction, the analysis demonstrated that significant operational improvements would be achieved by setting metering rates at a few percentage points below demand volume rates.

Projected traffic conditions by Year 2015 indicated that activating ramp metering in the westbound direction during weekday AM peak period (5 AM to 10 AM) and Sunday PM peak period (3 PM to 8 PM) would not result in significant operational improvements to the freeway system. Therefore, from a traffic operations standpoint, ramp meters in the westbound direction could be activated later, beyond Year 2015. However, actual freeway mainline conditions should be monitored on a regular basis to determine the exact timing of activating these ramp meters, which could occur by 2015.

As it's anticipated that freeway operations will become increasingly congested beyond 2015, additional analysis was conducted to determine an approximate timeline to set metering rates at below demand volumes to provide a more efficient system operation. Peak hour demand volumes for 2030 conditions were evaluated against available capacity to determine an appropriate timeline when metering rates should be set below demand-volume rates. Year 2030 peak hour demand volumes were determined from the Solano countywide travel demand model. The volume to capacity (V/C) ratio was determined by comparing peak hour demand volumes to available capacity on the corresponding freeway mainline segment. For this exercise, since the time recommended to start metering below-demand volume rates could be any year between 2015 and 2030, freeway capacity is conservatively assumed to be without the express lane extension to I-505.

A V/C threshold of 0.85 was used to determine when the freeway is approaching its capacity and ratios greater than that indicate the freeway would be at or near congestion. Exhibit 31 provides a summary of the percentage of the freeway mainline that would be at or over capacity by 2030, in each major city through the study corridor. As shown in the exhibit, the freeway would be significantly congested by 2030, indicating that implementation of ramp metering before 2030 would help manage and provide operational benefits to achieve a more efficient freeway system. Detailed V/C ratios are included in Appendix H.

Exhibit 31: Percentage of the I-80 Corridor in Congestion by Year 2030

City	Eastbound Mon-Thurs PM	Eastbound Friday PM	Westbound Mon-Friday AM	Westbound Sunday PM
Vallejo	82%	82%	84%	93%
Fairfield	55%	84%	86%	67%
Vacaville	59%	100%	64%	67%
Dixon	59%	100%	37%	69%

A straight line interpolation method was used to determine the approximate year when the v/c ratio reaches 0.85, which provides guidance on when to begin ramp metering through specific sections of the corridor. Since V/C ratios fluctuate between each segment, a generalized year was estimated for each major city along the corridor, as shown in Exhibit 32. The years shown for each city per peak period is the median value of all freeway segments projected with V/C ratios greater than 0.85.

The ramp metering implementation plan for Solano I-80 was recommended based on a number of considerations: existing traffic congestion, projected 2015 traffic congestion, projected traffic demand volume beyond 2015, and readiness of ramp metering equipment through various sections of the corridor. For example, if there's already congestion (or projected by 2015), and equipment is available, then activation of metering is recommended. Beyond 2015, the projected years were estimated based on travel demand forecast from the Solano STA model. However, in the event that ramp metering equipment would not be available by then (such as in Vallejo west of Redwood Street), "as soon as possible" was recommended. The Solano I-80 ramp metering implementation staging plan is illustrated in Exhibit 33.

Exhibit 7 showed that a short section of I-80 eastbound at Fairfield would experience congestion by 2015 during Monday to Thursday, however, since that short section does not constitute a majority based on length, the recommendation for metering below demand rate would be around 2018. For the City of Vallejo, since traffic congestion already exists along both directions of the corridor, and is projected to get worse by 2015, it is recommended to activate ramp meters as soon as ramp metering equipment becomes available. In summary:

- **Eastbound Friday PM Peak Period**: Activate ramp meters and set optimal metering rates (below demand volume rates) by 2015, or as soon as equipment becomes available.
- **Eastbound Monday through Thursday PM Peak Period**: First activate ramp meters and set rates to serve demand volume by 2015, or as soon as equipment becomes available. Then begin metering at optimal metering rates between approximately 2015 and 2018.
- **Westbound Monday through Friday AM Peak Period**: Activate ramp meters and set optimal metering rates in 2023, with the exception of the City of Vallejo, which should be metered as soon ramp metering equipment becomes available.
- **Westbound Sunday PM Peak Period**: Activate ramp meters and set optimal metering rates by about 2019, with the exception of the City of Vallejo, which should be metered as soon as ramp metering equipment becomes available.

Exhibit 32: Recommended Implementation Years to Begin Metering

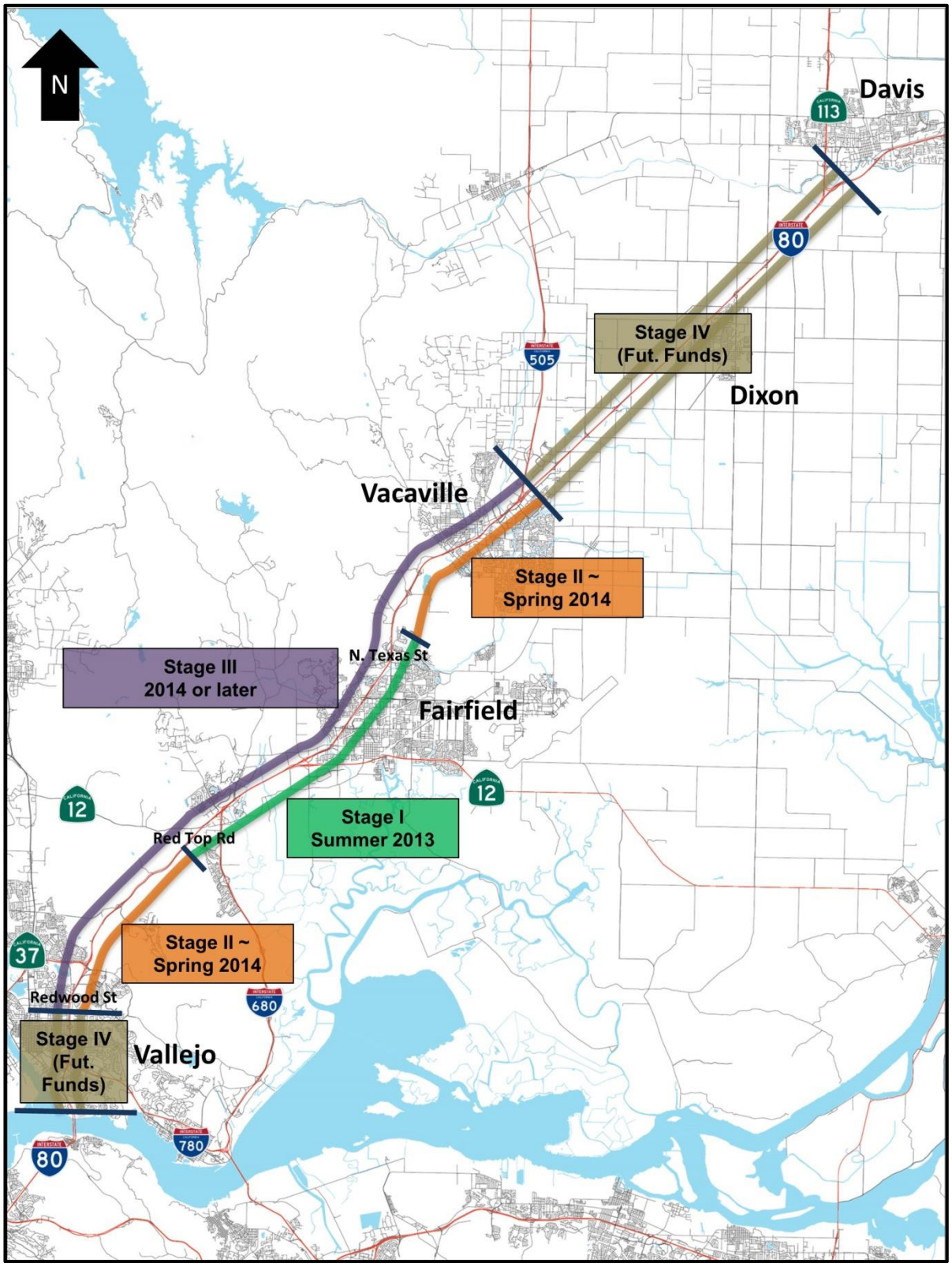
City	Eastbound Mon-Thurs PM	Eastbound Friday PM	Westbound Mon-Friday AM	Westbound Sunday PM
	At Demand Rate			
Vallejo	ASAP*	N/A	ASAP*	N/A
Fairfield	2013	N/A	2014 or later	2014 or later
Vacaville	2014	N/A	2014 or later	2014 or later
Dixon	2015 or later	2015 or later	2015 or later	2015 or later
	Below Demand Rate			
Vallejo	2015	ASAP*	2015	ASAP*
Fairfield	2018	2013	2023	2026
Vacaville	2015	2014	2023	2019
Dixon	2017	2015	2023	2022

* Future funds are pending for freeway on-ramps in Vallejo west of the Redwood Street interchange, and in Dixon east of I-505. “N/A” indicates that initial ramp metering will be activated at below demand rate.

Note that the timeline beyond 2015 presented above is based on the evaluation of future forecasting; actual freeway mainline conditions should be monitored on a regular basis to determine the exact timing of implementing ramp meters to better manage freeway operations.

The implementation plan considers multiple factors in addition to traffic congestion as the basis for meter activation. Recent studies beginning in 2008 have identified ramp metering for the I-80 corridor through Solano County as a high priority. Ramp metering has been shown to provide increased safety, as well as the ability to manage incidents, special events, and unexpected increases in demand. In addition to these benefits, ramp metering is consistent with the metropolitan area’s method of managing demand. The intent is to activate ramp meters before congestion becomes significant.

Exhibit 33: Solano I-80 Recommended Ramp Metering Implementation Year



8.1 NEXT STEPS

The draft metering rates and results presented in this report provide information necessary to evaluate the feasibility of activating ramp meters along the study corridor. It is necessary to collect more detailed freeway data prior to the actual activation of ramp metering to develop detailed time of day plans to implement in the field. MTC and Caltrans will continue their partnership with SoHIP members to implement and activate ramp meters. New ramp metering traffic-responsive timing plans should be developed prior to activation of the ramp meters. In addition, during the actual activation day, field crews should observe on-ramps and make field adjustments to metering rates as necessary based on observed conditions. Observations are typically made on multiple days during the opening week. Caltrans staff typically continues to monitor ramp meter operations periodically and as needed based on requests.

APPENDICES

Appendix A: Existing Freeway Volume and Lane Configuration

Appendix B: Existing Off-Peak Hour Comparison

Appendix C: FREQ Validation Memo

Appendix D: FREQ Future 2015 Demand Volumes

Appendix E: I-80/I-680/SR-12 Interchange Project Initial Construction Package

Appendix F: PowerPoint Slides of Ramp Storage & Caltrans Plans

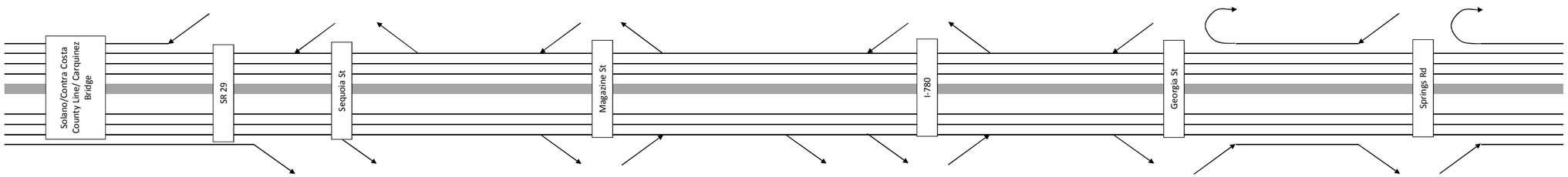
Appendix G: 2030 Potential Diversion Graphics

Appendix H: 2030 Peak Hour Forecast Results and V/C Ratios

Appendix A: Existing Freeway Volume and Lane Configuration

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

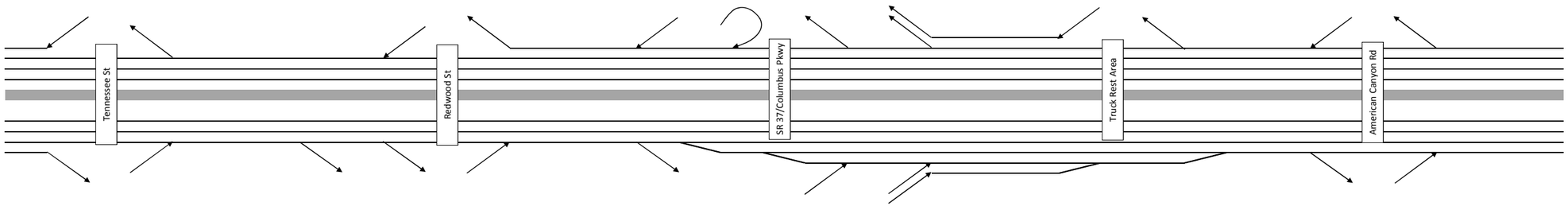
			WB ON FR SB RTE 29		WB OFF TO MARITIME ACADEMY RD	WB ON FR MARITIME ACADEMY RD		WB ON FROM MAGAZINE ST	WB OFF TO MAGAZINE		WB ON FROM RTE 780	WB OFF TO RTE 780		WB ON FR GEORGIA ST	WB OFF TO GEORGIA ST		WB ON FR SPRINGS RD	WB OFF TO SPRINGS RD	
		ML	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Loop**	**Diag**	**ML**	**Diag**	**Loop**	**ML**	**Diag**	**Loop**	**ML**
Midweek AM Period	5:00 AM - 6:00 AM	5,112	51	5,062	83	57	5,036	181	250	5,105	649	824	5,280	139	96	5,237	152	62	5,146
	6:00 AM - 7:00 AM	5,157	143	5,014	107	77	4,985	204	185	4,966	969	1,300	5,297	247	155	5,205	208	123	5,120
	7:00 AM - 8:00 AM	4,766	238	4,529	186	55	4,398	178	193	4,413	965	1,667	5,115	271	254	5,098	226	305	5,177
	8:00 AM - 9:00 AM	3,961	248	3,713	204	45	3,554	126	244	3,672	739	1,358	4,292	165	276	4,402	177	260	4,485
	9:00 AM - 10:00 AM	3,368	213	3,155	141	41	3,056	86	237	3,207	507	1,115	3,815	132	195	3,878	168	235	3,944
	Total	*22,364*	*892*	*21,473*	*719*	*274*	*21,028*	*775*	*1,109*	*21,363*	*3,828*	*6,264*	*23,798*	*953*	*974*	*23,820*	*931*	*983*	*23,872*
Sunday PM Period	3:00 PM - 4:00 PM	4,735	193	4,542	198	43	4,387	80	258	4,565	400	1,319	5,484	163	300	5,621	204	279	5,696
	4:00 PM - 5:00 PM	5,067	195	4,872	196	55	4,731	74	212	4,869	378	1,313	5,804	170	282	5,916	191	264	5,989
	5:00 PM - 6:00 PM	4,484	201	4,283	228	51	4,106	81	178	4,203	385	1,143	4,960	198	246	5,008	193	289	5,104
	6:00 PM - 7:00 PM	4,039	170	3,869	198	44	3,715	68	126	3,773	381	1,085	4,477	175	247	4,549	154	220	4,615
	7:00 PM - 8:00 PM	3,870	128	3,742	193	31	3,580	44	76	3,612	359	1,062	4,314	134	243	4,423	157	176	4,442
	Total	*22,195*	*887*	*21,308*	*1,013*	*224*	*20,519*	*347*	*850*	*21,022*	*1,903*	*5,920*	*25,039*	*840*	*1,318*	*25,517*	*899*	*1,228*	*25,846*



		CARQUINEZ BRIDGE	EB OFF TO NB RTE 29	E/B OFF TO SEQUOIA ST		E/B OFF TO MAGAZINE ST.	E/B ON FROM MAGAZINE ST		E/B OFF TO RTE 780	E/B OFF TO BENICIA RD	EB ON FR RTE 780		E/B OFF TO GEORGIA STREET	E/B ON FROM GEORGIA STREET		E/B OFF TO SPRINGS STREET	E/B ON FROM SPRINGS STREET	
		ML Count	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag/Loop**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**
Midweek PM Period	3:00 PM - 4:00 PM	4,503	313	47	4,143	69	471	4,545	724	189	1,616	5,248	157	299	5,390	188	156	5,359
	4:00 PM - 5:00 PM	4,688	409	65	4,214	69	444	4,589	751	207	1,647	5,278	191	294	5,381	204	175	5,352
	5:00 PM - 6:00 PM	4,737	409	61	4,267	97	467	4,637	867	292	1,744	5,222	199	383	5,406	223	196	5,379
	6:00 PM - 7:00 PM	4,109	306	49	3,754	76	394	4,072	737	190	1,438	4,583	184	315	4,715	195	117	4,637
	Total	*18,037*	*1,437*	*222*	*16,378*	*311*	*1,776*	*17,843*	*3,079*	*878*	*6,445*	*20,331*	*731*	*1,291*	*20,892*	*809*	*644*	*20,727*
Friday PM Period	3:00 PM - 4:00 PM	4,760	435	97	4,228	94	421	4,555	762	352	1,584	5,025	133	411	5,303	147	191	5,347
	4:00 PM - 5:00 PM	4,692	395	79	4,218	72	429	4,575	697	359	1,696	5,215	145	357	5,427	223	186	5,390
	5:00 PM - 6:00 PM	4,673	395	46	4,232	108	480	4,604	804	432	1,615	4,983	162	445	5,266	208	179	5,237
	6:00 PM - 7:00 PM	4,172	281	43	3,848	88	388	4,148	667	254	1,520	4,747	204	317	4,860	207	133	4,786
	7:00 PM - 8:00 PM	3,826	237	33	3,556	61	346	3,841	500	161	1,102	4,282	129	232	4,385	157	115	4,343
	Total	*22,122*	*1,743*	*298*	*20,081*	*423*	*2,064*	*21,722*	*3,429*	*1,558*	*7,517*	*24,252*	*773*	*1,762*	*25,241*	*942*	*804*	*25,103*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

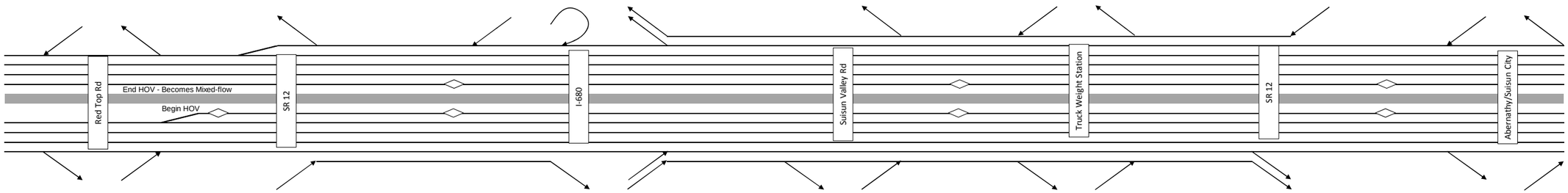
		WB ON FR COLL TENN ST	WB OFF TO COLL TENN ST		WB ON FR REDWOOD ST	WB OFF TO REDWOOD ST		WB ON FR EB RTE 37	WB ON FR CLMBS PKWY	WB OFF TO CLMBS PKWY	DUM WB OFF TO WB 37		WB ON FR TRUCK REST AREA	WB OFF TO TRUCK RA		WB ON FR AMERICAN CANYON	WB OFF TO AMERICAN CANYO	
		Diag/Loop	**Diag/Loop**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**
Midweek AM Period	5:00 AM - 6:00 AM	239	70	4,977	467	119	4,630	976	23	22	658	4,311	46	49	4,314	378	148	4,084
	6:00 AM - 7:00 AM	367	141	4,894	720	253	4,428	1,355	47	86	881	3,993	58	59	3,994	316	292	3,970
	7:00 AM - 8:00 AM	475	378	5,080	776	335	4,640	1,439	84	313	946	4,376	61	62	4,377	496	324	4,205
	8:00 AM - 9:00 AM	394	352	4,443	671	382	4,154	1,318	112	364	869	3,958	84	84	3,958	380	251	3,829
	9:00 AM - 10:00 AM	310	265	3,900	621	285	3,564	1,282	107	196	761	3,132	115	110	3,127	253	146	3,020
	Total	*1,783*	*1,205*	*23,294*	*3,253*	*1,374*	*21,415*	*6,368*	*372*	*981*	*4,114*	*19,769*	*363*	*364*	*19,770*	*1,823*	*1,161*	*19,108*
Sunday PM Period	3:00 PM - 4:00 PM	302	271	5,665	893	328	5,100	1,697	212	245	878	4,313	77	77	4,313	231	276	4,358
	4:00 PM - 5:00 PM	264	296	6,021	867	264	5,418	1,719	244	236	854	4,544	92	92	4,544	195	248	4,597
	5:00 PM - 6:00 PM	250	297	5,151	808	341	4,684	1,704	220	290	743	3,793	62	62	3,793	308	282	3,767
	6:00 PM - 7:00 PM	263	259	4,611	801	295	4,105	1,469	221	235	687	3,336	57	57	3,336	170	226	3,392
	7:00 PM - 8:00 PM	181	205	4,466	598	202	4,070	1,359	179	205	561	3,298	53	53	3,298	237	238	3,299
	Total	*1,260*	*1,328*	*25,914*	*3,967*	*1,430*	*23,377*	*7,948*	*1,076*	*1,211*	*3,721*	*19,284*	*341*	*341*	*19,284*	*1,141*	*1,270*	*19,413*



		E/B OFF TO TENNESSEE ST	E/B ON FROM TENNESSEE ST		EB OFF TO EB REDWOOD STREET	E/B OFF TO REDWOOD STREET	E/B ON FROM REDWOOD ST		EB OFF TO RTE 37/COLUMBUS PKWY	E/B ON FROM COLUMBUS PKWY	DUM E/B ON FROM E/B RTE 37			EB OFF TO AMERICAN CANION RD	EB ON FROM AMERICAN CANION RD	
		Diag	**Diag**	**ML**	**Diag**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**Diag**	**ML**	**ML**	**Diag**	**Diag**	**ML**
Midweek PM Period	3:00 PM - 4:00 PM	432	568	5,495	432	474	295	4,884	1,832	320	1,256	4,628	4,628	377	297	4,547
	4:00 PM - 5:00 PM	489	576	5,440	500	456	329	4,813	1,891	333	1,292	4,547	4,547	253	295	4,589
	5:00 PM - 6:00 PM	479	662	5,563	554	430	337	4,916	1,946	334	1,265	4,569	4,569	468	285	4,385
	6:00 PM - 7:00 PM	384	501	4,754	511	424	269	4,088	1,712	278	909	3,563	3,563	357	215	3,421
	Total	*1,783*	*2,307*	*21,251*	*1,997*	*1,784*	*1,230*	*18,700*	*7,380*	*1,265*	*4,721*	*17,306*	*17,306*	*1,455*	*1,092*	*16,942*
Friday PM Period	3:00 PM - 4:00 PM	326	591	5,612	382	382	263	5,111	1,780	319	1,340	4,990	4,990	371	324	4,944
	4:00 PM - 5:00 PM	488	652	5,554	537	494	266	4,789	1,878	321	1,155	4,387	4,387	519	329	4,197
	5:00 PM - 6:00 PM	410	682	5,509	537	418	276	4,830	1,947	353	1,185	4,421	4,421	497	291	4,215
	6:00 PM - 7:00 PM	444	553	4,895	529	397	294	4,263	1,825	316	959	3,713	3,713	389	271	3,595
	7:00 PM - 8:00 PM	337	403	4,409	406	382	231	3,852	1,469	246	804	3,433	3,433	364	177	3,246
	Total	*2,005*	*2,881*	*25,979*	*2,391*	*2,073*	*1,330*	*22,845*	*8,899*	*1,555*	*5,443*	*20,944*	*20,944*	*2,139*	*1,392*	*20,197*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

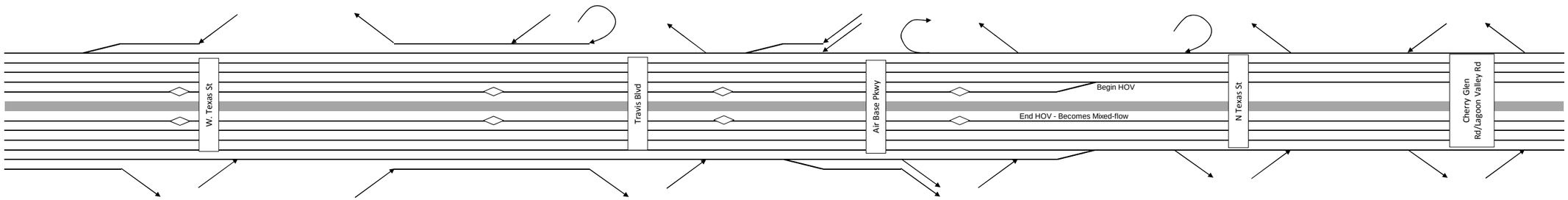
		WB ON FR REDTOP RD	WB OFF TO RED TOP		WB RTE 12-WB OFF;		WB ON FR GREEN VALL	WB ON FR NB 680	WB OFF TO SB RTE 680		WB OFF TO SUISUN VALLEY RD		W/B ON FROM SCALES	WBOFF TO WEIGH STA		WB ON FR RTE 12-FAIRFIELD		W/B ON FROM ABERNATHY	W/B OFF TO ABERNATHY
		Diag	**Diag**	**ML**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**ML**		**ML**	**Diag**	**Diag**	**ML**	**Diag**	**ML**	**Diag**	**Diag**
Midweek AM Period	5:00 AM - 6:00 AM	366	96	3,814	902	4,716	336	87	1,585	5,878	290	6,168	595	441	6,013	1,294	4,719	105	348
	6:00 AM - 7:00 AM	434	162	3,698	1,374	5,072	658	100	2,771	7,085	539	7,624	767	762	7,619	1,608	6,011	180	592
	7:00 AM - 8:00 AM	414	467	4,259	1,453	5,712	729	147	2,608	7,443	669	8,112	689	704	8,128	1,694	6,434	214	564
	8:00 AM - 9:00 AM	175	160	3,814	1,234	5,048	715	146	1,654	5,842	842	6,684	697	750	6,737	1,207	5,530	162	375
	9:00 AM - 10:00 AM	185	117	2,951	1,035	3,986	430	158	1,477	4,875	788	5,663	867	893	5,690	1,025	4,664	131	335
	Total	*1,575*	*1,003*	*18,536*	*5,999*	*24,535*	*2,868*	*637*	*10,095*	*31,124*	*3,127*	*34,251*	*3,615*	*3,550*	*34,186*	*6,828*	*27,359*	*792*	*2,214*
Sunday PM Period	3:00 PM - 4:00 PM	151	107	4,314	1,000	5,314	455	120	2,215	6,954	469	7,423	215	215	7,423	788	6,635	141	246
	4:00 PM - 5:00 PM	148	98	4,547	971	5,518	487	104	1,871	6,798	419	7,217	122	122	7,217	793	6,424	104	187
	5:00 PM - 6:00 PM	124	133	3,776	991	4,767	418	103	2,310	6,556	394	6,950	106	106	6,950	782	6,168	81	205
	6:00 PM - 7:00 PM	105	104	3,391	847	4,238	275	88	1,868	5,743	343	6,086	198	198	6,086	618	5,468	67	164
	7:00 PM - 8:00 PM	100	108	3,307	762	4,069	242	72	1,702	5,457	284	5,741	232	232	5,741	545	5,196	54	142
	Total	*628*	*550*	*19,335*	*4,571*	*23,906*	*1,877*	*487*	*9,966*	*31,508*	*1,909*	*33,417*	*873*	*873*	*33,417*	*3,526*	*29,891*	*447*	*944*



		E/B OFF TO RED TOP	E/B ON FROM RED TOP		RTE 12-EB-EB ON		E/B OFF TO GREEN VALLEY RD/680	E/B ON FR GREEN VALLEY/680		E/B OFF TO SUISUN VALLEY RD	E/B ON FR SUISUN VALLEY RD		EBOFF TO WEIGH STA	E/B ON FROM SCALES		EB OFF TO RTE 12		E/B OFF TO ABERNATHY	E/B ON FROM ABERNATHY
		Diag	**Diag**	**ML**	**Diag**	**ML**	**Diag**	**Diag**	**ML**			**ML**	**Diag**	**Diag**	**ML**	**Diag**	**ML**	**Diag**	**Diag**
Midweek PM Period	3:00 PM - 4:00 PM	215	329	4,661	1,436	6,097	750	2,707	8,054	356	788	8,486	247	247	8,486	1,359	7,127	116	591
	4:00 PM - 5:00 PM	239	202	4,552	1,373	5,925	792	2,825	7,958	313	749	8,395	191	191	8,395	1,467	6,928	126	631
	5:00 PM - 6:00 PM	260	158	4,283	1,295	5,578	838	3,139	7,879	336	808	8,351	134	134	8,351	1,529	6,822	181	599
	6:00 PM - 7:00 PM	200	132	3,353	1,021	4,374	570	2,516	6,320	328	540	6,532	118	118	6,532	1,150	5,382	102	312
	Total	*914*	*821*	*16,849*	*5,125*	*21,974*	*2,950*	*11,187*	*30,210*	*1,333*	*2,885*	*31,763*	*690*	*690*	*31,763*	*5,505*	*26,258*	*525*	*2,132*
Friday PM Period	3:00 PM - 4:00 PM	257	355	5,042	1,095	6,137	1,219	3,136	8,054	309	837	8,582	218	218	8,582	1,289	7,293	166	591
	4:00 PM - 5:00 PM	319	268	4,146	1,198	5,344	1,142	3,387	7,589	237	847	8,199	190	190	8,199	1,265	6,934	135	608
	5:00 PM - 6:00 PM	262	323	4,276	1,255	5,531	814	3,279	7,996	321	884	8,559	159	159	8,559	1,372	7,187	173	521
	6:00 PM - 7:00 PM	207	133	3,521	1,127	4,648	558	3,347	7,437	363	561	7,635	65	65	7,635	1,319	6,316	92	290
	7:00 PM - 8:00 PM	157	94	3,183	865	4,048	386	2,825	6,487	327	420	6,580	115	115	6,580	1,021	5,559	66	221
	Total	*1,202*	*1,173*	*20,168*	*5,540*	*25,708*	*4,119*	*15,974*	*37,563*	*1,557*	*3,548*	*39,554*	*747*	*747*	*39,554*	*6,266*	*33,288*	*631*	*2,231*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

