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August 2011

PROJECT STUDY REPORT

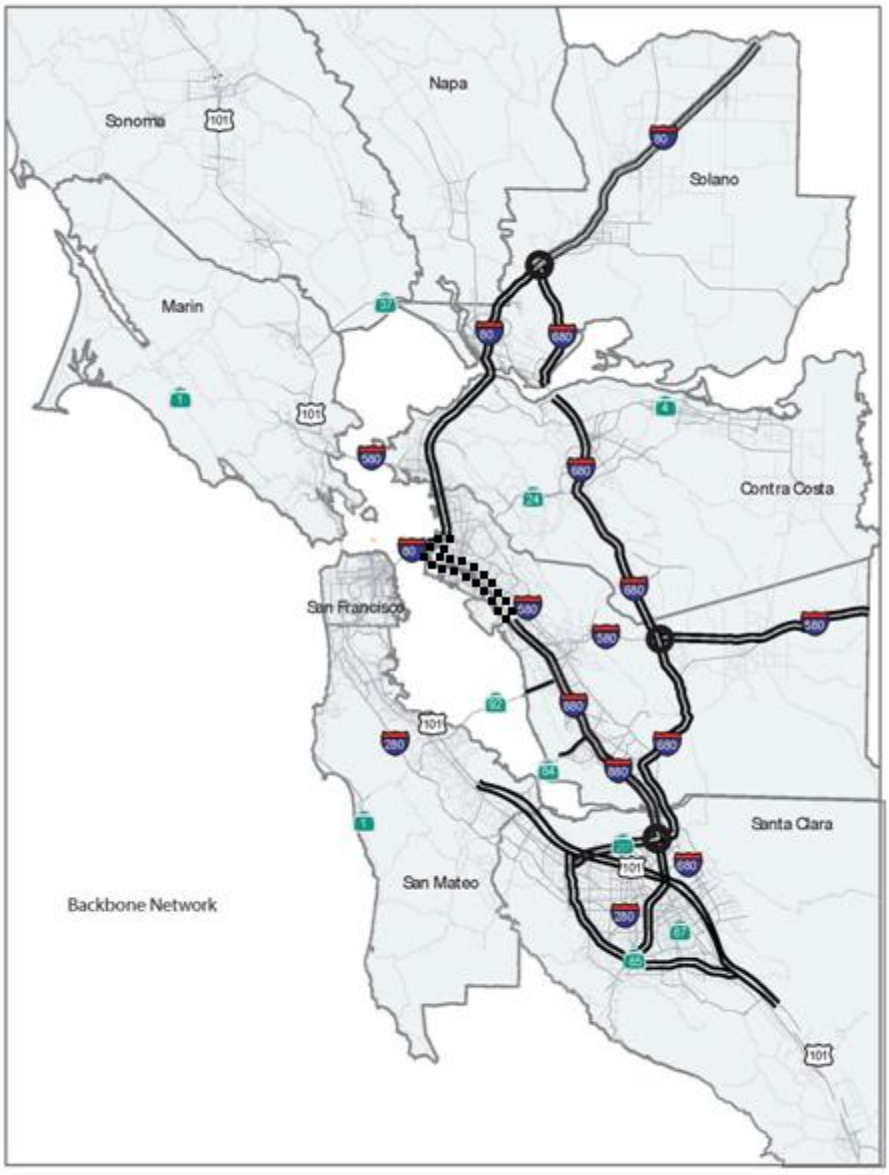
To
Support the Bay Area
Express Lane Backbone Network

On Various Bay Area Routes in Alameda, Contra Costa, Napa, San Mateo, Santa Clara and Solano Counties

APPROVAL RECOMMENDED: _____
PROJECT MANAGER

APPROVED: _____ _____
DISTRICT DIRECTOR *DATE*

9-2-11



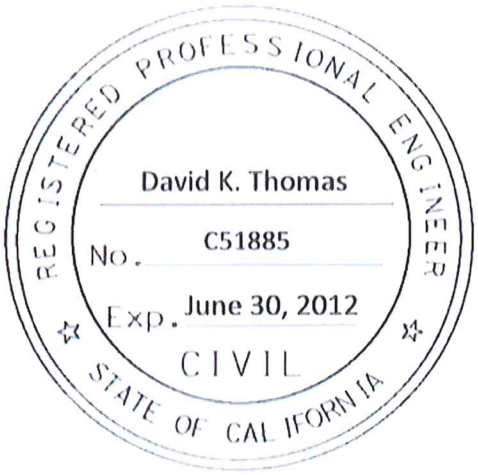
VICINITY MAP

On Various Bay Area Routes in Alameda, Contra Costa, Napa, San Mateo, Santa Clara and Solano Counties

This Project Study Report has been prepared under the direction of the following Registered Engineer. The registered civil engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

David K. Thomas
REGISTERED CIVIL ENGINEER

8/29/11
DATE



Reviewed by:

PATRICK K. PANG, Advanced Planning Office Chief

8/29/11
DATE

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1. INTRODUCTION

The Metropolitan Transportation Commission (MTC) and the California Department of Transportation (Caltrans) are pursuing development of an integrated Bay Area express lane network to enhance mobility and afford greater user flexibility of the transportation network within the San Francisco Bay Area. The Express Lanes allow single occupancy vehicles to use the carpool lanes by paying a toll, adjusted dynamically based on congestion.

The project will consist of an approximately 533-mile "backbone" network representing a subset of the full 800-mile network commitment included in MTC's long-range *Transportation 2035 Plan*. This report addresses only the 533-mile backbone network; remaining portions of the full 800-mile network may be developed under one or more separate projects. It is also noted that the 533-mile backbone network is the maximum extent for which MTC will request CTC approval; the express lane network for which MTC seeks authority from the CTC to implement may be smaller than the backbone network described in this PSR. A portion of the proposed backbone network already has prior statutory authority under AB 2032 (2004). Existing and planned carpool lanes will be converted to or constructed as express lanes. The express lanes will generate toll revenues to help finance completion of the carpool/express lane system. A summary breakdown of the proposed types of improvements to implement the backbone network is presented in **Table 1**.

Table 1: Summary of Proposed Express Lane Improvements

	Directional miles	**Total lane-miles (including dual lanes)**
Total Backbone Miles	**533.0**	**651.4**
Conversion	312.2	312.2
New lanes	188.0	298.1
Express lanes existing or under development	32.8	41.1
Authorized	246.0	364.4
New Authority	287.0	287.0
New Authority (beyond "backbone")	24.2	24.2

This report does not detail individual projects proposed within the overall network plan, but identifies general configurations, costs, and impacts along specified corridors and within major subareas. A summary of the express lane projects that comprise the network is included in **Attachment 1**. Individual projects will be subsequently programmed through a Project Study Report, Project Report or Project Study Report/Project Report as appropriate to the specific scope.

2. BACKGROUND

PREDECESSOR STUDIES

This Project Study Report (PSR) follows several planning studies by MTC relative to implementation of a Bay Area express lane network. Prominent among previous studies and reports is the *Transportation 2035 Plan*. That report puts forth a comprehensive 25-year, multi-modal transportation plan for the MTC's nine-county planning area, including the recommendation of an ultimate 800-mile express lane network.

Concurrent with preparation of the *Transportation 2035 Plan*, MTC has sponsored a Regional High Occupancy Toll (HOT) Lanes Network Feasibility Study. That study, completed in February 2009, examined the following main issues:

- Preliminary basic cost estimates for the HOT (Express) lane network
- Express lane revenue projection estimates (updated in 2011 to reflect current economic conditions)
- Establishment of design standards guidance for the express lane network
- Focused study of five express lane segments to represent a range of operational, geographic, infrastructure and socio-economic conditions

All aspects of the studies have been performed in partnership between MTC as the sponsor and Caltrans as the owner/operator of the State Highway System. Significant contributions to the study efforts have also come from the California Highway Patrol (CHP) and various county Congestion Management Agencies (CMAs) within the Bay Area to outline an approach to implementing and operating the regional network.

Numerous other planning studies and documents are relevant to the project and will be discussed under Section 5, CORRIDOR AND SYSTEM COORDINATION. Two reports of particular significance include the *2002 High-Occupancy-Vehicle (HOV) Lane Master Plan Update for the San Francisco Bay Area* (though largely superseded now by the Regional HOT Lanes Feasibility Study) and the *I-680 Investment Options Study*, 2003 which was prepared under the auspices of the Contra Costa Transportation Authority (CCTA). The report did not discount the HOT lane as a viable option, but viewed it somewhat unfavorably due to its lack of integration (at that time) into a regional network.

