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Dowling Associates, Inc.

Date: January 4, 2010

Memorandum

To: Paul Hom , El Dorado County Department of Transportation

cc: Silva Valley Pkwy. Interchange Traffic Analysis Project Development Team

From: Jim Damkowitch/Abhi Parikh, Dowling Associates, Inc.

Reference #: P08-004.06

Subject: US 50/Silva Valley Pkwy. Interchange Alternative Phasing Analysis

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As defined in Task Order 2 (Contract # 08-1661) for the Silva Valley Interchange Traffic Study scope of services, a technical memorandum documenting the analysis description, operational results and recommendations is to be developed by Dowling Associates. As a first step towards this end, Dowling Associates has developed this Travel Analysis & Forecasting Methodology memorandum that describes the analysis framework proposed for this traffic study. Formal concurrence from the County and the Project Development Team on the contents of this memorandum will serve to streamline the traffic analysis by precluding the need for re-analysis or changing assumptions mid-way through or near the completion of the traffic study. Dowling Associates will work with the County and PDT to resolve any concerns or issues identified during the review of this memorandum before technical work begins.

The methodology and analysis tools proposed by Dowling Associates, Inc. for the Silva Valley Pkwy. Interchange phasing analysis is described herein.

PROJECT BACKGROUND

The Final Traffic Operations Study for US-50 Silva Valley Interchange (Dowling Associates, June 1, 2009) documented the traffic impacts due to the construction of new Silva Valley interchange. As shown in **Table 1** and described below, this analysis assumed a 3 phase construction of the interchange

Original Phasing Assumptions

- Phase 1 – consists of diagonal EB and WB on-ramps and off-ramps without an over-crossing, where traffic is routed under US 50 via the existing 2-lane alignment of Silva Valley Pkwy.

- Phase 2 – Consists of two on-ramps and two off-ramps (as in Phase 1) and the over-crossing on a 4- lane Silva Valley Pkwy. but excludes the loop ramps

- Phase 3 – Consists of Phase 2 and addition of WB Loop on-ramp and EB Loop on-ramp. This is the ultimate configuration for the Silva Valley Interchange, expected to be in place by 2030.

The purpose of this analysis is to evaluate the impact of alternative phasing of Silva Valley Interchange on traffic operations in the immediate vicinity of the interchange. Alternative phasing is described below

Alternative Phasing Assumptions

Table 1 below presents the components of the interchange that are going to be constructed under the alternative phasing scenario.

- Alternative Phase 1 – Construction of EB off-ramp, EB Loop on-ramp, WB Diagonal Off-Ramp and WB Diagonal on-ramp and Silva Valley Pkwy Overcrossing on US 50

- Alternative Phase 2 – Ultimate configuration similar to Phase 3 in original phasing. Ultimate configuration is expected to be in place by 2030.

Table 1 Silva Valley Interchange – Construction Phasing Comparison

	Diagonal Ramps				Loop Ramps		
	Eastbound		Westbound		Eastbound	Westbound	Silva Valley Overcrossing on US-50
Phasing	On-Ramp	Off-Ramp	On-Ramp	Off-Ramp	On-Ramp	On-Ramp	
Original Phasing							
Phase 1	Yes	Yes	Yes	Yes	No	No	No
Phase 2	Yes	Yes	Yes	Yes	No	No	**Yes**
Phase 3	Yes	Yes	Yes	Yes	**Yes**	**Yes**	Yes
Alternative Phasing							
Phase 1	No	Yes	Yes	Yes	Yes	No	Yes
Phase 2	**Yes**	Yes	Yes	Yes	Yes	**Yes**	Yes

Note:- **Bold letters** indicates change from previous phase.

The Alternative Phasing assumptions are shown in **Figure 1**.

In addition to the alternative phasing analysis, this study will also evaluate the following two design modifications for merging the EB Loop on-ramp and EB Diagonal on-ramp with US 50.

1. Merge Loop EB on-ramp into US 50 before merging the diagonal EB on-ramp into US 50

2. Merge Loop EB on-ramp into Diagonal US 50 EB and then merge into US 50

Dowling Associates will base its design recommendation based on operational performance as defined in the Highway Capacity Manual 2000.

