Appendix 4.12-8 Final Traffic Volume Forecasts

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 6

To:	City of Redding - Engineering	**Date:**	August 12, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Final Traffic Volume Forecasts	**Job No.:**	45-5721-27
		File No.:	C2174MEM006
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

The following summarizes the approach to preparing the final traffic volumes forecasts that will be used for the Traffic Operations Report.

History

Technical Memorandum No. 4 contained proposed traffic forecasts. The following issues were identified with the data contained in Technical Memorandum No. 4:

- The PM peak hour traffic distribution for the BoxCo TAZ, from the Regional Model, did not match the ITE rates.
- The AM and PM peak hour traffic distribution for the California Gold TAZ, from the Regional Model, was suspect.

A select link analysis was performed for the BoxCo and California Gold TAZ's with the results presented in **Technical Memorandum No. 5**. Upon review of the select link analysis, it was evident that there was an imbalance between inbound and outbound trips for both TAZ's.

Via. a July 7, 2016 email, Omni-Means recommended:

- No adjustments to the overall peak hour trips from each of the TAZ's.
- Manually adjusting the inbound and outbound peak hour volumes for both TAZ's to closely match ITE rates. The manual adjustments will be based upon the ITE codes in Table 1:

Table 1: BoxCo and California Gold TAZ – Model Trips Adjusted to ITE IN/OUT Splits

		AM Peak Hour			PM Peak Hour		
Landuse	Descriptor	In	Out	Total	In	Out	Total
BoxCo[1]	Model (used in forecasts)	NA	NA	NA	444	445	889
California Gold	Model (used in forecasts)	188	166	354	236	217	453
	ITE from Traffic Study (for comparison only)	169	155	324	253	240	493

Notes 1. Trip generation for Boxco based on actual trip rates from the existing site were used. Adjusted upwards to reflect a gas station and additional retail.

Via. emails on July 11, 2016, City and Caltrans staff concurred with the July 7, 2016 Omni-Means recommendations and directed Omni-Means to:

- Manually adjust the portion of BoxCo TAZ trips that are to/from Interstate 5 to 60% to/from the north and 40% to/from the south.

Manual Adjustments

While making the adjustments described under "History" above, we noted some anomalies likely due to the model redistribution with the buildout of the proposed uses. There were instances where the 2025 volumes were lower than the existing counts. To account for these anomalies, we checked the forecasted turning movements for reasonableness and made adjustments where necessary.

Final Traffic Volume Forecasts

The final forecasts were derived with the AM forecasts presented in Table 2 and the PM forecasts presented in Table 3, and in the attached figures.

Table 2: AM Peak Hour Final Traffic Volume Forecasts

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Year 2025 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	15	15	20	145	5	155	275	1000	15	30	985	320
2	**S Bonnyview Rd/I-F SB Ramps**				190		555		890	275	250	790	
3	**S Bonnyview Rd/I-5 NB Ramps**	410		265				470	615			640	520
4	**Churn Creek Rd/S Bonnyview Rd**	160	30	65	70	25	405	365	355	170	65	585	130
5	Churn Creek Rd/Alrose				15		105	45	440	5	5	685	20
Year 2035 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	20	20	25	160	10	165	290	1055	20	40	1080	360
2	**S Bonnyview Rd/I-F SB Ramps**	0	0	0	225	0	620	0	945	300	265	865	0
3	**S Bonnyview Rd/I-5 NB Ramps**	465	0	295	0	0	0	485	690	0	0	665	540
4	**Churn Creek Rd/S Bonnyview Rd**	160	30	65	100	25	420	425	400	170	65	625	160
5	Churn Creek Rd/Alrose	0	0	0	15	0	105	45	515	5	5	745	20
Year 2045 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	20	20	25	170	10	175	305	1110	20	45	1170	395
2	**S Bonnyview Rd/I-F SB Ramps**				255		685		995	320	275	935	
3	**S Bonnyview Rd/I-5 NB Ramps**	520		320				500	760			690	555
4	**Churn Creek Rd/S Bonnyview Rd**	160	30	65	130	25	430	480	440	170	65	665	190
5	Churn Creek Rd/Alrose				15		105	45	585	5	5	805	20

Table 3: PM Peak Hour Final Traffic Volume Forecasts

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Year 2025 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	25	15	25	635	20	310	185	1090	25	20	1015	390
2	**S Bonnyview Rd/I-F SB Ramps**				280		575		1230	520	300	855	
3	**S Bonnyview Rd/I-5 NB Ramps**	325	5	250				630	880			825	285
4	**Churn Creek Rd/S Bonnyview Rd**	125	10	25	145	15	475	410	640	80	35	505	130
5	Churn Creek Rd/Alrose	10	5	5	25		95	105	700	5	5	565	30
Year 2035 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	25	20	35	715	20	340	200	1165	30	25	1070	440
2	**S Bonnyview Rd/I-F SB Ramps**	0	0	0	300	0	600	0	1335	580	330	935	0
3	**S Bonnyview Rd/I-5 NB Ramps**	360	5	275	0	0	0	680	950	0	0	900	345
4	**Churn Creek Rd/S Bonnyview Rd**	125	10	25	175	15	535	445	700	80	35	580	155
5	Churn Creek Rd/Alrose	10	5	5	25	0	95	105	785	5	5	665	30
Year 2045 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	25	20	40	795	20	365	215	1240	30	30	1120	485
2	**S Bonnyview Rd/I-F SB Ramps**				315		625		1435	640	355	1010	
3	**S Bonnyview Rd/I-5 NB Ramps**	395	5	295				730	1020			970	400
4	**Churn Creek Rd/S Bonnyview Rd**	125	10	25	200	15	595	480	755	80	35	650	180
5	Churn Creek Rd/Alrose	10	5	5	25		95	105	870	5	5	760	30

California Gold TAZ Peak Hour Adjustments

In order to document the adjustments that went into the final traffic volume forecasts, Table 4 presents the adjustments for the AM peak hour and Table 5 presents the adjustments for the PM peak hour, that are described under "History" above. The adjustments shown in Tables 4 and 5 represent the “net” adjustments between the regional model’s imbalanced trip generation/distribution and the manual trip generation/distribution. As such, there are instances where the adjustment shown in Tables 3 and 4 is negative.

For ease of calculations, the presented adjustments were applied to Year's 2025, 2035 and 2045 forecasts.

Table 4: California Gold AM Peak Hour Adjustments

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2025, 2035 & 2045 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	0	0	0	-5	0	0	0	5	0	0	14	-4
2	**S Bonnyview Rd/I-F SB Ramps**	0	0	0	-48	0	0	0	0	0	13	11	0
3	**S Bonnyview Rd/I-5 NB Ramps**	0	0	-27	0	0	0	0	-47	0	0	24	26
4	**Churn Creek Rd/S Bonnyview Rd**	0	-1	0	5	-1	50	-74	0	0	0	0	-7
5	**Churn Creek Rd/Alrose**	0	0	0	0	0	0	0	5	0	0	-7	0

Table 5: California Gold PM Peak Hour Adjustments

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2025, 2035 & 2045 Forecasts													
1	S Bonnyview Rd/Bechelli Lane	0	0	-1	-6	0	0	0	15	0	0	-3	-3
2	S Bonnyview Rd/I-F SB Ramps	0	0	0	39	0	0	0	9	0	-40	-5	0
3	S Bonnyview Rd/I-5 NB Ramps	0	0	2	0	0	0	0	47	0	0	-45	-36
4	Churn Creek Rd/S Bonnyview Rd	0	-2	0	1	-2	-82	49	0	0	0	0	10
5	Churn Creek Rd/Alrose	0	0	0	0	0	0	0	1	0	0	10	0

BoxCO TAZ PM Peak Hour Adjustments

In order to document the adjustments that went into the final traffic volume forecasts, Table 6 presents the Year 2025 adjustments for the PM peak hour, that are described under "History" above:

Table 6: Year 2025 BoxCo PM Peak Hour Adjustments

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2025 Forecasts													
1	S Bonnyview Rd/Bechelli Lane	0	-1	0	-72	-2	-22	24	0	0	0	0	90
2	S Bonnyview Rd/I-F SB Ramps	0	0	0	0	0	67	0	-29	-43	0	23	0
3	S Bonnyview Rd/I-5 NB Ramps	12	0	0	0	0	0	-14	-14	0	0	10	0
4	Churn Creek Rd/S Bonnyview Rd	-3	0	0	0	0	7	-2	-10	-2	0	7	0
5	Churn Creek Rd/Alrose	0	0	0	0	0	0	0	-10	0	0	7	0

Table 7 presents the Year 2035 and Year 2045 adjustments for the PM peak hour, that are described under "History" above:

Table 7: Year 2035 and 2045 BoxCo PM Peak Hour Adjustments

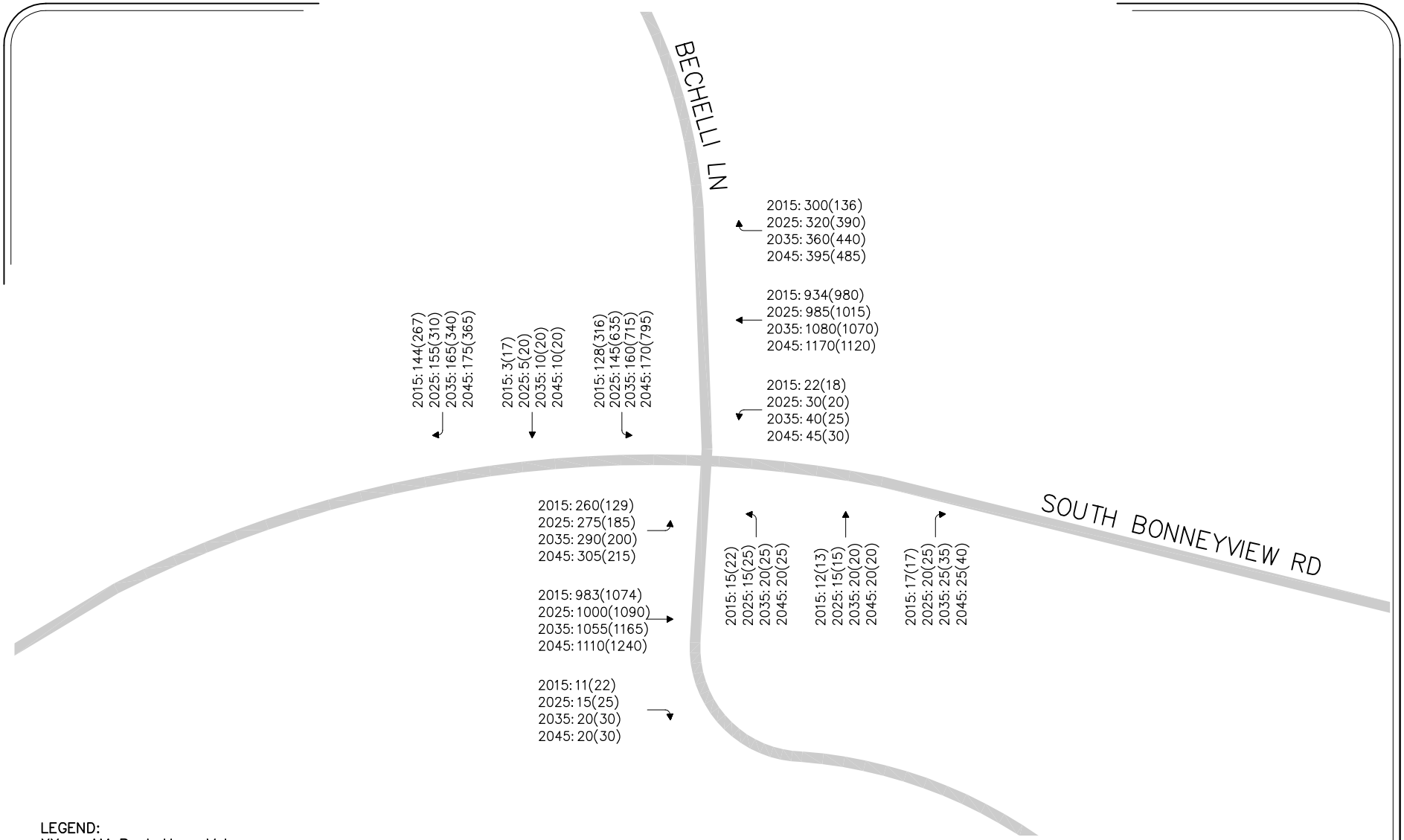
Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2035 & 2045 Forecasts													
1	S Bonnyview Rd/Bechelli Lane	0	-1	0	-76	-2	-23	25	0	0	0	0	95
2	S Bonnyview Rd/I-F SB Ramps	0	0	0	0	0	70	0	-30	-45	0	24	0
3	S Bonnyview Rd/I-5 NB Ramps	13	0	0	0	0	0	-15	-15	0	0	11	0
4	Churn Creek Rd/S Bonnyview Rd	-3	0	0	0	0	7	-2	-11	-2	0	7	0
5	Churn Creek Rd/Alrose	0	0	0	0	0	0	0	-11	0	0	7	0

Next Steps

1. Final agency approval of the data presented in this Technical Memorandum.
2. Agency concurrence regarding Traffic Operations technical analysis parameters. The information will be presented in Technical memorandum No. 7.

Traffic Forecast Figures

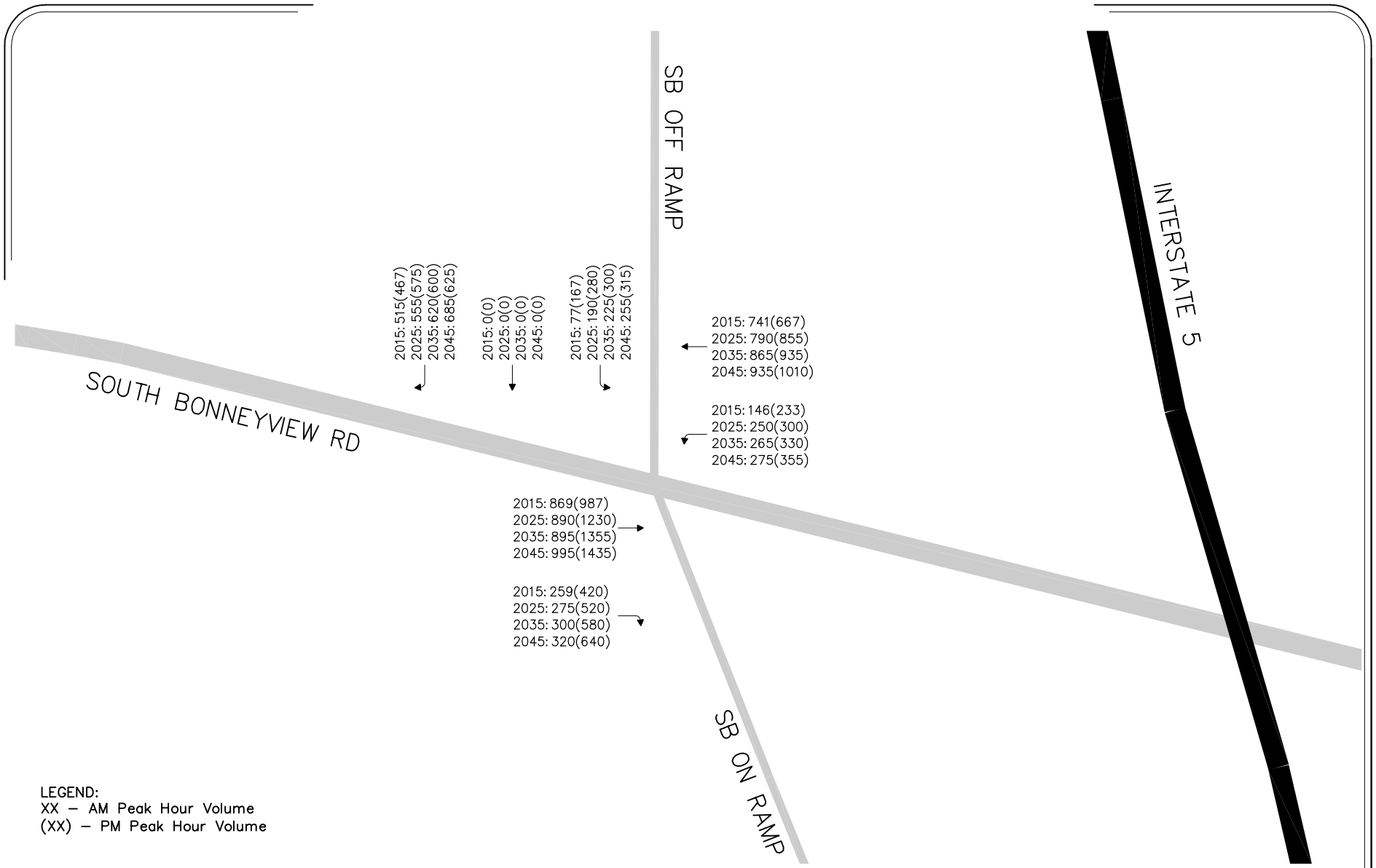
Attached are final traffic forecast figures.



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

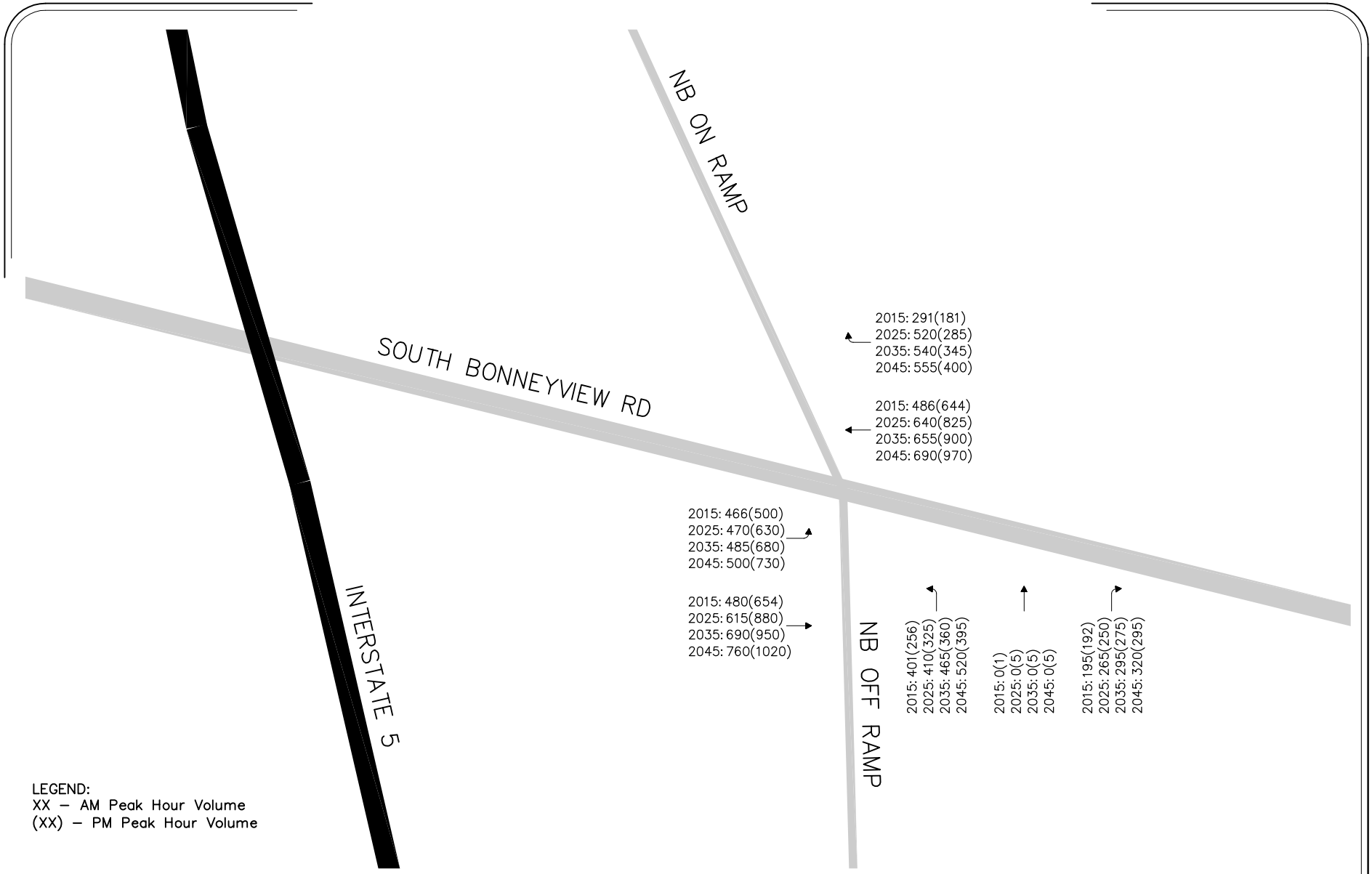
I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS



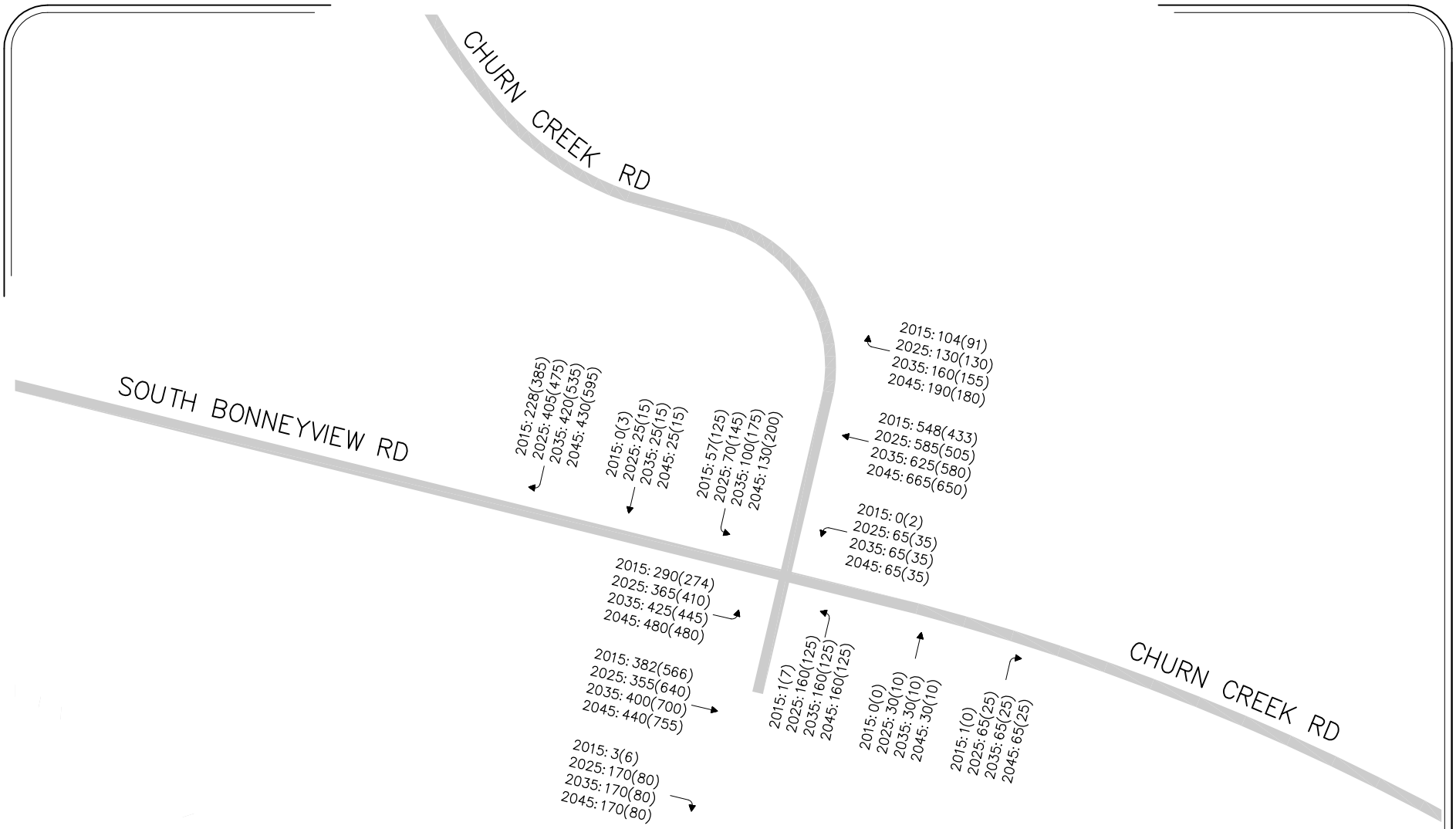
I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS



I-5/South Bonnyview Interchange PSR Traffic Operations Report

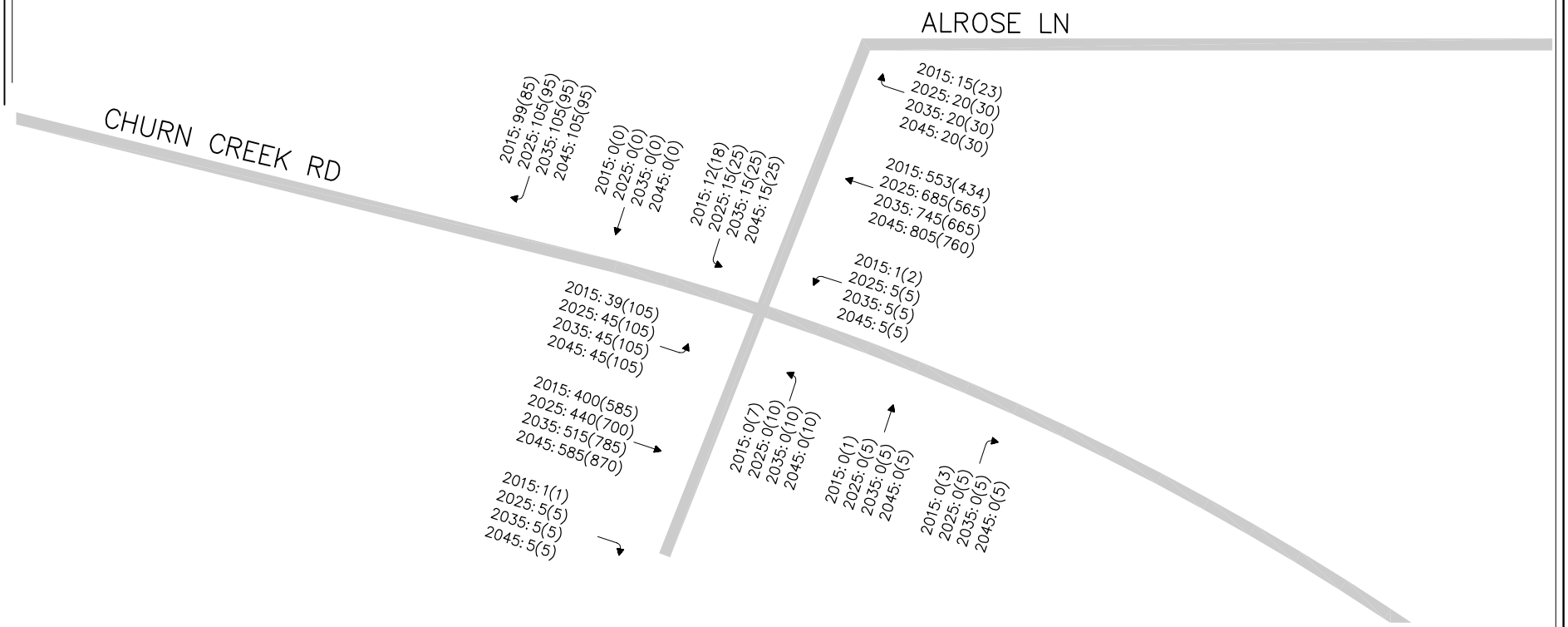
FINAL TRAFFIC FORECASTS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS

Appendices

This page intentionally left blank.

Interstate 5 / S. Bonnyview Road Interchange Traffic Operations Report - Project Study Report

Prepared for:

City of Redding

Prepared by:

omni · means
A GHD company

Interstate 5 / S. Bonnyview Road Interchange
Traffic Operations Report for Project Study Report

Prepared for:
City of Redding
777 Cypress Avenue
Redding, CA 96001

Prepared by:
Omni-Means, Ltd.
330 Hartnell Avenue, Suite B
Redding, CA 96002
530.242.1700

May 2017

45-5721-27
R2174TS001.docx

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDIX

Introduction

This report presents the Traffic Operations Report (TOR) for the Project Study Report (PSR) for the reconstruction of the Interstate 5 / South Bonnyview Road Interchange (Project). The TOR is a technical supporting document for the PSR being prepared by Caltrans. The analysis of the Project is a cooperative effort between Caltrans and the City of Redding (City) that is prompted by past and anticipated urban land development in the Project vicinity that is anticipated to increase traffic volumes and result in unacceptable traffic operations.

Work on the TOR began in May 2016 under the guidance of a focused Project Development Team (PDT) made up of Caltrans, City and Omni-Means personnel. The PDT met sixteen times over a twelve month period. The PDT meetings were conducted in a workshop format to establish direction and confirm assumptions, methodologies, analysis and conclusions. Technical analysis in support of the TOR was prepared in the form of fifteen Technical Memorandums which underlay the TOR and are included in the Appendix.

Study Area

The Project study area encompasses the Interstate 5 / South Bonnyview Road Interchange and the adjacent City-jurisdiction intersections. More specifically, the TOR focuses on the traffic operations for the following facilities:

- South Bonnyview Road / Bechelli Lane Intersection.
- South Bonnyview Road / Interstate 5 Southbound (SB) Ramps Intersection.
- South Bonnyview Road / Interstate 5 Northbound (NB) Ramps Intersection.
- South Bonnyview Road / Churn Creek Road Intersection.
- Churn Creek Road / Alrose Lane Intersection.

Project Area Transportation System

Roadways that provide primary circulation in the vicinity of the Project are as follows:

Interstate 5 (I-5) is an interstate freeway facility that traverses in the south-north direction through the State of California. In northern California, I-5 serves as the primary inter-regional auto and truck travel route that connects the northern counties with the Sacramento Valley. Within Shasta County, I-5 serves as a major commuter and truck route linking the Cities of Anderson, Redding, and Shasta Lake. There is a full-access tight-diamond interchange with South Bonnyview Road at Exit 675.

Churn Creek Road is a two to four-lane, north-south arterial that traverses between Airport Road and College View Drive. Churn Creek Road connects rural areas south of the City to the following arterial streets to the east of the Project – Rancho Road and Victor Avenue. North of the Project, Churn Creek Road serves residential and commercial areas as well as area schools.

South Bonnyview Road is a four-lane, east-west arterial that traverses between State Route 273 and Churn Creek Road. South Bonnyview Road provides a link across the Sacramento River between the south-west Redding area and I-5. South Bonnyview Road crosses I-5 via Churn Creek Road Overcrossing (Bridge Number 06-0122). The following Project-related South Bonnyview Road intersections are signalized:

- Bechelli Lane
- I-5 SB Ramps
- I-5 NB Ramps
- Churn Creek Road

Bechelli Lane is a two to four-lane, north-south arterial that runs between south of South Bonnyview Road to its northern terminus, approximately one mile to the north of East Cypress Avenue. Bechelli lane provides access to residential and commercial areas.

Alrose Lane is a two-lane local City street that serves commercial and residential areas north of Churn Creek Road. South of Churn Creek Road, and serving as the fourth leg of an unsignalized intersection with Churn Creek Road, there is a driveway to a small health club and office building.

Design Year

The PDT selected year 2045 as the 20-year design year in accordance with Caltrans Highway Design Manual Section 103.2.

Existing Traffic Counts

Omni-Means collected weekday AM and weekday PM peak hour intersection turn movement counts at the study intersections on Thursday, November 12, 2015. The existing traffic volumes were used as a base-line for future year projections.

Technical Memorandum Number (TM#) 3 in the Appendix summarizes year 2015 existing traffic volumes. See **Figures 1 though 5** for year 2015 existing traffic volumes.

Traffic Forecasts

After commencement of the analysis presented in the TOR, the Bureau of Indian Affairs (BIA) published a Notice of Intent (NOI) on November 29, 2016 to prepare an Environmental Impact Statement (EIS) for the proposed Redding Rancheria Fee-to-Trust and Casino Project (Rancheria Development), south-west of the Project. Since the majority of the analysis was complete when the NOI was published, the forecasts, and subsequent traffic operations analysis were split into two primary approaches:

- Base forecasts and analysis were performed without consideration of the Rancheria Development.
- Additional forecasts and analysis were performed with the addition of the Rancheria Development. To further understand the incremental impact of the Rancheria Development, the traffic operations analysis was performed with both half and full Rancheria Development.

Base Forecasts (Without Rancheria Development)

Future year traffic volumes were forecast by using the Shasta Regional Transportation Agency (SRTA) Activity-Based Travel Demand Model (ShastaSIM), with adjustments for potential land development that is not included in ShastaSIM as published.

The adjustments, and the final forecasted traffic volumes are summarized in TM# 1 to TM# 6, contained in the Appendix. Following is a summary of the land development adjustments to ShastaSIM, that are assumed to be in place in year 2045.

- A Costco-anchored development will be constructed north of South Bonnyview Road, west of I-5 and east of Bechelli Lane.
- The Churn Creek Marketplace shopping center (approximately 150,000 square feet (sqft)).
- A gas station with mini-mart with a coffee shop and a sandwich shop, south of South Bonnyview Road and east of I-5.
- Phase II of the Blue Shield development.
- Additional residential dwelling units along South Bonnyview Road, between Route 273 and the Sacramento River.
- Additional residential dwelling units, south of the Rivercrest Estates subdivision.
- Occupancy of the partially constructed multi-story office building, south of South Bonnyview Road and adjacent to the east bank of the Sacramento River.
- Neighborhood shopping center at the intersection of Rancho Road and Shasta View Drive.
- Buildout of the Shastina Ranch, Stonesfair and Schellenger subdivisions. Each of these approved or anticipated residential subdivisions are located south of Rancho Road and west of Airport Road.
- The addition of over 300 jobs in the Stillwater Business Park.

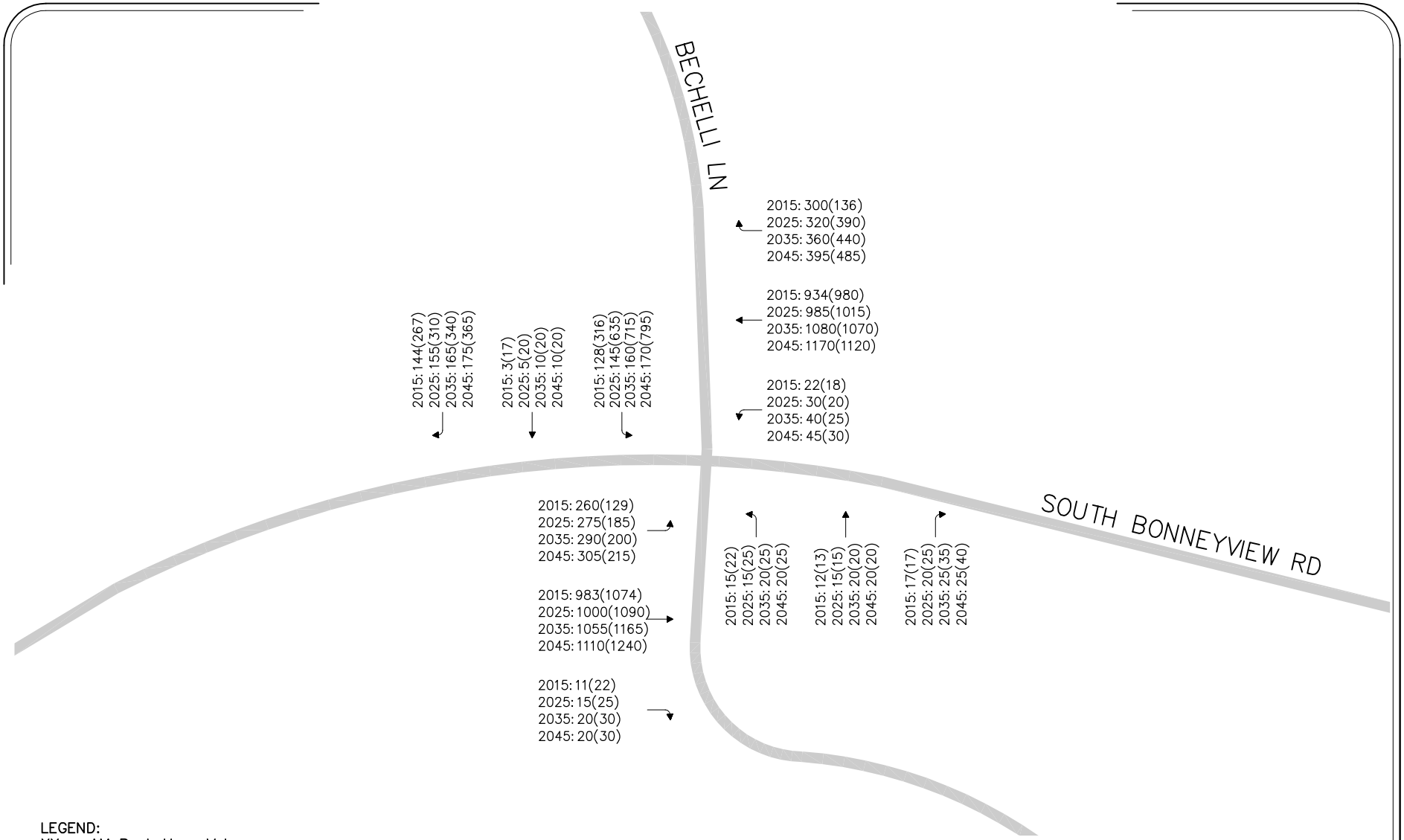
In addition to the forecasts for year 2045, forecasts were developed for year 2025 and year 2035 to represent the Project occupancy year and a 10-year interim year of construction.

The year 2025, 2035 and 2045 forecasted traffic volumes used for analysis are presented in **Figures 1 through 5**.

Forecasts (With Rancheria Development)

Kimley-Horn (K-H), subconsultant to the EIS prime consultant, analytical Environmental Services (AES), prepared a *Trip Generation and Distribution Methodology* Memorandum on September 7, 2016 for the Rancheria Development. The weekday PM peak hour trip generation and distribution information in the K-H Memorandum was accepted by the PDT for use in this TOR.

The K-H Memorandum did not address weekday AM peak hour trip generation. The weekday AM peak hour trip generation for the Rancheria Development was derived and is presented in **Table 1.**



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 1

FINAL TRAFFIC FORECASTS

8/11/2016 5:06 PM K:\PRJ\2174\T2174\T2174TG007.DWG

JOB NO: 45-5721-27

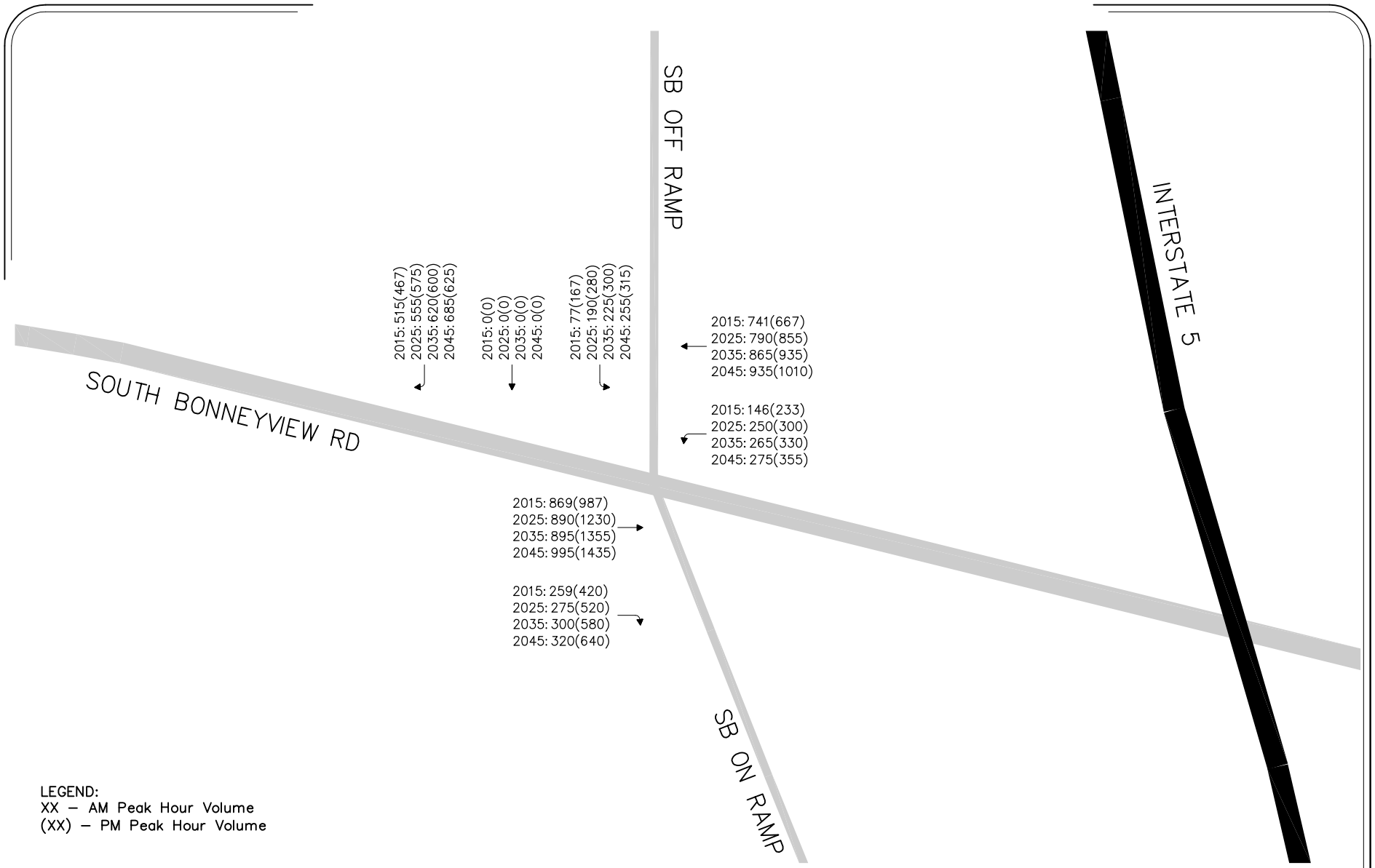


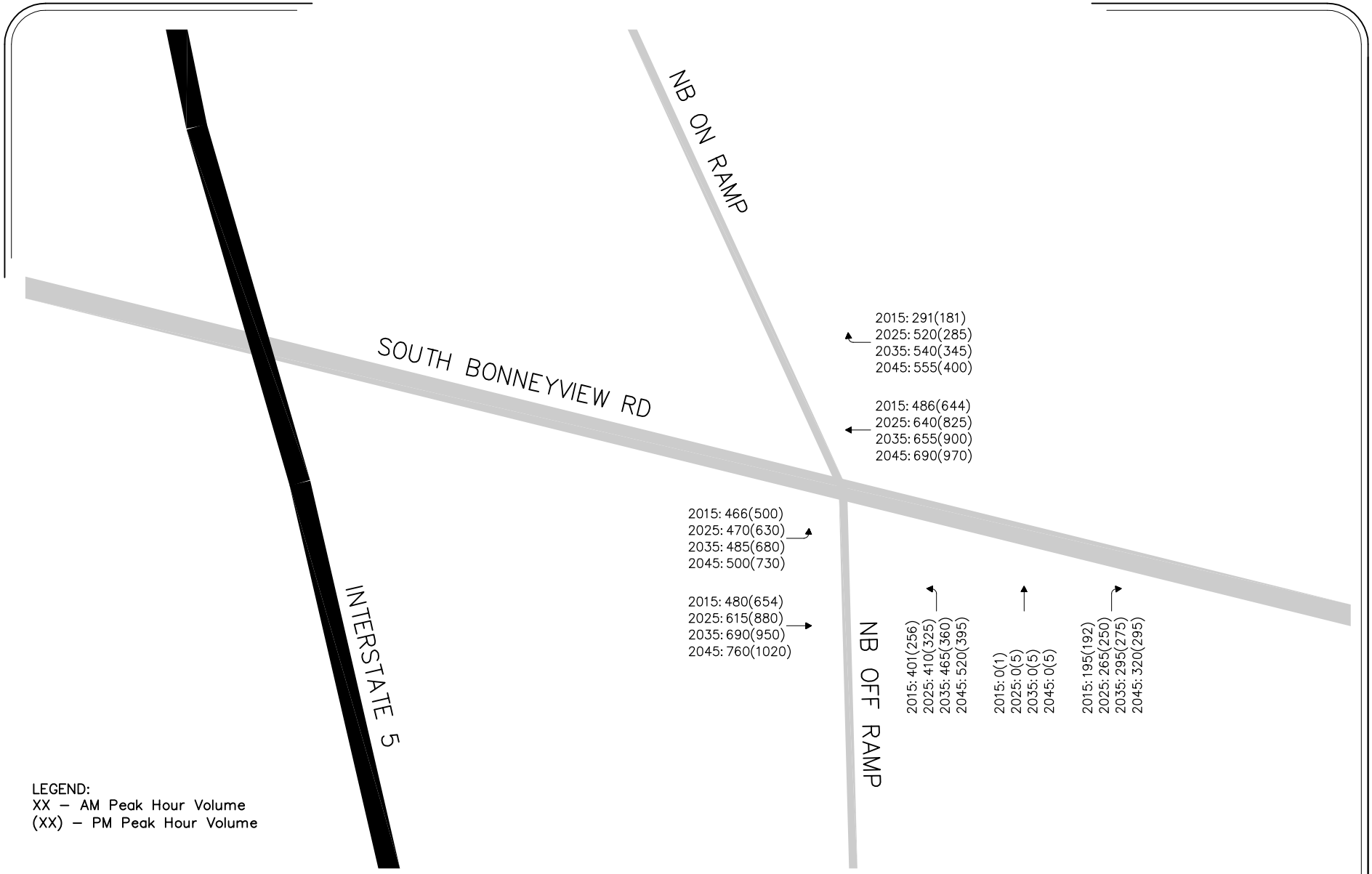
Figure 2

I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS

8/11/2016 5:08 PM K:\PRJ\2174\T2174\T2174TG007.DWG

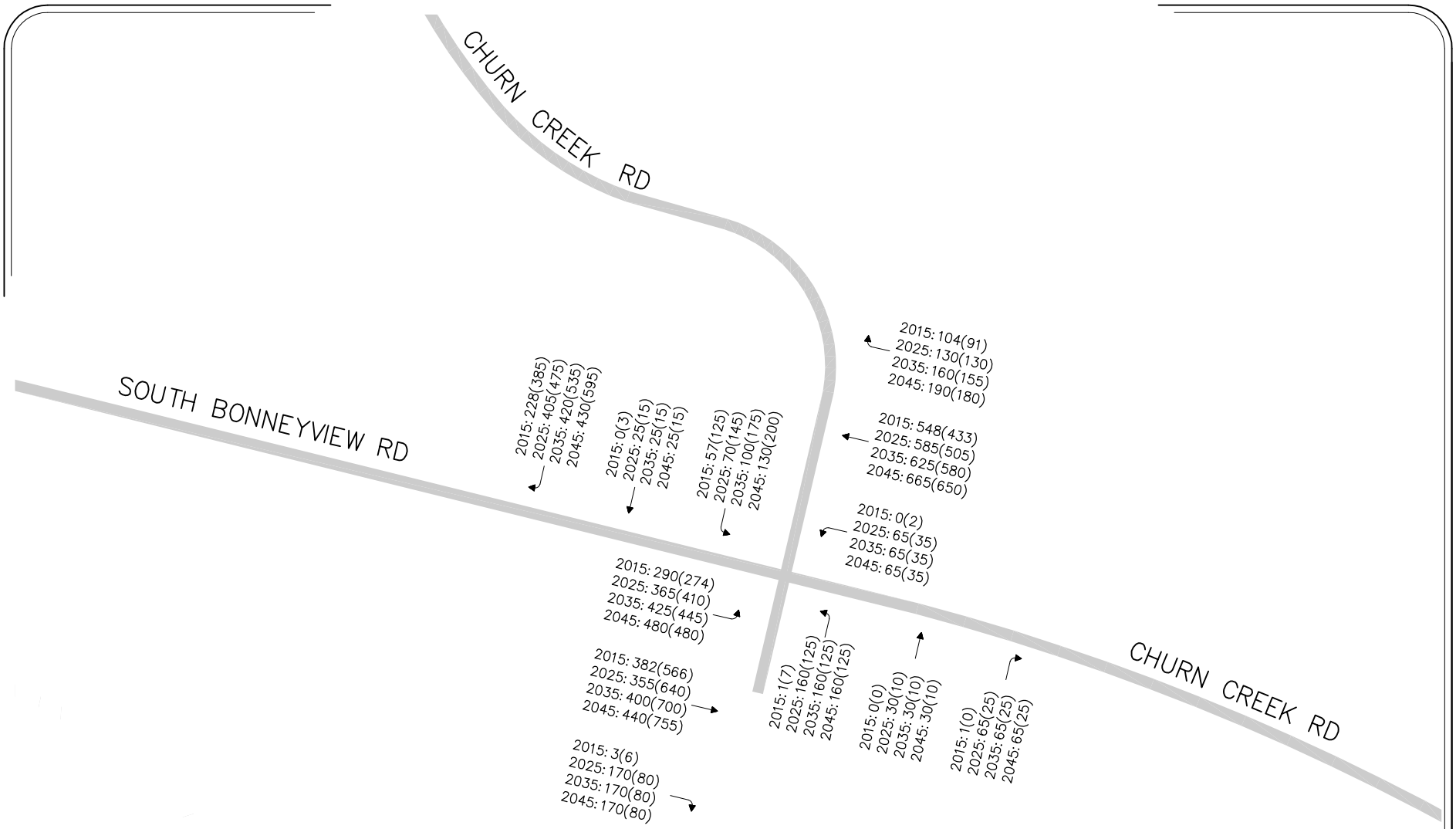
JOB NO: 45-5721-27



I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 3

FINAL TRAFFIC FORECASTS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

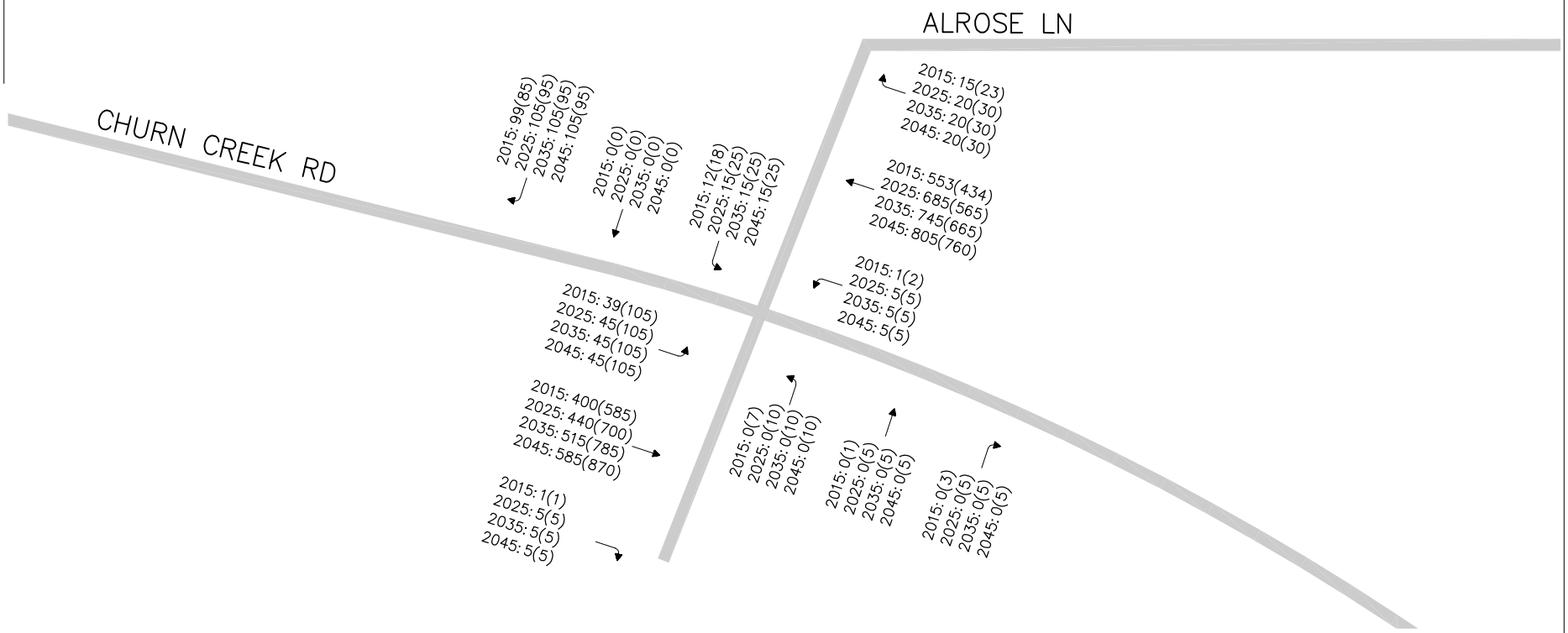
I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 4

FINAL TRAFFIC FORECASTS

8/11/2016 5:14 PM K:\PRJ\2174\T2174\T2174TG007.DWG

JOB NO: 45-5721-27



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 5

FINAL TRAFFIC FORECASTS

TABLE 1
WEEKDAY AM PEAK HOUR RANCHERIA DEVELOPMENT TRIP GENERATION

Land Use	ITE Code	Quantity	Units	Weekday AM Peak Hour		
				In	Out	Total
Casino	N/A	140,000	SF	206	88	294
Conference Center	N/A	10,080	SF	178	45	223
Event Center	N/A	1,800	Seats	12	2	14
Hotel	310	250	Rooms	18	15	33
Sporting Goods Superstore	861	130,000	SF	111	83	194
Subtotal Vehicle Trips				525	233	758
Diverted Link Trips (10%) - Applied only to Casino and Sporting Goods Store				(32)	(17)	(49)
Net New Vehicle Trips				493	216	709

In order to provide a sensitivity analysis, the Rancheria Development analysis was performed with traffic volumes representing one half of the Rancheria Development and the full Rancheria Development. For comparison, the casino portion of the Rancheria Development is expected to generate approximately 57 percent of the total weekday PM peak hour traffic as compared to the full Rancheria Development.

The "With Rancheria Development" analysis was only performed for the year 2045 conditions.

The year 2045 forecasted traffic volumes used for analysis, for "Half Rancheria Development" and "Full Rancheria Development" are presented in TM# 15 in the Appendix and are summarized in **Figures 6 through 10**.

Project Alternatives

The PDT directed the development and analysis of four primary alternatives in addition to a No-Build alternative.

Base Alternatives

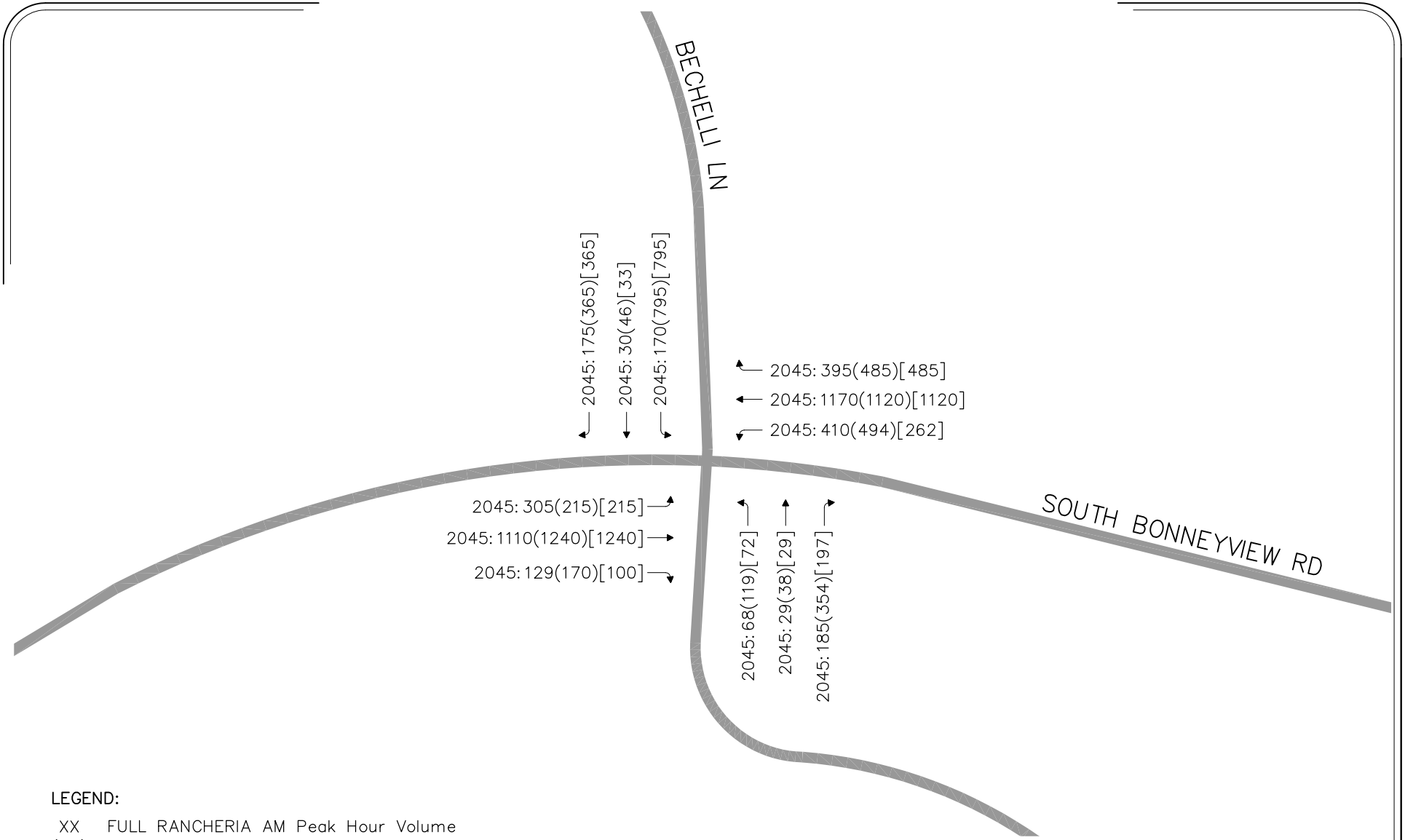
The following alternatives were identified by the PDT for analysis in this TOR:

Alternative 1 – Traditional Tight Diamond Interchange

Alternative 1 perpetuates the Caltrans Type L-1 Tight Diamond interchange and uses traditional signal controls at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. Roadways and ramps are widened and ramps are lengthened to accommodate forecasted traffic. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 11** for Alternative 1 geometry.