ENABLING LEGISLATION

California Streets and Highways Code Section 149.7 (enacted under AB 1467, 2006), allows the California Transportation Commission (CTC) to authorize, until December 31, 2011, two express lane facilities in Northern California. The CTC's Guidelines require that a PSR be included with the sponsor's application to the CTC. The backbone express lane network as a whole is defined as a single system which can be implemented as one or more projects as defined under AB 1467. Most recently, AB 1105 (2012, Chaptered 7/25/2011) authorized 13.2 directional-miles of express lane on US 101 in San Mateo County.

The express lane network for which MTC seeks authority from the CTC to implement may be smaller than the backbone network described in this PSR.

IMPLEMENTATION PROJECTS

The regional express lane backbone network has been divided into 33 specific segments for implementation, as depicted in the study area map shown in **Attachment 1**. Project locations, limits and scope are listed in Section **6, Alternatives**, of this report. Future implementation of each of these systems will be preceded by an appropriate programming document.

PROJECT SPONSORS

MTC is the primary project sponsor. Caltrans is a participating partner in the network studies and is the approving authority for this PSR. Additional participants include the several county CMAs, Alameda County CMA, Contra Costa Transportation Authority, Napa County Transportation and Planning Agency, City/County Association of Governments of San Mateo County, Santa Clara Valley Transportation Authority and Solano Transportation Authority. The CHP is also a participating agency on the project.

PREVIOUS IMPLEMENTATION COMMITMENTS

Several related projects have already been initiated within the project study area and are at various stages in the project development process.

AB 2032, 2004, authorized two Bay Area Express lane demonstration projects in Alameda County and two in Santa Clara County. AB 574, 2007, amended the initial legislation to remove the four-year limitation on toll operations. Details of authorized projects included in the backbone network are provided in Table 2 below. Although MTC will only be seeking CTC authority for implementation of projects that have not been authorized under previous legislation, these authorized projects are included in this PSR because they will operate as part of the express lane network.

Table 2: Authorized Projects in Express Lane Backbone Network

County	Corridor	Directional Miles
Alameda	I-580 from SJQ County Line to I-680 IC (including I-580/I-680 direct connectors)	43.7 miles
Alameda	I-680 from CC County Line to SCL County Line	43.0 miles
Santa Clara County	I-680 from ALA County Line to SR-237	4.6 miles
Santa Clara County	US-101 from SM County Line to Cochrane (including US-101/SR-85 direct connectors)	74.2 miles
Santa Clara County	SR-85 from US-101N IC to US-101S IC	48.0 miles
Santa Clara County	SR-237 from I-880 IC to SR-85 IC (including SR-237/I-880 direct connectors)	19.4 miles
San Mateo County	US-101 from SCL County Line to Whipple	13.2 miles

- The first express lane in the region was opened on September 20, 2010 on a 14-mile segment of southbound Interstate 680 in Alameda and Santa Clara counties over the Sunol grade between SR-84 and SR-237. The project was developed by the Sunol Smart Carpool Lane Joint Powers Authority (SSCLJPA).
- The Alameda County Transportation Commission (ACTC) is developing express lanes on I-580 as the second Alameda County project. Plans call for an 11-mile eastbound express lane from east of the I-580/I-680 interchange to the Altamont Pass, expected to begin construction in 2012 and be open in 2014. The 13-mile westbound express lane is planned from the Altamont Pass to west of the I-580/I-680 interchange, with construction expected to begin in 2013 and to be open in 2014.
- The Santa Clara Valley Transportation Authority (VTA) is planning to develop and operate an express lane program on two corridors. VTA has conducted a feasibility study for the introduction of express lanes in Santa Clara County, with the original plan to implement the lanes on portions of SR-85 and US-101. The PSR for that project, 04-4A790K, was approved on 10/28/10. The VTA board subsequently approved the development of express lanes on the SR-237/I-880 HOV connector, due to be completed in early 2012. Santa Clara County also has statutory authority to implement an additional 36 directional miles of express lanes on US-101 between Cochrane Road and the San Benito County line, which are not included in the backbone network.

SB 4X, 2009, sets forth contracting options (such as Design-Build) and other provisions that may be relevant to the express lane network.

3. PURPOSE AND NEED

NEED

- Significant congestion currently exists in the general purpose lanes during peak hours on Bay Area freeway corridors within the backbone network. This level of congestion will continue to get worse as traffic demand increases in the future.
- The existing HOV lane system is characterized by gaps, limiting travel time savings and trip reliability.
- Available unused capacity in the existing HOV lane system needs to be utilized to enhance transportation system efficiency.
- There is limited funding available to close gaps in existing HOV lane system.

PURPOSE

- Optimize capacity in the existing Bay Area freeway corridors to better meet current and future traffic demands.
- Close the gaps within the existing HOV lane system to increase travel time savings and reliability for HOVs and buses. Maximize the efficiency of freeway facilities by better utilizing available unused capacity in the existing HOV lane system.

- Provide a funding mechanism to accelerate closure of gaps in HOV lanes and to complete the network sooner.

4. DEFICIENCIES

Significant daily congestion currently exists on freeways corridors within the express lanes network study limits and will continue to increase with future traffic growth. As this is a programmatic document, a high level, qualitative traffic assessment was conducted. Studies will be performed in subsequent phases of the project delivery process for individual projects. Those studies will be conducted in accordance with Caltrans Traffic Operations Policy Directive (TOPD) No. 11-02, "Updated Managed Lane Design". Existing conditions are evaluated based on bottleneck locations, congestion levels resulting from these bottlenecks, HOV lane system utilization, express transit service and accidents.

BOTTLENECK EVALUATION

Details of existing bottleneck locations for each corridor within the express lanes network study limits are shown in **Attachment 3**. Bottlenecks were identified from speed profiles conducted by Caltrans District 4 in 2007. The 2007 District 4 *State of the System Report* was used to identify the extent and quantify the amount of congestion resulting from the bottlenecks. This report was prepared through a collaborative effort between District 4 and the Metropolitan Transportation Commission and includes a listing of congested segments throughout District 4, congestion occurrence periods, as well as quantifiable weekday daily delay that travelers experienced. The deficiency analysis is based on 2007 conditions as those represent high levels of congestion and represent the most recent complete set of data throughout the Bay Area.

Several HOV lane improvement projects have been implemented over portions of the network since the 2007 data were compiled and those improvements may have resulted in operating conditions that differ from those reported in **Attachment 3**. The specific project limits of these improvements are listed in **Table 3.**

Table 3: HOV/Express Lane Projects Implemented Since 2007

Route	County(s)	Post Miles	Location (HOV lanes except as noted)	Direction
I-80	Solano	19.2 to R11.4	Airbase Pkwy to Redtop Rd	EB/WB
I-80	Contra Costa	12.8 to 10.1	Cummings Skyway to SR-4 IC	EB
I-680	Alameda/ Santa Clara	R11.8 (ALA) to M7.7 (SCL)	SR-84 IC to SR-237 IC, HOV lane converted to Express lane	SB
I-580	Alameda	18.8 to R8.3	Hacienda to Greenville	EB
I-880	Alameda	R2.0 to 0.0	Mission Blvd to SCL/ALA Co. line	NB/SB
SR-84	Alameda	R4.9 to R6.0	Newark Blvd to I-880 IC	WB

In addition to bottleneck locations, weekday daily delay associated with the respective bottlenecks is also presented in **Attachment 3** for the directional corridors. Delay is an effective measure in quantifying congestion levels caused by the presence of bottlenecks throughout the Bay Area. Each of the corridors included in the Express Lanes Network experience recurrent peak period delays. Several peak period bottlenecks often develop on

some corridors with large delays and delays for these bottlenecks have been combined and reported in terms of overall peak period delay for the corridor. The corridor delays presented in **Attachment 3** demonstrate that recurrent congestion exists throughout the Express Lanes Network and many of the corridors experience significant delays. In addition, some corridors experience congestion during both peak periods in the same direction.

HIGH OCCUPANCY VEHICLE LANE SUMMARY

The most recent comprehensive HOV data for the Bay Area has been extracted from the annual HOV report, *2009 Bay Area HOV Lanes* (refer to **Figure 1**), and summarized throughout the express lanes network study limits in **Table 4**. The report does not include summaries for all HOV lane segments within the express lanes network study limits, specifically for some corridors in the off-peak direction of commute traffic activity, and these segments are noted in **Table 4** with an 'N/A'.