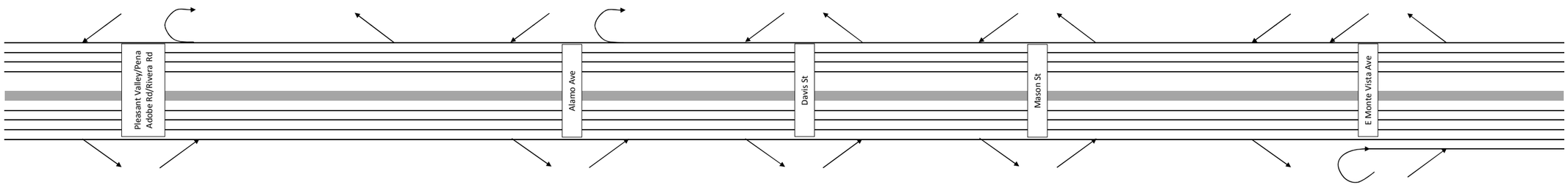
		ML	WB ON FR W TEXAS AND ROCKVL Diag	ML	WB OFF TO OLIVER RD Diag	ML	WB ON FR TRAVIS BLVD EB Diag	WB ON FR TRAVIS BLVD.WB Loop	WB OFF TO TRAVIS BV E/W Diag	ML	W/B ON FROM AIR BASE PKY Diag	W/B OFF TO E/B AIR BASE PKY Loop	W/B OFF TO AIR BASE PKY Diag	ML	W/B ON FROM NORTH TEXAS ST Loop	WB OFF TO TEXAS Diag	ML	WB ON FR CHERRY GLEN Diag	WB OFF TO CHERRY GLEN Diag
Midweek AM Period	5:00 AM - 6:00 AM	4,963	278	4,684	413	5,097	182	216	198	4,898	977	62	65	4,048	258	120	3,909	46	4
	6:00 AM - 7:00 AM	6,423	367	6,056	564	6,620	227	324	372	6,441	1,210	201	175	5,607	367	249	5,489	76	11
	7:00 AM - 8:00 AM	6,784	378	6,406	703	7,109	277	360	622	7,094	1,491	407	281	6,290	404	561	6,447	128	35
	8:00 AM - 9:00 AM	5,743	327	5,416	738	6,154	244	296	756	6,370	1,223	250	236	5,632	298	530	5,864	74	12
	9:00 AM - 10:00 AM	4,868	292	4,576	508	5,084	199	281	671	5,275	836	206	227	4,871	276	360	4,956	66	10
	Total	*28,780*	*1,642*	*27,138*	*2,926*	*30,065*	*1,130*	*1,476*	*2,619*	*30,078*	*5,738*	*1,125*	*984*	*26,449*	*1,604*	*1,820*	*26,665*	*391*	*72*
Sunday PM Period	3:00 PM - 4:00 PM	6,740	314	6,426	422	6,848	211	772	681	6,546	836	235	103	6,048	248	474	6,274	40	16
	4:00 PM - 5:00 PM	6,507	271	6,236	379	6,615	193	707	706	6,421	856	237	88	5,890	241	410	6,059	51	23
	5:00 PM - 6:00 PM	6,292	240	6,052	405	6,457	232	644	655	6,236	842	269	77	5,740	242	437	5,935	59	21
	6:00 PM - 7:00 PM	5,565	187	5,378	311	5,689	235	614	547	5,387	642	233	76	5,054	180	392	5,266	41	9
	7:00 PM - 8:00 PM	5,284	158	5,126	264	5,390	185	538	338	5,005	526	217	80	4,776	142	311	4,945	17	8
	Total	*30,388*	*1,170*	*29,218*	*1,781*	*30,999*	*1,056*	*3,275*	*2,927*	*29,595*	*3,702*	*1,191*	*424*	*27,508*	*1,053*	*2,024*	*28,479*	*208*	*77*



		ML	EB OFF TO W TEXAS AND MAGLN Diag	EB ON FROM MAGELLAN RD Diag	ML	EB ON FROM BECK RD Diag	ML	E/B OFF TO TRAVIS BL Diag/Loop	E/B ON FROM TRAVIS BL Diag	ML	Diff	E/B OFF TO AIR BASE PKY Diag	E/B ON FROM AIR BASE PKY Diag	ML	EB OFF TO N TEXAS ST Diag	E/B ON FROM NORTH TEXAS Diag	ML	E/B OFF TO CHERRY GLEN Diag	E/B ON FROM CHERRY GLEN Diag
Midweek PM Period	3:00 PM - 4:00 PM	7,601	781	219	7,039	903	7,942	1,189	1,066	7,819	878	1,418	651	7,052	477	580	7,155	71	81
	4:00 PM - 5:00 PM	7,433	1,018	439	6,854	939	7,793	1,042	1,049	7,800	188	1,400	709	7,109	460	557	7,206	94	118
	5:00 PM - 6:00 PM	7,239	1,092	432	6,579	1,173	7,752	1,089	1,232	7,895	274	1,363	757	7,289	577	560	7,272	111	127
	6:00 PM - 7:00 PM	5,592	738	209	5,063	752	5,815	1,039	932	5,708	-245	1,380	490	4,818	559	461	4,721	56	59
	Total	*27,865*	*3,629*	*1,299*	*25,535*	*3,766*	*29,301*	*4,358*	*4,279*	*29,222*	1,094	*5,561*	*2,608*	*26,269*	*2,073*	*2,158*	*26,354*	*332*	*386*
Friday PM Period	3:00 PM - 4:00 PM	7,718	901	417	7,234	850	8,084	943	999	8,140	898	926	642	7,855	480	589	7,964	66	105
	4:00 PM - 5:00 PM	7,408	806	416	7,018	996	8,014	1,034	1,052	8,032	496	894	684	7,822	460	592	7,953	82	138
	5:00 PM - 6:00 PM	7,535	943	404	6,996	997	7,993	922	1,071	8,142	488	955	752	7,938	497	615	8,056	82	146
	6:00 PM - 7:00 PM	6,514	563	195	6,146	723	6,869	1,103	934	6,700	-195	1,025	510	6,184	491	506	6,200	51	70
	7:00 PM - 8:00 PM	5,714	335	76	5,455	441	5,896	890	878	5,884	-158	1,011	308	5,180	385	350	5,146	38	29
	Total	*34,888*	*3,548*	*1,508*	*32,848*	*4,007*	*36,855*	*4,892*	*4,934*	*36,897*	1,530	*4,812*	*2,895*	*34,979*	*2,313*	*2,652*	*35,318*	*318*	*488*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

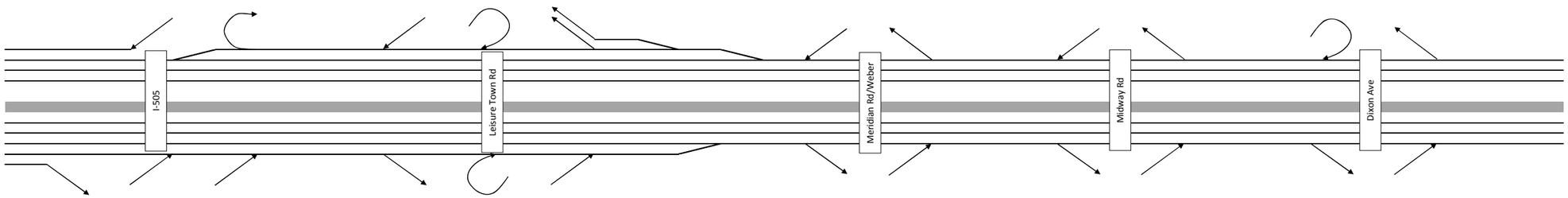
		ML	WB ON FR PLEASANT VALLEY Diag	WB OFF TO PLEASANT VALLEY Loop	ML	WB OFF TO CHERRY GLEN Diag	ML	W/B ON FROM ALAMO AVE Diag	W/B OFF TO ALAMO AVE Loop	ML	WB ON FR DAVIS ST Diag	WB OFF TO DAVIS ST. Diag	ML	WB ON FR MASON/DEPOT Diag	WB OFF TO MASON/DEPOT Diag	ML	WB ON FR MONTE VISTA/BROWNS VALLEY Diag	WB ON FR MONTE VISTA Diag	W/B OFF TO MONTIE VISTA AVE Diag	ML
Midweek AM Period	5:00 AM - 6:00 AM	3,867	9	4	3,862	1	3,863	565	244	3,541	265	112	3,388	354	233	3,268	304	28	81	3,017
	6:00 AM - 7:00 AM	5,424	9	9	5,424	9	5,432	1,022	286	4,696	347	110	4,459	487	332	4,304	464	66	189	3,963
	7:00 AM - 8:00 AM	6,354	13	26	6,367	23	6,391	1,383	528	5,536	499	247	5,283	729	471	5,026	757	60	273	4,481
	8:00 AM - 9:00 AM	5,803	15	23	5,811	16	5,827	1,423	429	4,833	361	164	4,636	578	403	4,461	520	54	342	4,229
	9:00 AM - 10:00 AM	4,899	17	30	4,913	19	4,932	834	317	4,415	266	153	4,302	446	386	4,242	397	110	372	4,107
	Total	*26,346*	*62*	*93*	*26,377*	*68*	*26,445*	*5,228*	*1,803*	*23,020*	*1,738*	*786*	*22,068*	*2,594*	*1,825*	*21,300*	*2,442*	*318*	*1,256*	*19,796*
Sunday PM Period	3:00 PM - 4:00 PM	6,250	13	33	6,270	25	6,295	638	373	6,030	525	253	5,758	534	420	5,644	861	147	693	5,329
	4:00 PM - 5:00 PM	6,031	16	24	6,039	47	6,086	503	368	5,951	509	260	5,702	505	409	5,606	776	214	520	5,136
	5:00 PM - 6:00 PM	5,897	13	20	5,904	25	5,929	519	278	5,688	496	256	5,448	442	352	5,358	655	265	637	5,075
	6:00 PM - 7:00 PM	5,234	10	18	5,242	15	5,257	422	279	5,114	401	223	4,936	343	264	4,858	570	198	419	4,509
	7:00 PM - 8:00 PM	4,936	7	15	4,944	13	4,957	373	227	4,811	285	126	4,652	260	202	4,594	477	48	291	4,360
	Total	*28,348*	*59*	*110*	*28,399*	*125*	*28,524*	*2,455*	*1,525*	*27,594*	*2,216*	*1,118*	*26,496*	*2,083*	*1,647*	*26,061*	*3,339*	*872*	*2,560*	*24,410*



		ML	E/B OFF TO PLEASANT VALLEY Diag	E/B ON FROM PLEASANT VALLEY Diag	ML	E/B OFF TO ALAMO AVE Diag	E/B ON FROM ALAMO AVE Diag	ML	E/B OFF TO DAVIS ST Diag	E/B ON FROM DAVIS ST Diag	ML	E/B OFF CLIFFSIDE DR Diag	E/B ON CLIFFSIDE DR Diag	ML	EB OFF TO ALLISON DRIVE Diag	EB ON FR SB ALLISON DRIVE Loop	EB ON FR NB ALLISON DRIVE Diag	ML
Midweek PM Period	3:00 PM - 4:00 PM	7,166	17	41	7,190	1,100	722	6,812	458	358	6,712	527	512	6,696	1,196	213	156	5,869
	4:00 PM - 5:00 PM	7,231	21	46	7,255	1,249	659	6,664	516	355	6,504	638	471	6,337	1,303	212	125	5,371
	5:00 PM - 6:00 PM	7,287	17	42	7,312	1,424	646	6,533	491	382	6,424	637	434	6,221	1,355	199	150	5,216
	6:00 PM - 7:00 PM	4,724	12	35	4,748	994	501	4,255	377	266	4,144	504	358	3,998	1,488	183	118	2,812
	Total	*26,408*	*67*	*163*	*26,504*	*4,768*	*2,528*	*24,264*	*1,842*	*1,362*	*23,783*	*2,306*	*1,775*	*23,253*	*5,342*	*808*	*550*	*19,268*
Friday PM Period	3:00 PM - 4:00 PM	8,003	22	49	8,031	991	716	7,756	550	366	7,572	621	555	7,506	1,143	265	159	6,787
	4:00 PM - 5:00 PM	8,009	20	56	8,045	1,060	651	7,636	446	358	7,547	593	521	7,475	1,441	223	146	6,403
	5:00 PM - 6:00 PM	8,120	11	60	8,169	1,188	601	7,582	470	338	7,450	606	423	7,267	1,394	236	154	6,262
	6:00 PM - 7:00 PM	6,219	20	41	6,240	853	462	5,848	409	289	5,728	477	361	5,613	1,431	219	124	4,526
	7:00 PM - 8:00 PM	5,137	12	32	5,157	647	387	4,897	258	218	4,857	336	281	4,802	1,240	142	109	3,812
	Total	*35,488*	*85*	*239*	*35,641*	*4,740*	*2,817*	*33,718*	*2,133*	*1,568*	*33,154*	*2,633*	*2,141*	*32,662*	*6,649*	*1,085*	*692*	*27,790*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

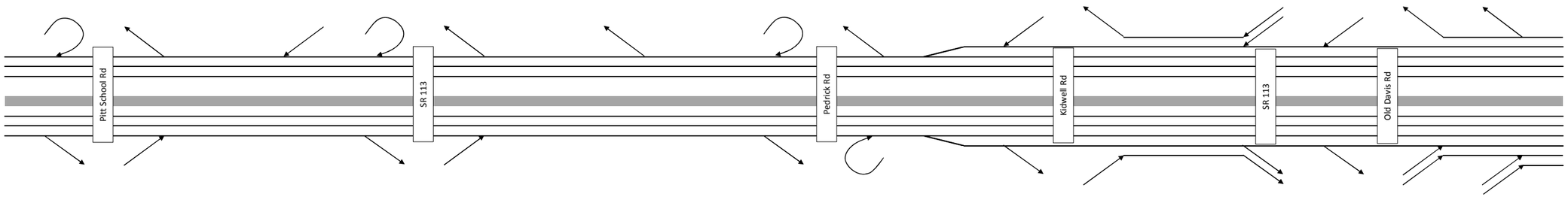
			W/B ON FROM S/B RTE 505	W/B OFF TO N/B RTE 505		W/B DIAG ON FROM SB LEISURE TOWN	W/B LOOP ON FROM NB LEISURE TOWN	W/B OFF TO LEISURE TOWN		WB ON FR MERIDIAN RD	WB OFF TO MERIDIAN RD		W/B ON FROM MIDWAY RD	W/B OFF TO MIDWAY RD		WB ON FR DIXON GRANT	WB OFF TO DIXON GRANT	
			Diag	**Loop**	**ML**	**Diag**	**Loop**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Loop**	**Diag**	**ML**
Midweek AM Period	5:00 AM - 6:00 AM		456	10	2,571	21	45	297	2,801	25	7	2,783	64	47	2,766	183	51	2,635
	6:00 AM - 7:00 AM		684	10	3,289	48	73	500	3,667	37	55	3,685	94	166	3,756	259	64	3,561
	7:00 AM - 8:00 AM		857	21	3,645	101	109	593	4,028	56	32	4,004	148	147	4,003	337	71	3,738
	8:00 AM - 9:00 AM		751	29	3,507	78	124	544	3,848	45	13	3,816	137	77	3,756	295	79	3,540
	9:00 AM - 10:00 AM		592	32	3,546	56	163	357	3,684	41	4	3,647	93	72	3,626	214	70	3,482
	Total		*3,340*	*101*	*16,557*	*304*	*514*	*2,289*	*18,028*	*203*	*110*	*17,934*	*536*	*508*	*17,907*	*1,287*	*335*	*16,955*
Sunday PM Period	3:00 PM - 4:00 PM	5,313	975	26	4,380	93	87	367	4,567	36	8	4,540	57	62	4,545	175	111	4,481
	4:00 PM - 5:00 PM	5,127	1,003	28	4,162	80	90	333	4,325	49	6	4,282	75	69	4,276	157	123	4,242
	5:00 PM - 6:00 PM	5,055	958	41	4,158	106	64	348	4,336	39	8	4,305	61	43	4,287	126	83	4,244
	6:00 PM - 7:00 PM	4,505	835	11	3,684	112	53	301	3,821	21	2	3,802	49	47	3,800	133	133	3,800
	7:00 PM - 8:00 PM	4,330	738	11	3,633	49	48	232	3,767	15	1	3,753	32	44	3,765	97	101	3,769
	Total	*24,331*	*4,510*	*117*	*20,017*	*440*	*342*	*1,581*	*20,816*	*160*	*26*	*20,683*	*274*	*266*	*20,674*	*689*	*551*	*20,536*



		E/B OFF TO NUT TREE / 505	EB ON FR SB RTE 505	EB ON FR NUT TREE OC		E/B OFF TO LEISURE TOWN	E/B ON FROM SB LEISURE TOWN	E/B DIAG ON FROM NB LEISURE TOWN		E/B OFF TO MERIDIAN RD	E/B ON FROM MERIDIAN RD		E/B OFF TO MIDWAY RD	E/B ON FROM MIDWAY RD		E/B OFF TO DIXON GRANT	E/B ON FROM DIXON GRANT	
		Diag	**Loop**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**			**ML**
Midweek PM Period	3:00 PM - 4:00 PM	815	161	360	5,574	476	222	201	5,521	77	33	5,477	163	132	5,446	306	102	5,242
	4:00 PM - 5:00 PM	768	124	359	5,086	405	276	251	5,208	92	44	5,160	166	148	5,142	311	121	4,952
	5:00 PM - 6:00 PM	754	142	337	4,941	390	264	240	5,056	85	34	5,004	177	130	4,958	334	94	4,717
	6:00 PM - 7:00 PM	631	89	252	2,522	354	169	154	2,490	55	11	2,446	128	56	2,374	239	80	2,215
	Total	*2,969*	*515*	*1,308*	*18,123*	*1,626*	*931*	*846*	*18,275*	*309*	*122*	*18,087*	*633*	*466*	*17,920*	*1,190*	*396*	*17,126*
Friday PM Period	3:00 PM - 4:00 PM	1,168	172	385	6,177	424	223	203	6,178	95	37	6,121	155	142	6,107	304	141	5,944
	4:00 PM - 5:00 PM	1,089	141	353	5,808	342	241	220	5,926	75	31	5,882	180	126	5,828	375	129	5,581
	5:00 PM - 6:00 PM	1,042	159	324	5,704	363	257	233	5,831	73	18	5,776	171	100	5,705	337	122	5,489
	6:00 PM - 7:00 PM	915	101	279	3,991	366	168	153	3,946	61	12	3,897	114	64	3,847	305	110	3,652
	7:00 PM - 8:00 PM	721	76	271	3,438	233	130	119	3,453	41	7	3,419	86	36	3,369	266	72	3,175
	Total	*4,935*	*650*	*1,612*	*25,117*	*1,728*	*1,019*	*928*	*25,335*	*346*	*106*	*25,095*	*707*	*469*	*24,856*	*1,588*	*574*	*23,841*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

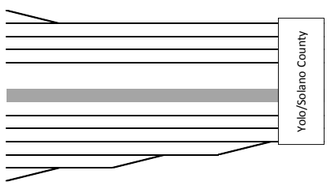
		WB ON FR PITT SCHOOL RD	WB OFF TO PITT SCHOOL RD		W/B ON FROM CURREY RD	W/B ON FR WB RTE 113 S	W/B OFF TO RTE 113 S		W/B OFF TO MILK FARM		W/B ON FROM PEDRICK RD	W/B OFF TO PEDRICK RD		W/B ON FROM KIDWELL RD	W/B OFF TO KIDWELL RD		DUM W/B ON TO S/B 113	W/B ON FROM OLD DAVIS	W/B OFF TO N/B 113	W/B OFF TO OLD DAVIS RD
		Loop	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**ML**	**Diag**	**ML**	**Loop**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**Diag**	**Diag**
Midweek AM Period	5:00 AM - 6:00 AM	156	81	2,560	4	95	133	2,594	6	2,600	92	104	2,611	11	25	2,625	340	3	152	56
	6:00 AM - 7:00 AM	237	89	3,414	7	99	210	3,518	9	3,527	111	134	3,551	14	30	3,567	492	7	388	251
	7:00 AM - 8:00 AM	309	142	3,571	7	123	314	3,755	15	3,770	132	115	3,752	10	37	3,779	644	15	734	311
	8:00 AM - 9:00 AM	237	158	3,461	12	140	319	3,628	9	3,636	145	127	3,618	16	33	3,636	562	18	745	419
	9:00 AM - 10:00 AM	210	169	3,441	10	127	256	3,560	11	3,571	122	105	3,555	18	40	3,577	458	21	630	242
	Total	*1,148*	*639*	*16,446*	*39*	*584*	*1,232*	*17,055*	*49*	*17,103*	*601*	*584*	*17,086*	*68*	*165*	*17,183*	*2,496*	*64*	*2,648*	*1,279*
Sunday PM Period	3:00 PM - 4:00 PM	247	227	4,461	16	146	337	4,636	16	4,652	204	178	4,626	8	18	4,636	583	31	488	58
	4:00 PM - 5:00 PM	202	245	4,284	20	157	320	4,428	17	4,444	168	229	4,505	9	13	4,508	597	39	457	52
	5:00 PM - 6:00 PM	219	253	4,279	18	151	314	4,424	12	4,435	182	177	4,431	7	19	4,443	534	24	404	48
	6:00 PM - 7:00 PM	178	241	3,863	11	142	300	4,011	12	4,022	151	125	3,996	5	9	4,001	434	20	458	64
	7:00 PM - 8:00 PM	204	255	3,820	9	149	236	3,898	12	3,909	90	100	3,920	8	12	3,924	412	21	347	30
	Total	*1,050*	*1,221*	*20,707*	*74*	*745*	*1,508*	*21,396*	*67*	*21,463*	*796*	*809*	*21,477*	*36*	*71*	*21,512*	*2,560*	*134*	*2,154*	*252*



		E/B OFF TO PIT SCHOOL RD	E/B ON FROM PIT SCHOOL RD		E/B OFF TO RTE 113 S	E/B ON FROM N/B RTE 113 SOUTH			E/B OFF TO PEDRICK RD	E/B ON FROM PEDRICK RD		E/B OFF TO KIDWELL RD	E/B ON FROM KIDWELL RD		DUM E/B OFF TO N/B 113	E/B OFF TO OLD DAVIS	E/B ON FROM S/B 113	E/B ON FROM OLD DAVIS RD
		Diag	**Loop**	**ML**	**Diag**	**Diag**	**ML**	**ML**	**Diag**	**Loop**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**Diag**	**Diag**
Midweek PM Period	3:00 PM - 4:00 PM	302	264	5,204	207	409	5,406	5,406	144	127	5,389	15	52	5,426	630	34	753	255
	4:00 PM - 5:00 PM	381	243	4,814	174	466	5,106	5,106	154	116	5,067	16	45	5,097	712	28	840	190
	5:00 PM - 6:00 PM	398	248	4,568	197	370	4,741	4,741	142	98	4,697	9	23	4,711	646	27	885	215
	6:00 PM - 7:00 PM	315	204	2,103	157	290	2,236	2,236	107	62	2,191	5	13	2,199	521	13	662	72
	Total	*1,395*	*959*	*16,689*	*736*	*1,535*	*17,488*	*17,488*	*547*	*403*	*17,344*	*45*	*133*	*17,433*	*2,509*	*102*	*3,140*	*731*
Friday PM Period	3:00 PM - 4:00 PM	383	267	5,828	229	428	6,027	6,027	164	98	5,961	9	42	5,995	786	30	694	184
	4:00 PM - 5:00 PM	413	258	5,426	192	412	5,646	5,646	188	100	5,558	16	48	5,590	897	22	732	150
	5:00 PM - 6:00 PM	458	262	5,294	221	400	5,473	5,473	152	90	5,411	14	31	5,428	900	28	679	166
	6:00 PM - 7:00 PM	355	268	3,565	185	312	3,691	3,691	106	59	3,644	8	16	3,652	717	14	610	54
	7:00 PM - 8:00 PM	291	214	3,098	183	226	3,141	3,141	87	19	3,073	6	17	3,083	523	13	502	42
	Total	*1,900*	*1,269*	*23,211*	*1,010*	*1,777*	*23,977*	*23,977*	*697*	*366*	*23,647*	*53*	*154*	*23,748*	*3,824*	*107*	*3,218*	*597*

Solano I-80 Ramp Metering
Feasbility Study
Existing Traffic Volume

		SOLANO/YOLO COUNTY LINE **ML Count**	
			Midweek AM Period
Midweek AM Period	5:00 AM - 6:00 AM	2,490	5:00 AM - 6:00 AM
	6:00 AM - 7:00 AM	3,707	6:00 AM - 7:00 AM
	7:00 AM - 8:00 AM	4,166	7:00 AM - 8:00 AM
	8:00 AM - 9:00 AM	4,220	8:00 AM - 9:00 AM
	9:00 AM - 10:00 AM	3,969	9:00 AM - 10:00 AM
	Total	*18,551*	Total
			Sunday PM Period
Sunday PM Period	3:00 PM - 4:00 PM	4,568	3:00 PM - 4:00 PM
	4:00 PM - 5:00 PM	4,382	4:00 PM - 5:00 PM
	5:00 PM - 6:00 PM	4,336	5:00 PM - 6:00 PM
	6:00 PM - 7:00 PM	4,070	6:00 PM - 7:00 PM
	7:00 PM - 8:00 PM	3,868	7:00 PM - 8:00 PM
	Total	*21,224*	Total



		ML	
			Midweek PM Period
Midweek PM Period	3:00 PM - 4:00 PM	5,769	3:00 PM - 4:00 PM
	4:00 PM - 5:00 PM	5,387	4:00 PM - 5:00 PM
	5:00 PM - 6:00 PM	5,137	5:00 PM - 6:00 PM
	6:00 PM - 7:00 PM	2,399	6:00 PM - 7:00 PM
	Total	*18,693*	Total
			Friday PM Period
Friday PM Period	3:00 PM - 4:00 PM	6,057	3:00 PM - 4:00 PM
	4:00 PM - 5:00 PM	5,553	4:00 PM - 5:00 PM
	5:00 PM - 6:00 PM	5,345	5:00 PM - 6:00 PM
	6:00 PM - 7:00 PM	3,586	6:00 PM - 7:00 PM
	7:00 PM - 8:00 PM	3,092	7:00 PM - 8:00 PM
	Total	*23,633*	Total

Appendix B: Existing Off-Peak Hour Comparison

Appendix B - 1
Assessment of Existing Off-Peak Direction Traffic Levels
By Travel Direction (EB, WB)

Eastbound Direction

	AM Off-Peak Direction					PM Peak Direction					
Location/Time	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	**AM 4-Hour Total**	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: PM/AM**
Vallejo Mainline EB East of Carquinez Bridge	1,627	2,511	2,578	2,468	**9,184**	4,503	4,688	4,737	4,109	**18,037**	**196%**
Vallejo Mainline EB East of SR 29	1,605	2,419	2,447	2,291	**8,762**	4,222	4,297	4,263	3,718	**16,499**	**188%**
Fairfield Mainline EB West of North Texas St	3,011	4,059	3,991	3,953	**15,013**	6,704	6,696	6,718	5,412	**25,530**	**170%**
Vacaville Mainline EB East of Mason St	2,921	3,833	3,790	3,733	**14,277**	5,605	5,695	5,462	4,590	**21,352**	**150%**
Vacaville Mainline EB E. of Monte Vista Ave/Allison Dr	2,910	3,811	3,690	3,421	**13,832**	4,882	4,910	4,492	3,550	**17,834**	**129%**
Vacaville Mainline EB East of Leisure Town Rd	2,410	3,198	2,887	2,590	**11,085**	4,410	4,249	4,078	3,332	**16,069**	**145%**
Mainline EB Solano/Yolo County Line	2,394	3,866	3,829	3,118	**13,207**	4,646	4,631	4,310	3,430	**17,016**	**129%**

Westbound Direction

	AM Peak Direction					PM Off-Peak Direction					
Location/Time	5:00 AM - 6:00 AM	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	**AM 4-Hour Total**	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: AM/PM**
Mainline WB Solano/Yolo County Line *	3,707	4,166	4,220	3,969	**16,061**	4,026	4,415	4,330	3,178	**15,949**	**101%**
Vacaville Mainline WB E. of Monte Vista Ave/Allison Dr	3,945	4,356	3,876	3,781	**15,958**	4,348	4,357	2,988	2,098	**13,791**	**116%**
Vacaville Mainline WB East of Mason St	4,226	4,818	4,565	4,332	**17,941**	5,169	4,931	3,865	2,837	**16,802**	**107%**
Fairfield WB On-Ramp ** SR 12 Westbound On-ramp	1,314	1,633	1,720	1,225	**5,891**	1,033	1,092	1,229	770	**4,124**	**143%**
Fairfield WB On-Ramp ** Air Base Parkway On-ramp	977	1,210	1,491	1,223	**4,902**	1,124	1,059	1,014	790	**3,987**	**123%**
Vallejo Mainline WB East of SR 29	4,045	5,032	4,296	3,362	**16,735**	2,811	2,847	2,888	2,392	**10,937**	**153%**

* Note that at this location, 6-10 AM total volume is shown, as they are higher than 5-9 AM total volume.

** Note that there were no valid recent mainline counts available in Fairfield, comparison is made at two highest on-ramp volumes.