Alternative 2 – Diverging Diamond Interchange (DDI) With Traditional Signals at City Intersections

Alternative 2 proposes a DDI that is a type of diamond interchange in which the two directions of traffic on the non-freeway road cross to the opposite side on both sides of the overcrossing at the freeway. It is unusual in that it requires traffic on the freeway overcrossing to briefly drive on the opposite side of the road from what is customary for the jurisdiction. Roadways and ramps are widened and ramps are lengthened to accommodate forecasted traffic. Traditional signal controls are used at the South Bonnyview Road intersections with Bechelli Lane and Churn



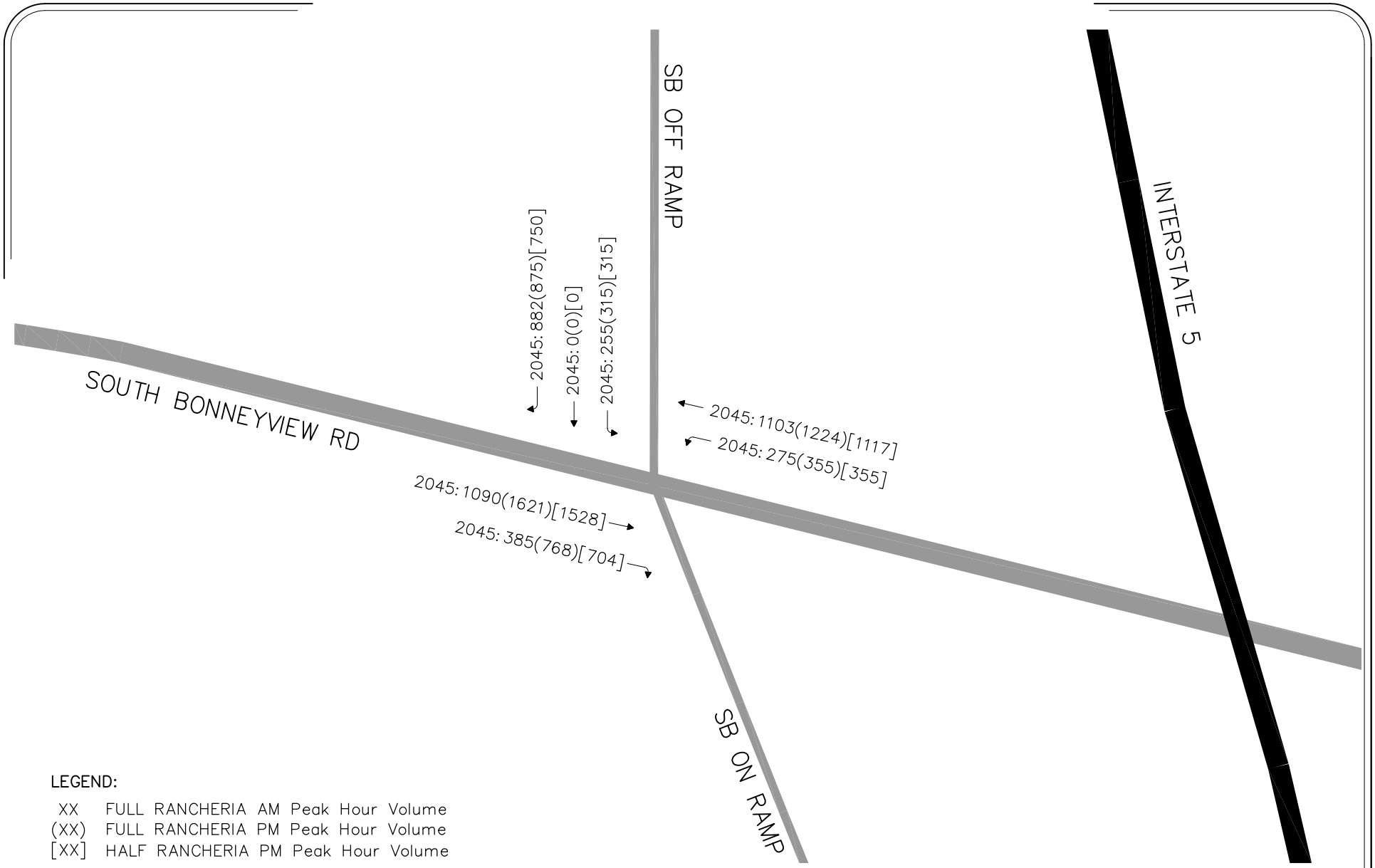
LEGEND:

XX FULL RANCHERIA AM Peak Hour Volume
(XX) FULL RANCHERIA PM Peak Hour Volume
[XX] HALF RANCHERIA PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 6

FINAL RANCHERIA TRAFFIC FORECASTS



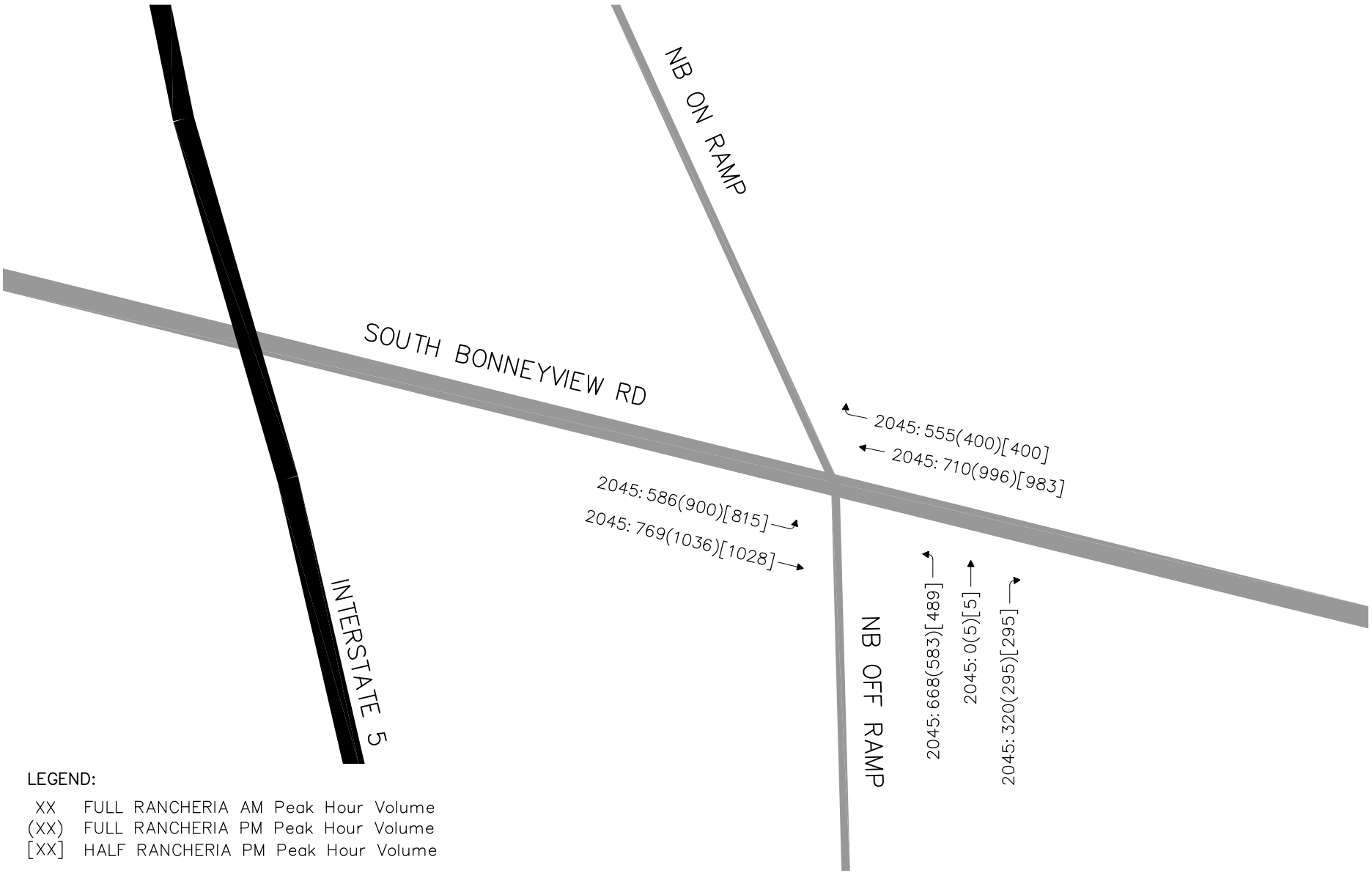
LEGEND:

XX FULL RANCHERIA AM Peak Hour Volume
(XX) FULL RANCHERIA PM Peak Hour Volume
[XX] HALF RANCHERIA PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 7

FINAL RANCHERIA TRAFFIC FORECASTS



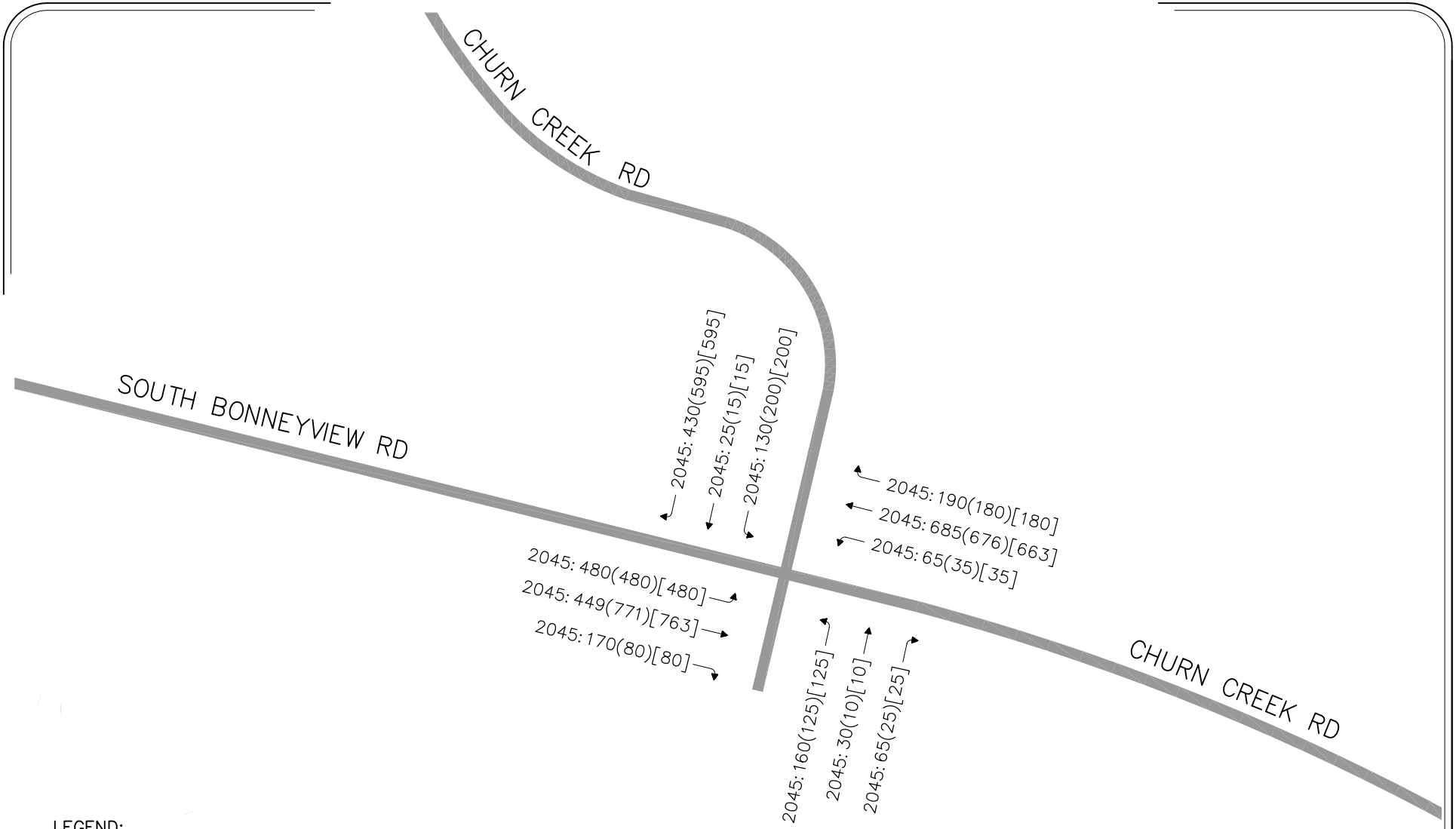
LEGEND:

XX FULL RANCHERIA AM Peak Hour Volume
(XX) FULL RANCHERIA PM Peak Hour Volume
[XX] HALF RANCHERIA PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 8

FINAL RANCHERIA TRAFFIC FORECASTS



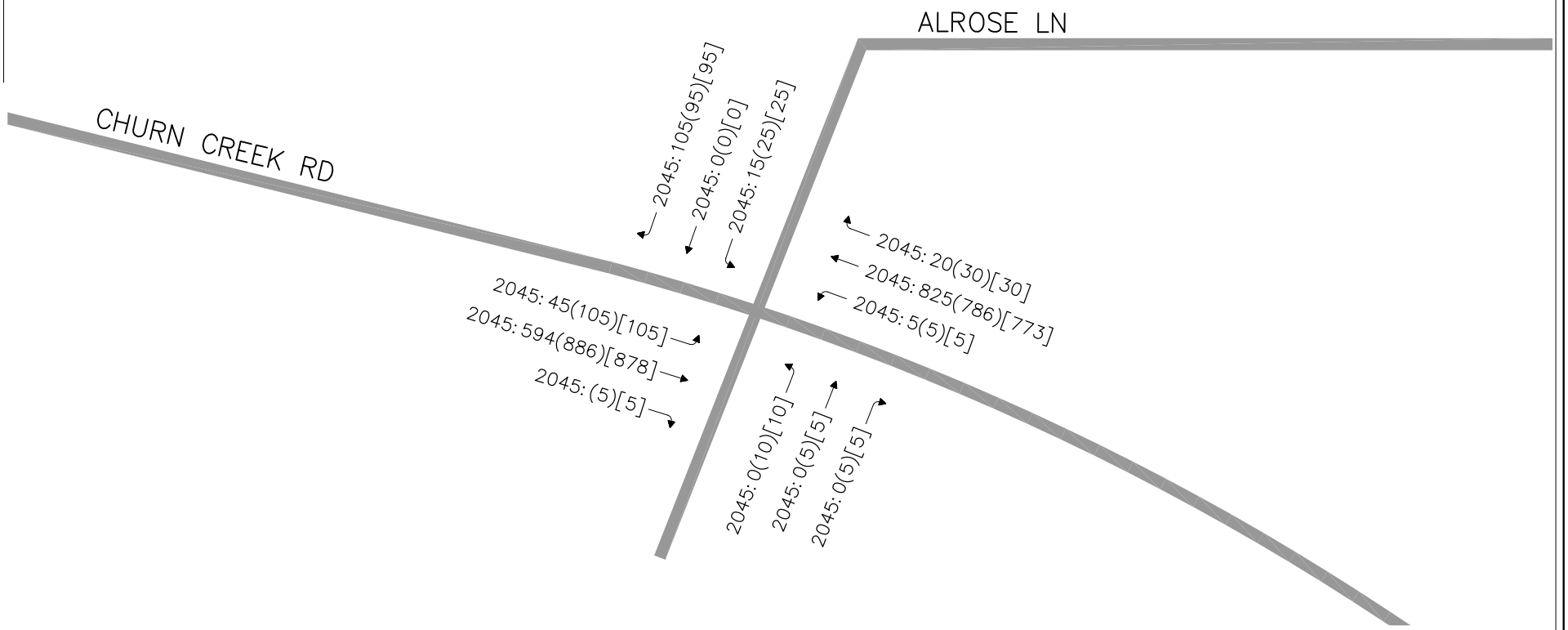
LEGEND:

XX FULL RANCHERIA AM Peak Hour Volume
(XX) FULL RANCHERIA PM Peak Hour Volume
[XX] HALF RANCHERIA PM Peak Hour Volume

Figure 9

I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL RANCHERIA TRAFFIC FORECASTS



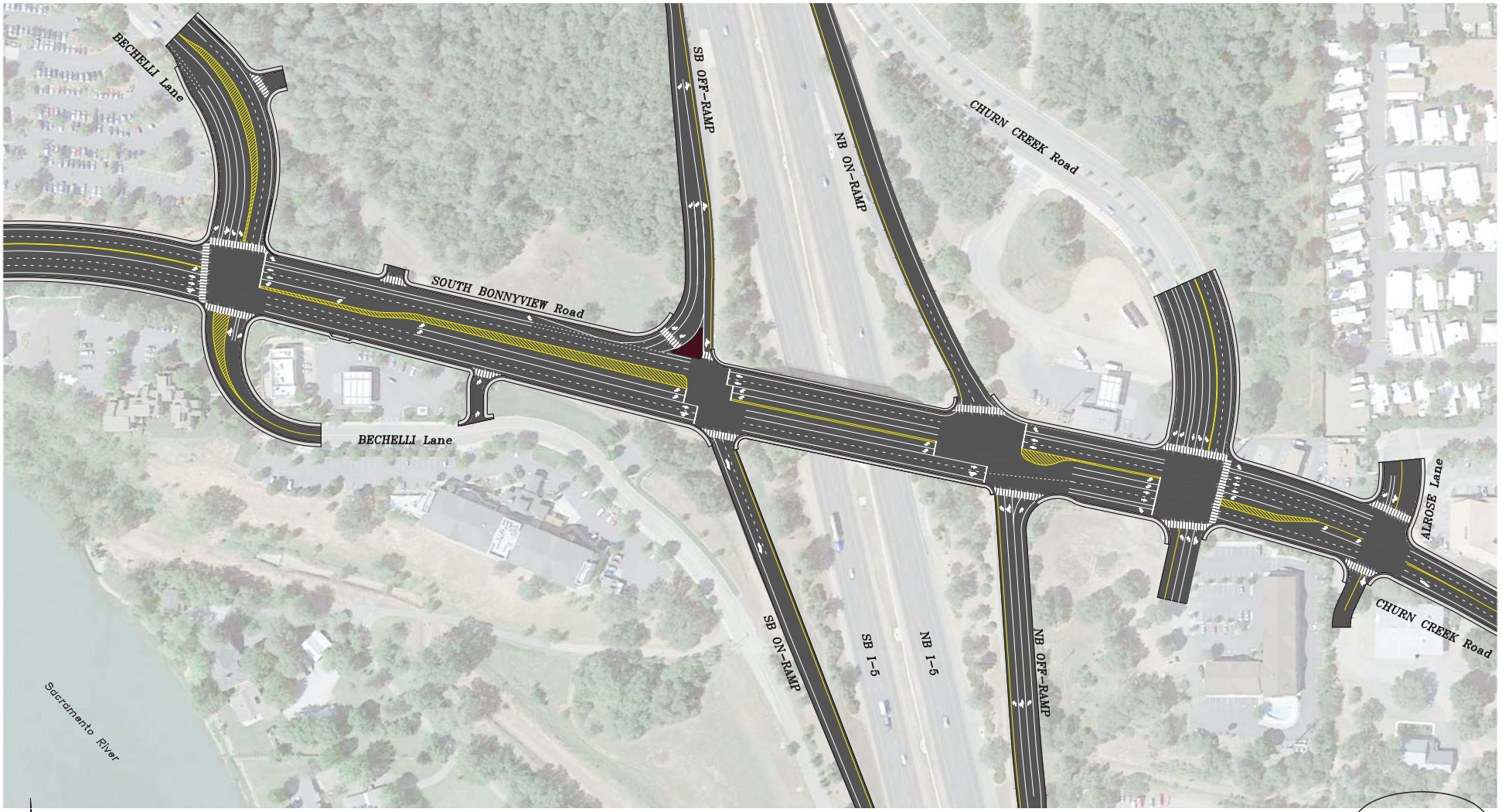
LEGEND:

XX FULL RANCHERIA AM Peak Hour Volume
(XX) FULL RANCHERIA PM Peak Hour Volume
[XX] HALF RANCHERIA PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

Figure 10

FINAL RANCHERIA TRAFFIC FORECASTS



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 11

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

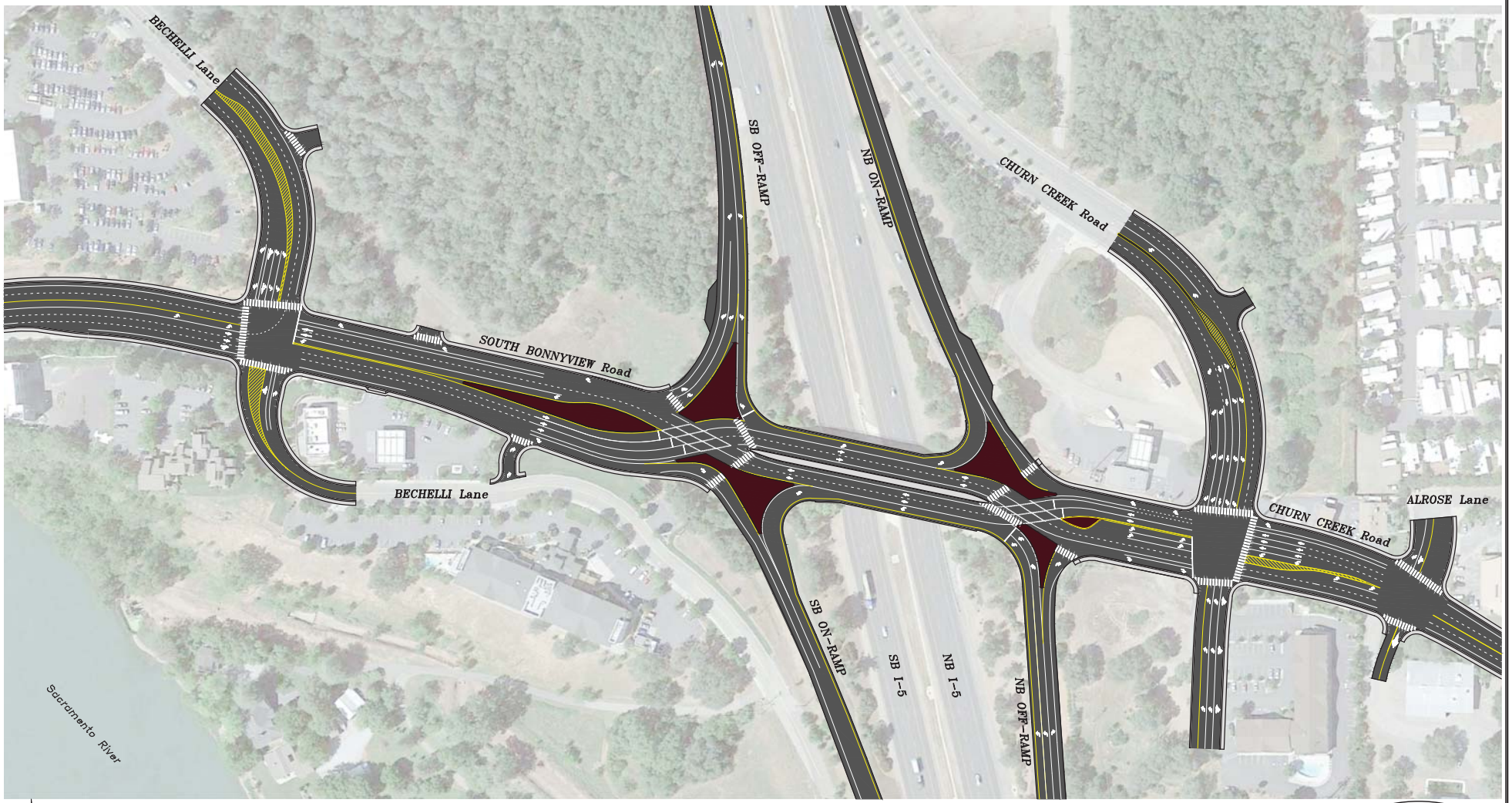
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 1
TRADITIONAL TIGHT DIAMOND INTERCHANGE
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX011
DATE	05/02/17

SHEET No. EX
1 OF 1

J:\PRJ\2174\2174EX011.DWG
5/2/2017 4:44 PM



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 12

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations In
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 2
DDI WITH TRADITIONAL SIGNALS
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX014
DATE	04/28/17

SHEET No. EX

1 OF 1

5/2/2017 4:49 PM J:\PRJ\2174\2174EX014.DWG

Creek Road. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 12** for Alternative 2 geometry.

Alternative 3 – Roundabout Corridor

Alternative 3 proposes the use of modern roundabouts at the South Bonnyview Road intersections with Bechelli Lane, I-5 SB ramps, I-5 NB ramps and Churn Creek Road. Roundabouts provide circular intersections with fewer conflict points than traditional intersections. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 13** for Alternative 3 geometry.

Alternative 4 – DDI With Roundabouts at City Intersections

Alternative 4 proposes a hybrid of Alternatives 2 and 3 by using a DDI with roundabouts at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 14** for Alternative 4 geometry.

No-Build – Maintain Existing Roadway Geometry

The No-Build alternative applies the forecasted traffic volumes on the existing roadway geometry.

Alternative Dropped from Further Consideration

After completion of the year 2045 traffic operations analysis for Alternatives 1, 2, 3 and 4, the PDT decided that Alternative 3, Roundabout Corridor, would be dropped from further consideration. *Note: Refer to the Caltrans PSR for any discussion regarding this decision.*

With Rancheria Development Alternatives

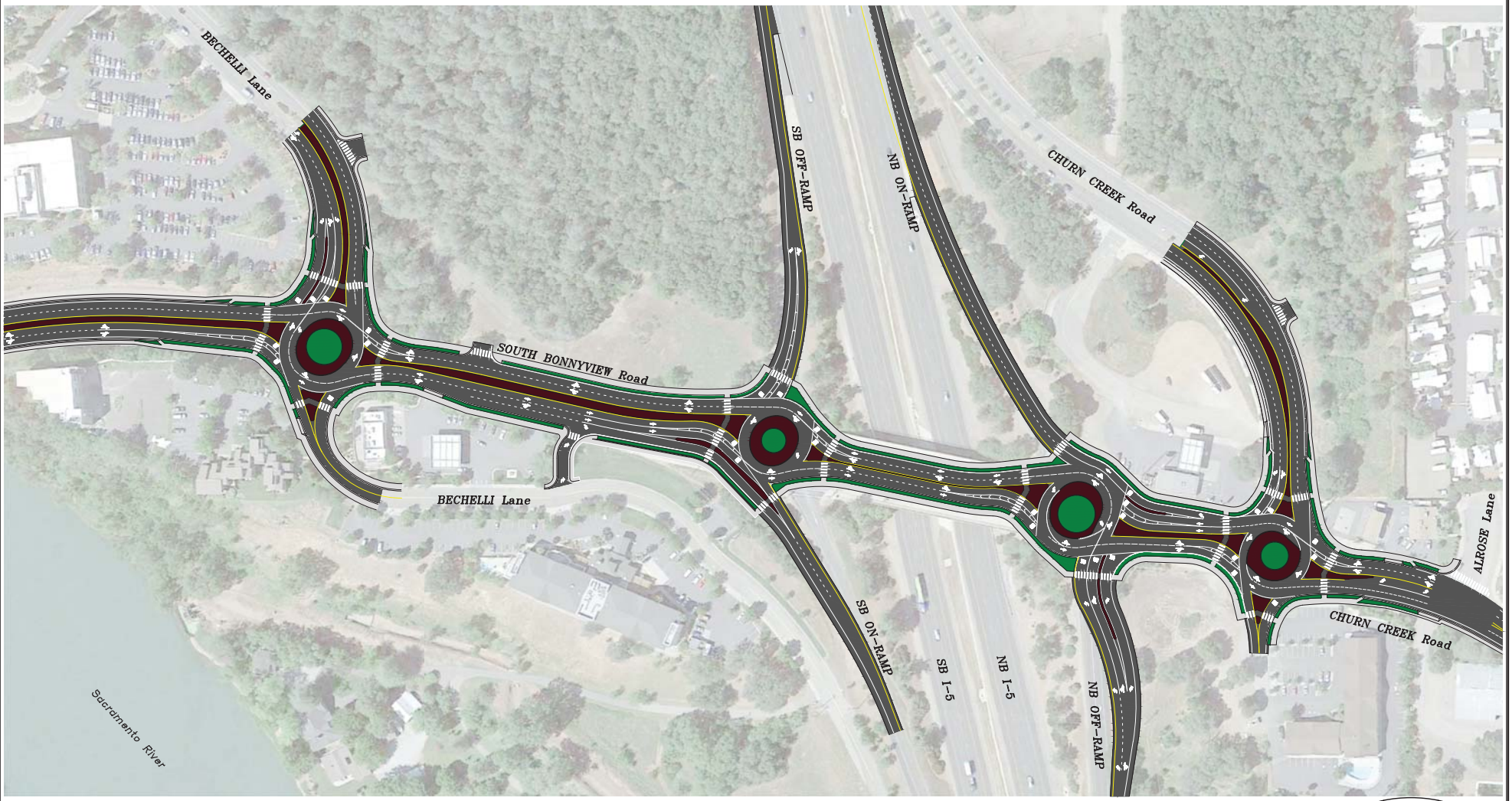
As discussed in “Traffic Forecasts” above, traffic forecasts for Half Rancheria Development and Full Rancheria Development were applied to base Alternatives 1, 2 and 4, to create the following alternatives:

Alternative 1A – Traditional Tight Diamond Interchange (with Half Rancheria Development)

Alternative 1A perpetuates the Caltrans Type L-1 Tight Diamond interchange and uses traditional signal controls at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. Roadways and ramps are widened and ramps are lengthened to accommodate forecasted traffic. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 15** for Alternative 1A geometry.

Alternative 2A – Diverging Diamond Interchange (DDI) With Traditional Signals at City Intersections (with Half Rancheria Development)

Alternative 2A proposes a DDI that is a type of diamond interchange in which the two directions of traffic on the non-freeway road cross to the opposite side on both sides of the overcrossing at the freeway. It is unusual in that it requires traffic on the freeway overcrossing to briefly drive on the opposite side of the road from what is customary for the jurisdiction. Roadways and ramps are widened and ramps are lengthened to accommodate forecasted traffic. Traditional signal



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 13

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

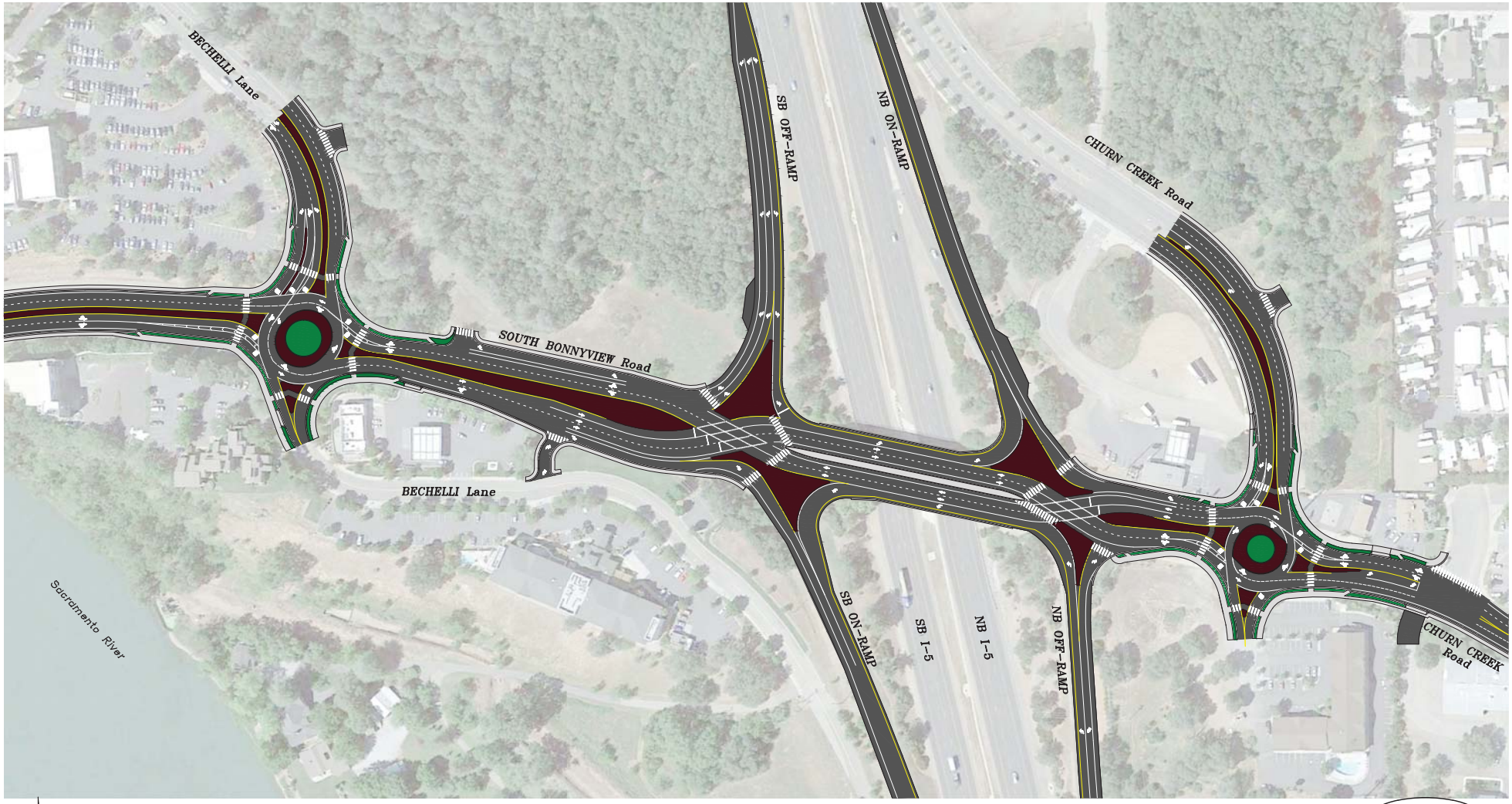
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 3
ROUNDABOUT CORRIDOR
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX009
DATE	04/26/17

SHEET No. EX
1 OF 1

5/2/2017 4:42 PM J:\PRJ\2174\2174EX009.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 14

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 4
DDI WITH ROUNDABOUTS
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX012
DATE	04/28/17

SHEET No. EX

1 OF 1

J:\PRJ\2174\2174EX012.DWG
5/2/2017 4:44 PM

PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 15

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

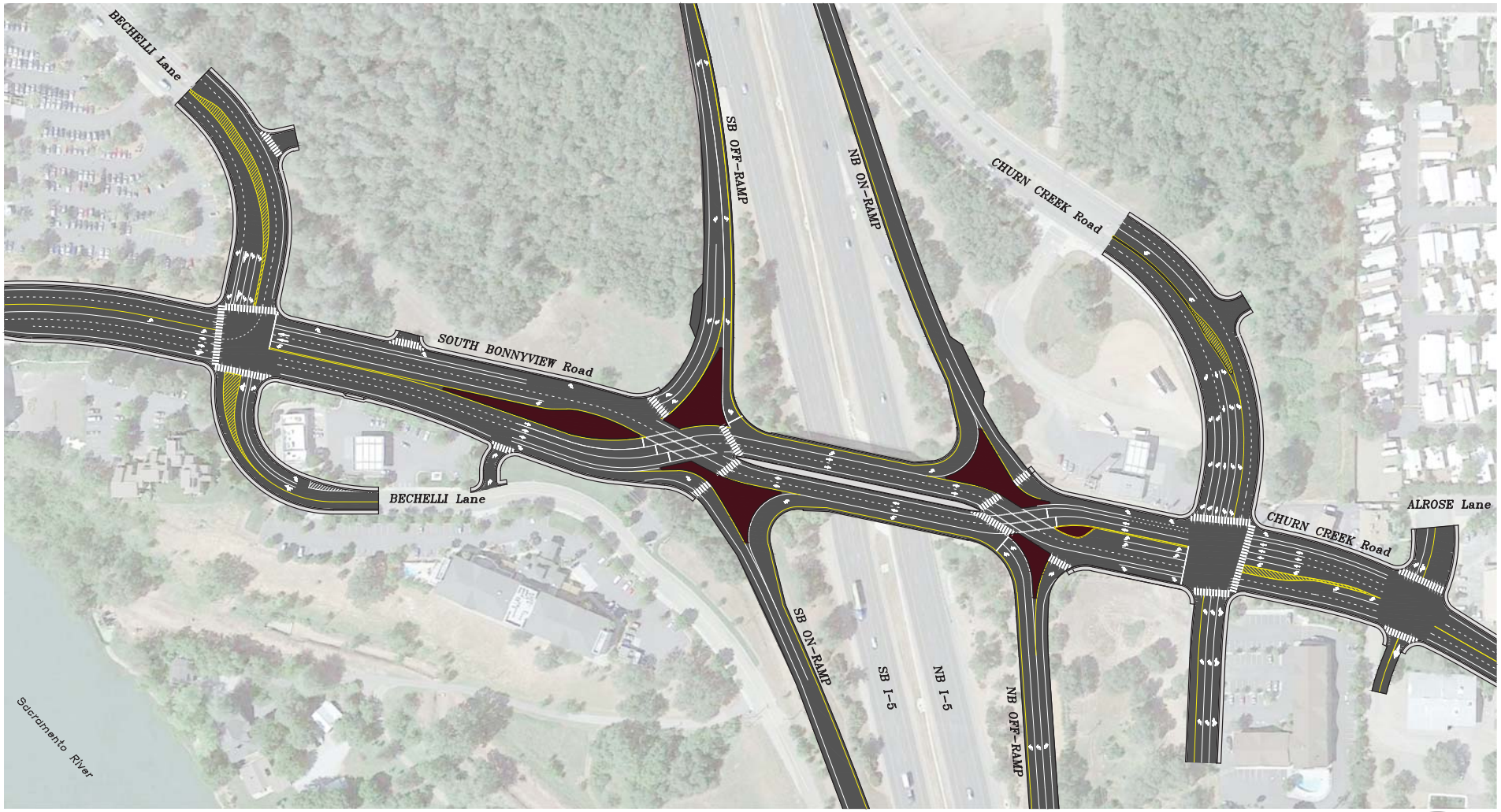
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 1A
TRADITIONAL TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX015
DATE	04/26/17

SHEET No. EX
1 OF 1

5/2/2017 4:50 PM J:\PRJ\2174\2174EX015.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 16

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
530 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations In
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 2A
DDI WITH TRADITIONAL SIGNALS
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX0016
DATE	04/27/17

SHEET No. EX
1 OF 1

5/2/2017 4:51 PM J:\PRJ\2174\2174EX0016.DWG

controls are used at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 16** for Alternative 2A geometry.

Alternative 4A – DDI With Roundabouts at City Intersections (with Half Rancheria Development)

Alternative 4A proposes a hybrid of Alternatives 2 and 3 by using a DDI with roundabouts at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 17** for Alternative 4A geometry.

Alternative 1B – Traditional Tight Diamond Interchange (with Full Rancheria Development)

Alternative 1B perpetuates the Caltrans Type L-1 Tight Diamond interchange and uses traditional signal controls at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. Roadways and ramps are widened and ramps are lengthened to accommodate forecasted traffic. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 18** for Alternative 1B geometry.

Alternative 2B – Diverging Diamond Interchange (DDI) With Traditional Signals at City Intersections (with Full Rancheria Development)

Alternative 2B proposes a DDI that is a type of diamond interchange in which the two directions of traffic on the non-freeway road cross to the opposite side on both sides of the overcrossing at the freeway. It is unusual in that it requires traffic on the freeway overcrossing to briefly drive on the opposite side of the road from what is customary for the jurisdiction. Roadways and ramps are widened and ramps are lengthened to accommodate forecasted traffic. Traditional signal controls are used at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 19** for Alternative 2B geometry.

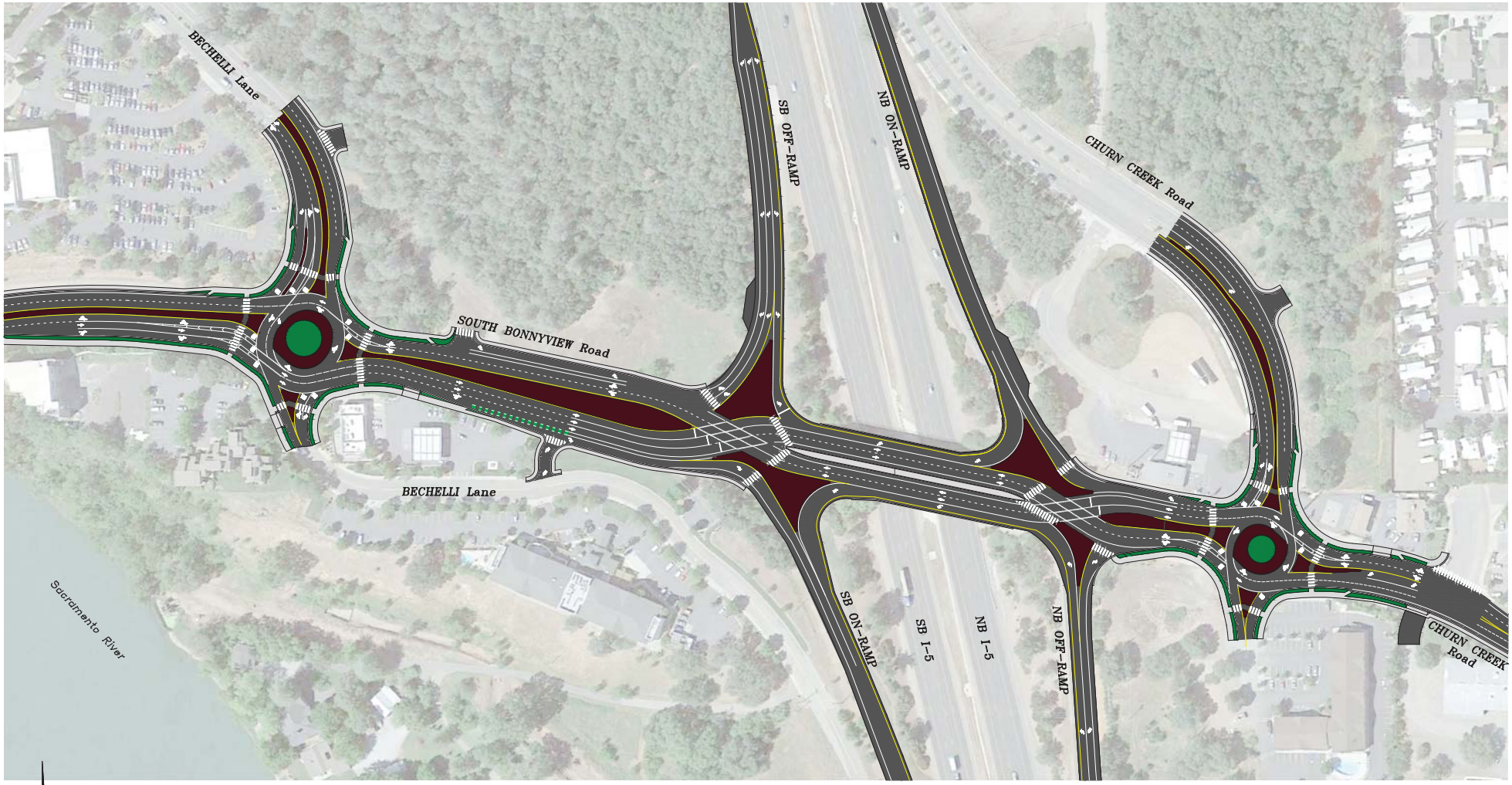
Alternative 4B – DDI With Roundabouts at City Intersections (with Full Rancheria Development)

Alternative 4B proposes a hybrid of Alternatives 2 and 3 by using a DDI with roundabouts at the South Bonnyview Road intersections with Bechelli Lane and Churn Creek Road. The Churn Creek Road intersection at Alrose Lane has stop control under this alternative. See **Figure 20** for Alternative 4B geometry.

Level of Service (LOS) and Vehicle Queuing Methodologies and Guidelines

General LOS Methodologies

Intersection and ramp level of services (LOS) have been calculated for all control types using the methods documented the Transportation Research Board publications *Highway Capacity Manual (HCM) 2000 and 2010*. LOS determinations are presented on a letter grade scale from



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE17

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

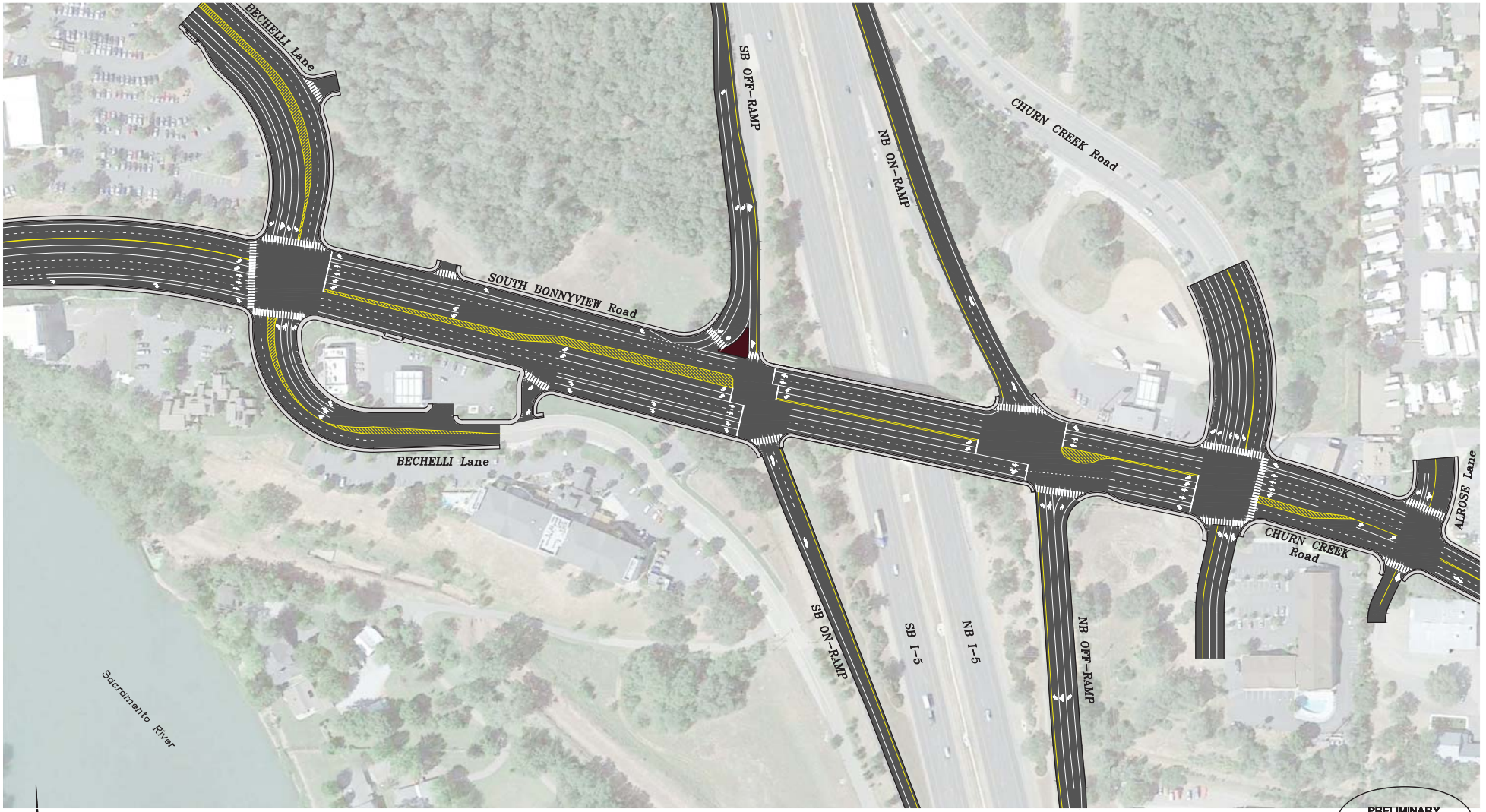
I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 4A
DDI WITH ROUNDABOUTS
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX013
DATE	04/26/17

SHEET No. EX

1 OF 1

5/2/2017 12:11 PM J:\PRJ\2174\2174EX013.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 18

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

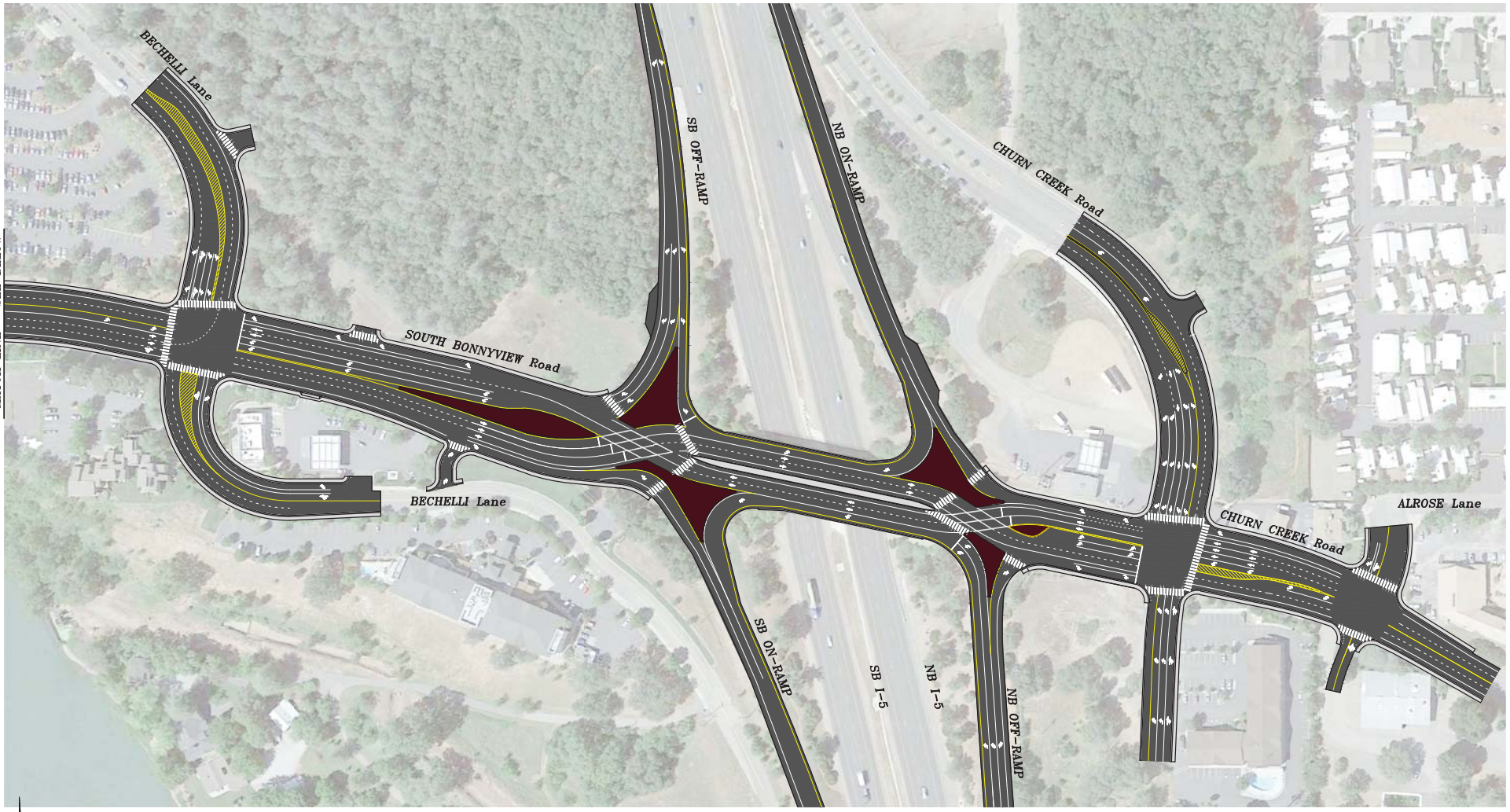
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 1B
TRADITIONAL TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX021
DATE	04/26/17

SHEET No. EX
1 OF 1

5/2/2017 4:53 PM J:\PRJ\2174\2174EX021.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 19

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
530 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations In
ROSEVILLE
WALNUT CREEK
VISALIA

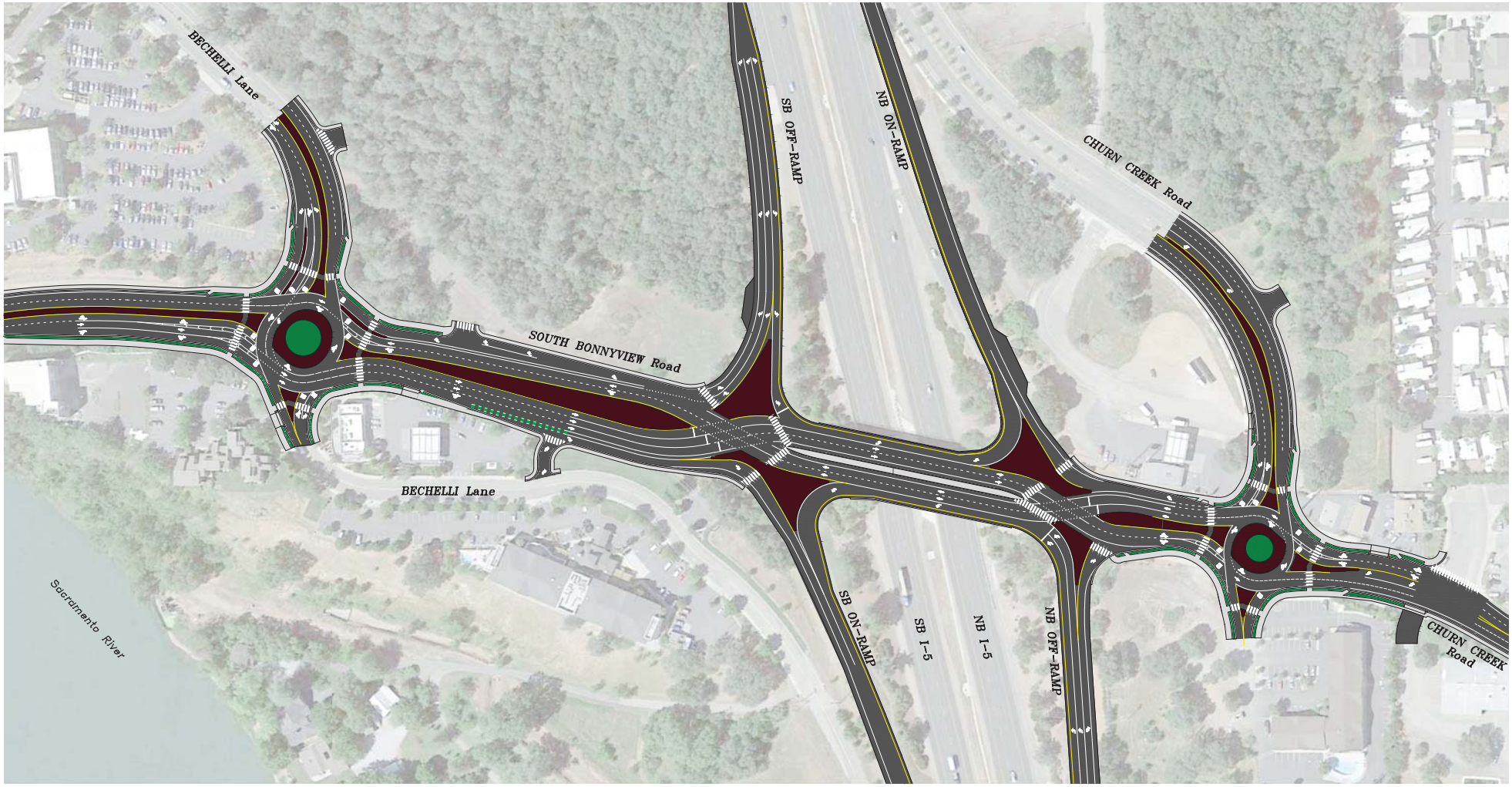
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 2B
DDI WITH TRADITIONAL SIGNALS
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX023
DATE	04/26/17

SHEET No. EX
1 OF 1

J:\PRJ\2174\2174EX023.DWG
5/2/2017 4:55 PM



PRELIMINARY, NOT FOR CONSTRUCTION

FIGURE 20

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
ALTERNATIVE 4B
DDI WITH ROUNDABOUTS
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX025
DATE	04/26/17

SHEET No. EX

1 OF 1

J:\PRJ\2174\2174EX025.DWG
5/2/2017 4:56 PM

"A" to "F", whereby LOS "A" represents "free-flow" conditions and LOS "F" represents over capacity conditions.

Intersection LOS and Vehicle Queuing Methodologies

Intersection LOS is calculated for all control types. **Table 2** presents the LOS definitions for different types of intersection controls.

Due to the different intersection control types, different software tools were used depending on the intersection control, as further described in TM# 7 in the Appendix.

TABLE 2
LEVEL OF SERVICE (LOS) CRITERIA FOR INTERSECTIONS

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay/Vehicle		
				Signalized or Roundabout	Un signalized	All-Way Stop
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	<10.0	<10.0	<10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10.0 and <20.0	>10.0 and <15.0	>10.0 and <15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted	>20.0 and <35.0	>15.0 and <25.0	>15.0 and <25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35.0 and <55.0	>25.0 and <35.0	>25.0 and <35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55.0 and <80.0	>35.0 and <50.0	>35.0 and <50.0

Level of Service	Type of Flow	Delay	Maneuverability	Stopped Delay/Vehicle		
				Signalized or Roundabout	Un signalized	All-Way Stop
F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	>80.0	>50.0	>50.0

References: 2000 Highway Capacity Manual

Synchro Parameters for Traffic Signals

Snychro, by *Trafficware Group Inc.*, is an analysis and optimization software application that implements the analysis methods contained in HCM 2000 and 2010. For both intersection LOS and vehicle queuing, the technical parameters presented in **Table 3** were used for traditional traffic signals:

TABLE 3
SYNCHRO TECHNICAL PARAMETERS FOR SIGNALIZED INTERSECTIONS

1	Analysis Period - 15 Minutes
2	Peak Hour Factor (PHF)- 0.92 or higher for Year 2025, 2035 and 2045 conditions. PHF greater than 0.92 due to Existing counts showing PHF higher.
3	% Trucks: weekday peak hour analysis - from counts
4	Flat Grade
5	25 ft. assumed vehicle length for stacking and queues
6	Cycle Length - 80 sec min, 150 sec max (optimize signal timing)
7	Coordinated Cycle Length - obtained from City and Caltrans (optimize signal timing for Year 2025, 2035 & 2045 conditions)
8	Total Lost Time Per Signal Phase - 4 seconds (24 sec max for 8-phase signal)
9	Ideal saturation flow rate - 1,900 vhp or 1,710 vhp as provided in the HCM
10	Pedestrian Speed - 3.5 ft/s and 10 mph for bicycles
11	Pedestrian calls - 2025 (6); 2035 (10); 2045 (15). Existing ranges from 0 to 3
Source: Figure 4.5 City of Redding TIA Guideline January 2009, modified as appropriate	

SIDRA Parameters for Roundabouts

SIDRA Intersection is an analysis and optimization software application that uses both gap-acceptance and roundabout geometry to analyze roundabout performance. For roundabout intersection LOS calculations, the technical parameters in **Table 4** were used:

TABLE 4
SIDRA TECHNICAL PARAMETERS FOR ROUNDABOUT INTERSECTIONS

SIDRA standard model will be used for roundabouts analysis.
A 1.1 environmental factor will be used in SIDRA for Year 2025 conditions, 1.05 for Year 2035 conditions and 1.0 for design year conditions.
PHF, heavy vehicles and pedestrians consistent with the Table 1 parameters.
Omni-Means verified that the SIDRA truck length corresponds with expected conditions.

VISSM Parameters for a DDI

VISSIM, by *PTV Planung Transport Verkehr AG*, is an analysis and optimization software application that uses behavior-based modeling of complex transportation geometry. For both intersection LOS and vehicle queuing, the technical parameters in **Table 5** were used for the DDI ramp intersections:

TABLE 5
VISSM TECHNICAL PARAMETERS FOR DDI INTERSECTIONS

The DDI will be modeled in VISSIM based on the preliminary concept prepared by Caltrans.
80 second minimum cycle length will be utilized.
PHF, heavy vehicles and pedestrians consistent with the Table 1 parameters.
Signal phasing will be based on the information published within the Diverging Diamond Interchange informational guide (FHWA, August 2014)

VISSM Parameters for Roundabouts

For vehicle queuing, the technical parameters in **Table 6** were used for roundabout intersections:

TABLE 6
VISSM TECHNICAL PARAMETERS FOR ROUNDABOUTS INTERSECTIONS

The roundabout interchange will be modeled in VISSIM based on preliminary concepts prepared by Omni-Means.
PHF, heavy vehicles and pedestrians consistent with the Table 1 parameters.
Conflict areas and/or priority rules are the two methods in VISSIM to simulate vehicle yielding behavior at the entry. We will use these methods to model the vehicle yielding behavior at the entries.

LOS Standards

The following LOS standards are applied in this TOR:

- LOS D or better for I-5 ramp intersections. The two ramp intersections have a LOS D standard due to the City's General Plan LOS D standard for "freeway interchanges".
- LOS D or better for South Bonnyview Road / Bechelli Lane and South Bonnyview Road / Churn Creek Road intersections. These two City intersections have a LOS D standard due to the City's General Plan LOS D standard for "river crossings".
- LOS C or better for Churn Creek Road / Alrose lane.

Additional information regarding City and Caltrans LOS guidelines and standards are provided in the following sections.

City LOS Guidelines

The City currently maintains its General Plan Transportation Element that is accessible via the following internet site: *http://www.cityofredding.org/home/showdocument?id=5513.* The Transportation Element contains the following information of particular interest to this study:

> *Policy T1A: Establish the following peak-hour LOS standards for transportation planning and project review. They reflect the special circumstances of various areas of the community:*
>
> - *Use LOS "C" – for most arterial streets and their intersections.*
> - *Use LOS "D" – for the Downtown area where vitality, activity, and pedestrian and transit use are primary goals.*
> - *Use LOS "D" – for streets within the State highway system and interchanges.*
> - *Use LOS "D" – for river-crossing street corridors whose capacity is affected by adjacent intersections.*

Caltrans LOS Guidelines

The Caltrans published *Guide for the Preparation of Traffic Impact Studies* (dated December 2002) states the following:

> *"Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities, however, Caltrans acknowledges that this may not be always feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS."*

Vehicle Queue Standards

Vehicle queues are considered acceptable within this TOR if the queues are accommodated within the "pocket" area for left- and right-turn lanes. When thru-movement queues are longer than an adjacent left- or right-turn lane pocket, the queues are considered unacceptable and the left-and right-turn pockets must be lengthened to allow access to the turn pockets.

No Build Conditions Analysis

The base (Without Rancheria Development) forecasted traffic volumes were applied to the existing geometry to determine the LOS and vehicle queues.

No Build conditions analysis was not performed for the "With Rancheria Development" forecasted traffic volumes.

Year 2015 No Build Conditions (Without Rancheria Development)

Year 2015 conditions are contained within the *South Bonnyview / Churn Creek Retail Center Traffic Impact Analysis Report, Omni-Means, May 2016*.