The existing HOV lane network has available unused capacity in many corridors. Express lanes would allow traffic to shift into the Express Lane network so the capacity would be used. The overall corridor mobility within these corridors would therefore improve. This shift would reduce demand for mixed-flow lane capacity at bottleneck locations which reduces bottleneck related congestion and provides vehicles that shift a shorter and more reliable travel time. Only one HOV lane segment currently operates at or near the defined 1650 vehicles per hour per lane capacity. This is I-80 westbound from the Contra Costa County Line to Powell Street in Emeryville. The HOV lane usage translates into an average overall network utilization of approximately 58% during the A.M. peak hour and 50% during the P.M. peak hour. Based on the existing HOV lane utilization rates, excess capacity exists that could be more efficiently managed through express lane operations by allowing general purpose traffic to shift into the HOV/express lane for a price to obtain a more reliable and shorter travel time.

The express lanes can also serve as a "safety valve" for non-peak hour, non-recurrent congestion that arises from incidents or special activities (e.g., a concert or sporting event). In this situation, the lanes provide a parallel alternate route; whereas other alternate routes may exact a significant time penalty at no cost, the express lane offers a minimal delay alternative for a nominal cost. This can be a very real benefit for the user with a specific instance time constraint when faced with an unexpected delay. The very existence of the option can be a comforting incentive to the occasional user and provides a real as well as perceived improvement in system reliability.

Figure 1 – HOV System

Table 4: Existing Peak Hour Conditions HOV Lane Utilization

Freeway Segments	Post Miles (From/To)	AM Peak Hour				PM Peak Hour			
		Vehicles	Persons	Occupancy Rate (per/veh)	% Utilization	Vehicles	Persons	Occupancy Rate (per/veh)	% Utilization
I-680 Northbound									
Alcosta Blvd to Livorna Rd	R0.0/R11.3	1,018	2,410	2.4	61.7	1,034	2,465	2.4	62.7
SR-242 to Marina Vista I/C	R18.7/24.3	172	491	2.9	10.4	1,129	2,421	2.1	68.4
N/O Marina Vista I/C to Benicia Bridge Toll	24.3/25.5	119	285	2.4	7.2	276	721	2.6	16.7
I-680 Southbound									
Marina Vista I/C to N/O North Main St	24.3/15.6	N/A	N/A	N/A	-	396	811	2.0	24.0
Livorna Rd to Alcosta Blvd	R11.3/R0.0	853	1,853	2.2	51.7	694	1,889	2.7	42.1
SR-84 to ALA/SCL County Line*	R11.9/M0.0	1,090	2,103	1.9	66.1	315	637	2.0	19.1
Alameda County Line to SR 237*	M9.9/M7.7	501	1,086	2.2	30.4	303	622	2.1	18.4
I-580 Eastbound									
N Livermore Ave to W/O Greenville Rd	12.5/R7.7	N/A	N/A	N/A	-	524	1,235	1.2	31.8
SR-92 Westbound									
Hesperian Blvd to San Mateo Bridge Toll	R5.8/R2.6	1,050	2,184	2.1	63.6	475	1,279	2.7	28.8
SR-84 Westbound									
I-880 to Dumbarton Bridge Toll	R6.0/R3.2	1,196	2,826	2.4	72.5	375	1,011	2.7	22.7
SR-237 Eastbound									
Mathilda Ave to SR-880/237 I/C	3.0/9.3	N/A	N/A	N/A	-	669	1,531	2.3	40.5
SR-237 Westbound									
I-880/237 I/C to Mathilda Ave	9.3/3.0	936	2,231	2.4	56.7	518	1,030	2.0	31.4
SR-85 Northbound									
US-101 to Almaden Expwy	0.0/6.1	640	1,299	2.0	38.8	N/A	N/A	N/A	-
Almaden Expwy to I-280	6.1/R18.5	1,118	2,336	2.1	67.8	N/A	N/A	N/A	-
I-280 to US-101	R18.5/R23.9	947	2,060	2.2	57.4	N/A	N/A	N/A	-
SR-85 Southbound									
US-101 to I-280	R23.9/R18.5	N/A	N/A	N/A	-	1,095	2,164	2.0	66.4
I-280 to Almaden Expwy	R18.5/6.1	N/A	N/A	N/A	-	1,202	2,525	2.1	72.8
Almaden Expwy to US-101	6.1/0.0	N/A	N/A	N/A	-	824	1,609	2.0	49.9
I-880 Northbound									
Santa Clara County Line to Whipple Rd	0.0/13.7	424	898	2.1	25.7	1,077	2,384	2.2	65.3
Whipple Rd to South of SR-238	13.7/20.7	1,182	2,818	2.4	71.6	1,363	3,345	2.5	82.6
14th St to SFOBB Toll Plaza	R34.0/2.0 (I-80)	856	3,117	3.6	51.9	N/A	N/A	N/A	-
I-880 Southbound									
Marina Blvd to Whipple Rd	22.8/13.7	1,276	2,501	2.0	77.3	1,002	2,631	2.6	60.7
Whipple Rd to Santa Clara County Line	13.7/0.0	784	1,873	2.4	47.5	1,070	2,131	2.0	64.8
I-80 Eastbound									
I-880 to Contra Costa County Line	2.3/8.0	N/A	N/A	N/A	-	1,123	3,976	3.5	68.1
Alameda County Line to SR-4	0.0/10.1	N/A	N/A	N/A	-	1,006	3,796	3.8	61.0
I-80 Westbound									
Powell St to SFOBB (HOV Flyover)	3.8/3.7	1,445	4,593	3.2	87.6	495	1,670	3.4	30.0
Contra Costa County Line to Powell St	0.0/3.8	1,668	4,950	3.0	101.1	N/A	N/A	N/A	-
Solano County Line to SR-4	14.1/10.1	901	3,120	3.5	54.6	N/A	N/A	N/A	-
SR-4 to Alameda County Line	10.1/0.0	1,262	4,846	3.8	76.5	N/A	N/A	N/A	-
SR-101 Northbound									
Cochrane Rd to Bernal Rd	R17.8/R26.8	943	2,014	2.1	57.2	N/A	N/A	N/A	-
Bernal Rd to I-280/I-680	R26.8/34.9	734	1,697	2.3	44.5	N/A	N/A	N/A	-
I-280/I-680 to Guadalupe Pkwy	34.9/39.9	1,230	2,492	2.0	74.5	N/A	N/A	N/A	-
Guadalupe Pkwy to Ellis St	39.9/47.0	967	2,081	2.2	58.6	N/A	N/A	N/A	-
Ellis St to SCL/SM County Line	47.0/52.6	895	1,784	2.0	54.2	791	1,746	2.2	47.9
SM/SCL County Line to Whipple Ave	0.0/6.6	1,125	2,300	2.0	68.2	785	1,961	2.5	47.6
SR-101 Southbound									
Whipple Ave to SM/SCL County Line	6.6/0.0	613	1,546	2.5	37.2	897	1,885	2.1	54.4
SM/SCL County Line to Ellis St	52.6/47.0	1,036	2,762	2.7	62.8	1,142	2,439	2.1	69.2
Ellis St to Guadalupe Pkwy	47.0/39.9	N/A	N/A	N/A	-	1,021	2,287	2.2	61.9
Guadalupe Pkwy to I -280/I-680	39.9/34.9	N/A	N/A	N/A	-	897	1,904	2.1	54.4
I-280/I-680 to Bernal Rd	34.9/R26.8	N/A	N/A	N/A	-	652	1,459	2.2	39.5
Bernal Rd to Cochrane Rd	R26.8/R17.8	N/A	N/A	N/A	-	840	1,724	2.1	50.9

*Table based on 2009 data, existing express lane now operational.