Appendix B - 2
Assessment of Existing Off-Peak Direction Traffic Levels
By Peak Period (AM, PM)

AM

	AM Off-Peak Direction (EB)					AM Peak Direction (WB)					
Location/Time	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	**AM 4-Hour Total**	5:00 AM - 6:00 AM	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	**AM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: WB/EB**
Vallejo Mainline East of SR 29	1,605	2,419	2,447	2,291	**8,762**	4,045	5,032	4,296	3,362	**16,735**	**191%**
Vacaville Mainline East of Mason St	2,921	3,833	3,790	3,733	**14,277**	4,226	4,818	4,565	4,332	**17,941**	**126%**
Vacaville Mainline E. of Monte Vista Ave/Allison Dr	2,910	3,811	3,690	3,421	**13,832**	3,945	4,356	3,876	3,781	**15,958**	**115%**
Mainline Solano/Yolo County Line*	2,394	3,866	3,829	3,118	**13,207**	3,707	4,166	4,220	3,969	**16,061**	**122%**

PM

	PM Off-Peak Direction (WB)					PM Peak Direction (EB)					
Location/Time	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: EB/WB**
Mainline Solano/Yolo County Line	4,026	4,415	4,330	3,178	**15,949**	4,646	4,631	4,310	3,430	**17,016**	**107%**
Vacaville Mainline E. of Monte Vista Ave/Allison Dr	4,348	4,357	2,988	2,098	**13,791**	4,882	4,910	4,492	3,550	**17,834**	**129%**
Vacaville Mainline East of Mason St	5,169	4,931	3,865	2,837	**16,802**	5,605	5,695	5,462	4,590	**21,352**	**127%**
Vallejo Mainline East of SR 29	2,811	2,847	2,888	2,392	**10,937**	4,222	4,297	4,263	3,718	**16,499**	**151%**

Appendix B - 2
Assessment of Off-Peak Direction Traffic Levels
By Travel Direction (EB, WB)

Eastbound Direction

	AM Off-Peak Direction					PM Peak Direction					
Location/Time	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	**AM 4-Hour Total**	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: PM/AM**
Vallejo Mainline EB East of Carquinez Bridge	1,627	2,511	2,578	2,468	**9,184**	4,503	4,688	4,737	4,109	**18,037**	**196%**
Vallejo Mainline EB East of SR 29	1,605	2,419	2,447	2,291	**8,762**	4,222	4,297	4,263	3,718	**16,499**	**188%**
Fairfield Mainline EB West of North Texas St	3,011	4,059	3,991	3,953	**15,013**	6,704	6,696	6,718	5,412	**25,530**	**170%**
Vacaville Mainline EB East of Mason St	2,921	3,833	3,790	3,733	**14,277**	5,605	5,695	5,462	4,590	**21,352**	**150%**
Vacaville Mainline EB E. of Monte Vista Ave/Allison Dr	2,910	3,811	3,690	3,421	**13,832**	4,882	4,910	4,492	3,550	**17,834**	**129%**
Vacaville Mainline EB East of Leisure Town Rd	2,410	3,198	2,887	2,590	**11,085**	4,410	4,249	4,078	3,332	**16,069**	**145%**
Mailine EB Solano/Yolo County Line	2,394	3,866	3,829	3,118	**13,207**	4,646	4,631	4,310	3,430	**17,016**	**129%**

Westbound Direction

	AM Peak Direction					PM Off-Peak Direction					
Location/Time	5:00 AM - 6:00 AM	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	**AM 4-Hour Total**	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: AM/PM**
Mailine WB Solano/Yolo County Line *	3,707	4,166	4,220	3,969	**16,061**	4,026	4,415	4,330	3,178	**15,949**	**101%**
Vacaville Mainline WB E. of Monte Vista Ave/Allison Dr	3,945	4,356	3,876	3,781	**15,958**	4,348	4,357	2,988	2,098	**13,791**	**116%**
Vacaville Mainline WB East of Mason St	4,226	4,818	4,565	4,332	**17,941**	5,169	4,931	3,865	2,837	**16,802**	**107%**
Fairfield WB On-Ramp ** SR 12 Westbound On-ramp	1,314	1,633	1,720	1,225	**5,891**	1,033	1,092	1,229	770	**4,124**	**143%**
Fairfield WB On-Ramp ** Air Base Parkway On-ramp	977	1,210	1,491	1,223	**4,902**	1,124	1,059	1,014	790	**3,987**	**123%**
Vallejo Mainline WB East of SR 29	4,045	5,032	4,296	3,362	**16,735**	2,811	2,847	2,888	2,392	**10,937**	**153%**

* Note that at this location, 6-10 AM total volume is shown, as they are higher than 5-9 AM total volume.

** Note that there were no valid recent mainline counts available in Fairfield, comparison is made at two highest on-ramp volumes.

Appendix B - 3
Assessment of Off-Peak Direction Traffic Levels
By Peak Period (AM, PM)

AM

	AM Off-Peak Direction (EB)					AM Peak Direction (WB)					
Location/Time	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	**AM 4-Hour Total**	5:00 AM - 6:00 AM	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: PM/AM**
Vallejo Mainline East of SR 29	1,605	2,419	2,447	2,291	**8,762**	4,045	5,032	4,296	3,362	**16,735**	**191%**
Vacaville Mainline East of Mason St	2,921	3,833	3,790	3,733	**14,277**	4,226	4,818	4,565	4,332	**17,941**	**126%**
Vacaville Mainline E. of Monte Vista Ave/Allison Dr	2,910	3,811	3,690	3,421	**13,832**	3,945	4,356	3,876	3,781	**15,958**	**115%**
Mailine Solano/Yolo County Line*	2,394	3,866	3,829	3,118	**13,207**	3,707	4,166	4,220	3,969	**16,061**	**122%**

PM

	PM Off-Peak Direction (WB)					PM Peak Direction (EB)					
Location/Time	5:00 AM - 6:00 AM	6:00 AM - 7:00 AM	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	**AM 4-Hour Total**	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM	6:00 PM - 7:00 PM	**PM 4-Hour Total**	**Peak/Off-Peak Dir Ratio: AM/PM**
Mailine Solano/Yolo County Line *	4,026	4,415	4,330	3,178	**15,949**	4,646	4,631	4,310	3,430	**17,016**	**107%**
Vacaville Mainline E. of Monte Vista Ave/Allison Dr	4,348	4,357	2,988	2,098	**13,791**	4,882	4,910	4,492	3,550	**17,834**	**129%**
Vacaville Mainline East of Mason St	5,169	4,931	3,865	2,837	**16,802**	5,605	5,695	5,462	4,590	**21,352**	**127%**
Vallejo Mainline East of SR 29	2,811	2,847	2,888	2,392	**10,937**	4,222	4,297	4,263	3,718	**16,499**	**151%**

* Note that at this location, 6-10 AM total volume is shown, as they are higher than 5-9 AM total volume.

** Note that there were no valid recent mainline counts available in Fairfield, comparison is made at two highest on-ramp volumes.

Appendix C: FREQ Validation Memo

180 Grand Avenue, Suite 250
Oakland, CA 94612
www.dowlinginc.com

510.839.1742 x102
510.839.0871 fax
bcisco@dowlinginc.com

Dowling Associates, Inc.

Date: October 17, 2011

Memorandum

To: Sze Lei Leong and Joy Lee (MTC)

Cc: Alan Chow and Adrian Levy (Caltrans District 4)

From: Kevin Chen and Bill Cisco

Subject: Solano I-80 Ramp Metering Feasibility Study P09033.003

Final FREQ Model Calibration and Validation Results – Existing Conditions (Deliverable 2.1B)

Introduction

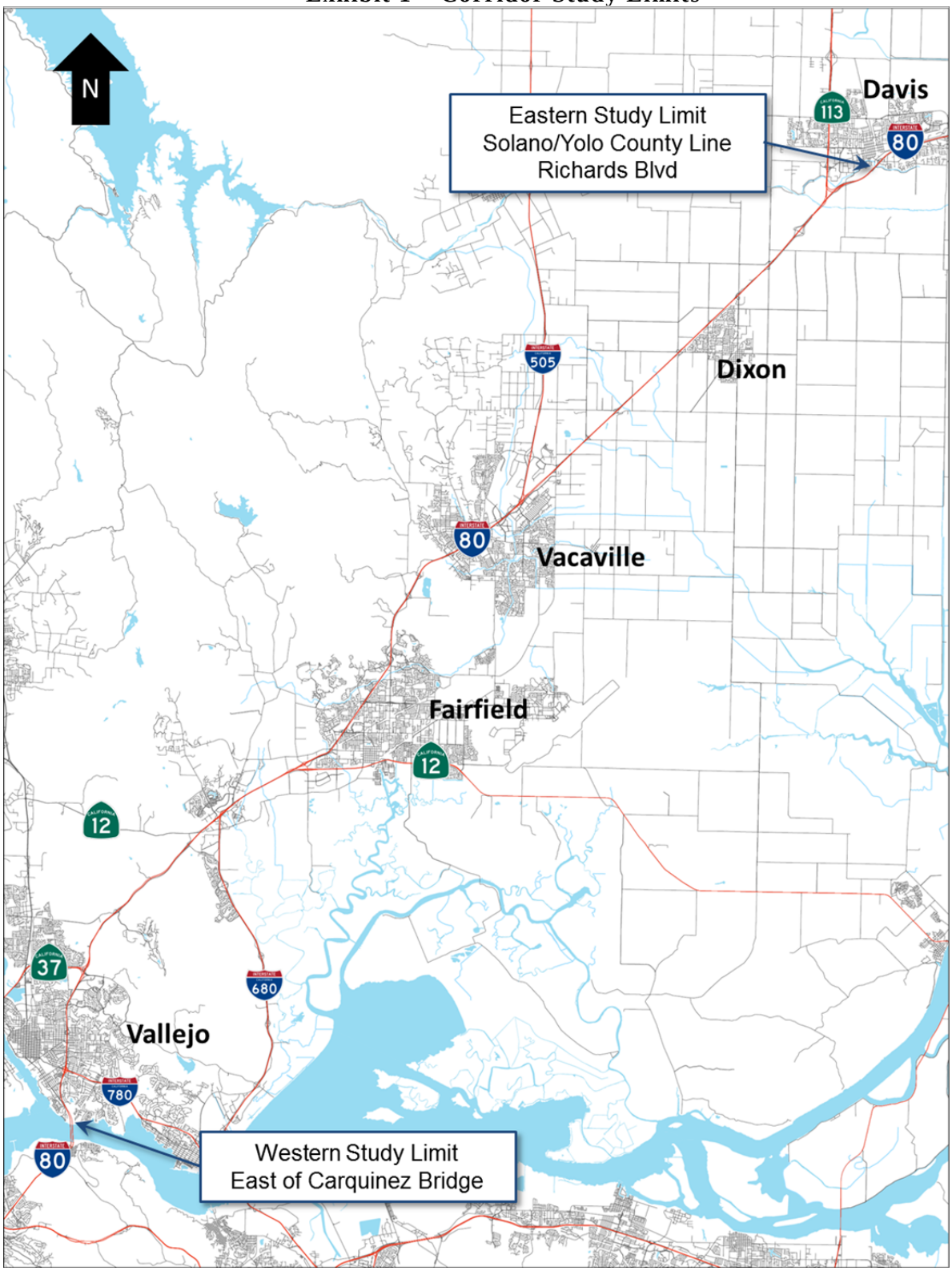
The Metropolitan Transportation Commission (MTC) is working with Caltrans and local jurisdictions to develop and implement ramp metering plans for the I-80 corridor in Solano County, covering a total distance of approximately 44 miles between Vallejo on the west and unincorporated Solano County bordering Davis on the east. The study corridor limits and vicinity are shown in Exhibit 1.

The study includes both the eastbound and westbound directions of the corridor. For the eastbound direction, peak periods analyzed include midweek afternoon from 3:00 PM to 7:00 PM, and Friday afternoon from 3:00 PM to 8:00 PM. For the westbound direction, peak periods analyzed include midweek morning from 5:00 AM to 10:00 AM, and Sunday afternoon from 3:00 PM to 8:00 PM.

As described previously in the Existing Conditions Technical (ECT) Memorandum, dated August 22, 2011, there is currently a bottleneck outside of the eastern study limit at the Yolo County Causeway during the Friday afternoon peak commute period, resulting in queues extending into the study area. Therefore, the FREQ model limit for this particular time period (Friday PM) is extended through the Causeway to model and simulate the bottleneck and its effects in the analysis, rather than ending the model at the county line in the middle of a congested freeway segment.

This memo provides a summary of the FREQ model development, calibration process and validation results for existing conditions.

Exhibit 1 – Corridor Study Limits



FREQ Model Development and Input Data

The FREQ model is developed based on a set of comprehensive data including traffic volumes, geometries, and capacities. The freeway capacities reflect the presence of heavy vehicles and profile grades that exist in the corridor.

Existing freeway mainline and ramp volumes were compiled and provided as part of the ECT memo. As freeway mainline counts were collected upstream of freeway queues, all traffic counts reflect actual demand. Since existing traffic volumes were provided on an hourly basis, time slice period in the FREQ models were also setup to perform hourly analyses as well.

The Solano I-80 corridor within the study area generally has three to four mixed-flow travel lanes in each direction, with an HOV lane within the city of Fairfield, and auxiliary lanes through several interchanges. A truck climbing lane extends east of Route 37 interchange to the crest of hill, west of the American Canyon interchange.

FREQ Subsection (SS) Capacities

Freeway capacities for the FREQ calibration were set based on traffic counts through freeway subsections operating at capacity (bottleneck subsections). Auxiliary lane capacities were generally set based on the lower of the two maximum hourly traffic volumes from the upstream on-ramp and the downstream off-ramp of the subsection.

On the western end of the Solano I-80 corridor, specifically within the City of Vallejo from east of the Carquinez Bridge to Redwood Street, freeway interchanges are rather closely-spaced, which results in slightly lower than normal freeway capacity. Within this section of freeway, the capacity is set at 1,825 vphpl (vehicles per hour per lane). This is based on evaluation of PEMS throughput counts near the Route 37 interchange (further downstream of bottleneck at the Tennessee Street interchange), and freeway bottleneck calibration.

East of the Redwood Street interchange, freeway capacity is generally set at 1,950 vphpl. This is based on evaluation of the bottleneck throughput counts at the Yolo Causeway (PEMS database). In addition, where the HOV lane terminates and drops a lane between Air Base Parkway on-ramp and North Texas Street off-ramp in the eastbound direction, and between Route 12 off-ramp and Red Top Road off-ramp in the westbound direction, freeway capacity is set at a reduced rate of 1,825 vphpl, to account for the capacity reduction as a result of the lane drop weaving effects. Detailed FREQ subsection capacities and other design features are summarized in Exhibit 2 for the eastbound direction, and in Exhibit 3 for the westbound direction.

In addition, all on-ramp and off-ramp capacities are set using the default value of 1,500 vehicles per hour per lane, except for the following locations, where default capacities were adjusted:

- For all freeway to freeway direct connectors, capacity is set at 1,800 vphpl, based on evaluation of existing throughput counts:

Eastbound Direction:

- Route 780 off-ramp
- Route 780 on-ramp
- Route 37 off-ramp
- Route 12 on-ramp
- Route 680 on-ramp
- Route 12 off-ramp
- Route 505 off-ramp
- Route 113 off-ramp
- Route 113 on-ramp

Westbound direction:

- Route 113 on-ramp
- Route 12 on-ramp
- Route 680 off-ramp
- Route 12 off-ramp
- Route 37 off-ramp
- Route 37 on-ramp
- Route 780 off-ramp

- For Route 37 off-ramp, the capacity is set at 1,950 vphpl, based on the traffic volumes counted at this location.

FREQ Subsection Free Flow Speeds

Freeway free flow speeds are set based on field observations. From east of the Carquinez Bridge to the Redwood Street interchange in Vallejo, due to closely-spaced interchanges, free-flow speed is set at 65 MPH. East of the Redwood Street interchange, free flow speed is set at 70 MPH through the remainder of the corridor to Davis and the Yolo County Causeway.

Exhibit 2 – Detailed FREQ Subsection Information - Eastbound

Subsection No.	# of Lanes	Subsection Cap	Subsection Length	Free-flow Speed	Origin-Dest.	Subsection Location
1	4	7300	1000	65	OD	N/O_CarqBr/Sonoma_Off
2	3	5475	1820	65	D	Sonoma_Off/Sequoia_Off
3	3	5475	2305	65	D	Sequoia_Off/Magazine_Off
4	3	5475	530	65		Magazine_Off/Magazine_On
5	3	5475	1340	65	OD	Magazine_On/I-780_Off
6	3	5475	1570	65	D	I-780_Off/Frontage_Off
7	3	5475	880	65		Frontage_Off/I-780_On
8	3	5475	2095	65	OD	I-780_On/Georgia_Off
9	3	5475	690	65		Georgia_Off/Georgia_On
10	4	5775	535	65	OD	Georgia_On/Solano_Off
11	3	5475	485	65		Solano_Off/Solano_On
12	4	5675	650	65	OD	Solano_On/Tennessee_Off
13	3	5475	1850	65		Tennessee_Off/On
14	3	5475	3130	65	OD	Tennessee_On/RedwoodOff1
15	3	5850	1165	65	D	RedwoodOff1/Redwood_Off2
16	3	5850	595	65		Redwood_Off2/Redwood_On
17	3	5850	3400	70	OD	Redwood_On/SR 37_Off
18	3	5850	1430	70		SR 37_Off/Lane Add1
19	4	7800	925	70		Lane Add1/Lane Add2
20	5	9750	610	70		Lane Add2/Columbus_On
21	5	9750	1850	70	O	Columbus_On/SR 37_On
22	6	11150	1895	70	O	SR 37_On/Lane Drop1
23	5	9750	2015	70		Lane Drop1/Lane Drop2
24	4	7800	5530	70	D	Lane Drop2/AmeriCany_Off
25	4	7800	2220	70		AmeriCany_Off/On
26	4	7800	14645	70	OD	AmeriCany_On/RedTop_Off
27	4	7800	2320	70		RedTop_Off/RedTop_On
28	4	7800	1990	70	OD	RedTop_On/SR12_On_HOV
29	4	7800	1990	70	O	SECOND HALF OF SPLIT SS
30	5	9100	465	70	OD	SR12_On/I-680_Off
31	4	7800	3585	70		I-680_Off/I-680_On
32	5	9750	1190	70	OD	I-680_On/SuisunValle_Off
33	5	9750	2095	70		SuisunValle_Off/On
34	5	9750	2170	70	OD	SuisunValle_On/Truck_Off
35	5	9750	1980	70		Truck_Off/Truck_On
36	5	9750	5695	70	OD	Truck_On/SR12_Off
37	4	7800	1900	70	D	SR12_Off/SuisunCity_Off
38	4	7800	2175	70		SuisunCity_Off/On

Subsection No.	# of Lanes	Subsection Cap	Subsection Length	Free-flow Speed	Origin-Dest.	Subsection Location
39	5	8500	1165	70	OD	SuisunCity_On/WTexas_Off
40	4	7800	2065	70		WTexas_Off/WTexas_On
41	4	7800	3285	70	O	WTexas_On/Beck_On
42	5	9000	935	70	OD	Beck_On/Travis_Off
43	4	7800	2050	70		Travis_Off/Travis_On
44	4	7800	3230	70	O	Travis_On/Lane Add
45	5	9300	1220	70	D	LaneAdd/Air Base_Off
46	4	7800	1865	70		Air Base_Off/Air Base_On
47	4	7800	2675	70	OD	Air Base_On/HOVEnd
48	4	7300	4435	70	OD	HOVEnd/N Texas_Off
49	4	7800	2360	70		N Texas_Off/N Texas_On
50	4	7800	9580	70	OD	N Texas_On/LagoonV_Off
51	4	7800	1745	70		LagoonV_Off/LagoonV_On
52	4	7800	2650	70	OD	LagoonV_On/PenaAdobe_Off
53	4	7800	915	70		PenaAdobe_Off/On
54	4	7800	5875	70	OD	PenaAdobe_On/Alamo_Off
55	4	7800	1795	70		Alamo_Off/Alamo_On
56	4	7800	1625	70	OD	Alamo_On/Davis_Off
57	4	7800	810	70		Davis_Off/Davis_On
58	4	7800	1425	70	OD	Davis_On/Mason_Off
59	4	7800	1200	70		Mason_Off/Mason_On
60	4	7800	2705	70	OD	Mason_On/NutTree_Off
61	4	7800	1465	70		NutTree_Off/LoopOn
62	5	8300	1115	70	O	NutTree_LoopOn/DiagOn
63	5	8300	2595	70	OD	NutTree_DiagOn/I-505_Off
64	4	7800	2365	70		I-505_Off/I-505_On
65	4	7800	1130	70	O	I-505_Off/Orange_On
66	4	7800	5300	70	OD	Orange_On/LeisureTown_Of
67	4	7800	1560	70		LeisureTown_Off/LoopOn
68	4	7800	1310	70	O	LeisureTn_LoopOn/DiagOn
69	4	7800	2120	70	O	LeisureT_DiagOn/LaneDrop
70	3	5850	3470	70	D	LaneDrop/Weber_Off
71	3	5850	1315	70		Weber_Off/Weber_On
72	3	5850	5390	70	OD	Weber_On/Midway_Off
73	3	5850	2045	70		Midway_Off/Midway_On
74	3	5850	13055	70	OD	Midway_On/Dixon_Off
75	3	5850	1485	70		Dixon_Off/Dixon_On
76	3	5850	5615	70	OD	Dixon_On/PittSchool_Off
77	3	5850	1300	70		PittSchool_Off/On

Subsection No.	# of Lanes	Subsection Cap	Subsection Length	Free-flow Speed	Origin-Dest.	Subsection Location
78	3	5850	6465	70	OD	PittSchool_On/Curry_Off
79	3	5850	1515	70		Curry_Off/Curry_On
80	3	5850	5445	70	OD	Curry_On/Pedrick_Off
81	3	5850	1835	70		Pedrick_Off/Pedrick_On
82	3	5850	4655	70	O	Pedrick_On/Lane Add
83	4	7800	1695	70	D	Lane Add/Kidwell_Off
84	4	7800	2985	70		Kidwell_Off/Kidwell_On
85	5	7900	2790	70	OD	Kidwell_On/SR 113_Off
86	4	7800	3825	70	D	SR 113_Off/OldDavis_Off
87	4	7800	3145	70		OldDavis_Off/SR 113_On
88	5	8700	2035	70	O	SR 113_On/OldDavis_On
89	6	10050	1370	70	O	OldDavis_On/LaneDrop_1
90	5	9750	875	70		LaneDrop_1/LaneDrop_2
91	4	7800	1505	70		LaneDrop_2/LaneDrop_3
92	3	5850	2020	70	D	LaneDrop_3/Richards_Off
93	3	5850	1604	70		Richards_Off/Richards_on
94	3	5850	8817	70	O	Richards_on/Lane Add
95	4	6350	1442	70	D	Lane Add/Mace_off
96	3	5850	1272	70		Mace_off/Mace_loop_on
97	3	5850	1005	70	O	Mace_loop_on/diag_on
98	3	5850	13330	70	OD	Mace_diag_on/Chiles_off
99	3	5850	1312	70		Chiles_off/Chiles_on
100	3	5850	17245	70	OD	Chiles_on/Enterprise_off

Exhibit 3 – Detailed FREQ Subsection Information - Westbound

Subsection No.	# of Lanes	Subsection Cap	Subsection Length	Free-flow Speed	Origin-Dest.	Subsection Location
1	4	7800	3735	70	O	Richards_On/Lane Add
2	5	9000	1185	70	D	Lane Add/Old Davis_Off
3	5	9000	1350	70	D	Old Davis_Off/SR 113_Off
4	4	7800	2010	70		SR 113_Off/Old Davis_On
5	4	7800	3610	70	O	Old Davis_On/SR 113_On
6	5	7900	4615	70	OD	SR 113_On/Kidwell_Off
7	4	7800	3330	70		Kidwell_Off/Kidwell_On
8	4	7800	1810	70	O	Kidwell_On/Lane Drop
9	3	5850	3145	70	D	Lane Drop/Pedrick_Off
10	3	5850	1930	70		Pedrick_Off/Pedrick_On
11	3	5850	2790	70	OD	Pedrick_On/MilkFarm_Off
12	3	5850	3470	70	D	MilkFarm_Off/SR 113S_Off
13	3	5850	1290	70		SR 113S_Off/SR 113S_On
14	3	5850	730	70	O	SR 113S_On/Currey_On
15	3	5850	5015	70	OD	Currey_On/PittSchool_Off
16	3	5850	1340	70		PittSchool_Off/On
17	3	5850	6180	70	OD	PittSchool_On/Dixon_Off
18	3	5850	1390	70		Dixon_Off/Dixon_On
19	3	5850	13965	70	OD	Dixon_On/Midway_Off
20	3	5850	1250	70		Midway_Off/Midway_On
21	3	5850	5920	70	OD	Midway_On/Meridan_Off
22	3	5850	1430	70		Meridan_Off/Meridan_On
23	3	5850	1900	70	O	Meridan_On/Lane Add1
24	4	7800	2065	70		Lane Add1/Lane Add2
25	5	8400	1530	70	D	Lane Add2/LeisureTn_Off
26	4	7800	1515	70		LeisureTown_Off/Loop_On
27	4	7800	945	70	O	Loop_On/Diag_On
28	4	7800	5640	70	OD	Diag_On/I-505_Off
29	4	7800	1490	70		I-505_Off/Lane Drop
30	3	5850	1365	70		Lane Drop/I-505_On
31	4	7800	1355	70	OD	I-505_On/EMonteVista_Off
32	4	7800	1830	70		EMonteVista_Off/On
33	4	7800	1010	70	O	EMonteVista_On/BrVall_On
34	4	7800	4415	70	OD	BrVall_On/Mason_Off
35	4	7800	1020	70		Mason_Off/Mason_On
36	4	7800	1370	70	OD	Mason_On/Davis_Off
37	4	7800	940	70		Davis_Off/Davis_On
38	4	7800	2590	70	OD	Davis_On/Merchant_Off

Subsection No.	# of Lanes	Subsection Cap	Subsection Length	Free-flow Speed	Origin-Dest.	Subsection Location
39	4	7800	1120	70		Merchant_Off/Merchant_On
40	4	7800	2005	70	OD	Mercht_On/CherryGlen_Off
41	4	7800	3700	70	D	CherryGOff/PenaAdobe_Off
42	4	7800	1245	70		PenaAdobe_Off/On
43	4	7800	2315	70	OD	PenaAdobe_On/LagoonV_Off
44	4	7800	1640	70		LagoonValley_Off/On
45	4	7800	9570	70	OD	LagnVal_On/NTexas_Off
46	4	7800	1260	70		NTexas_Off/On
47	4	7800	4975	70	OD	NTexas_On/HOVBegin
48	4	7800	3445	70	OD	HOVBegin/AirBaseW_Off
49	4	7800	1005	70	D	AirBaseWB_Off/EB_Off
50	4	7800	1465	70		AirBaseEB_Off/AirBase_On
51	5	9300	1850	70	O	AirBase_On/Lane Drop
52	4	7800	2580	70	D	Lane Drop/Travis_Off
53	4	7800	915	70		Travis_Off/TravisLoop_On
54	5	8600	600	70	O	TravisLoop_On/Diag_On
55	5	8600	945	70	OD	TravisDiag_On/WTexas_Off
56	4	7800	3035	70		WTexas_Off/WTexas_On
57	5	8200	680	70	O	WTexas_On/Lane Drop
58	4	7800	2880	70	D	Lane Drop/SuisunCity_Off
59	4	7800	2040	70		SuisunCity_Off/On
60	4	7800	3270	70	O	SuisunCity_On/SR 12_On
61	5	9750	4565	70	OD	SR 12_On/Truck_Off
62	5	9750	2135	70		Truck_Off/Truck_On
63	5	9750	2430	70	OD	Truck_On/SuisunVal_Off
64	5	9750	2160	70	D	SuisunVal_Off/I-680_Off
65	4	7800	1445	70		I-680_Off/I-680_On
66	4	7800	2035	70	O	I-680_On/GreenVal_On
67	4	7800	2180	70	OD	GreenVal_On/SR 12_Off
68	4	7800	265	70		SR 12_Off/HOVEnd
69	4	7300	1522	70	D	HOVEnd/RedTop_Off
70	4	7300	1523	70	OD	SECOND HALF OF SPLIT SS
71	4	7800	2265	70		RedTop_Off/RedTop_On
72	4	7800	14740	70	OD	RedTopOn/AmericanCan_Off
73	4	7800	1900	70		AmericanCanyon_Off/On
74	4	7800	5860	70	OD	AmericanCan_On/RestA_Off
75	4	7800	1915	70		RestArea_Off/On
76	5	8000	1725	70	OD	RestArea_On/SR 37_Off
77	4	7800	1200	70	D	SR 37_Off/Columbus_Off

Subsection No.	# of Lanes	Subsection Cap	Subsection Length	Free-flow Speed	Origin-Dest.	Subsection Location
78	4	7800	1205	70		Columbus_Off/Columbus_On
79	4	7800	1210	70	O	Columbus_On/SR 37_On
80	4	7800	4750	70	OD	SR 37_On/Redwood_Off
81	3	5475	1650	65		Redwood_Off/Redwood_On
82	3	5475	2960	65	OD	Redwood_On/Tennessee_Off
83	3	5475	1870	65		Tennessee_Off/On
84	4	5875	620	65	OD	Tennessee_On/Solano_Off
85	3	5475	630	65		Solano_Off/Solano_On
86	4	5775	1000	65	OD	Solano_On/Georgia_Off
87	3	5475	730	65		Georgia_Off/Georgia_On
88	3	5475	1480	65	OD	Georgia_On/I-780_Off
89	3	5475	2495	65		I-780_Off/I-780_On
90	3	5475	1150	65	OD	I-780_On/Magazine_Off
91	3	5475	485	65		Magazine_Off/Magazine_On
92	3	5475	2010	65	OD	MagazineOn/MaritimeA_Off
93	3	5475	375	65		MaritimeAcademy_Off/On
94	4	7300	895	65	O	MaritimeAcad_On/SR29_On
95	4	7300	1250	65	OD	SR29_On/ML_WestEnd

FREQ Validation Criteria

The following criteria were used to check for the validation results of calibrated FREQ output:

1. Bottlenecks and queues: correctly simulate bottleneck location with reasonable queue length and duration of queues (start and end times of congestion);
2. Travel times: 85% of all cases within +/- 15% of available actual travel times;
3. Traffic volumes: reasonable comparison of simulated (FREQ processed) origin and destination traffic volumes.

FREQ Validation Results

This section summarizes calibrated FREQ simulation results, and validation comparison to observed data.