Year 2015 LOS and delays for the existing geometry are presented in **Table 7.**

TABLE 7
YEAR 2015 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour			PM Peak Hour		
				Delay	LOS	Warrant Met?[3]	Delay	LOS	Warrant Met?[3]
1	S. Bonnyview Rd/Bechelli Lane	Signal	C	17.2	B	-	22.4	C	-
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	28.4	C	-	27.3	C	-
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	32.5	C	-	29.8	C	-
4	S. Bonnyview Rd/Churn Creek Rd	Signal	C	17.2	B	-	22.4	C	-
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	13.6	B	-	**26.9**	**D**	**No**

Notes:

1 TWSC = Two Way Stop Control

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2015 critical queues for the existing geometry are presented in **Table 8**.

TABLE 8
YEAR 2015 INTERSECTION VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Existing 95th Percentile Queue (ft) AM Peak Hour	Existing 95th Percentile Queue (ft) PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**251**	145	200
	Eastbound Thru		241	228	
	Eastbound Thru/Right		149	170	
	Westbound Left		49	43	145
	Westbound Thru		199	214	
	Westbound Right		98	51	200
	Northbound Left/Thru		69	74	
	Northbound Right		**57**	**52**	30
	Southbound Left		139	216	
	Southbound Left/Thru		87	189	
	Southbound Right		100	155	190
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**255**	**269**	250
	Eastbound Right		92	140	250
	Westbound Left		155	228	
	Westbound Thru		131	181	
	Southbound Left/Thru		113	**192**	175
	Southbound Right		309	253	
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	463	418	
	Eastbound Thru		189	216	
	Westbound Thru		164	222	
	Westbound Right		**121**	102	110
	Northbound Left/Thru		341	227	
	Northbound Right		87	96	285
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**168**	**147**	130
	Eastbound Thru		76	167	
	Westbound Left		-	8	
	Westbound Thru		91	11	
	Westbound Thru/Right		161	97	
	Northbound Left/Thru		5	111	
	Northbound Right		12	25	
	Southbound Left/Thru		80	159	
	Southbound Right		99	176	

TABLE 8
YEAR 2015 INTERSECTION VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Existing 95th Percentile Queue (ft) AM Peak Hour	PM Peak Hour	Available Storage
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	Signal	90	153	
	Westbound Left/Thru		-	7	
	Westbound Thru/Right		-	4	
	Northbound Left/Thru/Right		-	34	
	Southbound Thru	Signal	235	340	
	Southbound Thru/Right		200	259	

1. Worst lane movement (of the approach) value stated.

Year 2025 No Build Conditions (Without Rancheria Development)

Year 2025 No Build conditions are presented in TM# 13 in the Appendix.

Year 2025 No Build LOS and delays for the existing geometry are presented in **Table 9**.

TABLE 9
YEAR 2025 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	**S. Bonnyview Rd/Bechelli Lane**	**Signal**	**C**	20.5	C	**76.3**	**E**
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	30.2	C	45.2	D
3	**S. Bonnyview Rd/I-5 NB Ramps**	**Signal**	**D**	45.4	D	**64.9**	**E**
4	S. Bonnyview Rd/Churn Creek Rd	Signal	C	27.7	C	26.5	C
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	16.8	C	**64.8**	**F**

Notes:
1 TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2025 critical queues for the existing geometry are presented in **Table 10**.

TABLE 10
YEAR 2025 95TH PERCENTILE VEHICLES QUEUES

Int. #	Intersection/Approach	Control Type	Year 2025 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**259**	**333**	200
	Eastbound Thru		348	525	
	Eastbound Thru/Right		251	468	
	Westbound Left		52	42	145
	Westbound Thru		239	230	
	Westbound Right		130	128	200
	Northbound Left/Thru		60	71	
	Northbound Right		45	54	75
	Southbound Left		116	420	
	Southbound Left/Thru		82	439	
	Southbound Right		88	**273**	110
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**418**	**918**	250
	Eastbound Right		100	**364**	250
	Westbound Left		183	199	380
	Westbound Thru		119	132	
	Southbound Left/Thru		319	518	
	Southbound Right		**324**	**521**	180
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	**466**	**421**	380
	Eastbound Thru		250	408	
	Westbound Thru		251	254	
	Westbound Right		**233**	**185**	110
	Northbound Left/Thru		338	286	
	Northbound Right		137	169	285

TABLE 10
YEAR 2025 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Year 2025 - 95th Percentile Queue (ft) AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**205**	**276**	130
	Eastbound Thru		231	311	
	Eastbound Right		83	91	115
	Westbound Left		**100**	**78**	75
	Westbound Thru		206	214	
	Westbound Thru/Right		254	254	
	Northbound Left/Thru		206	215	
	Northbound Right		-	170	
	Southbound Left/Thru		580	590	
	Southbound Right		-	-	
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	TWSC	94	118	
	Westbound Left/Thru		68	12	
	Westbound Thru/Right		162	76	
	Northbound Left/Thru/Right		-	43	
	Southbound Left/Thru		38	54	
	Southbound Right		116	77	

1. Worst lane movement (of the approach) value stated.

Year 2035 No Build Conditions (Without Rancheria Development)

Year 2035 No Build conditions are presented in TM# 13 in the Appendix.

Year 2035 No Build LOS and delays for the existing geometry are presented in **Table 11**.

TABLE 11
YEAR 2035 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	**S. Bonnyview Rd/Bechelli Lane**	**Signal**	**C**	22.3	C	**109.4**	**F**
2	**S. Bonnyview Rd/I-5 SB Ramps**	**Signal**	**D**	44.7	D	**55.9**	**E**
3	**S. Bonnyview Rd/I-5 NB Ramps**	**Signal**	**D**	**97.0**	**F**	**86.1**	**F**
4	S. Bonnyview Rd/Churn Creek Rd	Signal	C	28.6	C	28.0	C
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	19.5	C	**101.0**	**F**

Notes:
1 TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2035 critical queues for the existing geometry are presented in **Table 12**.

TABLE 12
YEAR 2035 95TH PERCENTILE VEHICLES QUEUES

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**342**	**415**	200
	Eastbound Thru		542	702	
	Eastbound Thru/Right		485	684	
	Westbound Left		71	62	145
	Westbound Thru		**246**	239	
	Westbound Right		145	133	200
	Northbound Left/Thru		78	99	
	Northbound Right		59	72	75
	Southbound Left		**181**	407	
	Southbound Left/Thru		124	437	
	Southbound Right		80	**281**	110
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**856**	**948**	250
	Eastbound Right		250	**413**	250
	Westbound Left		183	231	380
	Westbound Thru		143	126	
	Southbound Left/Thru		605	502	
	Southbound Right		**476**	**549**	180
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	**456**	**416**	380
	Eastbound Thru		357	393	
	Westbound Thru		265	278	
	Westbound Right		**139**	**229**	110
	Northbound Left/Thru		401	336	
	Northbound Right		167	247	285

TABLE 12
YEAR 2035 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft) AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**232**	**254**	130
	Eastbound Thru		249	300	
	Eastbound Right		101	70	115
	Westbound Left		**100**	**83**	75
	Westbound Thru		219	214	
	Westbound Thru/Right		251	246	
	Northbound Left/Thru		230	194	
	Northbound Right		-	-	
	Southbound Left/Thru		587	587	
	Southbound Right		-	-	
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	TWSC	106	120	
	Westbound Left/Thru		93	71	
	Westbound Thru/Right		193	154	
	Northbound Left/Thru/Right		-	48	
	Southbound Left/Thru		67	87	
	Southbound Right		139	136	

1. Worst lane movement (of the approach) value stated.

Year 2045 No Build Conditions (Without Rancheria Development)

Year 2045 No Build conditions are presented in TM# 13 in the Appendix.

Year 2045 No Build LOS and delays for the existing geometry are presented in **Table 13**.

TABLE 13
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	**S. Bonnyview Rd/Bechelli Lane**	**Signal**	**C**	24.5	C	**146.6**	**F**
2	**S. Bonnyview Rd/I-5 SB Ramps**	**Signal**	**D**	**64.4**	**E**	**65.5**	**E**
3	**S. Bonnyview Rd/I-5 NB Ramps**	**Signal**	**D**	**60.7**	**E**	**108.2**	**F**
4	**S. Bonnyview Rd/Churn Creek Rd**	**Signal**	**C**	31.5	C	**35.2**	**D**
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	23.3	C	**176.3**	**F**

Notes:
1 TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2045 critical queues for the existing geometry are presented in **Table 14**.

TABLE 14
YEAR 2045 95TH PERCENTILE VEHICLES QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**377**	**398**	200
	Eastbound Thru		644	709	
	Eastbound Thru/Right		598	708	
	Westbound Left		87	71	145
	Westbound Thru		255	243	
	Westbound Right		149	152	200
	Northbound Left/Thru		72	106	
	Northbound Right		52	**91**	75
	Southbound Left		179	388	
	Southbound Left/Thru		152	403	
	Southbound Right		100	**286**	110
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**923**	**947**	250
	Eastbound Right		**276**	**491**	250
	Westbound Left		202	208	380
	Westbound Thru		134	130	
	Southbound Left/Thru		610	496	
	Southbound Right		**523**	**553**	180
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	**451**	**429**	380
	Eastbound Thru		381	393	
	Westbound Thru		255	276	
	Westbound Right		**232**	**243**	110
	Northbound Left/Thru		513	309	
	Northbound Right		**340**	220	285

TABLE 14
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**244**	**260**	130
	Eastbound Thru		276	306	
	Eastbound Right		98	82	115
	Westbound Left		**107**	**82**	75
	Westbound Thru		225	228	
	Westbound Thru/Right		239	257	
	Northbound Left/Thru		234	218	
	Northbound Right		-	-	
	Southbound Left/Thru		585	579	
	Southbound Right		-	-	
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	TWSC	116	122	
	Westbound Left/Thru		141	102	
	Westbound Thru/Right		299	220	
	Northbound Left/Thru/Right		-	64	
	Southbound Left/Thru		140	117	
	Southbound Right		211	151	

1. Worst lane movement (of the approach) value stated.

Alternative 1, 1A and 1B Conditions Analysis (Traditional Tight Diamond)

The Alternative 1's represent a "build" condition that is assumed to be in operation in year 2025. The critical consideration is whether the alternatives will provide acceptable traffic operations after 20-years (year 2045). In order to present data that can be used for a 10-year design life interim phase, year 2035 traffic operations are also considered.

Alternative 1 Condition Analysis

Year 2035 Alternative 1 Conditions (Without Rancheria Development)

Year 2035 Alternative 1 conditions are presented in TM# 11 (Revised) in the Appendix.

Year 2035 Alternative 1 LOS and delays are presented in **Table 15**.

TABLE 15
YEAR 2035 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.5	C	26.7	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	22.3	C	25.3	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	25.0	C	25.0	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	29.1	C	28.4	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	13.2	B	20.7	C

Notes:
1 TWSC = Two Way Stop Control
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

Year 2035 critical queues are presented in **Table 16**.

TABLE 16
YEAR 2035 95TH PERCENTILE VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	277	211	400
	Eastbound Thru		224	227	
	Eastbound Thru/Right		200	243	350
	Westbound Left		109	78	150
	Westbound Thru		325	348	
	Westbound Right		132	133	550
	Northbound Left/Thru		62	81	
	Northbound Right		45	59	75
	Southbound Left		63	193	300
	Southbound Left/Thru		80	276	
	Southbound Right		87	157	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	155	226	490
	Eastbound Right		104	250	350
	Westbound Left		152	182	
	Westbound Thru		209	217	
	Southbound Left		111	140	300
	Southbound Left/Thru		107	144	
	Southbound Right		215	212	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	245	367	
	Eastbound Thru		172	209	
	Westbound Thru		259	276	
	Westbound Right		235	178	
	Northbound Left		278	255	450
	Northbound Left/Thru		320	294	
	Northbound Right		125	154	400

TABLE 16
YEAR 2035 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**187**	**212**	175
	Eastbound Thru		123	218	
	Eastbound Right		82	92	145
	Westbound Left		88	57	
	Westbound Thru		225	212	
	Westbound Right		106	114	200
	Northbound Left		107	131	
	Northbound Thru/Right		108	68	
	Southbound Left		97	148	225
	Southbound Thru		45	31	
	Southbound Right		115	182	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	49	71	110
	Westbound Left/Thru		17	48	
	Westbound Thru/Right		12	18	
	Northbound Left/Thru/Right		-	42	
	Southbound Left/Thru		28	39	
	Southbound Right		71	60	

1. Worst lane movement (of the approach) value stated.

Year 2045 Alternative 1 Conditions (Without Rancheria Development)

Year 2045 Alternative 1 conditions are presented in TM# 14 in the Appendix.

Year 2045 Alternative 1 LOS and delays for the existing geometry are presented in **Table 17**.

TABLE 17
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.2	C	29.7	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	22.6	C	26.2	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	25.7	C	27.4	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	28.6	C	27.1	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	13.8	B	23.5	C

Notes:
1 LOS = Delay based on average of all approaches for Roundabout
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 18**.

TABLE 18
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	Year 2045 - 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	475	306	400
	Eastbound Thru		406	266	
	Eastbound Thru/Right		229	223	350
	Westbound Left		128	138	150
	Westbound Thru		378	339	
	Westbound Right		154	129	550
	Northbound Left/Thru		70	87	
	Northbound Right		48	65	75
	Southbound Left		72	301	300
	Southbound Left/Thru		95	381	
	Southbound Right		96	263	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	205	662	490
	Eastbound Thru/Right		227	674	
	Westbound Left		143	201	300
	Westbound Thru		248	239	
	Southbound Left/Thru		231	255	
	Southbound Right		235	225	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	335	481	
	Eastbound Thru		207	271	
	Westbound Thru		272	295	
	Westbound Right		255	235	
	Northbound Left		526	438	500
	Northbound Left/Thru		585	492	
	Northbound Right		416	308	500

TABLE 18
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	217	235	175
	Eastbound Thru		136	246	
	Eastbound Right		72	132	145
	Westbound Left		86	58	
	Westbound Thru		254	228	
	Westbound Right		164	128	200
	Northbound Left		137	112	
	Northbound Thru/Right		109	65	
	Southbound Left		125	171	225
	Southbound Thru		45	283	
	Southbound Right		105	229	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	46	80	100
	Westbound Left/Thru		16	70	
	Westbound Thru/Right		22	35	
	Northbound Left/Thru/Right		-	54	
	Southbound Left/Thru		24	46	
	Southbound Right		71	77	

1. Worst lane movement (of the approach) value stated.

Year 2045 Alternative 1A Conditions (With Half Rancheria Development)

Year 2045 Alternative 1A conditions are presented in TM# 15 in the Appendix.

Year 2045 Alternative 1A LOS and delays for the existing geometry are presented in **Table 19**.

TABLE 19
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour	
				Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	37.6	D
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	18.4	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	29.0	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	30.7	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	23.3	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 20**.

TABLE 20
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	- 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**
	Eastbound Left	Signal	297	400
	Eastbound Thru		336	
	Eastbound Thru/Right		56	350
	Westbound Left		321	350
	Westbound Thru		425	
	Westbound Right		194	550
	Northbound Left/Thru		267	
	Northbound Right		194	150
	Southbound Left		214	300
	Southbound Left/Thru		298	
	Southbound Right		167	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**
	Eastbound Thru	Signal	188	300
	Eastbound Right		313	350
	Westbound Left		127	300
	Westbound Thru		67	
	Southbound Left		135	300
	Southbound Left/Thru		167	
	Southbound Right		336	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**
	Eastbound Left	Signal	338	
	Eastbound Thru		193	
	Westbound Thru		259	
	Westbound Right		171	
	Northbound Left		264	450
	Northbound Left/Thru		311	
	Northbound Right		160	400

TABLE 20
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	- 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**
	Eastbound Left	Signal	227	175
	Eastbound Thru		184	
	Eastbound Right		46	145
	Westbound Left		61	
	Westbound Thru		204	
	Westbound Right		96	200
	Northbound Left		105	
	Northbound Thru/Right		63	
	Southbound Left		175	225
	Southbound Thru		28	
	Southbound Right		172	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**
	Eastbound Left	TWSC	74	110
	Westbound Left/Thru		38	
	Westbound Thru/Right		8	
	Northbound Left/Thru/Right		46	
	Southbound Left/Thru		40	
	Southbound Right		67	

1. Worst lane movement (of the approach) value stated.

Year 2045 Alternative 1B Conditions (With Full Rancheria Development)

Year 2045 Alternative 1B conditions are presented in TM# 15 in the Appendix.

Year 2045 Alternative 1B LOS and delays for the existing geometry are presented in **Table 21**.

TABLE 21
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.4	C	33.7	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	19.8	B	24.0	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	49.5	D	52.7	D
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	27.7	C	26.5	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	14.0	B	24.0	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 22**.

TABLE 22
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	Year 2045 - 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	213	189	400
	Eastbound Thru		300	368	
	Eastbound Right		116	172	350
	Westbound Left		244	243	275
	Westbound Thru		355	337	
	Westbound Right		131	142	550
	Northbound Left		77	170	200
	Northbound Left/Thru		147	260	
	Northbound Right		113	320	300
	Southbound Left		73	308	400
	Southbound Left/Thru		107	665	
	Southbound Right		108	258	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	143	262	300
	Eastbound Right		51	94	300
	Westbound Left		144	131	300
	Westbound Thru		331	172	
	Southbound Left		123	145	300
	Southbound Left/Thru		119	150	
	Southbound Right		372	382	425
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	282	403	
	Eastbound Thru		157	172	
	Westbound Thru		262	252	
	Westbound Right		263	246	
	Northbound Left		315	452	450
	Northbound Left/Thru		357	519	
	Northbound Right		160	330	400

TABLE 22
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES (CONTINUED)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	Year 2045 - 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	221	211	175
	Eastbound Thru		128	187	
	Eastbound Right		82	39	145
	Westbound Left		104	55	
	Westbound Thru		285	257	
	Westbound Right		221	103	200
	Northbound Left		165	217	
	Northbound Thru/Right		105	65	
	Southbound Left		141	171	230
	Southbound Thru		58	40	
	Southbound Right		144	274	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	51	80	110
	Westbound Left/Thru		24	66	
	Westbound Thru/Right		96	18	
	Northbound Left/Thru/Right		-	58	
	Southbound Left/Thru		27	42	
	Southbound Right		88	69	

1. Worst lane movement (of the approach) value stated.

Alternative 2, 2A and 2B Conditions Analysis (Diverging Diamond with Traditional Signals)

The Alternative 2's represent a "build" condition that is assumed to be in operation in year 2025. The critical consideration is whether the alternatives will provide acceptable traffic operations after 20-years (year 2045). In order to present data that can be used for a 10-year design life interim phase, year 2035 traffic operations are also considered.

Alternative 2 Condition Analysis

Year 2035 Alternative 2 Conditions (Without Rancheria Development)

Year 2035 Alternative 2 conditions are presented in TM# 11 (Revised) in the Appendix.

Year 2035 Alternative 2 LOS and delays are presented in **Table 23**.

TABLE 23
YEAR 2035 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	32.2	C	22.9	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	11.7	B	12.2	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	10.2	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	21.0	C	18.6	B

Notes:
1 LOS = Delay based on average of all approaches for Roundabout
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2035 critical queues are presented in **Table 24** and **Table 25**.

TABLE 24
YEAR 2035 95TH PERCENTILE AM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) AM Peak Hour[1] Average	Year 2035 Queue (ft) AM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	52.9	244.4	400
	Eastbound Thru/Right		10.3	150.9	
	Westbound Left/Thru/Right		54.5	393.2	550
	Northbound Left/Thru		6.6	86.1	100
	Northbound Right		4.7	85	100
	Southbound Left/Thru/Right		39.0	197.2	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	19.1	208	630
	Westbound Left/Thru		42.2	324.5	500
	Southbound Left		4.7	105.4	450
	Southbound Right		222.0	420.8	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	20.6	353.6	480
	Westbound Thru/Right		45.2	**303**	215
	Northbound Left		7.7	126.2	450
	Northbound Right		176.0	241.9	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	22.7	**238.4**	150
	Eastbound Thru		8.2	145.4	210
	Westbound Left		26.8	127	
	Westbound Thru		21.0	238.9	
	Northbound Left		7.9	147.8	
	Northbound Thru/Right		50.5	237.7	
	Southbound Left/Thru		16.4	105.5	225
	Southbound Right		15.0	238.7	350

1. Worst lane movement (of the approach) value stated.

TABLE 25
YEAR 2035 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) PM Peak Hour[1] Average	Year 2035 Queue (ft) PM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	38.6	285.9	400
	Eastbound Thru/Right		27.8	256.6	
	Westbound Left/Thru/Right		62.1	421.5	550
	Northbound Left/Thru		7.5	86.1	100
	Northbound Right		6.6	85.1	100
	Southbound Left/Thru/Right		115.2	**465.3**	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	69.5	515.5	630
	Westbound Left/Thru		35.7	282.4	500
	Southbound Left		7.5	126.8	450
	Southbound Right		211.0	321.1	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	34.7	367.8	480
	Westbound Thru/Right		40.6	**301.3**	200
	Northbound Left		5.5	106.1	450
	Northbound Right		176.0	224.1	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	29.4	**305.5**	150
	Eastbound Thru		13.2	**253.4**	210
	Westbound Left		20.5	127.5	
	Westbound Thru		7.5	212.7	
	Northbound Left		7.6	128.1	
	Northbound Thru/Right		43.4	104.3	
	Southbound Left/Thru		21.5	151.9	225
	Southbound Right		17.9	280.9	350

1. Worst lane movement (of the approach) value stated.

Year 2045 Alternative 2 Conditions (Without Rancheria Development)

Year 2045 Alternative 2 conditions are presented in TM# 14 in the Appendix.

Year 2045 Alternative 2 LOS and delays for the existing geometry are presented in **Table 26**.

TABLE 26
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	15.8	B	23.9	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B	12.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.0	B	10.5	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	21.0	C	19.0	B

Notes:
1 LOS = Delay based on average of all approaches for Roundabout
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 27** and **Table 28**.

TABLE 27
YEAR 2045 95TH PERCENTILE AM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	40.3	291.5	400
	Eastbound Thru/Right		17.7	217.2	
	Westbound Left/Thru/Right		62.4	412.8	550
	Northbound Left/Thru		6.4	86.1	100
	Northbound Right		4.6	85	100
	Southbound Left/Thru/Right		37.9	210.5	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru/Right	Signal	34.5	311.5	630
	Westbound Left/Thru		47.6	331	500
	Southbound Left		5.2	121.5	450
	Southbound Right		212.0	556.6	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Signal	25.1	293.9	480
	Westbound Thru/Right		50.1	318.9	450
	Northbound Left		9.2	141.7	450
	Northbound Right		176.0	224.1	400
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left	Signal	30.4	339.9	150
	Eastbound Thru		10.7	228.5	210
	Westbound Left		33.0	126.6	
	Westbound Thru		14.5	286.5	
	Northbound Left		7.4	165.9	
	Northbound Thru/Right		56.4	133.2	
	Southbound Left/Thru		18.9	109.8	225
	Southbound Right		17.0	251.2	350

1. Worst lane movement (of the approach) value stated.

TABLE 28
YEAR 2045 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	45.5	376.9	400
	Eastbound Thru/Right		30.4	255.6	
	Westbound Left/Thru/Right		71.0	444.3	550
	Northbound Left/Thru		7.9	86.1	100
	Northbound Right		8.2	85.1	100
	Southbound Left/Thru/Right		161.8	480.9	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	86.3	587.1	630
	Westbound Left/Thru		39.9	343.5	500
	Southbound Left		8.0	129.7	450
	Southbound Right		213.0	468.2	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	40.5	493.9	480
	Westbound Thru/Right		47.9	307.3	450
	Northbound Left		6.5	118.5	450
	Northbound Right		18.3	156	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	32.8	298	150
	Eastbound Thru		16.6	285	210
	Westbound Left		22.9	126.3	
	Westbound Thru		5.7	248.8	
	Northbound Left		7.9	128.2	
	Northbound Thru/Right		50.6	99.7	
	Southbound Left/Thru		22.7	148.7	225
	Southbound Right		22.2	289.5	350

1. Worst lane movement (of the approach) value stated.

Year 2045 Alternative 2A Conditions (With Half Rancheria Development)

Year 2045 Alternative 2A conditions are presented in TM# 15 in the Appendix.

Year 2045 Alternative 2A LOS and delays for the existing geometry are presented in **Table 29**.

TABLE 29
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour	
				Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.4	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.5	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	20.0	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 30**.

TABLE 30
YEAR 2045 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	55.8	265.9	400
	Eastbound Thru/Right		60.4	289.1	
	Westbound Left/Thru/Right		164.3	416.8	550
	Northbound Left/Thru		19.8	142.9	100
	Northbound Right		8.9	214.5	100
	Southbound Left/Thru		75.0	379.4	300
	Southbound Right		27.8	286.6	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	76.8	447	630
	Westbound Left/Thru		49.2	321.2	500
	Southbound Left		5.0	102.2	450
	Southbound Right		57.3	607.4	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	37.3	411.1	480
	Westbound Thru/Right		48.5	292.4	450
	Northbound Left		9.8	127.4	450
	Northbound Right		19.3	223.8	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	35.6	237.2	150
	Eastbound Thru		18.8	231.9	210
	Westbound Left		9.1	102.9	
	Westbound Thru		54.9	232.6	
	Northbound Left		30.0	126.1	
	Northbound Thru/Right		6.3	62.7	
	Southbound Left/Thru		23.4	168.4	225
	Southbound Right		26.2	286.2	350

1. Worst lane movement (of the approach) value stated.

Year 2045 Alternative 2B Conditions (With Full Rancheria Development)

Year 2045 Alternative 2B conditions are presented in TM# 15 in the Appendix.

Year 2045 Alternative 2B LOS and delays for the existing geometry are presented in **Table 31**.

TABLE 31
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	20.5	C	27.5	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	16.3	B	14.8	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	10.7	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	23.0	C	20.3	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 32** and **33**.

TABLE 32
YEAR 2045 95TH PERCENTILE AM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	50.3	268.4	400
	Eastbound Thru/Right		57.5	347.5	
	Westbound Left		36.8	211.0	550
	Westbound Thru		51.9	370.9	550
	Westbound Right		5.8	206.5	550
	Northbound Left/Thru		26.3	150.4	100
	Northbound Right		23.5	205.8	100
	Southbound Left/Thru/Right		26.7	118.9	300
	Southbound Right		17.8	214.7	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	43.6	307.7	630
	Westbound Left/Thru		161.3	620.7	500
	Southbound Left		5.4	86.7	450
	Southbound Right		41.2	360.7	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	25.1	317.2	480
	Westbound Thru/Right		68.9	301.6	450
	Northbound Left		23	187.9	450
	Northbound Right		24.2	224.1	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	34.5	225.5	150
	Eastbound Thru		10.4	127.4	210
	Westbound Left		41.1	132.6	
	Westbound Thru		15.7	124.8	
	Northbound Left		10.7	86.3	
	Northbound Thru/Right		61.5	303.0	
	Southbound Left/Thru		22.6	106.6	225
	Southbound Right		22.5	204.0	350

1. Worst lane movement (of the approach) value stated.

TABLE 33
YEAR 2045 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	57.9	287.8	400
	Eastbound Thru/Right		99.8	426.1	
	Westbound Left		52.9	296.2	550
	Westbound Thru		68.2	361.1	550
	Westbound Right		9.4	276.9	550
	Northbound Left/Thru		60.2	294.7	100
	Northbound Right		50.1	363.7	100
	Southbound Left/Thru/Right		82.9	461.9	300
	Southbound Right		31.7	361.4	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	108.5	562.1	630
	Westbound Left/Thru		82.0	533.0	500
	Southbound Left		8.1	120.3	450
	Southbound Right		29.7	296.4	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	47.8	539.1	480
	Westbound Thru/Right		55.6	331.1	450
	Northbound Left		13.3	147.9	450
	Northbound Right		19.7	223.9	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	37.5	263.4	150
	Eastbound Thru		15.4	228.0	210
	Westbound Left		9.8	102.5	
	Westbound Thru		56.7	220.3	
	Northbound Left		28.4	108.1	
	Northbound Thru/Right		6.3	62.7	
	Southbound Left/Thru		23.5	168.1	225
	Southbound Right		28.0	287.5	350

1. Worst lane movement (of the approach) value stated.

Alternative 4, 4A and 4B Conditions Analysis (Diverging Diamond with Traditional Signals)

The Alternative 4's represent a "build" condition that is assumed to be in operation in year 2025. The critical consideration is whether the alternatives will provide acceptable traffic operations after 20-years (year 2045). In order to present data that can be used for a 10-year design life interim phase, year 2035 traffic operations are also considered.

Alternative 4 Condition Analysis

Year 2035 Alternative 4 Conditions (Without Rancheria Development)

Year 2035 Alternative 4 conditions are presented in TM# 11 in the Appendix.

Year 2035 Alternative 4 LOS and delays for the existing geometry are presented in **Table 34**.

TABLE 34
YEAR 2035 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	12.2	B	26.3	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	11.7	B	12.2	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	10.2	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	10.3	B	11.4	B

Notes:
1 LOS = Delay based on average of all approaches for Roundabout
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 35** and **Table 36**.

TABLE 35
YEAR 2035 95TH PERCENTILE AM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) AM Peak Hour[1] Average	Year 2035 Queue (ft) AM Peak Hour[1] Max[2]	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		129.5	
	Eastbound Thru/Right			128.5	
	Westbound Left/Thru			221.8	
	Westbound Thru/Right			226	
	Northbound Left/Thru/Right			16.8	
	Southbound Left			20.8	
	Southbound Left/Thru			20.8	
	Southbound Right			33.7	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	14.5	127.1	630
	Westbound Left/Thru		50.1	283.3	500
	Southbound Left		3.9	83.8	450
	Southbound Right		31.2	396.5	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	31.6	200	480
	Westbound Thru/Right		24.7	**280.9**	215
	Northbound Left		10.7	140.4	450
	Northbound Right		2.4	151.3	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		77.1	
	Eastbound Thru/Right			79.7	
	Westbound Left/Thru			114.9	
	Westbound Thru/Right			122.5	
	Northbound Left/Thru/Right			61	
	Southbound Left/Thru			32.7	
	Southbound Right			111.1	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

TABLE 36
YEAR 2035 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) PM Peak Hour[1] Average	Year 2035 Queue (ft) PM Peak Hour[1] Max[2]	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		465	
	Eastbound Thru/Right			500.2	
	Westbound Left/Thru			185.6	
	Westbound Thru/Right			183.2	
	Northbound Left/Thru/Right			36.2	
	Southbound Left			88.7	
	Southbound Left/Thru			101.2	
	Southbound Right			104.2	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	21.6	154.3	630
	Westbound Left/Thru		46.6	277.8	500
	Southbound Left		6.4	103.4	450
	Southbound Right		25.3	313.3	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	59.7	315.4	480
	Westbound Thru/Right		25.6	**340.6**	215
	Northbound Left		7.5	141.2	450
	Northbound Right		5.9	193.1	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		113.1	
	Eastbound Thru/Right			118	
	Westbound Left/Thru			95	
	Westbound Thru/Right			99.9	
	Northbound Left/Thru/Right			46.1	
	Southbound Left/Thru			47.1	
	Southbound Right			156.7	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Year 2045 Alternative 4 Conditions (Without Rancheria Development)

Year 2045 Alternative 4 conditions are presented in TM# 14 in the Appendix.

Year 2045 Alternative 4 LOS and delays for the existing geometry are presented in **Table 37**.

TABLE 37
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	11.8	B	23.6	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	11.8	B	11.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	12.0	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	11.3	B	12.2	B

Notes:
1 LOS = Delay based on average of all approaches for Roundabout
3. Warrant = Based on California MUTCD Warrant 3
4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 38** and **Table 39**.

TABLE 38
YEAR 2045 95TH PERCENTILE AM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		113.9	
	Eastbound Thru/Right			112.8	
	Westbound Left/Thru			237.5	
	Westbound Thru/Right			242	
	Northbound Left/Thru/Right			16	
	Southbound Left			22.2	
	Southbound Left/Thru			22.2	
	Southbound Right			35.7	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	17.8	155	630
	Westbound Left/Thru		53.8	261.6	500
	Southbound Left		4.3	84	450
	Southbound Right		61.4	538.7	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	48.3	213.9	480
	Westbound Thru/Right		27.9	340.4	215
	Northbound Left		62.2	402.5	450
	Northbound Right		10.1	168.8	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		89.2	250
	Eastbound Thru/Right			93.1	250
	Westbound Left/Thru			147.3	
	Westbound Thru/Right			162.4	
	Northbound Left/Thru/Right			65.7	150
	Southbound Left/Thru			40.3	
	Southbound Right			117.7	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

TABLE 39
YEAR 2045 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		379.2	
	Eastbound Thru/Right			420.3	
	Westbound Left/Thru			195	
	Westbound Thru/Right			195	
	Northbound Left/Thru/Right			45.4	
	Southbound Left			95.8	
	Southbound Left/Thru			113.1	
	Southbound Right			114.8	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	25.1	171	630
	Westbound Left/Thru		49.3	252	500
	Southbound Left		6.7	108	450
	Southbound Right		30.6	451	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	69.8	358.2	480
	Westbound Thru/Right		29.4	300	215
	Northbound Left		21.3	285.6	450
	Northbound Right		6.6	188.5	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		119.4	250
	Eastbound Thru/Right			125.5	250
	Westbound Left/Thru			110.4	
	Westbound Thru/Right			118	
	Northbound Left/Thru/Right			45	150
	Southbound Left/Thru			52.9	
	Southbound Right			183.4	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Year 2045 Alternative 4A Conditions (With Half Rancheria Development)

Year 2045 Alternative 4A conditions are presented in TM# 15 in the Appendix.

Year 2045 Alternative 4A LOS and delays for the existing geometry are presented in **Table 40**.

TABLE 40
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour	
				Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	20.1	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	12.9	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	12.4	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 41**.

TABLE 41
YEAR 2045 95TH PERCENTILE VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		144.3	
	Eastbound Thru			144.3	
	Eastbound Thru/Right			173.3	
	Westbound Left/Thru			320.5	
	Westbound Thru/Right			323.3	
	Northbound Left/Thru			33.4	
	Northbound Right			55.9	
	Southbound Left			149.6	
	Southbound Left/Thru			190.4	
	Southbound Right			195.7	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	33.2	206.6	630
	Westbound Left/Thru		57.9	240.7	500
	Southbound Left		6.0	82.6	450
	Southbound Right		88.5	541.7	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	84.4	368.9	480
	Westbound Thru/Right		32.3	295.9	215
	Northbound Left		59.5	510.7	450
	Northbound Right		9.3	218.4	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		120.8	250
	Eastbound Thru/Right			127	250
	Westbound Left/Thru			113.7	
	Westbound Thru/Right			121.7	
	Northbound Left/Thru/Right			45.4	150
	Southbound Left/Thru			53.6	
	Southbound Right			187	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Year 2045 Alternative 4B Conditions (With Full Rancheria Development)

Year 2045 Alternative 4B conditions are presented in TM# 15 in the Appendix.

Year 2045 Alternative 4B LOS and delays for the existing geometry are presented in **Table 42**.

TABLE 42
YEAR 2045 INTERSECTION LOS AND DELAYS

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	11.2	B	26.5	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	12.3	B	14.8	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.7	B	10.7	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	11.6	B	12.6	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 critical queues are presented in **Table 43** and **44**.

TABLE 43
YEAR 2045 95TH PERCENTILE AM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		81.9	
	Eastbound Thru			81.9	
	Eastbound Thru/Right			87.8	
	Westbound Left/Thru			237.1	
	Westbound Thru/Right			247	
	Westbound Right			78.4	
	Northbound Left/Thru			21.8	
	Northbound Right			32.3	
	Southbound Left			31.3	
	Southbound Left/Thru			31.3	
	Southbound Right			46.6	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	21.0	151.5	630
	Westbound Left/Thru		70.0	332.7	500
	Southbound Left		11.5	153.0	450
	Southbound Right		56.7	533.9	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	56.6	270.5	480
	Westbound Thru/Right		31.6	281.4	215
	Northbound Left		20.7	167.4	450
	Northbound Right		9.8	235.2	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		90.4	250
	Eastbound Thru/Right			94.4	250
	Westbound Left/Thru			154.1	
	Westbound Thru/Right			170.4	
	Northbound Left/Thru/Right			66.3	150
	Southbound Left/Thru			41.3	
	Southbound Right			120.8	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

TABLE 44
YEAR 2045 95TH PERCENTILE PM VEHICLE QUEUES

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		264.5	
	Eastbound Thru			264.5	
	Eastbound Thru/Right			353	
	Westbound Left/Thru			234.5	
	Westbound Thru/Right			241.1	
	Westbound Right			101.1	
	Northbound Left/Thru			58.6	
	Northbound Right			150	
	Southbound Left			161	
	Southbound Left/Thru			216.3	
	Southbound Right			221.9	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	38.5	272.9	630
	Westbound Left/Thru		68.8	334.4	500
	Southbound Left		18.9	218.8	450
	Southbound Right		42.2	506.4	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	81.1	349.9	480
	Westbound Thru/Right		33.9	282.6	215
	Northbound Left		17.1	149.0	450
	Northbound Right		8.3	170.3	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		122.1	250
	Eastbound Thru/Right			128.4	250
	Westbound Left/Thru			116.8	
	Westbound Thru/Right			125.3	
	Northbound Left/Thru/Right			45.8	150
	Southbound Left/Thru			54.3	
	Southbound Right			190.5	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Appendices

Appendix A: Technical Memorandums

Technical Memorandum No. 1

To:	City of Redding - Engineering	**Date:**	May 06, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham		
Re:	Proposed Approach to Traffic Volume Projections	**Job No.:**	45-5721-27
		File No.:	C2174MEM001
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Based on input received at the May 6, 2016 mini-PDT meeting, Omni-Means will develop future year traffic volumes based on the following guidelines:

Year 2045 (Design Year)

Considerations

1. The Shasta County Regional Travel Demand Model (Model) can provide projections to year 2035.
2. Omni-Means has already adjusted the Model to provide 2035 volumes for the study area via. the March 2016 Traffic Impact Analysis Report (TIAR) prepared for the California Gold project on Churn Creek Road.
3. A BoxCo development should be considered for the NW quadrant of the I/C.
4. An AM/PM and coffee shop should be considered for the SE quadrant of the I/C.
5. The California Gold development should be assumed as constructed per the Use Permit application to the City.
6. If BoxCo gets developed at this location, the remaining developable land in the immediate interchange area will be more likely to develop.

Approach

1. Prepare the following for mini-PDT approval:
   1) Un-adjusted Model TAZ info for greater area. Include development assumptions and linkages.
   2) Present proposed linkage modifications (i.e. No driveways from Rother property to S. Bonnyview).
   3) Present proposed development assumption changes.
   4) Present methodology for customization of development assumptions that will be needed to better match proposed developments (eg. BoxCo).
2. Add full development of California Gold project in appropriate TAZ.

3. Add full development of a 160ksf BoxCo with 16 fueling positions (on the 2 Rother parcels (15 +/- acres)).
4. Add 5 acres of general retail development on the Redding Business Trust parcel (north of Rother and south of swale). Assume approximately 60ksf of retail containing 1 fast food with drivethru.
5. Add Pre-Application proposed development in SE quadrant of the I/C.
6. Add Phase II Blue Shield (and double check that unfinished office building that overlooks the river is included as developed).
7. Technical Parameters:
   - Use the Model for trip assignments after making the above modifications.
   - Perform reality check of Model trip assignments.

Year 2025 (Phase I I/C Construction Complete)

Approach

1. Straight line to derive 2025.
2. Add 80% development of California Gold project.
3. Add full development of a 160ksf BoxCo with 16 fueling positions (on the 2 Rother parcels (15 +/- acres)).
4. Add 50% of general retail development on the Redding Business Trust parcel.
5. Add Pre-Application proposed development in SE quadrant.
6. Do NOT add phase II Blue Shield.
7. Technical Parameters:
   - Use the Model.
   - Perform reality check of Model trip assignments.

Year 2035 (Phase II I/C Construction Complete)

Approach

1. Straight line between 2025 and 2045.

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 2

To:	City of Redding - Engineering	**Date:**	May 18, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham		
Re:	Proposed Approach to Traffic Volume Projections	**Job No.:**	45-5721-27
		File No.:	C2174MEM002
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Based on input received at the May 18, 2016 mini-PDT meeting, Omni-Means will develop future year traffic volumes based on the following guidelines:

Historic Traffic Growth at Interchange

1. See **Attachment A.** Approx. 1.5% annual growth through 2013.

Review 2015 & 2035 "Base Line" Volumes

1. "Base Line" 2015 and 2035 volumes per the March 2016 S. Bonnyview / Churn Creek Retail Center TIAR, Omni-Means. Refer to **Attachment B.** Travel Demand Model shows 1.0% - 1.2% annual growth rate through 2035 (Note: The 2035 #'s and growth rate assume the S. Bonnyview / churn Creek Retail parcels are VACANT... which accounts for the low annual growth rate reflected on Attachment B).

Proposed 2035 & 2045 Travel Demand Model Adjustments

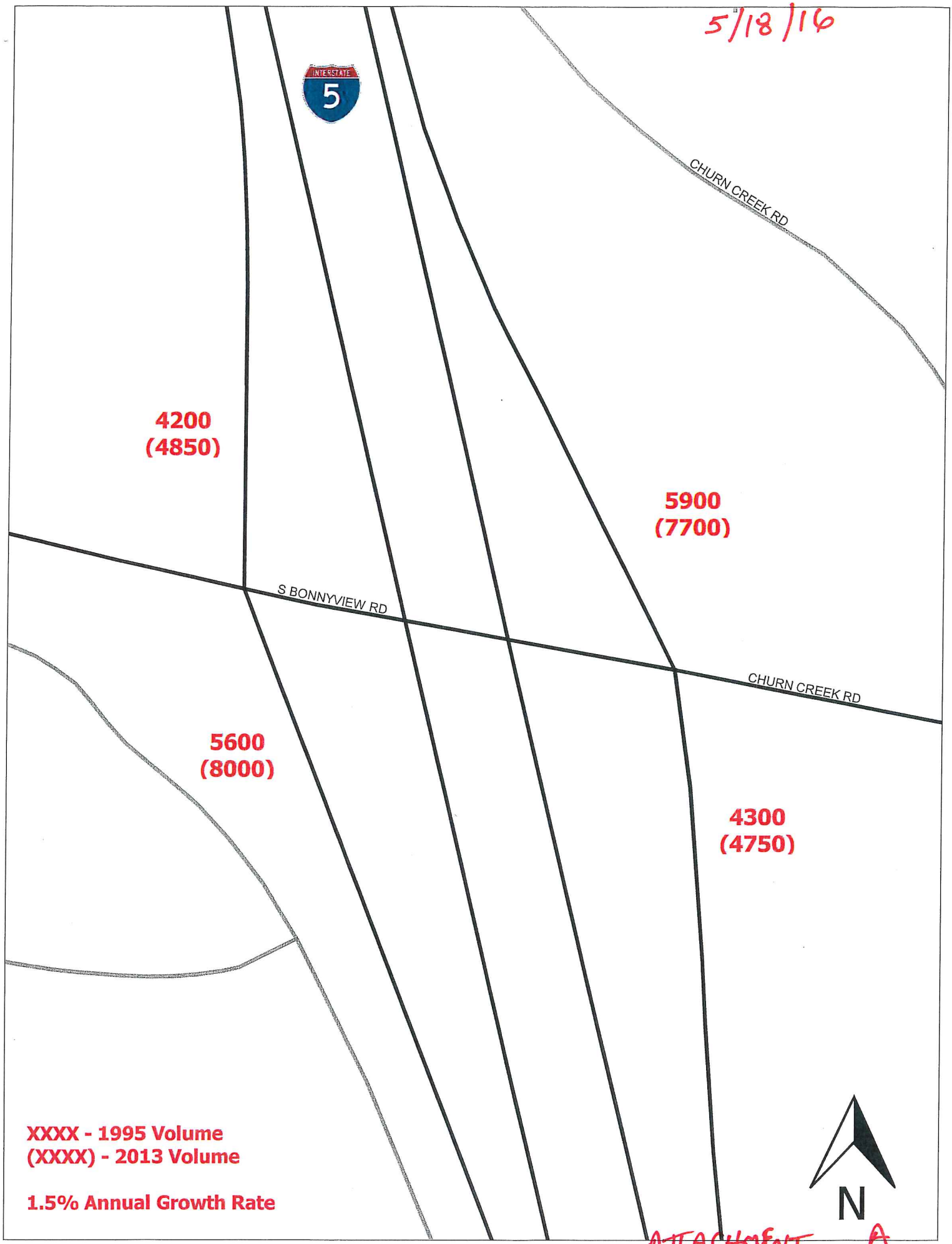
Refer to **Attachment C** for the following cross-references:

1) Stay with model assumptions with straight-line DU's to 2045.
2) Stay with model assumptions with straight-line DU's to 2045.
3) No new development.
4) For DU's, increase 2035 as shown and straight-line to 2045. Assumes approx. 12 acres of 3 units per acre out to 2045.
5) See **Attachment D** for Blue Shield. The existing employees are captured in another TAZ in the model. Assume double in size by 2035 and flat to 2045 (i.e. add 400 employees).

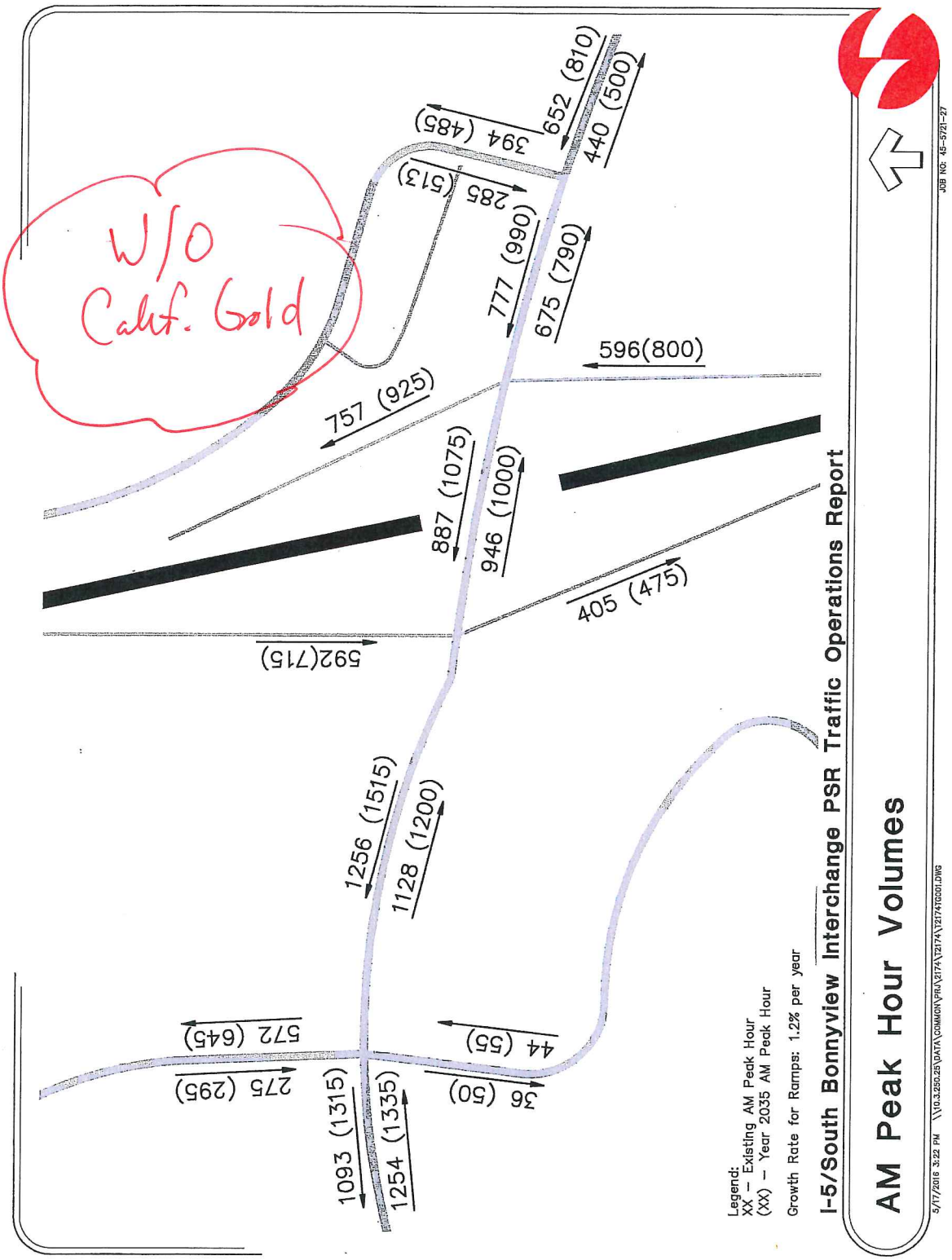
6) Create new TAZ and assume 27 additional DU's in 2035 and flat to 2045. Represents SF development north of the creek.
7) 2035 and 2045 employee counts are placeholders. EMP #'s will be manually adjusted to reflect development assumptions documented in Tech. Memo. No. 1. See **Attachment F** for Tech. Memo. No. 1.
8) Add employees for 2035 and 2045 based on the assumption of office occupancy of the partially completed building overlooking the river.
9) See note on Attachment.
10) See note on Attachment.
11) See note on Attachment.
12) Use model assumptions for 2035. Assume build out of the retail center for 2045. See note on Attachment.
13) Stay with model assumptions for 2035 and straight-line DU's to 2045.
14) Stay with model assumptions for 2035 and no increase for 2045 (2035 is most likely overstated as is).
15) Stay with model assumptions for 2035 and no increase for 2045 since the 2035 DU number is already full build out.
16) Corrections to more accurately reflect existing and the historical pace of development are proposed. See Attachment E.

Next Steps - Derive 2025, 2035 & 2045 Volumes

1. Make all the model adjustments described above.
2. Run the model.
3. Reality checks and adjustments.
4. Available for next mini-PDT meeting.

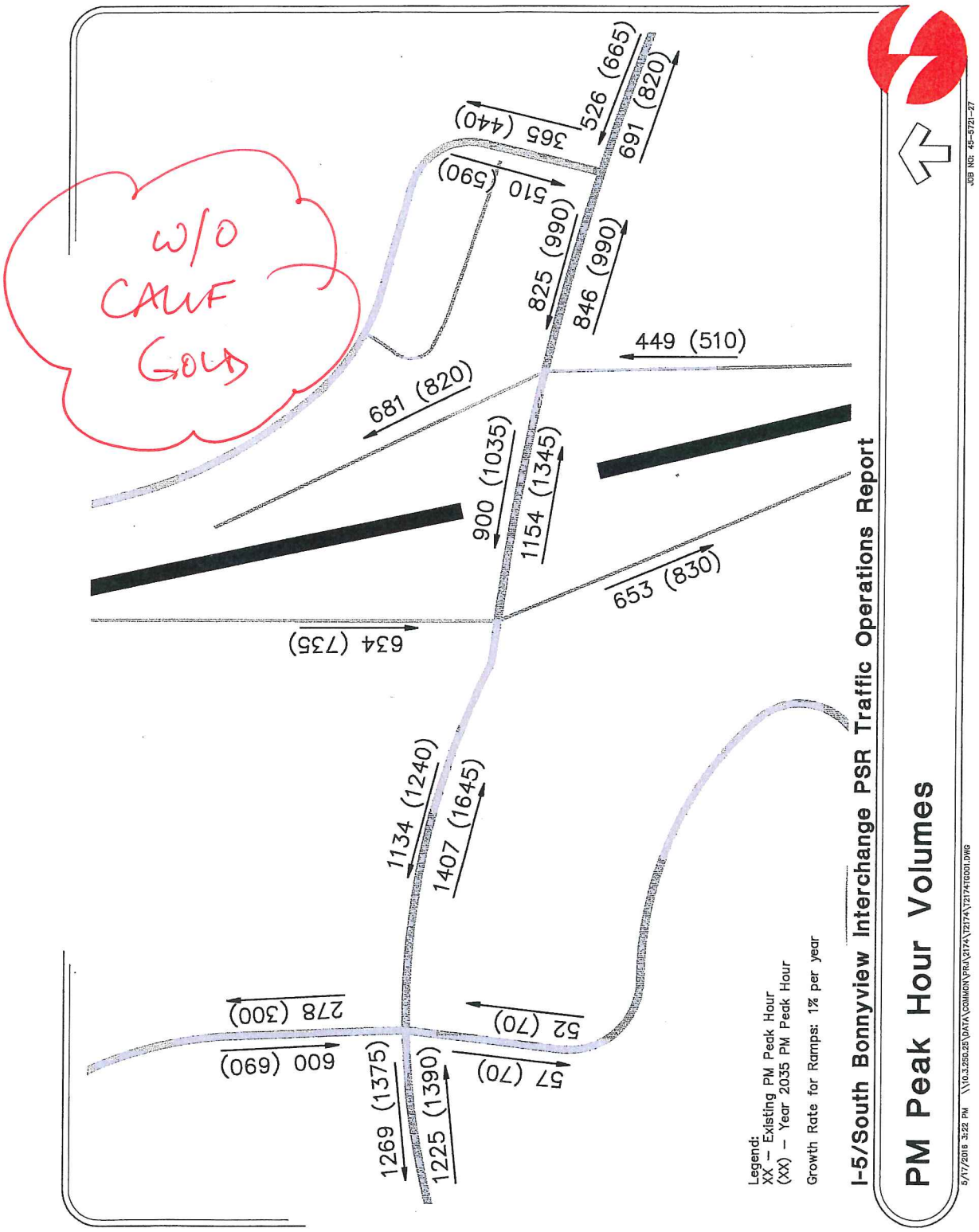

5/18/16
INTERSTATE
5
CHURN CREEK RD
4200
(4850)
5900
(7700)
S BONNYVIEW RD
CHURN CREEK RD
5600
(8000)
4300
(4750)
XXXX - 1995 Volume
(XXXX) - 2013 Volume
1.5% Annual Growth Rate
N
ATTACHMENT A

5/18/16



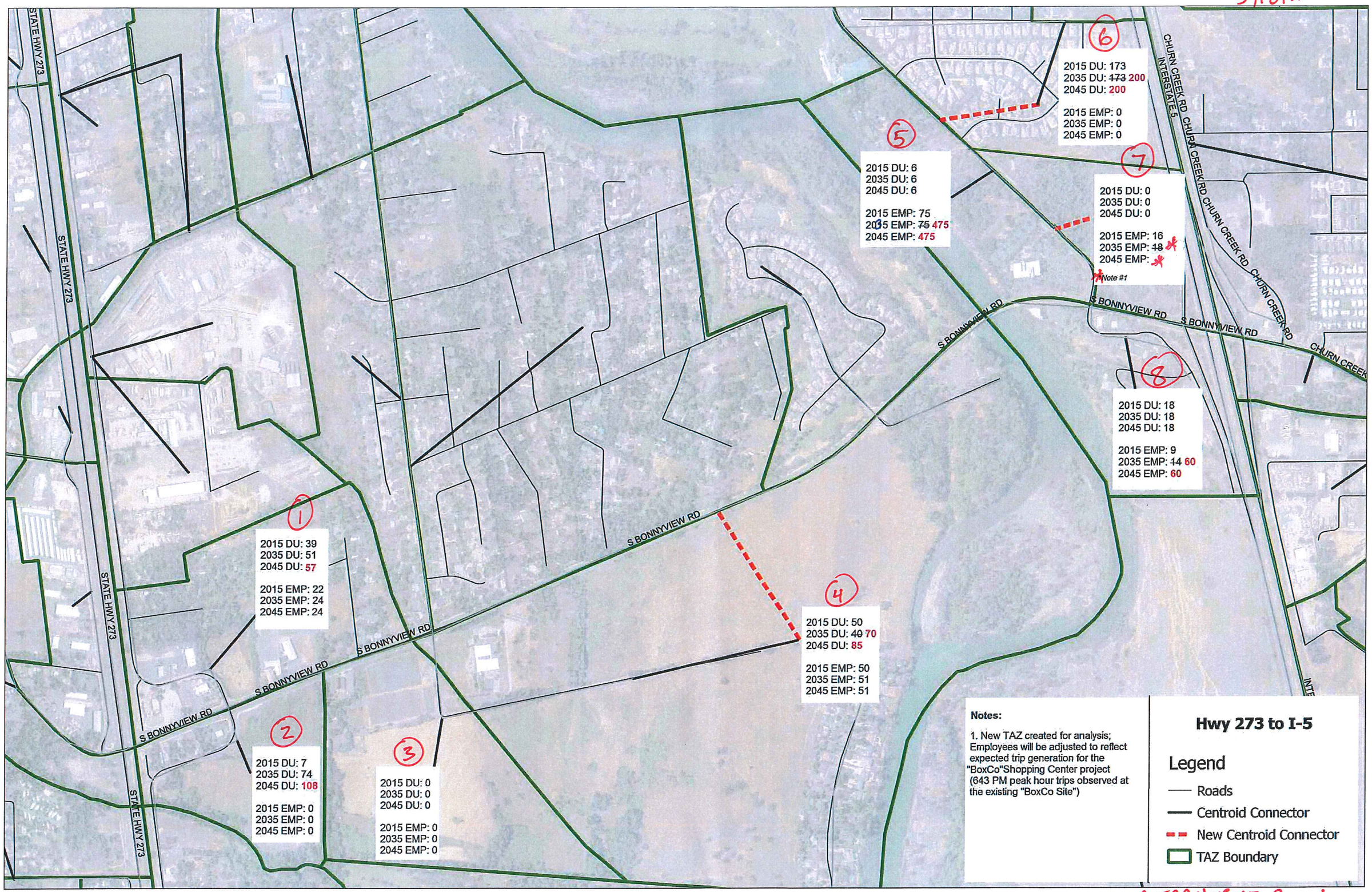
ATTACHMENT B-1

5/18/16



ATTACHMENT B-2

5/18/16



ATTACHMENT C - 1

5/18/16

*TAZ above has 926 DU (2015) and 962 DU (2035)

11

10

2015 DU: 0
2035 DU: 374
2045 DU: 374

2015 EMP: 154
2035 EMP: ~~298~~ *
2045 EMP: *

*Note #2

12

2015 DU: 563
2035 DU: 564
2045 DU: 563

2015 EMP: 29
2035 EMP: 35
2035 EMP: *

*Note #4

13

2015 DU: 16
2035 DU: 38
2045 DU: 50

2015 EMP: 24
2035 EMP: 26
2045 EMP: 26

16

Stillwater Business Park:
(east of Airport Road)

2015 DU: 13
2035 DU: 13
2045 DU: 19

2015 EMP: ~~331~~ 0
2035 EMP: ~~298~~ 200
2045 EMP: 331

9

2015 DU: 0
2035 DU: 0
2045 DU: 0

2015 EMP: 0
2035 EMP: ~~7~~ *
2045 EMP: *

*Note #3

14

2015 DU: 221
2035 DU: 718
2045 DU: 718

2015 EMP: 13
2035 EMP: 13
2045 EMP: 13

15

2015 DU: 84
2035 DU: 436
2045 DU: 436

2015 EMP: 5
2035 EMP: 57
2045 EMP: 57

BONNYVIEW RD
CHURN CREEK RD
CHURN CREEK RD CHURN CREEK RD
CHURN CREEK RD
CHURN CREEK RD
CHURN CREEK RD
CHURN CREEK RD
CHURN CREEK RD
RANCHO RD RANCHO RD RANCHO RD RANCHO RD RANCHO RD RANCHO RD RANCHO RD
RANCHO RD RANCHO RD RANCHO RD RANCHO RD RANCHO
SHASTA VIEW DR
SHASTA VIEW DR
SHASTA VIEW DR
SHASTA VIEW DR
GOODWATER AVE
GOODWATER AVE
GOODWATER AVE
AIRPORT RD
AIRPORT RD
AIRPORT RD
AIRPORT RD
AIRPORT RD
AIRPORT RD
SHASTA VIEW DR
INTERS

I-5 to Airport Road

Legend

- Roads
- Centroid Connector
- New Centroid Connector
- TAZ Boundary

Notes:

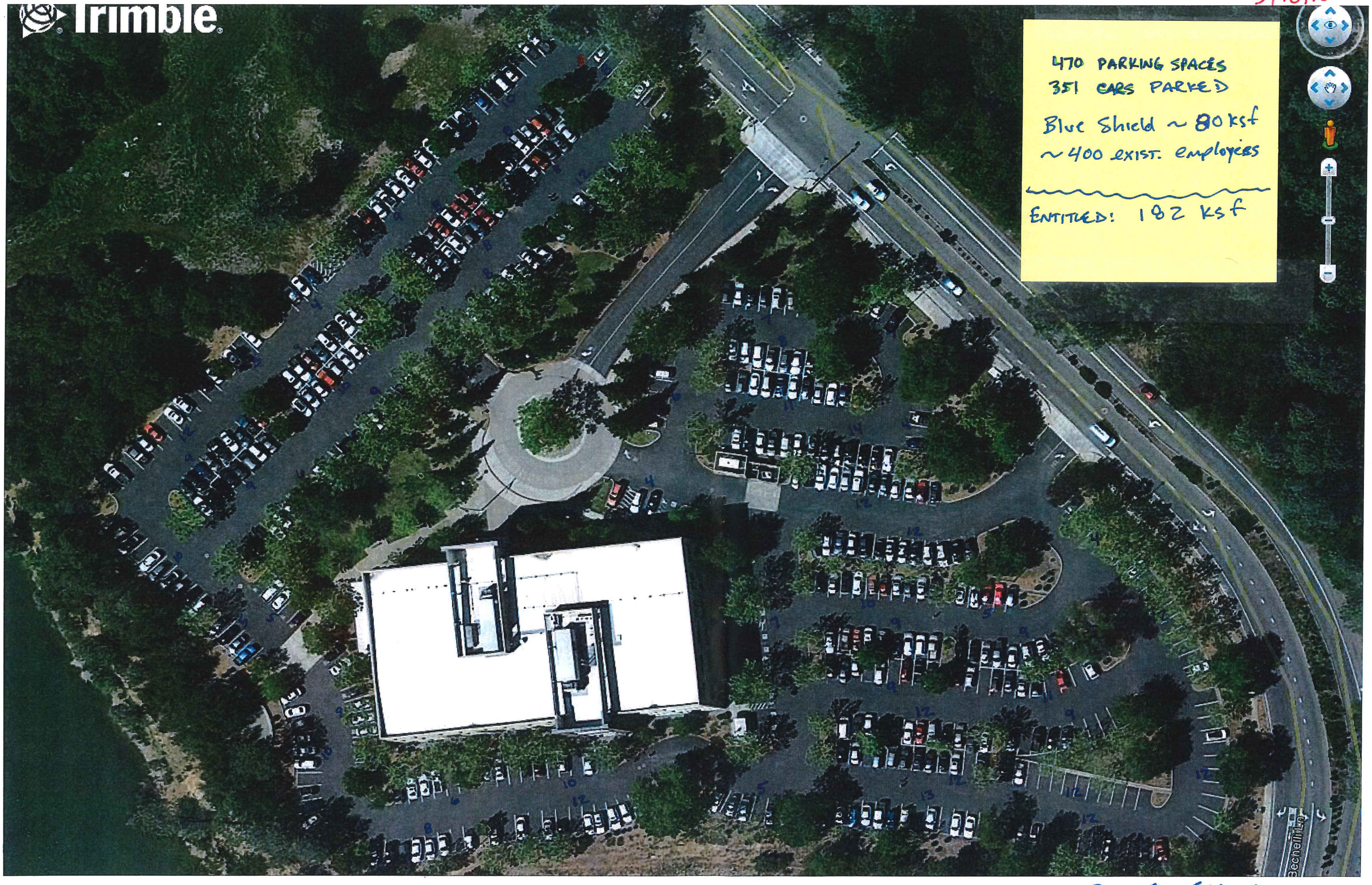
2. Employees will be adjusted to reflect expected trip generation for the S. Bonnyview/Churn Creek retail project (323 AM and 493 PM peak hour trips from the traffic study)

3. Employees will be adjusted to reflect expected trip generation for The Terraces retail project (142 AM and 138 PM peak hour trips)

4. Employees will be adjusted to reflect expected trip generation for the Shasta View retail project (149 AM and 392 PM peak hour trips)

ATTACHMENT C-2

5/18/16



BLUE SHIELD

ATTACHMENT D

5/18/16

Russ Wenham - TAZ

From: Makinzie Clark
To: Wenham, Russ
Date: 5/17/2016 9:58 AM
Subject: TAZ

ATTACHMENT E

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 1

To:	City of Redding - Engineering	**Date:**	May 06, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham		
Re:	Proposed Approach to Traffic Volume Projections	**Job No.:**	45-5721-27
		File No.:	C2174MEM001
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Based on input received at the May 6, 2016 mini-PDT meeting, Omni-Means will develop future year traffic volumes based on the following guidelines:

Year 2045 (Design Year)

Considerations

1. The Shasta County Regional Travel Demand Model (Model) can provide projections to year 2035.
2. Omni-Means has already adjusted the Model to provide 2035 volumes for the study area via. the March 2016 Traffic Impact Analysis Report (TIAR) prepared for the California Gold project on Churn Creek Road.
3. A BoxCo development should be considered for the NW quadrant of the I/C.
4. An AM/PM and coffee shop should be considered for the SE quadrant of the I/C.
5. The California Gold development should be assumed as constructed per the Use Permit application to the City.
6. If BoxCo gets developed at this location, the remaining developable land in the immediate interchange area will be more likely to develop.