STUDY AREA

As defined in the TO-2 scope of work, the traffic operations analysis for alternative phasing will cover the following study intersections

1. Silva Valley Pkwy. and US 50 Eastbound Ramp
2. Silva Valley Pkwy. and US 50 Westbound Ramp
3. Silva Valley Pkwy. and Country Club Drive (future)
4. White Rock Road and Jorger Cuttoff Road (unsignalized)

FUTURE TRAFFIC VOLUME FORECASTING

The source of all future traffic volumes used as part of this traffic study is the Final Traffic Operations Study for US-50 Silva Valley Interchange (Dowling Associates, June 1, 2009). The volume set used to generate future volumes for this alternative phasing analysis was based on the Silva Valley I/C Phase 3 analysis forecasts using the El Dorado County DOT traffic model. Per the County's direction, the Silva Valley Interchange travel forecasts reflect annual average traffic conditions i.e., seasonal variation in traffic is not addressed. Unlike other forecasts generated for past studies within El Dorado County, these forecasts explicitly address commercial trucks via an off-model commercial truck volume adjustment.

Future volume forecasting for this analysis is based on the following analysis framework:

1. Study area reflects a closed system – no net change in the study area traffic volume will result from any given phasing alternative.

2. Alternative Phase 1 is a combination of phase 2 and phase 3 of the original phasing analysis. Therefore, turning movement volumes from phase 3 are used as the basis of this analysis.

3. At US 50 **EB Ramps/Silva Valley Pkwy**, the eliminated movements at the Diagonal EB on-ramp are converted from NB Right to NB Left with the assumption that the Loop EB on-ramp will carry the US 50 EB traffic. SB right turn movement to US 50 EB will remain the same

4. Similarly at **US 50 WB Ramps/Silva Valley Pkwy**, eliminated movement from Loop WB on-ramp is converted from NB Right to NB Left assuming the Diagonal WB on-ramp will carry the US 50 WB traffic. SB right turn movement to US 50 WB will remain the same.

Figure 2 and 3 presents the resulting trip diversion for 2020 and 2030 respectively.

Figure 4 presents 2020 Intersection Volumes and Freeway Volumes, **Figure 5** presents 2030 Intersection Volumes and Freeway Volumes.