1. Bottlenecks and Queues

Freeway bottleneck and congestion are described in existing conditions technical memo (Deliverable 1.1C). Exhibit 4 provides a summary of recurring bottleneck locations identified through field observations and data collection:

Exhibit 4 – Observed Freeway Bottleneck and Queues Summary (from ECT Memo)

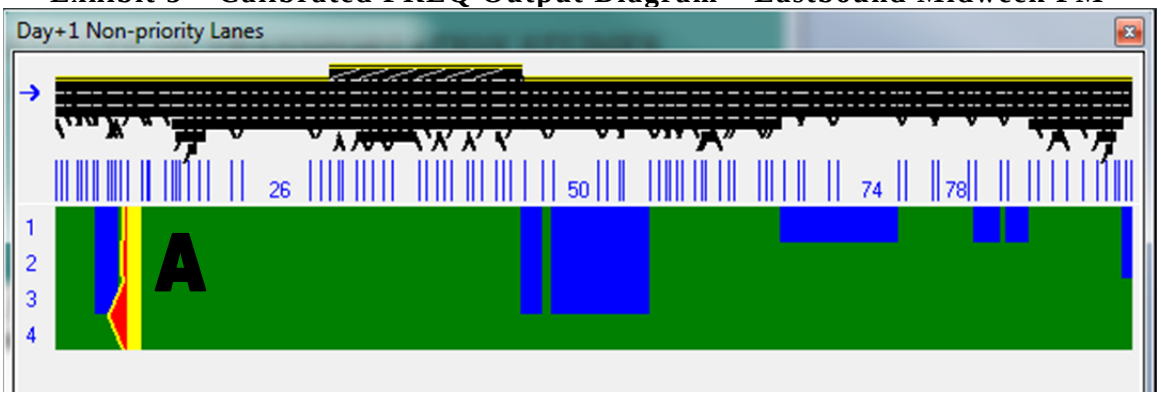
Bottleneck Location	Freeway Queues and Congestion Location	Approx. Start Time	Approx. End Time
Eastbound Direction - Midweek PM Peak Period			
A - Tennessee St on-ramp	Through a section within City of Vallejo, between Georgia Street and Redwood Street, traffic volume was apparently denser compared to other parts of the corridor, as freeway capacity is generally lower due to very-closely spaced interchanges. In addition, based on evaluation of traffic volumes, this section of the freeway could experience minor congestion on days where traffic volumes fluctuate on the higher side of the range.	3:00 PM	6:00 PM
Eastbound Direction - Friday PM Peak Period			
A - Tennessee St on-ramp	Queues typically extend to the vicinity between Georgia Street and I-780 interchanges.	3:00 PM	7:00 PM
B - Lane Drop west of North Texas Street off-ramp	Queues typical extend to the vicinity between Suisun Parkway and West Texas Street.	3:00 PM	7:00 PM
B - Yolo County Causeway	Queues typically extend into the study area in the vicinity of SR 113 (east) interchange.	3:00 PM	8:00 PM
Westbound Direction - Midweek AM Peak Period			
None			
Westbound Direction - Sunday PM Peak Period			
A - Redwood Street on-ramp	Queues typically extend to the vicinity of SR 37 interchange.	3:00 PM	7:00 PM

a. Eastbound Midweek PM Peak

Exhibit 5 provides the graphical output of the calibrated FREQ model for eastbound midweek PM peak conditions, which demonstrated that the bottleneck locations and queues were replicated reasonably well with observed conditions:

Bottleneck A (between Tennessee on-ramp and Redwood Street off-ramp): simulated on subsection (SS) 14, with queues extending between Solano Ave/Springs Road off-ramp and on-ramp. Queues started to develop after 3PM and dissipated between 6PM and 7 PM.

Exhibit 5 – Calibrated FREQ Output Diagram – Eastbound Midweek PM



Note: letters (e.g. A) denotes locations of bottleneck.

b. Eastbound Friday PM Peak

Exhibit 6 provides the graphical output of the calibrated FREQ model for eastbound Friday PM peak conditions, which demonstrated that the bottleneck locations and queues were replicated reasonably well with observed conditions:

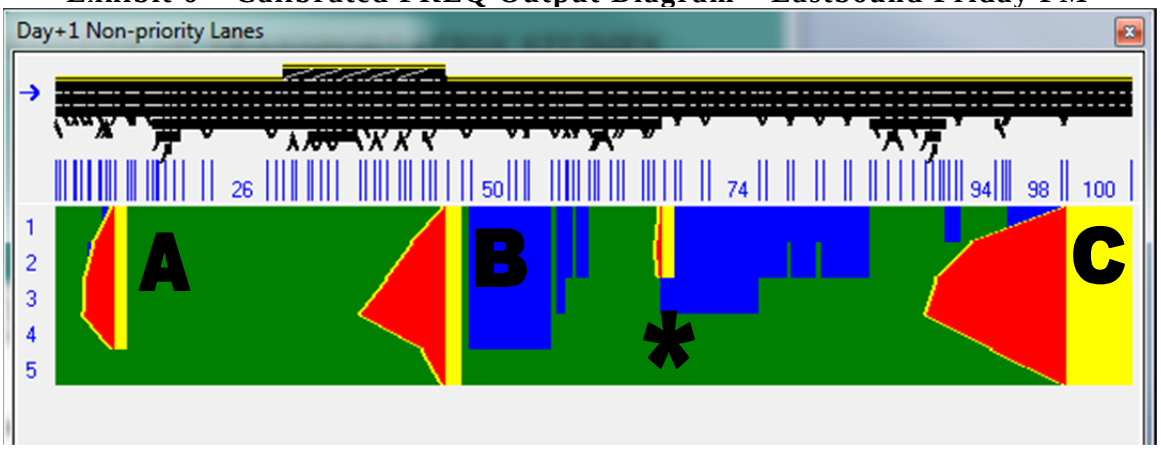
Bottleneck A (between Tennessee on-ramp and Redwood Street off-ramp): simulated on SS14, with queues extending east of Route 780 off-ramp. Queues started to develop after 3 PM and dissipated before 7 PM.

Bottleneck B (at Lane Drop west of North Texas Street off-ramp): simulated on SS 48, with queues extending between Route 12 off-ramp and Suisun Parkway off-ramp. Queues started to develop after 3 PM and dissipated between 7 PM and 8 PM.

Bottleneck C (at the Yolo County Causeway): simulated on SS 100, with queues extending between Route 113 on-ramp and Old Davis Road on-ramp. Queues started to develop after 3 PM and dissipated before 8 PM.

Note that as shown by an ***** on Exhibit 6, FREQ has simulated minor congestion at SS69-70, where the mainline drops from 4 lanes to 3 lanes between Leisure Town Road and Weber Road. This is a reasonable simulation, as field observations had noted occasional dense traffic on this section of the freeway, due to the lane drop.

Exhibit 6 – Calibrated FREQ Output Diagram – Eastbound Friday PM

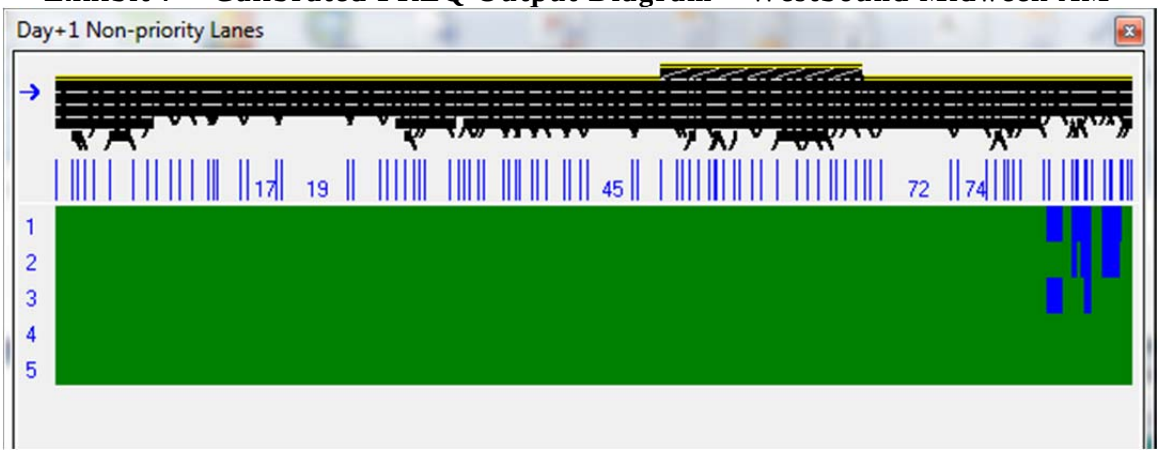


Note: letters (e.g. A) denotes locations of bottleneck.

c. Westbound Midweek AM Peak

Exhibit 7 provides the graphical output of the calibrated FREQ model for westbound midweek AM peak conditions, which demonstrated that there is no bottleneck or queue within the corridor, matching field observed conditions.

Exhibit 7 – Calibrated FREQ Output Diagram – Westbound Midweek AM

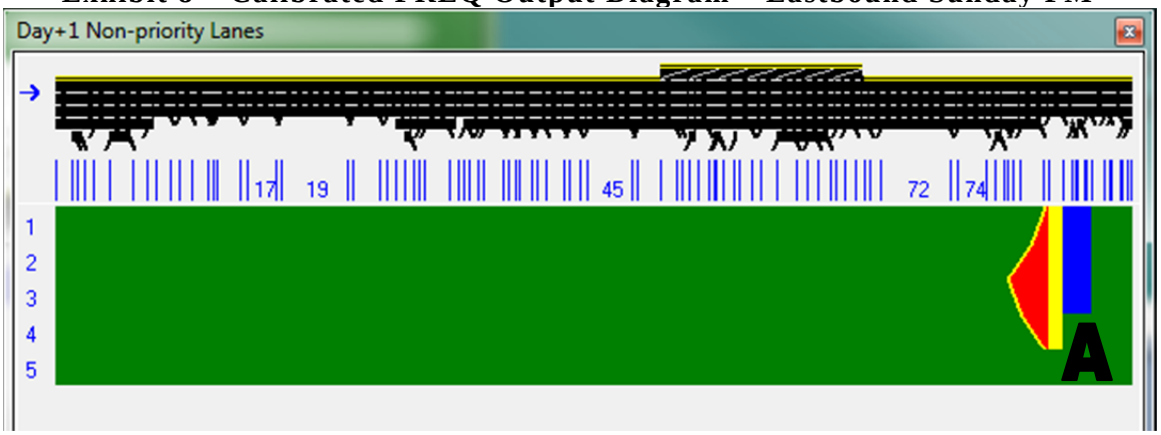


d. Westbound Sunday PM Peak

Exhibit 8 provides the graphical output of the calibrated FREQ model for westbound Sunday PM peak conditions, which demonstrated that the bottleneck locations and queues were replicated reasonably well with observed conditions:

Bottleneck A (Redwood Street on-ramp): simulated on subsection SS82, with queues extending east of Route 37 on-ramp. Queues started to develop after 3 PM and dissipated between 7 PM and 8 PM.

Exhibit 8 – Calibrated FREQ Output Diagram – Eastbound Sunday PM



Note: letters (e.g. A) denotes locations of bottleneck.

2. Travel Times

As explained in the ECT memo, due to limited field observations and floating car surveys, actual travel times during congestion could vary widely within each of the study periods.

Three sources of travel time data are used to compare against FREQ calibrated travel times.

- Caltrans Tach Runs (GPS floating car survey)
- Dowling's Floating Car Survey and Field Observation
- PEMS Travel Time Data (Based on FasTrak Toll Tag Readers)

These sources provided travel time data through various sections of the freeway and through different dates of when traffic counts were recorded. Therefore, they provide a source of reference for the travel times the corridor typically experiences.

a. Eastbound Midweek PM Peak

Exhibit 9 provides a summary and comparison of FREQ simulated versus observed travel times through the corridor for the eastbound midweek PM peak. As shown in the exhibit, differences in each time slice are no more than 4% and are all within the acceptable +/-15% variance target.

Exhibit 9 –Travel Time Comparison – Simulated Versus Observed For Eastbound Direction During Midweek PM Period

Start Time	End Time	Simulated (Minutes) FREQ			Observed Data (Minutes) Dowling	Caltrans	PEMS	Percent Difference		
		E/O Carquinez Br to Richards Blvd	Magazine on-ramp to Lesure Town off-ramp	N/O Tennessee to W/O SR113	E/O Carquinez Br to Richards Blvd	Magazine on-ramp to Lesure Town off-ramp	N/O Tennessee to W/O SR113	E/O Carquinez Br to Richards Blvd	Magazine on-ramp to Lesure Town off-ramp	N/O Tennessee to W/O SR113
3:00 PM	4:00 PM	41.6	25.9	35.0		26.1	33.6		0%	4%
4:00 PM	5:00 PM	41.0	25.9	34.4		25.9	33.9		0%	1%
5:00 PM	6:00 PM	41.3	26.5	34.3	40	26.1	34.1	3%	2%	0%
6:00 PM	7:00 PM	39.8	25.7	32.6		25.3	33.9		2%	-4%
Average		40.9	26.0	34.0		25.8	33.1		1%	3%

b. Eastbound Friday PM Peak

Exhibit 10 provides a summary and comparison of FREQ simulated versus observed travel times through the corridor for the eastbound Friday PM peak. As shown in the exhibit, differences in each time slice are within the acceptable +/-15% variance target. Note that for the section between Pitt School Road on-ramp and Enterprise Boulevard off-ramp, additional adjustments were made to the original travel time data provided by Caltrans. Caltrans travel time data for this section was collection on September 9, 2011, while University of California at Davis was still on summer vacation (regular school session started on September 22, 2011). Based on Dowling Associates' field observations in May 2011 (while UC Davis was still in session), freeway queues from the Causeway bottleneck extended beyond the Route 113 on-ramp, and lasted from about 5 PM to about 8 PM. The level of congestion observed on the freeway is more severe in May compared to the tach run data collected by Caltrans in early September, which shows freeway queues only extended to the vicinity between the Old Davis Road on-ramp and Richards Boulevard off-ramp. Based on Dowling's observations in May, it took approximately 17 minutes to travel through less than 1½ miles of queue approaching the Richards Boulevard off-ramp in Davis. Therefore, Caltrans tach run travel times were adjusted between 5:00 PM and 8:00 PM, to account for an additional 14 to 15.5 minutes of delay during typical travel conditions, when UC Davis is in regular school session.

Exhibit 10 –Travel Time Comparison – Simulated Versus Observed For Eastbound Direction During Friday PM Period

Start Time	End Time	Simulated (Minutes) FREQ				Observed Data (Minutes) Dowling	Caltrans Origional*	Caltrans Adjusted*	PEMS	Percent Difference		
		Carquinez Br to Richards Blvd	Pitt School to Enterprise	Richards off to Enterprise	N/O Tennessee to W/O SR113	Carquinez Br to Richards Blvd	Pitt School to Enterprise		N/O Tennessee to W/O SR113	Carquinez Br to Richards Blvd	Pitt School to Enterprise	N/O Tennessee to W/O SR113
3:00 PM	4:00 PM	46.5	20.9	12.9	39.2		21.9	21.9	44		-5%	-13%
4:00 PM	5:00 PM	53.7	31.9	22.4	44.1		28.5	28.5	45		11%	-3%
5:00 PM	6:00 PM	65.9	39.1	24.2	50.0	62	26.6	39.6	42	6%	-1%	15%
6:00 PM	7:00 PM	52.7	30.8	20.2	41.8		18.6	34.1	36		-11%	14%
7:00 PM	8:00 PM	42.6	28.4	21.3	36.5		15.7	31.2	33		-10%	9%
Average		52.3	30.2	20.2	42.3		22.2	31.0	40.2		-3%	5%

c. Westbound Midweek AM Peak

Exhibit 11 provides a summary and comparison of FREQ simulated versus observed travel times through the corridor for westbound midweek AM peak. As shown in the exhibit, differences in each time slice are 7% or less, and are within the acceptable +/-15% variance target.

Exhibit 11 –Travel Time Comparison – Simulated Versus Observed For Westbound Direction During Midweek AM Period

Start Time	End Time	Simulated (Minutes) FREQ			Observed Data (Minutes) Dowling	Caltrans	PEMS	Percent Difference		
		Richards Blvd to Carquinez Br	Lesure Town on-ramp to Magazine off-ramp	W/O SR113 to N/O Tennessee	Richards Blvd to Carquinez Br	Lesure Town on-ramp to Magazine off-ramp	W/O SR113 to N/O Tennessee	Richards Blvd to Carquinez Br	Lesure Town on-ramp to Magazine off-ramp	W/O SR113 to N/O Tennessee
5:00 AM	6:00 AM	39.1	25.0	30.3		24.9	31.7		0%	-5%
6:00 AM	7:00 AM	39.1	25.0	30.3		25.4	32.5		-1%	-7%
7:00 AM	8:00 AM	39.3	25.2	30.6	40	25.7	32.6	-2%	-2%	-6%
8:00 AM	9:00 AM	38.9	24.9	30.3		26.2	32.3		-5%	-7%
9:00 AM	10:00 AM	38.8	24.8	30.2		25.6	32.2		-3%	-7%
Average		39.0	25.0	30.4		25.5	32.3		-2%	-6%

d. Westbound Sunday PM Peak

Exhibit 12 provides a summary and comparison of FREQ simulated versus observed travel times through the corridor for the westbound Sunday PM peak. As shown in the exhibit, differences in each time slice are within the acceptable +/-15% variance target.

Exhibit 12 –Travel Time Comparison – Simulated Versus Observed For Westbound Direction During Sunday PM Period

Start Time	End Time	Simulated (Minutes) FREQ		Observed Data (Minutes) Dowling	PEMS	Percent Difference	
		Richards Blvd to Carquinez Br	W/O SR113 to N/O Tennessee	Richards Blvd to Carquinez Br	W/O SR113 to N/O Tennessee	Richards Blvd to Carquinez Br	W/O SR113 to N/O Tennessee
4:00 PM	5:00 PM	45.2	36.4		34.1		6%
5:00 PM	6:00 PM	46.6	37.9	44	34.7	6%	8%
6:00 PM	7:00 PM	42.0	33.4		35.1		-5%
7:00 PM	8:00 PM	38.8	30.2		34.1		-13%
Average		43.1	34.5		34.5		0%

3. Traffic volumes

FREQ simulated (or processed) origin-destination traffic volumes were compared to actual traffic volume counts at on-ramps and off-ramps, as well as input traffic volumes at the beginning (entry) and ending (exit) subsections of the freeway mainline. Comparison summary tables are provided in the Appendix. In general, simulated traffic volumes matched actual counts very well. Locations where traffic volumes are low (i.e. less than 100 vph) were more difficult to match on a percentage basis. These low traffic volume locations are not significant and would not significantly affect the calibration of the model or validation results.

As described earlier, there is currently a bottleneck outside of the eastern study limit at the Yolo County Causeway during the Friday afternoon peak commute period, resulting in queues extending into the study area; and therefore the FREQ model limit for this particular time period (Friday PM) is extended through the Causeway to model and simulate the bottleneck and its effects in the analysis, rather than ending the model at the county line in the middle of a congested freeway segment. The FREQ simulated volumes reflect the bottleneck throughput at this location.

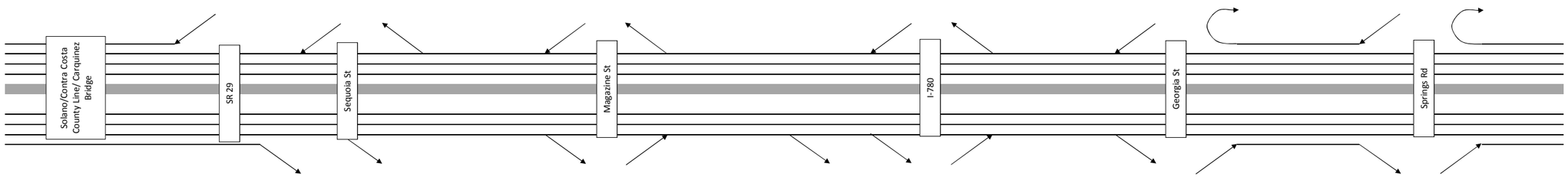
Conclusion

In conclusion, the FREQ models developed and calibrated for the Solano I-80 corridor existing conditions were satisfactorily validated. Major bottleneck locations, lengths of queues, and duration of congestion were shown to match reasonably well with observed conditions. Travel times through the corridor shown in FREQ were well within 15 percent (a majority was actually within 10%) of the observed travel times. Finally, FREQ processed traffic volumes matched well with traffic counts at on-ramps, off-ramps, and the entry and exit to the freeway corridor.

Appendix D: FREQ Future 2015 Demand Volumes

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

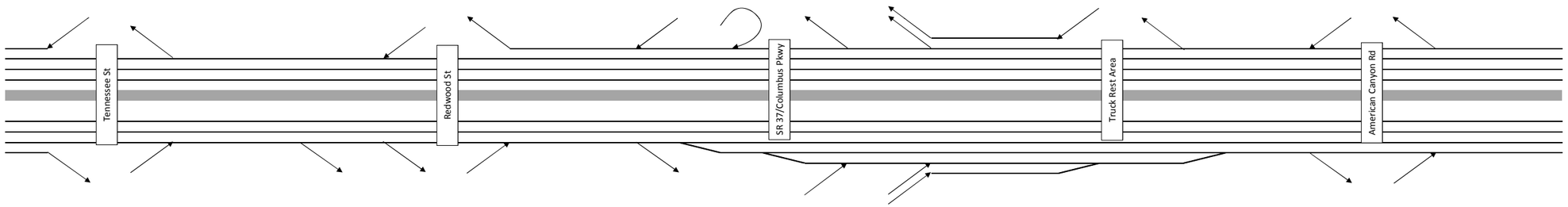
				WB ON FR SB RTE 29		WB OFF TO MARITIME ACADEMY RD	WB ON FR MARITIME ACADEMY RD		WB ON FROM MAGAZINE ST	WB OFF TO MAGAZINE		WB ON FROM RTE 780	WB OFF TO RTE 780		WB ON FR GEORGIA ST	WB OFF TO GEORGIA ST		WB ON FR SPRINGS RD	WB OFF TO SPRINGS RD	
		ML		**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Loop**	**Diag**	**ML**	**Diag**	**Loop**	**ML**	**Diag**	**Loop**	**ML**
Midweek AM Period	5:00 AM - 6:00 AM	5,581		158	5,423	129	208	5,503	360	411	5,553	820	824	5,557	204	143	5,495	183	105	5,417
	6:00 AM - 7:00 AM	5,736		275	5,461	163	265	5,562	425	383	5,520	1,180	1,300	5,640	328	213	5,525	246	176	5,455
	7:00 AM - 8:00 AM	5,373		377	4,997	245	252	5,003	410	401	4,994	1,187	1,667	5,474	356	315	5,433	266	361	5,528
	8:00 AM - 9:00 AM	4,511		374	4,137	258	223	4,103	336	432	4,199	940	1,358	4,617	242	331	4,706	213	310	4,803
	9:00 AM - 10:00 AM	3,855		325	3,531	188	199	3,541	272	404	3,673	685	1,115	4,103	200	243	4,146	200	279	4,226
	Total	*25,057*	*12%*	*1,508*	*23,549*	*983*	*1,146*	*23,712*	*1,803*	*2,031*	*23,940*	*4,813*	*6,264*	*25,391*	*1,329*	*1,245*	*25,306*	*1,108*	*1,231*	*25,429*
Sunday PM Period	3:00 PM - 4:00 PM	5,008		326	4,682	271	180	4,591	186	473	4,877	503	1,319	5,692	228	383	5,848	243	349	5,955
	4:00 PM - 5:00 PM	5,332		330	5,002	268	230	4,964	172	388	5,180	475	1,313	6,018	237	360	6,141	227	331	6,244
	5:00 PM - 6:00 PM	4,718		340	4,378	312	213	4,279	189	326	4,416	484	1,143	5,075	276	314	5,113	230	362	5,245
	6:00 PM - 7:00 PM	4,320		288	4,033	271	184	3,946	158	231	4,019	479	1,085	4,624	244	316	4,695	183	276	4,788
	7:00 PM - 8:00 PM	4,165		217	3,949	264	130	3,814	102	139	3,851	451	1,062	4,461	187	310	4,585	187	220	4,618
	Total	*23,543*	*6%*	*1,500*	*22,043*	*1,386*	*937*	*21,594*	*808*	*1,557*	*22,343*	*2,392*	*5,920*	*25,870*	*1,172*	*1,684*	*26,382*	*1,070*	*1,538*	*26,850*



		CARQUINEZ BRIDGE		EB OFF TO NB RTE 29	E/B OFF TO SEQUOIA ST		E/B OFF TO MAGAZINE ST.	E/B ON FROM MAGAZINE ST		E/B OFF TO RTE 780	E/B OFF TO BENICIA RD	EB ON FR RTE 780		E/B OFF TO GEORGIA STREET	E/B ON FROM GEORGIA STREET		E/B OFF TO SPRINGS STREET	E/B ON FROM SPRINGS STREET	
		ML Count		**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag/Loop**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**
Midweek PM Period	3:00 PM - 4:00 PM	5,476		502	177	4,797	69	471	5,199	874	251	1,616	5,690	157	299	5,832	191	156	5,798
	4:00 PM - 5:00 PM	5,631		592	191	4,848	69	444	5,223	896	267	1,647	5,707	191	294	5,810	207	175	5,778
	5:00 PM - 6:00 PM	5,654		587	183	4,883	97	467	5,253	1,008	350	1,744	5,638	199	383	5,822	226	196	5,793
	6:00 PM - 7:00 PM	4,708		422	129	4,157	76	394	4,475	829	228	1,438	4,855	184	315	4,987	196	117	4,907
		21,469	*19%*	*2,104*	*681*	*18,685*	*311*	*1,776*	*20,150*	*3,608*	*1,097*	*6,445*	*21,890*	*731*	*1,291*	*22,451*	*820*	*644*	*22,275*
Friday PM Period	3:00 PM - 4:00 PM	5,789		698	365	4,726	94	421	5,053	920	467	1,584	5,249	133	411	5,527	149	191	5,569
	4:00 PM - 5:00 PM	5,636		572	232	4,831	72	429	5,188	831	463	1,696	5,590	145	357	5,802	226	186	5,762
	5:00 PM - 6:00 PM	5,577		567	138	4,872	108	480	5,244	935	518	1,615	5,405	162	445	5,688	211	179	5,657
	6:00 PM - 7:00 PM	4,780		388	113	4,279	88	388	4,579	750	305	1,520	5,044	204	317	5,157	209	133	5,081
	7:00 PM - 8:00 PM	4,471		350	108	4,013	61	346	4,298	589	215	1,102	4,596	129	232	4,699	159	115	4,655
	Total	*26,252*	*19%*	*2,575*	*957*	*22,720*	*423*	*2,064*	*24,361*	*4,025*	*1,969*	*7,517*	*25,884*	*773*	*1,762*	*26,873*	*954*	*804*	*26,723*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

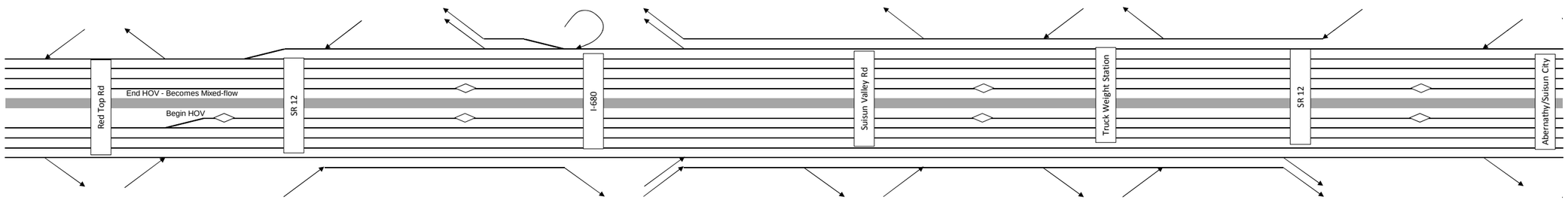
		WB ON FR COLL TENN ST	WB OFF TO COLL TENN ST		WB ON FR REDWOOD ST	WB OFF TO REDWOOD ST		WB ON FR EB RTE 37	WB ON FR CLMBS PKWY	WB OFF TO CLMBS PKWY	DUM WB OFF TO WB 37		WB ON FR TRUCK REST AREA	WB OFF TO TRUCK RA		WB ON FR AMERICAN CANYON	WB OFF TO AMERICAN CANYO	
		Diag/Loop	**Diag/Loop**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**
Midweek AM Period	5:00 AM - 6:00 AM	259	173	5,331	467	188	5,052	979	28	90	681	4,816	46	49	4,819	379	148	4,588
	6:00 AM - 7:00 AM	392	268	5,331	720	338	4,950	1,358	53	170	909	4,617	58	59	4,618	317	292	4,593
	7:00 AM - 8:00 AM	502	512	5,538	776	424	5,187	1,443	91	401	976	5,030	61	62	5,031	497	324	4,858
	8:00 AM - 9:00 AM	418	473	4,858	671	463	4,650	1,322	118	444	896	4,550	84	84	4,550	381	251	4,421
	9:00 AM - 10:00 AM	331	373	4,267	621	356	4,003	1,285	113	267	785	3,656	115	110	3,652	254	146	3,544
	Total	*1,903*	*1,799*	*25,325*	*3,253*	*1,768*	*23,841*	*6,386*	*403*	*1,371*	*4,247*	*22,670*	*363*	*364*	*22,671*	*1,827*	*1,161*	*22,004*
Sunday PM Period	3:00 PM - 4:00 PM	322	405	6,037	893	422	5,567	1,702	230	342	906	4,884	77	77	4,884	232	276	4,928
	4:00 PM - 5:00 PM	282	442	6,404	867	340	5,877	1,724	264	330	881	5,100	92	92	5,100	195	248	5,153
	5:00 PM - 6:00 PM	267	444	5,422	808	439	5,053	1,709	238	405	767	4,278	62	62	4,278	309	282	4,251
	6:00 PM - 7:00 PM	281	387	4,894	801	380	4,473	1,473	239	328	709	3,797	57	57	3,797	170	226	3,853
	7:00 PM - 8:00 PM	193	306	4,731	598	260	4,393	1,363	194	287	579	3,702	53	53	3,702	238	238	3,702
	Total	*1,345*	*1,983*	*27,489*	*3,967*	*1,841*	*25,362*	*7,970*	*1,166*	*1,693*	*3,841*	*21,760*	*341*	*341*	*21,760*	*1,144*	*1,270*	*21,886*