Approach

1. Prepare the following for mini-PDT approval:
   1) Un-adjusted Model TAZ info for greater area. Include development assumptions and linkages.
   2) Present proposed linkage modifications (i.e. No driveways from Rother property to S. Bonnyview).
   3) Present proposed development assumption changes.
   4) Present methodology for customization of development assumptions that will be needed to better match proposed developments (eg. BoxCo).
2. Add full development of California Gold project in appropriate TAZ.

ATTACHMENT F-1

3. Add full development of a 160ksf BoxCo with 16 fueling positions (on the 2 Rother parcels (15 +/- acres)).
4. Add 5 acres of general retail development on the Redding Business Trust parcel (north of Rother and south of swale). Assume approximately 60ksf of retail containing 1 fast food with drivethru.
5. Add Pre-Application proposed development in SE quadrant of the I/C.
6. Add Phase II Blue Shield (and double check that unfinished office building that overlooks the river is included as developed).
7. Technical Parameters:
   - Use the Model for trip assignments after making the above modifications.
   - Perform reality check of Model trip assignments.

Year 2025 (Phase I I/C Construction Complete)

Approach

1. Straight line to derive 2025.
2. Add 80% development of California Gold project.
3. Add full development of a 160ksf BoxCo with 16 fueling positions (on the 2 Rother parcels (15 +/- acres)).
4. Add 50% of general retail development on the Redding Business Trust parcel.
5. Add Pre-Application proposed development in SE quadrant.
6. Do NOT add phase II Blue Shield.
7. Technical Parameters:
   - Use the Model.
   - Perform reality check of Model trip assignments.

Year 2035 (Phase II I/C Construction Complete)

Approach

1. Straight line between 2025 and 2045.

ATTACHMENT F-2

omni · means
ENGINEERS · PLANNERS

TECHNICAL MEMORANDUM

To:	City of Redding, Public Works Department	**Date:**	July 7, 2013
Attn:	Mr. Chuck Aukland, PE	**Project:**	City of Redding Traffic Engineering
From:	Russ Wenham, PE, TE, PTOE		
Re:	**Costco Shopping Center (City of Redding) Trip Generation**	**Job No.:**	45-5721-22
		File No.:	C1703MEM003.DOCX
CC:			

INTRODUCTION

The City of Redding retained OMNI-MEANS to gather traffic generation data for the existing Costco Shopping Center (shopping center) in the City of Redding. The shopping center is located at 1300 Dana Drive.

EXISTING SHOPPING CENTER

The 123,000 square feet (123 ksf) shopping center was constructed in 1990 and includes the following services: Tire Center, Pharmacy, Vision Center, Restaurant, Appliances, Household Items, Clothing, Electronics, Food, Furniture, Hardware, Health & Beauty, Jewelry, Office Products, Lawn & Garden, Pet Supplies and Sporting Goods. The shopping center does not have a vehicle fueling station as is typical for many newer Costco's.

EXISTING TRIP GENERATION

The shopping center is accessed by one driveway to Friendly Road and one driveway to Old Alturas Road. Entering and exiting vehicles were manually counted as follows:

- Weekday (4pm to 6pm):
  - Friendly Road Driveway: Tuesday, March 5, 2013 and Wednesday, March 13, 2013.
  - Old Alturas Road Driveway: Wednesday, March 6, 2013 and Thursday, March 14, 2013.
- Saturday (11am to 2pm):
  - Friendly Road Driveway: March 9, 2013 and March 16, 2013.
  - Old Alturas Road Driveway: March 9, 2013 and March 16, 2013.

As summarized in **Table 1 and Table 2**, the following data was recorded or derived:

- Weekday PM Peak Hour:
  - The average peak hour volume was 643 vehicles with 49% entering and 51% exiting.
  - The peak hour was from 4:30pm to 5:30pm.
  - The peak hour volume was 4% higher on the 2nd day of counts than on the 1st day of counts.

330 Hartnell, Suite B, Redding, CA 96002 ~ (530) 242-1700 fax (530) 242-1711

ATTACH. F-1

TABLE 1
REDDING COSTCO - 1300 Dana Drive, Redding, CA
Trip Generation Data Summary - WEEKDAY PM PEAK

PM Period	Tues, 3/5/13 Friendly Road Driveway			Wed, 3/13/13 Friendly Road Driveway			Wed, 3/6/13 Old Alturas Rd Driveway			Thurs, 3/14/13 Old Alturas Rd Driveway			Weekday PM Peak Hour for Entire Development			
	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Peak Hour
4:00-4:15	43	71	114	37	45	82	26	19	45	32	21	53	69	78	147	
4:15-4:30	55	65	120	50	39	89	39	18	57	29	20	49	87	71	158	
4:30-4:45	48	53	101	60	63	123	26	24	50	40	31	71	87	86	173	
4:45-5:00	53	59	112	50	55	105	27	22	49	17	27	44	74	82	155	
5:00-5:15	40	60	100	52	62	114	17	21	38	31	28	59	70	86	156	643
5:15-5:30	51	59	110	58	53	111	30	21	51	29	18	47	84	76	160	
5:30-5:45	37	51	88	42	57	99	25	16	41	26	23	49	65	74	139	
5:45-6:00	32	45	77	57	50	107	14	33	47	27	15	42	65	72	137	
Totals	359	463	822	406	424	830	204	174	378	231	183	414	600	622	1222	
Peak Hour:	199	248	447	220	233	453	118	83	201	117	106	223	315	328	643	
PHF:			0.93			0.92			0.88			0.79			0.93	

Peak Hr. Variations: 1% @ Friendly Road Driveway.
10% @ Old Alturas Drieway.
4% Day-to-Day Variance.

Notes:
xxx *Denotes Peak Hour.*

- Saturday Peak Hour:
  - The average peak hour volume was 798 vehicles with 53% entering and 47% exiting.
  - The peak hour was from 12:45pm to 1:45pm.
  - The peak hour volume was 23% higher on the 2nd day of counts than on the 1st day of counts.

TABLE 2
REDDING COSTCO - 1300 Dana Drive, Redding, CA
Trip Generation Data Summary - SATURDAY

PM Period	Sat, 3/9/13 Friendly Road Driveway			Sat, 3/16/13 Friendly Road Driveway			Sat, 3/9/13 Old Alturas Rd Driveway			Sat, 3/16/13 Old Alturas Rd Driveway			Saturday Peak Hour for Entire Development			
	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Entering Vehicles	Exiting Vehicles	Total Vehicles	Peak Hour
11:00-11:15	20	29	49	45	60	105	34	16	50	17	15	32	58	60	118	
11:15-11:30	38	43	81	43	55	98	40	21	61	42	14	56	82	67	148	
11:30-11:45	38	35	73	42	40	82	41	24	65	38	22	60	80	61	140	
11:45-12:00	40	46	86	42	43	85	36	39	75	46	19	65	82	74	156	
12:00-12:15	60	61	121	56	54	110	50	39	89	47	37	84	107	96	202	
12:15-12:30	30	55	85	25	49	74	55	29	84	44	24	68	77	79	156	
2:30-12:45	50	65	115	45	52	97	36	34	70	29	29	58	80	90	170	798
12:45-1:00	65	60	125	60	54	114	60	47	107	47	37	84	116	99	215	
1:00-1:15	85	80	165	45	49	94	33	32	65	40	32	72	102	97	198	
1:15-1:30	60	50	110	54	50	104	43	34	77	42	29	71	100	82	181	
1:30-1:45	60	65	125	55	61	116	61	45	106	38	23	61	107	97	204	
1:45-2:00	60	61	121	60	54	114	47	35	82	40	29	69	104	90	193	
Totals	606	650	1256	572	621	1193	536	395	931	470	310	780	1092	988	2080	
Peak Hour:	270	255	525	214	214	428	197	158	355	167	121	288	424	374	798	
PHF:			1.05			0.92			0.83			0.86			0.93	

Variations: 23% @ Friendly Road Driveway.
23% @ Old Alturas Drieway.
23% Day-to-Day Variance.

Notes:
xxx *Denotes Peak Hour.*

330 Hartnell, Suite B, Redding, CA 96002 ~ (530) 242-1700 fax (530) 242-1711

ATTACH. F-2

TRIP GENERATION RATE

The goal is to compare the existing trip generation rate to the published rates in *Trip Generation Manual, 9th Edition, Institute of Transportation Engineers* (ITE Manual). **Table 3 and Table 4** summarizes the ITE Manual and actual observed trip rates.

TABLE 3
Weekday PM Peak Hour

ITE Trip Generation Analysis

Landuse Category	Units	PM Peak Rate/Units		
		Total	In	Out
Discount Club (857)	per ksf	4.18	50%	50%
Landuse	**Quantity**	**PM Peak Hour Trips**		
		Total	In	Out
COSTCO	123	514	257	257

Notes:
1. ksf = 1,000 square feet.
2. Trip rates based on equations as presented in the ITE Trip Generation Manual 9th edition Pg. 1714).

Observed Trip Generation

Landuse Category	Units	PM Peak Rate/Units		
		Total	In	Out
Discount Club (857)	per ksf	5.23	49%	51%
Landuse	**Quantity**	**PM Peak Hour Trips**		
		Total	In	Out
COSTCO	123	643	315	328

Notes:
1. ksf = 1,000 square feet.
2. Trip rates based on actual counts.

For the Weekday PM Peak Hour, the observed total trip rate is 20% higher than the ITE Manual rate. It is noteworthy that the data in the ITE Manual is highly variable with Weekday PM Peak Hour trip rates ranging from 1.85 to 8.13 trips per ksf.

TABLE 4
Saturday Peak Hour

ITE Trip Generation Analysis

Landuse Category	Units	SAT Peak Rate/Units		
		Total	In	Out
Discount Club (857)	per ksf	6.37	49%	51%
Landuse	**Quantity**	**PM Peak Hour Trips**		
		Total	In	Out
COSTCO	123	784	384	400

Notes:
1. ksf = 1,000 square feet.
2. Trip rates based on equations as presented in the ITE Trip Generation Manual 9th edition (pg. 1718).

Observed Trip Generation

Landuse Category	Units	SAT Peak Rate/Units		
		Total	In	Out
Discount Club (857)	per ksf	6.49	53%	47%
Landuse	**Quantity**	**PM Peak Hour Trips**		
		Total	In	Out
COSTCO	123	798	424	374

Notes:
1. ksf = 1,000 square feet.
2. Trip rates based on actual counts.

For the Saturday Peak Hour, observed total trip rate is 2% higher than the actual observed rate. While this is encouraging, it is noteworthy that the data in the ITE Manual is highly variable with Saturday Peak Hour trip rates ranging from 3.79 to 12.52 trips per ksf.

RECOMMENDATIONS FOR USING THIS DATA

If the goal is to establish a local trip rate, this data should be used with caution and the guidance contained in the ITE Manual User's Guide and Handbook should be considered:

> *"Sufficient sample size is necessary to enable the analyst to draw valid conclusions from the trip generation study... Common practice in the traffic planning industry has been to collect trip generation data at three to five sites that truly meet the recommended site selection criteria with the assumption that these data will yield a relatively stable sample.*

330 Hartnell, Suite B, Redding, CA 96002 ~ (530) 242-1700 fax (530) 242-1711

ATTACH F-3

If the analyst intends to establish a local trip generation rate, it is recommended that at least three sites (and preferably at least five) be surveyed."

330 Hartnell, Suite B, Redding, CA 96002 ~ (530) 242-1700 fax (530) 242-1711

ATTACH. F-4

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 3

To:	City of Redding - Engineering	**Date:**	June 10, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Proposed Approach to Traffic Volume Projections	**Job No.:**	45-5721-27
		File No.:	C2174MEM003
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Based on the approach outlined in the 5/18/16 Technical Memorandum No. 2, Omni-Means developed ***DRAFT*** future year traffic volumes.

2015 Traffic Volumes

Omni-Means collected AM and PM peak hour intersection turn movement counts at the study intersections on Thursday, November 12, 2015. These volumes were used as a base-line for future year projections. See attached figure for the traffic volumes.

2025 Traffic Volumes

Omni-Means used the latest version of the Shasta Regional Travel Demand Model (Model) to derive the Year 2025 volumes. The following adjustments were made to the Model for this project:

1. Dwelling units and numbers of employees were updated.
2. Assumed 160ksf BoxCo, 16 fueling positions & 30ksf general retail. The BoxCo TAZ was artificially adjusted in the Model to match ITE rates. ITE rates for the fueling positions were reduced by 50% for internal capture with the BoxCo (i.e. 50% of the fueling trips are new trips to the TAZ).
3. Assumed 80% development. The California Gold (S. Bonnyview / Churn Creek Retail) TAZ was artificially adjusted in the Model to approximately match the ITE methodology used in the Use Permit application's May 2016 traffic analysis by Omni-Means.
4. Assumed full development. The Terraces TAZ was artificially adjusted in the Model to approximately match the ITE methodology used in the 10-15-16 Use Permit pre-application traffic analysis by KD Anderson.

2045 Traffic Volumes

1. The Model only goes out to Year 2035. Before making any of the adjustments described below, the Model's base Year 2035 traffic was increased by approximately 0.25% per year to represent a "starting place" for Year 2045 traffic.
2. Dwelling units and numbers of employees were updated.
3. Assumed full build-out of BoxCo site with artificial adjustments in the Model to match ITE rates.

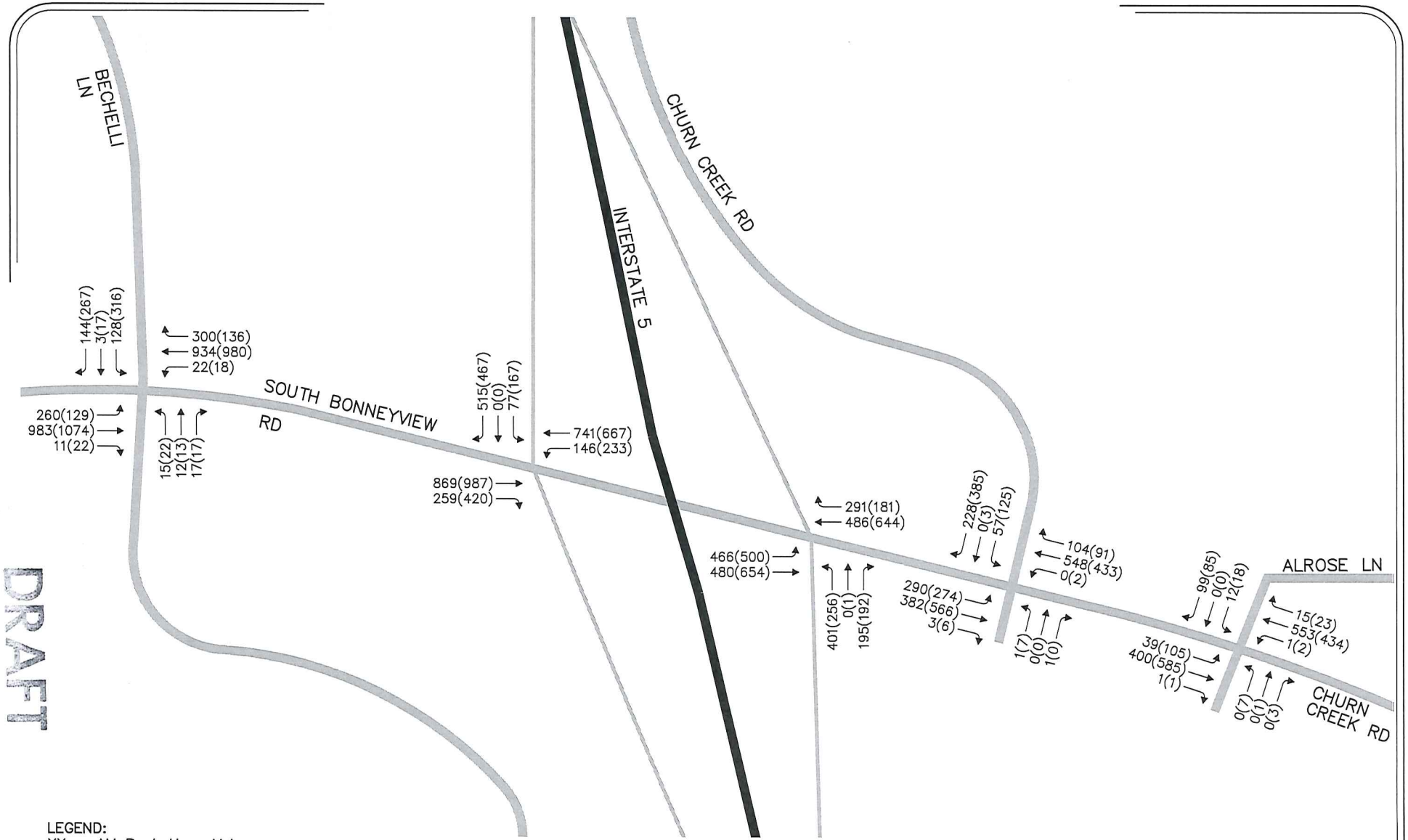
4. Assumed full build-out of California Gold site with artificial adjustments in the Model to match ITE rates.
5. Assumed full development as described in Year 2025 section.

2035 Traffic Volumes

Year 2035 volumes were simply interpolated between the Year 2025 and Year 2045 volumes. See attached figure that shows the derived volumes.

Next Steps -

1. Review draft June 10, 2016 turn movement volumes to identify any anomalies in the data.
2. Manually reduce the BoxCo development AM peak hour volumes. Isolate the BoxCo traffic numbers and adjust to 55% to/from I-5.
3. Prepare graphics or tables to show the adjustments and present proposed final traffic volumes.

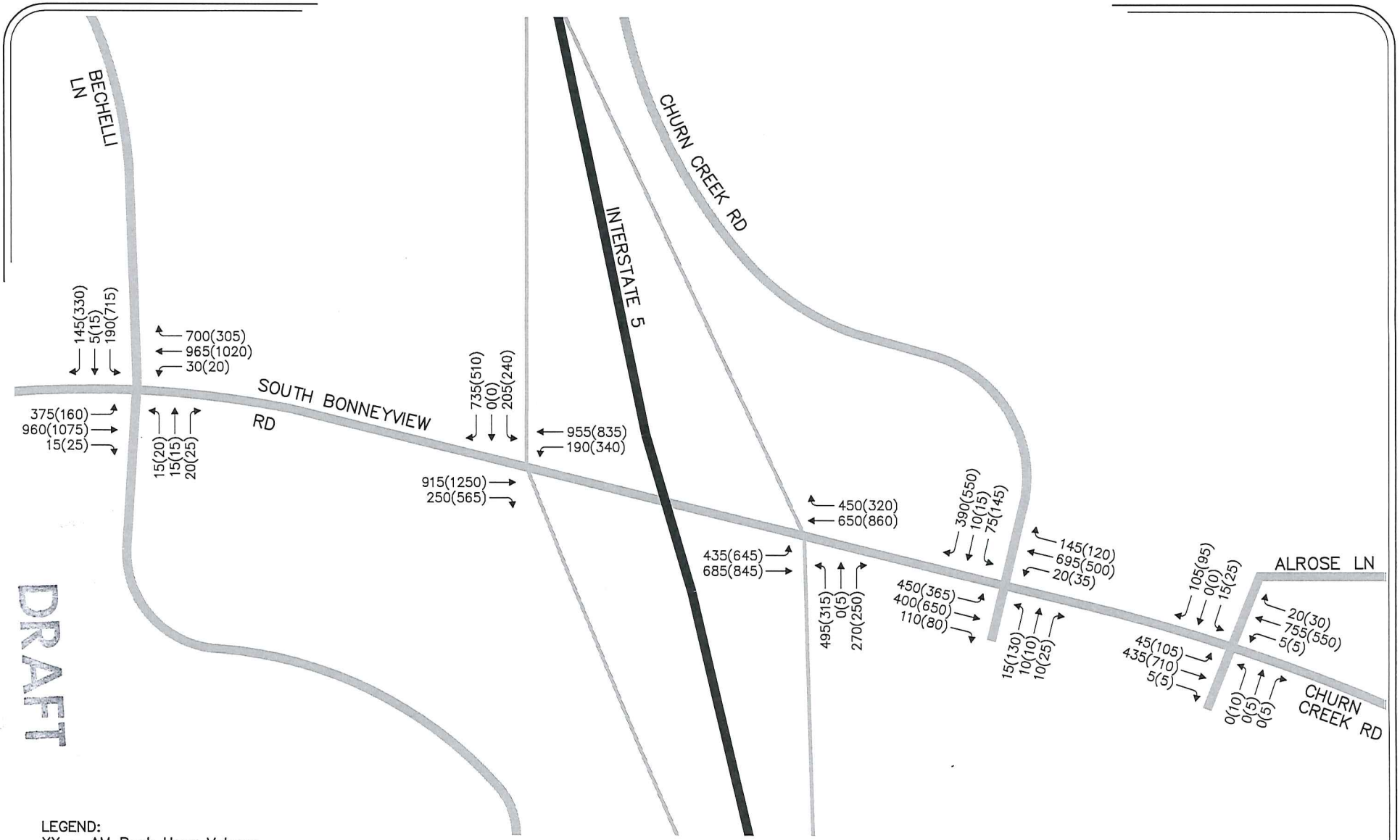


DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

2015 TRAFFIC VOLUMES

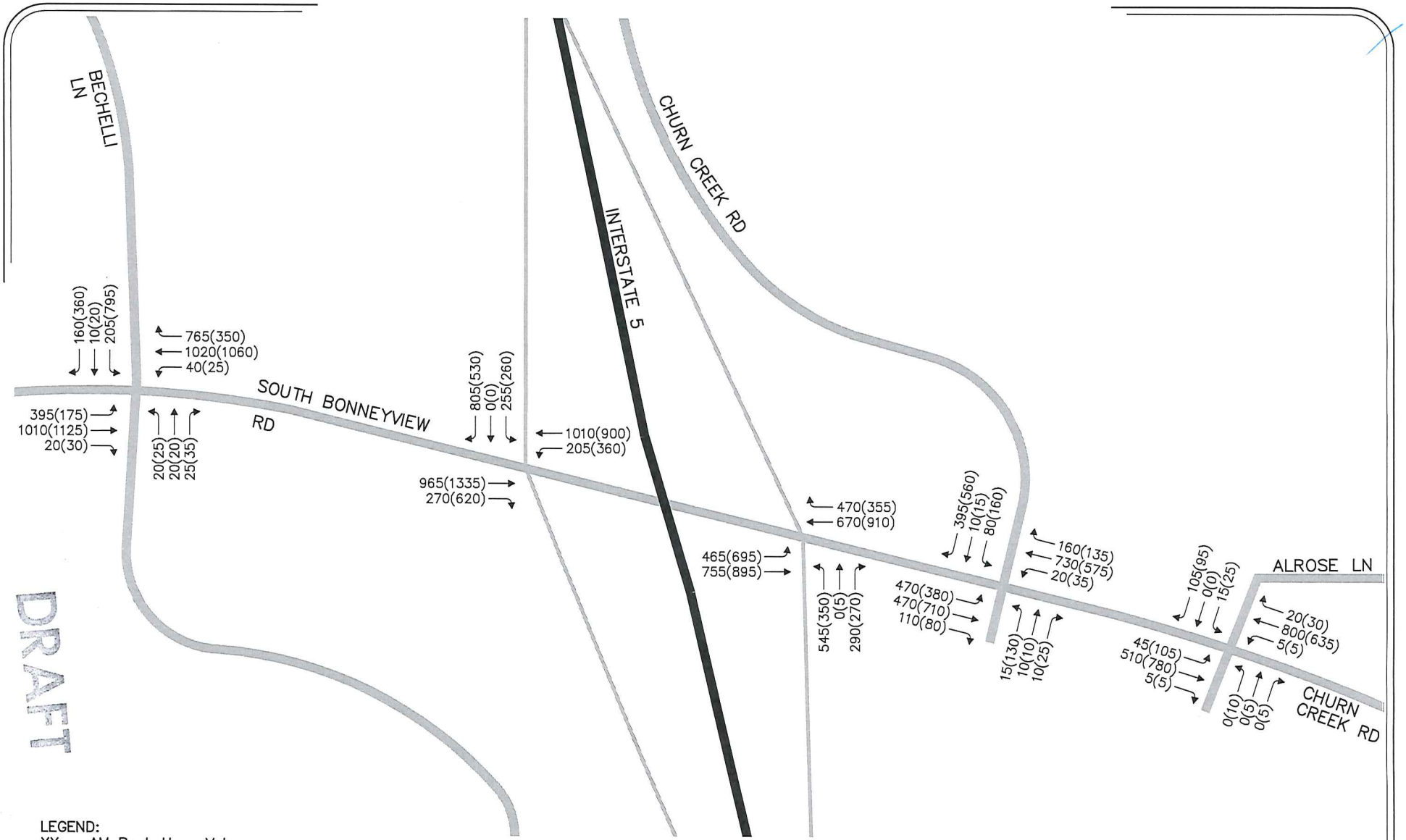


DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

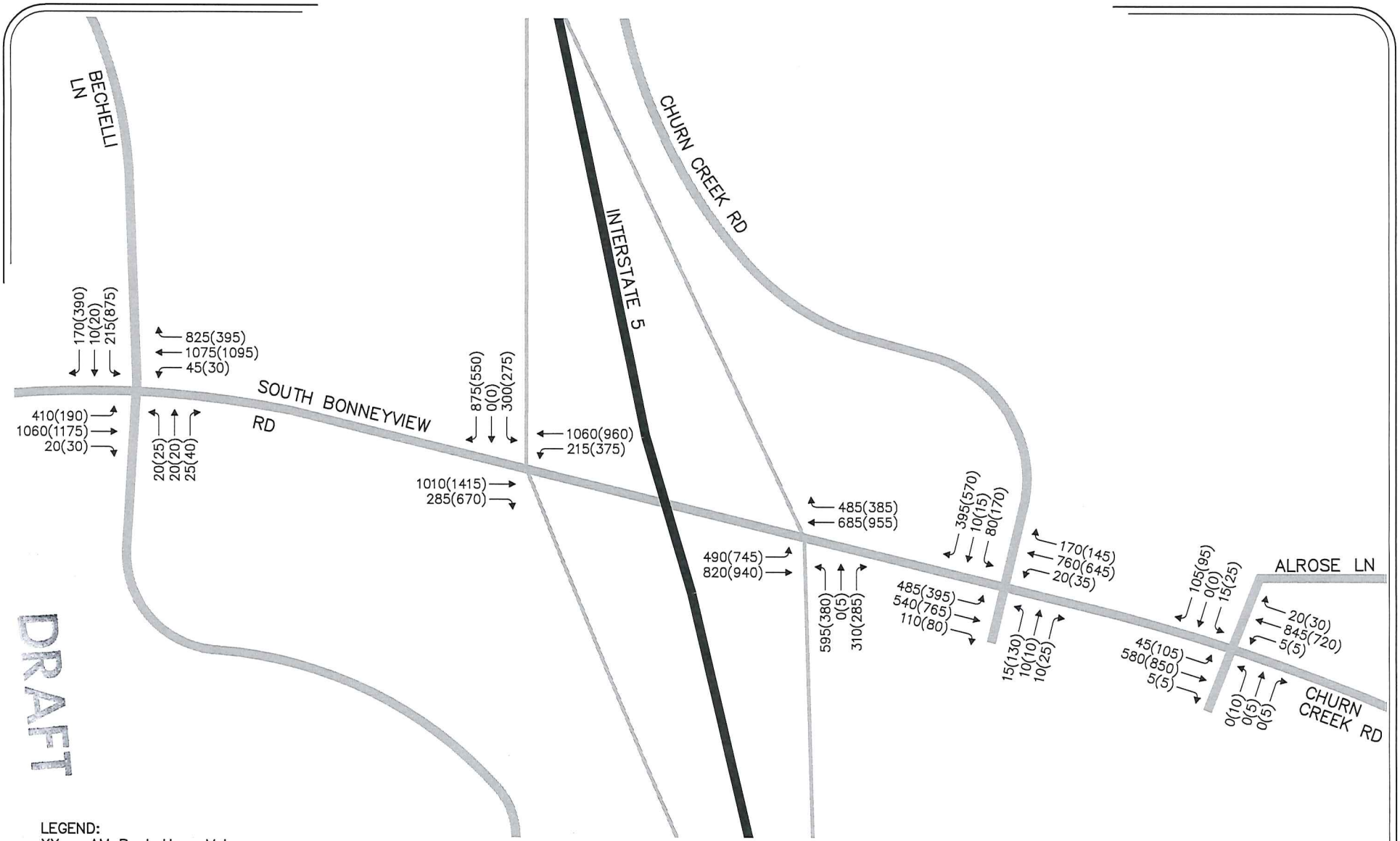
2025 TRAFFIC PROJECTIONS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

2035 TRAFFIC PROJECTIONS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

2045 TRAFFIC PROJECTIONS

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 4

To:	City of Redding - Engineering	**Date:**	June 30, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Traffic Forecasts - Proposed Volumes	**Job No.:**	45-5721-27
		File No.:	C2174MEM004
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

This technical memorandum focuses on the adjustments that were done to the ***preliminary forecasts presented in June 10, 2016 technical memorandum No. 3. In addition, this technical memorandum proposed traffic volumes to be used for the traffic operations analysis.***

June 10, 2016 Data Anomalies

Issue: City and Caltrans staff were concerned that there may be some anomalies in the traffic volumes presented in Technical Memorandum No. 3.

Resolution: Detailed intersection-by-intersection traffic volume figures have been prepared. No anomalies were identified that warrant adjustments. See **Attachment A.**

BoxCo Trip Distribution

Issue: At the 6/10/16 meeting, agreement was reached that approximately 55% of the BoxCo's trips should be to/from Interstate 5.

Resolution: Trip distribution for the BoxCo TAZ was obtained using the Shasta Regional Travel Demand Model's (Model) select zone component. The Model forecasts that the BoxCo site will attract about 56% of the traffic from I-5. This is consistent with the PDT's recommendation. As such, adjustments associated with the trip distribution are not proposed.

BoxCo AM Trip Generation Adjustment

Issue: The forecasts in Technical Memorandum No. 3 included trips from the BoxCo site during the AM peak hour.

Resolution: A review of the 2015 adjacent street peak hour data indicates that the AM peak hour occurs between 7:15 and 8:15 AM. This is outside of an anticipated BoxCo's operating hours. As such, trips from the BoxCo site had to be adjusted (removed) from the forecasts. While one can expect a small number of employee and delivery trips during the peak hour, for simplicity of calculation, the all of the AM peak hour trips will be removed from the proposed traffic forecasts. See **Attachment B** for proposed adjustments that will be made to Technical Memorandum No. 3 data.

The Terraces AM Trip Generation Adjustment

Issue: The Model underestimates the trips from the TAZ that contains The Terraces.

Resolution: A review of the Model trips from this TAZ reveals that the Model's trip generation is significantly lower than the trip generation from the traffic study. This is due to high intense uses being proposed for the site. As such, AM peak hour trip adjustments are proposed in **Attachment C.**

Final Proposed Peak Hour Traffic Forecasts

Final AM peak hour forecasts were derived by adjusting the Technical Memorandum No. 3 data:

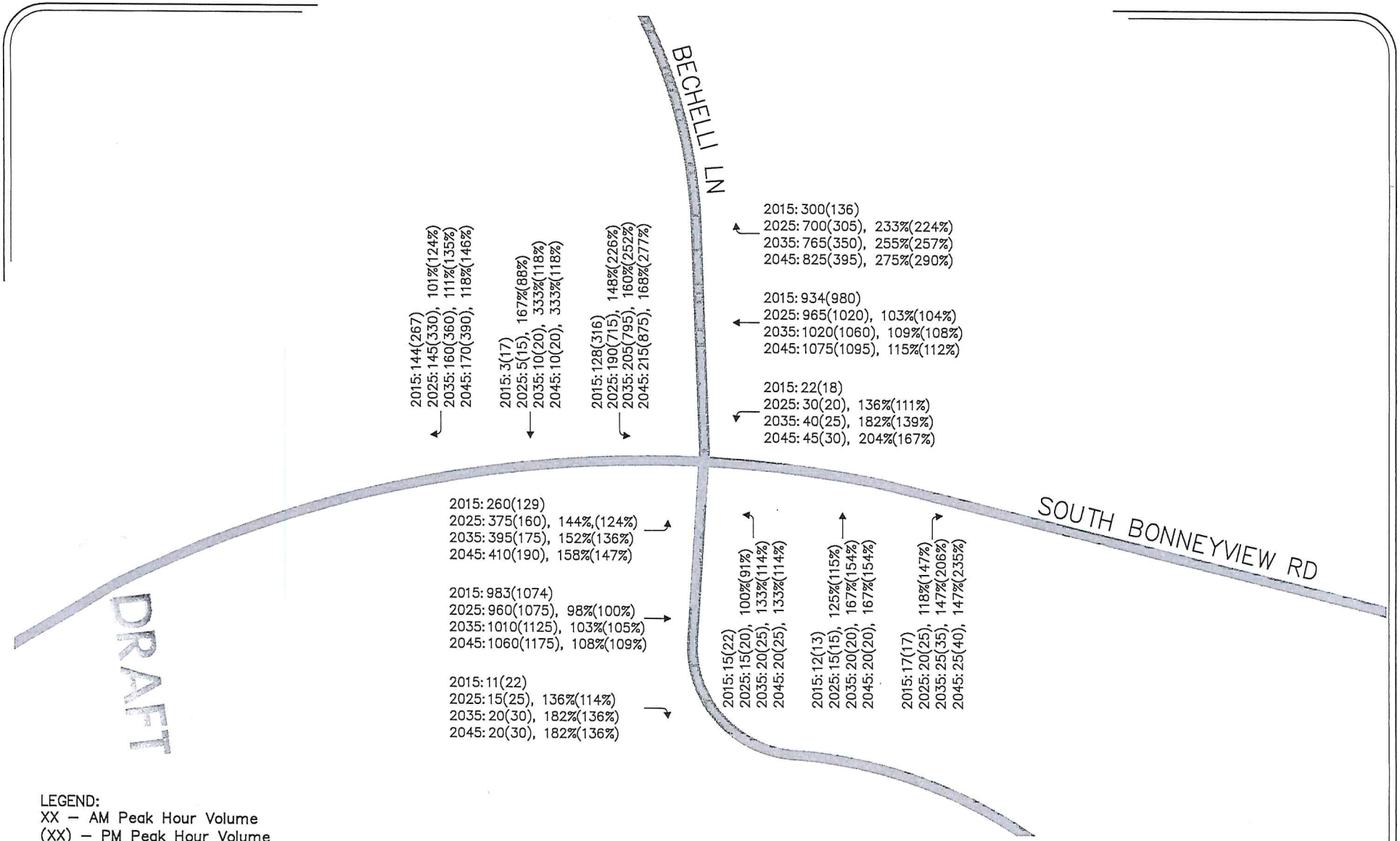
- To remove Model trips from BoxCo.
- To adjust trips for The Terraces.

For the PM peak hour, no change to the data presented in Technical Memorandum No. 3 is proposed.

Final proposed traffic forecasts, to be used for the traffic operations analysis, are presented in **Attachment D.**

Next Steps

1. Perform Model select link analysis for the BoxCo TAZ for the PM peak hour.
2. Perform Model select link analysis for the California Gold TAZ for AM and PM peak hours.
3. Present results from the select link analysis. Omni-Means to email the results to the CT/City team by C.O.B. on Friday, 7/1/16. CT/City team to provide review by C.O.B. on Friday 7/8/16.
4. Next meetings: 7/15/16 at 7am.
5. Goals for next meeting:
   - Final approval of traffic forecasts.
   - Presentation/approval of technical analysis parameters and tools for T. Ops. analysis.
   - Roles/resp. for T. Ops. analysis.



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

A-1

INTERSECTION VOLUME SUMMARIES - JUNE 10, 2016 DATA

6/28/2016 11:04 AM K:\PRJ\2174\T2174\T2174TG003.DWG

JOB NO: 45-5721-27

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

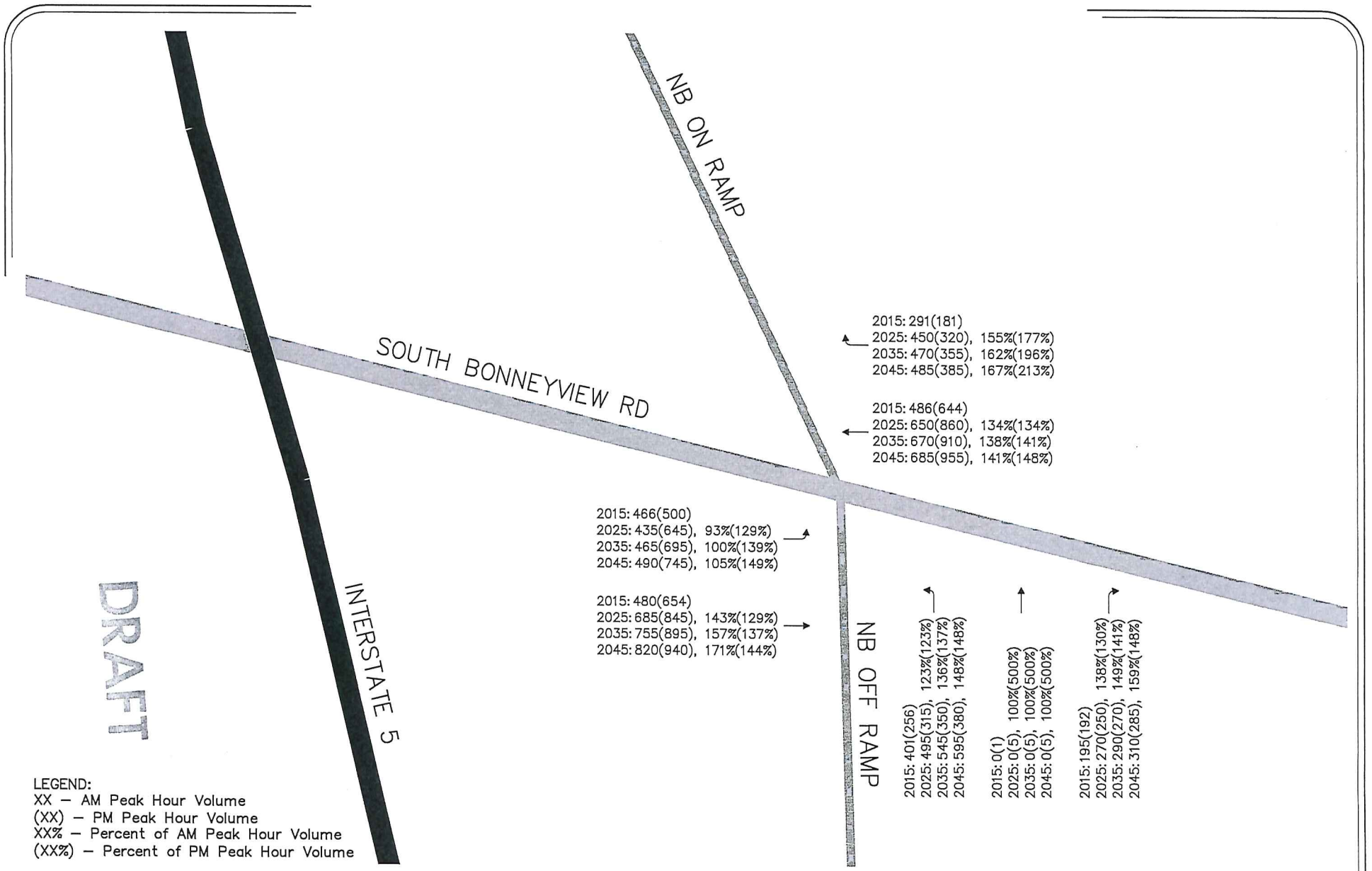
I-5/South Bonnyview Interchange PSR Traffic Operations Report

INTERSECTION VOLUME SUMMARIES - JUNE 10, 2016 DATA

A-2

6/28/2016 11:04 AM K:\PRJ\2174\T2174\T2174TG003.DWG

JOB NO: 45-5721-27



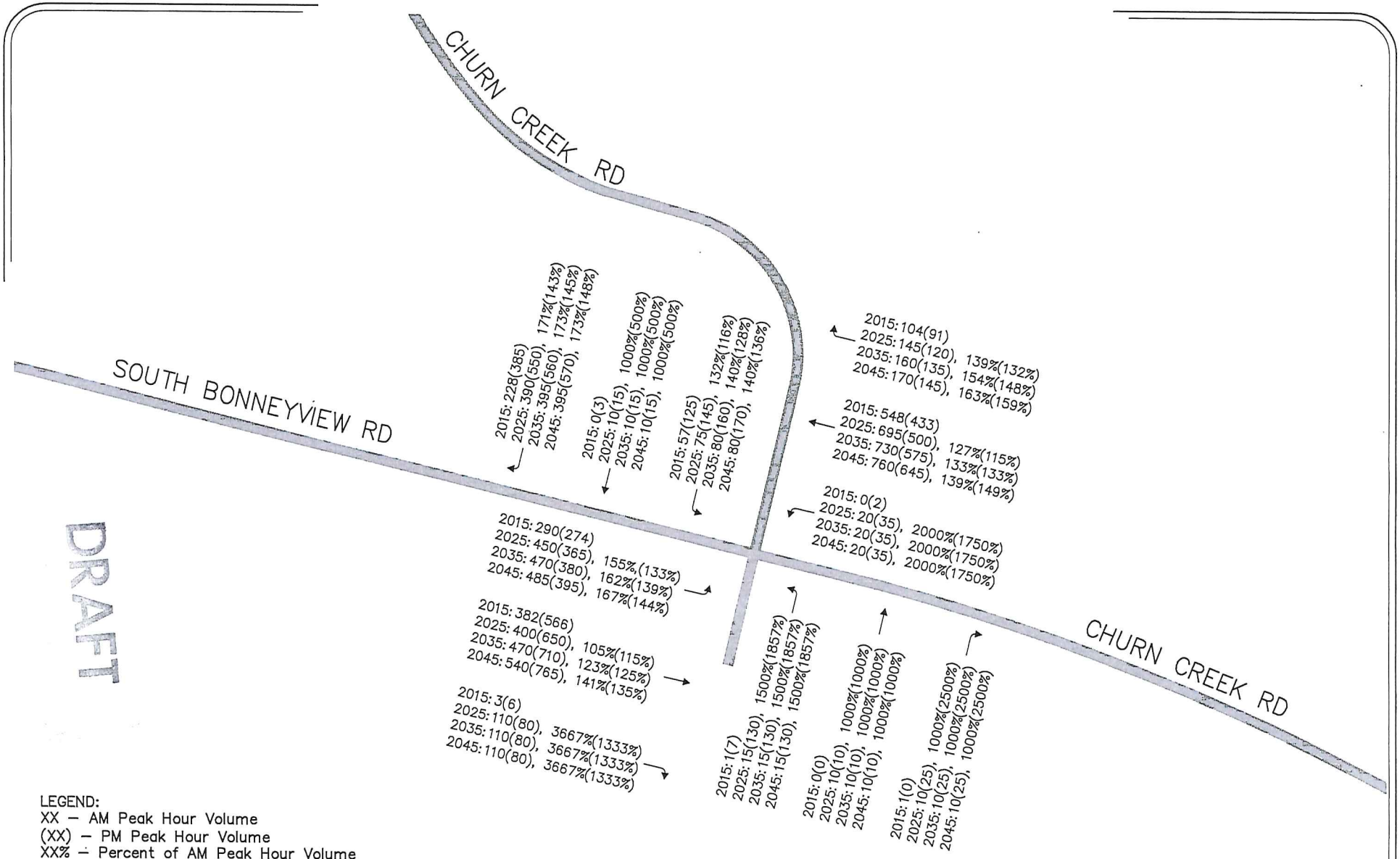
A-3

I-5/South Bonnyview Interchange PSR Traffic Operations Report

INTERSECTION VOLUME SUMMARIES - JUNE 10, 2016 DATA

6/28/2016 11:04 AM K:\PRJ\2174\T2174\T2174TGD03.DWG

JOB NO: 45-5721-27



DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

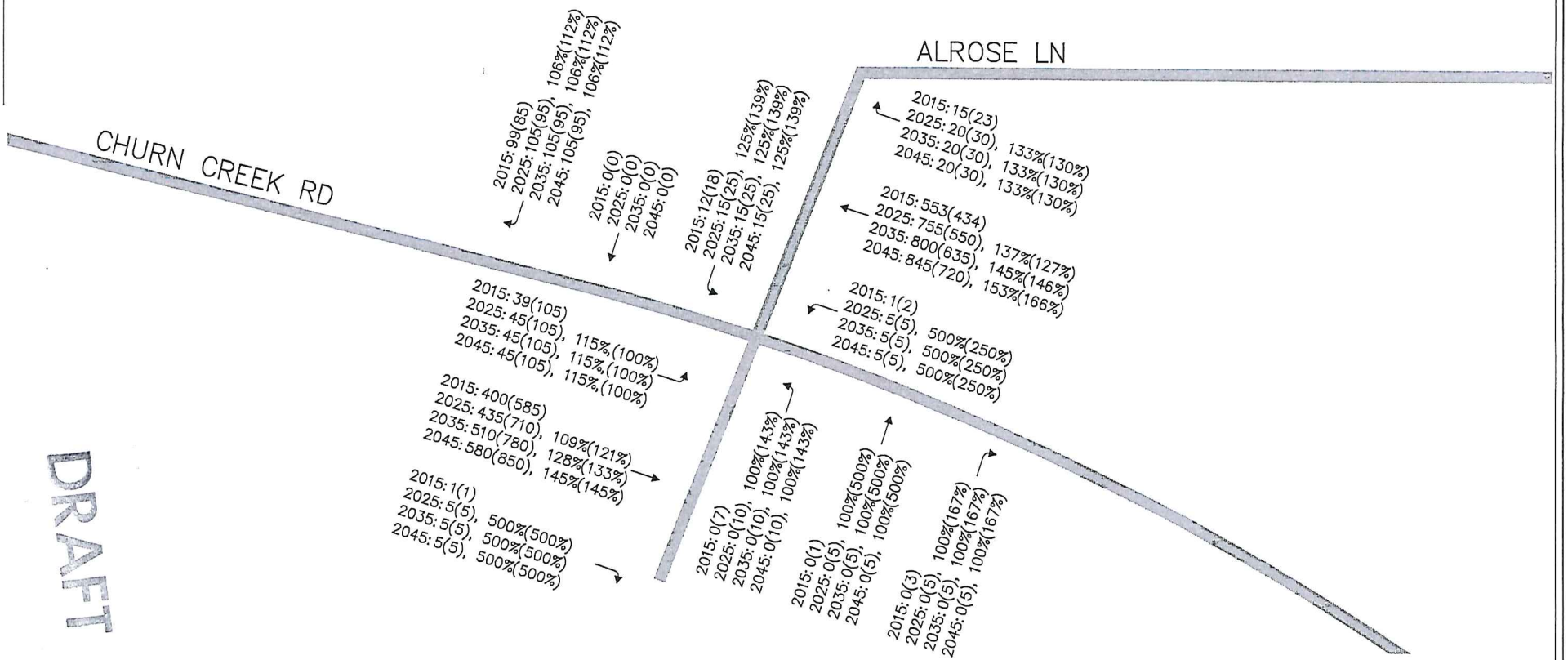
I-5/South Bonnyview Interchange PSR Traffic Operations Report

A-4

INTERSECTION VOLUME SUMMARIES - JUNE 10, 2016 DATA

6/28/2016 11:03 AM K:\PRJ\2174\T2174\T2174TG003.DWG

JOB NO: 45-5721-27



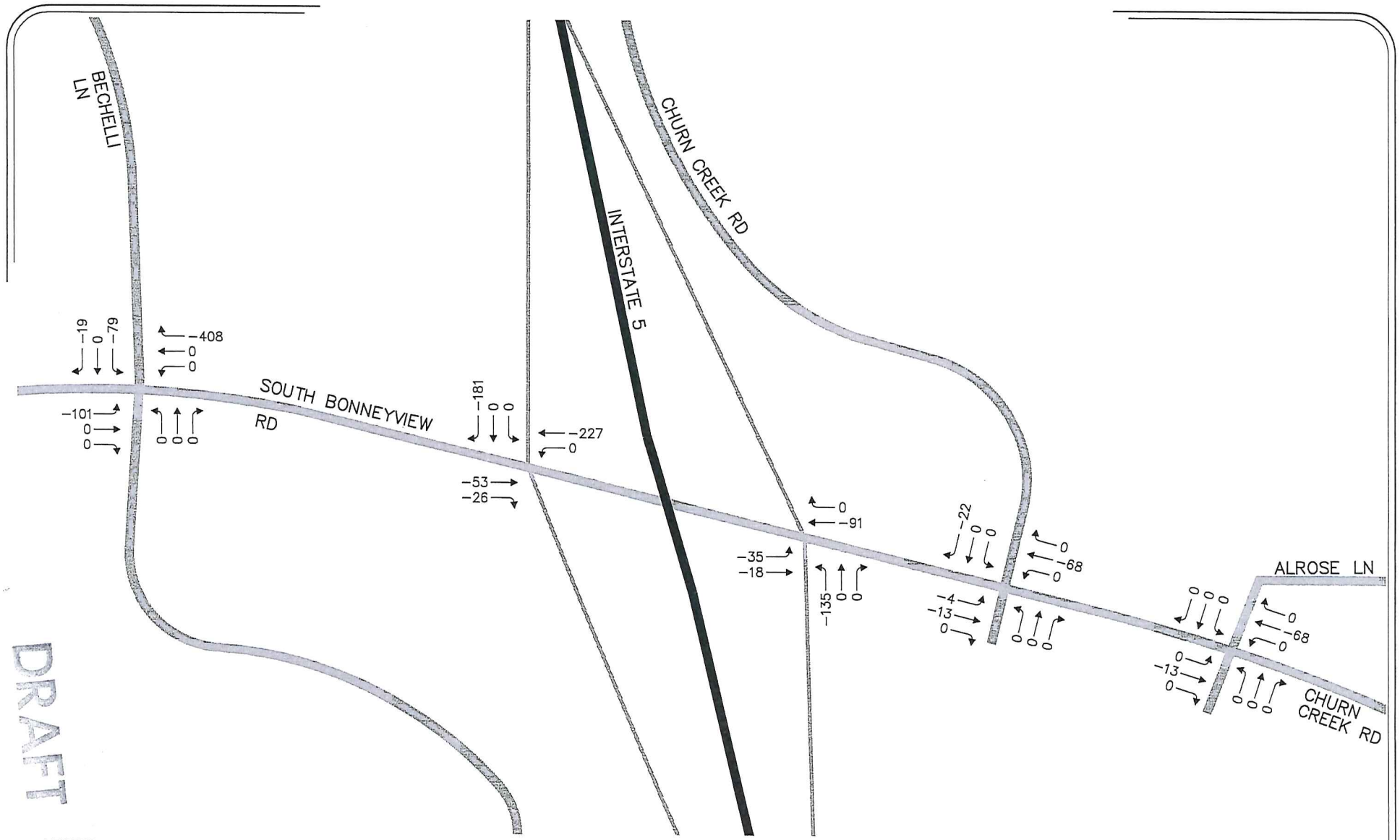
DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

INTERSECTION VOLUME SUMMARIES - JUNE 10, 2016 DATA

A-5



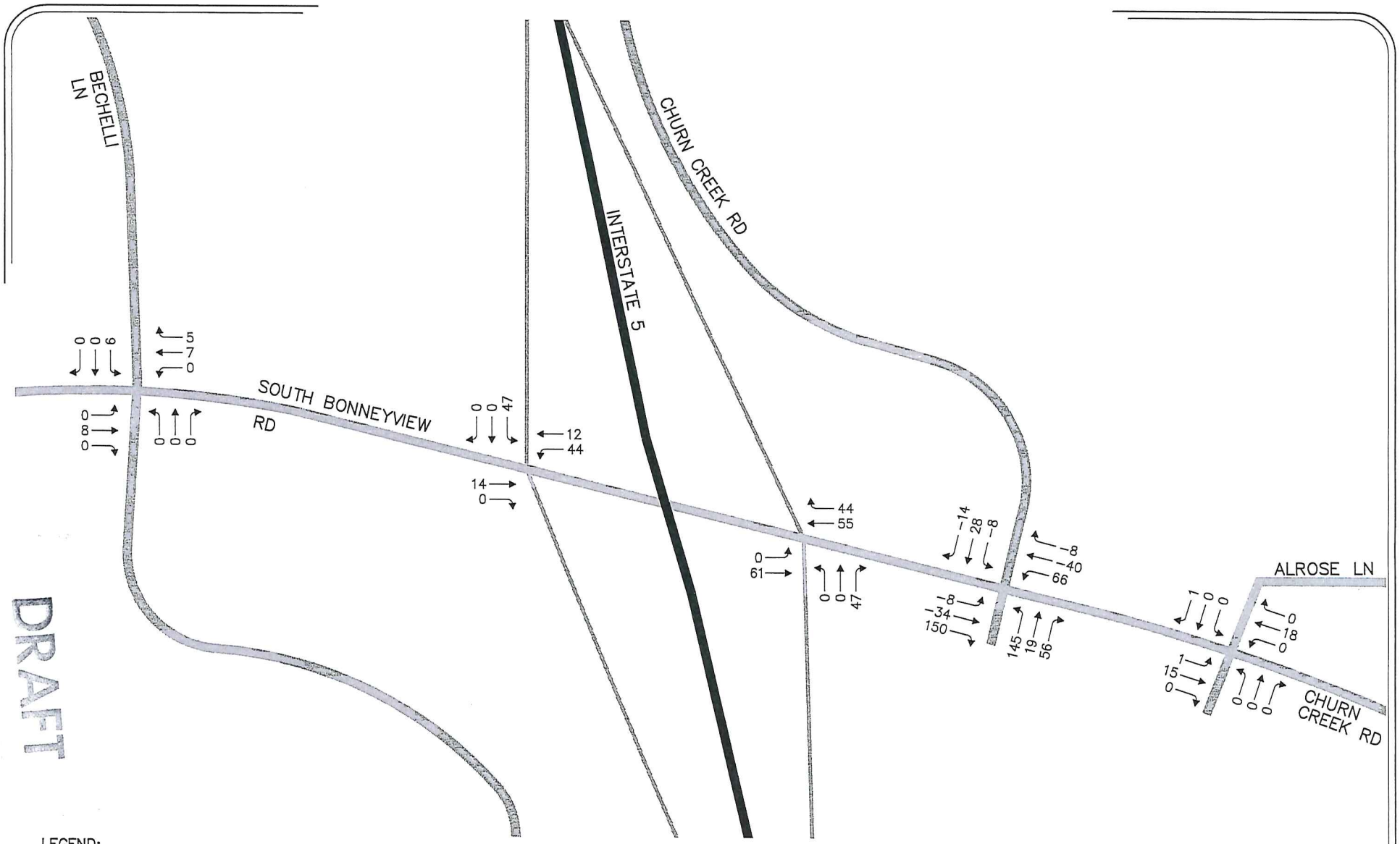
DRAFT

LEGEND:
XX – AM Peak Hour Volume for "BoxCo" used in 6/10/16 Tech Memo No. 3 (To be Deducted from final Traffic Forecasts)

I-5/South Bonnyview Interchange PSR Traffic Operations Report

AM PEAK ADJUSTMENT FOR 2045 "BOXCO"

B



DRAFT

LEGEND:
XX – AM Peak Hour Volume for "The Terraces" used in 6/10/16 Tech Memo No. 3 (To be added/subtracted from final Traffic Forecasts)

I-5/South Bonnyview Interchange PSR Traffic Operations Report

AM PEAK ADJUSTMENT FOR 2045 "THE TERRACES"

DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

PROPOSED INTERSECTION VOLUMES - JUNE 30, 2016

D-1

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

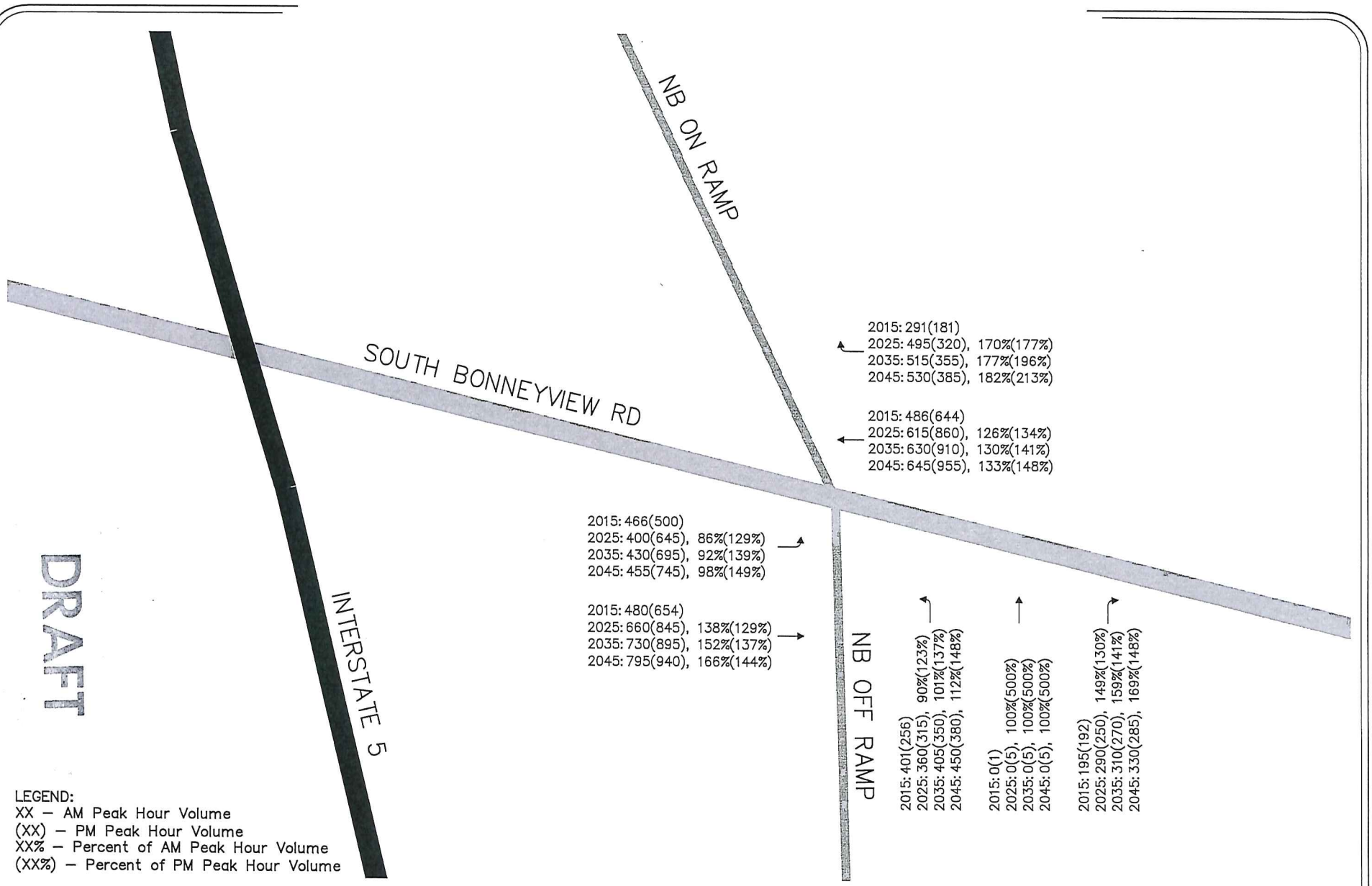
I-5/South Bonnyview Interchange PSR Traffic Operations Report

PROPOSED INTERSECTION VOLUMES - JUNE 30, 2016

D-2

6/29/2016 6:04 PM K:\PRJ\2174\T2174\T2174TG005.DWG

JOB NO: 45-5721-27



DRAFT

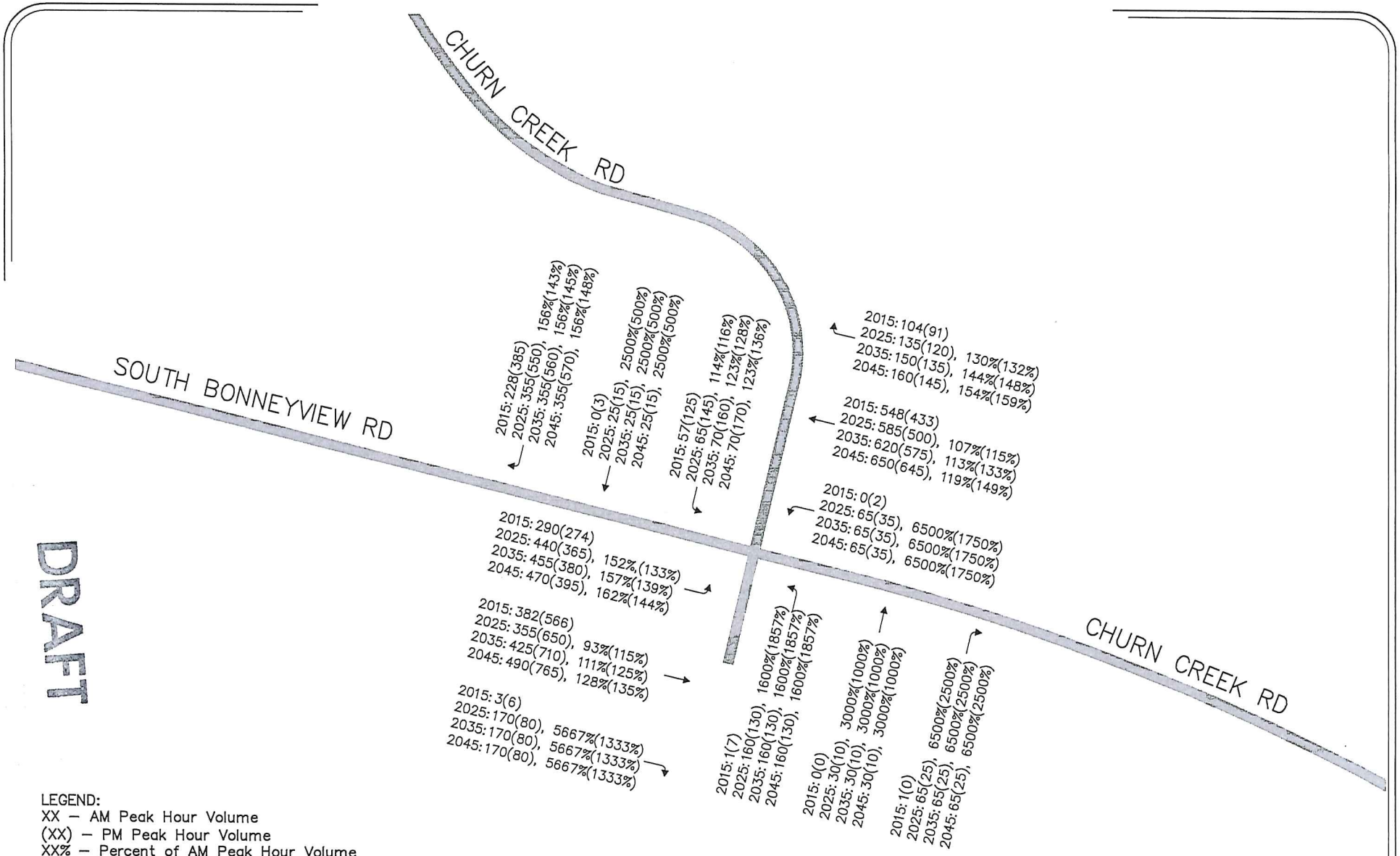
I-5/South Bonnyview Interchange PSR Traffic Operations Report

PROPOSED INTERSECTION VOLUMES - JUNE 30, 2016

D-3

6/29/2016 8:03 PM K:\PRJ\2174\T2174\T2174TG005.DWG

JOB NO: 45-5721-27



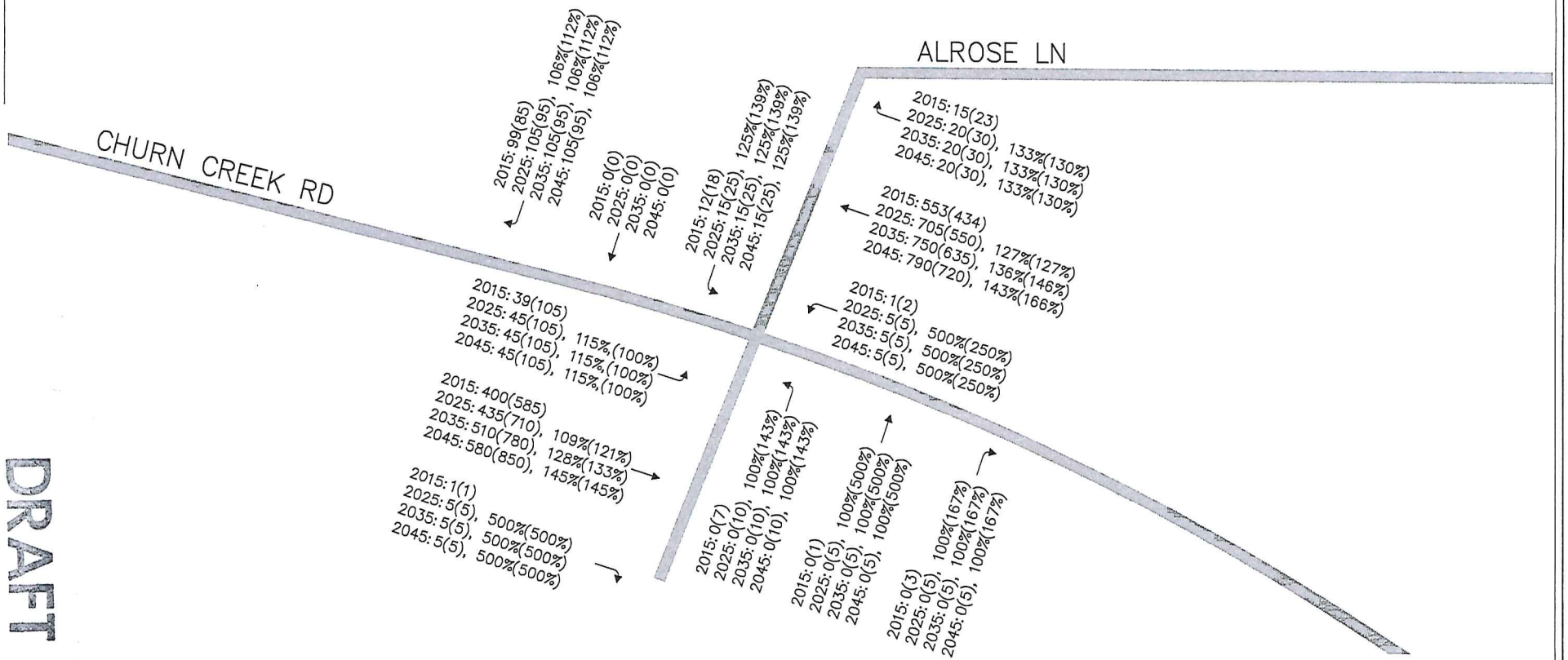
DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

PROPOSED INTERSECTION VOLUMES - JUNE 30, 2016

D-4



DRAFT

LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume
XX% – Percent of AM Peak Hour Volume
(XX%) – Percent of PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

PROPOSED INTERSECTION VOLUMES - JUNE 30, 2016

D-5

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 5

To:	City of Redding - Engineering	**Date:**	June 30, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Model Select Link Analysis for "BoxCo" and "California Gold" Developments	**Job No.:**	45-5721-27
		File No.:	C2174MEM005
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

This technical memorandum provides select link analysis for the developments identified in the subject.

2045 "BOXCO" Select Link Anlaysis

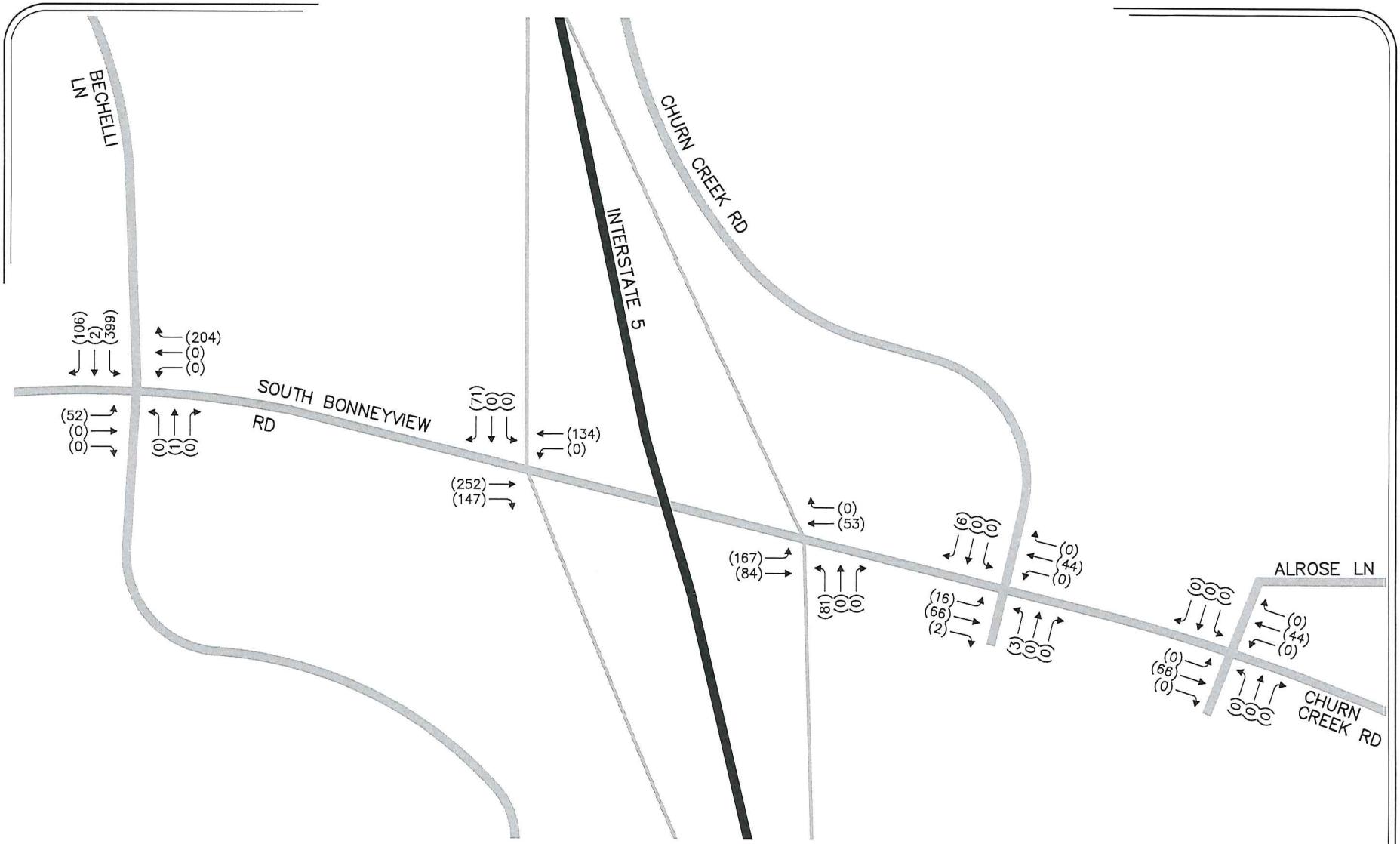
See **Attachment A.** As presented in Technical Memorandum No. 4, the AM vehicle trips have been "zero'ed" out for simplicity. Therefore, AM peak hour turn movements are **not** provided. PM peak hour turn movements are presented.

2045 "California Gold" Select Link Analysis

See **Attachment B.** Both AM and PM peak hour turn movements are presented.

Action Requested

1. City and Caltrans review of the attached data.
2. City and Caltrans approval of the proposed traffic forecasts presented in Technical Memorandum No. 4.



LEGEND:
(XX) – "BoxCo" TAZ PM Peak Hour

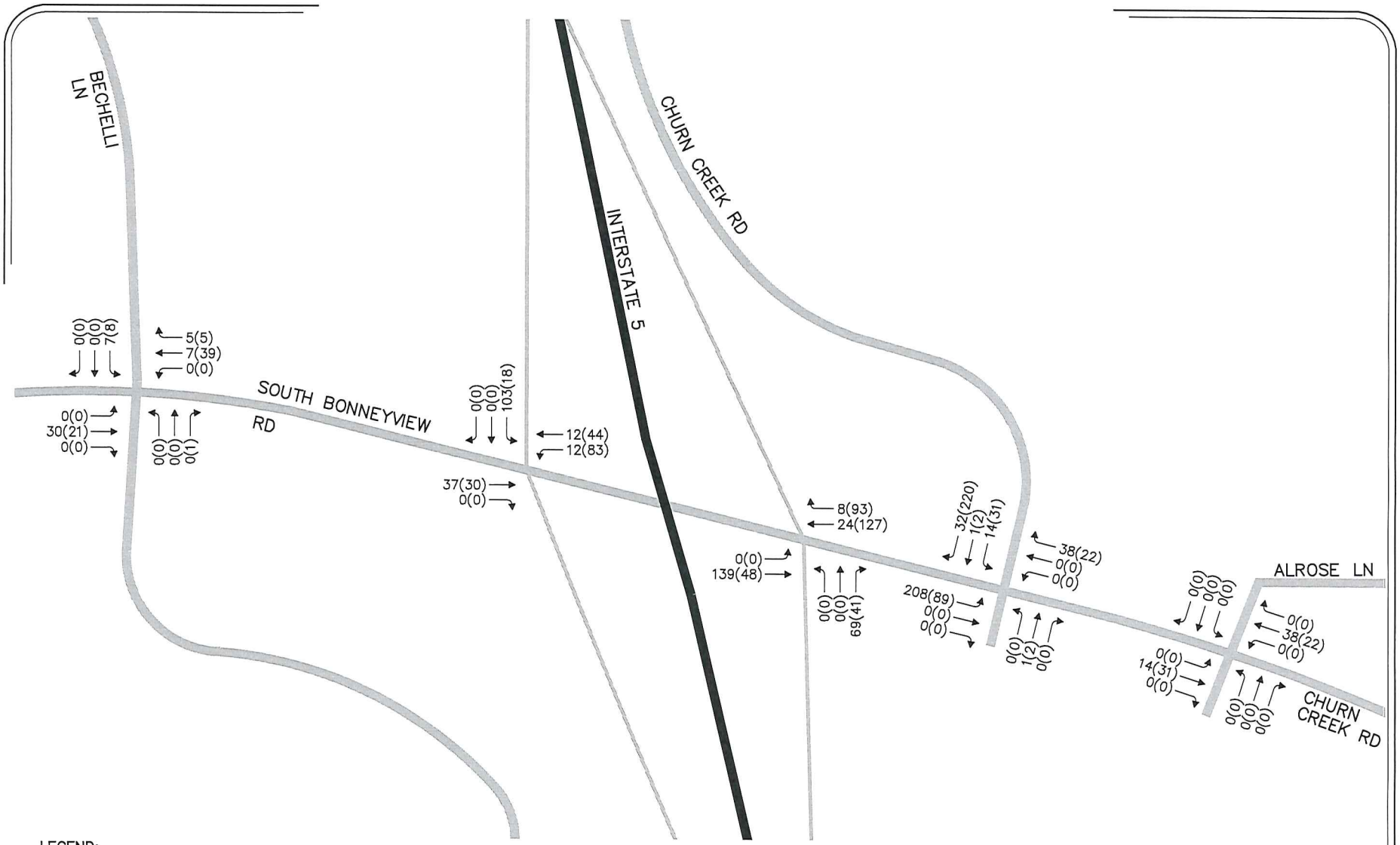
I-5/South Bonnyview Interchange PSR Traffic Operations Report

2045 SELECT LINK ANALYSIS "BOXCO"

A

6/30/2016 3:12 PM K:\PRJ\2174\T2174\T2174TG006.DWG

JOB NO: 45-5721-27



LEGEND:
XX – "California Gold" TAZ AM Peak Hour
(XX) – "California Gold" TAZ PM Peak Hour

I-5/South Bonnyview Interchange PSR Traffic Operations Report

2045 SELECT LINK ANALYSIS "CALIFORNIA GOLD"

B

6/30/2016 3:12 PM K:\PRJ\2174\T2174\T2174TG006.DWG

JOB NO: 45-5721-27

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 6

To:	City of Redding - Engineering	**Date:**	August 12, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Final Traffic Volume Forecasts	**Job No.:**	45-5721-27
		File No.:	C2174MEM006
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

The following summarizes the approach to preparing the final traffic volumes forecasts that will be used for the Traffic Operations Report.

History

Technical Memorandum No. 4 contained proposed traffic forecasts. The following issues were identified with the data contained in Technical Memorandum No. 4:

- The PM peak hour traffic distribution for the BoxCo TAZ, from the Regional Model, did not match the ITE rates.
- The AM and PM peak hour traffic distribution for the California Gold TAZ, from the Regional Model, was suspect.

A select link analysis was performed for the BoxCo and California Gold TAZ's with the results presented in **Technical Memorandum No. 5**. Upon review of the select link analysis, it was evident that there was an imbalance between inbound and outbound trips for both TAZ's.

Via. a July 7, 2016 email, Omni-Means recommended:

- No adjustments to the overall peak hour trips from each of the TAZ's.
- Manually adjusting the inbound and outbound peak hour volumes for both TAZ's to closely match ITE rates. The manual adjustments will be based upon the ITE codes in Table 1:

Table 1: BoxCo and California Gold TAZ – Model Trips Adjusted to ITE IN/OUT Splits

		AM Peak Hour			PM Peak Hour		
Landuse	Descriptor	In	Out	Total	In	Out	Total
BoxCo[1]	Model (used in forecasts)	NA	NA	NA	444	445	889
California Gold	Model (used in forecasts)	188	166	354	236	217	453
	ITE from Traffic Study (for comparison only)	169	155	324	253	240	493

Notes 1. Trip generation for Boxco based on actual trip rates from the existing site were used. Adjusted upwards to reflect a gas station and additional retail.

Table 3: PM Peak Hour Final Traffic Volume Forecasts

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Year 2025 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	25	15	25	635	20	310	185	1090	25	20	1015	390
2	**S Bonnyview Rd/I-F SB Ramps**				280		575		1230	520	300	855	
3	**S Bonnyview Rd/I-5 NB Ramps**	325	5	250				630	880			825	285
4	**Churn Creek Rd/S Bonnyview Rd**	125	10	25	145	15	475	410	640	80	35	505	130
5	Churn Creek Rd/Alrose	10	5	5	25		95	105	700	5	5	565	30
Year 2035 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	25	20	35	715	20	340	200	1165	30	25	1070	440
2	**S Bonnyview Rd/I-F SB Ramps**	0	0	0	300	0	600	0	1335	580	330	935	0
3	**S Bonnyview Rd/I-5 NB Ramps**	360	5	275	0	0	0	680	950	0	0	900	345
4	**Churn Creek Rd/S Bonnyview Rd**	125	10	25	175	15	535	445	700	80	35	580	155
5	Churn Creek Rd/Alrose	10	5	5	25	0	95	105	785	5	5	665	30
Year 2045 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	25	20	40	795	20	365	215	1240	30	30	1120	485
2	**S Bonnyview Rd/I-F SB Ramps**				315		625		1435	640	355	1010	
3	**S Bonnyview Rd/I-5 NB Ramps**	395	5	295				730	1020			970	400
4	**Churn Creek Rd/S Bonnyview Rd**	125	10	25	200	15	595	480	755	80	35	650	180
5	Churn Creek Rd/Alrose	10	5	5	25		95	105	870	5	5	760	30

California Gold TAZ Peak Hour Adjustments

In order to document the adjustments that went into the final traffic volume forecasts, Table 4 presents the adjustments for the AM peak hour and Table 5 presents the adjustments for the PM peak hour, that are described under "History" above. The adjustments shown in Tables 4 and 5 represent the “net” adjustments between the regional model’s imbalanced trip generation/distribution and the manual trip generation/distribution. As such, there are instances where the adjustment shown in Tables 3 and 4 is negative.

For ease of calculations, the presented adjustments were applied to Year's 2025, 2035 and 2045 forecasts.

Table 4: California Gold AM Peak Hour Adjustments

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2025, 2035 & 2045 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	0	0	0	-5	0	0	0	5	0	0	14	-4
2	**S Bonnyview Rd/I-F SB Ramps**	0	0	0	-48	0	0	0	0	0	13	11	0
3	**S Bonnyview Rd/I-5 NB Ramps**	0	0	-27	0	0	0	0	-47	0	0	24	26
4	**Churn Creek Rd/S Bonnyview Rd**	0	-1	0	5	-1	50	-74	0	0	0	0	-7
5	**Churn Creek Rd/Alrose**	0	0	0	0	0	0	0	5	0	0	-7	0

Via. emails on July 11, 2016, City and Caltrans staff concurred with the July 7, 2016 Omni-Means recommendations and directed Omni-Means to:

- Manually adjust the portion of BoxCo TAZ trips that are to/from Interstate 5 to 60% to/from the north and 40% to/from the south.

Manual Adjustments

While making the adjustments described under "History" above, we noted some anomalies likely due to the model redistribution with the buildout of the proposed uses. There were instances where the 2025 volumes were lower than the existing counts. To account for these anomalies, we checked the forecasted turning movements for reasonableness and made adjustments where necessary.

Final Traffic Volume Forecasts

The final forecasts were derived with the AM forecasts presented in Table 2 and the PM forecasts presented in Table 3, and in the attached figures.

Table 2: AM Peak Hour Final Traffic Volume Forecasts

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Year 2025 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	15	15	20	145	5	155	275	1000	15	30	985	320
2	**S Bonnyview Rd/I-F SB Ramps**				190		555		890	275	250	790	
3	**S Bonnyview Rd/I-5 NB Ramps**	410		265				470	615			640	520
4	**Churn Creek Rd/S Bonnyview Rd**	160	30	65	70	25	405	365	355	170	65	585	130
5	Churn Creek Rd/Alrose				15		105	45	440	5	5	685	20
Year 2035 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	20	20	25	160	10	165	290	1055	20	40	1080	360
2	**S Bonnyview Rd/I-F SB Ramps**	0	0	0	225	0	620	0	945	300	265	865	0
3	**S Bonnyview Rd/I-5 NB Ramps**	465	0	295	0	0	0	485	690	0	0	665	540
4	**Churn Creek Rd/S Bonnyview Rd**	160	30	65	100	25	420	425	400	170	65	625	160
5	Churn Creek Rd/Alrose	0	0	0	15	0	105	45	515	5	5	745	20
Year 2045 Forecasts													
1	**S Bonnyview Rd/Bechelli Lane**	20	20	25	170	10	175	305	1110	20	45	1170	395
2	**S Bonnyview Rd/I-F SB Ramps**				255		685		995	320	275	935	
3	**S Bonnyview Rd/I-5 NB Ramps**	520		320				500	760			690	555
4	**Churn Creek Rd/S Bonnyview Rd**	160	30	65	130	25	430	480	440	170	65	665	190
5	Churn Creek Rd/Alrose				15		105	45	585	5	5	805	20

Table 5: California Gold PM Peak Hour Adjustments

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2025, 2035 & 2045 Forecasts													
1	S Bonnyview Rd/Bechelli Lane	0	0	-1	-6	0	0	0	15	0	0	-3	-3
2	S Bonnyview Rd/I-F SB Ramps	0	0	0	39	0	0	0	9	0	-40	-5	0
3	S Bonnyview Rd/I-5 NB Ramps	0	0	2	0	0	0	0	47	0	0	-45	-36
4	Churn Creek Rd/S Bonnyview Rd	0	-2	0	1	-2	-82	49	0	0	0	0	10
5	Churn Creek Rd/Alrose	0	0	0	0	0	0	0	1	0	0	10	0

BoxCO TAZ PM Peak Hour Adjustments

In order to document the adjustments that went into the final traffic volume forecasts, Table 6 presents the Year 2025 adjustments for the PM peak hour, that are described under "History" above:

Table 6: Year 2025 BoxCo PM Peak Hour Adjustments

Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2025 Forecasts													
1	S Bonnyview Rd/Bechelli Lane	0	-1	0	-72	-2	-22	24	0	0	0	0	90
2	S Bonnyview Rd/I-F SB Ramps	0	0	0	0	0	67	0	-29	-43	0	23	0
3	S Bonnyview Rd/I-5 NB Ramps	12	0	0	0	0	0	-14	-14	0	0	10	0
4	Churn Creek Rd/S Bonnyview Rd	-3	0	0	0	0	7	-2	-10	-2	0	7	0
5	Churn Creek Rd/Alrose	0	0	0	0	0	0	0	-10	0	0	7	0

Table 7 presents the Year 2035 and Year 2045 adjustments for the PM peak hour, that are described under "History" above:

Table 7: Year 2035 and 2045 BoxCo PM Peak Hour Adjustments

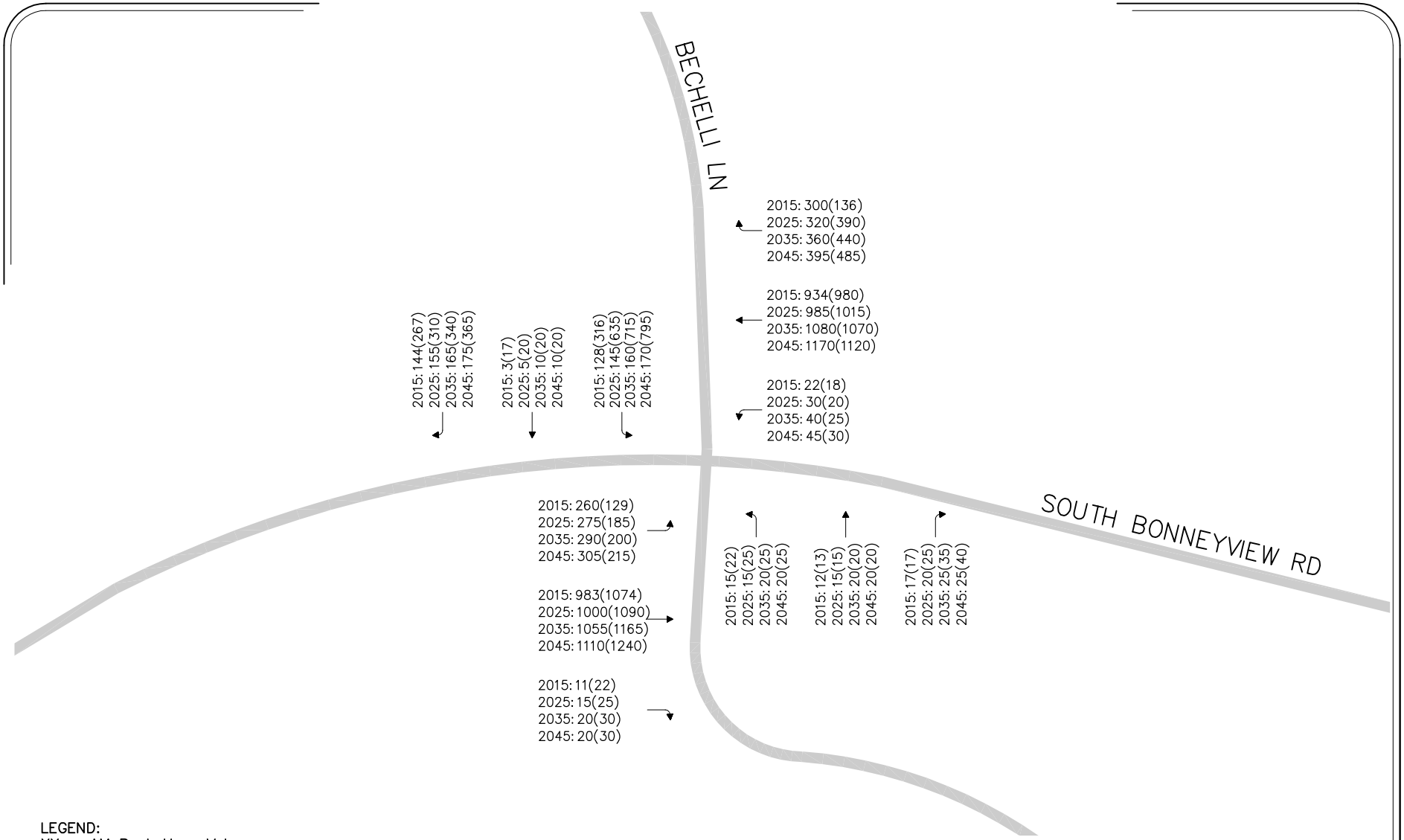
Intersection No.		NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBL	WBT	WBR
Adjustments to 2035 & 2045 Forecasts													
1	S Bonnyview Rd/Bechelli Lane	0	-1	0	-76	-2	-23	25	0	0	0	0	95
2	S Bonnyview Rd/I-F SB Ramps	0	0	0	0	0	70	0	-30	-45	0	24	0
3	S Bonnyview Rd/I-5 NB Ramps	13	0	0	0	0	0	-15	-15	0	0	11	0
4	Churn Creek Rd/S Bonnyview Rd	-3	0	0	0	0	7	-2	-11	-2	0	7	0
5	Churn Creek Rd/Alrose	0	0	0	0	0	0	0	-11	0	0	7	0

Next Steps

1. Final agency approval of the data presented in this Technical Memorandum.
2. Agency concurrence regarding Traffic Operations technical analysis parameters. The information will be presented in Technical memorandum No. 7.

Traffic Forecast Figures

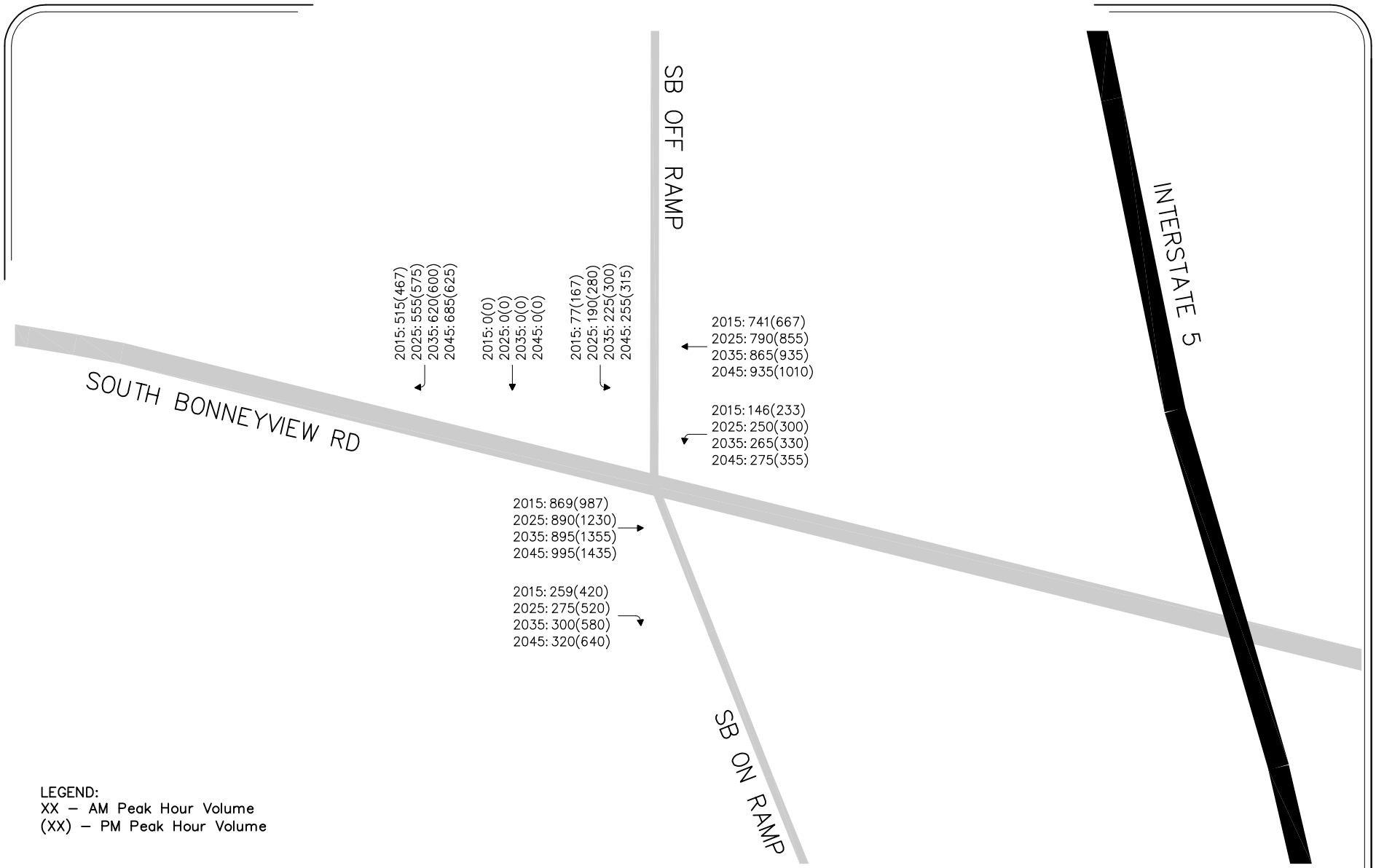
Attached are final traffic forecast figures.



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

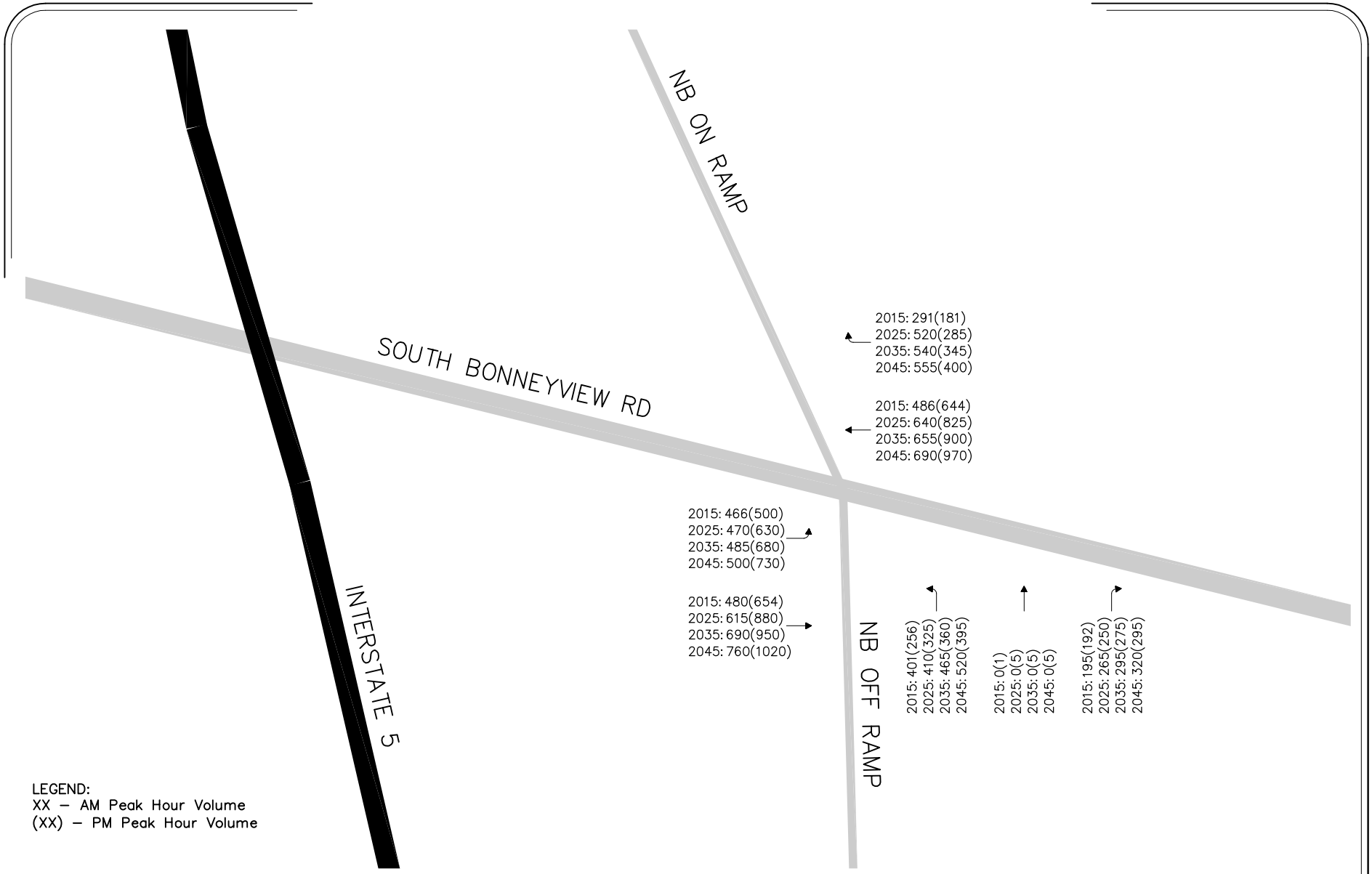
I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS



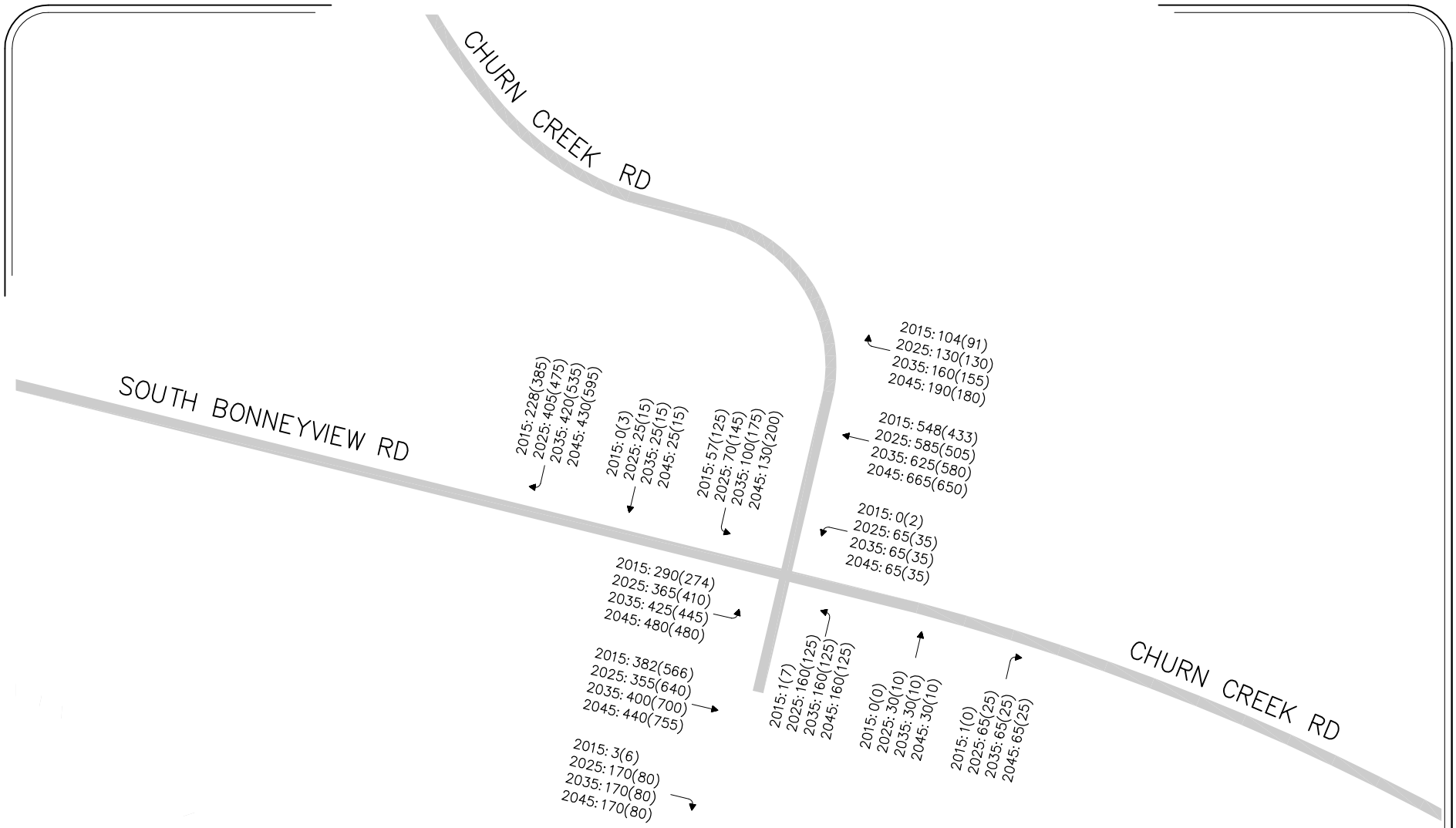
I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS



I-5/South Bonnyview Interchange PSR Traffic Operations Report

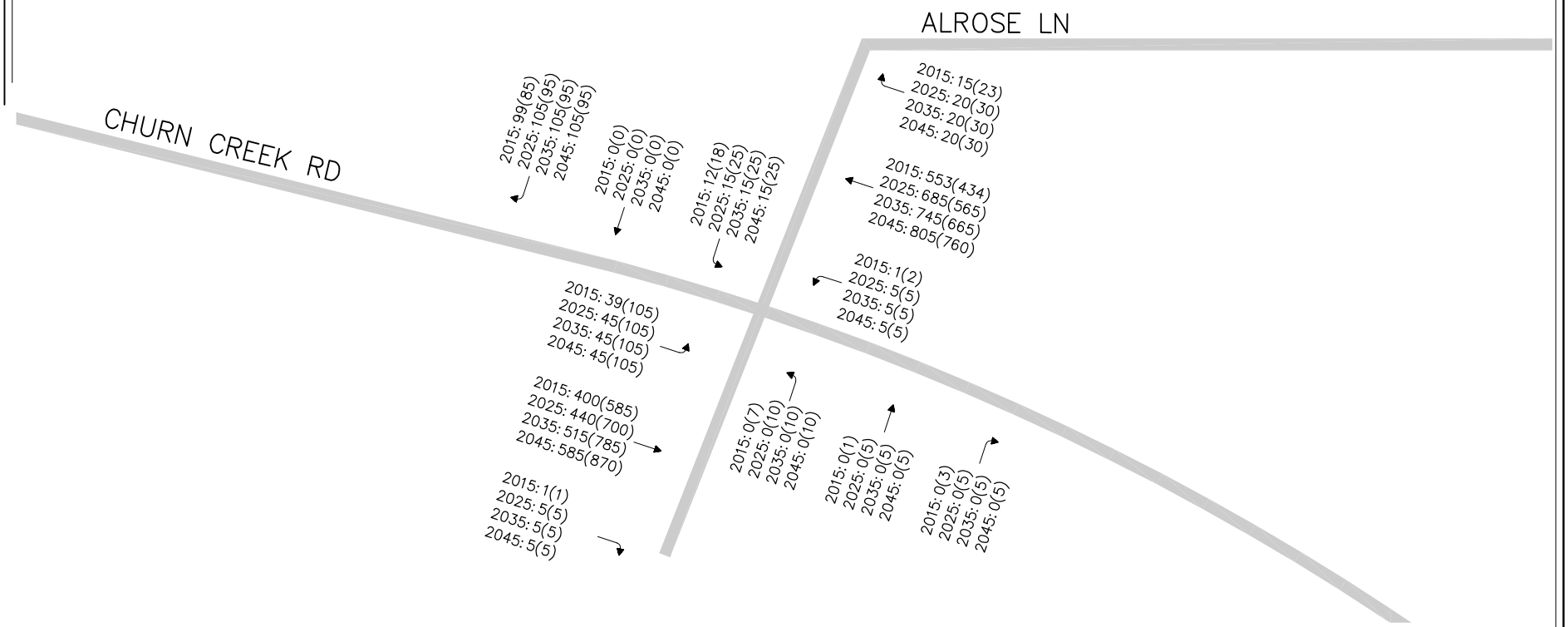
FINAL TRAFFIC FORECASTS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS



LEGEND:
XX – AM Peak Hour Volume
(XX) – PM Peak Hour Volume

I-5/South Bonnyview Interchange PSR Traffic Operations Report

FINAL TRAFFIC FORECASTS

omni · means
ENGINEERING SOLUTIONS

Technical Memorandum No. 7

To:	City of Redding - Engineering	**Date:**	July 15, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Traffic Operations Analysis - Approach to Work	**Job No.:**	45-5721-27
		File No.:	C2174MEM007
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

The following summarizes the planned approach to the Traffic Operations Analysis for the above-referenced project, as presented at the July 15, 2016 focused PDT meeting.

Technical Analysis Parameters

Table 1
Synchro Parameters for Traffic Signals

1	Analysis Period - 15 Minutes
2	Peak Hour Factor (PHF)- 0.92 or higher for Year 2025, 2035 and 2045 conditions. PHF greater than 0.92 due to Existing counts showing PHF higher.
3	% Trucks: weekday peak hour analysis - from counts
4	Flat Grade
5	25 ft. assumed vehicle length for stacking and queues
6	Cycle Length - 80 sec min, 150 sec max (optimize signal timing)
7	Coordinated Cycle Length - obtained from City and Caltrans (optimize signal timing for Year 2025, 2035 & 2045 conditions)
8	Total Lost Time Per Signal Phase - 4 seconds (24 sec max for 8-phase signal)
9	Ideal saturation flow rate - 1,900 vhp or 1,710 vhp as provided in the HCM
10	Pedestrian Speed - 3.5 ft/s and 10 mph for bicycles
11	Pedestrian calls - 2025 (6); 2035 (10); 2045 (15). Existing ranges from 0 to 3
Source: Figure 4.5 City of Redding TIA Guideline January 2009, modified as appropriate	

Table 2
SIDRA Parameters for Roundabouts

SIDRA standard model will be used for roundabouts analysis.
A 1.1 environmental factor will be used in SIDRA for Year 2025 conditions, 1.05 for Year 2035 conditions and 1.0 for design year conditions.
PHF, heavy vehicles and pedestrians consistent with the Table 1 parameters.
Omni-Means will verify that the SIDRA truck length corresponds with expected conditions.

Table 3
VISSM Parameters for a Diverging Diamond Interchange (DDI)

The DDI will be modeled in VISSIM based on the preliminary concept prepared by Caltrans.
80 second minimum cycle length will be utilized.
PHF, heavy vehicles and pedestrians consistent with the Table 1 parameters.
Signal phasing will be based on the information published within the Diverging Diamond Interchange informational guide (FHWA, August 2014)

Table 4
VISSM Parameters Roundabouts

The roundabout interchange will be modeled in VISSIM based on preliminary concepts prepared by Omni-Means.
PHF, heavy vehicles and pedestrians consistent with the Table 1 parameters.
Conflict areas and/or priority rules are the two methods in VISSIM to simulate vehicle yielding behavior at the entry. We will use these methods to model the vehicle yielding behavior at the entries.

LOS Standards

The following LOS standards will be used for the Traffic Operations analysis:

- LOS D or better for I-5 ramp intersections.
- LOS D or better for S. Bonnyview/Bechelli and S. Bonnyview/Churn Creek. These two City intersections will have a LOS D standard due to the City's General Plan LOS D standard for "river crossings" and "interchanges".
- LOS C or better for Churn Creek/Alrose.

The City and Caltrans LOS policies and guidelines are quoted in the subsequent sections.

City General Plan Transportation Element LOS Policy

The City of Redding currently maintains its General Plan Transportation Element that is accessible via the following internet site: *http://www.cityofredding.org/home/showdocument?id=5513.* The Transportation Element contains the following information of particular interest to this study:

> *Policy T1A: Establish the following peak-hour LOS standards for transportation planning and project review. They reflect the special circumstances of various areas of the community:*
>
> - *Use LOS "C" – for most arterial streets and their intersections.*
> - *Use LOS "D" – for the Downtown area where vitality, activity, and pedestrian and transit use are primary goals.*
> - *Use LOS "D" – for streets within the State highway system and interchanges.*

- *Use LOS "D" – for river-crossing street corridors whose capacity is affected by adjacent intersections.*

Caltrans LOS Guidelines

The Caltrans published Guide for the Preparation of Traffic Impact Studies (dated December 2002) states the following:

> *"Caltrans endeavors to maintain a target LOS at the transition between LOS "C" and LOS "D" on State highway facilities, however, Caltrans acknowledges that this may not be always feasible and recommends that the lead agency consult with Caltrans to determine the appropriate target LOS."*

LOS Definitions

Table 2 presents the Highway Capacity Manual LOS definitions that will be used.

Table 2
LOS Definitions

Level of Service	Stopped Delay/Vehicle (sec)		
	Signalized	Un-Signalized	All-Way Stop
A	< 10.0	< 10.0	< 10.0
B	>10.0 and < 20.0	>10.0 and < 15.0	>10.0 and < 15.0
C	>20.0 and < 35.0	>15.0 and < 25.0	>15.0 and < 25.0
D	>35.0 and < 55.0	>25.0 and < 35.0	>25.0 and < 35.0
E	>55.0 and < 80.0	>35.0 and < 50.0	>35.0 and < 50.0
F	> 80.0	> 50.0	> 50.0

Vehicle Queue Standards

- Accommodate queues with "Detail 38" (aka "pocket") area.
- Omni-Means will give attention to lane utilization imbalances, short weaves and left turns in close proximity to a preceding intersection.

Next Steps

Traffic Operations

1. T. Ops. for Alt. 1 (traditional tight diamond).
   - For next meeting: Perform 2035 and 2045 analysis.
2. Geometric design for Alt. 1 (by Caltrans)
3. T. Ops. for Alt. 2 (DDI) & Alt. 3 (Roundabouts).
4. Geometric design for Alt. 2 (by Caltrans) and Alt. 3 (by Omni-Means).
5. Determine "hybrid" Alt. 4.
6. T. Ops. for Alt. 4.
7. Geometric design for Alt. 4 (by Caltrans and Omni-Means)

Agency Assignments

1. Rob Stinger and Dale Wider to verify District 2 management support for LOS standards identified above.

Information to Assist with Traffic Operations Analysis Review

Omni-Means will provide the following information with the T. Ops. summary for each alternative:

1. LOS tables.
2. Critical vehicle queue tables.
3. Conceptual layouts for mitigated conditions on aerial background.
4. Queue lengths shown graphically on the conceptual layouts.
5. Mitigated conditions conceptual layouts as backgrounds for simulations.

Technical Memorandum No. 8

To:	City of Redding - Engineering	**Date:**	November 22, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	T. Operations for Alternative 1 (Tight Diamond) and Alternative 3 (Roundabout Corridor) Year 2045	**Job No.:**	45-5721-27
		File No.:	C2174MEM008.DOCX
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Year 2045 AM and PM peak hour volumes were applied to Alternative 1 (Tight Diamond) and Alternative 3 (Roundabout Corridor) and mitigated lane geometrics developed.

Traffic Forecasts

Refer to Technical Memorandum No. 6.

Technical Parameters for Traffic Operations Analysis

Refer to Technical Memorandum No. 7.

Alternatives

Alternative 1 - Traditional Tight Diamond

The LOS/Delay and 95th percentile queue lengths for the AM and PM peak hours are presented in Tables 1 and 2.

Alternative 3 - Roundabout Corridor

The LOS/Delay and 95th percentile queue lengths for the AM and PM peak hours are presented in Tables 3 and 4.

Mitigated LOS and Delays

Alternative 1 - Traditional Tight Diamond

Year 2045 mitigated LOS and delays for Alternative 1 (Tight Diamond) is presented in Table 1.

Table 1: Year 2045 LOS and Delays for Alternative 1

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	C	27.4	C	30.9	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	21.2	C	22.3	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	24.1	C	26.1	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	C	27.8	C	26.8	C
5	Churn Creek Rd/Alrose Lane	TWSC	C	13.6	B	23.5	C

Notes:

1 TWSC = Two Way Stop Control

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

Year 2045 mitigated 95th percentile for Alternative 1 (Tight Diamond) is presented in Table 2. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 2: 95th Percentile Queue for Alternative 1

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	330	244	400
	Eastbound Thru		265	253	
	Eastbound Thru/Right		232	272	350
	Westbound Left		**156**	118	150
	Westbound Thru		436	423	
	Westbound Right		152	131	550
	Northbound Left/Thru		69	78	
	Northbound Right		46	65	75
	Southbound Left		60	233	300
	Southbound Left/Thru		90	295	
	Southbound Right		93	189	
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru	Signal	175	251	490
	Eastbound Right		108	330	350
	Westbound Left		152	197	300
	Westbound Thru		235	241	
	Southbound Left		124	130	300
	Southbound Left/Thru		130	148	
	Southbound Right		230	224	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left	Signal	247	420	
	Eastbound Thru		204	237	
	Westbound Thru		262	277	
	Westbound Right		257	213	
	Northbound Left		418	355	450
	Northbound Left/Thru		480	389	
	Northbound Right		266	189	400

Table 2: 95th Percentile Queue for Alternative 1 (Continued)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**227**	**225**	175
	Eastbound Thru		141	217	
	Eastbound Right		89	93	145
	Westbound Left		97	60	
	Westbound Thru		256	232	
	Westbound Right		186	111	200
	Northbound Left		134	154	
	Northbound Thru/Right		135	59	
	Southbound Left		122	172	225
	Southbound Thru		44	30	
	Southbound Right		123	283	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	54	78	100
	Westbound Left/Thru		56	70	
	Westbound Thru/Right		104	27	
	Northbound Left/Thru/Right		-	50	
	Southbound Left/Thru		26	45	
	Southbound Right		79	73	

1. Worst lane movement (of the approach) value stated.

Alternative 3 - Roundabout Corridor

Year 2045 mitigated LOS and delays for Alternative 3 (Roundabout Corridor) is presented in Table 3.

Table 3: Year 2045 LOS and Delays for Alternative 3

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	C	11.8	B	23.6	C
2	S. Bonnyview Rd/I-5 SB Ramps	RNDBT	D	11.8	B	21.0	C
3	S. Bonnyview Rd/I-5 NB Ramps	RNDBT	D	8.4	A	9.8	A
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	C	11.3	B	12.2	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

Year 2045 mitigated 95th percentile for Alternative 3 (Roundabout Corridor) is presented in Table 4. In instances where there are more than two lanes for a particular movement/approach, queuing reported is

for the worse lane movement/approach. The queues are developed from the SIDRA version 7 using Highway Capacity Manual methodology.