Figure 1 - Silva Valley Parkway I/C Alternative Phasing

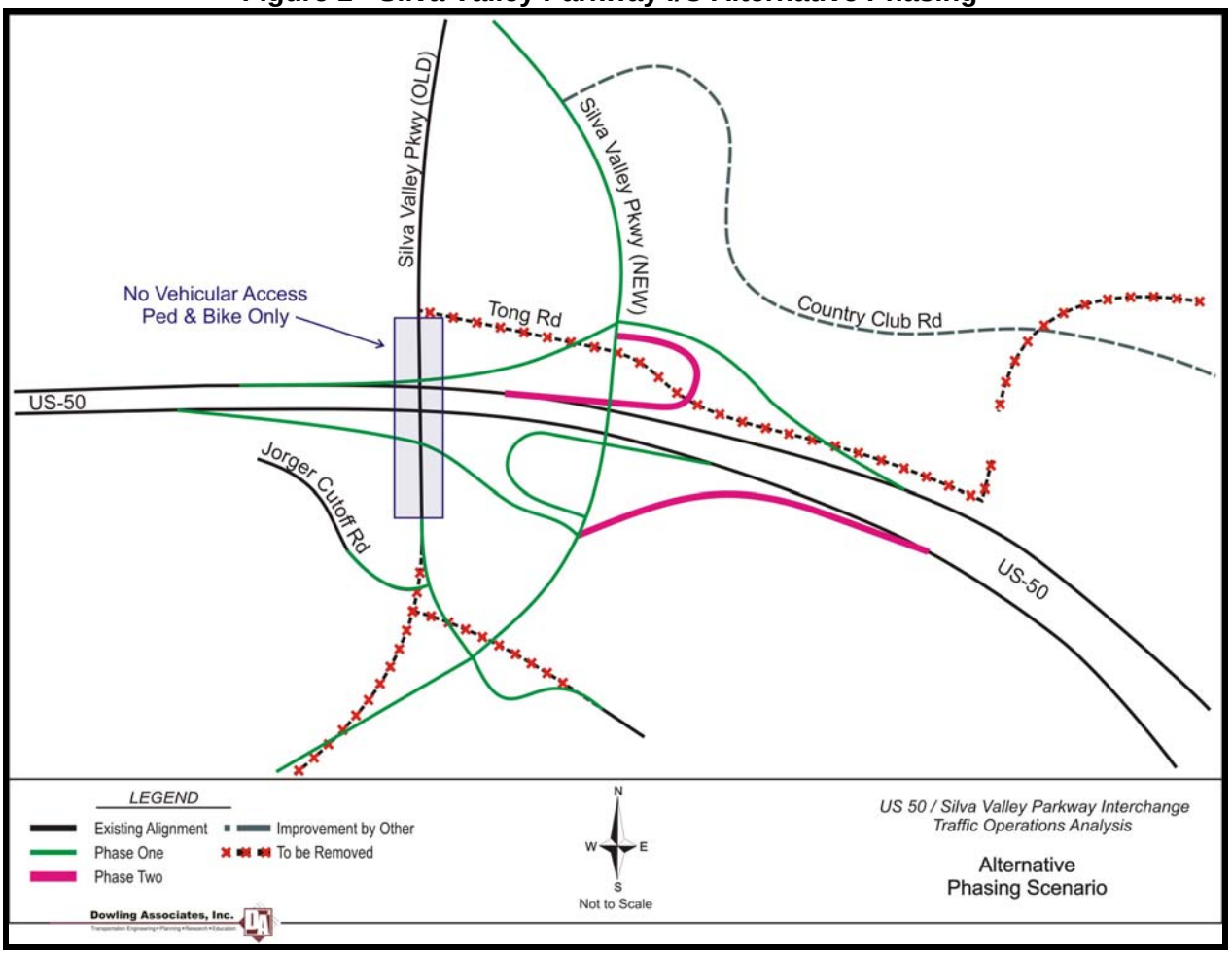