		E/B OFF TO TENNESSEE ST	E/B ON FROM TENNESSEE ST		EB OFF TO EB REDWOOD STREET	E/B OFF TO REDWOOD STREET	E/B ON FROM REDWOOD ST		EB OFF TO RTE 37/COLUMBUS PKWY	E/B ON FROM COLUMBUS PKWY	DUM E/B ON FROM E/B RTE 37			EB OFF TO AMERICAN CANION RD	EB ON FROM AMERICAN CANION RD	
		Diag	**Diag**	**ML**	**Diag**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**Diag**	**ML**	**ML**	**Diag**	**Diag**	**ML**
Midweek PM Period	3:00 PM - 4:00 PM	468	690	6,020	432	474	318	5,432	1,884	451	1,395	5,394	5,394	387	356	5,362
	4:00 PM - 5:00 PM	523	694	5,948	500	456	351	5,344	1,941	460	1,427	5,290	5,290	263	352	5,379
	5:00 PM - 6:00 PM	512	777	6,057	554	430	359	5,432	1,994	457	1,395	5,290	5,290	478	341	5,153
	6:00 PM - 7:00 PM	406	576	5,077	511	424	283	4,425	1,744	359	994	4,034	4,034	363	251	3,923
		1,910	*2,737*	*23,102*	*1,997*	*1,784*	*1,311*	*20,633*	*7,563*	*1,727*	*5,211*	*20,008*	*20,008*	*1,491*	*1,300*	*19,817*
Friday PM Period	3:00 PM - 4:00 PM	353	718	5,934	382	382	284	5,453	1,831	450	1,488	5,560	5,560	380	388	5,569
	4:00 PM - 5:00 PM	523	786	6,025	537	494	284	5,278	1,928	443	1,275	5,068	5,068	539	393	4,922
	5:00 PM - 6:00 PM	439	800	6,018	537	418	294	5,357	1,996	483	1,308	5,152	5,152	507	348	4,993
	6:00 PM - 7:00 PM	470	636	5,247	529	397	309	4,630	1,859	408	1,049	4,228	4,228	396	317	4,149
	7:00 PM - 8:00 PM	364	491	4,782	406	382	247	4,241	1,505	343	900	3,979	3,979	371	226	3,834
	Total	*2,149*	*3,431*	*28,005*	*2,391*	*2,073*	*1,418*	*24,959*	*9,119*	*2,127*	*6,021*	*23,988*	*23,988*	*2,193*	*1,671*	*23,467*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

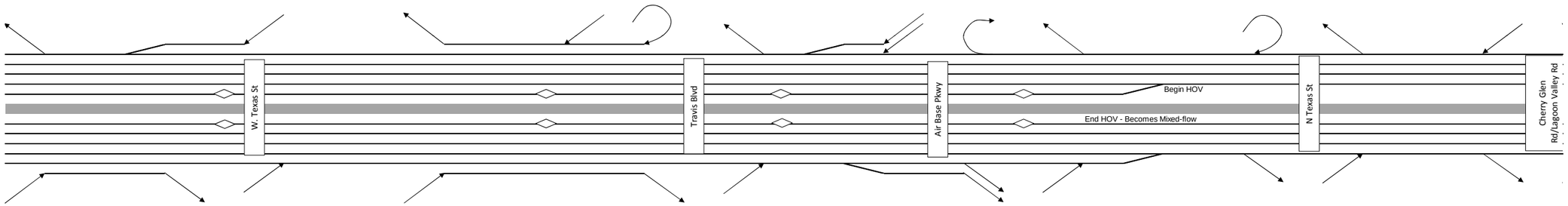
		WB ON FR REDTOP RD	WB OFF TO RED TOP		WB ON FR GREEN VALL	WB RTE 12-WB OFF;	WB ON FR NB 680	WB OFF TO SB RTE 680		WB OFF TO SUISUN VALLEY RD		W/B ON FROM SCALES	WBOFF TO WEIGH STA		WB ON FR RTE 12-FAIRFIELD		W/B ON FROM ABERNATHY
		Diag	**Diag**	**ML**	**Diag**	**Diag**	**Loop**	**Diag**	**ML**		**ML**	**Diag**	**Diag**	**ML**	**Diag**	**ML**	**Diag**
Midweek AM Period	5:00 AM - 6:00 AM	508	114	4,194	336	902	87	1,610	6,284	290	6,573	595	441	6,419	1,442	4,976	105
	6:00 AM - 7:00 AM	609	184	4,169	658	1,374	100	2,801	7,586	539	8,125	767	762	8,120	1,791	6,328	180
	7:00 AM - 8:00 AM	597	490	4,752	729	1,453	147	2,640	7,968	669	8,637	689	704	8,653	1,886	6,767	214
	8:00 AM - 9:00 AM	341	181	4,261	715	1,234	146	1,683	6,318	842	7,159	697	750	7,213	1,381	5,832	162
	9:00 AM - 10:00 AM	332	135	3,347	430	1,035	158	1,503	5,297	788	6,085	867	893	6,111	1,179	4,932	131
	Total	*2,387*	*1,105*	*20,722*	*2,868*	*5,999*	*637*	*10,237*	*33,453*	*3,127*	*36,579*	*3,615*	*3,550*	*36,514*	*7,679*	*28,835*	*792*
Sunday PM Period	3:00 PM - 4:00 PM	229	118	4,817	455	1,000	120	2,246	7,488	469	7,957	215	215	7,957	886	7,071	141
	4:00 PM - 5:00 PM	224	108	5,036	487	971	104	1,897	7,314	419	7,733	122	122	7,733	892	6,841	104
	5:00 PM - 6:00 PM	188	147	4,210	418	991	103	2,342	7,022	394	7,416	106	106	7,416	880	6,537	81
	6:00 PM - 7:00 PM	159	115	3,808	275	847	88	1,894	6,187	343	6,530	198	198	6,530	695	5,834	67
	7:00 PM - 8:00 PM	152	119	3,670	242	762	72	1,726	5,843	284	6,127	232	232	6,127	613	5,515	54
	Total	*952*	*606*	*21,541*	*1,877*	*4,571*	*487*	*10,106*	*33,854*	*1,909*	*35,763*	*873*	*873*	*35,763*	*3,966*	*31,797*	*447*



		E/B OFF TO RED TOP	E/B ON FROM RED TOP		RTE 12-EB-EB ON		E/B OFF TO GREEN VALLEY RD/680	E/B ON FR GREEN VALLEY/680		E/B OFF TO SUISUN VALLEY RD	E/B ON FR SUISUN VALLEY RD		EBOFF TO WEIGH STA	E/B ON FROM SCALES		EB OFF TO RTE 12		E/B OFF TO ABERNATHY
		Diag	**Diag**	**ML**	**Diag**	**ML**	**Diag**	**Diag**	**ML**			**ML**	**Diag**	**Diag**	**ML**	**Diag**	**ML**	**Diag**
Midweek PM Period	3:00 PM - 4:00 PM	518	544	5,388	1,464	6,852	750	2,758	8,860	391	818	9,287	247	247	9,287	1,644	7,643	147
	4:00 PM - 5:00 PM	533	410	5,257	1,400	6,657	792	2,874	8,739	346	778	9,171	191	191	9,171	1,743	7,428	156
	5:00 PM - 6:00 PM	545	361	4,968	1,321	6,289	838	3,187	8,638	369	836	9,105	134	134	9,105	1,797	7,308	210
	6:00 PM - 7:00 PM	387	264	3,801	1,038	4,839	570	2,547	6,816	350	558	7,025	118	118	7,025	1,326	5,700	121
		1,983	*1,579*	*19,413*	*5,224*	*24,637*	*2,950*	*11,366*	*33,053*	*1,456*	*2,991*	*34,588*	*690*	*690*	*34,588*	*6,510*	*28,078*	*634*
Friday PM Period	3:00 PM - 4:00 PM	619	587	5,537	1,116	6,653	1,219	3,195	8,629	339	869	9,159	218	218	9,159	1,559	7,599	210
	4:00 PM - 5:00 PM	711	545	4,756	1,222	5,978	1,142	3,446	8,282	263	880	8,899	190	190	8,899	1,503	7,396	167
	5:00 PM - 6:00 PM	550	737	5,180	1,281	6,461	814	3,329	8,976	352	914	9,538	159	159	9,538	1,613	7,925	201
	6:00 PM - 7:00 PM	400	266	4,016	1,146	5,162	558	3,389	7,993	387	580	8,185	65	65	8,185	1,520	6,665	109
	7:00 PM - 8:00 PM	362	235	3,708	885	4,593	386	2,869	7,076	352	440	7,164	115	115	7,164	1,235	5,930	84
	Total	*2,642*	*2,371*	*23,196*	*5,650*	*28,846*	*4,119*	*16,229*	*40,956*	*1,694*	*3,683*	*42,945*	*747*	*747*	*42,945*	*7,430*	*35,515*	*771*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

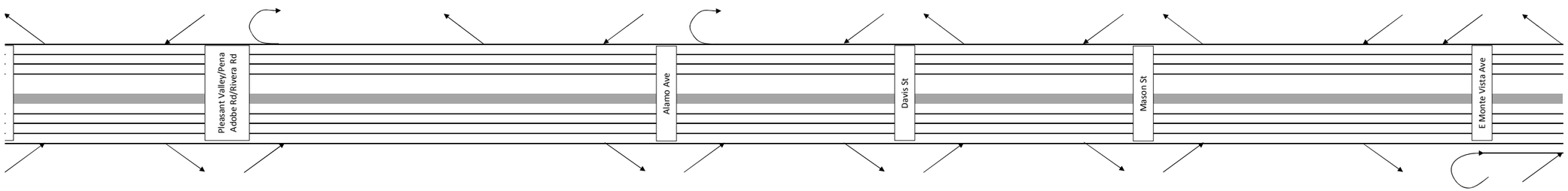
		W/B OFF TO ABERNATHY		WB ON FR W TEXAS AND ROCKVL		WB OFF TO OLIVER RD		WB ON FR TRAVIS BLVD EB	WB ON FR TRAVIS BLVD.WB	WB OFF TO TRAVIS BV E/W		W/B ON FROM AIR BASE PKY	W/B OFF TO E/B AIR BASE PKY	W/B OFF TO AIR BASE PKY		W/B ON FROM NORTH TEXAS ST	WB OFF TO TEXAS		WB ON FR CHERRY GLEN
		Diag	**ML**	**Diag**	**ML**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**	**ML**	**Loop**	**Diag**	**ML**	**Diag**
Midweek AM Period	5:00 AM - 6:00 AM	472	5,344	331	5,013	413	5,426	182	249	215	5,210	983	144	76	4,447	258	120	4,309	65
	6:00 AM - 7:00 AM	746	6,895	432	6,463	564	7,027	227	365	392	6,827	1,217	303	188	6,101	367	249	5,982	99
	7:00 AM - 8:00 AM	725	7,278	446	6,832	703	7,535	277	403	643	7,498	1,498	513	295	6,807	404	561	6,964	152
	8:00 AM - 9:00 AM	520	6,190	389	5,802	738	6,540	244	334	775	6,736	1,230	346	249	6,101	298	530	6,333	96
	9:00 AM - 10:00 AM	464	5,264	346	4,918	508	5,426	199	315	688	5,599	842	291	238	5,286	276	360	5,371	86
	Total	*2,928*	*30,971*	*1,944*	*29,028*	*2,926*	*31,954*	*1,130*	*1,667*	*2,712*	*31,870*	*5,769*	*1,595*	*1,046*	*28,741*	*1,604*	*1,820*	*28,958*	*497*
Sunday PM Period	3:00 PM - 4:00 PM	325	7,255	372	6,884	422	7,306	211	872	705	6,928	841	333	110	6,530	248	474	6,756	51
	4:00 PM - 5:00 PM	247	6,984	321	6,663	379	7,042	193	798	731	6,782	861	336	94	6,351	241	410	6,520	65
	5:00 PM - 6:00 PM	271	6,727	284	6,443	405	6,848	232	727	678	6,567	847	381	82	6,183	242	437	6,378	75
	6:00 PM - 7:00 PM	217	5,984	221	5,763	311	6,074	235	693	566	5,712	645	330	81	5,478	180	392	5,690	52
	7:00 PM - 8:00 PM	188	5,648	187	5,461	264	5,725	185	608	350	5,283	529	308	85	5,147	142	311	5,316	22
	Total	*1,248*	*32,598*	*1,385*	*31,214*	*1,781*	*32,995*	*1,056*	*3,698*	*3,031*	*31,272*	*3,722*	*1,689*	*451*	*29,689*	*1,053*	*2,024*	*30,660*	*265*



		E/B ON FROM ABERNATHY		EB OFF TO W TEXAS AND MAGLN	EB ON FROM MAGELLAN RD		EB ON FROM BECK RD		E/B OFF TO TRAVIS BL	E/B ON FROM TRAVIS BL.		Diff	E/B OFF TO AIR BASE PKY	E/B ON FROM AIR BASE PKY		EB OFF TO N TEXAS ST	E/B ON FROM NORTH TEXAS		E/B OFF TO CHERRY GLEN
		Diag	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**ML**	**Diag/Loop**	**Diag**	**ML**		**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**
Midweek PM Period	3:00 PM - 4:00 PM	687	8,182	1,297	566	7,451	968	8,419	1,360	1,196	8,255		1,500	724	7,479	477	652	7,654	71
	4:00 PM - 5:00 PM	724	7,996	1,518	775	7,253	1,002	8,255	1,207	1,175	8,223		1,480	780	7,523	460	627	7,690	94
	5:00 PM - 6:00 PM	689	7,786	1,578	758	6,967	1,234	8,201	1,250	1,354	8,305		1,440	826	7,691	577	628	7,742	111
	6:00 PM - 7:00 PM	371	5,950	1,056	423	5,317	792	6,109	1,144	1,012	5,976		1,430	535	5,081	559	506	5,028	56
		2,471	*29,914*	*5,449*	*2,523*	*26,988*	*3,995*	*30,983*	*4,961*	*4,738*	*30,760*		*5,850*	*2,866*	*27,775*	*2,073*	*2,412*	*28,114*	*332*
Friday PM Period	3:00 PM - 4:00 PM	687	8,076	1,496	1,078	7,658	911	8,569	1,079	1,121	8,611		980	713	8,345	480	662	8,527	66
	4:00 PM - 5:00 PM	698	7,927	1,202	735	7,459	1,063	8,522	1,199	1,178	8,502		945	752	8,310	460	666	8,515	82
	5:00 PM - 6:00 PM	600	8,324	1,363	710	7,671	1,049	8,720	1,058	1,177	8,839		1,009	820	8,650	497	689	8,842	82
	6:00 PM - 7:00 PM	345	6,901	805	394	6,490	761	7,252	1,215	1,014	7,051		1,063	556	6,545	491	555	6,609	51
	7:00 PM - 8:00 PM	279	6,125	592	287	5,820	482	6,302	1,009	963	6,257		1,051	357	5,563	385	402	5,580	38
	Total	*2,609*	*37,353*	*5,459*	*3,204*	*35,098*	*4,266*	*39,365*	*5,559*	*5,454*	*39,260*		*5,048*	*3,200*	*37,412*	*2,313*	*2,974*	*38,073*	*318*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

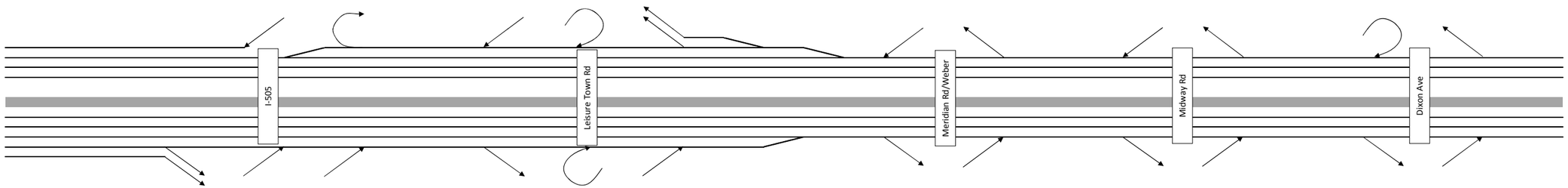
		WB OFF TO CHERRY GLEN		WB ON FR PLEASANT VALLEY	WB OFF TO PLEASANT VALLEY		WB OFF TO CHERRY GLEN		W/B ON FROM ALAMO AVE	W/B OFF TO ALAMO AVE		WB ON FR DAVIS ST	WB OFF TO DAVIS ST.		WB ON FR MASON/DEPOT	WB OFF TO MASON/DEPOT		WB ON FR MONTE VISTA/BROWNS VALLEY	WB ON FR MONTE VISTA	W/B OFF TO MONTIE VISTA AVE
		Diag	**ML**	**Diag**	**Loop**	**ML**	**Diag**	**ML**	**Diag**	**Loop**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**Diag**
Midweek AM Period	5:00 AM - 6:00 AM	27	4,271	35	13	4,248	7	4,255	568	244	3,930	271	117	3,776	364	234	3,646	304	33	96
	6:00 AM - 7:00 AM	40	5,923	41	20	5,901	16	5,917	1,026	286	5,177	354	115	4,938	499	333	4,772	464	73	208
	7:00 AM - 8:00 AM	65	6,877	47	37	6,867	31	6,899	1,387	528	6,040	507	253	5,785	742	472	5,516	757	67	293
	8:00 AM - 9:00 AM	39	6,276	46	33	6,264	23	6,287	1,426	429	5,289	368	169	5,091	590	404	4,905	520	60	360
	9:00 AM - 10:00 AM	34	5,319	44	39	5,314	26	5,340	838	317	4,819	272	158	4,705	457	387	4,635	397	116	388
	Total	*205*	*28,665*	*213*	*142*	*28,595*	*103*	*28,698*	*5,246*	*1,803*	*25,255*	*1,773*	*812*	*24,294*	*2,652*	*1,830*	*23,473*	*2,442*	*349*	*1,344*
Sunday PM Period	3:00 PM - 4:00 PM	46	6,751	45	50	6,757	38	6,795	640	373	6,528	536	262	6,253	546	421	6,129	861	161	742
	4:00 PM - 5:00 PM	66	6,521	55	37	6,502	72	6,574	505	368	6,437	519	269	6,187	516	410	6,080	776	235	557
	5:00 PM - 6:00 PM	60	6,363	45	30	6,349	38	6,387	521	278	6,144	506	265	5,903	451	353	5,805	655	291	682
	6:00 PM - 7:00 PM	26	5,663	34	27	5,656	23	5,679	423	279	5,535	409	231	5,356	350	265	5,271	570	217	449
	7:00 PM - 8:00 PM	23	5,317	24	23	5,316	20	5,336	374	227	5,188	291	130	5,028	265	202	4,965	477	53	312
	Total	*220*	*30,615*	*202*	*167*	*30,580*	*190*	*30,771*	*2,463*	*1,525*	*29,832*	*2,261*	*1,156*	*28,727*	*2,129*	*1,651*	*28,249*	*3,339*	*957*	*2,741*



		E/B ON FROM CHERRY GLEN		E/B OFF TO PLEASANT VALLEY	E/B ON FROM PLEASANT VALLEY		E/B OFF TO ALAMO AVE	E/B ON FROM ALAMO AVE		E/B OFF TO DAVIS ST	E/B ON FROM DAVIS ST		E/B OFF CLIFFSIDE DR	E/B ON CLIFFSIDE DR		EB OFF TO ALLISON DRIVE	EB ON FR SB ALLISON DRIVE	EB ON FR NB ALLISON DRIVE
		Diag	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Diag**	**ML**	**Diag**	**Loop**	**Diag**
Midweek PM Period	3:00 PM - 4:00 PM	100	7,684	17	41	7,708	1,167	722	7,263	539	361	7,085	549	512	7,047	1,211	213	233
	4:00 PM - 5:00 PM	137	7,733	21	46	7,757	1,314	659	7,102	594	358	6,866	660	471	6,677	1,318	212	200
	5:00 PM - 6:00 PM	145	7,775	17	42	7,800	1,488	646	6,958	567	385	6,775	657	434	6,552	1,369	199	223
	6:00 PM - 7:00 PM	71	5,043	12	35	5,067	1,035	501	4,532	427	268	4,373	517	358	4,214	1,497	183	166
		453	*28,235*	*67*	*163*	*28,332*	*5,005*	*2,528*	*25,855*	*2,128*	*1,372*	*25,099*	*2,384*	*1,775*	*24,491*	*5,395*	*808*	*822*
Friday PM Period	3:00 PM - 4:00 PM	130	8,591	22	49	8,618	1,051	716	8,283	647	369	8,005	647	555	7,913	1,157	265	238
	4:00 PM - 5:00 PM	160	8,593	20	56	8,629	1,115	651	8,164	514	361	8,011	613	521	7,919	1,457	223	233
	5:00 PM - 6:00 PM	166	8,926	11	60	8,975	1,241	601	8,336	543	341	8,133	626	423	7,930	1,409	236	228
	6:00 PM - 7:00 PM	84	6,642	20	41	6,663	889	462	6,236	463	291	6,064	489	361	5,936	1,440	219	174
	7:00 PM - 8:00 PM	43	5,585	12	32	5,606	685	387	5,308	315	220	5,213	350	281	5,144	1,249	142	162
	Total	*583*	*38,337*	*85*	*239*	*38,491*	*4,981*	*2,817*	*36,326*	*2,482*	*1,581*	*35,425*	*2,725*	*2,141*	*34,841*	*6,712*	*1,085*	*1,035*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

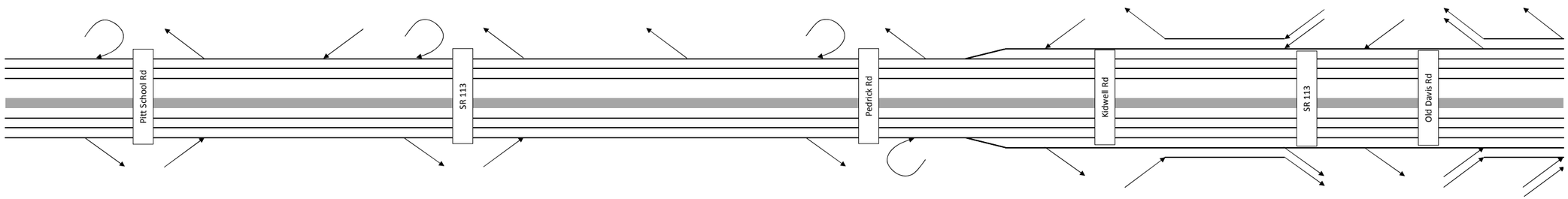
		ML	W/B ON FROM S/B RTE 505 Diag	W/B OFF TO N/B RTE 505 Loop	ML	W/B DIAG ON FROM SB LEISURE TOWN Diag	W/B LOOP ON FROM NB LEISURE TOWN Loop	W/B OFF TO LEISURE TOWN Diag	ML	WB ON FR MERIDIAN RD Diag	WB OFF TO MERIDIAN RD Diag	ML	W/B ON FROM MIDWAY RD Diag	W/B OFF TO MIDWAY RD Diag	ML	WB ON FR DIXON GRANT Loop	WB OFF TO DIXON GRANT Diag
Midweek AM Period	5:00 AM - 6:00 AM	3,405	608	10	2,807	26	77	336	3,040	30	16	3,026	83	49	2,992	263	55
	6:00 AM - 7:00 AM	4,442	872	10	3,580	54	113	548	3,962	43	66	3,985	118	167	4,035	358	69
	7:00 AM - 8:00 AM	4,984	1,054	21	3,951	107	151	644	4,337	62	44	4,319	173	149	4,295	441	76
	8:00 AM - 9:00 AM	4,685	929	29	3,784	83	162	590	4,128	50	23	4,101	160	79	4,020	389	84
	9:00 AM - 10:00 AM	4,510	750	32	3,792	61	197	397	3,931	45	14	3,900	113	74	3,860	297	74
	Total	*22,027*	*4,214*	*101*	*17,914*	*331*	*700*	*2,515*	*19,398*	*230*	*163*	*19,331*	*646*	*517*	*19,202*	*1,748*	*357*
Sunday PM Period	3:00 PM - 4:00 PM	5,848	1,230	26	4,644	101	119	403	4,828	41	13	4,800	69	63	4,794	238	118
	4:00 PM - 5:00 PM	5,626	1,265	28	4,390	87	122	366	4,546	56	9	4,500	90	70	4,479	213	131
	5:00 PM - 6:00 PM	5,541	1,209	41	4,373	115	88	382	4,552	44	13	4,521	74	44	4,490	171	89
	6:00 PM - 7:00 PM	4,932	1,054	11	3,889	121	72	331	4,026	24	3	4,006	59	48	3,995	181	142
	7:00 PM - 8:00 PM	4,747	931	11	3,826	53	66	255	3,962	17	2	3,946	39	45	3,953	132	108
	Total	*26,694*	*5,689*	*117*	*21,122*	*478*	*467*	*1,737*	*21,914*	*181*	*39*	*21,772*	*331*	*270*	*21,711*	*936*	*588*



		ML	E/B OFF TO NUT TREE / 505 Diag	EB ON FR SB RTE 505 Loop	EB ON FR NUT TREE OC Diag	ML	E/B OFF TO LEISURE TOWN Diag	E/B ON FROM SB LEISURE TOWN Loop	E/B DIAG ON FROM NB LEISURE TOWN Diag	ML	E/B OFF TO MERIDIAN RD Diag	E/B ON FROM MERIDIAN RD Diag	ML	E/B OFF TO MIDWAY RD Diag	E/B ON FROM MIDWAY RD Diag	ML	E/B OFF TO DIXON GRANT	E/B ON FROM DIXON GRANT
Midweek PM Period	3:00 PM - 4:00 PM	6,282	993	280	377	5,945	580	222	226	5,813	94	51	5,770	192	139	5,717	378	114
	4:00 PM - 5:00 PM	5,772	941	239	376	5,446	506	276	275	5,491	108	62	5,444	194	154	5,404	380	132
	5:00 PM - 6:00 PM	5,605	922	254	353	5,291	488	264	263	5,331	101	51	5,280	204	137	5,213	402	105
	6:00 PM - 7:00 PM	3,066	741	162	262	2,750	418	169	169	2,670	66	22	2,626	146	60	2,541	283	87
		20,725	*3,597*	*935*	*1,368*	*19,432*	*1,992*	*931*	*934*	*19,305*	*369*	*185*	*19,120*	*735*	*490*	*18,875*	*1,444*	*438*
Friday PM Period	3:00 PM - 4:00 PM	7,258	1,423	300	403	6,539	517	223	228	6,473	116	58	6,415	183	149	6,381	376	158
	4:00 PM - 5:00 PM	6,918	1,334	273	369	6,226	428	241	241	6,280	89	43	6,234	211	132	6,156	460	141
	5:00 PM - 6:00 PM	6,986	1,273	286	339	6,337	454	257	256	6,396	87	27	6,336	198	106	6,244	406	136
	6:00 PM - 7:00 PM	4,890	1,074	185	291	4,291	432	168	168	4,195	73	25	4,147	130	69	4,085	362	120
	7:00 PM - 8:00 PM	4,198	890	164	283	3,755	304	130	135	3,717	53	20	3,684	103	42	3,622	326	83
	Total	*30,249*	*5,994*	*1,207*	*1,686*	*27,148*	*2,134*	*1,019*	*1,029*	*27,061*	*418*	*173*	*26,816*	*825*	*497*	*26,488*	*1,929*	*639*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

		ML	WB ON FR PITT SCHOOL RD Loop	WB OFF TO PITT SCHOOL RD Diag	ML	W/B ON FROM CURREY RD Diag	W/B ON FR WB RTE 113 S Loop	W/B OFF TO RTE 113 S Diag	ML	W/B OFF TO MILK FARM Diag	ML	W/B ON FROM PEDRICK RD Loop	W/B OFF TO PEDRICK RD Diag	ML	W/B ON FROM KIDWELL RD Diag	W/B OFF TO KIDWELL RD Diag	ML	DUM W/B ON TO S/B 113 Diag	W/B ON FROM OLD DAVIS Diag	W/B OFF TO N/B 113 Diag	W/B OFF TO OLD DAVIS RD Diag
Midweek AM Period	5:00 AM - 6:00 AM	2,784	168	126	2,742	4	100	133	2,772	6	2,777	92	154	2,839	11	25	2,853	382	10	191	64
	6:00 AM - 7:00 AM	3,745	251	144	3,639	7	104	210	3,737	9	3,746	111	196	3,832	14	30	3,848	544	16	436	261
	7:00 AM - 8:00 AM	3,931	324	200	3,807	7	129	314	3,985	15	4,000	132	180	4,047	10	37	4,074	699	24	785	321
	8:00 AM - 9:00 AM	3,714	251	211	3,674	12	145	319	3,836	9	3,844	145	185	3,885	16	33	3,903	612	26	791	428
	9:00 AM - 10:00 AM	3,637	222	216	3,630	10	132	256	3,745	11	3,756	122	157	3,791	18	40	3,813	502	28	670	250
	Total	*17,810*	*1,215*	*896*	*17,492*	*39*	*610*	*1,232*	*18,075*	*49*	*18,123*	*601*	*872*	*18,394*	*68*	*165*	*18,491*	*2,739*	*103*	*2,874*	*1,323*
Sunday PM Period	3:00 PM - 4:00 PM	4,675	261	318	4,731	16	152	337	4,900	16	4,916	204	266	4,978	8	18	4,988	640	51	530	60
	4:00 PM - 5:00 PM	4,397	214	343	4,526	20	164	320	4,662	17	4,679	168	342	4,853	9	13	4,856	655	63	497	54
	5:00 PM - 6:00 PM	4,408	231	355	4,532	18	158	314	4,670	12	4,681	182	265	4,764	7	19	4,777	587	39	438	50
	6:00 PM - 7:00 PM	3,955	188	339	4,106	11	148	300	4,246	12	4,258	151	187	4,294	5	9	4,299	477	32	498	67
	7:00 PM - 8:00 PM	3,928	216	358	4,070	9	156	236	4,141	12	4,153	90	150	4,212	8	12	4,216	452	34	376	31
	Total	*21,363*	*1,111*	*1,712*	*21,964*	*74*	*779*	*1,508*	*22,619*	*67*	*22,687*	*796*	*1,209*	*23,101*	*36*	*71*	*23,135*	*2,810*	*219*	*2,338*	*261*