Table 4: 95th Percentile Queue for Alternative 3

Int. #	Intersection/Approach	Control Type	Year 2045 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left/Thru	Roundabout	113.9	379.2	
	Eastbound Thru/Right		112.8	420.3	
	Westbound Left/Thru		237.5	195	
	Westbound Thru/Right		242	195	
	Northbound Left/Thru/Right		16	45.4	
	Southbound Left		22.2	95.8	
	Southbound Left/Thru		22.2	113.1	
	Southbound Right		35.7	114.8	
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru	Roundabout	128.6	493.1	
	Eastbound Right		71.3	480.5	500
	Westbound Left/Thru		0	0	
	Westbound Thru		0	0	
	Southbound Left/Thru		57.1	77.7	
	Southbound Right		233	184.5	400
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Roundabout	0	0	
	Eastbound Thru		0	0	
	Westbound Thru		84.8	139.2	
	Westbound Right		123.4	118.2	200
	Northbound Left		39.9	35.8	
	Northbound Left/Thru		39.9	35.8	
	Northbound Right		33.9	39.3	200
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left/Thru	Roundabout	89.2	119.4	
	Eastbound Thru/Right		93.1	125.5	
	Westbound Left/Thru		147.3	110.4	
	Westbound Thru/Right		162.4	118	
	Northbound Left/Thru/Right		65.7	45	
	Southbound Left/Thru		40.3	52.9	
	Southbound Right		117.7	183.4	

1. Worst lane movement (of the approach) value stated.

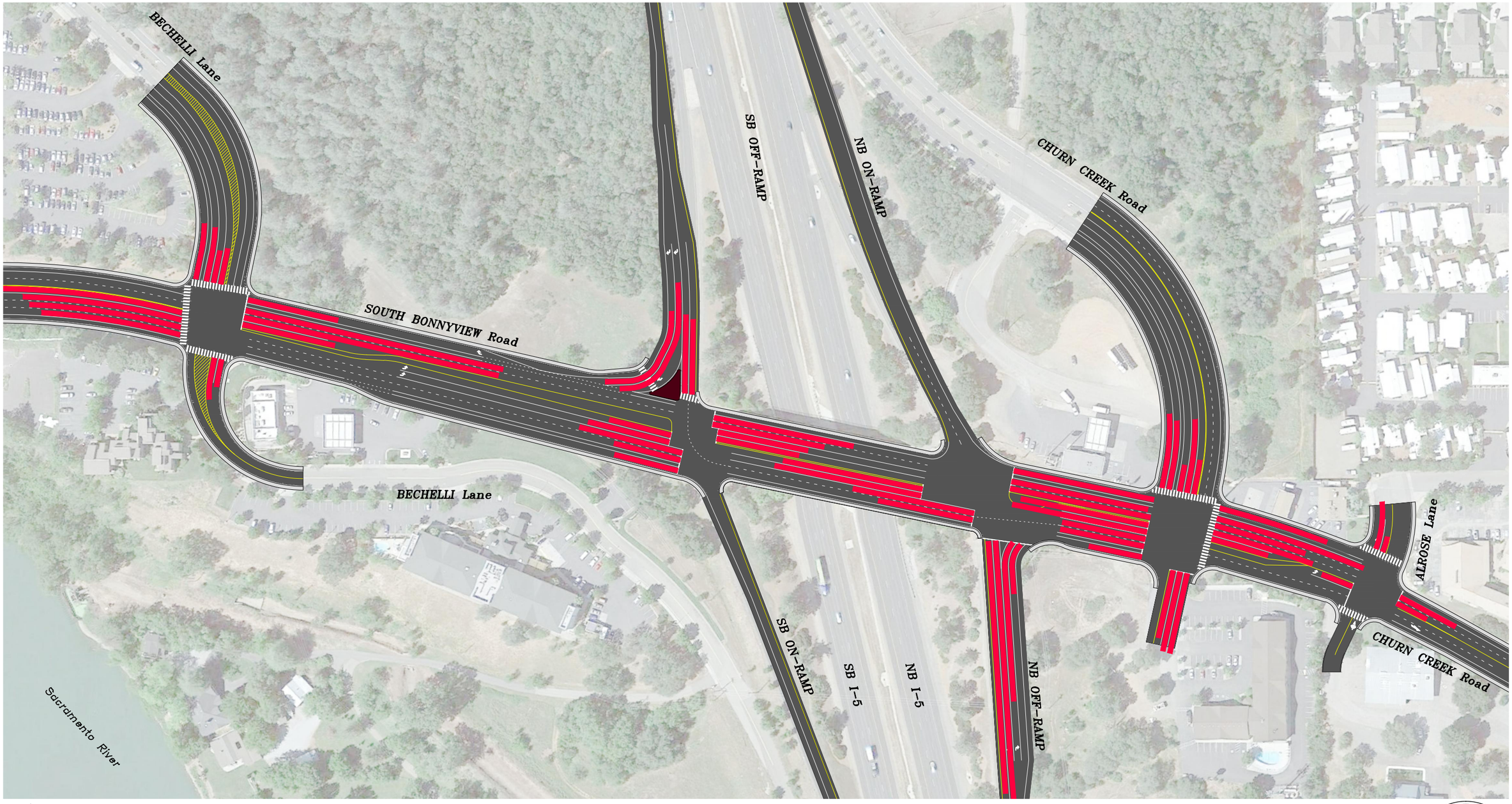
Attachments:

Attachment 1: Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 2: Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 3: Roundabout Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 4: Roundabout Lane Geometrics and 95th Percentile Queues for PM Peak Hour



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

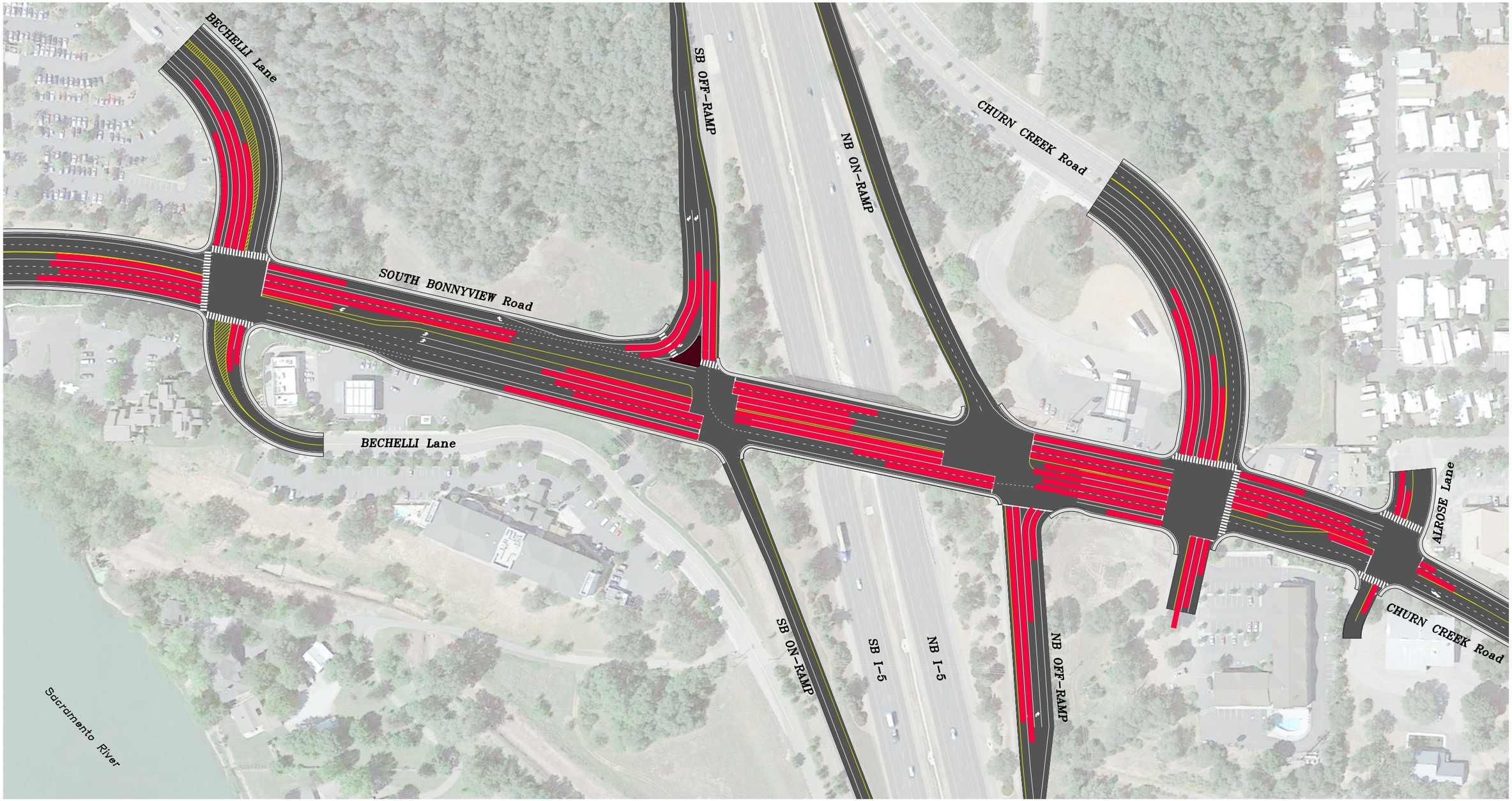
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
ALTERNATIVE 1 - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	RAW
DRAWN	ASH
CHECKED	RAW
FILE NAME	2174EX001
DATE	11/10/16

SHEET No. EX 1 OF 2

J:\PRJ\2174\2174EX001.DWG
11/18/2016 10:27 AM



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

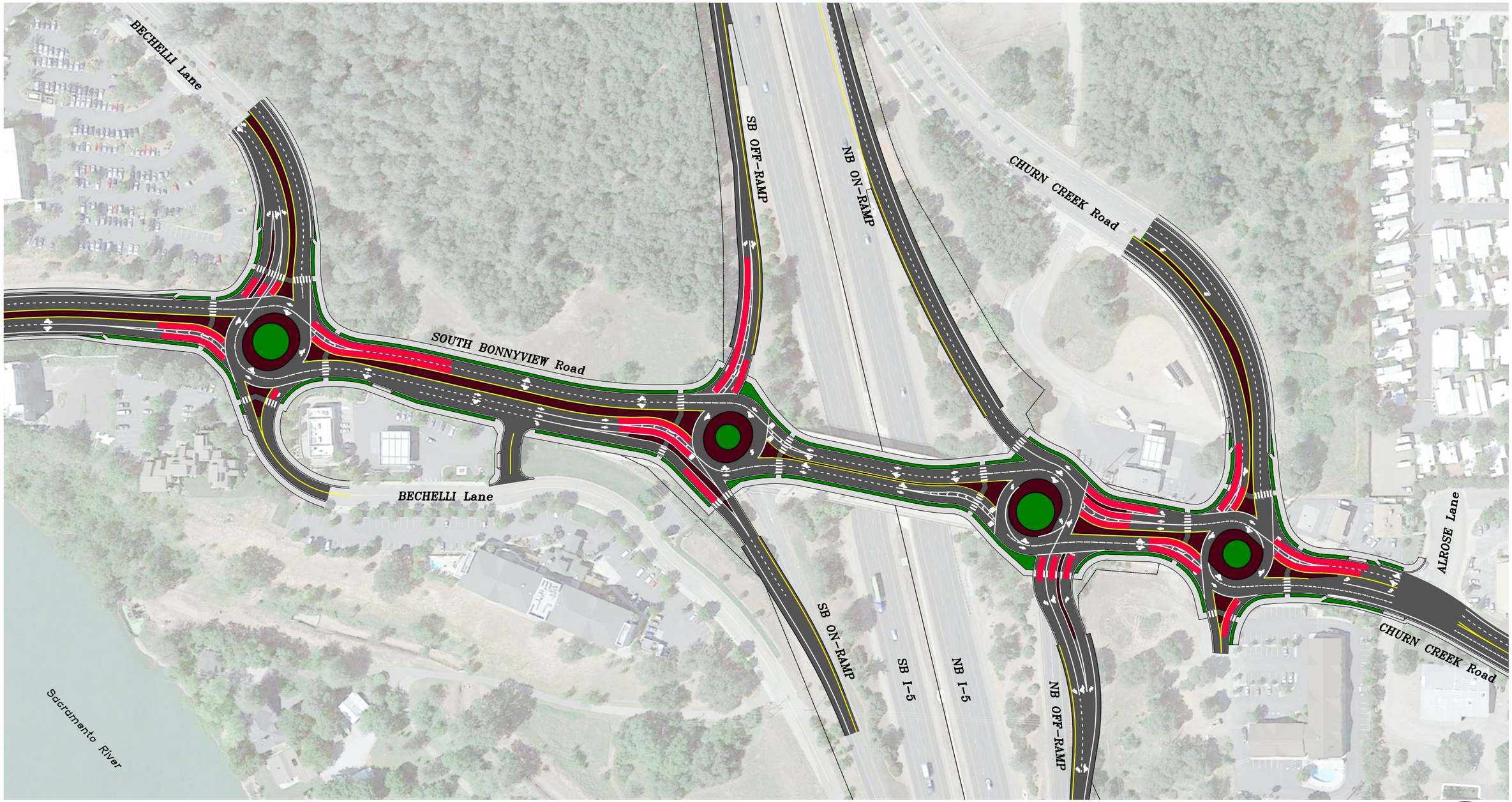
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
ALTERNATIVE 1 - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	RAW
DRAWN	ASH
CHECKED	RAW
FILE NAME	2174EX001
DATE	11/10/16

SHEET No. EX 2 OF 2

11/18/2016 10:26 AM J:\PRJ\2174\2174EX001.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

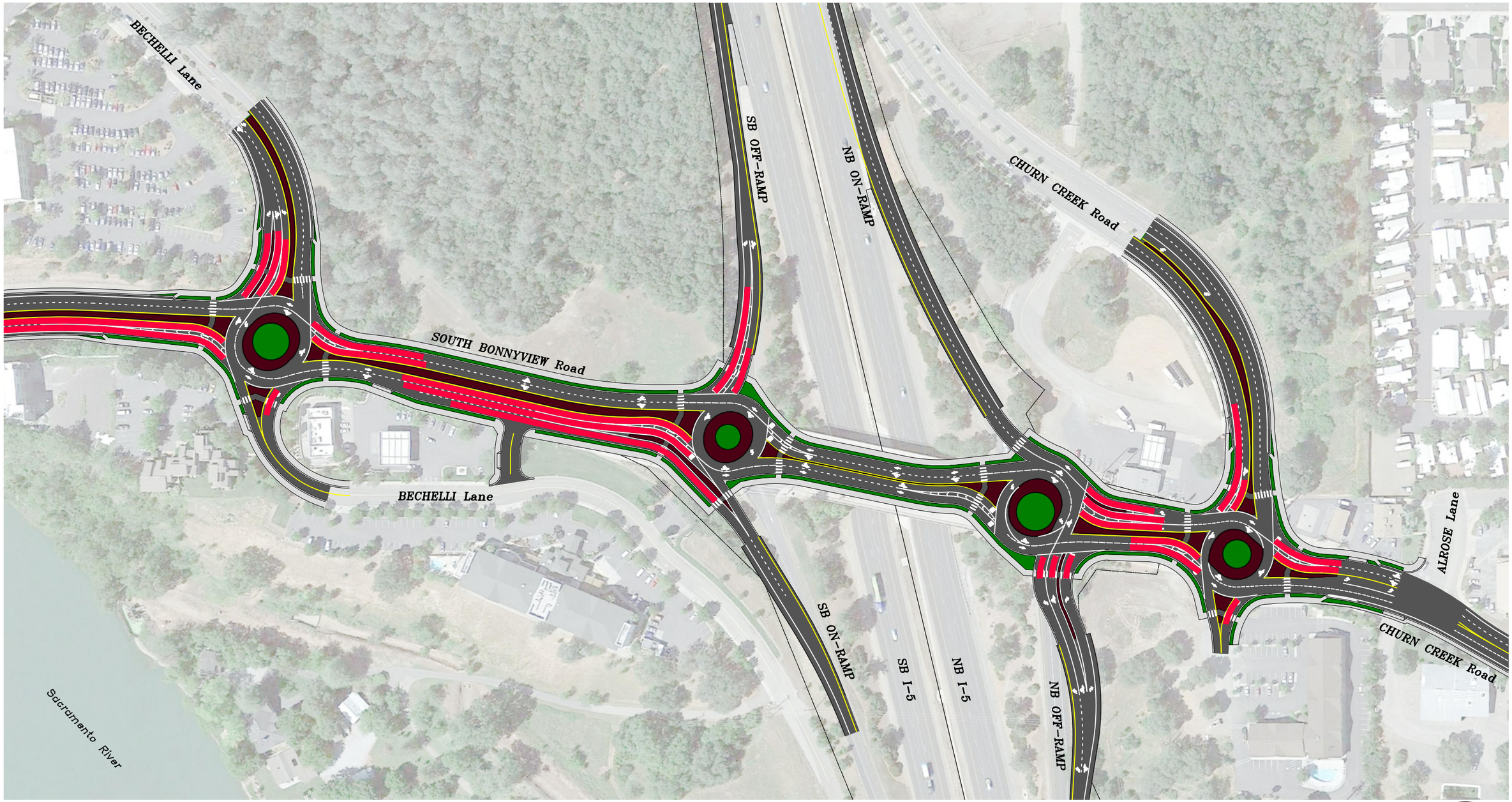
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
ALTERNATIVE 3 - ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX003
DATE	11/10/16

SHEET No. EX 2 OF 2

J:\PRJ\2174\2174EX002.DWG
11/22/2016 11:45 AM



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
ALTERNATIVE 3 - ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX003
DATE	11/10/16

SHEET No. EX 2 OF 2

11/22/2016 11:45 AM J:\PRJ\2174\2174EX002.DWG

Technical Memorandum No. 9

To:	City of Redding - Engineering	**Date:**	November 22, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Year 2045 T. Operations for Alternative 2 (DDI)	**Job No.:**	45-5721-27
		File No.:	C2174MEM009
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Year 2045 AM and PM peak hour volumes were applied to Alternative 2 (Diverging Diamond Interchange [DDI]).

Traffic Forecasts

Refer to Technical Memorandum No. 6.

Technical Parameters for Traffic Operations Analysis

Refer to Technical Memorandum No. 7.

Alternative 2 – DDI Concept

The LOS/Delay and average and maximum queue lengths for the AM and PM peak hour are presented in Tables 1, 2, and 3.

Alternative 2 – DDI Concept

Year 2045 mitigated LOS and delays for Alternative 2 (DDI) are presented in Table 1.

Table 1: Year 2045 LOS and Delays for Alternative 2

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	15.8	B	23.9	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B	12.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.0	B	10.5	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	21.0	C	19.0	B

Year 2045 mitigated 95th percentile queues for Alternative 2 (DDI) are presented in Tables 2 and 3. In instances where there are more than two lanes for a particular movement/approach, queuing reported

is for the worse lane movement/approach. Queues were determining using VISSIM 8 micro simulation using car following and lane change methodology developed by Wiedermann and Sparmann.

Table 2: Queue for Alternative 2 - AM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1] Average	Year 2045 Queue (ft) AM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	40.3	291.5	400
	Eastbound Thru/Right		17.7	217.2	
	Westbound Left/Thru/Right		62.4	412.8	550
	Northbound Left/Thru		6.4	86.1	100
	Northbound Right		4.6	85	100
	Southbound Left/Thru/Right		37.9	210.5	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru/Right	Signal	34.5	311.5	630
	Westbound Left/Thru		47.6	331	500
	Southbound Left		5.2	121.5	450
	Southbound Right		212.0	**556.6**	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Signal	25.1	293.9	480
	Westbound Thru/Right		50.1	**318.9**	215
	Northbound Left		9.2	141.7	450
	Northbound Right		176.0	224.1	450
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left	Signal	30.4	**339.9**	150
	Eastbound Thru		10.7	**228.5**	210
	Westbound Left		33.0	126.6	
	Westbound Thru		14.5	286.5	
	Northbound Left		7.4	165.9	
	Northbound Thru/Right		56.4	133.2	
	Southbound Left/Thru		18.9	109.8	225
	Southbound Right		17.0	251.2	350

1. Worst lane movement (of the approach) value stated.

Table 3: Queue for Alternative 2 - PM Peak Hour

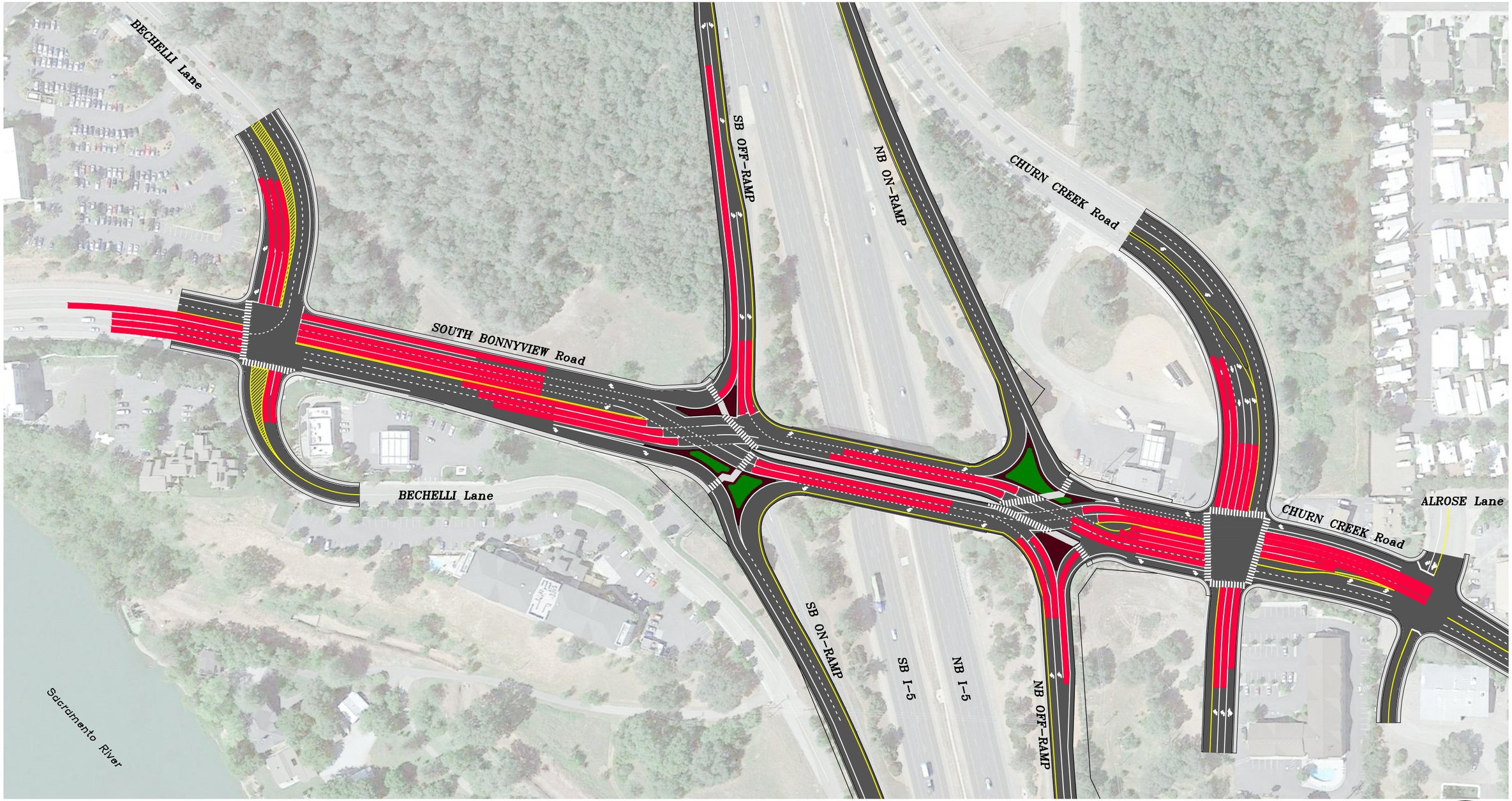
Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1] Average	Year 2045 Queue (ft) PM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	45.5	376.9	400
	Eastbound Thru/Right		30.4	255.6	
	Westbound Left/Thru/Right		71.0	444.3	550
	Northbound Left/Thru		7.9	86.1	100
	Northbound Right		8.2	85.1	100
	Southbound Left/Thru/Right		161.8	**480.9**	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru/Right	Signal	86.3	587.1	630
	Westbound Left/Thru		39.9	343.5	500
	Southbound Left		8.0	129.7	450
	Southbound Right		213.0	**468.2**	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Signal	40.5	**493.9**	480
	Westbound Thru/Right		47.9	307.3	450
	Northbound Left		6.5	118.5	450
	Northbound Right		18.3	156	400
Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) Average	Year 2045 Queue (ft) Max	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left	Signal	32.8	**298**	150
	Eastbound Thru		16.6	**285**	210
	Westbound Left		22.9	126.3	
	Westbound Thru		5.7	248.8	
	Northbound Left		7.9	128.2	
	Northbound Thru/Right		50.6	99.7	
	Southbound Left/Thru		22.7	148.7	225
	Southbound Right		22.2	289.5	350

1. Worst lane movement (of the approach) value stated.

Attachments:

Attachment 1: Diverging Diamond Interchange Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 2: Diverging Diamond Interchange Lane Geometrics and 95th Percentile Queues for PM Peak Hour



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

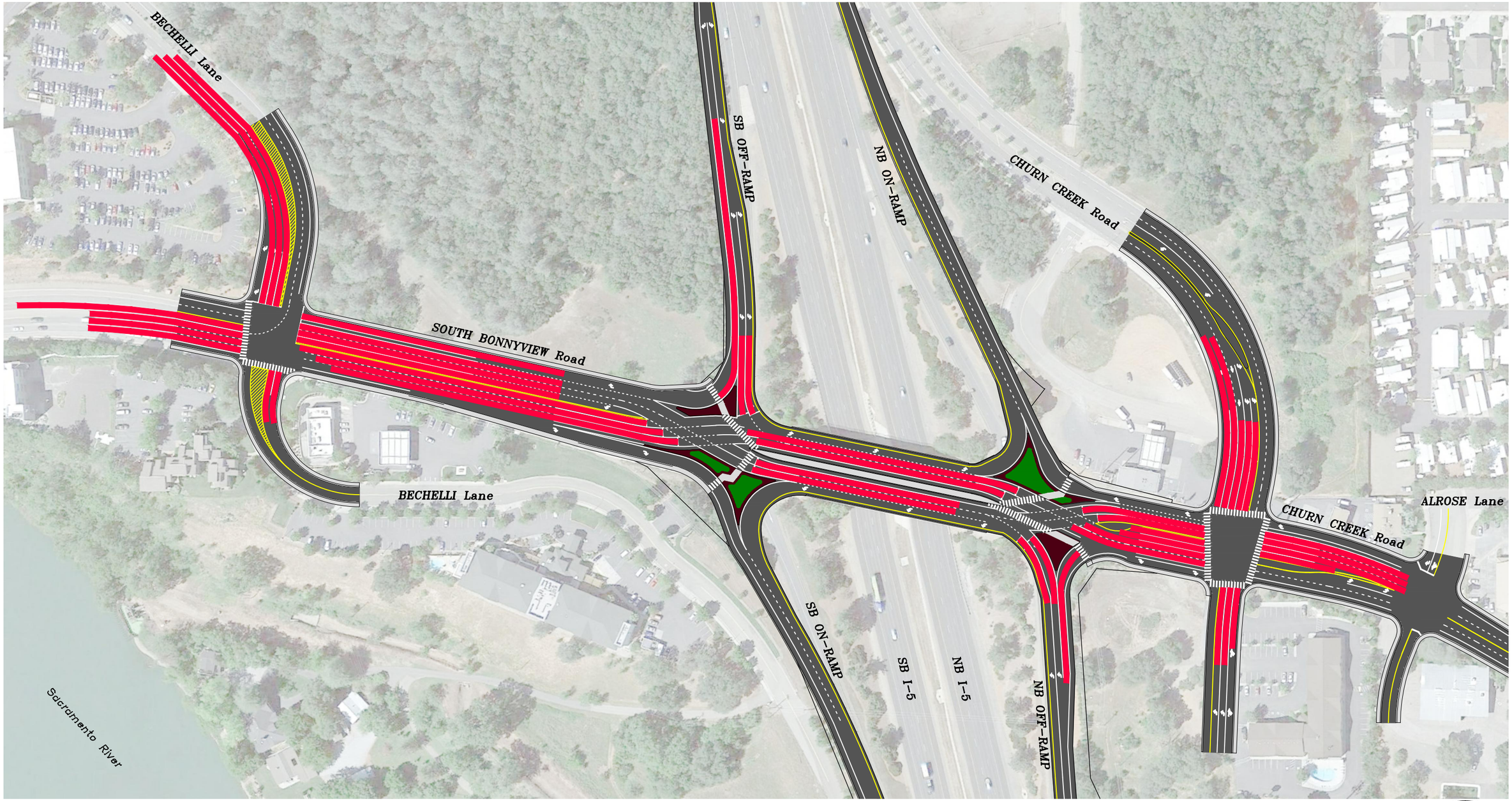
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
ALTERNATIVE 2 - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX005
DATE	11/10/16

SHEET No. EX 2 OF 2

11/22/2016 12:09 PM J:\PRJ\2174\2174EX005.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
ALTERNATIVE 2 - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX005
DATE	11/10/16

SHEET No. EX
2 OF 2

11/22/2016 12:09 PM J:\PRJ\2174\2174EX005.DWG

Technical Memorandum No. 10

To:	City of Redding - Engineering	**Date:**	November 22, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Year 2045 T. Operations for Alternative 4 (DDI/Roundabout)	**Job No.:**	45-5721-27
		File No.:	C2174MEM010.DOCX
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Year 2045 AM and PM peak hour volumes were applied to Alternative 4 (Diverging Diamond Interchange [DDI]/Roundabouts).

Traffic Forecasts

Refer to Technical Memorandum No. 6.

Technical Parameters for Traffic Operations Analysis

Refer to Technical Memorandum No. 7.

Alternative 4 – DDI/Roundabouts Concept

The lane geometrics and average and maximum queue lengths for the critical PM peak hour is presented in Tables 1 and 2**.**

Alternative 4 – DDI/Roundabouts Concept

Year 2045 mitigated LOS and delays for Alternative 4 (DDI/Roundabouts) are presented in Table 1.

Table 1: Year 2045 LOS and Delays for Alternative 4

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	C	11.8	B	23.6	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B	12.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.0	B	10.5	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	C	11.3	B	12.2	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated average and maximum queues for Alternative 4 (DDI/Roundabouts) are presented in Tables 2 and 3. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues have been developed from SIDRA version 7 for the roundabouts and VISSIM 8 for the signalized intersection. SIDRA uses Highway Capacity Manual methodology while VISSIM employs micro simulation using car following and lane change methodology developed by Wiedermann and Sparmann respectively.

Table 2: Queue for Alternative 4 - AM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1] Average	Year 2045 Queue (ft) AM Peak Hour[1] Max[2]	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		113.9	
	Eastbound Thru/Right			112.8	
	Westbound Left/Thru			237.5	
	Westbound Thru/Right			242	
	Northbound Left/Thru/Right			16	
	Southbound Left			22.2	
	Southbound Left/Thru			22.2	
	Southbound Right			35.7	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	20.5	104.2	630
	Westbound Left/Thru		54.6	273.5	500
	Southbound Left		5.8	84.5	450
	Southbound Right		36.6	**507.6**	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	65.9	209.6	480
	Westbound Thru/Right		28.4	**244.2**	215
	Northbound Left		10.6	118.1	450
	Northbound Right		3.0	102.5	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		89.2	
	Eastbound Thru/Right			93.1	
	Westbound Left/Thru			147.3	
	Westbound Thru/Right			162.4	
	Northbound Left/Thru/Right			65.7	
	Southbound Left/Thru			40.3	
	Southbound Right			117.7	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Table 3: Queue for Alternative 4 - PM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1] Average	Year 2045 Queue (ft) PM Peak Hour[1] Max[2]	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		379.2	
	Eastbound Thru/Right			420.3	
	Westbound Left/Thru			195	
	Westbound Thru/Right			195	
	Northbound Left/Thru/Right			45.4	
	Southbound Left			95.8	
	Southbound Left/Thru			113.1	
	Southbound Right			114.8	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	24.7	170.9	630
	Westbound Left/Thru		51.6	278.7	500
	Southbound Left		6.8	119.3	450
	Southbound Right		29.7	412.8	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	70.0	397.1	480
	Westbound Thru/Right		29.4	**340.3**	215
	Northbound Left		8.5	123	450
	Northbound Right		6.6	175.6	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		119.4	
	Eastbound Thru/Right			125.5	
	Westbound Left/Thru			110.4	
	Westbound Thru/Right			118	
	Northbound Left/Thru/Right			45	
	Southbound Left/Thru			52.9	
	Southbound Right			183.4	

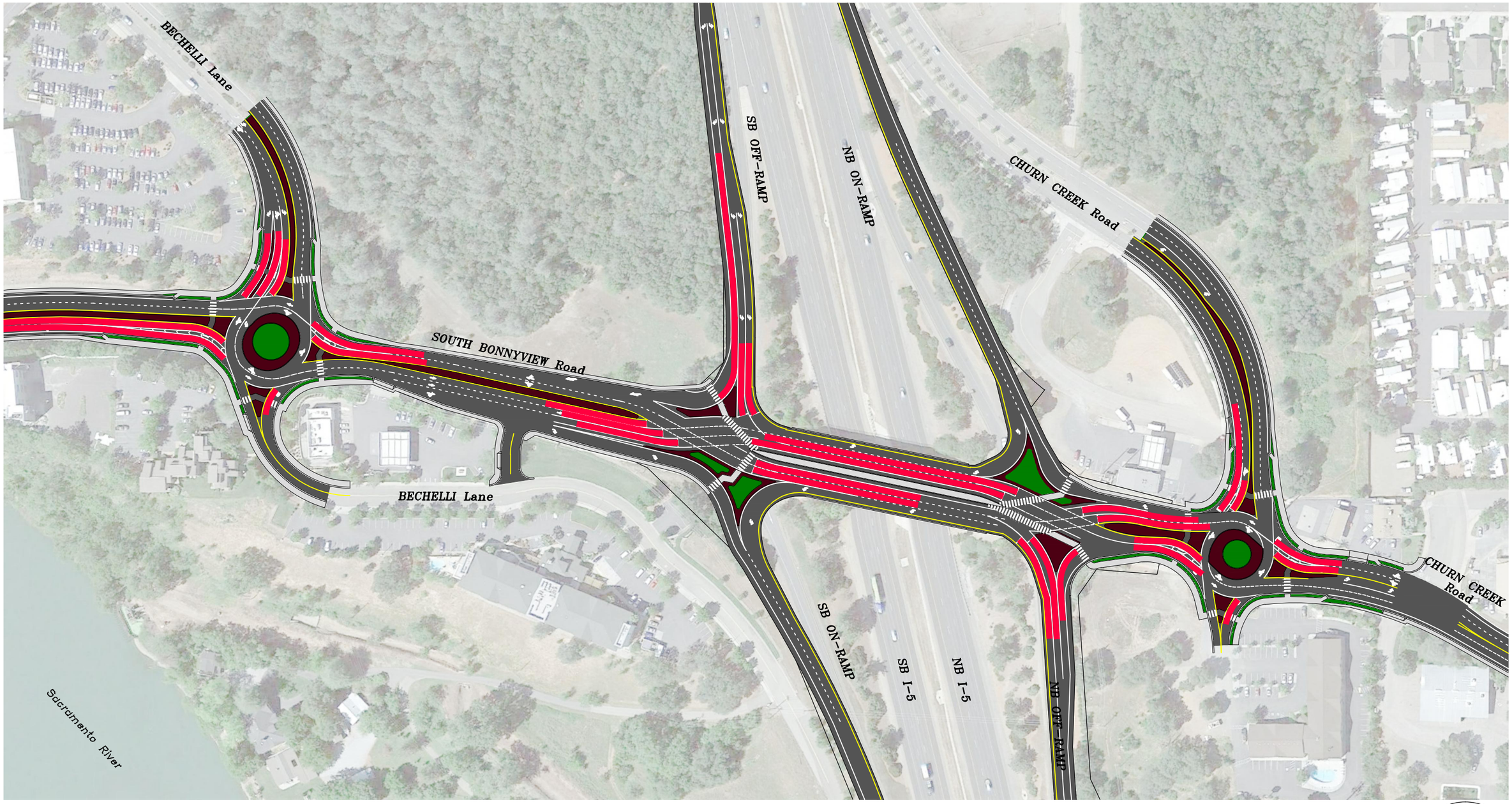
1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Attachments:

Attachment 1: Diverging Diamond Interchange/Roundabout Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 2: Diverging Diamond Interchange/Roundabout Lane Geometrics and 95th Percentile Queues for PM Peak Hour



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

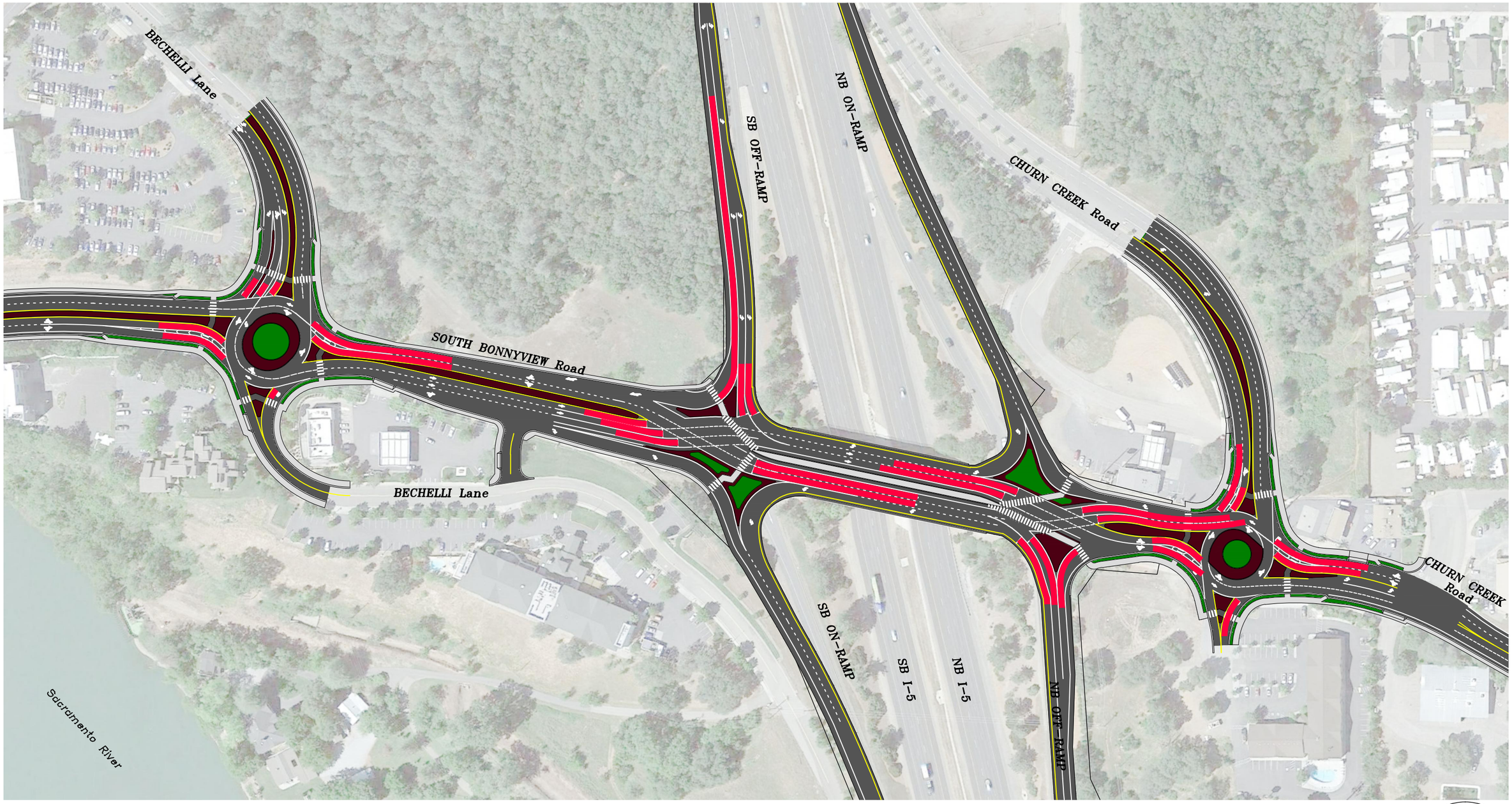
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
ALTERNATIVE 4 - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX004
DATE	11/10/16

SHEET No. EX
2 OF 2

J:\PRJ\217A\2174EX004.DWG
11/22/2016 12:00 PM



PRELIMINARY, NOT FOR CONSTRUCTION

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
ALTERNATIVE 4 - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX004
DATE	11/10/16

SHEET No. EX
1 OF 2

J:\PRJ\217A\2174EX004.DWG
11/22/2016 12:00 PM

Technical Memorandum No. 11 (Revised)

To:	City of Redding - Engineering	**Date:**	~~November 22, 2016~~ April 28, 2017
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Year 2035 T. Operations for Alt 1 (Tight Diamond), Alt 2 (DDI), Alt 3 (Roundabout Corridor), & Alt 4 (DDI/Roundabouts)	**Job No.:**	45-5721-27
		File No.:	C2174MEM011.DOCX
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Year 2035 AM and PM peak hour volumes were applied to Alternative 1 (Tight Diamond) Alternative 2 (Diverging Diamond Interchange [DDI]), Alternative 3 (Roundabout Corridor), and Alternative 4 (DDI/Roundabouts) and mitigated lane geometrics were developed.

Traffic Forecasts

Refer to Technical Memorandum No. 6.

Technical Parameters for Traffic Operations Analysis

Refer to Technical Memorandum No. 7.

Alternatives

Alternative 1 - Traditional Tight Diamond

The LOS/Delay and 95th percentile queue lengths for the AM and PM peak hours are presented in Tables 1 and 2**.**

Alternative 2 – DDI Interchange

The LOS/Delay and average and maximum queue lengths for the AM and PM peak hour are presented in Tables 3, 4 and 5**.**

Alternative 3 - Roundabout Corridor

The LOS/Delay and 95th percentile queue lengths for the AM and PM peak hours are presented in Tables 6 and 7**.**

Alternative 4 – DDI/Roundabouts Corridor

The LOS/Delay and average and maximum queue lengths for the AM and PM peak hour are presented in Tables 8, 9 and 10.

Mitigated LOS and Delays

Alternative 1 - Traditional Tight Diamond

Year 2035 mitigated LOS and delays for Alternative 1 (Tight Diamond) are presented in Table 1.

Table 1: Year 2035 LOS and Delays for Alternative 1

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.5	C	26.7	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	22.3	C	25.3	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	25.0	C	25.0	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	29.1	C	28.4	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	13.2	B	20.7	C

Notes:

1 TWSC = Two Way Stop Control

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

Year 2035 mitigated 95th percentile queues for Alternative 1 (Tight Diamond) are presented in Table 2. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 2: 95th Percentile Queue for Alternative 1

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft)[1]		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	277	211	400
	Eastbound Thru		224	227	
	Eastbound Thru/Right		200	243	350
	Westbound Left		109	78	150
	Westbound Thru		325	348	
	Westbound Right		132	133	550
	Northbound Left/Thru		62	81	
	Northbound Right		45	59	75
	Southbound Left		63	193	300
	Southbound Left/Thru		80	276	
	Southbound Right		87	157	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	155	226	490
	Eastbound Right		104	250	350
	Westbound Left		152	182	
	Westbound Thru		209	217	
	Southbound Left		111	140	300
	Southbound Left/Thru		107	144	
	Southbound Right		215	212	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	245	367	
	Eastbound Thru		172	209	
	Westbound Thru		259	276	
	Westbound Right		235	178	
	Northbound Left		278	255	450
	Northbound Left/Thru		320	294	
	Northbound Right		125	154	400

Table 2: 95th Percentile Queue for Alternative 1 (Continued)

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft)[1] AM Peak Hour	Year 2035 - 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**187**	**212**	175
	Eastbound Thru		123	218	
	Eastbound Right		82	92	145
	Westbound Left		88	57	
	Westbound Thru		225	212	
	Westbound Right		106	114	200
	Northbound Left		107	131	
	Northbound Thru/Right		108	68	
	Southbound Left		97	148	225
	Southbound Thru		45	31	
	Southbound Right		115	182	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	49	71	110
	Westbound Left/Thru		17	48	
	Westbound Thru/Right		12	18	
	Northbound Left/Thru/Right		-	42	
	Southbound Left/Thru		28	39	
	Southbound Right		71	60	

1. Worst lane movement (of the approach) value stated.

Alternative 2 – DDI Interchange

Year 2035 mitigated LOS and delays for Alternative 2 (DDI) are presented in Table 3.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 3: Year 2035 LOS and Delays for Alternative 2

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	32.2	C	22.9	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	11.7	B	12.2	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	10.2	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	21.0	C	18.6	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2035 mitigated average and maximum queues for Alternative 2 (DDI) are presented in Tables 4 and 5. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. Queues were determining using VISSIM which employs micro simulation using car following and lane change methodology developed by Wiedermann and Sparmann respectively.

Table 4: Queues for Alternative 2 - AM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	52.9	244.4	400
	Eastbound Thru/Right		10.3	150.9	
	Westbound Left/Thru/Right		54.5	393.2	550
	Northbound Left/Thru		6.6	86.1	100
	Northbound Right		4.7	85	100
	Southbound Left/Thru/Right		39.0	197.2	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru/Right	Signal	19.1	208	630
	Westbound Left/Thru		42.2	324.5	500
	Southbound Left		4.7	105.4	450
	Southbound Right		222.0	420.8	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Signal	20.6	353.6	480
	Westbound Thru/Right		45.2	**303**	215
	Northbound Left		7.7	126.2	450
	Northbound Right		176.0	241.9	450
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left	Signal	22.7	**238.4**	150
	Eastbound Thru		8.2	145.4	210
	Westbound Left		26.8	127	
	Westbound Thru		21.0	238.9	
	Northbound Left		7.9	147.8	
	Northbound Thru/Right		50.5	237.7	
	Southbound Left/Thru		16.4	105.5	225
	Southbound Right		15.0	238.7	350

1. Worst lane movement (of the approach) value stated.

Table 5: 95th Percentile Queue for Alternative 2 - PM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) PM Peak Hour[1] Average	Year 2035 Queue (ft) PM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	38.6	285.9	400
	Eastbound Thru/Right		27.8	256.6	
	Westbound Left/Thru/Right		62.1	421.5	550
	Northbound Left/Thru		7.5	86.1	100
	Northbound Right		6.6	85.1	100
	Southbound Left/Thru/Right		115.2	**465.3**	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru/Right	Signal	69.5	515.5	630
	Westbound Left/Thru		35.7	282.4	500
	Southbound Left		7.5	126.8	450
	Southbound Right		211.0	321.1	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Signal	34.7	367.8	480
	Westbound Thru/Right		40.6	**301.3**	200
	Northbound Left		5.5	106.1	450
	Northbound Right		176.0	224.1	450
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left	Signal	29.4	**305.5**	150
	Eastbound Thru		13.2	**253.4**	210
	Westbound Left		20.5	127.5	
	Westbound Thru		7.5	212.7	
	Northbound Left		7.6	128.1	
	Northbound Thru/Right		43.4	104.3	
	Southbound Left/Thru		21.5	151.9	225
	Southbound Right		17.9	280.9	350

1. Worst lane movement (of the approach) value stated.

Alternative 3 - Roundabout Corridor

Year 2035 mitigated LOS and delays for Alternative 3 (Roundabout Corridor) is presented in Table 6.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 6: Year 2035 LOS and Delays for Alternative 3

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	12.2	B	26.3	C
2	S. Bonnyview Rd/I-5 SB Ramps	RNDBT	D	10.6	B	16.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	RNDBT	D	8.1	A	8.8	A
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	10.3	B	11.4	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2035 mitigated 95th percentile queues for Alternative 3 (Roundabout Corridor) are presented in Table 7. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the SIDRA version 7 using Highway Capacity Manual methodology.

Table 7: 95th Percentile Queue for Alternative 3

Int. #	Intersection/Approach	Control Type	Year 2035 95th Percentile Queue (ft)[1] AM Peak Hour	Year 2035 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout	129.5	465	
	Eastbound Thru/Right		128.5	500.2	
	Westbound Left/Thru		221.8	185.6	
	Westbound Thru/Right		226	183.2	
	Northbound Left/Thru/Right		16.8	36.2	
	Southbound Left		20.8	88.7	
	Southbound Left/Thru		20.8	101.2	
	Southbound Right		33.7	104.2	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Roundabout	109.9	357.4	
	Eastbound Right		63.8	309.1	500
	Westbound Left/Thru		0	0	
	Westbound Thru		0	0	
	Southbound Left/Thru		49.7	71.6	
	Southbound Right		181.1	170.8	400
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout	0	0	
	Eastbound Thru		0	0	
	Westbound Thru		76.3	111.8	
	Westbound Right		115.4	83.9	200
	Northbound Left		32.8	29.8	
	Northbound Left/Thru		32.8	29.8	
	Northbound Right		31.1	33.5	200
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout	77.1	113.1	
	Eastbound Thru/Right		79.7	118	
	Westbound Left/Thru		114.9	95	
	Westbound Thru/Right		122.5	99.9	
	Northbound Left/Thru/Right		61	46.1	
	Southbound Left/Thru		32.7	47.1	
	Southbound Right		111.1	156.7	

1. Worst lane movement (of the approach) value stated.

Alternative 4 – DDI/Roundabouts Corridor

Year 2035 mitigated LOS and delays for Alternative 4 (DDI/Roundabouts) is presented in Table 8.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 8: Year 2035 LOS and Delays for Alternative 4

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	12.2	B	26.3	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	11.7	B	12.2	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	10.2	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	10.3	B	11.4	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2035 mitigated average and maximum queues for Alternative 4 (DDI/Roundabouts) is presented in Table 9 and 10. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues have been developed from SIDRA version 7 for the roundabouts and VISSIM 8 for the signalized intersection. SIDRA uses Highway Capacity Manual methodology while VISSIM employs micro simulation using car following and lane change methodology developed by Wiedermann and Sparmann respectively.

Table 9: Queue for Alternative 4 - AM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		129.5	
	Eastbound Thru/Right			128.5	
	Westbound Left/Thru			221.8	
	Westbound Thru/Right			226	
	Northbound Left/Thru/Right			16.8	
	Southbound Left			20.8	
	Southbound Left/Thru			20.8	
	Southbound Right			33.7	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	14.5	127.1	630
	Westbound Left/Thru		50.1	283.3	500
	Southbound Left		3.9	83.8	450
	Southbound Right		31.2	396.5	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	31.6	200	480
	Westbound Thru/Right		24.7	**280.9**	215
	Northbound Left		10.7	140.4	450
	Northbound Right		2.4	151.3	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		77.1	
	Eastbound Thru/Right			79.7	
	Westbound Left/Thru			114.9	
	Westbound Thru/Right			122.5	
	Northbound Left/Thru/Right			61	
	Southbound Left/Thru			32.7	
	Southbound Right			111.1	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Table 10: Queue for Alternative 4 - PM Peak Hour

Int. #	Intersection/Approach	Control Type	Year 2035 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		465	
	Eastbound Thru/Right			500.2	
	Westbound Left/Thru			185.6	
	Westbound Thru/Right			183.2	
	Northbound Left/Thru/Right			36.2	
	Southbound Left			88.7	
	Southbound Left/Thru			101.2	
	Southbound Right			104.2	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	21.6	154.3	630
	Westbound Left/Thru		46.6	277.8	500
	Southbound Left		6.4	103.4	450
	Southbound Right		25.3	313.3	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	59.7	315.4	480
	Westbound Thru/Right		25.6	**340.6**	215
	Northbound Left		7.5	141.2	450
	Northbound Right		5.9	193.1	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		113.1	
	Eastbound Thru/Right			118	
	Westbound Left/Thru			95	
	Westbound Thru/Right			99.9	
	Northbound Left/Thru/Right			46.1	
	Southbound Left/Thru			47.1	
	Southbound Right			156.7	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Attachments:

Attachment 1: Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 2: Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 3: Diverging Diamond Interchange Lane Geometrics and 95th Percentile Queues for AM Peak Hour

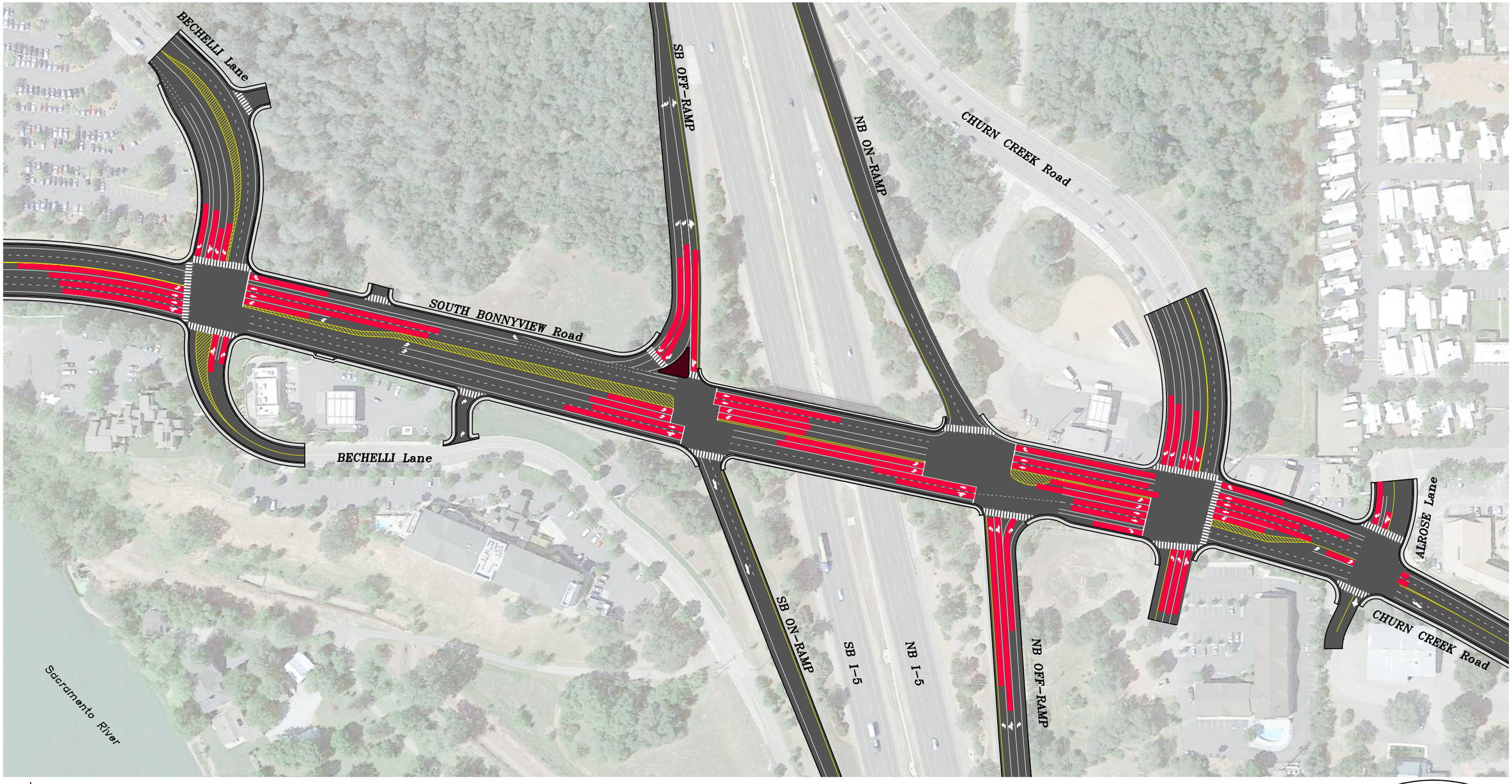
Attachment 4: Diverging Diamond Interchange Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 5: Roundabout Corridor Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 6: Roundabout Corridor Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 7: Diverging Diamond Interchange/Roundabout Corridor Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 8: Diverging Diamond Interchange/Roundabout Corridor Lane Geometrics and 95th Percentile Queues for PM Peak Hour



PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 1

REVISIONS

NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

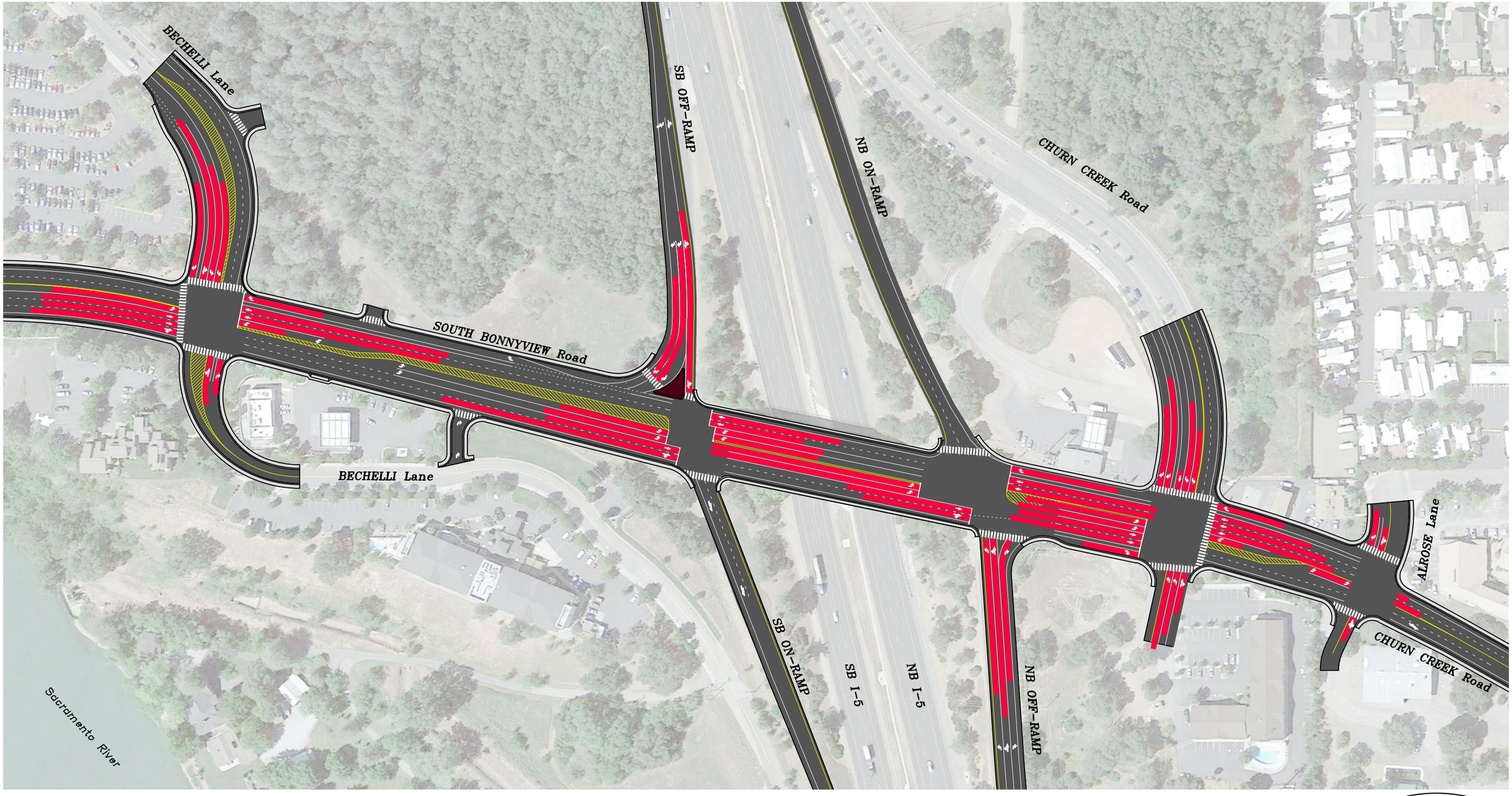
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 AM QUEUE LENGTHS
ALTERNATIVE 1 - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	RAW
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX007
DATE	04/25/17

SHEET No. EX
1 OF 2

J:\PRJ\2174\2174EX007.DWG
4/28/2017 3:13 PM



PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 2

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

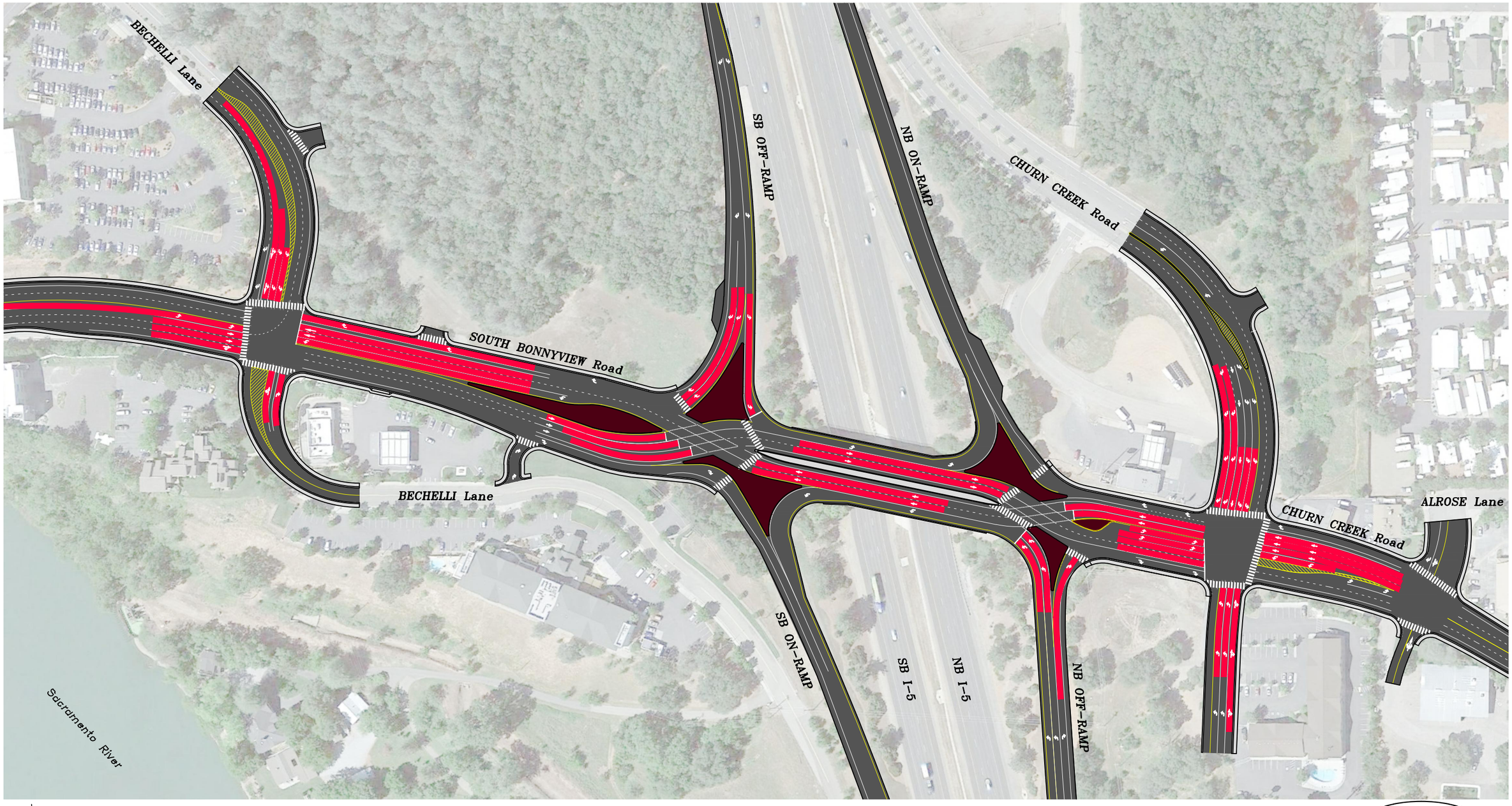
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 PM QUEUE LENGTHS
ALTERNATIVE 1 - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	RAW
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX007
DATE	4/25/17

SHEET No. EX 2 OF 2

4/28/2017 3:14 PM J:\PRJ\2174\2174EX007.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 3