Figure 2 – Future 2020 Volume Diversion

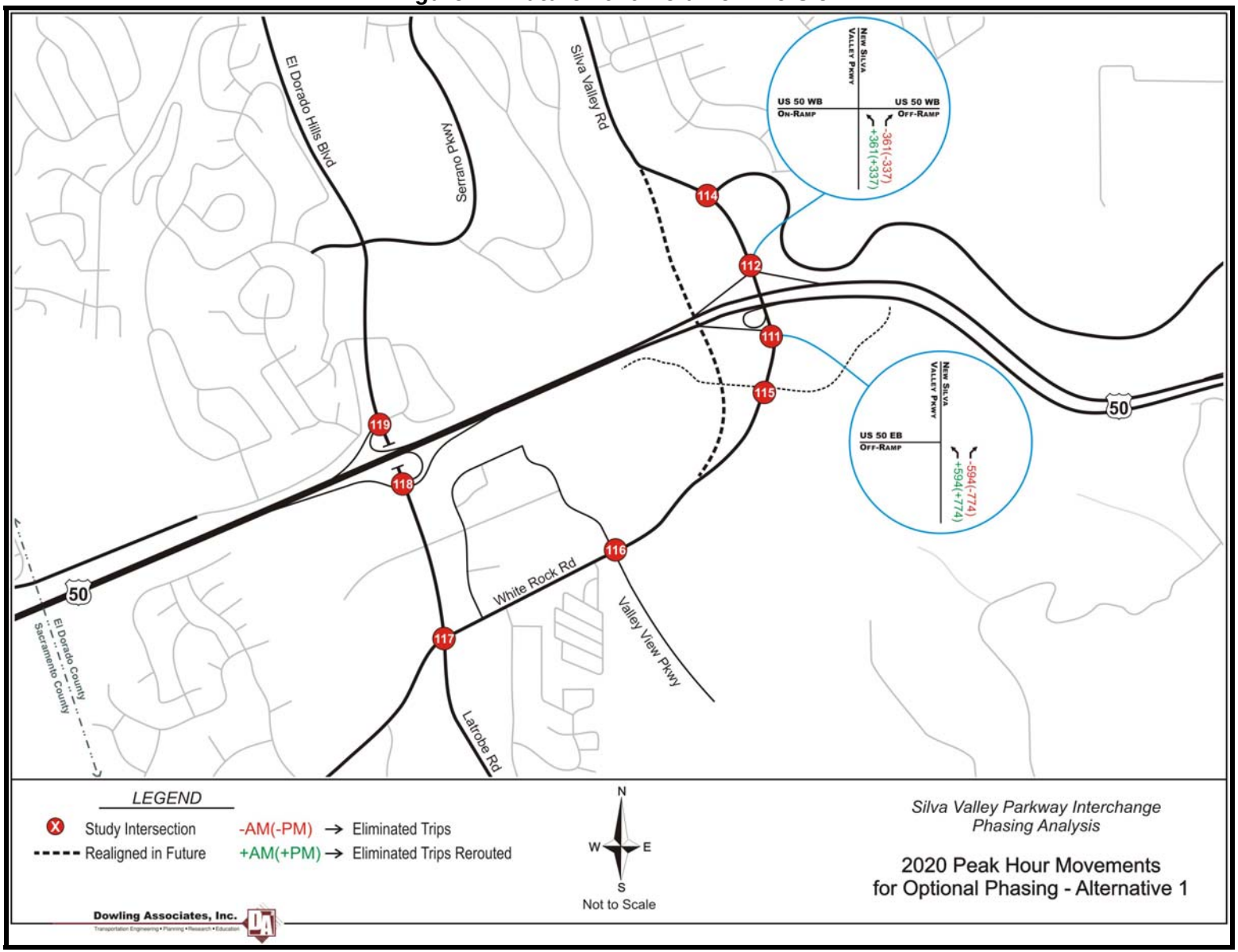


Figure 3 – Future 