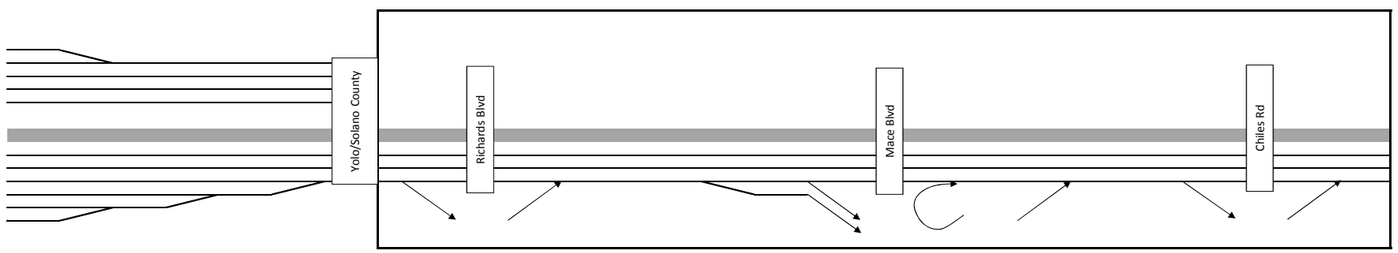


		ML	E/B OFF TO PIT SCHOOL RD Diag	E/B ON FROM PIT SCHOOL RD Loop	ML	E/B OFF TO RTE 113 S Diag	E/B ON FROM N/B RTE 113 SOUTH Diag	ML	ML	E/B OFF TO PEDRICK RD Diag	E/B ON FROM PEDRICK RD Loop	ML	E/B OFF TO KIDWELL RD Diag	E/B ON FROM KIDWELL RD Diag	ML	DUM E/B OFF TO N/B 113 Diag	E/B OFF TO OLD DAVIS Diag	E/B ON FROM S/B 113 Diag	E/B ON FROM OLD DAVIS RD Diag
Midweek PM Period	3:00 PM - 4:00 PM	5,453	322	329	5,460	210	433	5,683	5,683	144	154	5,693	15	52	5,730	640	60	787	270
	4:00 PM - 5:00 PM	5,156	400	306	5,062	177	489	5,374	5,374	154	142	5,362	16	45	5,392	721	53	873	205
	5:00 PM - 6:00 PM	4,916	416	309	4,809	200	392	5,002	5,002	142	123	4,983	9	23	4,997	655	52	917	229
	6:00 PM - 7:00 PM	2,345	328	244	2,261	159	305	2,407	2,407	107	78	2,378	5	13	2,386	527	29	683	81
		17,870	*1,466*	*1,188*	*17,592*	*746*	*1,619*	*18,466*	*18,466*	*547*	*498*	*18,417*	*45*	*133*	*18,505*	*2,544*	*194*	*3,260*	*784*
Friday PM Period	3:00 PM - 4:00 PM	6,163	408	333	6,088	232	453	6,309	6,309	164	118	6,263	9	42	6,297	799	53	725	195
	4:00 PM - 5:00 PM	5,837	434	324	5,728	195	433	5,965	5,965	188	122	5,899	16	48	5,931	909	41	761	162
	5:00 PM - 6:00 PM	5,974	479	327	5,822	224	424	6,022	6,022	152	114	5,984	14	31	6,001	913	53	704	177
	6:00 PM - 7:00 PM	3,844	369	321	3,796	188	327	3,935	3,935	106	75	3,905	8	16	3,913	726	31	629	61
	7:00 PM - 8:00 PM	3,379	306	270	3,343	186	243	3,400	3,400	87	36	3,349	6	17	3,359	532	31	523	50
	Total	*25,198*	*1,997*	*1,575*	*24,776*	*1,025*	*1,880*	*25,631*	*25,631*	*697*	*465*	*25,400*	*53*	*154*	*25,501*	*3,879*	*210*	*3,342*	*645*

Solano I-80 Ramp Metering
Feasbility Study - Deliverable 2.2B
Appendix B - 2015 Traffic Volume

		SOLANO/YOLO COUNTY LINE	
		ML Count	
			Midweek AM Period
Midweek AM Period	5:00 AM - 6:00 AM	2,716	5:00 AM - 6:00 AM
	6:00 AM - 7:00 AM	3,985	6:00 AM - 7:00 AM
	7:00 AM - 8:00 AM	4,458	7:00 AM - 8:00 AM
	8:00 AM - 9:00 AM	4,484	8:00 AM - 9:00 AM
	9:00 AM - 10:00 AM	4,203	9:00 AM - 10:00 AM
	Total	*19,846*	Total
			Sunday PM Period
Sunday PM Period	3:00 PM - 4:00 PM	4,887	3:00 PM - 4:00 PM
	4:00 PM - 5:00 PM	4,688	4:00 PM - 5:00 PM
	5:00 PM - 6:00 PM	4,639	5:00 PM - 6:00 PM
	6:00 PM - 7:00 PM	4,354	6:00 PM - 7:00 PM
	7:00 PM - 8:00 PM	4,138	7:00 PM - 8:00 PM
	Total	*22,706*	Total

This extended segment is only needed for Friday PM Peak Period



		ML		ML	Richards Blvd Off-Ramp	Richards Blvd On-Ramp	ML	Mace Blvd Off-Ramp	Mace Blvd Loop On-Ramp	Mace Blvd Diag On-Ramp	ML	Chiles Rd Off-Ramp	Chiles Rd On-Ramp	ML
			Midweek PM Period											
Midweek PM Period	3:00 PM - 4:00 PM	6,086	3:00 PM - 4:00 PM	6,086										
	4:00 PM - 5:00 PM	5,695	4:00 PM - 5:00 PM	5,695										
	5:00 PM - 6:00 PM	5,436	5:00 PM - 6:00 PM	5,436										
	6:00 PM - 7:00 PM	2,594	6:00 PM - 7:00 PM	2,594										
		19,811	Total	*19,811*										
			Friday PM Period											
Friday PM Period	3:00 PM - 4:00 PM	6,366	3:00 PM - 4:00 PM	6,366	503	414	6,277	413	440	289	6,593	55	526	7,064
	4:00 PM - 5:00 PM	5,903	4:00 PM - 5:00 PM	5,903	563	406	5,746	403	382	282	6,008	54	886	6,840
	5:00 PM - 6:00 PM	5,915	5:00 PM - 6:00 PM	5,915	520	356	5,750	440	381	294	5,986	59	1,006	6,933
	6:00 PM - 7:00 PM	3,847	6:00 PM - 7:00 PM	3,847	401	361	3,807	399	398	325	4,131	52	693	4,772
	7:00 PM - 8:00 PM	3,369	7:00 PM - 8:00 PM	3,369	422	337	3,284	314	385	221	3,576	40	162	3,698
	Total	*25,400*	Total	*25,400*	*2,409*	*1,874*	*24,865*	*1,967*	*1,985*	*1,412*	*26,294*	*259*	*3,273*	*29,308*

Appendix E: I-80/I-680/SR-12 Interchange Project Initial Construction Package

SCALE: 1" = 800' (11"X17")
DATE: JANUARY 2012
JOB: 58-0521B

INITIAL CONSTRUCTION PACKAGE
I-80/I-680/SR-12 INTERCHANGE PROJECT (ALT C-1)

MARK THOMAS & COMPANY, INC.
3000 OAK ROAD, SUITE 650
WALNUT CREEK, CALIFORNIA 94597
(925) 938-0383

Appendix F: PowerPoint Slides of Ramp Storage & Caltrans Plans

Appendix F: Ramp Storage Graphics for I-80

Two graphics files can be downloaded from the following FTP site:

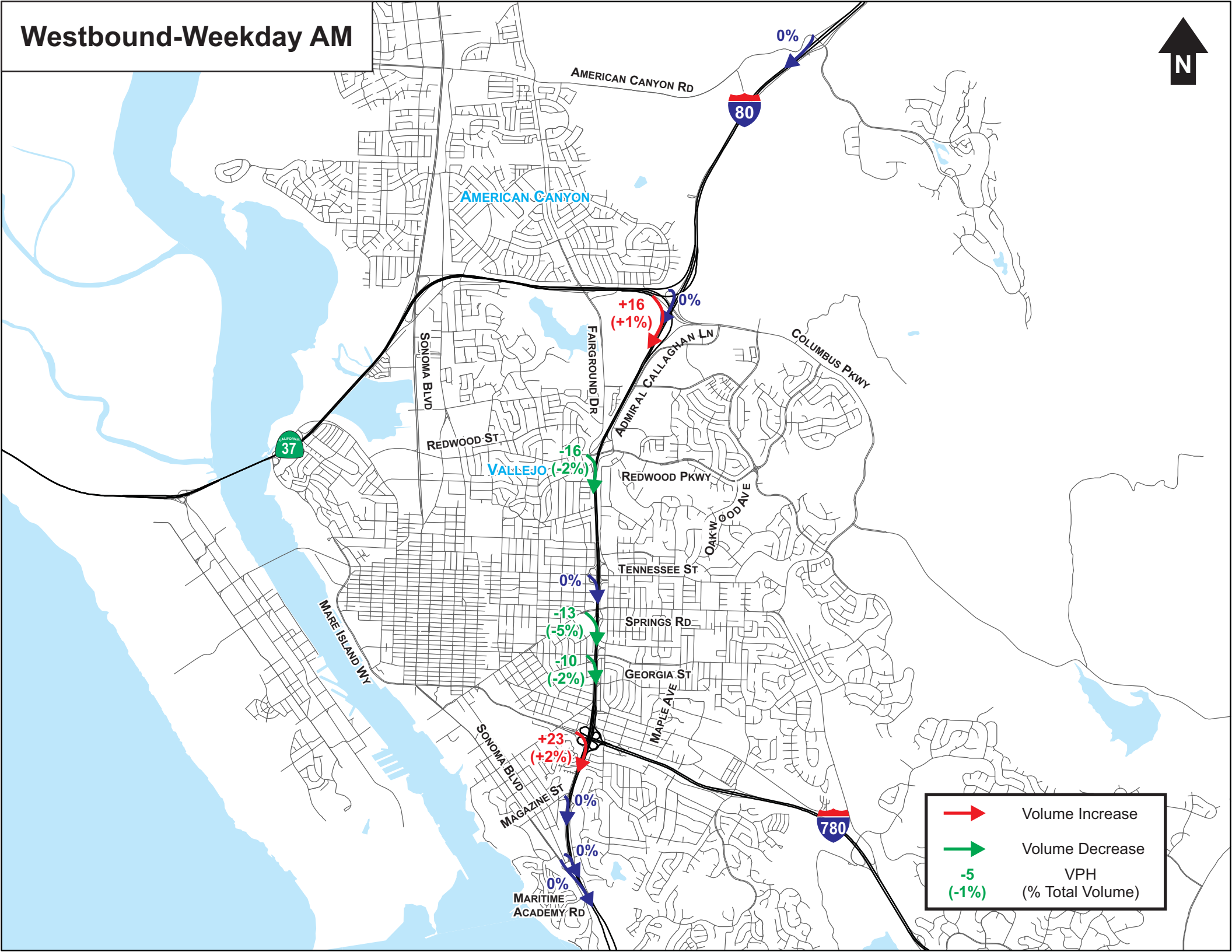
The FTP site is: http://www.kittelson.com/ftp
User ID : MTCRampMetering
Password : 123456

Click into the "Solano 80" folder to locate the following 2 PowerPoint files:

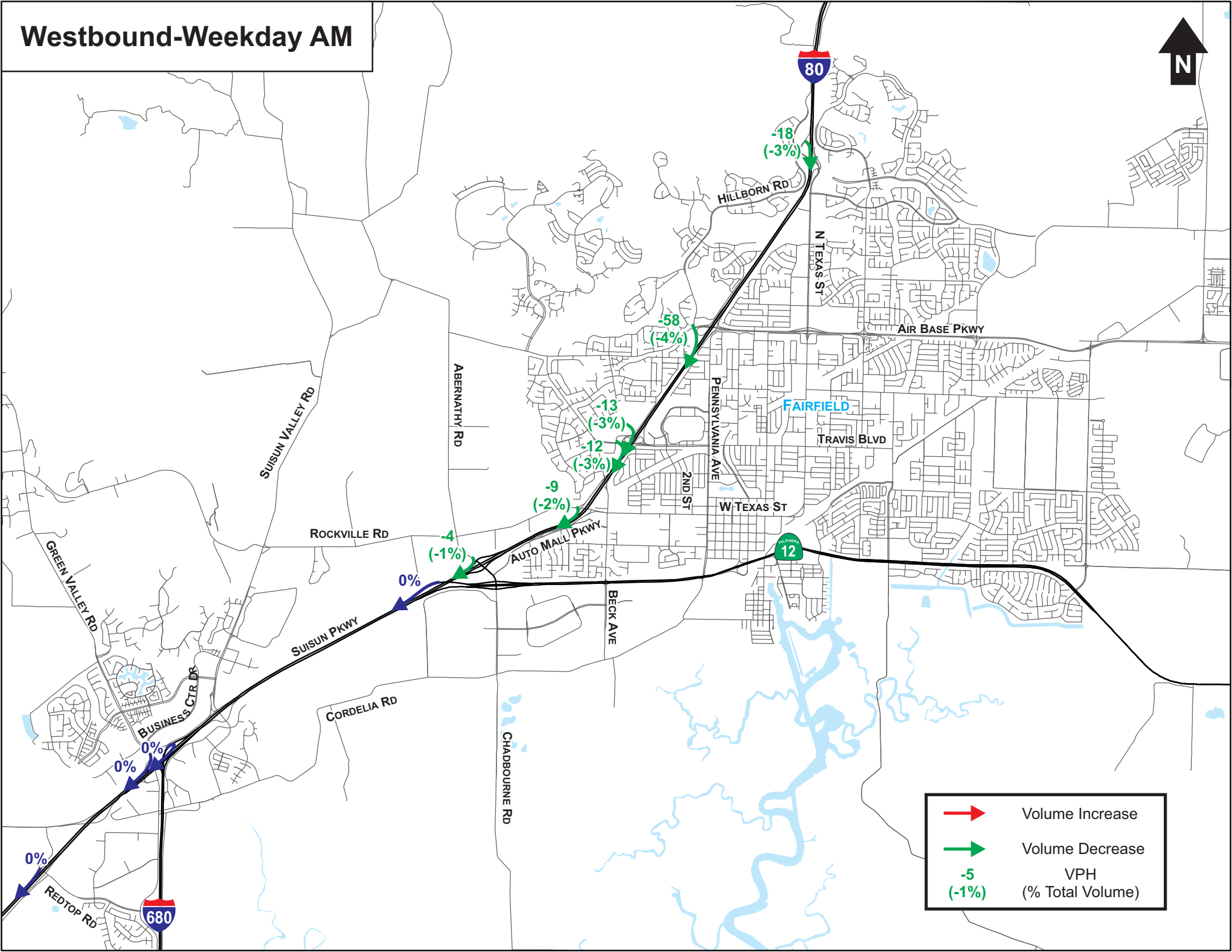
1. Appendix_F1_EB_RampStorage.ppt
2. Appendix_F2_WB_RampStorage.ppt