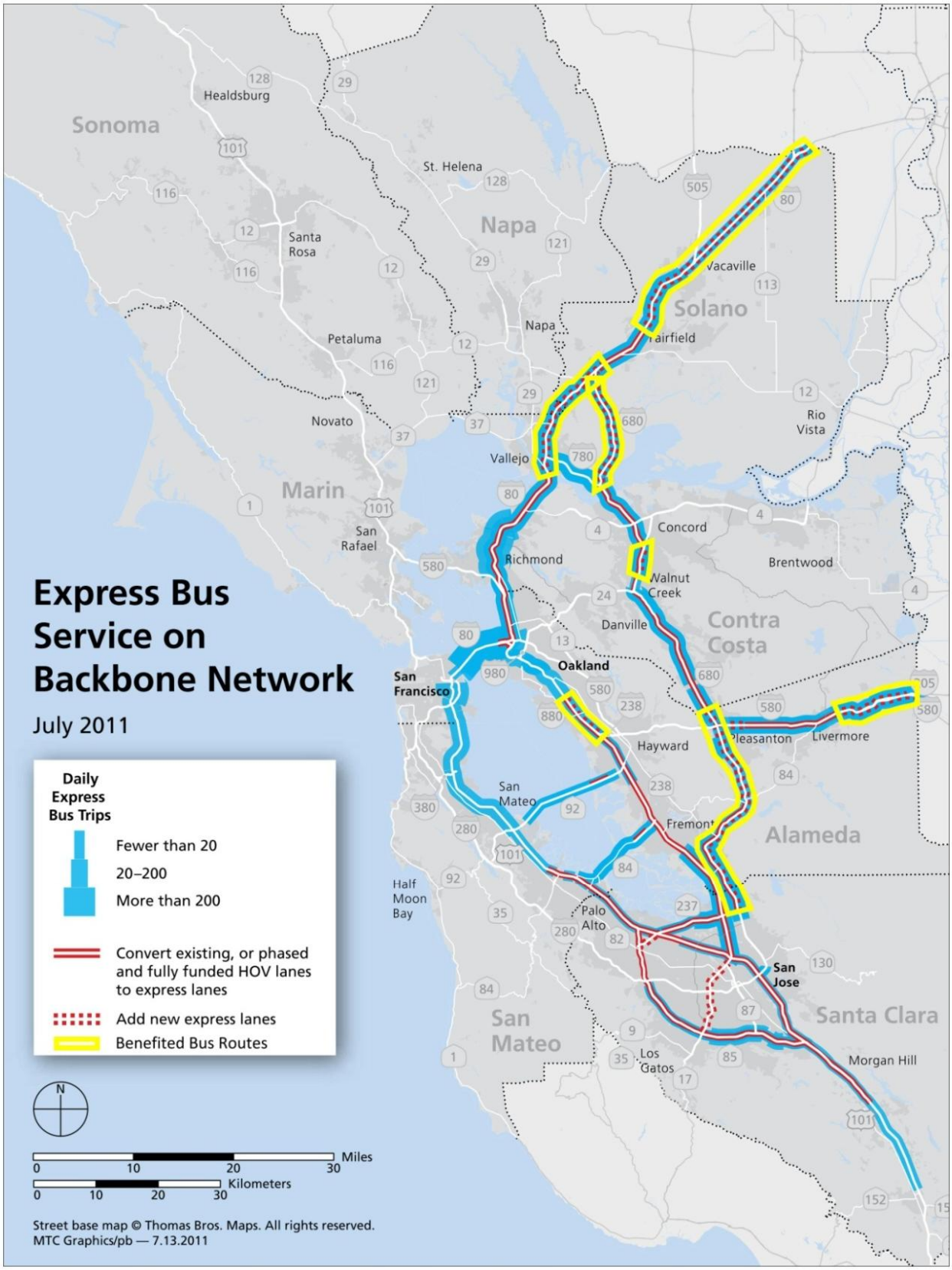
EXPRESS BUS TRANSIT SUMMARY

Transit benefits are expected as a result of closing gaps in the current HOV system. Travel time savings associated with express bus routes that currently experience deteriorated levels of service due to freeway system bottlenecks would be improved with the availability of a continuous HOV facility that could serve as a bypass to bottlenecks. The Bay Area's large population and workforce, much of it commuting during peak periods, constitute a major market for public transportation. Over 20 bus systems serve the region and the region experiences a high mode share for transit work trips. **Figure 2** presents the regional express bus system service levels throughout the express lanes network study limits and identifies current and funded HOV lanes that would be converted to express lanes and the remaining gaps in the regional express lanes network.

Transit agencies currently operate over 100 express bus routes which include freeway bus service, rail feeder services operating express buses to BART and Caltrain stations, and cross-town limited-stop routes. The majority of express bus routes operate primarily during peak periods in the peak direction to serve commuters. Growth in express bus ridership is dependent upon service levels and travel time reliability however, even without HOV improvements that would directly benefit express bus service, demand will continue to increase.

After accounting for current HOV projects that are fully funded through Regional Measure 2, the Corridor Mobility Investment Account, the State Transportation Improvement Program and local sales tax measures, the Bay Area's HOV network will contain gaps that serve existing express bus routes. Due to funding constraints, express lane applications may advance implementation of additional corridor capacity and therefore enhance corridor transit operations. Additional discussion on bus transit benefits of the express lane network is included in the Operational Assessment Summary in Section 6, ***Alternatives***, and in **Attachment 8**, ***Operational Assessment***.

Figure 2 – Bay Area Express Bus System Service Levels



ACCIDENT SUMMARY

Accident data throughout the express lanes network study limits is summarized in **Table 5** for the three year period from October 1, 2006 through September 30, 2009. Accident rates for the mainline segments throughout the network and direct connectors that are proposed to be part of the express lanes network are summarized where data is available. Actual accident rates are compared with the statewide average accident rates for similar facilities.

Table 5: Summary of Express Lanes Network Existing Accident Rates

Project No.	Route	Segment	Accident Number				Actual Accident Rate*			Statewide Average Accident Rate*		
			Total	Fatal	Injury	PDO	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total
Freeway Mainline Segment												
1	I-80E	I-505 to Pedrick Rd	402	8	113	281	0.008	0.12	0.39	0.009	0.27	0.83
1	I-80W	I-505 to Pedrick Rd	425	4	130	291	0.004	0.13	0.41	0.009	0.27	0.83
2	I-80E	Nut Tree Rd to I-505	13	0	6	6	0.000	0.24	0.52	0.009	0.27	0.87
2	I-80W	Nut Tree Rd to I-505	21	0	3	3	0.000	0.12	0.84	0.009	0.27	0.87
2	I-80E	Airbase Pkwy to Nut Tree Rd	437	2	121	314	0.003	0.16	0.57	0.009	0.28	0.89
2	I-80W	Airbase Pkwy to Nut Tree Rd	530	1	165	364	0.001	0.22	0.70	0.009	0.28	0.89
3	I-80E	I-680 to Airbase Pkwy	668	4	217	447	0.006	0.34	1.01	0.010	0.31	1.01
3	I-80W	I-680 to Airbase Pkwy	588	0	172	416	0.000	0.26	0.89	0.100	0.31	1.01
4	I-80E	American Canyon Rd to I-680	230	3	80	147	0.009	0.25	0.70	0.008	0.23	0.70
4	I-80E	SR-37 to American Rd	37	1	15	21	0.013	0.21	0.49	0.007	0.18	0.51
4	I-80W	American Canyon Rd to I-680	234	0	79	155	0.000	0.24	0.71	0.008	0.23	0.70
4	I-80W	SR-37 to American Rd	32	0	12	20	0.000	0.16	0.42	0.007	0.18	0.51
5	I-80E	Carquinez Bridge to SR-37	539	2	156	381	0.004	0.33	1.14	0.010	0.30	0.98
5	I-80W	Carquinez Bridge to SR-37	352	3	115	234	0.006	0.25	0.74	0.010	0.30	0.98
6	I-80E	Carquinez Bridge to SR-4	140	3	48	51	0.013	0.22	0.61	0.009	0.29	0.93
6	I-80W	Carquinez Bridge to SR-4	175	1	65	66	0.004	0.29	0.77	0.009	0.29	0.93
6	I-80E	SR-4 to San Pablo Ave	190	4	68	118	0.015	0.27	0.70	0.009	0.29	0.93
6	I-80W	SR-4 to San Pablo Ave	183	1	66	116	0.004	0.25	0.68	0.009	0.29	0.93
7	I-80E	Central Ave to SR-4	836	6	280	550	0.006	0.27	0.79	0.011	0.34	1.11
7	I-80E	I-580 to Central Ave	863	3	232	628	0.004	0.28	1.03	0.011	0.35	1.14
7	I-80W	Central Ave to SR-4	803	7	243	553	0.007	0.24	0.76	0.011	0.34	1.11
7	I-80W	I-580 to Central Ave	1,793	4	397	1,392	0.005	0.48	2.13	0.011	0.35	1.14
9	I-680N	I-780 to Gold Hill Rd	217	3	69	145	0.006	0.15	0.46	0.011	0.26	0.79
9	I-680S	I-780 to Gold Hill Rd	168	2	51	115	0.004	0.11	0.36	0.011	0.26	0.79
11	I-680N	SR-242 to Marina Vista	436	4	141	291	0.009	0.33	0.98	0.008	0.25	0.80
13	I-680S	SR-242 to Marina Vista	256	2	91	163	0.004	0.21	0.57	0.008	0.25	0.80
11	I-680N	Livorna Rd to Marina Vista	911	3	296	299	0.002	0.23	0.71	0.009	0.29	0.93
13	I-680S	Livorna Rd to Marina Vista	802	4	241	245	0.003	0.19	0.63	0.009	0.29	0.93
14	I-680N	Alcosta Blvd to Livorna Rd	633	1	202	430	0.001	0.20	0.62	0.009	0.29	0.94
14	I-680S	Alcosta Blvd to Livorna Rd	336	6	103	227	0.006	0.11	0.33	0.009	0.29	0.94
15	I-680N	SR-84 to Alcosta Blvd	207	1	74	132	0.001	0.10	0.27	0.011	0.31	0.98
15	I-680S	SR-84 to Alcosta Blvd	262	1	98	163	0.003	0.13	0.35	0.011	0.31	0.98
16	I-680N	Scott Creek Rd to SR-84	391	1	137	253	0.001	0.16	0.45	0.011	0.31	0.98
16	I-680N	Calaveras Rd to Scott Creek Rd	54	1	17	36	0.006	0.11	0.33	0.011	0.33	1.06
17	I-680S	Scott Creek Rd to SR-84	564	4	191	369	0.005	0.22	0.64	0.011	0.31	0.98
17	I-680S	Calaveras Rd to Scott Creek Rd	52	1	15	36	0.006	0.10	0.32	0.011	0.33	1.06
19	I-580W	Greenville Rd to I-205	270	2	84	184	0.005	0.21	0.67	0.006	0.17	0.46
19	I-580E	Greenville Rd to I-205	301	6	117	178	0.015	0.31	0.75	0.006	0.17	0.46
20	I-580E	I-680 to Greenville Rd	815	1	247	567	0.001	0.20	0.66	0.010	0.31	1.00
21	I-580W	I-680 to Greenville Rd	1,426	3	421	1,002	0.002	0.35	1.16	0.010	0.31	1.00