2030 Volume Diversion

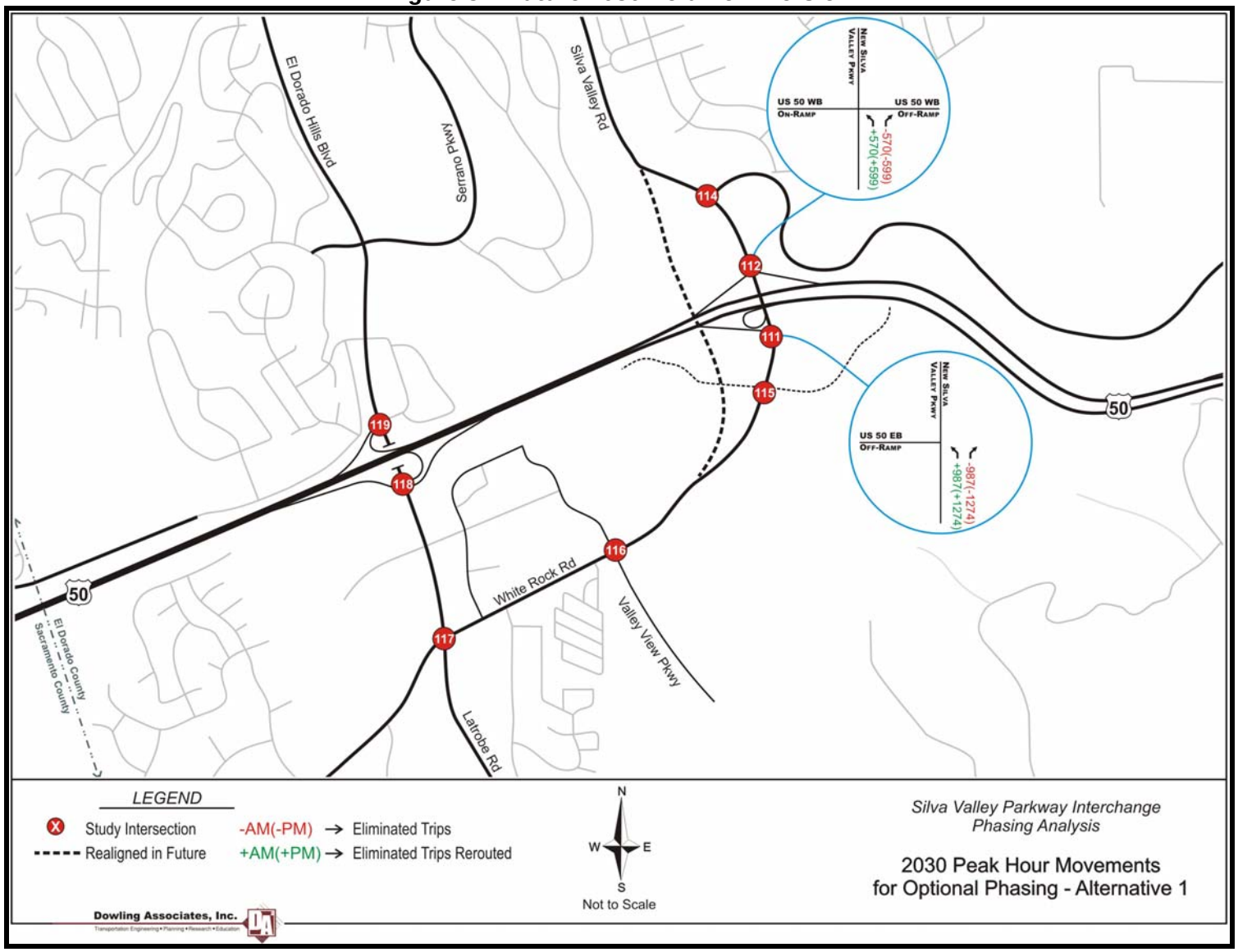


Figure 4 – Future 2020 Intersection and