Appendix G: 2030 Potential Diversion Graphics

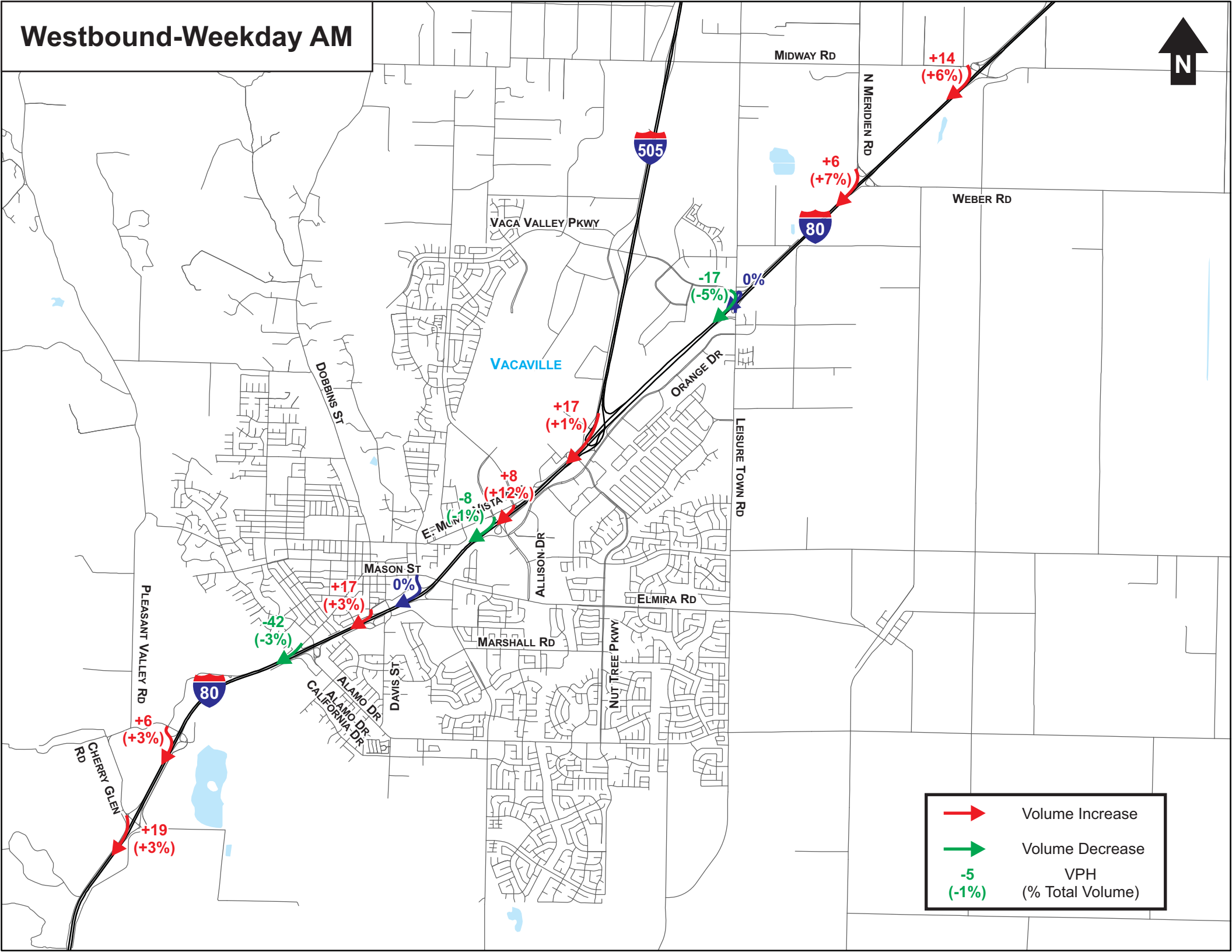
Westbound-Weekday AM



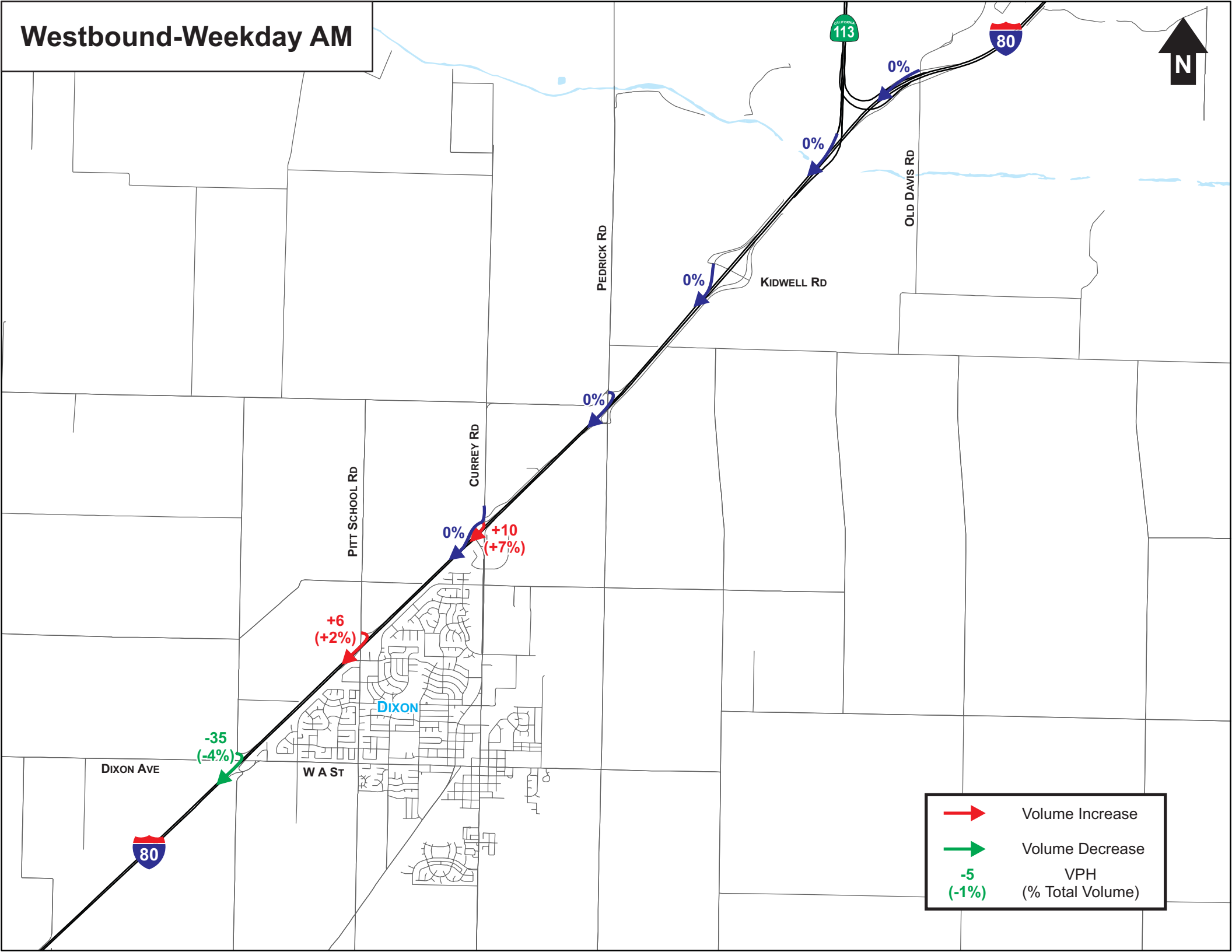
Westbound-Weekday AM



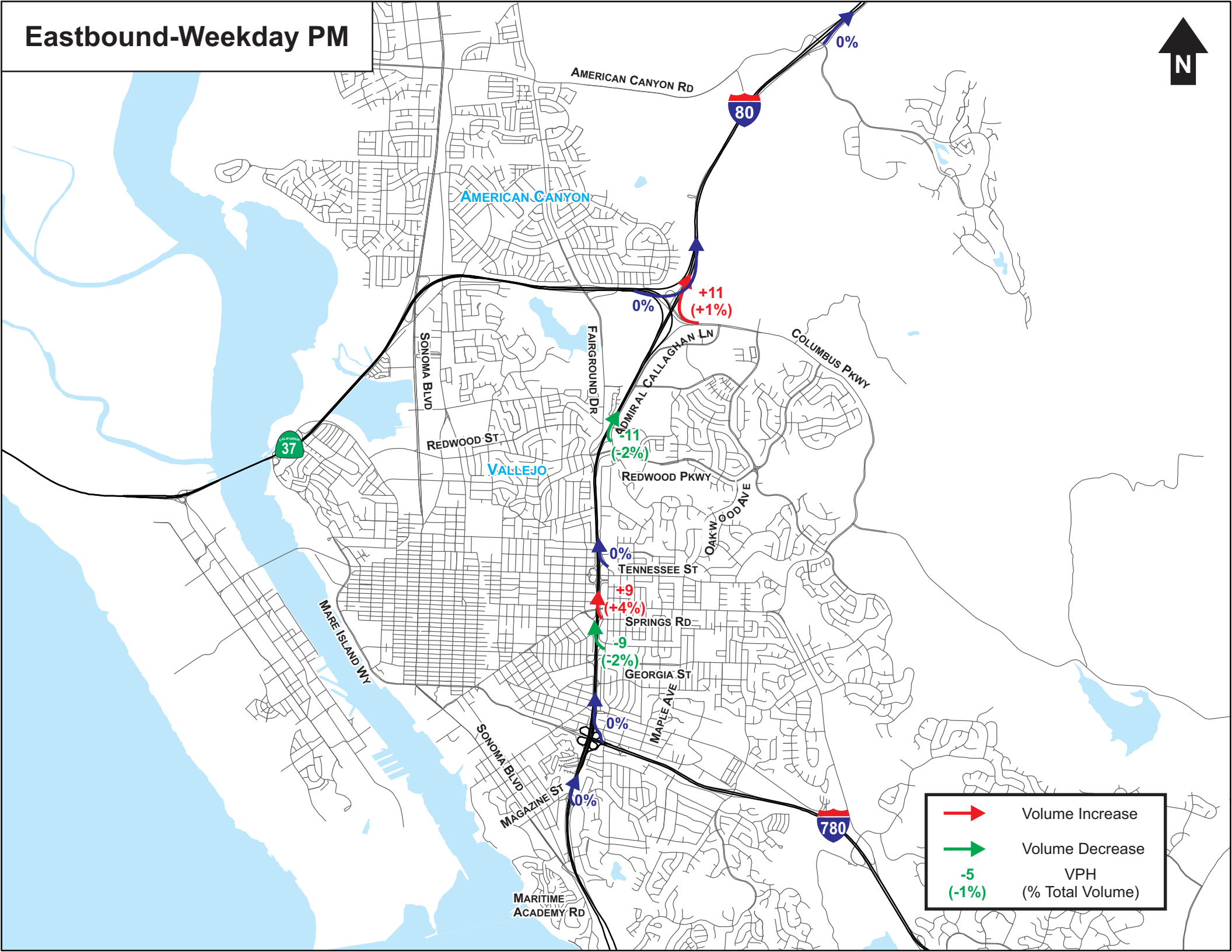
Westbound-Weekday AM



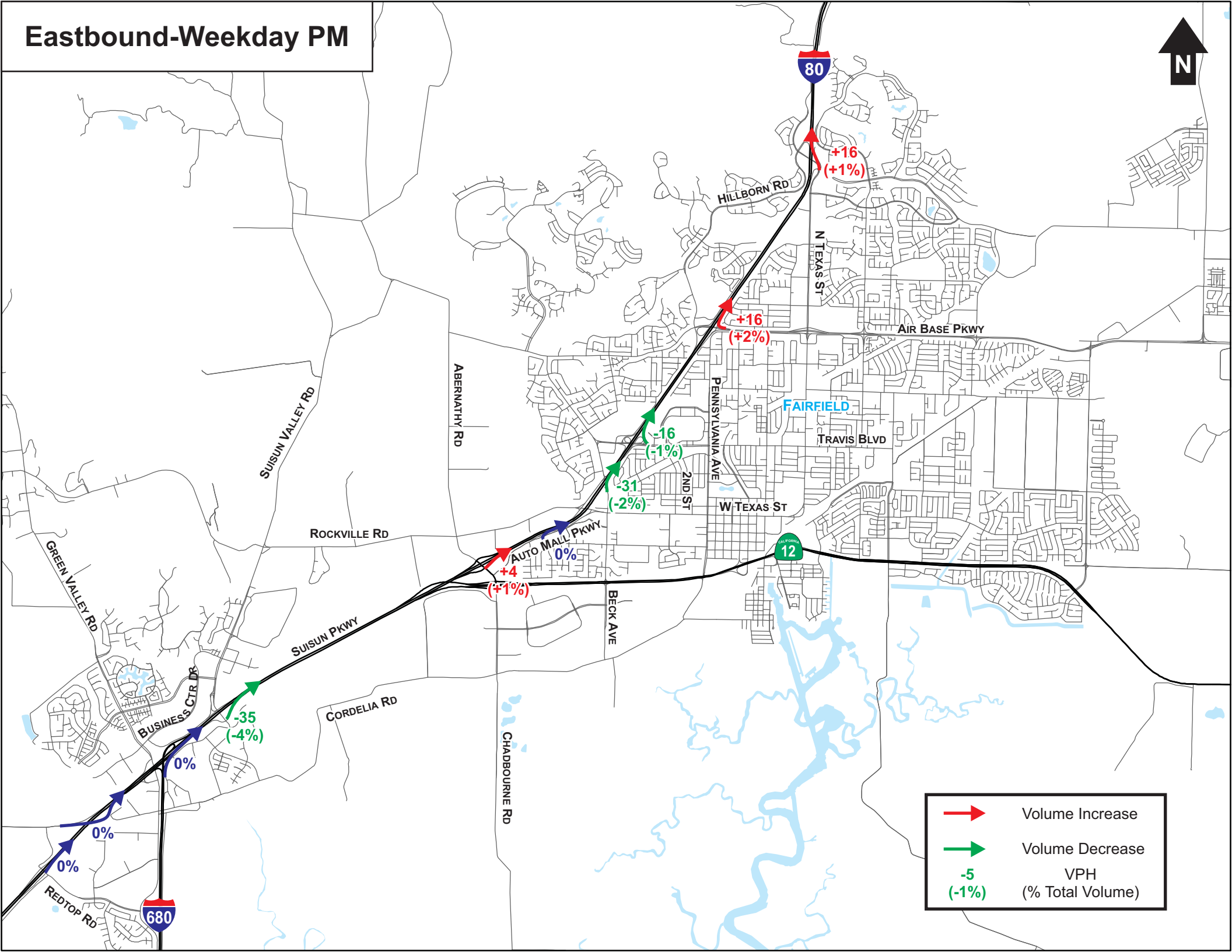
Westbound-Weekday AM



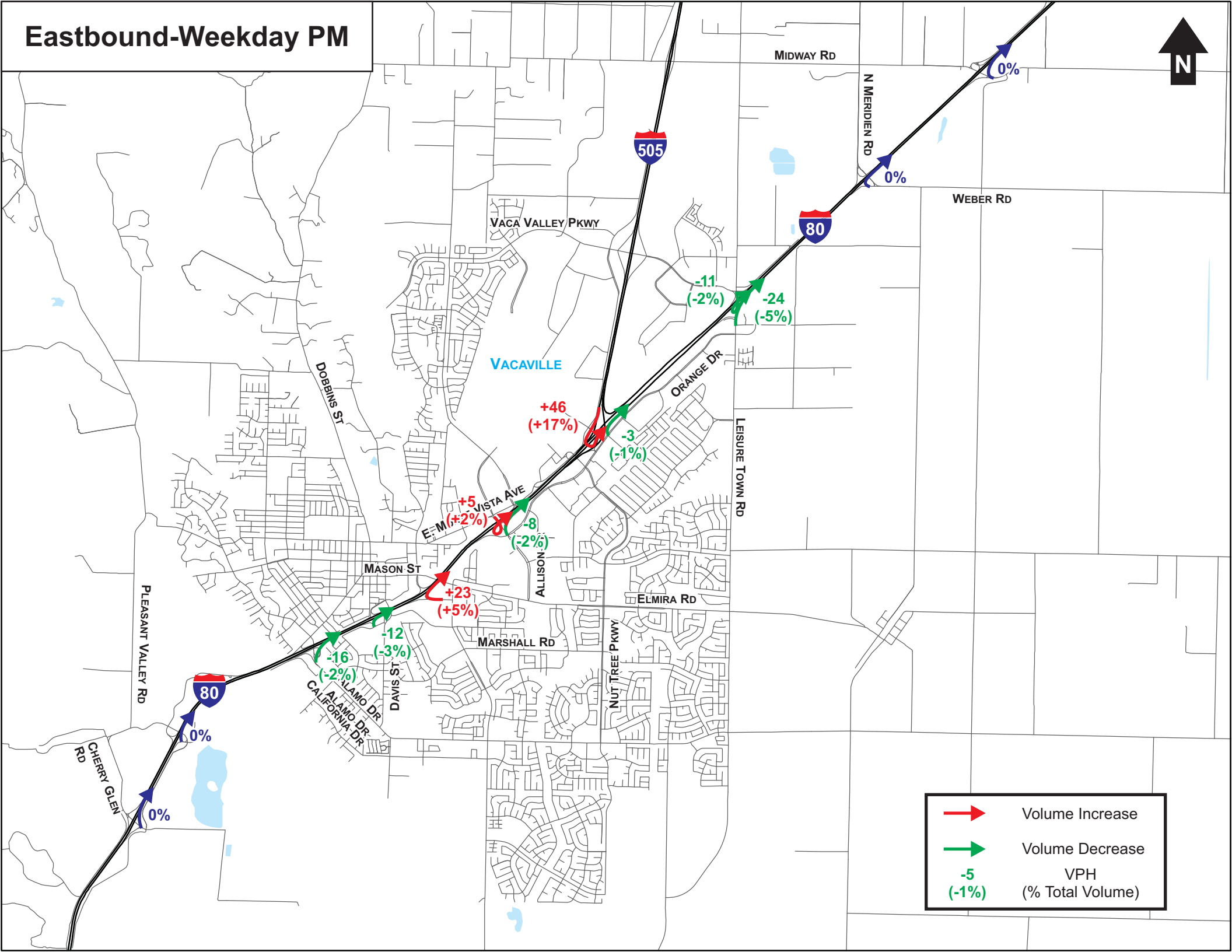
Eastbound-Weekday PM



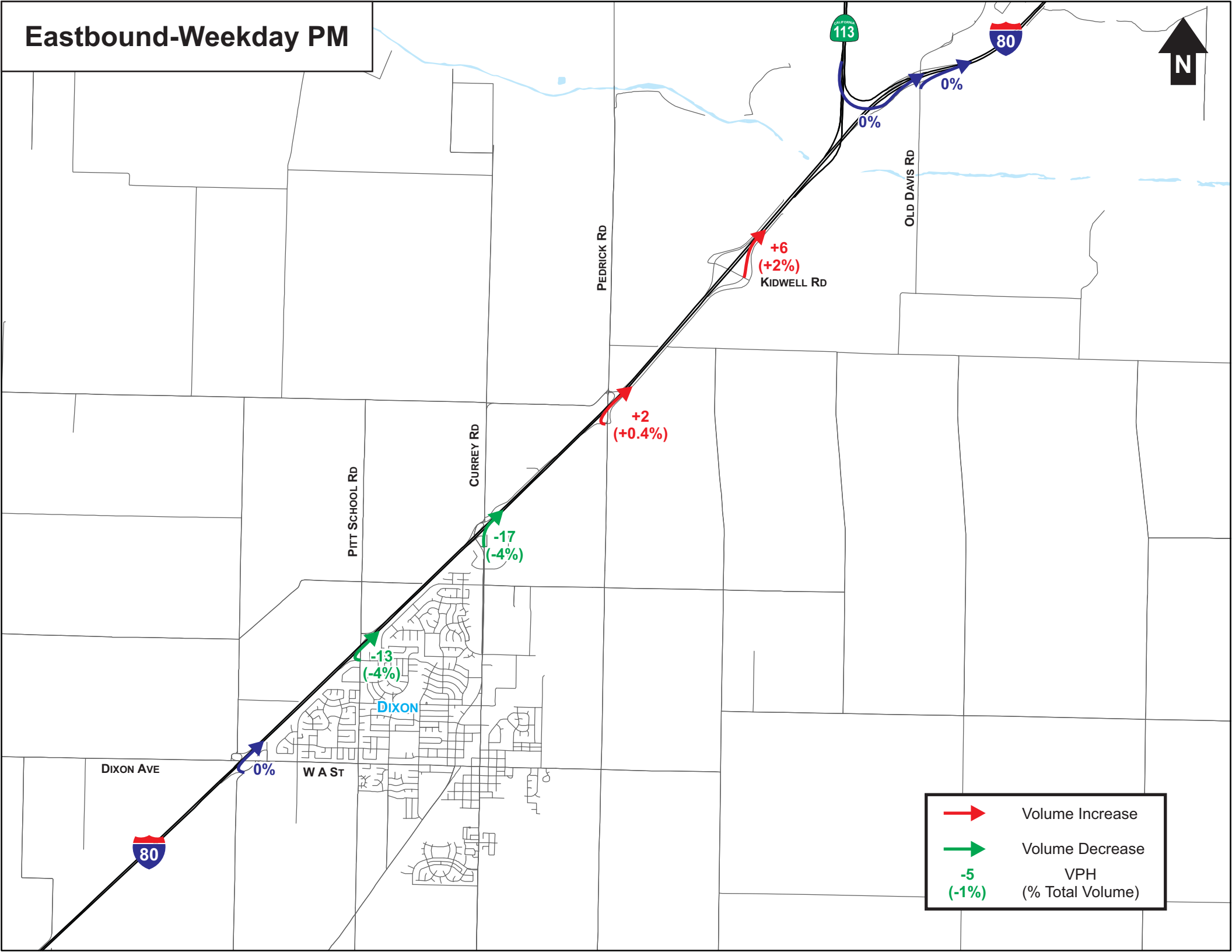
Eastbound-Weekday PM



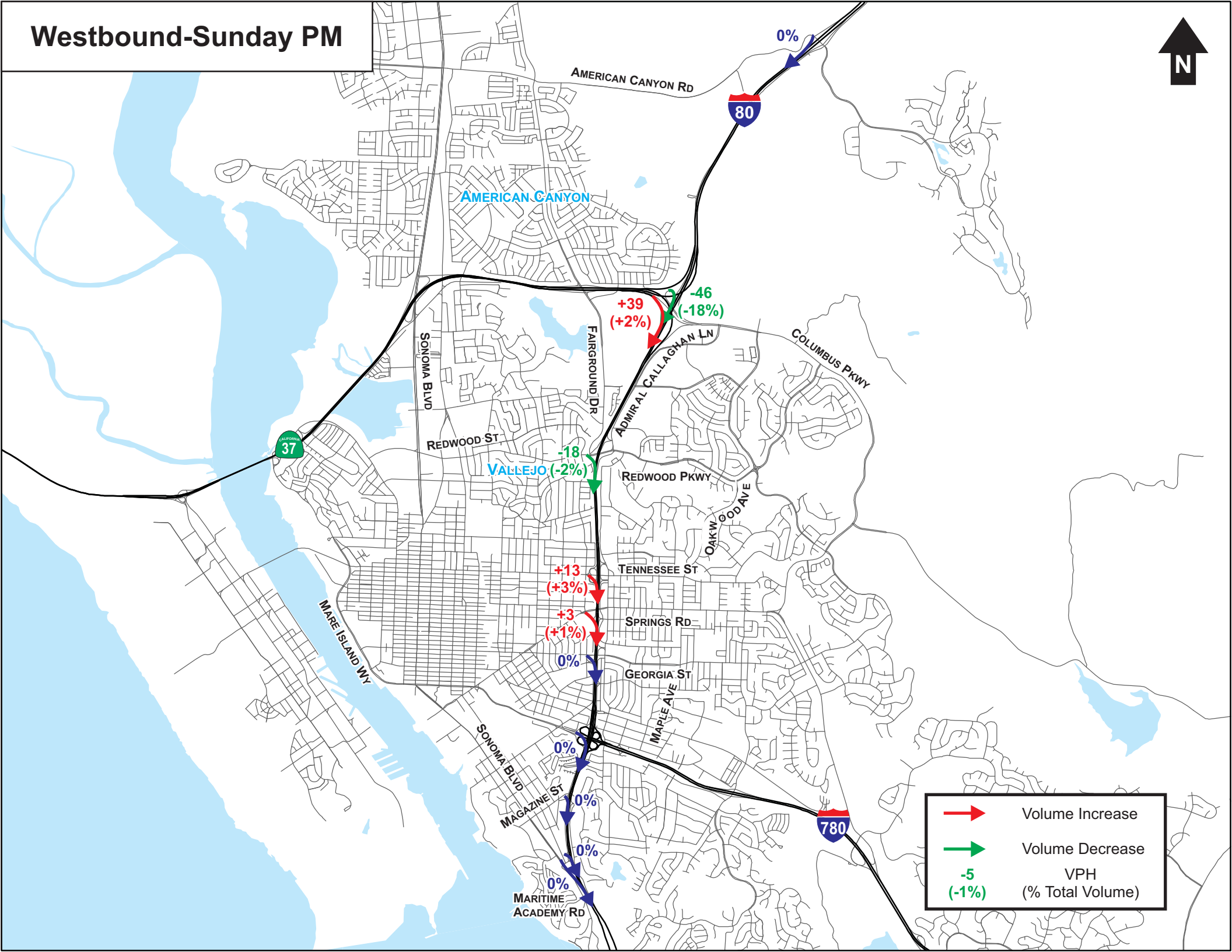
Eastbound-Weekday PM



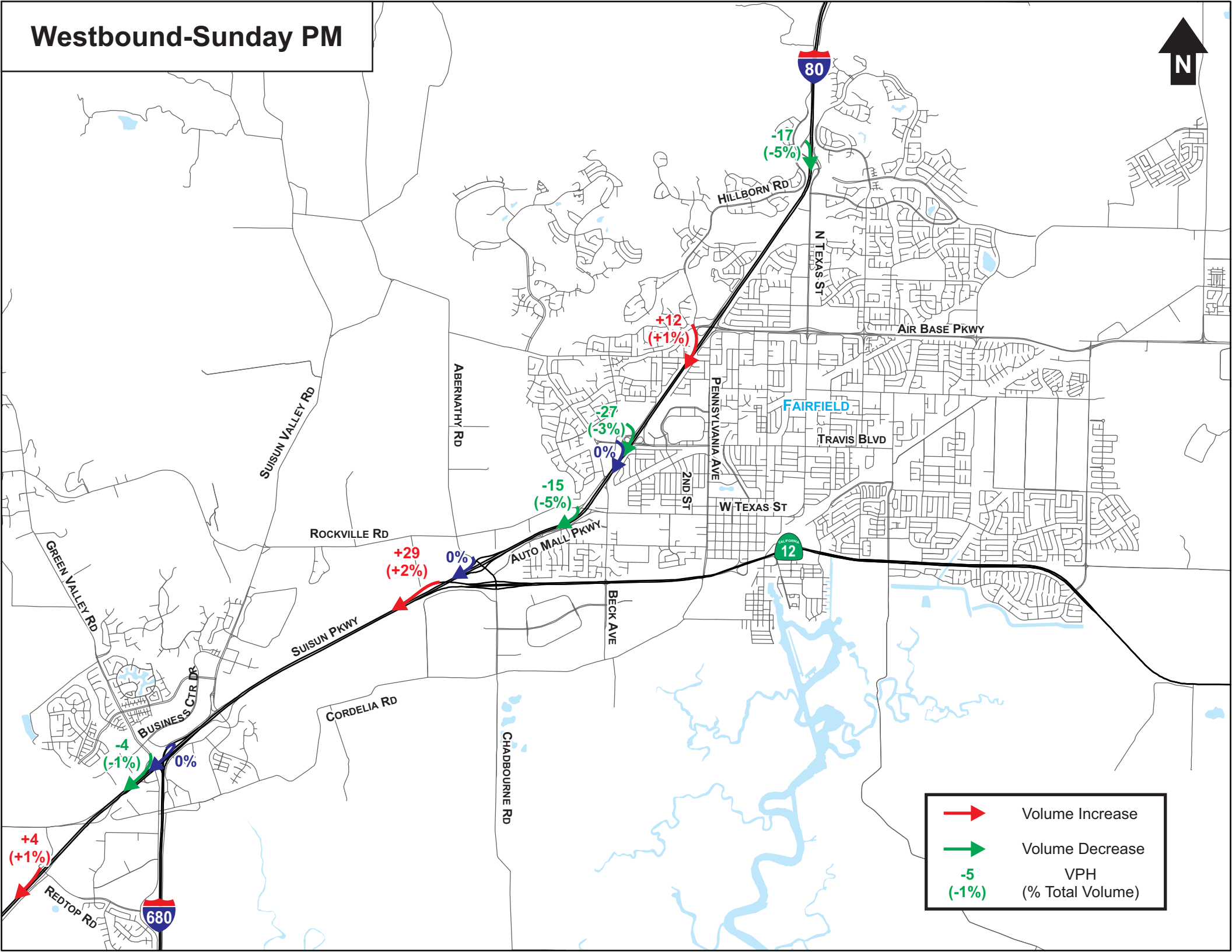
Eastbound-Weekday PM



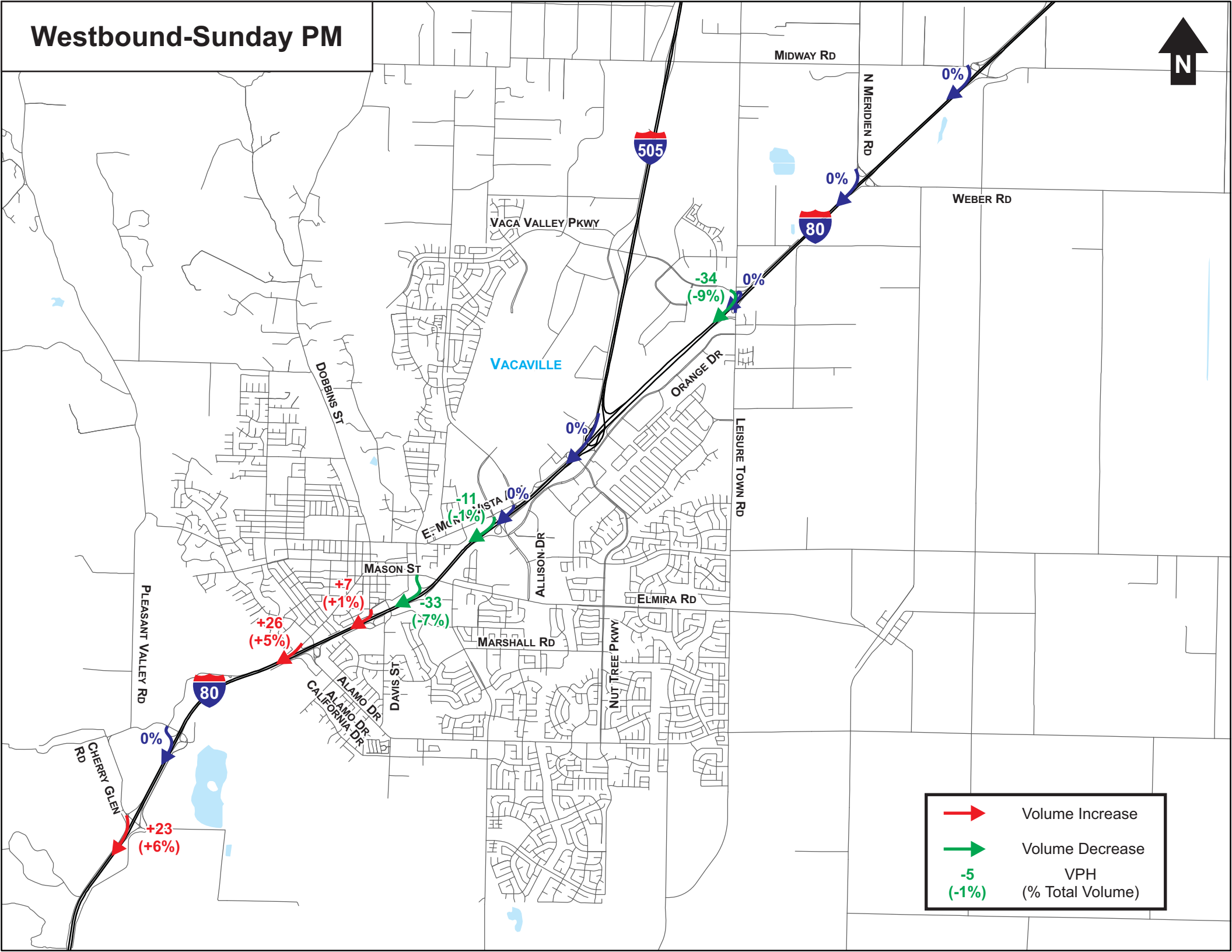
Westbound-Sunday PM



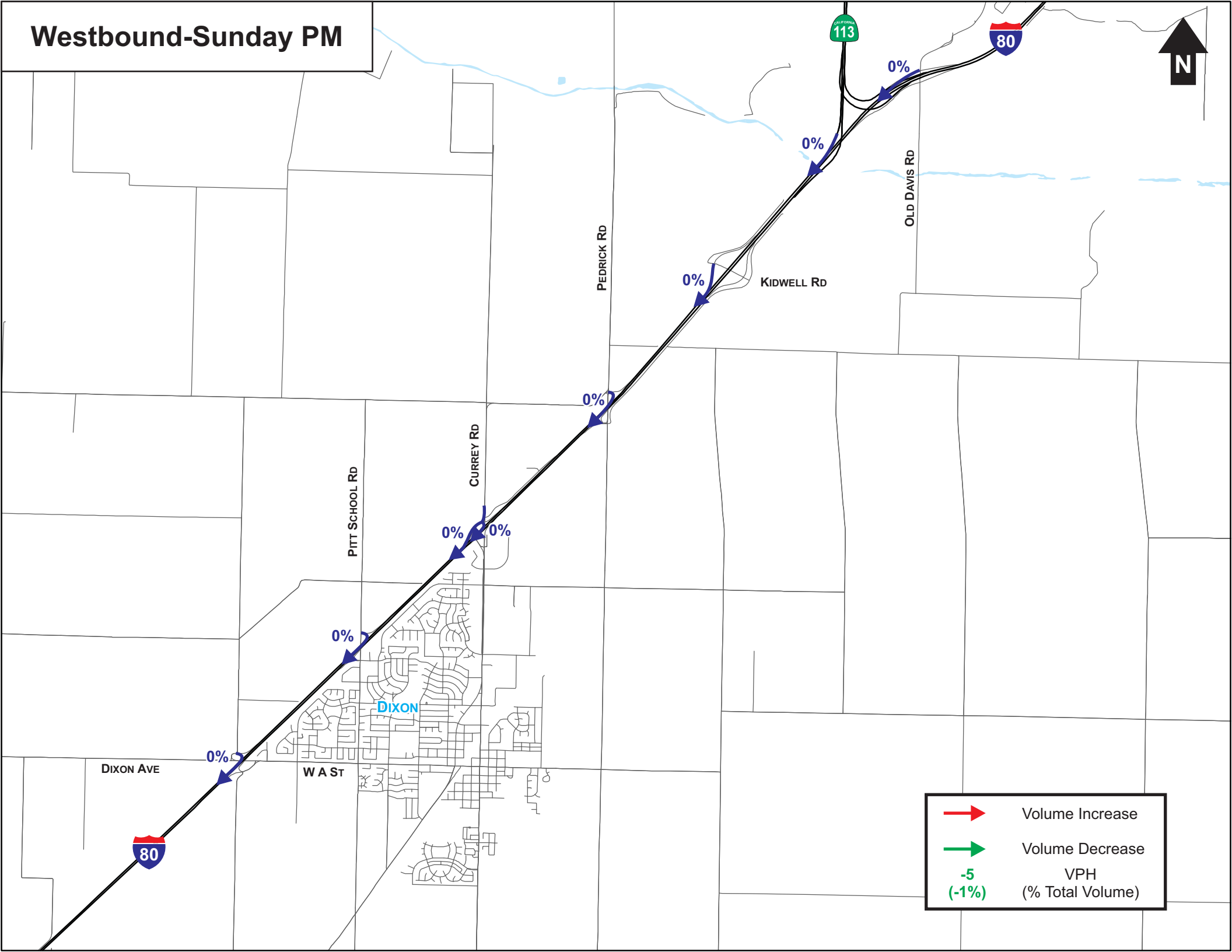
Westbound-Sunday PM



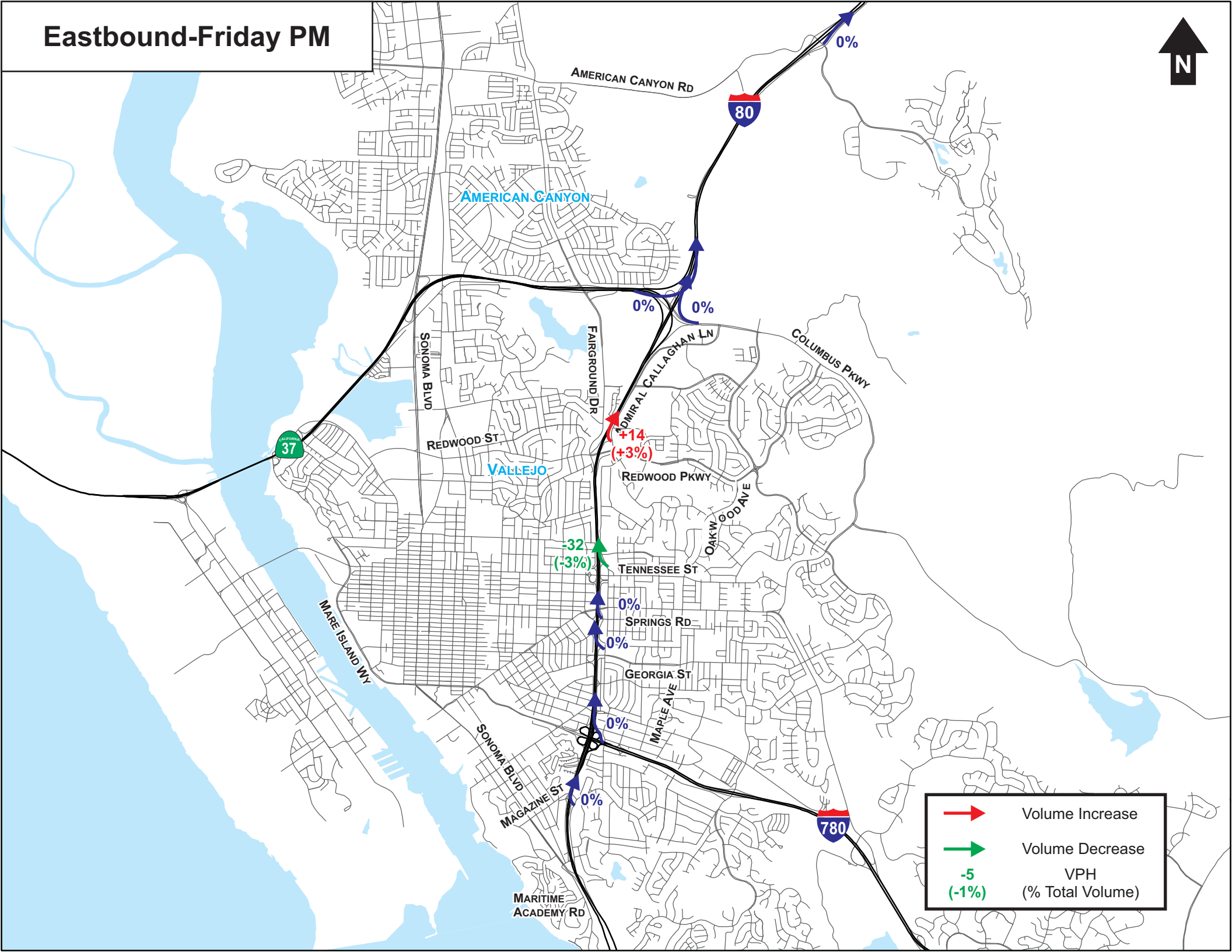
Westbound-Sunday PM



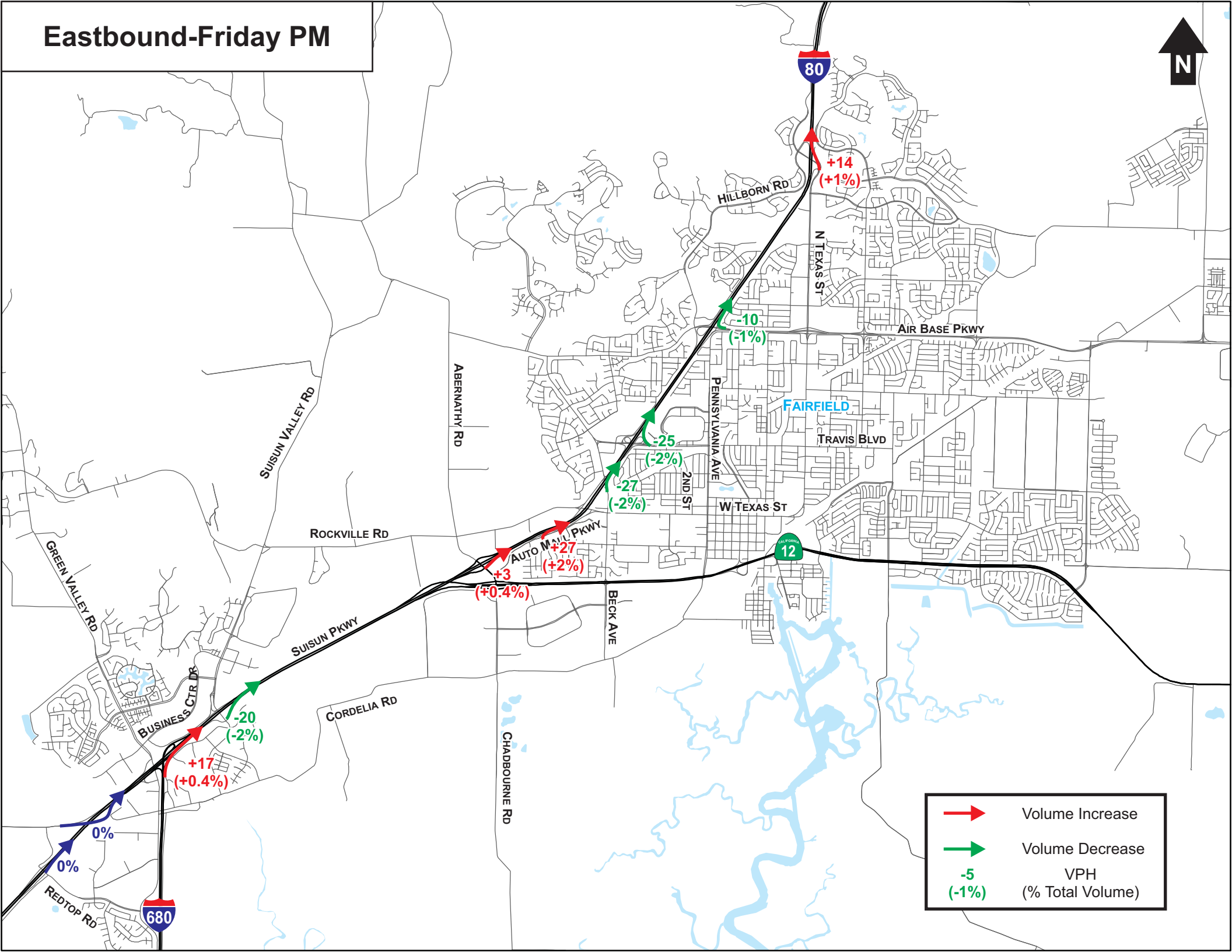
Westbound-Sunday PM



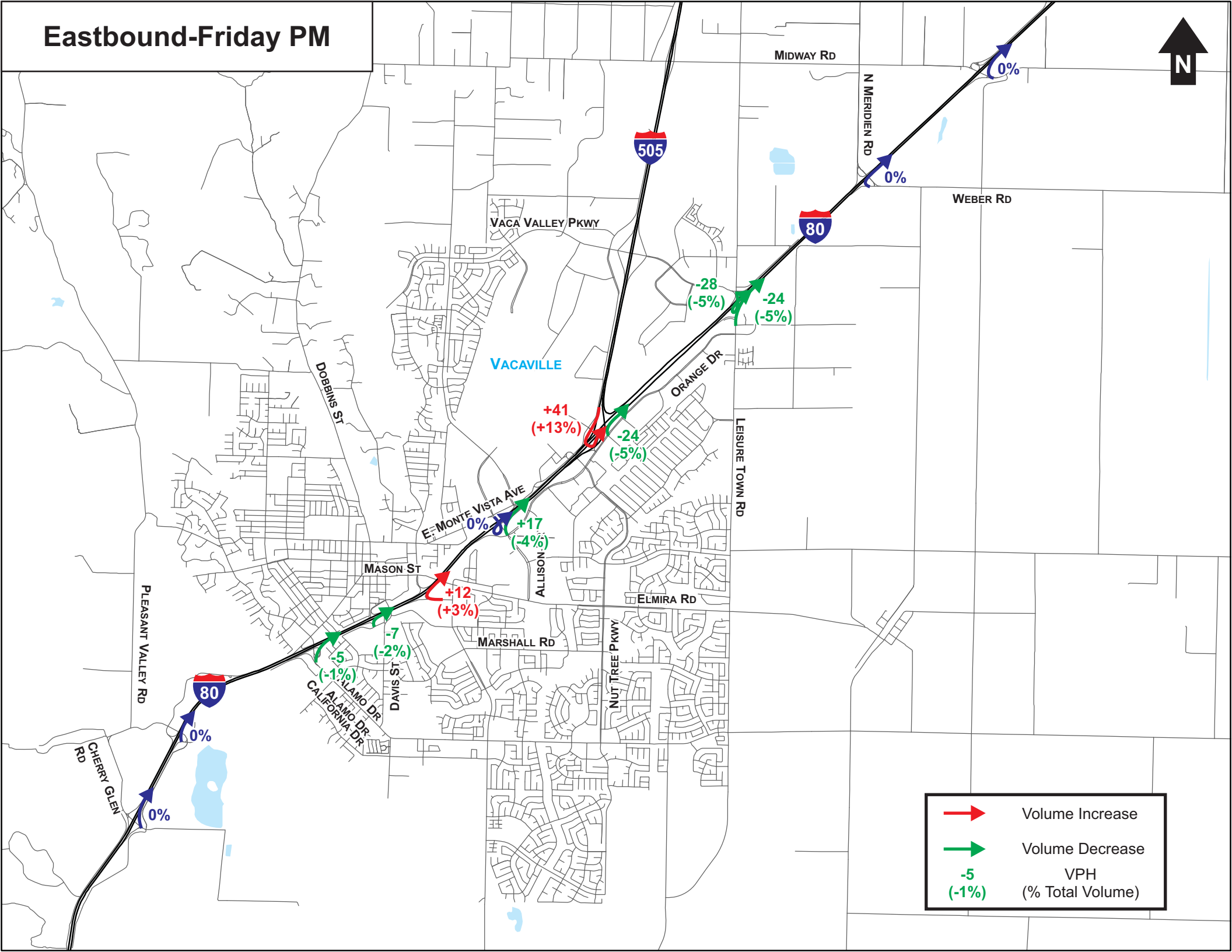
Eastbound-Friday PM



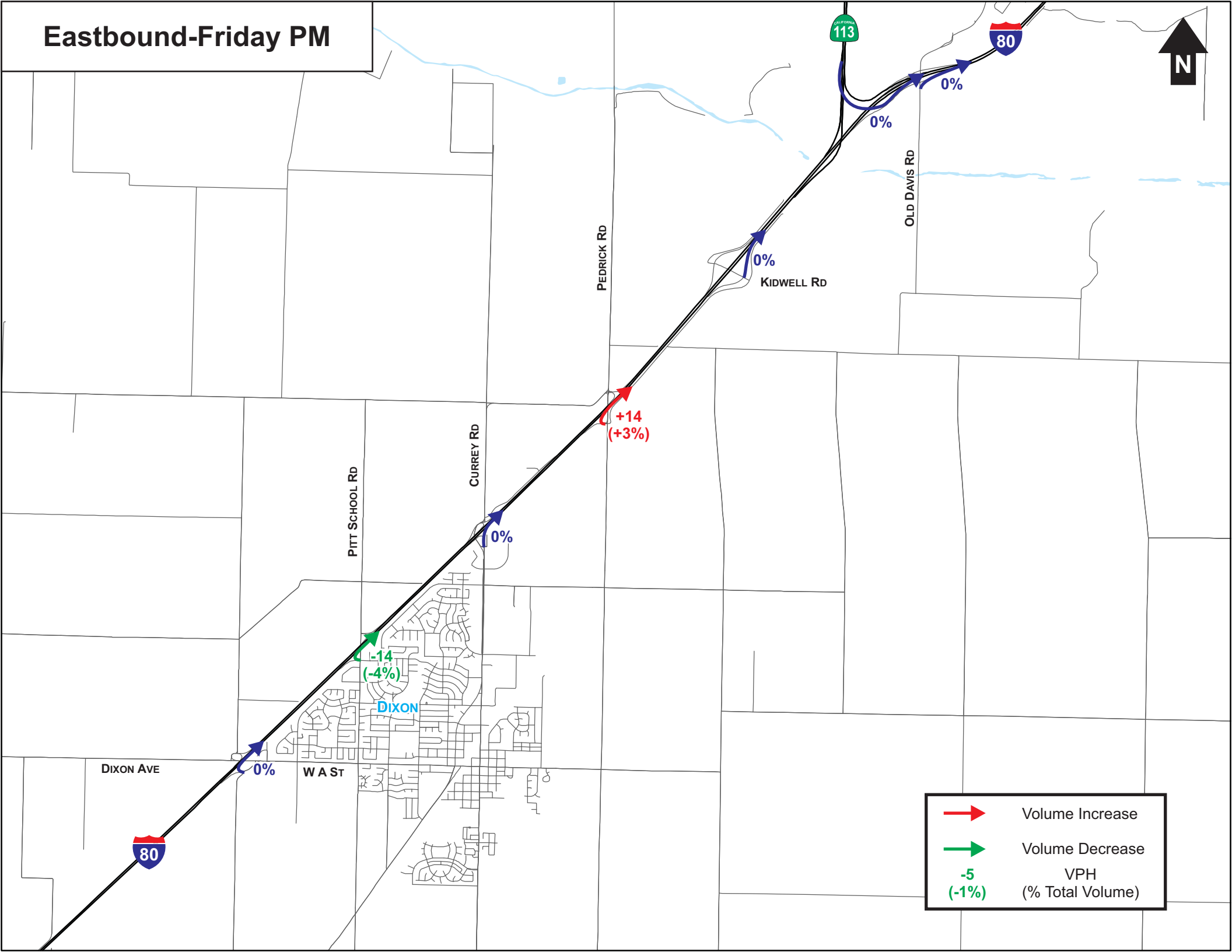
Eastbound-Friday PM



Eastbound-Friday PM



Eastbound-Friday PM



Appendix H: 2030 Peak Hour Forecast Results and V/C Ratios

2030 Westbound V/C Analysis

Westbound	Capacity		2030 Forcast Vol		2015 Queues		AM V/C		SUN V/C		Initial Year V/C >0.85		Range		
	AM	SUN	AM	SUN	AM	SUN	2015	2030	2015	2030	AM	SUN	AM	SUN	
Richards_On/Lane Add	7800	7800	5,130	5,383			0.57	0.66	0.60	0.69					
Lane Add/Old Davis_Off	9000	9000	5,130	5,383			0.50	0.57	0.52	0.60					
Old Davis_Off/SR 113_Off	9000	9000	4,754	5,325			0.46	0.53	0.51	0.59					
SR 113_Off/Old Davis_On	7800	7800	3,895	4,840			0.43	0.50	0.53	0.62					
Old Davis_On/SR 113_On	7800	7800	3,961	4,959			0.43	0.51	0.54	0.64					
SR 113_On/Kidwell_Off	7900	7900	5,105	5,982			0.52	0.65	0.61	0.76					
Kidwell_Off/Kidwell_On	7800	7800	4,955	5,905			0.52	0.64	0.62	0.76					
Kidwell_On/Lane Drop	7800	7800	5,035	5,960			0.52	0.65	0.62	0.76					
Lane Drop/Pedrick_Off	5850	5850	5,035	5,960			0.69	0.86	0.83	1.02	2029	2016			
Pedrick_Off/Pedrick_On	5850	5850	4,681	5,417			0.66	0.80	0.77	0.93		2022			
Pedrick_On/MilkFarm_Off	5850	5850	4,824	5,623			0.68	0.82	0.80	0.96		2019			
MilkFarm_Off/SR 113S_Off	5850	5850	4,809	5,611			0.68	0.82	0.80	0.96		2019			
SR 113S_Off/SR 113S_On	5850	5850	4,479	5,282			0.63	0.77	0.74	0.90		2025			
SR 113S_On/Currey_On	5850	5850	4,614	5,457			0.65	0.79	0.77	0.93		2022			
Currey_On/PittSchool_Off	5850	5850	4,621	5,477			0.65	0.79	0.77	0.94		2022			
PittSchool_Off/On	5850	5850	4,421	5,109			0.61	0.76	0.71	0.87		2027			
PittSchool_On/Dixon_Off	5850	5850	4,776	5,377			0.67	0.82	0.75	0.92		2023			
Dixon_Off/Dixon_On	5850	5850	4,679	5,263			0.66	0.80	0.73	0.90		2025			
Dixon_On/Midway_Off	5850	5850	5,527	5,621			0.73	0.94	0.77	0.96	2023	2021			
Midway_Off/Midway_On	5850	5850	5,364	5,572			0.71	0.92	0.75	0.95	2025	2022	**2023**	**2022**	MED
Midway_On/Meridan_Off	5850	5850	5,587	5,676			0.74	0.96	0.77	0.97	2022	2020	2029	2027	MAX
Meridan_Off/Meridan_On	5850	5850	5,504	5,651			0.73	0.94	0.77	0.97	2023	2021	2022	2016	MIN
Meridan_On/Lane Add1	5850	5850	5,582	5,710			0.74	0.95	0.78	0.98	2022	2020	**2024**	**2022**	AVG
Lane Add1/Lane Add2	7800	7800	5,582	5,710			0.55	0.72	0.58	0.73					
Lane Add2/LeisureTn_Off	8400	8400	5,582	5,710			0.51	0.66	0.54	0.68					
LeisureTown_Off/Loop_On	7800	7800	4,627	5,137			0.47	0.59	0.54	0.66					
Loop_On/Diag_On	7800	7800	4,778	5,233			0.49	0.61	0.55	0.67					
Diag_On/I-505_Off	7800	7800	5,113	5,616			0.50	0.66	0.56	0.72					
I-505_Off/Lane Drop	7800	7800	5,091	5,573			0.50	0.65	0.56	0.71					
Lane Drop/I-505_On	5850	5850	5,091	5,573			0.67	0.87	0.75	0.95	2028	2022			
I-505_On/EMonteVista_Off	7800	7800	6,778	7,559			0.64	0.87	0.72	0.97	2028	2022			
EMonteVista_Off/On	7800	7800	6,375	6,610			0.60	0.82	0.65	0.85		2030			
EMonteVista_On/BrVall_On	7800	7800	6,442	6,920			0.61	0.83	0.68	0.89		2027			
BrVall_On/Mason_Off	7800	7800	7,647	8,017			0.71	0.98	0.78	1.03	2022	2019			
Mason_Off/Mason_On	7800	7800	7,175	7,664			0.65	0.92	0.73	0.98	2026	2022			
Mason_On/Davis_Off	7800	7800	7,917	8,140			0.74	1.01	0.79	1.04	2021	2018			
Davis_Off/Davis_On	7800	7800	7,640	7,849			0.71	0.98	0.76	1.01	2022	2020			
Davis_On/Merchant_Off	7800	7800	8,148	8,383			0.77	1.04	0.83	1.07	2019	2016			
Merchant_Off/Merchant_On	7800	7800	7,593	8,091			0.70	0.97	0.78	1.04	2023	2019			
Mercht_On/CherryGlen_Off	7800	7800	8,980	8,639			0.88	1.15	0.84	1.11		2015			
CherryGOff/PenaAdobe_Off	7800	7800	8,896	8,532			0.88	1.14	0.83	1.09		2016	**2023**	**2019**	MED
PenaAdobe_Off/On	7800	7800	8,859	8,500			0.87	1.14	0.83	1.09		2016	2028	2030	MAX
PenaAdobe_On/LagoonV_Off	7800	7800	9,051	8,711			0.88	1.16	0.84	1.12		2015	2019	2015	MIN
LagoonValley_Off/On	7800	7800	8,536	8,192			0.87	1.09	0.83	1.05		2016	**2024**	**2020**	AVG
LagnVal_On/NTexas_Off	7800	7800	9,213	8,554			0.89	1.18	0.84	1.10		2015			
NTexas_Off/On	7800	7800	8,270	7,820			0.82	1.06	0.78	1.00	2016	2019			
NTexas_On/HOVBegin	7800	7800	8,790	8,147			0.87	1.13	0.81	1.04		2017			
HOVBegin/AirBaseW_Off	9450	9750	8,790	8,147			0.76	0.93	0.65	0.84	2022				
AirBaseWB_Off/EB_Off	9450	9750	8,495	8,064			0.72	0.90	0.64	0.83	2025				
AirBaseEB_Off/AirBase_On	9450	9750	7,983	7,669			0.66	0.84	0.61	0.79	2030				
AirBase_On/Lane Drop	10950	11250	9,483	8,561			0.69	0.87	0.60	0.76	2028				
Lane Drop/Travis_Off	9450	9750	9,483	8,561			0.82	1.00	0.69	0.88	2017	2027			
Travis_Off/TravisLoop_On	9450	9750	8,721	7,754			0.74	0.92	0.62	0.80	2024				
TravisLoop_On/Diag_On	10250	10550	9,201	8,678			0.71	0.90	0.65	0.82	2026				
TravisDiag_On/WTexas_Off	10250	10550	9,591	9,022			0.74	0.94	0.67	0.86	2023	2029			
WTexas_Off/WTexas_On	9450	9750	8,852	8,596			0.74	0.94	0.68	0.88	2023	2027			
WTexas_On/Lane Drop	9850	10150	9,298	8,901			0.75	0.94	0.69	0.88	2022	2027			
Lane Drop/SuisunCity_Off	9450	9750	9,298	8,901			0.79	0.98	0.72	0.91	2019	2025			
SuisunCity_Off/On	9450	9750	8,506	8,596			0.71	0.90	0.69	0.88	2026	2027			
SuisunCity_On/SR 12_On	9450	9750	9,212	8,876			0.73	0.97	0.70	0.91	2022	2025			
SR 12_On/Truck_Off	11400	11700	12,962	10,742			0.75	1.14	0.66	0.92	2018	2026			
Truck_Off/Truck_On	11400	11700	12,222	10,631			0.69	1.07	0.65	0.91	2021	2026			
Truck_On/SuisunVal_Off	11400	11700	12,946	10,742			0.75	1.14	0.66	0.92	2018	2026			
SuisunVal_Off/I-680_Off	11400	11700	12,121	10,257			0.69	1.06	0.62	0.88	2021	2028			
I-680_Off/I-680_On	9450	9750	8,121	6,700			0.58	0.86	0.55	0.69	2029				
I-680_On/Decel Lane	9450	9750	8,542	7,011			0.59	0.90	0.57	0.72	2027				
Decel Lane/SR 12_Off	11050	11350	9,307	7,473			0.49	0.84	0.49	0.66	2030				
SR 12_Off/GreenV_On	9450	9750	6,782	5,750			0.43	0.72	0.47	0.59			**2023**	**2026**	MED

Westbound	Capacity		2030 Forcast Vol		2015 Queues		AM V/C		SUN V/C		Initial Year V/C >0.85		Range		
	AM	SUN	AM	SUN	AM	SUN	2015	2030	2015	2030	AM	SUN	AM	SUN	
HOVEnd/RedTop_Off	8950	9125	6,782	5,750			0.56	0.76	0.55	0.63			2030	2029	MAX
SECOND HALF OF SPLIT SS	7300	7300	6,782	5,750			0.65	0.93	0.69	0.79	2025		2016	2015	MIN
RedTop_Off/RedTop_On	7800	7800	5,915	5,488			0.55	0.76	0.63	0.70			**2023**	**2025**	AVG
RedTopOn/AmericanCan_Off	7800	7800	6,787	5,789			0.62	0.87	0.66	0.74	2028				
AmericanCanyon_Off/On	7800	7800	6,447	5,493			0.58	0.83	0.63	0.70					
AmericanCan_On/RestA_Off	7800	7800	7,177	5,970		1.0	0.64	0.92	1.00	1.00	2026	2015			
RestArea_Off/On	7800	7800	7,112	5,905		1.0	0.64	0.91	1.00	1.00	2026	2015			
RestArea_On/SR 37_Off	8000	8000	7,176	5,970		1.0	0.63	0.90	1.00	1.00	2027	2015			
SR 37_Off/Columbus_Off	7800	7800	5,695	4,802		1.0	0.52	0.73	1.00	1.00		2015			
Columbus_Off/Columbus_On	7800	7800	5,077	4,155		1.0	0.47	0.65	1.00	1.00		2015			
Columbus_On/SR 37_On	7800	7800	5,168	4,408		1.0	0.48	0.66	1.00	1.00		2015			
SR 37_On/Redwood_Off	7800	7800	6,726	6,351	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015			
Redwood_Off/Redwood_On	5475	5475	6,158	5,746	1.0	1.0	1.00	1.12	1.00	1.05	2015	2015			
Redwood_On/Tennessee_Off	5475	5475	6,973	6,639	1.0	1.0	1.00	1.27	1.00	1.21	2015	2015			
Tennessee_Off/On	5475	5475	6,282	6,015	1.0		1.00	1.15	0.93	1.10	2015	2015			
Tennessee_On/Solano_Off	5875	5875	7,001	6,420	1.0		1.00	1.19	0.92	1.09	2015	2015			
Solano_Off/Solano_On	5475	5475	6,640	6,049	1.0		1.00	1.21	0.93	1.10	2015	2015			
Solano_On/Georgia_Off	5775	5775	6,906	6,295	1.0		1.00	1.20	0.92	1.09	2015	2015			
Georgia_Off/Georgia_On	5475	5475	6,591	5,972	1.0		1.00	1.20	0.91	1.09	2015	2015			
Georgia_On/I-780_Off	5475	5475	7,140	6,437	1.0		1.00	1.30	0.96	1.18	2015	2015			
I-780_Off/I-780_On	5475	5475	5,389	5,237			0.70	0.98	0.75	0.96	2022	2022			
I-780_On/Magazine_Off	5475	5475	6,576	5,760			0.91	1.20	0.84	1.05	2015	2015			