Table 5: Summary of Express Lanes Network Existing Accident Rates (Continued)

Project No.	Route	Segment	Accident Number				Actual Accident Rate*			Statewide Average Accident Rate*		
			Total	Fatal	Injury	PDO	Fatal	Fatal + Injury	Total	Fatal	Fatal + Injury	Total
Freeway Mainline Segment												
22b	I-880N	Marina Blvd to Hegenberger Rd	275	3	73	199	0.010	0.24	0.89	0.011	0.34	1.10
23a	I-880S	Marina Blvd to Hegenberger Rd	206	1	71	134	0.003	0.23	0.66	0.011	0.34	1.10
22a	I-880N	Dixon Landing Rd to Marina Blvd	1,133	5	361	767	0.004	0.29	0.90	0.011	0.33	1.07
23a	I-880S	Dixon Landing Rd to Marina Blvd	1,189	5	380	804	0.004	0.30	0.94	0.011	0.33	1.07
22a	I-880N	SR-237 to Dixon Landing Rd	97	1	22	23	0.005	0.11	0.48	0.014	0.43	1.41
23a	I-880S	SR-237 to Dixon Landing Rd	72	0	18	18	0.000	0.09	0.36	0.014	0.43	1.41
23b	I-880N	US-101 to SR-237	310	2	88	220	0.003	0.16	0.54	0.015	0.48	1.52
23b	I-880S	US-101 to SR-237	390	0	110	280	0.000	0.19	0.68	0.015	0.48	1.52
24	I-880N	I-280 to US-101	241	0	68	173	0.000	0.20	0.70	0.011	0.33	1.08
24	I-880S	I-280 to US-101	297	2	79	216	0.006	0.24	0.87	0.011	0.33	1.08
24	SR-17N	SR-85 to I-280	209	0	55	154	0.000	0.14	0.54	0.010	0.31	1.01
24	SR-17S	SR-85 to I-280	140	1	32	107	0.003	0.09	0.36	0.010	0.31	1.01
26,27	SR-237E	SR-85 to I-880	326	2	78	246	0.004	0.16	0.63	0.012	0.42	1.07
26,27	SR-237W	SR-85 to I-880	367	0	113	254	0.000	0.22	0.71	0.012	0.42	1.07
28	SR-85N	Winchester Blvd to US 101 N IC	376	2	101	103	0.003	0.13	0.49	0.010	0.31	0.99
28	SR-85S	Winchester Blvd to US 101 N IC	385	0	114	114	0.000	0.15	0.50	0.010	0.31	0.99
28	SR-85N	Bernal Rd to Winchester Blvd	359	3	98	258	0.004	0.14	0.51	0.010	0.30	0.96
28	SR-85S	Bernal Rd to Winchester Blvd	367	1	150	216	0.001	0.16	0.52	0.010	0.30	0.96
30	US-101N	Cochrane Rd to Oregon Expressway	792	5	202	585	0.005	0.21	0.79	0.100	0.31	1.00
30	US-101S	Cochrane Rd to Oregon Expressway	676	3	193	480	0.003	0.20	0.68	0.010	0.31	1.00
30	US-101N	Oregon Expy to University Ave	133	0	44	44	0.000	0.28	0.84	0.011	0.34	1.11
30	US-101S	Oregon Expy to University Ave	179	1	49	50	0.006	0.31	1.12	0.011	0.34	1.11
31	US-101N	University Ave to Whipple Ave	478	1	159	318	0.001	0.23	0.69	0.011	0.33	1.07
31	US-101S	University Ave to Whipple Ave	756	2	216	538	0.003	0.31	1.08	0.011	0.33	1.07
32	SR-84W	Toll Plaza to I-880	85	0	24	61	0.000	0.26	0.92	0.008	0.26	0.79
33	SR-92W	San Mateo Bridge to Hesperian Blvd	45	1	12	32	0.007	0.09	0.32	0.012	0.40	1.22
25	-	I-880 NB on from SR-237 EB	5	0	1	4	0.000	0.04	0.19	0.004	0.15	0.45
		SR-237 HOV EB off to I-880 NB	5	0	1	4	0.000	0.10	0.52	0.005	0.20	0.60
		I-880 SB off to SR-237 WB	9	0	3	6	0.000	1.03	3.10	0.005	0.15	0.45
		I-880 HOV SB off to SR-237 WB	4	0	1	3	0.000	0.12	0.48	0.005	0.15	0.45

Denotes total facility accident rate exceeds Statewide average

Source: Caltrans, TASAS Table B - Selective Accident Rate Calculation Report

* Fatal accidents per million vehicle miles travelled for mainline segments, per million vehicles for connector

PDO: Property Damage Only

While some of the observed segment accident rates are higher than Statewide average rates, the majority of corridors experience fewer accidents than Statewide averages. The table also reflects several instances where observed accident rates on connectors exceed Statewide averages. A Traffic Safety Analysis for each of the projects shall be performed per guidelines outlined in the "Traffic Operations Policy Directive No. 11-02" during the next phase of the project development process.

The accident data is for information only at this conceptual stage. Further analysis of the available accident information will be performed in the corridor/project specific scoping or approval documents. In that process, segments with higher than average rates will be

closely examined to determine the feasibility of nonstandard features and whether specific safety improvement can be considered as part of the project.

5. CORRIDOR AND SYSTEM COORDINATION

The development of the regional express lane backbone network is being guided by a committee comprised of staff from MTC, Caltrans District 4 and Headquarters, CHP Golden Gate Division, and the Bay Area CMAs. The proposed regional express lane backbone network intends to build upon the numerous prior plans and studies already developed. References to these documents are provided in **Table 6**.