Freeway Volumes

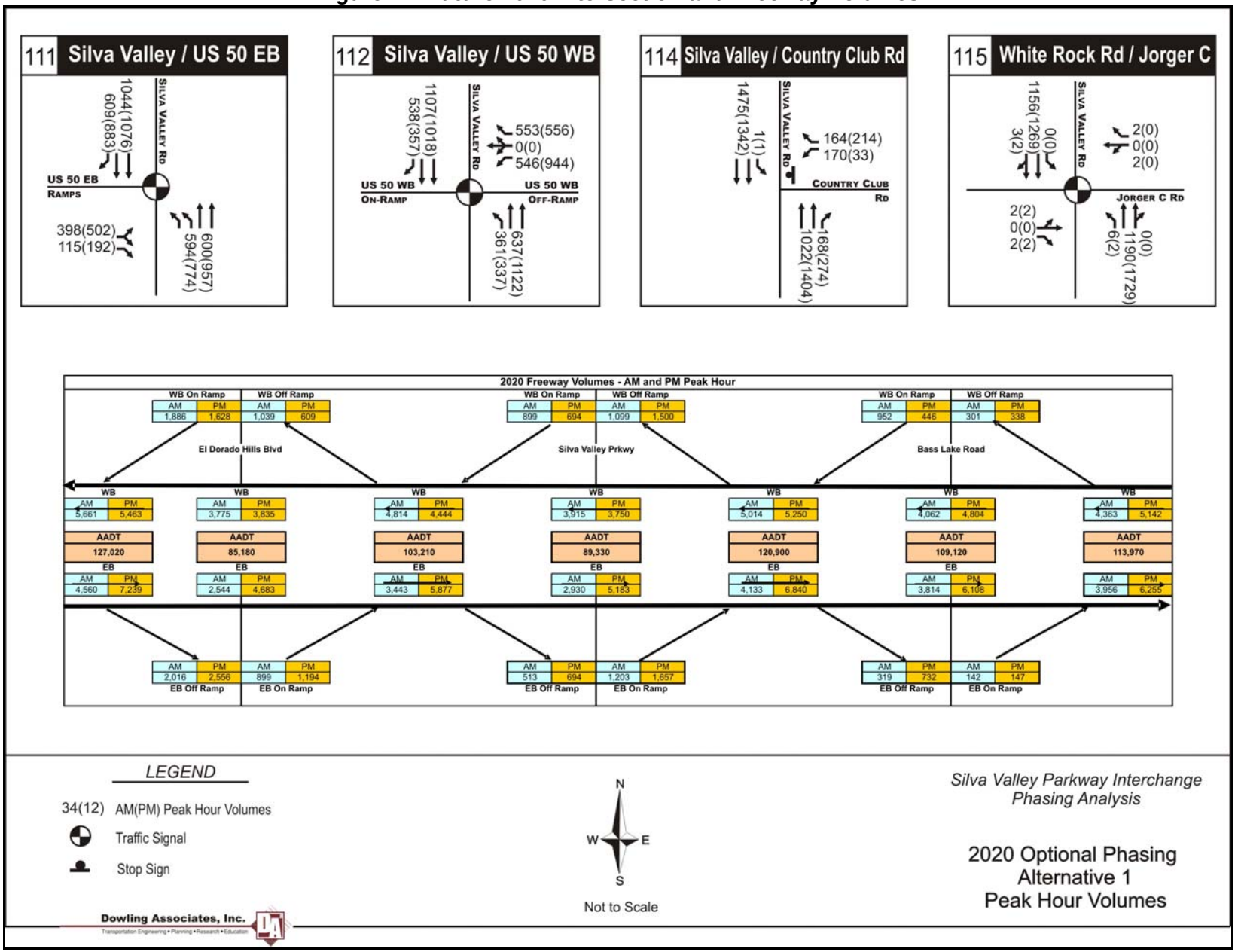
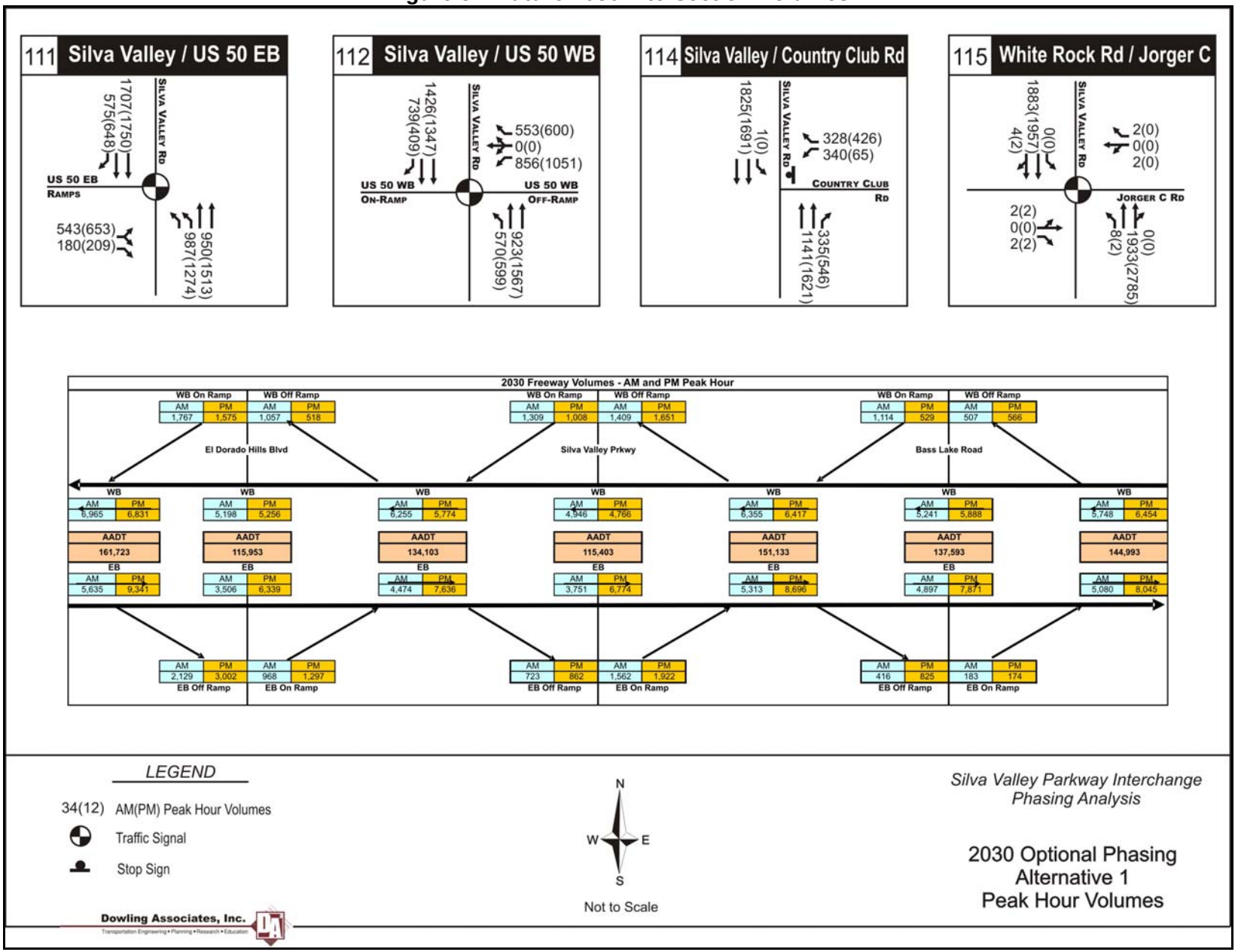