Magazine_Off/Magazine_On	5475	5475	5,977	5,244			0.84	1.09	0.77	0.96	2015	2021			
MagazineOn/MaritimeA_Off	5475	5475	6,387	5,457			0.91	1.17	0.80	1.00	2015	2018	**2015**	**2015**	MED
MaritimeAcademy_Off/On	5475	5475	4,565	3,763			0.87	0.83	0.77	0.69	2015		2028	2022	MAX
MaritimeAcad_On/SR29_On	7300	7300	4,992	4,353			0.69	0.68	0.61	0.60			2015	2015	MIN
SR29_On/ML_WestEnd	7300	7300	5,955	5,316			0.74	0.82	0.66	0.73			**2018**	**2016**	AVG

Note: Sunday has higher capacity than AM because the HOV lane would operate as a mixed-flow lane (HOV lane has a lower capacity at 1650 vphpl)
2015 Queues - Based on FREQ analysis. 1.0 is used at locations where queuing is anticipated from the 2015 analysis.

2030 Eastbound V/C Analysis

Eastbound	Capacity		2030 Forcast Vol		2015 Queues		Midwk V/C		Fri V/C		Initial Year V/C >0.85		Range		
	MidWk	Fri	MidWk	Fri	MidWk	Fri	2015	2030	2015	2030	Midwk	Fri	Midwk	Fri	
N/O_CarqBr/Sonoma_Off	7300	7300	8,711	8,593	1.0	1.0	1.00	1.19	1.00	1.18	2015	2015			
Sonoma_Off/Sequoia_Off	5475	5475	7,635	7,554	1.0	1.0	1.00	1.39	1.00	1.38	2015	2015			
Sequoia_Off/Magazine_Off	5475	5475	6,772	6,903	1.0	1.0	1.00	1.24	1.00	1.26	2015	2015			
Magazine_Off/Magazine_On	5475	5475	6,340	6,423	1.0	1.0	1.00	1.16	1.00	1.17	2015	2015			
Magazine_On/I-780_Off	5475	5475	6,862	6,965	1.0	1.0	1.00	1.25	1.00	1.27	2015	2015			
I-780_Off/Frontage_Off	5475	5475	5,201	5,424	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015			
Frontage_Off/I-780_On	5475	5475	4,427	4,279	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015			
I-780_On/Georgia_Off	5475	5475	6,377	6,103	1.0	1.0	1.00	1.16	1.00	1.11	2015	2015			
Georgia_Off/Georgia_On	5475	5475	5,931	5,740	1.0	1.0	1.00	1.08	1.00	1.05	2015	2015			
Georgia_On/Solano_Off	5775	5775	6,359	6,243	1.0	1.0	1.00	1.10	1.00	1.08	2015	2015			
Solano_Off/Solano_On	5475	5475	6,133	6,032	1.0	1.0	1.00	1.12	1.00	1.10	2015	2015			
Solano_On/Tennessee_Off	5675	5675	6,353	6,234	1.0	1.0	1.00	1.12	1.00	1.10	2015	2015			
Tennessee_Off/On	5475	5475	5,572	5,566	1.0	1.0	1.00	1.02	1.00	1.02	2015	2015			
Tennessee_On/RedwoodOff1	5475	5475	6,611	6,647	1.0	1.0	1.00	1.21	1.00	1.21	2015	2015			
RedwoodOff1/Redwood_Off2	5850	5850	5,691	5,755			0.85	0.97	0.85	0.98	2015	2015			
Redwood_Off2/Redwood_On	5850	5850	5,239	5,316			0.78	0.90	0.79	0.91	2024	2022			
Redwood_On/SR 37_Off	5850	5850	5,786	5,769			0.84	0.99	0.84	0.99	2016	2016			
SR 37_Off/Lane Add1	5850	5850	3,789	3,770			0.53	0.65	0.53	0.64					
Lane Add1/Lane Add2	7800	7800	3,789	3,770			0.40	0.49	0.40	0.48					
Lane Add2/Columbus_On	9750	9750	3,789	3,770			0.32	0.39	0.32	0.39					
Columbus_On/SR 37_On	9750	9750	4,614	4,651			0.37	0.47	0.37	0.48					
SR 37_On/Lane Drop1	11150	11150	6,924	6,838			0.45	0.62	0.44	0.61			**2015**	**2015**	MED
Lane Drop1/Lane Drop2	9750	9750	6,924	6,838			0.51	0.71	0.50	0.70			2027	2028	MAX
Lane Drop2/AmeriCany_Off	7800	7800	6,924	6,838			0.64	0.89	0.63	0.88	2027	2028	2015	2015	MIN
AmeriCany_Off/On	7800	7800	6,016	5,874			0.58	0.77	0.56	0.75			**2016**	**2016**	AVG
AmeriCany_On/RedTop_Off	7800	7800	6,655	6,533			0.62	0.85	0.61	0.84	2029	2030			
RedTop_Off/RedTop_On	7800	7800	5,865	5,737			0.56	0.75	0.54	0.74					
RedTop_On/SR12_On_HOV	7800	7800	6,458	6,962			0.60	0.83	0.64	0.89		2027			
SECOND HALF OF SPLIT SS	9450	9450	6,458	6,962			0.52	0.68	0.55	0.74					
SR12_On/I-680_Off	10750	10750	8,389	8,833			0.58	0.78	0.61	0.82					
I-680_Off/I-680_On	9450	9450	7,040	7,523			0.57	0.74	0.59	0.80					
I-680_On/SuisunValle_Off	11400	11400	11,000	11,483		1.0	0.73	0.96	1.00	1.01	2022	2015			
SuisunValle_Off/On	11400	11400	10,353	10,864		1.0	0.70	0.91	1.00	1.00	2025	2015			
SuisunValle_On/Truck_Off	11400	11400	11,245	11,850		1.0	0.77	0.99	1.00	1.04	2020	2015			
Truck_Off/Truck_On	11400	11400	11,245	11,850		1.0	0.76	0.99	1.00	1.04	2020	2015			
Truck_On/SR12_Off	11400	11400	11,245	11,850		1.0	0.77	0.99	1.00	1.04	2020	2015			
SR12_Off/SuisunCity_Off	9450	9450	7,554	8,538		1.0	0.77	0.80	1.00	1.00		2015			
SuisunCity_Off/On	9450	9450	6,943	7,954		1.0	0.75	0.73	1.00	1.00		2015			
SuisunCity_On/WTexas_Off	10150	10150	7,724	8,641		1.0	0.76	0.76	1.00	1.00		2015			
WTexas_Off/WTexas_On	9450	9450	5,228	6,484		1.0	0.66	0.55	1.00	1.00		2015			
WTexas_On/Beck_On	9450	9450	6,729	7,867		1.0	0.74	0.71	1.00	1.00		2015			
Beck_On/Travis_Off	10650	10650	8,276	9,196		1.0	0.76	0.78	1.00	1.00		2015			
Travis_Off/Travis_On	9450	9450	6,955	8,078		1.0	0.74	0.74	1.00	1.00		2015			
Travis_On/Lane Add	9450	9450	8,406	9,352	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015			
LaneAdd/Air Base_Off	10950	10950	8,406	9,352	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015			
Air Base_Off/Air Base_On	9450	9450	6,668	8,133	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015	**2018**	**2015**	MED
Air Base_On/HOVEnd	9450	9450	7,646	9,114	1.0	1.0	1.00	1.00	1.00	1.00	2015	2015	2029	2030	MAX
HOVEnd/N Texas_Off	7300	7300	7,646	9,114	1.0	1.0	1.00	1.05	1.00	1.25	2015	2015	2015	2015	MIN
N Texas_Off/N Texas_On	7800	7800	6,886	8,461			0.87	0.88	0.88	1.08	2015	2015	**2019**	**2016**	AVG
N Texas_On/LagoonV_Off	7800	7800	8,034	9,734			0.95	1.03	0.97	1.25	2015	2015			
LagoonV_Off/LagoonV_On	7800	7800	7,352	9,233			0.93	0.94	0.96	1.18	2015	2015			
LagoonV_On/PenaAdobe_Off	7800	7800	7,975	9,954			0.95	1.02	0.98	1.28	2015	2015			
PenaAdobe_Off/On	7800	7800	7,898	9,906			0.95	1.01	0.98	1.27	2015	2015			
PenaAdobe_On/Alamo_Off	7800	7800	8,123	10,234			0.95	1.04	0.99	1.31	2015	2015			
Alamo_Off/Alamo_On	7800	7800	6,632	8,989			0.77	0.85	0.85	1.15	2029	2015			
Alamo_On/Davis_Off	7800	7800	7,354	9,668			0.86	0.94	0.93	1.24	2015	2015			
Davis_Off/Davis_On	7800	7800	6,742	9,082			0.79	0.86	0.87	1.16	2027	2015			
Davis_On/Mason_Off	7800	7800	7,152	9,449			0.83	0.92	0.91	1.21	2018	2015			
Mason_Off/Mason_On	7800	7800	6,493	8,822			0.75	0.83	0.84	1.13		2015			
Mason_On/NutTree_Off	7800	7800	6,978	9,300			0.81	0.89	0.90	1.19	2022	2015			
NutTree_Off/LoopOn	7800	7800	5,577	7,857			0.64	0.71	0.74	1.01		2021			
NutTree_LoopOn/DiagOn	8300	8300	5,800	8,124			0.63	0.70	0.72	0.98		2022			
NutTree_DiagOn/I-505_Off	8300	8300	6,200	8,538			0.65	0.75	0.75	1.03		2020			
I-505_Off/I-505_On	7800	7800	4,838	6,655			0.58	0.62	0.65	0.85		2029			
I-505_On/Orange_On	7800	7800	5,115	6,971			0.61	0.66	0.69	0.89		2026			
Orange_On/LeisureTown_Of	7800	7800	5,605	7,446			0.66	0.72	0.73	0.95		2023	**2015**	**2015**	MED
LeisureTown_Off/LoopOn	7800	7800	4,894	6,783			0.60	0.63	0.68	0.87		2028	2029	2029	MAX
LeisureTn_LoopOn/DiagOn	7800	7800	5,466	7,346			0.63	0.70	0.71	0.94		2024	2015	2015	MIN
LeisureT_DiagOn/LaneDrop	7800	7800	5,956	7,828			0.66	0.76	0.74	1.00		2021	**2019**	**2019**	AVG
LaneDrop/Weber_Off	5850	5850	5,956	7,828			0.89	1.02	0.99	1.34	2015	2015			

Eastbound	Capacity		2030 Forcast Vol		2015 Queues		Midwk V/C		Fri V/C		Initial Year V/C >0.85		Range		
Weber_Off/Weber_On	5850	5850	5,802	7,695			0.87	0.99	0.98	1.32	2015	2015			
Weber_On/Midway_Off	5850	5850	5,922	7,760			0.88	1.01	0.98	1.33	2015	2015			
Midway_Off/Midway_On	5850	5850	5,645	7,490			0.84	0.96	0.95	1.28	2016	2015			
Midway_On/Dixon_Off	5850	5850	5,814	7,622			0.87	0.99	0.97	1.30	2015	2015			
Dixon_Off/Dixon_On	5850	5850	5,010	6,810			0.80	0.86	0.91	1.16	2028	2015			
Dixon_On/PittSchool_Off	5850	5850	5,147	6,990			0.82	0.88	0.93	1.19	2022	2015			
PittSchool_Off/On	5850	5850	4,621	6,385			0.75	0.79	0.86	1.09		2015			
PittSchool_On/Curry_Off	5850	5850	4,955	6,741			0.80	0.85	0.91	1.15	2030	2015			
Curry_Off/Curry_On	5850	5850	4,755	6,517			0.77	0.81	0.88	1.11		2015			
Curry_On/Pedrick_Off	5850	5850	5,174	6,975			0.84	0.88	0.95	1.19	2018	2015			
Pedrick_Off/Pedrick_On	5850	5850	4,915	6,697			0.81	0.84	0.93	1.14		2015			
Pedrick_On/Lane Add	5850	5850	5,365	7,116			0.83	0.92	0.95	1.22	2018	2015			
Lane Add/Kidwell_Off	7800	7800	5,365	7,116			0.62	0.69	0.71	0.91		2025			
Kidwell_Off/Kidwell_On	7800	7800	5,218	6,885			0.62	0.67	0.71	0.88		2027			
Kidwell_On/SR 113_Off	7900	7900	5,510	7,287			0.62	0.70	0.70	0.92		2025			
SR 113_Off/OldDavis_Off	7800	7800	4,494	5,871		1.0	0.54	0.58	1.00	1.00		2015	**2017**	**2015**	MED
OldDavis_Off/SR 113_On	7800	7800	4,400	5,774		1.0	0.54	0.56	1.00	1.00		2015	2030	2027	MAX
SR 113_On/OldDavis_On	8700	8700	5,469	6,602		1.0	0.59	0.63	1.00	1.00		2015	2015	2015	MIN
OldDavis_On/LaneDrop_1	10050	10050	5,767	6,835		1.0	0.53	0.57	1.00	1.00		2015	**2019**	**2015**	AVG

2015 Queues - Based on FREQ analysis. 1.0 is used at locations where queuing is anticipated from the 2015 analysis.