Table 6: Relevant Bay Area Transportation Policy and Planning Documents

Agency	Subject	Key Points
MTC	RTIP	Approved regional transportation improvement plan for Bay Area as incorporated in FTIP
Title: *Regional Transportation Improvement Plan* (RTIP), Ref: http://www.mtc.ca.gov/funding/STIP/2010STIP/RES-3938_approved.pdf		
MTC	Long-range transportation plan	Comprehensive, multi-modal transportation for Bay Area through 2035 (RTP)
Title: *Change in Motion, Transportation 2035 Plan for the San Francisco Bay Area*, Ref: http://www.mtc.ca.gov/planning/2035_plan/index.htm		
MTC	HOT Lanes	Considers network-wide feasibility of HOT (Express) Lane implementation
Title: *Regional HOT Lanes Network Feasibility Study*, February 2009, Ref: http://www.mtc.ca.gov/planning/hov/HOT_Phase_3_report/2_HOT_Lanes_Final_Report.pdf		
Caltrans	Interregional planning	Provides a framework for integrating RTPs into an interregional transportation plan
Title: *Interregional Transportation Strategic Plan* (ITSP), 1998 Ref: http://www.dot.ca.gov/hq/tpp/offices/oasp/links_files/Strategic.PDF		
Caltrans	HOV/HOT/Express lanes	Statewide business plan for HOV/Express lane investigation and development
Title: *Statewide HOV/Express Lane Business Plan*, 2009 Ref: http://www.dot.ca.gov/hq/traffops/systemops/hov/Express_Lane/files/Caltrans%20HOV-ExpressLaneBizPlan%202009.pdf		
MTC	Bay Area HOV lanes	Updates 1997 Bay Area HOV lane master plan; includes HOT lane consideration
Title: *2002 High-Occupancy-Vehicle (HOV) Lane Master Plan Update for the San Francisco Bay Area* Ref: http://www.mtc.ca.gov/planning/hov/2002HOV_Plan_Final.pdf		
Caltrans	Bay Area HOV lane operations	Various operational characteristics (speed, volumes, time savings…) and planned improvements
Title: *2009 Bay Area HOV Lanes*, Caltrans District 4, 2010 Ref: http://www.dot.ca.gov/dist4/highwayops/docs/hov_report_2009.pdf		

Table 6: Relevant Bay Area Transportation Policy and Planning Documents (Continued)

Agency	Subject	Key Points
Caltrans	Statewide long-range planning	Establishes strategic, multimodal transportation goals to year 2025
Title: *Caltrans' California Transportation Plan*, 2006 Ref: http://www.dot.ca.gov/hq/tpp/offices/osp/ctp2025_files/CTP_2006.pdf		
FHWA	Federal guidance for HOT lanes	Provides recommendations for national standards related to planning, development and operation of HOT Lanes
Title: *A Guide for HOT Lane Development*, FHWA, Ref: http://www.dot.ca.gov/hq/traffops/systemops/hov/Express_Lane/files/FHWA_HOTLaneDevelopmentGuide.pdf		
State of California	Infrastructure planning	20-year plan to develop state infrastructure that will foster and support projected growth
Title: *Statewide Strategic Growth Plan*, 2008 Ref: *http://www.bondaccountability.ca.gov/Strategic_Growth_Plan/documents/CSGP_2008-0001.pdf*		

Caltrans Transportation Corridor Concept Reports (TCCRs) also provide related historic planning information. **Table 7** provides links to the TCCRs prepared in 2002/2003. TCCRs (primarily single sheet maps) contain HOV lane planning information but do not specifically refer to HOT or express lanes (other than for express bus service).

Proposition 1B, approved in November 2006, provided $4.5 billion in bond funding for a Corridor Mobility Improvement Account (CMIA). As part of the implementation guidelines for the CMIA, the CTC assigns priority to projects where there is a Corridor System Management Plan (CSMP) in place. Accordingly, Caltrans District 4 has been working with MTC and the CMAs to develop CSMPs. In those cases where CSMPs have been released, the more recent CSMPs are listed in **Table 7** in place of the older TCCRs.

Table 7: Corridor System Management Plans and Transportation Corridor Concept Reports

Route	Corridor Study Limits [Date of Completion]
17	***INTERSTATE 880 / STATE ROUTE 17 (Alameda I-80 to Santa Cruz SR-1 - SANTA CLARA AND SANTA CRUZ CTY PORTION)*** [5/25/02] *Link: maps/c11a_880_17_tcr_map_5_25_02_h20.pdf
80	***I-80 East Corridor System Management Plan***, [September 2010], *Link: csmp/i_80_east_final_csmp_full_doc_101110.pdf ***I-80 West Corridor System Management Plan***, [September 2010], *Link: csmp/i_80_w_csmp_final_full_doc.pdf
84	***SR-84 Corridor System Management Plan***, [December 2010], *Link: docs/csmp/sr84csmp_final_101220.pdf

Table 7: Corridor System Management Plans and Transportation Corridor Concept Reports (Continued)

Route	Corridor Study Limits [Date of Completion]
92	***STATE ROUTE 92 - SAN MATEO BRIDGE CORRIDOR*** ***(San Mateo SR-1 to Alameda SR-238)****,* [7/29/02] *Link: maps/c24_sr_92_tccr_map_7_29_02_h20.pdf
101	***US 101 SOUTH*** ***(Santa Clara SR-85 to San Benito SR-156),*** [8/8/02] *Link: maps/c14_101s_tccr_mapset_8_8_02_h20.pdf ***US 101 South Corridor System Management Plan***, [December 2010], *Link: csmp/us101s_csmp.pdf
580	***INTERSTATE 580 - Richmond/San Rafael Br. Corr.*** ***(Marin US-101 to Contra Costa I-580)***, [8/6/02] *Link: maps/c22_580w_tccr_map_8_3_02_h20.pdf ***I-580 East Corridor System Management Plan****,* [May, 2010], *Link: 580/580e_csmp_volume1.pdf and *Link: 580/580e_csmp_volume2.pdf
680	***INTERSTATE 680 NORTH*** ***(Alameda I-580 to Solano I-80)***, [3/15/02] *Link: maps/c7_680n_tccr_mapset_3_15_02_h20.pdf ***INTERSTATE 680 SOUTH*** ***(Alameda I-580 to Santa Clara US-101)***, [7/9/02] *Link: maps/c10_680s_tccr_mapset_7_9_02_h20.pdf
880	***I-880 Corridor System Management Plan***, [October 2010] *Link: csmp/880_csmp_final_10_11_10_full_document.pdf

*All links begin "http://www.dot.ca.gov/dist4/systemplanning/docs/"

The CMA for each county within the study area has developed a countywide transportation plan.

- *Alameda Countywide Transportation Plan*, Alameda County Transportation Authority, http://www.alamedactc.com/app_pages/view/797
- *2009 Countywide Comprehensive Transportation Plan*, Contra Costa Transportation Authority, June 2009, http://www.ccta.net/assets/documents/CTP/2009%20CTP%20Final%20Version%202009-08-19.pdf
- *2009, Contra Costa Congestion Management Program,* Contra Costa Transportation Authority, December 2009, http://www.ccta.net/assets/documents/CMP/2009_Contra_Costa_CMP_all.pdf
- *Strategic Plan 2009-2013,* San Mateo County Transportation Authority, December 2008, http://www.smcta.com/pdf/TA_Strategic_Plan_2009-2013_Final.pdf
- *Valley Transportation Plan 2035*, Santa Clara Valley Transportation Authority, 2009, http://www.vta.org/studies/vtp2035/pdf/vtp2035.pdf
- *2009 Comprehensive Transportation Plan for Sonoma County*, Sonoma County Transportation Authority, October 2009, http://www.sctainfo.org/reports/Comprehensive_Transportation_Plan/ctp_2009/FinalCTP2009.pdf

The Santa Clara Valley Transportation Authority (VTA) in Santa Clara County has commissioned several express lane studies. Four of those studies with particular relevance to the project are summarized in **Table 8**.

Table 8: County Congestion Management Agency Express Lane Studies

Agency	Subject	Synopsis
Santa Clara Valley Transp. Authority	HOT lane implementation in Santa Clara Co.	Lays out a plan for HOT lane implementation in Santa Clara County on I-880, SR-237, SR-85 and US 101.
Title: *Silicon Valley Express Lanes Program Implementation and Plan,* (November 2008) Ref: http://www.vta.org/expresslanes/documents/reports/svel_program_112108.pdf		
Santa Clara Valley Transp. Authority	Attitudes toward HOT lanes	Reports HOT lane misconceptions and differing attitudes of varying user groups
Title: *Focus Group Report: Attitudes Toward the State Route 85 HOT Lane,* (August 2008) Ref: http://www.vta.org/expresslanes/documents/reports/el_focus_group.pdf		
Santa Clara Valley Transp. Authority	HOT lane feasibility	Demonstrates feasibility of HOT lanes in Santa Clara County
Title: *Santa Clara County HOT Lane Feasibility Study* (December 2005) Ref: http://www.vta.org/projects/hot_lanes/hot_final.pdf		
Santa Clara Valley Transp. Authority	Equity Implications of HOT Lanes	Addresses whether HOT lanes afford inequitable benefits to a particular user group
Title: *Assessing the Equity Implications of HOT Lanes* (November 2004) Ref: http://www.vta.org/projects/hot_lanes/hot_equity.pdf		

As noted in Section 2, BACKGROUND, one express lane project has already been implemented and several others are under development.