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

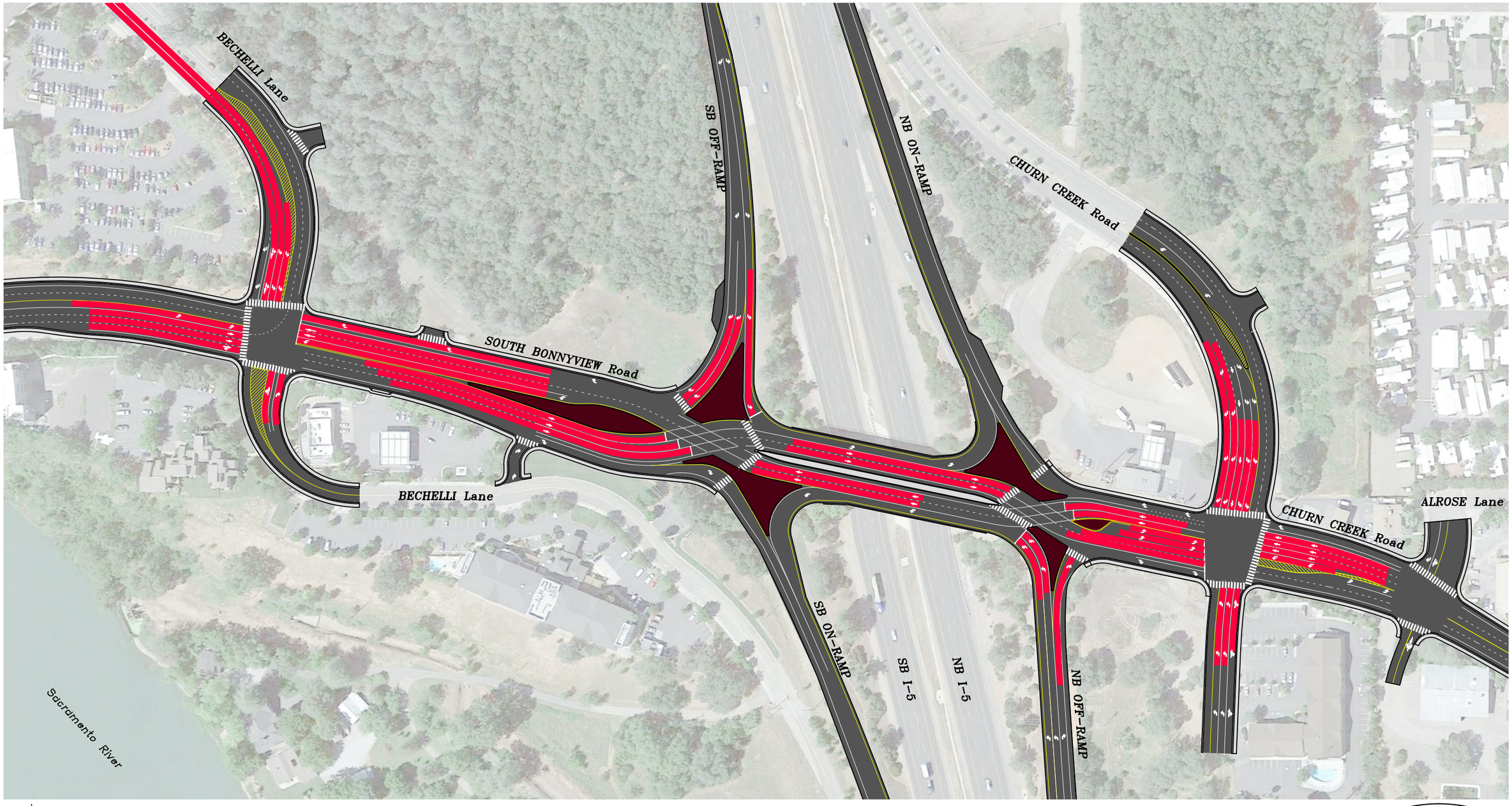
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 AM QUEUE LENGTHS
ALTERNATIVE 2 - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX008
DATE	04/25/17

SHEET No. EX
1 OF 1

J:\PRJ\2174\2174EX008.DWG 4/28/2017 3:16 PM



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 4

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

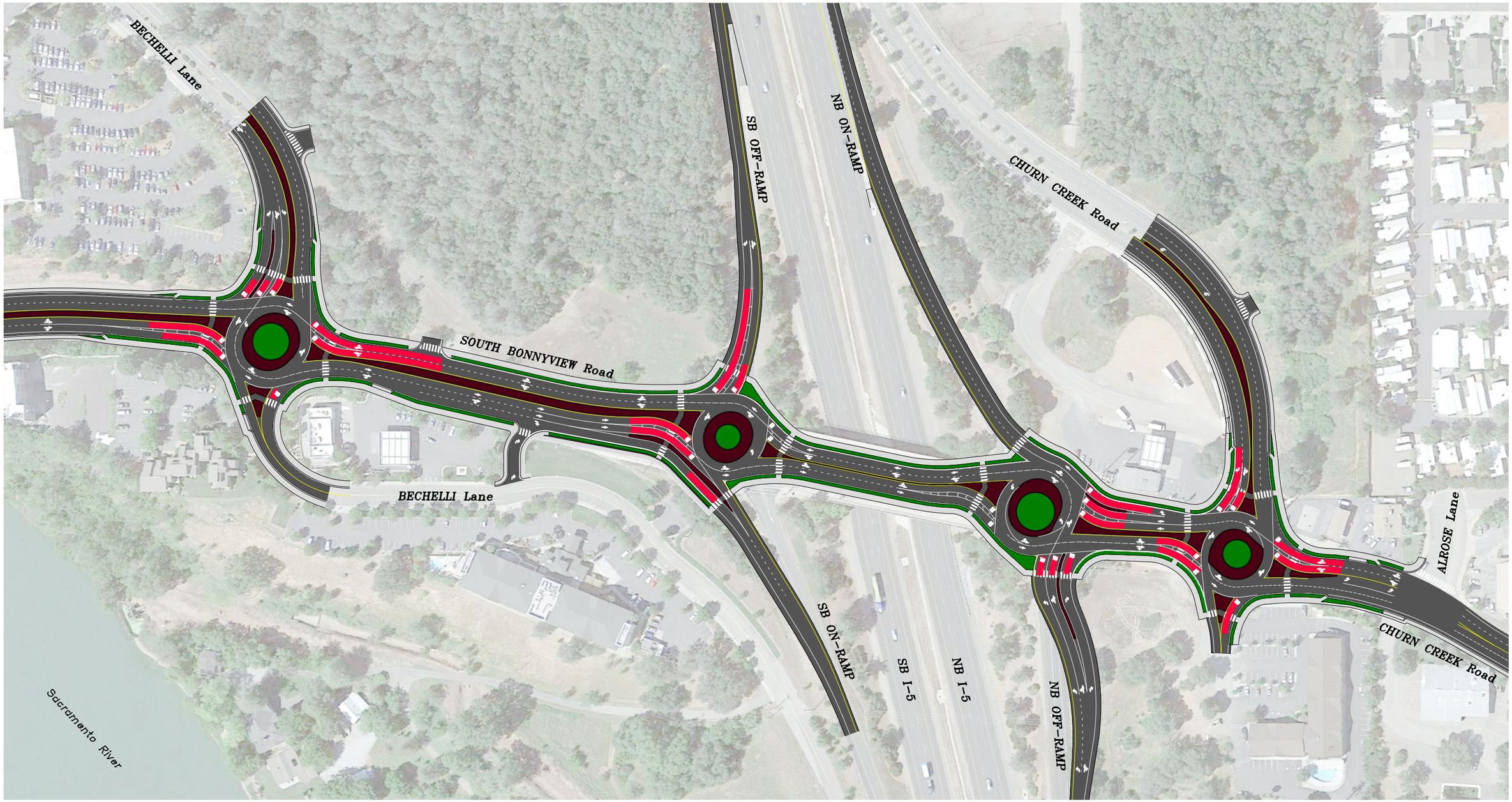
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 PM QUEUE LENGTHS
ALTERNATIVE 2 - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX008
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:16 PM J:\PRJ\2174\2174EX008.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 5

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

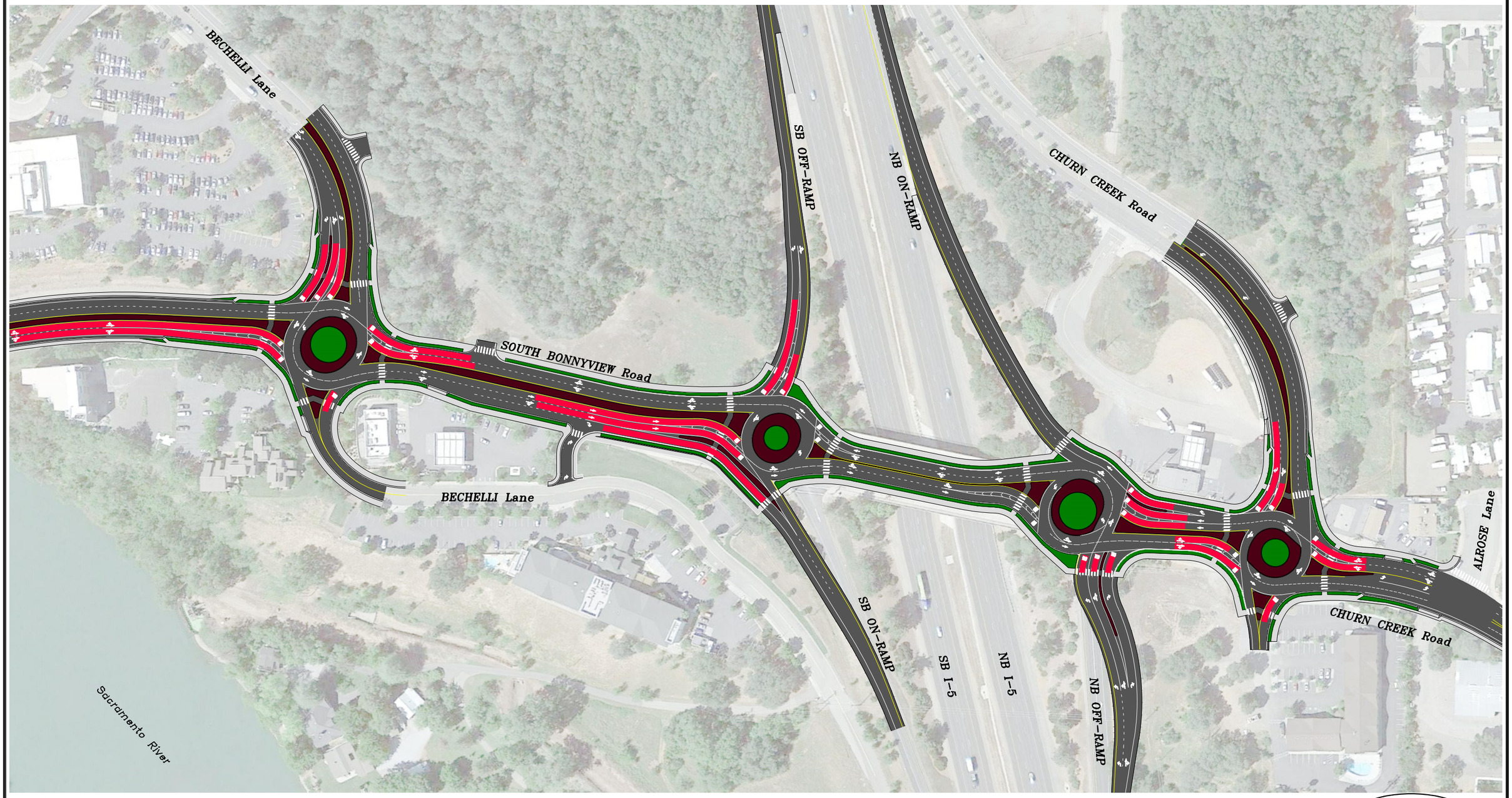
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 AM QUEUE LENGTHS
ALTERNATIVE 3 - ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX009
DATE	04/26/17

SHEET No. EX
1 OF 2

J:\PRJ\2174\2174EX009.DWG
4/28/2017 3:17 PM



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 6

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

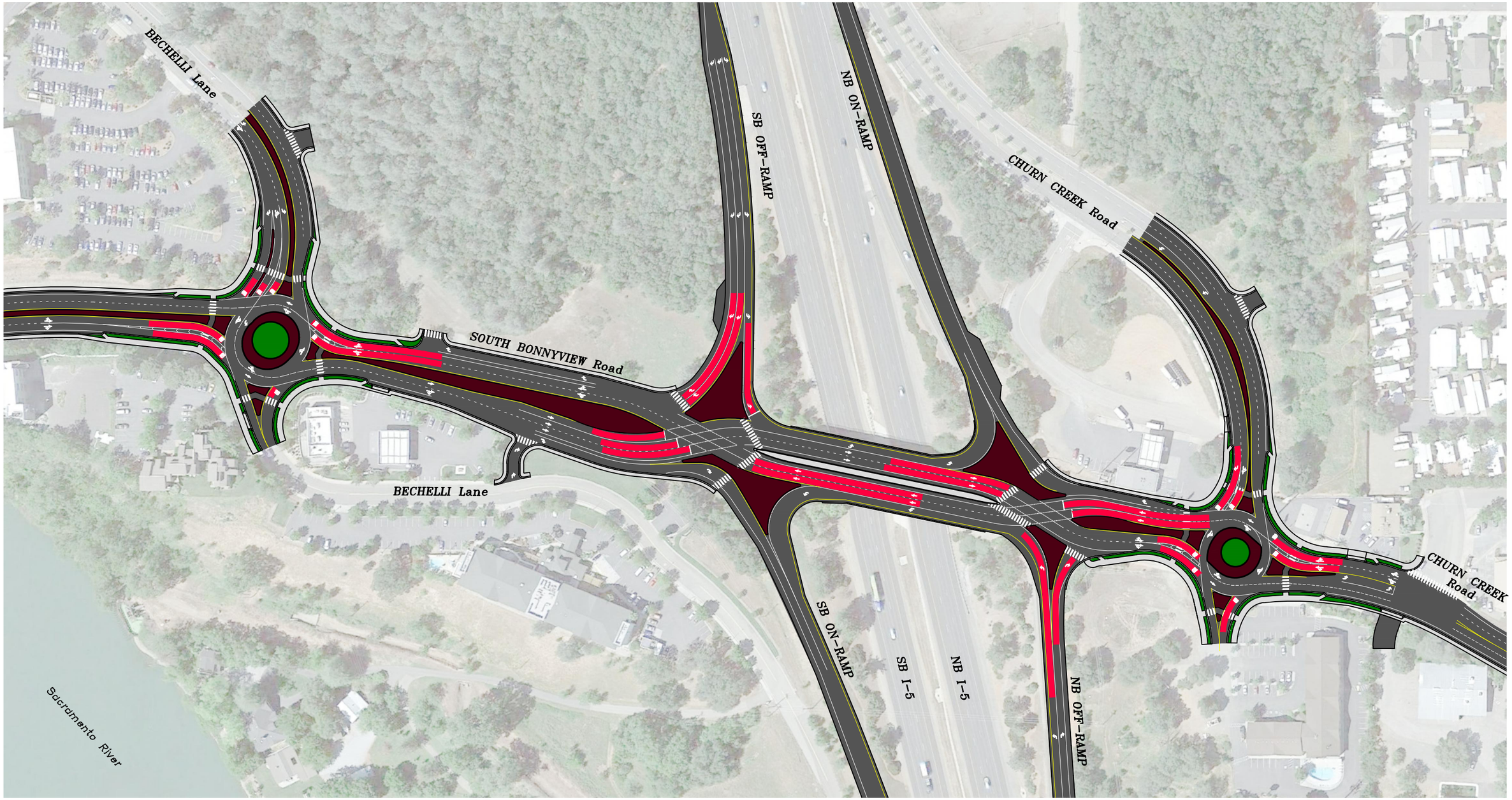
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 PM QUEUE LENGTHS
ALTERNATIVE 3 - ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX009
DATE	04/26/17

SHEET No. EX 2 OF 2

4/28/2017 3:18 PM J:\PRJ\2174\2174EX009.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 7

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

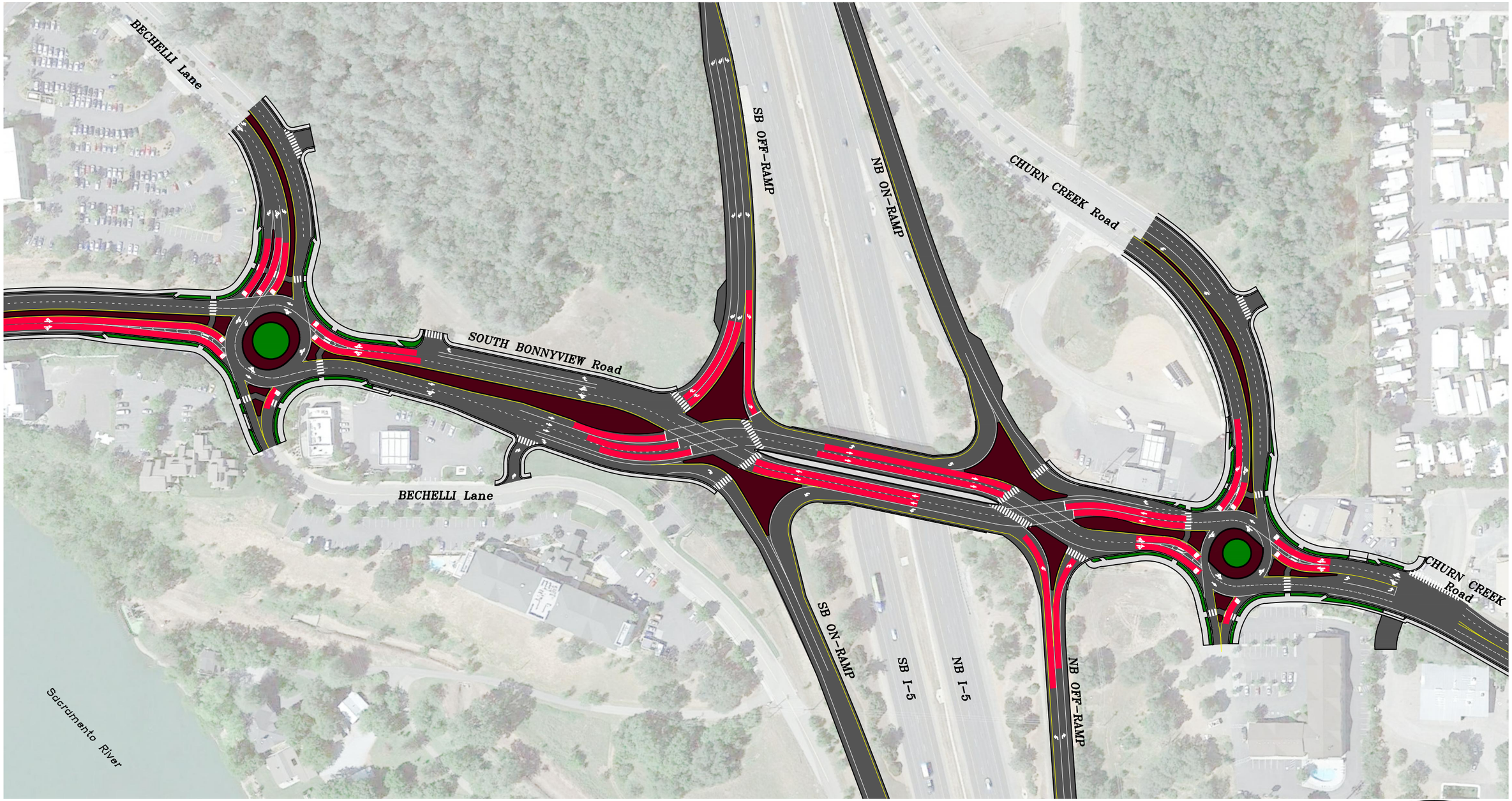
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 AM QUEUE LENGTHS
ALTERNATIVE 4 - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX010
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:28 PM J:\PRJ\2174\2174EX010.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 8

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2035 PM QUEUE LENGTHS
ALTERNATIVE 4 - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX010
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:27 PM J:\PRJ\2174\2174EX010.DWG

Technical Memorandum No. 12

To:	City of Redding - Engineering	**Date:**	November 22, 2016
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	Travel Time Run Summaries for the various Alternatives	**Job No.:**	45-5721-27
		File No.:	C2174MEM012.DOCX
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

This memorandum presents the expected travel times in the EB and WB directions on South Bonnyview Road for the four alternatives. The travel time information is presented for Year 2035 and Year 2045 AM and PM peak hours.

Traffic Forecasts

Refer to Technical Memorandum No. 6.

Technical Parameters for Travel Time Analysis

Alternative 1 – Traditional Tight Diamond

The Synchro/Sim-Traffic model that was utilized to analyze the operations in terms of delay, LOS and queues for this alternative has the ability to output directional travel times. The travel times reported in subsequent tables were obtained from the Synchro/Simtraffic version 9.1 model.

Alternative 2 – DDI Interchange

The VISSIM model that was utilized to analyze the operations in terms of delay, LOS and queues for this alternative has the ability to output directional travel times. The travel times reported in subsequent tables were obtained from the VISSIM 8 model.

Alternative 3 –Roundabouts Corridor

Travel time is comprised of two principal components - the running time and the delay experienced by the through movements. In simplistic terms, the running time is the time that a motorist takes to reach from point A to point B.

The roundabout operations were analyzed in SIDRA that provides the delay experienced by SIDRA 7 for through movements.

For simplicity, the running time was obtained from the Synchro/Sim-Traffic 9.1 model.
The sum of the running time and through delay was utilized to estimate the travel time for Alternative 3.

Alternative 4 – DDI/Roundabouts Corridor

The VISSIM model that was utilized to analyze the operations in terms of delay, LOS and queues for this alternative has the ability to output directional travel times. The travel times reported in subsequent tables were obtained from the VISSIM 8 model.

Travel Times

Table 1 presents the expected Year 2035 AM and PM peak hours travel times (in seconds) on South Bonnyview Road in the EB and WB directions.

Table 1: Year 2035 Travel Times for Alternatives 1 through 4

	EB		WB	
Alternatives	AM Peak Hour (sec)	PM Peak Hour (sec)	AM Peak Hour (sec)	PM Peak Hour (sec)
Alternative 1	108.5	110.1	102.6	152.7
Alternative 2	85.7	94.5	131.3	137.8
Alternative 3	101.2	158.7	114	111.9
Alternative 4	87.4	100.2	102.4	102.6

Table 2 presents the expected Year 2045 AM and PM peak hours travel times (in seconds) on South Bonnyview Road in the EB and WB directions.

Table 2: Year 2045 Travel Times for Alternatives 1 through 4

	EB		WB	
Aternatives	AM Peak Hour (sec)	PM Peak Hour (sec)	AM Peak Hour (sec)	PM Peak Hour (sec)
Alternative 1	107.5	125.2	177.9	174.7
Alternative 2	88.5	99.3	136.8	136.7
Alternative 3	101.9	163.6	123.4	116.4
Alternative 4	91.9	107.6	105.1	104.7

Technical Memorandum No. 13

To:	City of Redding - Engineering	**Date:**	~~November 28, 2016~~ May 5, 2017
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	T. Operation for No Build Alternative in 2025, 2035 and 2045	**Job No.:**	45-5721-27
		File No.:	C2174MEM013.DOCX
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Year 2025, 2035, and 2045 AM and PM peak hour volumes were applied to the No Build Alternative with existing geometry to determine if conditions are acceptable.

Traffic Forecasts

Refer to Technical Memorandum No. 6.

Technical Parameters for Traffic Operations Analysis

Refer to Technical Memorandum No. 7.

Alternatives

No Build Alternative – Existing Geometry

The LOS/Delay and 95th percentile queue lengths for the AM and PM peak hours are presented in Tables 1-6**.**

LOS and Delays

Year 2025 LOS and delays for the No Build Alternative are presented in Table 1.

Table 1: Year 2025 LOS and Delays for the No Build Alternative

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	**S. Bonnyview Rd/Bechelli Lane**	**Signal**	**C**	20.5	C	**76.3**	**E**
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	30.2	C	45.2	D
3	**S. Bonnyview Rd/I-5 NB Ramps**	**Signal**	**D**	45.4	D	**64.9**	**E**
4	S. Bonnyview Rd/Churn Creek Rd	Signal	C	27.7	C	26.5	C
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	16.8	C	**64.8**	**F**

Notes:

1 TWSC = Two Way Stop Control

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2025 95th percentile for the No Build Alternative is presented in Table 2. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 2: 2025 95th Percentile Queue for the No Build Alternative

Int. #	Intersection/Approach	Control Type	Year 2025 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**259**	**333**	200
	Eastbound Thru		348	525	
	Eastbound Thru/Right		251	468	
	Westbound Left		52	42	145
	Westbound Thru		239	230	
	Westbound Right		130	128	200
	Northbound Left/Thru		60	71	
	Northbound Right		45	54	75
	Southbound Left		116	420	
	Southbound Left/Thru		82	439	
	Southbound Right		88	**273**	110
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**418**	**918**	250
	Eastbound Right		100	**364**	250
	Westbound Left		183	199	380
	Westbound Thru		119	132	
	Southbound Left/Thru		319	518	
	Southbound Right		**324**	**521**	180
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	**466**	**421**	380
	Eastbound Thru		250	408	
	Westbound Thru		251	254	
	Westbound Right		**233**	**185**	110
	Northbound Left/Thru		338	286	
	Northbound Right		137	169	285

Int. #	Intersection/Approach	Control Type	Year 2025 - 95th Percentile Queue (ft) AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**205**	**276**	130
	Eastbound Thru		231	311	
	Eastbound Right		83	91	115
	Westbound Left		**100**	**78**	75
	Westbound Thru		206	214	
	Westbound Thru/Right		254	254	
	Northbound Left/Thru		206	215	
	Northbound Right		-	170	
	Southbound Left/Thru		580	590	
	Southbound Right		-	-	
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	TWSC	94	118	
	Westbound Left/Thru		68	12	
	Westbound Thru/Right		162	76	
	Northbound Left/Thru/Right		-	43	
	Southbound Left/Thru		38	54	
	Southbound Right		116	77	

1. Worst lane movement (of the approach) value stated.

Year 2035 LOS and delays for the No Build Alternative are presented in Table 3.

Table 3: Year 2035 LOS and Delays for the No Build Alternative

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	**S. Bonnyview Rd/Bechelli Lane**	**Signal**	**C**	22.3	C	**109.4**	**F**
2	**S. Bonnyview Rd/I-5 SB Ramps**	**Signal**	**D**	44.7	D	**55.9**	**E**
3	**S. Bonnyview Rd/I-5 NB Ramps**	**Signal**	**D**	**97.0**	**F**	**86.1**	**F**
4	S. Bonnyview Rd/Churn Creek Rd	Signal	C	28.6	C	28.0	C
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	19.5	C	**101.0**	**F**

Notes:

1 TWSC = Two Way Stop Control

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2035 95th percentile for the No Build Alternative is presented in Table 4. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 4: 2035 95th Percentile Queue for the No Build Alternative

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**342**	**415**	200
	Eastbound Thru		542	702	
	Eastbound Thru/Right		485	684	
	Westbound Left		71	62	145
	Westbound Thru		**246**	239	
	Westbound Right		145	133	200
	Northbound Left/Thru		78	99	
	Northbound Right		59	72	75
	Southbound Left		**181**	407	
	Southbound Left/Thru		124	437	
	Southbound Right		80	**281**	110
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**856**	**948**	250
	Eastbound Right		250	**413**	250
	Westbound Left		183	231	380
	Westbound Thru		143	126	
	Southbound Left/Thru		605	502	
	Southbound Right		**476**	**549**	180
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	**456**	**416**	380
	Eastbound Thru		357	393	
	Westbound Thru		265	278	
	Westbound Right		**139**	**229**	110
	Northbound Left/Thru		401	336	
	Northbound Right		167	247	285

Int. #	Intersection/Approach	Control Type	Year 2035 - 95th Percentile Queue (ft) AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**232**	**254**	130
	Eastbound Thru		249	300	
	Eastbound Right		101	70	115
	Westbound Left		**100**	**83**	75
	Westbound Thru		219	214	
	Westbound Thru/Right		251	246	
	Northbound Left/Thru		230	194	
	Northbound Right		-	-	
	Southbound Left/Thru		587	587	
	Southbound Right		-	-	
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	TWSC	106	120	
	Westbound Left/Thru		93	71	
	Westbound Thru/Right		193	154	
	Northbound Left/Thru/Right		-	48	
	Southbound Left/Thru		67	87	
	Southbound Right		139	136	

1. Worst lane movement (of the approach) value stated.

Year 2045 LOS and delays for the No Build Alternative are presented in Table 5.

Table 5: Year 2045 LOS and Delays for the No Build Alternative

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour Delay	AM Peak Hour LOS	PM Peak Hour Delay	PM Peak Hour LOS
1	**S. Bonnyview Rd/Bechelli Lane**	**Signal**	**C**	24.5	C	**146.6**	**F**
2	**S. Bonnyview Rd/I-5 SB Ramps**	**Signal**	**D**	**64.4**	**E**	**65.5**	**E**
3	**S. Bonnyview Rd/I-5 NB Ramps**	**Signal**	**D**	**60.7**	**E**	**108.2**	**F**
4	**S. Bonnyview Rd/Churn Creek Rd**	**Signal**	**C**	31.5	C	**35.2**	**D**
5	**Churn Creek Rd/Alrose Lane**	**TWSC**	**C**	23.3	C	**176.3**	**F**

Notes:

1 TWSC = Two Way Stop Control

2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for Signal

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 95th percentile for the No Build Alternative is presented in Table 6. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 6: 2045 95th Percentile Queue for the No Build Alternative

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)		Available Storage
			AM Peak Hour	PM Peak Hour	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	**377**	**398**	200
	Eastbound Thru		644	709	
	Eastbound Thru/Right		598	708	
	Westbound Left		87	71	145
	Westbound Thru		255	243	
	Westbound Right		149	152	200
	Northbound Left/Thru		72	106	
	Northbound Right		52	**91**	75
	Southbound Left		179	388	
	Southbound Left/Thru		152	403	
	Southbound Right		100	**286**	110
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	**923**	**947**	250
	Eastbound Right		**276**	**491**	250
	Westbound Left		202	208	380
	Westbound Thru		134	130	
	Southbound Left/Thru		610	496	
	Southbound Right		**523**	**553**	180
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	**451**	**429**	380
	Eastbound Thru		381	393	
	Westbound Thru		255	276	
	Westbound Right		**232**	**243**	110
	Northbound Left/Thru		513	309	
	Northbound Right		**340**	220	285

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft) AM Peak Hour	Year 2045 - 95th Percentile Queue (ft) PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	**244**	**260**	130
	Eastbound Thru		276	306	
	Eastbound Right		98	82	115
	Westbound Left		**107**	**82**	75
	Westbound Thru		225	228	
	Westbound Thru/Right		239	257	
	Northbound Left/Thru		234	218	
	Northbound Right		-	-	
	Southbound Left/Thru		585	579	
	Southbound Right		-	-	
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left/Thru/Right	TWSC	116	122	
	Westbound Left/Thru		141	102	
	Westbound Thru/Right		299	220	
	Northbound Left/Thru/Right		-	64	
	Southbound Left/Thru		140	117	
	Southbound Right		211	151	

1. Worst lane movement (of the approach) value stated.

Technical Memorandum No. 14

To:	City of Redding - Engineering	**Date:**	~~April 28, 2017~~ May 5, 2017
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	T. Operations for Alternative 1 **(Rev)** (Tight Diamond), Alternative 2 **(Rev)** (Diverging Diamond Interchange with Signals), and Alternative 4 **(Rev)** (Diverging Diamond with Roundabouts)	**Job No.:**	45-5721-27
		File No.:	C2174MEM014.DOCX
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

Upon reviewing the geometrics presented in Technical Memorandum Nos. 8, 9 and 10, the City/Caltrans focused PDT provided the following direction:

- Drop Alternate 3 (All Roundabouts) from further consideration due to the greater right of way impacts as compared to other alternatives.
- Alternatives 1, 2 and 4: Add the Churn Creek Marketplace Shopping Center and the proposed River Crossing Marketplace (Costco Site) driveways to the exhibits.
- Alternative 1:
  - Consider eliminating the EB right turn lane at the I-5 SB ramps intersection.
  - Consider reducing the I-5 SB off-ramp termini to 3 lanes.
  - Consider reducing the I-5 NB off-ramp termini to 3 lanes.
- Alternative 2:
  - No changes (with the exception of adding driveways to the exhibits).
- Alternative 4:
  - Consider reducing the NB departure from the Bechelli/S. Bonnyview roundabout intersection to 1 lane.
  - Consider reducing the NB departure from the S. Bonnyview/Churn Creek roundabout intersection to 1 lane.
  - Consider reducing the I-5 NB off-ramp termini to 2 lanes.

Year 2045 AM/PM peak hour volumes were applied to Alternative 1 (Tight Diamond) Alternative 2 (Diverging Diamond Interchange with Signals), and Alternative 4 (Diverging Diamond with Roundabouts) and updated LOS, delays, queues and exhibits are presented below.

All items identified above for consideration are incorporated into this Technical Memorandum No. 14.

Traffic Forecasts

No change. Refer to Technical Memorandum No. 6.

Technical Parameters for Traffic Operations Analysis

No change. Refer to Technical Memorandum No. 7.

LOS and Delays

Alternative 1 (Rev) - Traditional Tight Diamond

Year 2045 mitigated LOS and delays for Alternative 1 (Rev) (Tight Diamond) is presented in Table 1.

Table 1: Year 2045 LOS and Delays for Alternative 1 (Rev)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.2	C	29.7	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	22.6	C	26.2	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	25.7	C	27.4	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	28.6	C	27.1	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	13.8	B	23.5	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 1 (Rev) (Tight Diamond) is presented in Table 2. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 2: 95th Percentile Queue for Alternative 1 (Rev)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	475	306	400
	Eastbound Thru		406	266	
	Eastbound Thru/Right		229	223	350
	Westbound Left		128	138	150
	Westbound Thru		378	339	
	Westbound Right		154	129	550
	Northbound Left/Thru		70	87	
	Northbound Right		48	65	75
	Southbound Left		72	301	300
	Southbound Left/Thru		95	381	
	Southbound Right		96	263	
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru	Signal	205	662	490
	Eastbound Thru/Right		227	674	
	Westbound Left		143	201	300
	Westbound Thru		248	239	
	Southbound Left/Thru		231	255	
	Southbound Right		235	225	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left	Signal	335	481	
	Eastbound Thru		207	271	
	Westbound Thru		272	295	
	Westbound Right		255	235	
	Northbound Left		526	438	500
	Northbound Left/Thru		585	492	
	Northbound Right		416	308	500

Table 2: 95th Percentile Queue for Alternative 1 (Rev) (Continued)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	Year 2045 - 95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	217	235	175
	Eastbound Thru		136	246	
	Eastbound Right		72	132	145
	Westbound Left		86	58	
	Westbound Thru		254	228	
	Westbound Right		164	128	200
	Northbound Left		137	112	
	Northbound Thru/Right		109	65	
	Southbound Left		125	171	225
	Southbound Thru		45	283	
	Southbound Right		105	229	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	46	80	100
	Westbound Left/Thru		16	70	
	Westbound Thru/Right		22	35	
	Northbound Left/Thru/Right		-	54	
	Southbound Left/Thru		24	46	
	Southbound Right		71	77	

1. Worst lane movement (of the approach) value stated.

Alternative 2 (Rev) - Diverging Diamond Interchange with Signals

Year 2045 mitigated LOS and delays for Alternative 2 (Rev) (Diverging Diamond Interchange with Signals) is presented in Table 3.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 3: Year 2045 LOS and Delays for Alternative 2 (Rev)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	15.8	B	23.9	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B	12.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.0	B	10.5	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	21.0	C	19.0	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 2 (Rev) (Diverging Diamond Interchange with Signals) are presented in Tables 4 and 5. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the VISSIM version 8 using microsimulation.

Table 4: 95th Percentile AM Queue for Alternative 2 (Rev)

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1] Average	Year 2045 Queue (ft) AM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		--	--	--
	Eastbound Left	Signal	40.3	291.5	400
	Eastbound Thru/Right		17.7	217.2	
	Westbound Left/Thru/Right		62.4	412.8	550
	Northbound Left/Thru		6.4	86.1	100
	Northbound Right		4.6	85	100
	Southbound Left/Thru/Right		37.9	210.5	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		--	--	--
	Eastbound Thru/Right	Signal	34.5	311.5	630
	Westbound Left/Thru		47.6	331	500
	Southbound Left		5.2	121.5	450
	Southbound Right		212.0	278	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		--	--	--
	Eastbound Left/Thru	Signal	25.1	293.9	480
	Westbound Thru/Right		50.1	318.9	450
	Northbound Left		9.2	141.7	450
	Northbound Right		176.0	224.1	400
4	***S. Bonnyview Rd/Churn Creek Rd***		--	--	--
	Eastbound Left	Signal	30.4	339.9	150
	Eastbound Thru		10.7	228.5	210
	Westbound Left		33.0	126.6	
	Westbound Thru		14.5	286.5	
	Northbound Left		7.4	165.9	
	Northbound Thru/Right		56.4	133.2	
	Southbound Left/Thru		18.9	109.8	225
	Southbound Right		17.0	251.2	350

1. Worst lane movement (of the approach) value stated.

Table 5: 95th Percentile PM Queue for Alternative 2 (Rev)

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	45.5	376.9	400
	Eastbound Thru/Right		30.4	255.6	
	Westbound Left/Thru/Right		71.0	444.3	550
	Northbound Left/Thru		7.9	86.1	100
	Northbound Right		8.2	85.1	100
	Southbound Left/Thru/Right		161.8	480.9	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	86.3	587.1	630
	Westbound Left/Thru		39.9	343.5	500
	Southbound Left		8.0	260	450
	Southbound Right		213.0	233	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	40.5	493.9	480
	Westbound Thru/Right		47.9	307.3	450
	Northbound Left		6.5	118.5	450
	Northbound Right		18.3	156	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	32.8	298	150
	Eastbound Thru		16.6	285	210
	Westbound Left		22.9	126.3	
	Westbound Thru		5.7	248.8	
	Northbound Left		7.9	128.2	
	Northbound Thru/Right		50.6	99.7	
	Southbound Left/Thru		22.7	148.7	225
	Southbound Right		22.2	289.5	350

1. Worst lane movement (of the approach) value stated.

Alternative 4 (Rev) - Diverging Diamond Interchange with Roundabouts

Year 2045 mitigated LOS and delays for Alternative 4 (Rev) (Diverging Diamond Interchange with Roundabouts) is presented in Table 6.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 6: Year 2045 LOS and Delays for Alternative 4 (Rev)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	11.8	B	23.6	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	11.8	B	11.9	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	12.0	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	11.3	B	12.2	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 4 (Rev) (Diverging Diamond Interchange with Roundabouts) are presented in Tables 7 and 8. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from a combination of Sidra version 7 using Highway Capacity Manual Methodology and VISSIM version 8 using microsimulation.

Table 7: 95th Percentile AM Queue for Alternative 4 (Rev)

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		113.9	
	Eastbound Thru/Right			112.8	
	Westbound Left/Thru			237.5	
	Westbound Thru/Right			242	
	Northbound Left/Thru/Right			16	
	Southbound Left			22.2	
	Southbound Left/Thru			22.2	
	Southbound Right			35.7	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	17.8	155	630
	Westbound Left/Thru		53.8	261.6	500
	Southbound Left		4.3	164	450
	Southbound Right		61.4	269	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	48.3	213.9	480
	Westbound Thru/Right		27.9	340.4	215
	Northbound Left		62.2	402.5	450
	Northbound Right		10.1	168.8	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		89.2	250
	Eastbound Thru/Right			93.1	250
	Westbound Left/Thru			147.3	
	Westbound Thru/Right			162.4	
	Northbound Left/Thru/Right			65.7	150
	Southbound Left/Thru			40.3	
	Southbound Right			117.7	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Table 8: 95th Percentile PM Queue for Alternative 4 (Rev)

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		379.2	
	Eastbound Thru/Right			420.3	
	Westbound Left/Thru			195	
	Westbound Thru/Right			195	
	Northbound Left/Thru/Right			45.4	
	Southbound Left			95.8	
	Southbound Left/Thru			113.1	
	Southbound Right			114.8	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	25.1	171	630
	Westbound Left/Thru		49.3	252	500
	Southbound Left		6.7	216	450
	Southbound Right		30.6	226	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	69.8	358.2	480
	Westbound Thru/Right		29.4	300	215
	Northbound Left		21.3	285.6	450
	Northbound Right		6.6	188.5	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		119.4	250
	Eastbound Thru/Right			125.5	250
	Westbound Left/Thru			110.4	
	Westbound Thru/Right			118	
	Northbound Left/Thru/Right			45	150
	Southbound Left/Thru			52.9	
	Southbound Right			183.4	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Attachments:

Attachment 1: Alternative 1 (Rev) - Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for AM Peak Hour

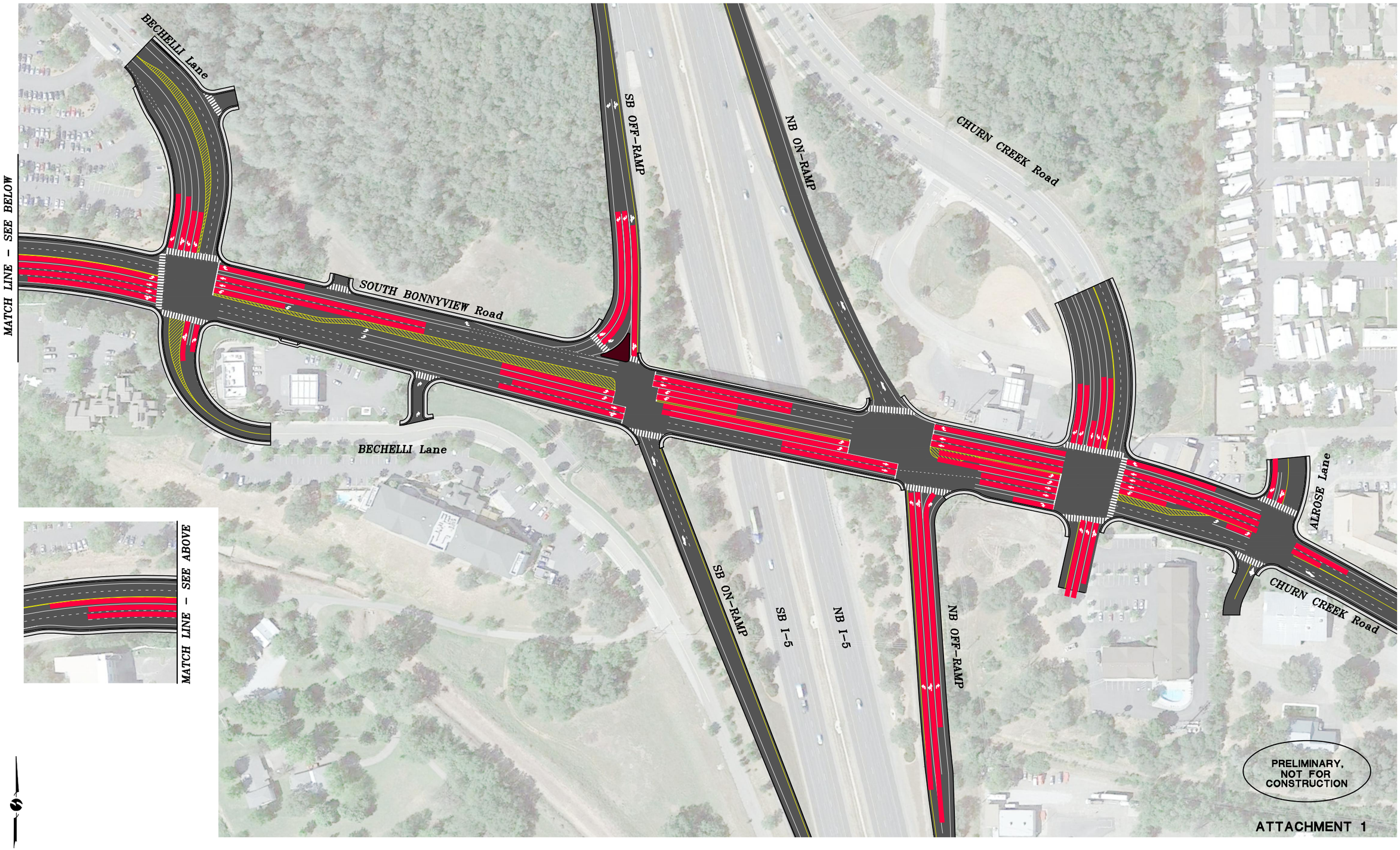
Attachment 2: Alternative 1 (Rev) - Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 3: Alternative 2 (Rev) - Diverging Diamond Interchange with Signals Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 4: Alternative 2 (Rev) - Diverging Diamond Interchange with Signals Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 5: Alternative 4 (Rev) - Diverging Diamond Interchange with Roundabouts Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 6: Alternative 4 (Rev) - Diverging Diamond Interchange with Roundabouts Lane Geometrics and 95th Percentile Queues for PM Peak Hour



ATTACHMENT 1

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave, Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

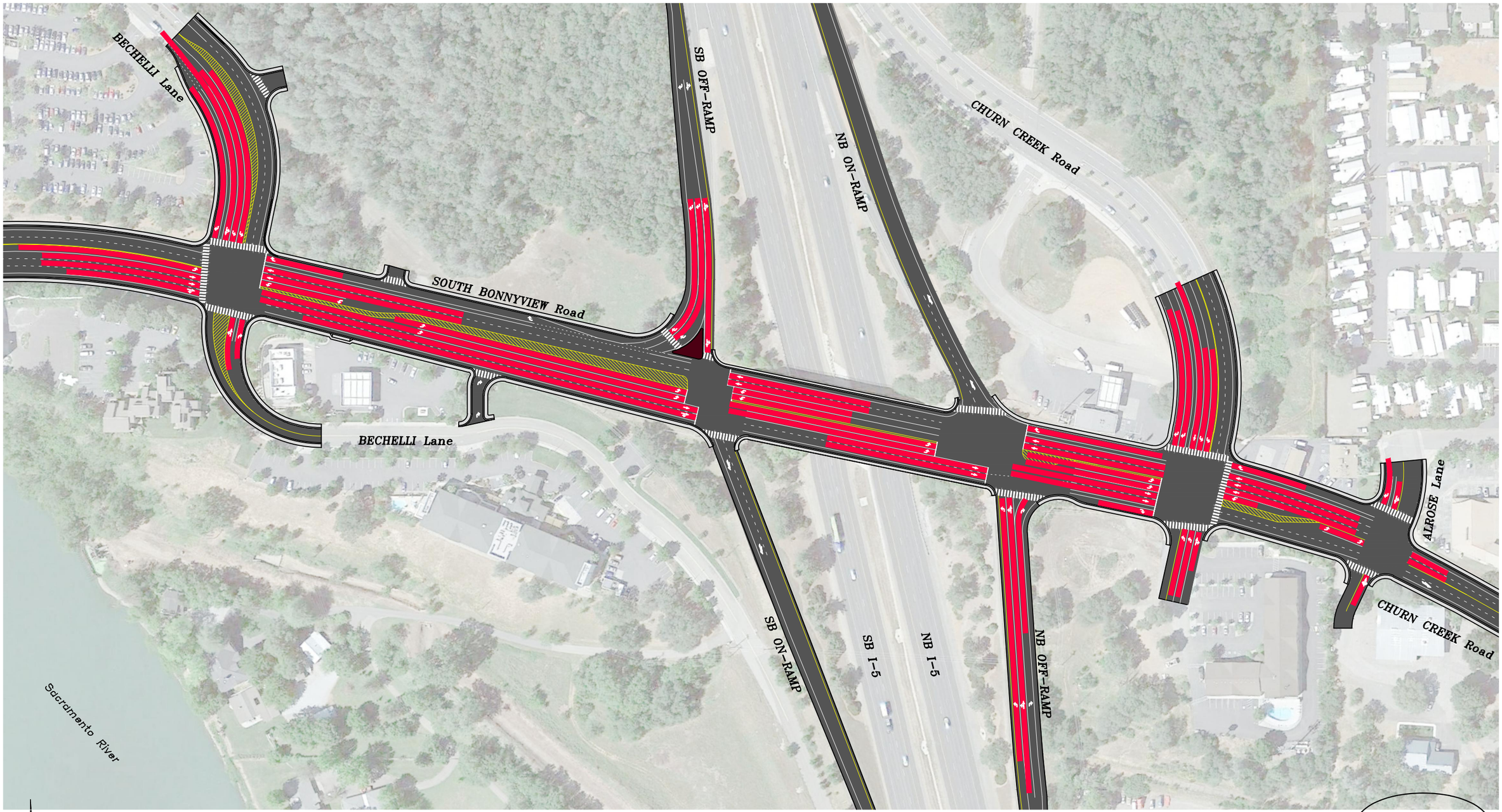
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
REVISED ALTERNATIVE 1 - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX011
DATE	04/20/2017

SHEET No. EX 1 OF 2

4/28/2017 3:30 PM J:\VPA\2174\2174EX011.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 2

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

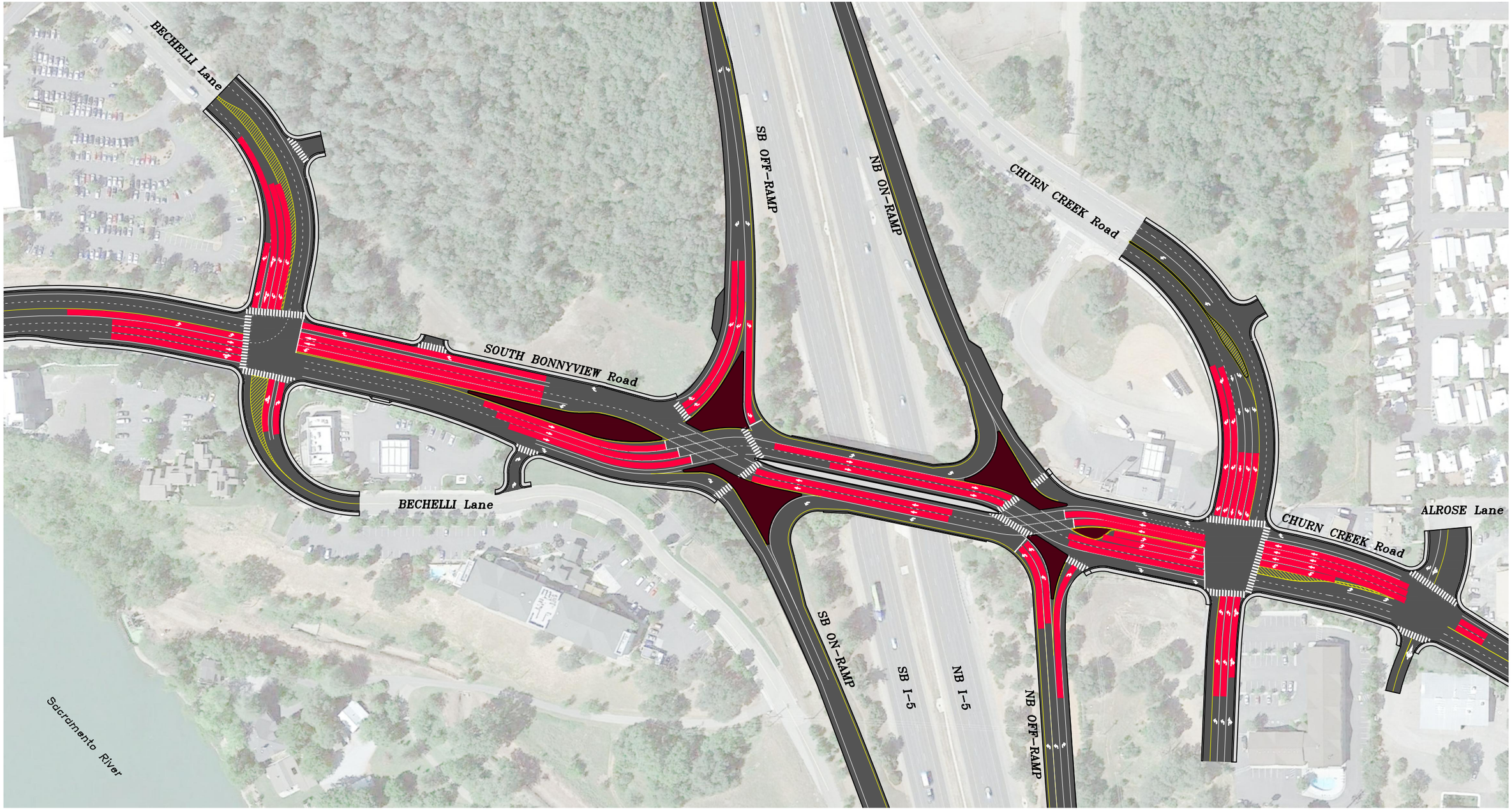
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
REVISED ALTERNATIVE 1 - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX011
DATE	04/20/17

SHEET No. EX 1 OF 1

4/28/2017 3:29 PM J:\PRJ\2174\2174EX011.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE A).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 3

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

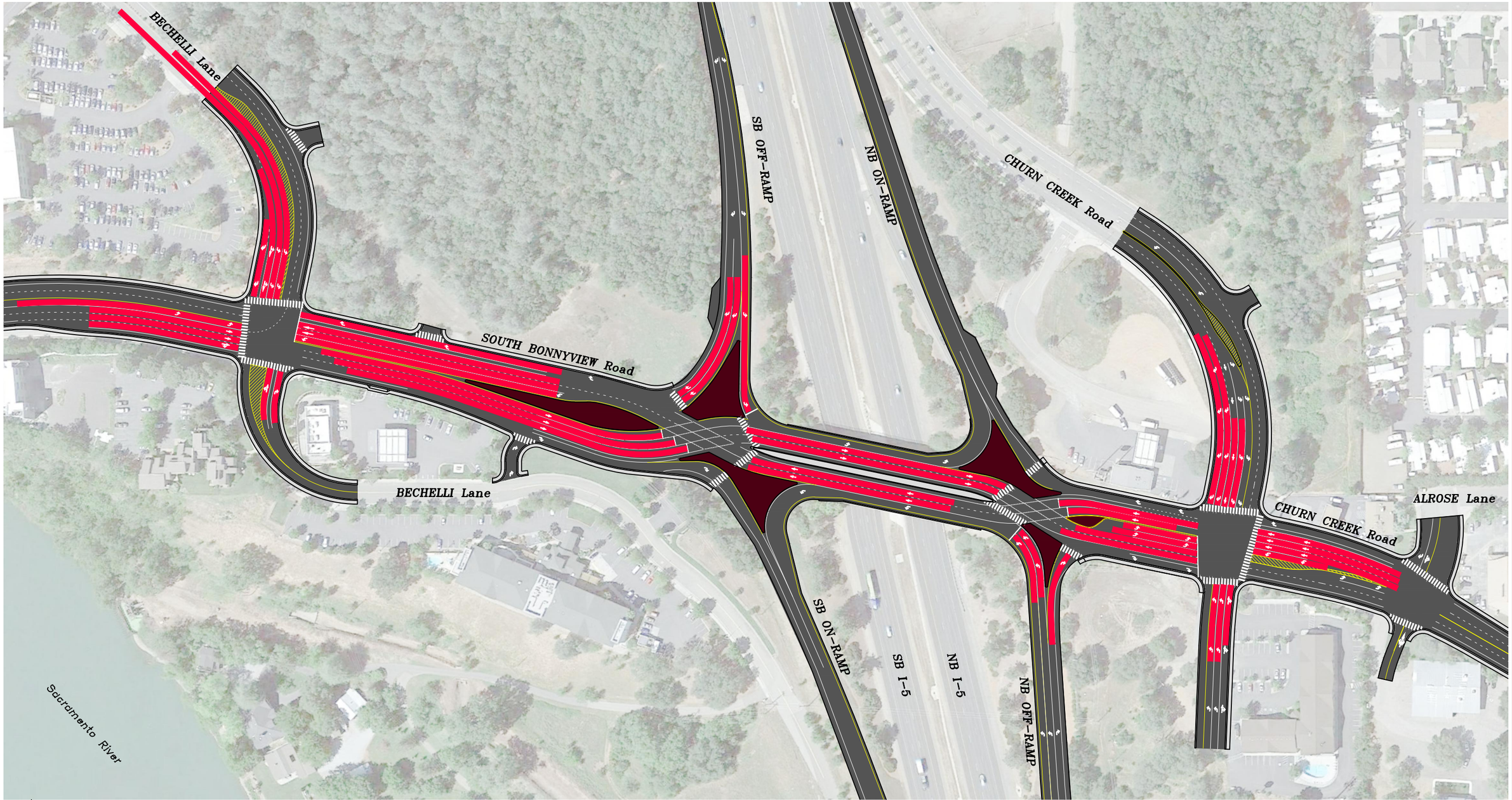
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
REVISED ALTERNATIVE 2 - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX014
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:31 PM J:\PRJ\217A\2174EX014.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE A).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 4

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

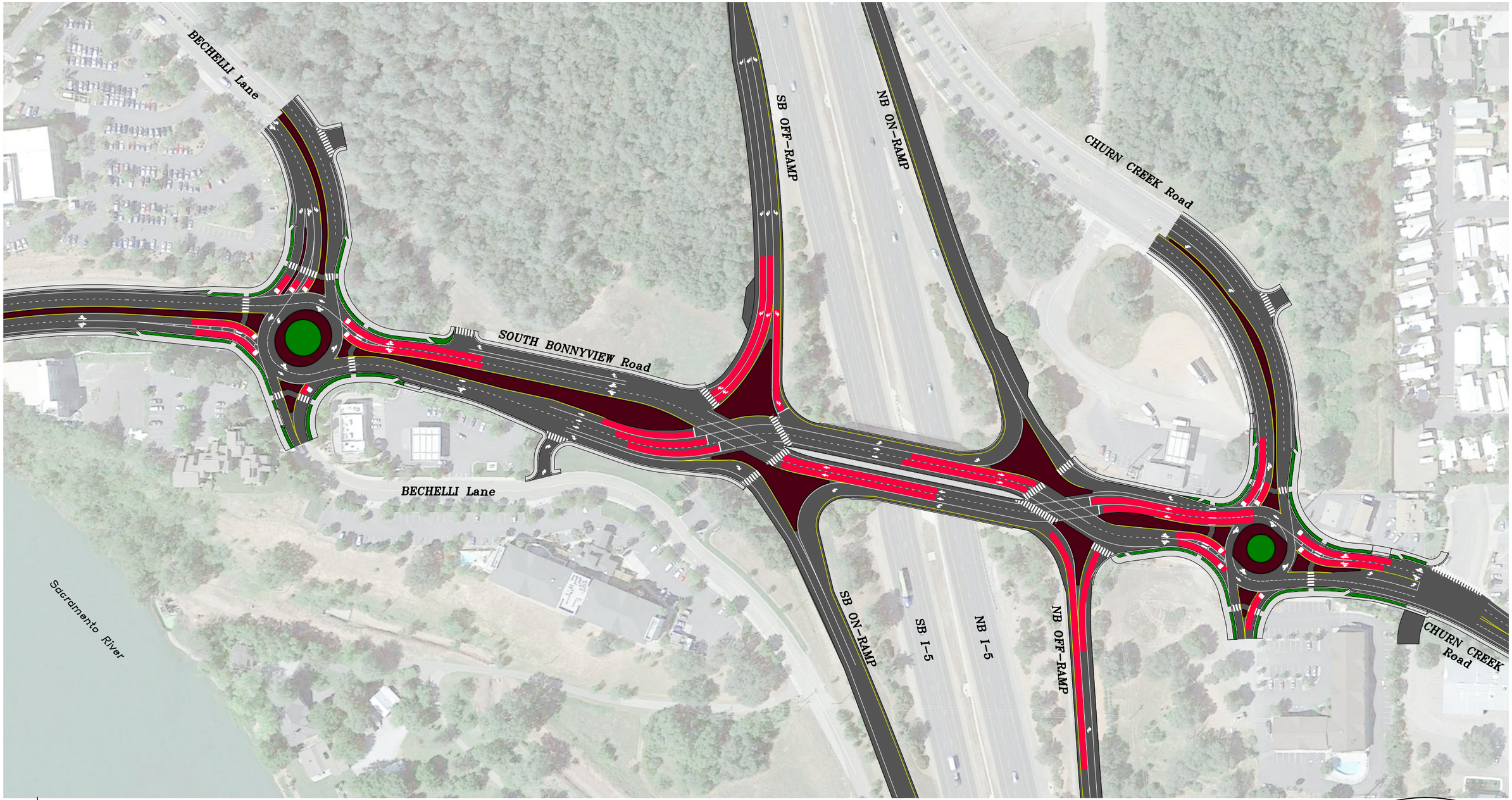
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
REVISED ALTERNATIVE 2 - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX014
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:31 PM J:\PRJ\217A\2174EX014.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE A).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 5

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

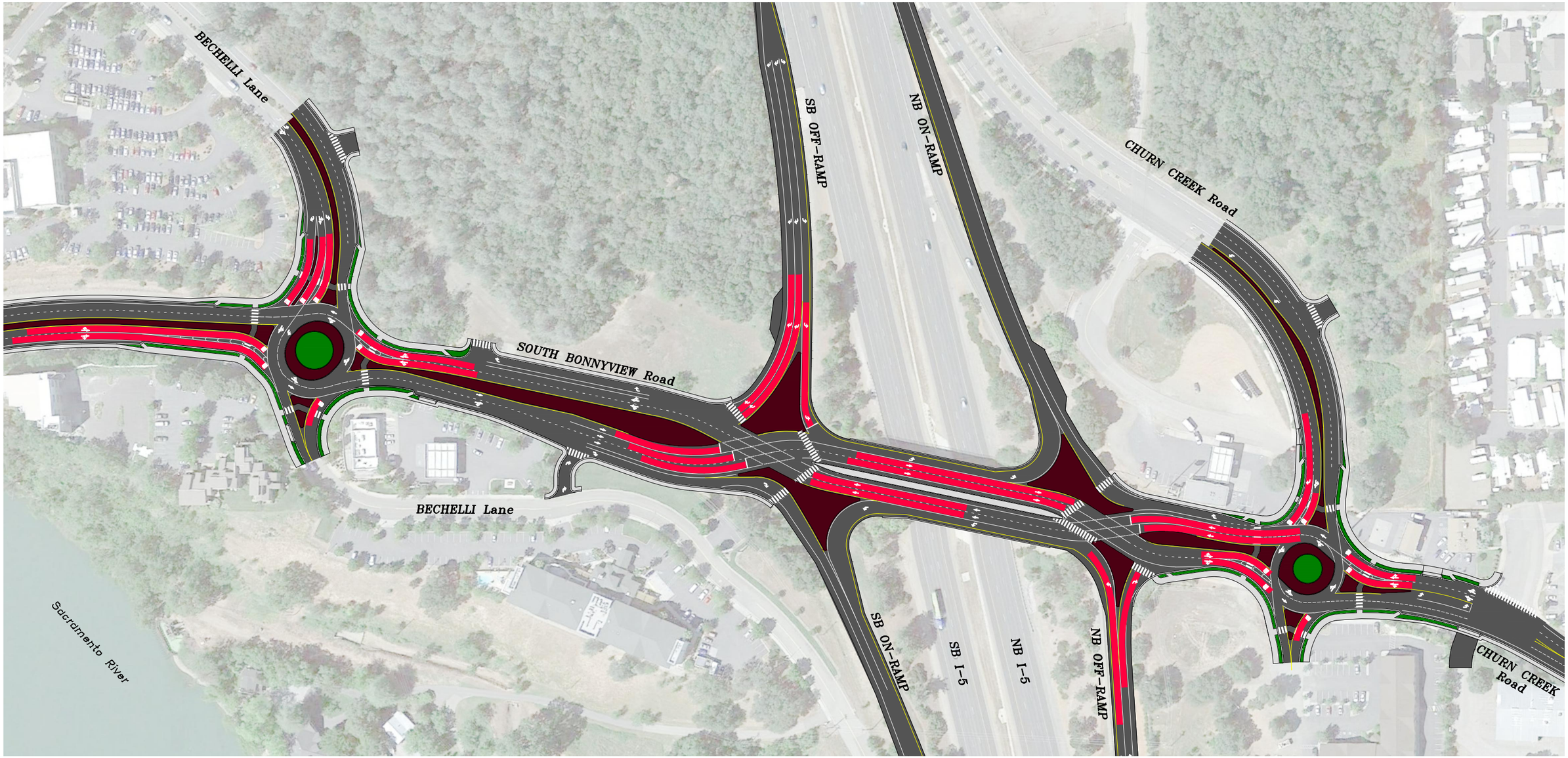
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS
REVISED ALTERNATIVE 4 - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX012
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:33 PM J:\PRJ\2174\2174EX012.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE A).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 6

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS
REVISED ALTERNATIVE 4 - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX012
DATE	04/28/17

SHEET No. EX
1 OF 1

4/28/2017 3:32 PM J:\PRJ\2174\2174EX012.DWG

Technical Memorandum No. 15

To:	City of Redding - Engineering	**Date:**	~~April 28, 2017~~ May 5, 2017
Attn:	Mr. Chuck Aukland, PE	**Project:**	I-5 / S. Bonnyview Interchange PSR
From:	Mr. Russ Wenham & Mr. Kamesh Vedula		
Re:	T. Operations for Alternative 1 (Tight Diamond), Alternative 2 (Diverging Diamond Interchange with Signals), and Alternative 4 (Diverging Diamond with Roundabouts) ***with Rancheria Development***	**Job No.:**	45-5721-27
		File No.:	C2174MEM015
CC:	Kent Manual, John Abshier, Brian Crane, Rob Stinger, John Wong, Derek Willis, Dale Widner		

The analysis for the I-5 / S. Bonnyview Interchange PSR commenced in May 2016.