Figure 5 – Future 2030 Intersection Volumes



FUTURE TRAFFIC OPERATIONS ANALYSIS

Generalized operational study methods, analysis criteria and assumptions that will be used for this study are provided in **Table 3** below. These are consistent with those used in the Final Traffic Operations Study for US-50 Silva Valley Interchange (Dowling Associates, June 1, 2009).

It should be noted that for state controlled intersections – the Caltrans LOS criteria will be applied to each individual movement. For locally controlled intersection facilities – local agency LOS criteria applies to the intersection as a whole.

Table 3. Operational Analysis Parameters

Operational Analysis Parameter	Silva Valley Parkway Traffic Study TO-2
Analysis Years	2020, 2030
Criteria Significance Local Jurisdiction	LOS E
Criteria Significance State Jurisdiction	LOS D
Travel Demand Model (Primary)	El Dorado DOT Model
US 50 Study Limits	w/o Silva Valley I/C & e/o Silva Valley I/C
Scenarios	Build - Alternative Phasing
Segment Analysis Type	Annual Average Daily Traffic
Intersection Analysis Type	AM & PM Peak Hour
Intersection Operational Analysis	HCM Operational Method
Operational Software Intersections	SYNCHRO-7
Operational Software Freeway Segment	HCM 2000 - HCS Spreadsheets
Operational Software Ramp Merge-Diverge	HCM 2000 - HCS Spreadsheets
Operational Software Weave	HCM 2000
# Intersections	4
	US 50 EB Ramps/Silva Valley Pkwy
	US 50 WB Ramps/Silva Valley Pkwy
	Silva Valley Pkwy/Country Club Drive
	White Rock/Jorger Cutoff

2020 Traffic Operations Analysis

Traffic operations for 2020 AM/PM peak hours were analyzed using the lane geometry assumptions listed under Alternative Phase 1 and turning movement volumes presented in **Figure 3**. The level of service results for 2020 are presented in **Table 4** and detailed LOS worksheets in **Appendix A**.

As shown in **Table 4**, all study intersections are forecast to operate at acceptable LOS D or better and meet the LOS threshold criteria identified in **Table 3**.

Table 4 – 2020 Peak Hour Level of Service

Intersection	AM Peak Hour		PM Peak Hour	
	Delay	LOS	Delay	LOS
Country Club Drive/Silva Valley Pkwy	8.80	C	9.00	A
US 50 WB Ramps/Silva Valley Pkwy	34.90	C	43.60	D
US 50 EB Ramps/Silva Valley Pkwy	22.90	C	48.70	D
White Rock Road/Jorger Cut-Off	0.1	A	0.1	A
Minor approach delay is higher but ignored due to insignificant volumes.				

2030 Traffic Operations Analysis

2030 peak hour traffic operations were analyzed using the turning movement volumes presented in **Figure 4.** The resulting LOS results are presented in **Table 5** and level of service worksheets are presented in **Appendix A**.

Table 5 – 2030 Peak Hour Level of Service

Intersection	AM Peak Hour		PM Peak Hour	
	Delay	LOS	Delay	LOS
Country Club Drive/Silva Valley Pkwy	22.9	C	27.5	C
US 50 WB Ramps/Silva Valley Pkwy	98.8	**F**	112.5	**F**
US 50 EB Ramps/Silva Valley Pkwy	118.1	**F**	172.1	**F**
White Rock Road/Jorger Cut-Off	2.6	A*	8.4	A*
Minor approach delay is higher but ignored due to insignificant volumes.				

As shown in **Table 5**, US 50 WB Ramp/Silva Valley Pkwy and US 50 EB Ramps/Silva Valley Pkwy are forecast to operate at unacceptable LOS F.

MITIGATIONS

Year 2020

All study intersections are forecast to operate at acceptable LOS. Therefore no mitigation measures are required for 2020 alternative phasing of Silva Valley Interchange.