The goal of the present project is to build upon prior studies to implement a continuous network of express lanes. Achievement of that goal will be attained by identifying existing bottlenecks and preferential lane gaps in order to implement an express lane network that will use excess capacity within the HOV lane network that has already been constructed and that which is planned.

The system wide approach being pursued in this project will insure consistency along corridors and across the network. The Corridor System Management Plans (CSMP) that have been, or are being developed, acknowledge the regional express lanes and the potential for conversion of HOV lanes. Specifically, the potential for express lane conversions are discussed in the I-80 (east) CSMP for Napa/Solano Counties, the SR-84 CSMP for Alameda County, the I-880 CSMP for Santa Clara County and the US 101 (south) CSMP for Santa Clara County.

6. ALTERNATIVES

Two project alternatives are being considered: a No-build alternative and a regional express lane backbone network alternative. Further details of each alternative and possible variations are described in the following subsections. As a program level PSR, this document is not intended to identify and resolve all safety and operational issues that may be encountered during development of individual projects. Resolution of those issues will occur during the preparation of subsequent project-specific PIDs as applicable to the respective corridor segments. Design considerations and requirements for individual projects will adhere to the Caltrans TOPD No. 11-02. This PSR will identify and describe a

range of geometric design options and leave the segment specific selection to the later project phases.

ALTERNATIVE 1 – NO-BUILD

Under the No-build alternative, the programmed HOV lanes will be constructed. Existing and future gaps in the HOV system will continue to hamper operations for carpools and transit. In addition, the available capacity in carpool lanes will not be utilized to the full system efficiency. Over time, capacity will be reached in the carpool lanes, leading to congestion in the lanes and inability to provide the intended travel time savings for maximized person throughput. While the Bay Area express lane backbone network would not be constructed, this alternative would not preclude the completion of express lanes already authorized under prior legislation or later development of individual express lane segments, but each would be developed as a separate project with individually justified logical termini and independent utility. Any new express lane corridors would require separate and new legislative authority. System-wide synergy of operational efficiency improvements and congestion mitigation are not likely to accrue with this alternative.

Several HOV or express lane projects could be implemented even if the regional backbone network is not pursued. These projects are listed in **Table 9** below and are assumed to be included in the No-Build alternative. The "Project Number" listed refers to the corresponding express lane project in **Table 10**, to assist in cross-referencing locations

Table 9: Future HOV or Express Lanes included in No-Build Alternative

Project No.	Route	County	Project Type	Begin	End
13	I-680 SB	Contra Costa	Construct HOV Lane	Rudgear Road	Livorna Road
20	I-580 EB	Alameda	Convert HOV Lane to Express Lane	Tassajara/ Santa Rita Road	Vasco Road
21a	I-580 WB	Alameda	Construct HOV Lane	San Ramon Rd/ Foothill Road	Greenville
23a	I-880 SB	Alameda	Construct HOV Lane	Hegenberger	Marina Blvd.
23b	I-880	Santa Clara	Construct HOV Lane	I-880/SR-237 HOV Connector	US 101 IC
28	SR-85	Santa Clara	Convert HOV Lane to Express Lane	US-101 (Mountain View)	US-101 (South San Jose)
30	US-101	Santa Clara	Convert HOV Lane to Express Lane	Cochrane	SCL/SM County Line
31	US-101	San Mateo	Convert HOV Lane to Express Lane	SCL/SM County Line	Whipple

ALTERNATIVE 2 – EXPRESS LANE ALTERNATIVE

The express lane alternative will implement an approximately 533-mile network of express lanes on nine Bay Area freeways. In many locations the implementation will be achieved by conversion of existing, underutilized HOV lanes to express lanes. New express lanes will be constructed in areas which do not already have HOV lanes.

Various scenarios are being considered for the development and operations of the Express Lanes Network, taking into account traffic demands and each individual corridor's unique needs. Most of the network is planned to provide one express lane in each direction, though areas of high demand may justify sections of two lanes. Caltrans Traffic Operations Policy Directive TOPD 11-02 has been used for planning and cost estimating.

Individual projects that would comprise the backbone network are listed in **Table 10**.

Table 10: Proposed Bay Area Express Lane Network - Segment Matrix

Project No.	Route*	County	Begin PM	End PM	Begin	End	Total Distance (lane-miles)	Current Corridor HOV/HOT Status
1	I-80	Solano	R 44.72	R 28.36	SOL/YOLO County Line	I-505 IC	32.7	Identified in I-80 East CSMP and 2009 RTP
2	I-80	Solano	R 28.36	19.18	I-505 IC	Airbase Pkwy IC	18.4	Planned HOV
3	I-80	Solano	19.18	R 11.39	Airbase Pkwy IC	Red Top Rd	15.6	Existing HOV, Planned HOT
4	I-80	Solano	R 11.39	5.65	Red Top Rd	SR-37	11.5	Identified in I-80 East CSMP and 2009 RTP
5	I-80	Solano	5.65	0.59	SR-37	Carquinez Bridge Toll Plaza	10.1	Identified in I-80 East CSMP and 2009 RTP
6	I-80 WB	Solano/ Contra Costa	0.59	12.75	Carquinez Bridge	Cummings Skyway	2.0	Existing HOV
		Contra Costa	12.75	10.06	Cummings Skyway	SR-4 IC	2.7	Existing HOV
	I-80 EB	Solano/ Contra Costa	0.59	12.75	Carquinez Bridge Toll Plaza	Cummings Skyway	2.0	HOV Bypass Lane at Toll Plaza
		Contra Costa	12.75	10.06	Cummings Skyway	SR-4 IC	2.7	Existing HOV
7	I-80	Contra Costa	10.06	0.00	SR-4 IC	CC/ALA County Line	20.1	Existing HOV
	I-80	Alameda	8.04	3.68	ALA/CC County Line	HOV Direct Connector Ramp	8.7	Existing HOV
	I-80 WB	Alameda	3.68	1.8	HOV Direct Connector Ramp	Bay Bridge Metering Lights	1.9	Existing HOV
	I-80 EB	Alameda	3.68	2.27	HOV Direct Connector Ramp	I-880 Connector	1.4	Existing HOV
8	I-80 I-680	Solano	I-80/I-680 Direct Connectors (I-80 WB to I-680 SB and I-680 NB to I-80 EB, including 3.8 lane miles to account for approach to Gold Hill Road)				5.6	Identified in I-80 East CSMP
9	I-680	Solano	R 10.02	M 0.68	Gold Hill Road	I-780	20.2	Identified in Solano Highway Operations Study and 2009 RTP
10	I-680 NB	Solano/ Contra Costa	M 0.68	24.26	Benicia-Martinez Bridge NB		2.1	HOV Bypass Lane at Toll Plaza
11	I-680 NB	Contra Costa	24.26	R 18.71	Marina Vista	SR-242	5.6	Existing HOV
		Contra Costa	R 18.71	15.61	SR-242	N. Main Street	3.1	Planned HOV

Table 10: Proposed Bay Area Express Lane Network - Segment Matrix (Continued)