On November 29, 2016, the Bureau of Indian Affairs (BIA) published a Notice of Intent to Prepare an Environmental Impact Statement (EIS) for the Proposed Redding Rancheria Fee-to-Trust and Casino Project, south-west of the I-5 / S. Bonnyview Interchange. Herein after the Redding Rancheria's project is referred to as "Rancheria Development".

The Rancheria Development application to BIA would place approximately 232 acres of fee land in trust by the United States and the Redding Rancheria would construct a casino resort. The resort would include an approximately 140,000 square foot casino, an approximately 250-room hotel, an event/convention center and an approximately 130,000 square foot outdoor sports retail center.

Kimley-Horn (K-H), subconsultant to EIS prime consultant Analytical Environmental Services (AES), prepared a *Trip Generation and Distribution Methodology* Memorandum on September 7, 2016. For weekday PM peak hour conditions, the trip generation and distribution contained in the September 7, 2016 K-H memorandum is sufficient for use in this I-5 / S. Bonnyview Interchange PSR study.

The K-H memorandum did not address weekday AM peak hour trip generation. The weekday AM peak hour trip generation for the Rancheria Development was derived by Omni-means and is presented in Table 1.

This memorandum analyzes the potential impact of the Rancheria Development on the results presented in previous Technical Memorandums. The corridor operations for Full Rancheria Development during the AM peak were found to be better than the Half Rancheria Development during the PM peak period. As such, it can be concluded that the Half Rancheria Development during the PM peak period will dictate the geometric requirements for the corridor. Therefore, detailed LOS and queue analysis was not performed for the Half Rancheria Development during the AM peak period. For geometric design purposes, the results of the weekday AM and PM peak hour analysis is presented below.

Traffic Forecasts

Refer to Technical Memorandum No. 6. for the without Rancheria Development base 2045 traffic volumes.

Table 1: AM Rancheria Trip Generation

Land Use	ITE Code	Quantity	Units	Weekday AM Peak Hour		
				In	Out	Total
Casino	N/A	140,000	SF	206	88	294
Conference Center	N/A	10,080	SF	178	45	223
Event Center	N/A	1,800	Seats	12	2	14
Hotel	310	250	Rooms	18	15	33
Sporting Goods Superstore	861	130,000	SF	111	83	194
Subtotal Vehicle Trips				525	233	758
Diverted Link Trips (10%) - Applied only to Casino and Sporting Goods Store				(32)	(17)	(49)
Net New Vehicle Trips				493	216	709

The potential traffic volumes from the Rancheria Development were obtained from the K-H *Trip Generation and Distribution Methodology* Memorandum on September 7, 2016.

In order to provide a *sensitivity analysis*, the analysis was performed with half Rancheria Development and full Rancheria Development. For *reality* check purposes the casino portion of the Rancheria Development will generate approximately 57% of the total weekday PM peak hour traffic.

Technical Parameters for Traffic Operations Analysis

No change. Refer to Technical Memorandum No. 7.

LOS and Delays

Alternative 1A - Traditional Tight Diamond - Half Rancheria Development

Year 2045 mitigated LOS and delays for Alternative 1A (Tight Diamond) is presented in Table 2.

Table 2: Year 2045 LOS and Delays for Alternative 1A

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour	
				Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	37.6	D
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	18.4	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	29.0	C
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	30.7	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	23.3	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 1A (Tight Diamond) is presented in Table 3. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 3: 95th Percentile Queue for Alternative 1A

Int. #	Intersection/Approach	Control Type	95th Percentile Queue (ft)[1] PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**
	Eastbound Left	Signal	297	400
	Eastbound Thru		336	
	Eastbound Thru/Right		56	350
	Westbound Left		321	350
	Westbound Thru		425	
	Westbound Right		194	550
	Northbound Left/Thru		267	
	Northbound Right		194	150
	Southbound Left		214	300
	Southbound Left/Thru		298	
	Southbound Right		167	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**
	Eastbound Thru	Signal	188	300
	Eastbound Right		313	350
	Westbound Left		127	300
	Westbound Thru		67	
	Southbound Left/Thru		302	
	Southbound Right		336	300
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**
	Eastbound Left	Signal	338	
	Eastbound Thru		193	
	Westbound Thru		259	
	Westbound Right		171	
	Northbound Left		264	450
	Northbound Left/Thru		311	
	Northbound Right		160	400

Table 3: 95th Percentile Queue for Alternative 1A (Continued)

Int. #	Intersection/Approach	Control Type	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**
	Eastbound Left	Signal	227	175
	Eastbound Thru		184	
	Eastbound Right		46	145
	Westbound Left		61	
	Westbound Thru		204	
	Westbound Right		96	200
	Northbound Left		105	
	Northbound Thru/Right		63	
	Southbound Left		175	225
	Southbound Thru		28	
	Southbound Right		172	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**
	Eastbound Left	TWSC	74	110
	Westbound Left/Thru		38	
	Westbound Thru/Right		8	
	Northbound Left/Thru/Right		46	
	Southbound Left/Thru		40	
	Southbound Right		67	

1. Worst lane movement (of the approach) value stated.

Alternative 2A - Diverging Diamond Interchange with Signals - Half Rancheria Development

Year 2045 mitigated LOS and delays for Alternative 2A (Diverging Diamond Interchange with Signals) is presented in Table 4.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 4: Year 2045 LOS and Delays for Alternative 2A

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour	
				Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.4	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.5	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	20.0	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 2A (Diverging Diamond Interchange with Signals) is presented in Table 5. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the VISSIM version 8 using microsimulation.

Table 5: 95th Percentile Queue for Alternative 2A

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	55.8	265.9	400
	Eastbound Thru/Right		60.4	289.1	
	Westbound Left/Thru/Right		164.3	416.8	550
	Northbound Left/Thru		19.8	142.9	100
	Northbound Right		8.9	214.5	100
	Southbound Left/Thru		75.0	379.4	300
	Southbound Right		27.8	286.6	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	76.8	447	630
	Westbound Left/Thru		49.2	321.2	500
	Southbound Left		5.0	204	450
	Southbound Right		57.3	303	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	37.3	411.1	480
	Westbound Thru/Right		48.5	292.4	450
	Northbound Left		9.8	127.4	450
	Northbound Right		19.3	223.8	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	35.6	237.2	150
	Eastbound Thru		18.8	231.9	210
	Westbound Left		9.1	102.9	
	Westbound Thru		54.9	232.6	
	Northbound Left		30.0	126.1	
	Northbound Thru/Right		6.3	62.7	
	Southbound Left/Thru		23.4	168.4	225
	Southbound Right		26.2	286.2	350

1. Worst lane movement (of the approach) value stated.

Alternative 4A - Diverging Diamond Interchange with Roundabouts - Half Rancheria Development

Year 2045 mitigated LOS and delays for Alternative 4A (Diverging Diamond Interchange with Roundabouts) is presented in Table 6.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 6: Year 2045 LOS and Delays for Alternative 4A

#	Intersection	Control Type[1,2]	Target LOS	PM Peak Hour	
				Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	20.1	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	13.3	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	12.9	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	12.4	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 4A (Diverging Diamond Interchange with Roundabouts) is presented in Table 7. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from a combination of Sidra version 7 using Highway Capacity Manual Methodology and VISSIM version 8 using microsimulation.

Table 7: 95th Percentile Queue for Alternative 4A

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		144.3	
	Eastbound Thru			144.3	
	Eastbound Thru/Right			173.3	
	Westbound Left/Thru			320.5	
	Westbound Thru/Right			323.3	
	Northbound Left/Thru			33.4	
	Northbound Right			55.9	
	Southbound Left			149.6	
	Southbound Left/Thru			190.4	
	Southbound Right			195.7	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	33.2	206.6	630
	Westbound Left/Thru		57.9	240.7	500
	Southbound Left		6.0	164.0	450
	Southbound Right		88.5	270.0	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	84.4	368.9	480
	Westbound Thru/Right		32.3	295.9	215
	Northbound Left		59.5	510.7	450
	Northbound Right		9.3	218.4	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		120.8	250
	Eastbound Thru/Right			127	250
	Westbound Left/Thru			113.7	
	Westbound Thru/Right			121.7	
	Northbound Left/Thru/Right			45.4	150
	Southbound Left/Thru			53.6	
	Southbound Right			187	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Alternative 1B - Traditional Tight Diamond - Full Rancheria Development

Year 2045 mitigated LOS and delays for Alternative 1B (Tight Diamond) is presented in Table 8.

Table 8: Year 2045 LOS and Delays for Alternative 1B

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	25.4	C	33.7	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	19.8	B	24.0	C
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	49.5	D	52.7	D
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	27.7	C	26.5	C
5	Churn Creek Rd/Alrose Lane	TWSC	D	14.0	B	24.0	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 1B (Tight Diamond) is presented in Tables 9. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the Synchro/Simtraffic version 9.1 using Highway Capacity Manual methodology and micro simulation.

Table 9: 95th Percentile Queue for Alternative 1B

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	213	189	400
	Eastbound Thru		300	368	
	Eastbound Right		116	172	350
	Westbound Left		244	243	275
	Westbound Thru		355	337	
	Westbound Right		131	142	550
	Northbound Left		77	170	200
	Northbound Left/Thru		147	260	
	Northbound Right		113	320	300
	Southbound Left		73	308	400
	Southbound Left/Thru		107	665	
	Southbound Right		108	258	
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru	Signal	143	262	300
	Eastbound Right		51	94	300
	Westbound Left		144	131	300
	Westbound Thru		331	172	
	Southbound Left/Thru		242	295	
	Southbound Right		372	382	425
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left	Signal	282	403	
	Eastbound Thru		157	172	
	Westbound Thru		262	252	
	Westbound Right		263	246	
	Northbound Left		315	452	450
	Northbound Left/Thru		357	519	
	Northbound Right		160	330	400

Table 9: 95th Percentile Queue for Alternative 1B (Continued)

Int. #	Intersection/Approach	Control Type	Year 2045 - 95th Percentile Queue (ft)[1] AM Peak Hour	PM Peak Hour	Available Storage
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	221	211	175
	Eastbound Thru		128	187	
	Eastbound Right		82	39	145
	Westbound Left		104	55	
	Westbound Thru		285	257	
	Westbound Right		221	103	200
	Northbound Left		165	217	
	Northbound Thru/Right		105	65	
	Southbound Left		141	171	230
	Southbound Thru		58	40	
	Southbound Right		144	274	300
5	***Churn Creek Rd/Alrose Lane***		**--**	**--**	**--**
	Eastbound Left	TWSC	51	80	110
	Westbound Left/Thru		24	66	
	Westbound Thru/Right		96	18	
	Northbound Left/Thru/Right		-	58	
	Southbound Left/Thru		27	42	
	Southbound Right		88	69	

1. Worst lane movement (of the approach) value stated.

Alternative 2B - Diverging Diamond Interchange with Signals - Full Rancheria Development

Year 2045 mitigated LOS and delays for Alternative 2B (Diverging Diamond Interchange with Signals) is presented in Table 10.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 10: Year 2045 LOS and Delays for Alternative 2B

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	Signal	D	20.5	C	27.5	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	16.3	B	14.8	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	11.2	B	10.7	B
4	S. Bonnyview Rd/Churn Creek Rd	Signal	D	23.0	C	20.3	C

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 2B (Diverging Diamond Interchange with Signals) are presented in Tables 11 and 12. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from the VISSIM version 8 using micro-simulation.

Table 11: 95th Percentile AM Queue for Alternative 2B

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1] Average	Year 2045 Queue (ft) AM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	50.3	268.4	400
	Eastbound Thru/Right		57.5	347.5	
	Westbound Left		36.8	211.0	550
	Westbound Thru		51.9	370.9	550
	Westbound Right		5.8	206.5	550
	Northbound Left/Thru		26.3	150.4	100
	Northbound Right		23.5	205.8	100
	Southbound Left/Thru/Right		26.7	118.9	300
	Southbound Right		17.8	214.7	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	43.6	307.7	630
	Westbound Left/Thru		161.3	620.7	500
	Southbound Left		5.4	174	450
	Southbound Right		41.2	360.7	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	25.1	317.2	480
	Westbound Thru/Right		68.9	301.6	450
	Northbound Left		23	187.9	450
	Northbound Right		24.2	224.1	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	34.5	225.5	150
	Eastbound Thru		10.4	127.4	210
	Westbound Left		41.1	132.6	
	Westbound Thru		15.7	124.8	
	Northbound Left		10.7	86.3	
	Northbound Thru/Right		61.5	303.0	
	Southbound Left/Thru		22.6	106.6	225
	Southbound Right		22.5	204.0	350

1. Worst lane movement (of the approach) value stated.

Table 12: 95th Percentile PM Queue for Alternative 2B

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1] Average	Year 2045 Queue (ft) PM Peak Hour[1] Max	Available Storage
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left	Signal	57.9	287.8	400
	Eastbound Thru/Right		99.8	426.1	
	Westbound Left		52.9	296.2	550
	Westbound Thru		68.2	361.1	550
	Westbound Right		9.4	276.9	550
	Northbound Left/Thru		60.2	294.7	100
	Northbound Right		50.1	363.7	100
	Southbound Left/Thru/Right		82.9	461.9	300
	Southbound Right		31.7	361.4	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	108.5	562.1	630
	Westbound Left/Thru		82.0	533.0	500
	Southbound Left		8.1	240.0	450
	Southbound Right		29.7	296.4	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	47.8	539.1	480
	Westbound Thru/Right		55.6	331.1	450
	Northbound Left		13.3	147.9	450
	Northbound Right		19.7	223.9	400
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left	Signal	37.5	263.4	150
	Eastbound Thru		15.4	228.0	210
	Westbound Left		9.8	102.5	
	Westbound Thru		56.7	220.3	
	Northbound Left		28.4	108.1	
	Northbound Thru/Right		6.3	62.7	
	Southbound Left/Thru		23.5	168.1	225
	Southbound Right		28.0	287.5	350

1. Worst lane movement (of the approach) value stated.

Alternative 4B - Diverging Diamond Interchange with Roundabouts - Full Rancheria Development

Year 2045 mitigated LOS and delays for Alternative 4B (Diverging Diamond Interchange with Roundabouts) is presented in Table 13.

Note:

1. Churn Creek Rd/ Alrose Ln was analyzed for worst case scenario only (Alternative 1).

Table 13: Year 2045 LOS and Delays for Alternative 4B

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	S. Bonnyview Rd/Bechelli Lane	RNDBT	D	11.2	B	26.5	C
2	S. Bonnyview Rd/I-5 SB Ramps	Signal	D	12.3	B	14.8	B
3	S. Bonnyview Rd/I-5 NB Ramps	Signal	D	10.7	B	10.7	B
4	S. Bonnyview Rd/Churn Creek Rd	RNDBT	D	11.6	B	12.6	B

Notes:

1 LOS = Delay based on average of all approaches for Roundabout

3. Warrant = Based on California MUTCD Warrant 3

4. Bold font denotes unacceptable LOS

Year 2045 mitigated 95th percentile queues for Alternative 4B (Diverging Diamond Interchange with Roundabouts) are presented in Tables 13 and 14. In instances where there are more than two lanes for a particular movement/approach, queuing reported is for the worse lane movement/approach. The queues are developed from a combination of Sidra version 7 using Highway Capacity Manual Methodology and VISSIM version 8 using microsimulation.

Table 14: 95th Percentile AM Queue for Alternative 4B

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) AM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		81.9	
	Eastbound Thru			81.9	
	Eastbound Thru/Right			87.8	
	Westbound Left/Thru			237.1	
	Westbound Thru/Right			247	
	Westbound Right			78.4	
	Northbound Left/Thru			21.8	
	Northbound Right			32.3	
	Southbound Left			31.3	
	Southbound Left/Thru			31.3	
	Southbound Right			46.6	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	21.0	151.5	630
	Westbound Left/Thru		70.0	332.7	500
	Southbound Left		11.5	153.0	450
	Southbound Right		56.7	533.9	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	56.6	270.5	480
	Westbound Thru/Right		31.6	281.4	215
	Northbound Left		20.7	167.4	450
	Northbound Right		9.8	235.2	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		90.4	250
	Eastbound Thru/Right			94.4	250
	Westbound Left/Thru			154.1	
	Westbound Thru/Right			170.4	
	Northbound Left/Thru/Right			66.3	150
	Southbound Left/Thru			41.3	
	Southbound Right			120.8	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Table 15: 95th Percentile PM Queue for Alternative 4B

Int. #	Intersection/Approach	Control Type	Year 2045 Queue (ft) PM Peak Hour[1]		Available Storage
			Average	Max[2]	
1	***S. Bonnyview Rd/Bechelli Lane***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		264.5	
	Eastbound Thru			264.5	
	Eastbound Thru/Right			353	
	Westbound Left/Thru			234.5	
	Westbound Thru/Right			241.1	
	Westbound Right			101.1	
	Northbound Left/Thru			58.6	
	Northbound Right			150	
	Southbound Left			161	
	Southbound Left/Thru			216.3	
	Southbound Right			221.9	300
2	***S. Bonnyview Rd/I-5 SB Ramps***		**--**	**--**	**--**
	Eastbound Thru/Right	Signal	38.5	272.9	630
	Westbound Left/Thru		68.8	334.4	500
	Southbound Left		18.9	218.8	450
	Southbound Right		42.2	506.4	450
3	***S. Bonnyview Rd/I-5 NB Ramps***		**--**	**--**	**--**
	Eastbound Left/Thru	Signal	81.1	349.9	480
	Westbound Thru/Right		33.9	282.6	215
	Northbound Left		17.1	149.0	450
	Northbound Right		8.3	170.3	450
4	***S. Bonnyview Rd/Churn Creek Rd***		**--**	**--**	**--**
	Eastbound Left/Thru	Roundabout		122.1	250
	Eastbound Thru/Right			128.4	250
	Westbound Left/Thru			116.8	
	Westbound Thru/Right			125.3	
	Northbound Left/Thru/Right			45.8	150
	Southbound Left/Thru			54.3	
	Southbound Right			190.5	

1. Worst lane movement (of the approach) value stated.

2. 95th Percentile Queue for the Roundabouts

Network Sensitivity - Half Rancheria Development

Alternative 4A - Eastbound Bonnyview Road at Bechelli Lane

To avoid significant impacts associated with widening the roundabout at S. Bonnyview Road and Bechelli Lane to three lanes eastbound a sensitivity analysis of the approach was done for the Rancheria Development was conducted. Using Sidra and the PM trip generation expected for the Rancheria Development from the K-H traffic study, it was found that only 12% of the expected PM trips can be accommodated by a two lane Eastbound approach. At 15% of the expected trip generation the two lane roundabout approach will reach LOS F and require a third lane.

Attachments:

Half Rancheria Development:

Attachment 1: Alternative 1A - Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 2: Alternative 2A - Diverging Diamond Interchange with Signals Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 3: Alternative 4A - Diverging Diamond Interchange with Roundabouts Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Full Rancheria Development

Attachment 4: Alternative 1B - Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for AM Peak Hour

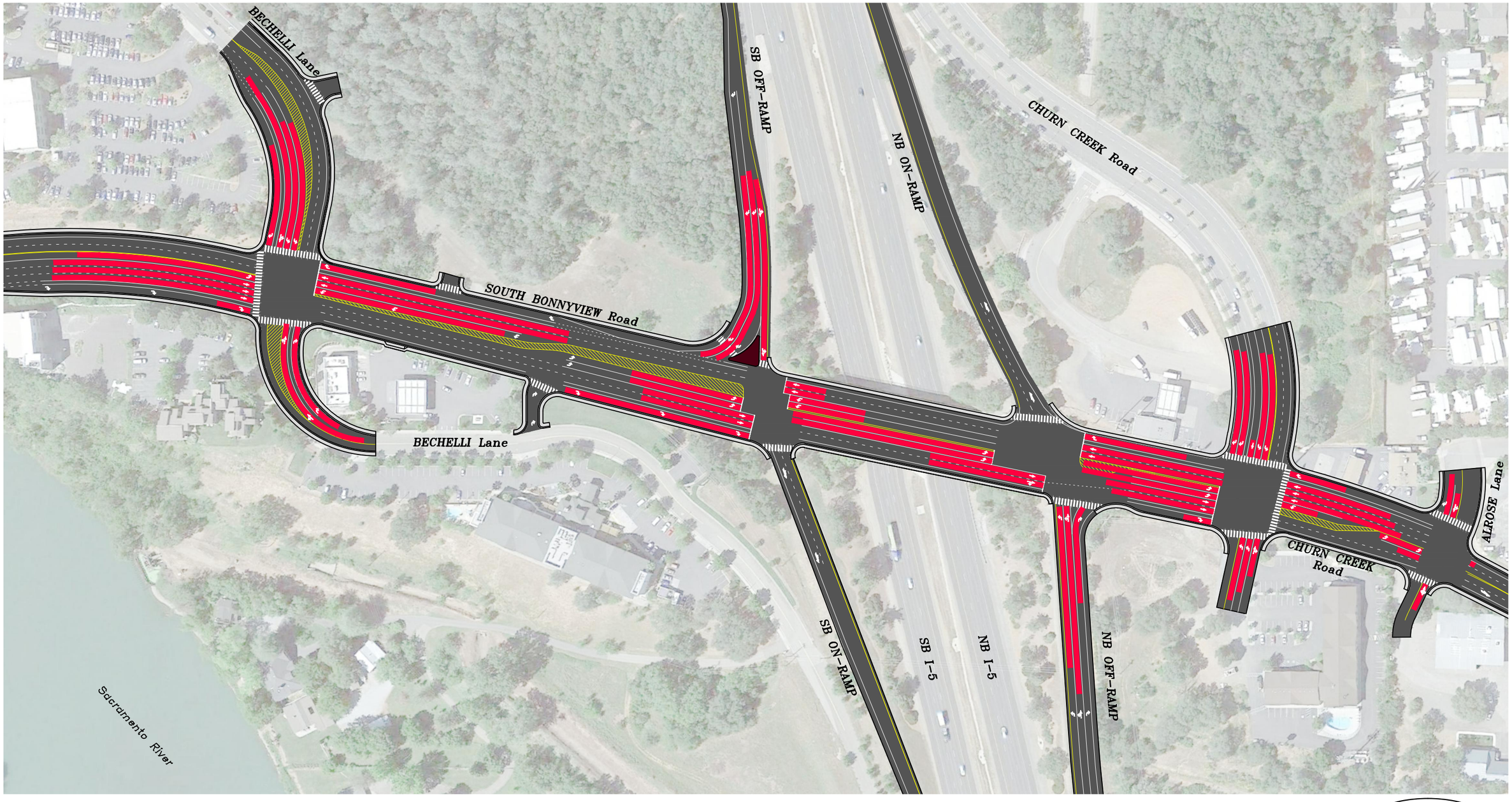
Attachment 5: Alternative 1B - Traditional Tight Diamond Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 6: Alternative 2B - Diverging Diamond Interchange with Signals Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 7: Alternative 2B - Diverging Diamond Interchange with Signals Lane Geometrics and 95th Percentile Queues for PM Peak Hour

Attachment 8: Alternative 4B - Diverging Diamond Interchange with Roundabouts Lane Geometrics and 95th Percentile Queues for AM Peak Hour

Attachment 9: Alternative 4B - Diverging Diamond Interchange with Roundabouts Lane Geometrics and 95th Percentile Queues for PM Peak Hour



PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 1

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

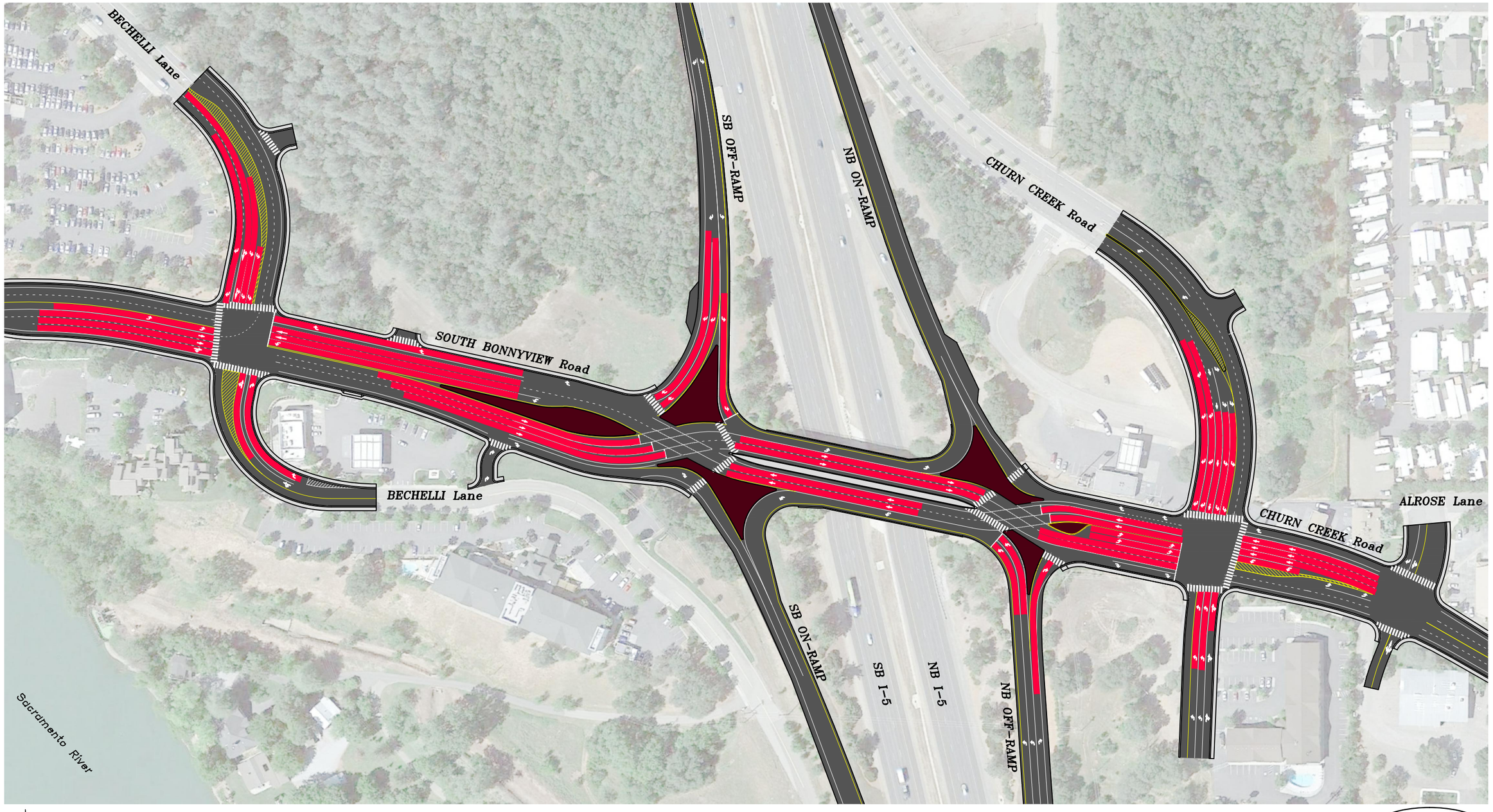
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS (HALF RANCHERIA DEVELOPMENT)
ALTERNATIVE 1A - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX015
DATE	04/26/17

SHEET No. EX 1 OF 1

4/28/2017 3:02 PM J:\PR\1\2174\2174EX015.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 2

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

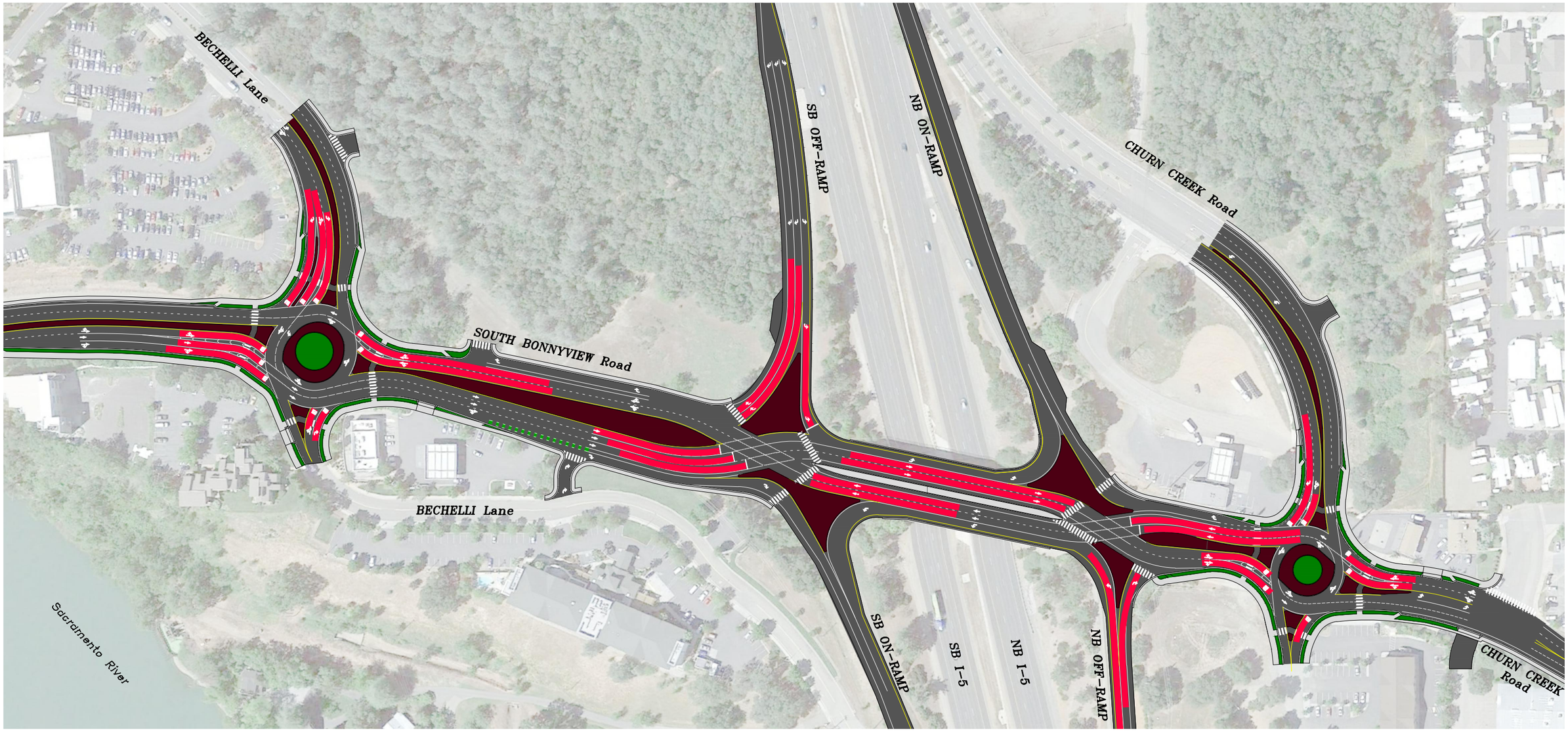
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave, Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS (HALF RANCHERIA DEVELOPMENT)
ALTERNATIVE 2A - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX0016
DATE	04/27/17

SHEET No. EX
1 OF 1

J:\PRJ\2174\2174EX016.DWG
4/28/2017 3:03 PM



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 3

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

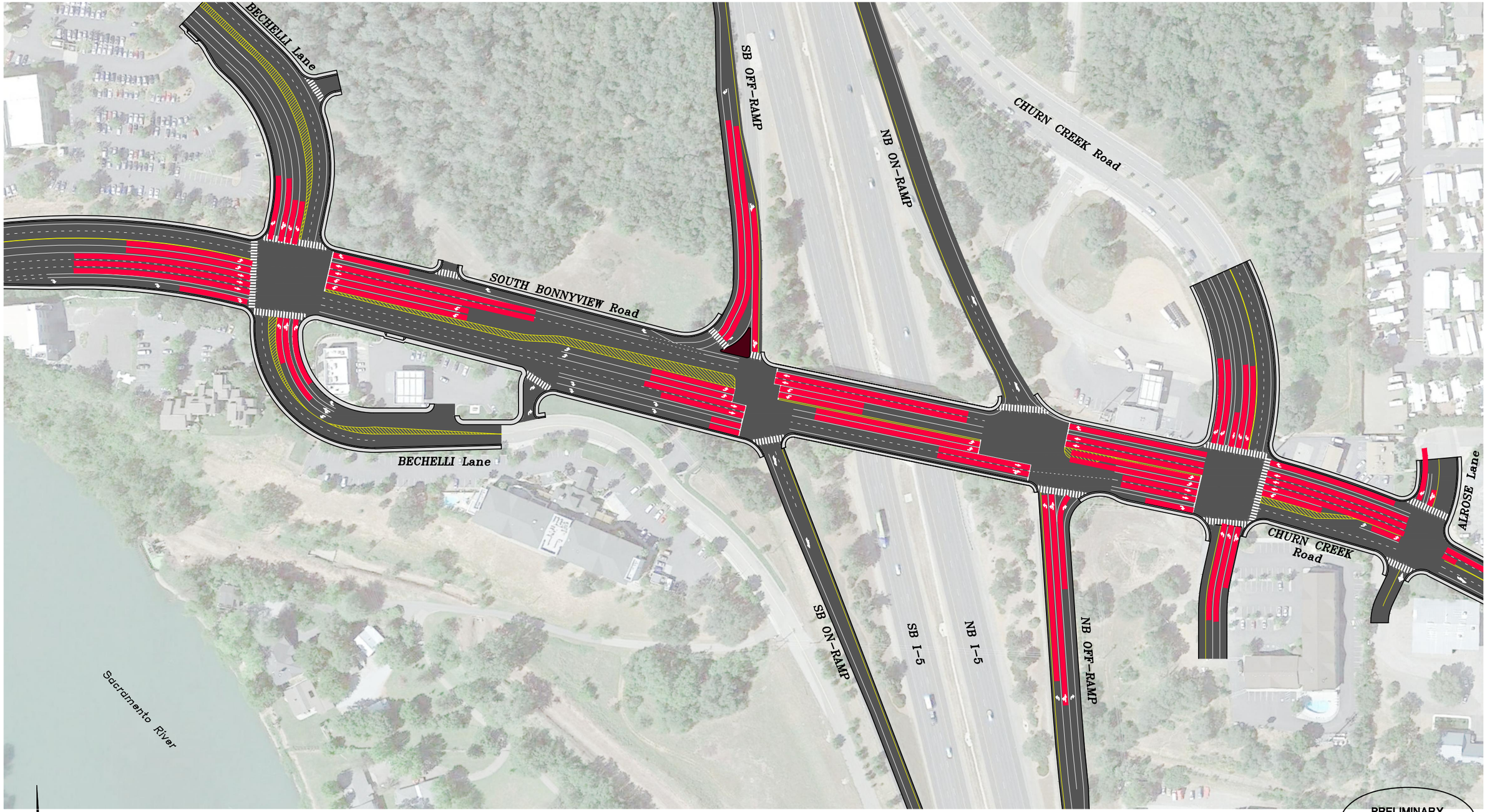
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS (HALF RANCHERIA DEVELOPMENT)
ALTERNATIVE 4A - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX013
DATE	04/26/17

SHEET No. EX
1 OF 1

4/28/2017 3:04 PM J:\PR\2174\2174EX013.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 4

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

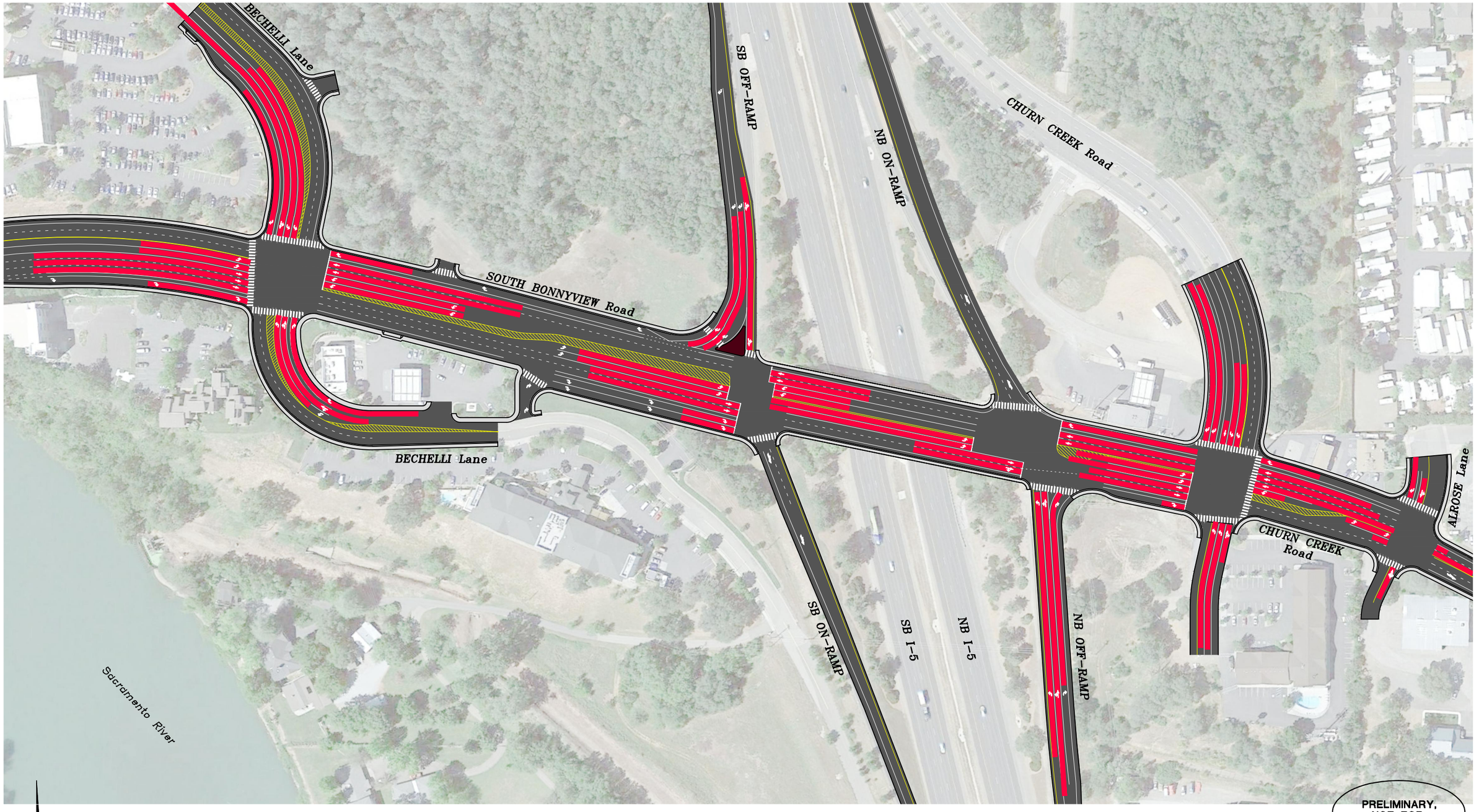
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS (FULL RANCHERIA DEVELOPMENT)
ALTERNATIVE 1B - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX021
DATE	04/26/17

SHEET No. EX 1 OF 1

4/28/2017 3:49 PM J:\PRJ\2174\2174EX021.DWG



PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 5

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

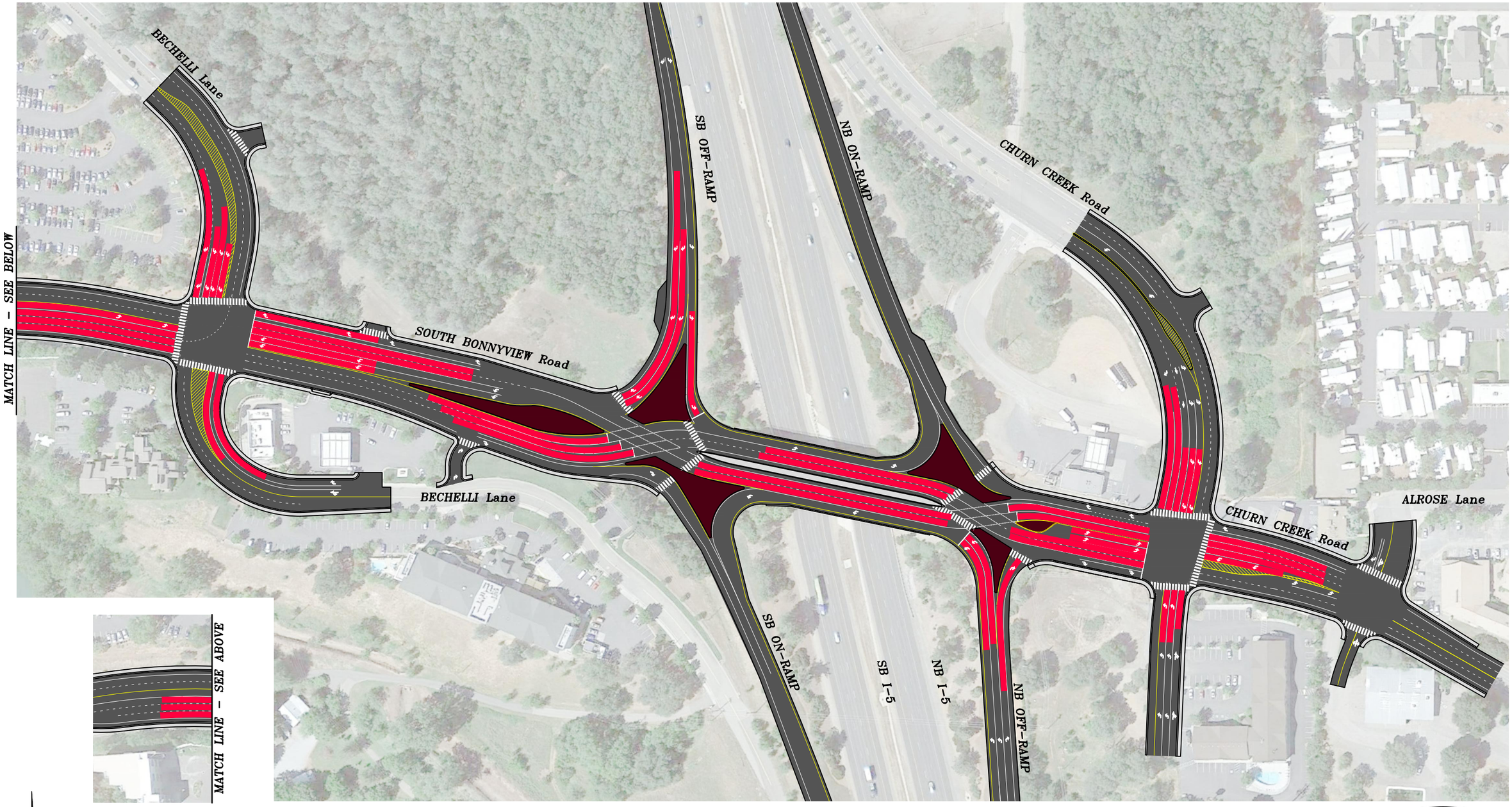
JOB NO. JOB_NO.

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS (FULL RANCHERIA DEVELOPMENT)
ALTERNATIVE 1B - TIGHT DIAMOND
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX021
DATE	04/26/17

SHEET No. EX
1 OF 1

4/28/2017 3:48 PM J:\PR\2174\2174EX021.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 6

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

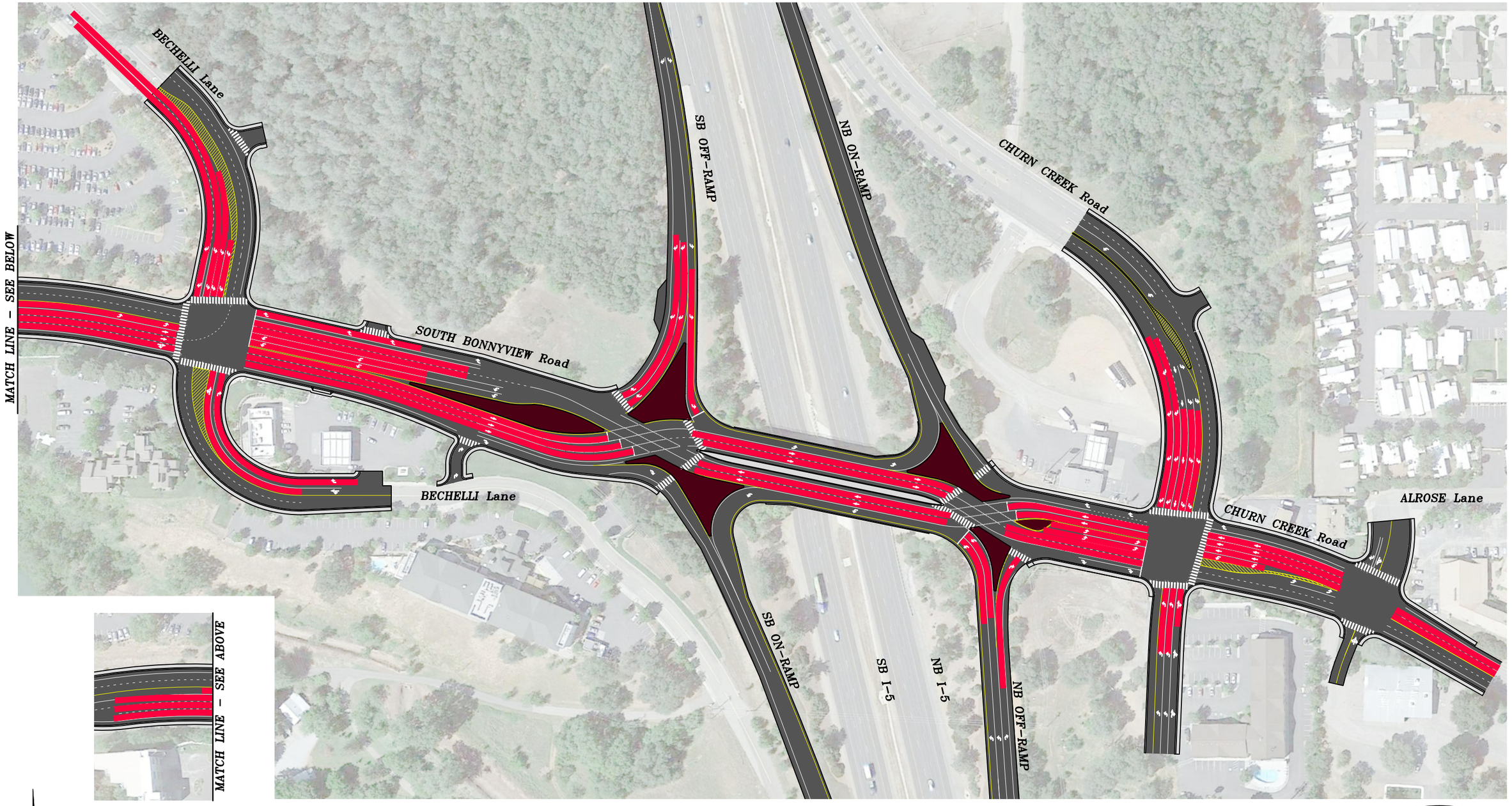
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS (FULL RANCHERIA DEVELOPMENT)
ALTERNATIVE 2B - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX023
DATE	04/26/17

SHEET No. EX 1 OF 1

4/28/2017 3:08 PM J:\PRJ\217A\2174EX023.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 7

REVISIONS

NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

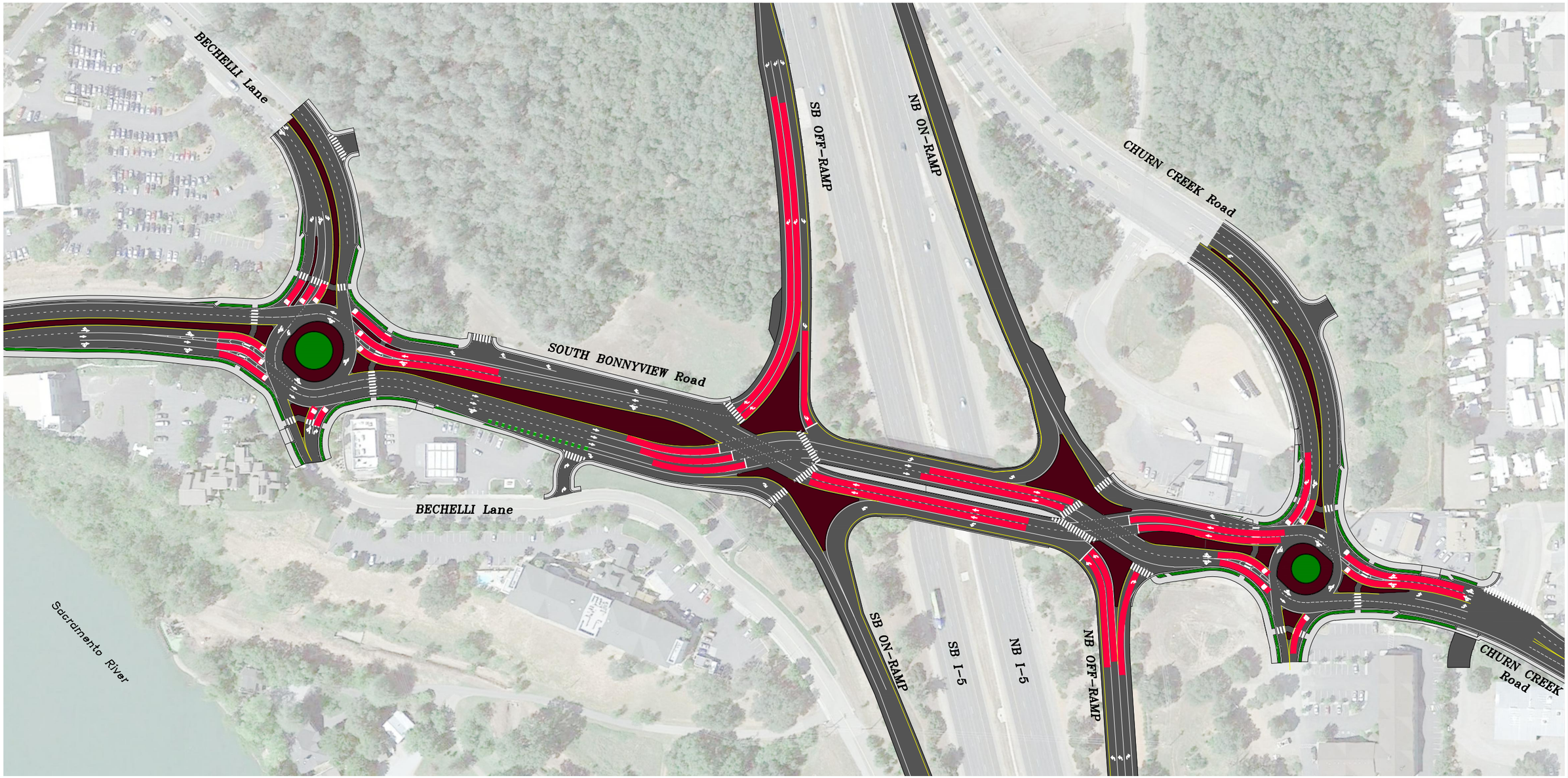
omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave, Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS (FULL RANCHERIA DEVELOPMENT)
ALTERNATIVE 2B - DDI & SIGNALS CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	MES
DRAWN	MES
CHECKED	RAW
FILE NAME	2174EX023
DATE	04/28/17

SHEET No. EX
1 OF 1

J:\PRJ\2174\2174EX023.DWG
4/28/2017 3:08 PM



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 8

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA

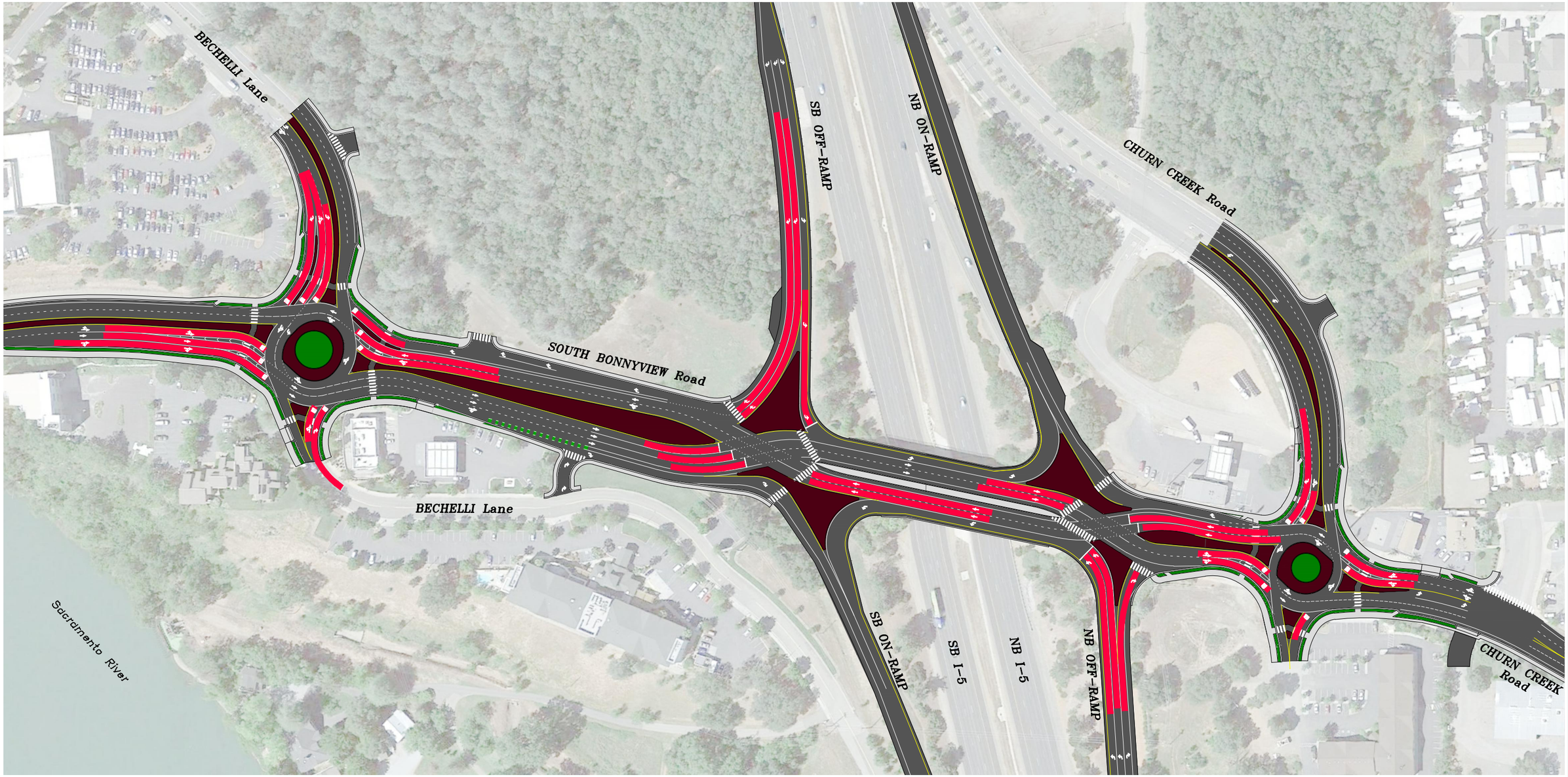
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 AM QUEUE LENGTHS (FULL RANCHERIA DEVELOPMENT)
ALTERNATIVE 4B - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX025
DATE	04/26/17

SHEET No. EX
1 OF 1

4/28/2017 3:10 PM J:\PRJ\2174\2174EX025.DWG



NOTE:
1. QUEUEING AT ALROSE LANE INTERSECTION IS ONLY PROVIDED FOR WORST CASE SCENARIO (ALTERNATIVE 1).

PRELIMINARY, NOT FOR CONSTRUCTION

ATTACHMENT 9

REVISIONS			
NO.	DESCRIPTION	DATE	BY

80 0 80
1 inch = 80 ft.

omni • means
ENGINEERS PLANNERS
REDDING
330 Hartnell Ave. Suite B
Redding, CA 96002
(530) 242-1700
Locations in
ROSEVILLE
WALNUT CREEK
VISALIA
JOB NO. 45-5721-27

I-5 / SOUTH BONNYVIEW INTERCHANGE PSR
YEAR 2045 PM QUEUE LENGTHS (FULL RANCHERIA DEVELOPMENT)
ALTERNATIVE 4B - DDI & ROUNDABOUT CONCEPT
REDDING, CALIFORNIA

SCALE	1"=80'
DESIGNED	SMH
DRAWN	SMH
CHECKED	RAW
FILE NAME	2174EX025
DATE	04/26/17

SHEET No. EX
1 OF 1

4/28/2017 3:10 PM J:\PRJ\2174\2174EX025.DWG