Year 2030

Recommended mitigation measure for mitigating the intersections of US 50 EB and WB Ramps with Silva Valley Pkwy is to build a Type L-9 interchange, which includes a diagonal EB On-ramp and Loop WB On Ramp. This configuration was analyzed as a full buildout configuration in Final Silva Valley Interchange PSR (June 2009, Dowling Associates) and is forecast to operate at acceptable LOS C or better as shown in **Table 6**.

Table 6 – Mitigated Level of Service

Intersection	2020 Mitigated LOS				2030 Mitigated LOS			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
US 50 WB Ramps/Silva Valley Pkwy	---	---	---	---	15	B	27	**B**
US 50 EB Ramps/Silva Valley Pkwy	---	---	---	---	12	B	24	**B**
**** Worst approach delay reported. Significant but unavoidable impact***								

2020 FREEWAY OPERATIONS AND RAMP DESIGN RECOMMENDATION

Ultimate configuration for Silva Valley Interchange is assumed to be Partial Clover Leaf "Type A" or Type L-9, as defined in California Highway Design Manual. EB access to US 50 will be provided by building an EB Loop on-ramp for SB Silva Valley Pkwy traffic and EB Diagonal on-ramp for NB Silva Valley Pkwy traffic. The final report for Silva Valley Interchange PSR analyzed the merge-diverge operations on the freeway. This memo analyzes and provides recommendation on selecting the most operationally efficient alternative from the following two alternatives

Merge Alternative 1 – EB Loop on-ramp merges first with EB US 50. Approximately 1,000 feet downstream EB Diagonal on-ramp merges with EB US 50.

Merge Alternative 2 – EB Loop on-ramp merges with EB Diagonal on-ramp. The combined EB on-ramp thereafter merges with EB US 50, approximately 1,000 feet from Silva Valley Pkwy Overcrossing.

To analyze the freeway operations for these two merge alternatives, HCM 2000 methodology was used. Results of this analysis are presented in **Table 7** and worksheets are provided in **Appendix B**.

Table 7 – Merge Analysis at Silva Valley Interchange EB On-ramp

Scenario	2020			
	AM Peak		PM Peak	
	Density	LOS	Density	LOS
Silva Valley EB Loop On	19.3	B	30.8	D
Silva Valley EB Diagonal On	21.7	C	33.7	D
Silva Valley EB Loop-Diagonal Merged	23.8	C	36.6	**E***
* **Bolded** letter indicates LOS threshold exceeded.				

Based on the 2020 operational analysis results presented above, building a EB Loop on-ramp and EB Diagonal on-ramp that merge separately with EB US 50 is recommended.

Freeway operations at merging locations are 'generally' affected by the interaction of vehicles in the outer two lanes of Freeway and the On Ramp volumes. Given that there are no off-ramps within 1 mile of the EB on-ramps, there is no weaving maneuver and therefore the volumes from the upstream loop on-ramp are expected to begin maneuvering to the inner lanes before the Diagonal on-ramp merges with US 50.

The separate merging of on-ramp reduces the flow rate intensity of the merge by splitting up this demand into two merge platoons at separate locations. This reduces the merging density, providing for better freeway traffic operations. With the increase in volumes beyond 2020, merge alternative 2 is expected to experience even greater operational deficiency given the combined impact of a single merge point with heavy volumes on the freeway.

Therefore, separate merging of US 50 EB Loop on-ramp and US 50 EB Diagonal on-ramp at Silva Valley Pkwy is recommended.

CONCLUSION

Traffic Operations analysis for intersection and freeway with the alternative phasing assumption for Silva Valley Interchange in this memo concludes the following

1. Intersection operation analysis indicates a forecast deficiency at the US 50 Ramps and Silva Valley Pkwy in 2030 with optional phasing alternative 1 (no EB Diagonal on-ramp and WB Loop on-ramp). The recommended mitigation measure is to build a Partial Clover Leaf “Type A” (Parclo A) or Type L-9 (as defined in the Highway Design Manual)
2. Merging of EB on-ramp – For a Parclo “A” type interchange, Dowling Associates Inc recommends merging the EB Loop on-ramp before merging Diagonal EB on-ramp with EB US 50. This design will provide greater operational efficiency on the freeway.