Project No.	Route*	County	Begin PM	End PM	Begin	End	Total Distance (lane-miles)	Current Corridor HOV/HOT Status
12	I-680 SB	Solano/ Contra Costa	M 0.68	24.26	Benicia-Martinez Bridge SB		2.1	No planned improvement identified
13	I-680 SB	Contra Costa	24.26	15.61	Marina Vista	N. Main Street	8.9	Existing HOV
		Contra Costa	15.61	R 12.61	N. Main Street	Rudgear Road	2.9	Identified in 2009 RTP
		Contra Costa	R 12.61	R 11.28	Rudgear Road	Livorna Road	1.5	HOV under construction
14	I-680	Contra Costa	R 11.28	R 0.01	Livorna Road	Alcosta	22.5	Existing HOV
15	I-680	Alameda	R 21.88	R 11.85 (Rte 84 E)	Alcosta	SR-84 IC	20.1	Identified in 2009 RTP
16	I-680 NB	Alameda	R 11.85 (Rte 84 E)	M 0.00	SR-84 IC	ALA/SCL County Line	11.4	Planned HOT
		Santa Clara	M 9.94	M 7.65	SCL/ALA County Line	SR-237 IC	2.3	Planned HOT
17	I-680 SB	Alameda	R 11.85 (Rte 84 E)	M 0.00	SR-84 IC	ALA/SCL County Line	11.4	Existing HOT
		Santa Clara	M 9.94	M 7.65	SCL/ALA County Line	SR-237 IC	2.3	Existing HOT
18	I-580/ I-680	Alameda	I-580/I-680 Direct Connectors (I-580 WB to I-680 SB and I-680 NB to I-580 EB, including 1.1 miles to connect to start of EB lane at Hacienda)				3.1	Identified in 2009 RTP
19	I-580	Alameda	R 8.26	0.00	Greenville	ALA/SJQ County Line	16.8	Identified in I-580 East CSMP and 2009 RTP
20	I-580 EB single lane	Alameda	18.82	17.96	Hacienda	Tassajara/ Santa Rita Road	0.9	Existing HOV, Planned HOT
	I-580 EB dual lanes	Alameda	17.96	9.68	Tassajara/ Santa Rita Road	Vasco Road	16.6	Existing 1-lane HOV, Planned 2-lane HOT
	I-580 EB single lane	Alameda	9.68	R 8.23	Vasco Road	Greenville	1.4	Existing HOV, Planned HOT
21a	I-580 WB	Alameda	R 21.43	R 8.27	San Ramon Rd/ Foothill Road	Greenville	13.2	Planned HOT
21b	I-580 WB second lane	Alameda	R 21.43	R 8.27	San Ramon Rd/ Foothill Road	Greenville	13.2	Funded 1-lane HOV; Planned 2-lane HOT
22a	I-880 NB	Alameda/ Santa Clara	20.32	0.00	Lewelling Rd	SCL/ALA County Line	20.0	Existing HOV
			10.50	9.5	SCL/ALA County Line	South of Dixon Landing Rd	1.0	Existing HOV
22b	I-880 NB	Alameda	25.50	20.32	Hegenberger	Lewelling Rd	5.2	Planned HOV
23a	I-880 SB	Alameda	25.50	22.84	Hegenberger	Marina Blvd.	2.7	HOV under design
			22.84	0.00	Marina Blvd.	SCL/ALA County Line	22.6	Existing HOV
		Santa Clara	10.50	9.2 (est.)	SCL/ALA County Line	South of Dixon Landing Road	1.3	Existing HOV
23b	I-880	Santa Clara	8.42	4.06	I-880/SR-237 HOV Connector	US 101 IC	8.7	Funded HOV
24	I-880	Santa Clara	4.06	0.000	US 101 IC	I-280 IC	8.2	Identified in I-880 CSMP
	SR-17		13.95	9.35	I-280 IC	SR-85 IC	9.2	No planned improvement identified

Table 10: Proposed Bay Area Express Lane Network - Segment Matrix (Continued)

Project No.	Route*	County	Begin PM	End PM	Begin	End	Total Distance (lane-miles)	Current Corridor HOV/HOT Status
25	SR-237	Santa Clara	SR-237/I-880 Direct Connector (I-880 SB to SR-237 WB and SR-237 EB to I-880 NB)				8.5	Existing HOV: HOT under construction
26	SR-237 EB	Santa Clara	2.99	6.90	Mathilda Avenue	N. First Street	3.9	Existing HOV; Planned HOT
	SR-237 WB		2.99	R 4.60	Mathilda Avenue	Lawrence Expressway	1.6	Existing HOV; Planned HOT
27	SR-237	Santa Clara	R 0.38	2.99	SR-85 IC	Mathilda Avenue	5.3	Planned HOT
28	SR-85 single lane	Santa Clara	23.83	18.41	US 101 N IC (Mountain View)	I-280 IC	10.8	Existing 1 lane HOV, Planned HOT
	SR-85 dual-lanes		18.41	5.22	I-280 IC	SR-87 IC	53.5	Existing HOV, Planned HOT
	SR-85 single lane		5.22	0.00	SR-87 IC	US 101 S IC (San Jose)	10.4	Existing HOV, Planned HOT
29	I-85/ US 101	Santa Clara	I-85/US 101 Direct Connectors (includes direct connectors at both ends of SR-85)				4.0	Existing HOV: Planned HOT
30	US 101 dual lanes	Santa Clara	R 52.55	R 17.82	SCL/SM County Line	Cochrane	140.4	Existing 1 lane HOV; Planned 2 lane HOT
31	US 101	San Mateo	0.00	6.62	SM/SCL County Line	Whipple	13.2	Planned HOT
32	SR-84 WB	Alameda	R 3.18	R 5.98	Toll Plaza	I-880 IC	2.8	Existing HOV
33	SR-92 WB	Alameda	R 2.59	R 5.76	Toll Plaza	Hesperian On-ramp	3.2	Existing HOV

*Both directions unless noted

Gap in express lane network – see below for discussion on other gap sections

Development Scenarios

The approach taken in this PSR is to identify two design variations for each corridor segment. The first variation would be a facility that embraces a "Rapid Delivery Approach". This is henceforth referred to as Design Variation 1. This variation would require justification and approval for nonstandard features in order to implement network segments that would take considerably longer to implement otherwise due to right of way, environmental, or other constraints. The second variation would be a facility that is in compliance or substantial compliance with applicable Caltrans cross-section standards; this variation facility is henceforth referred to as Design Variation 2.

Reversible lanes were examined in a separate study which concluded that only portions of three corridors exhibit traffic conditions conducive to reversible lane implementation. Furthermore, physical constraints and terrain in those corridors are such that reversible lanes would be very costly to construct and further consideration of reversible lanes was not recommended.

Attachment 2 provides typical cross-sections for the various corridors to illustrate Design Variations 1 and 2. The *non-standard* section shown in **Attachment 2** is representative of predominant locations for Design Variation 1 and limited locations for Design Variation 2. The *standard* section is representative of limited locations for Design Variation 1 and predominant locations for Design Variation 2. Approval of exceptions to design standards will be required at various locations to implement the project, but this PSR does not attempt

to document nor obtain specific approval for such situations. Preparation and approval of Design Exception Fact Sheets will be pursued during preparation of individual project initiation documents.

Express Lane operations are discussed in the sections below, which summarize access, enforcement, HOV occupancy and toll operations as they relate to Express Lanes.

Access

For this program-level PSR, it was uniformly assumed that all express lanes in the backbone network would be separated from general purpose lanes by a 2 to 4-foot buffer with access points provided at a spacing of approximately 4 miles. The combined ingress-egress "Weave Zone" option from Caltrans TOPD No. 11-02 has been assumed in most cases; however, a "Weave Lane" is assumed at an average spacing of 20 miles. It is acknowledged that some express lane projects currently in more detailed project development phases may be considering other design and access configurations.

Under either Design Variation 1 or Design Variation 2, additional outside widening is expected to be required to accommodate the ingress-egress sections for the weave lane option. Accordingly, the Design Variation 1 and Design Variation 2 cost estimates include a per lane-mile cost to account for the weave lane ingress-egress section widening requirements at a 20-mile average spacing.

Enforcement

Enforcement of the express lane will be provided visually and in person by the California Highway Patrol (CHP) and supplemented through electronic means. For CHP enforcement, it will be necessary to provide protected zones in the median to facilitate traffic safety and express lane use enforcement by the California Highway Patrol (CHP). These zones are to be located at a maximum spacing of five miles. Configuration of the zones is based on Chapter 6 of the Caltrans HOV Guidelines, 2003.

Under either Design Variation 1 or Design Variation 2, additional outside widening is expected to be required to accommodate the enforcement sections. Accordingly, the Design Variation 1 and Design Variation 2 cost estimates include a per lane-mile cost to account for the enforcement widening requirements at a 5-mile average spacing. The HOV Guidelines provide for both directional and bi-directional enforcement zones. Directional zones were assumed for cost estimating purposes since those are shorter and offer more flexibility in placement within the facility. In specific instances, to be identified as projects are developed, bidirectional zones may be feasible and more economical to implement.

The automated electronic enforcement system is described under "Toll Operations" below.

HOV Occupancy

Per statutes (Streets and Highways Code, Section 149) HOVs would be allowed to use the express lanes for free. Existing Bay Area HOV lanes operate with either a two-or-more persons or three-or-more person per vehicle definition for HOVs, as determined by Caltrans. For this PSR, it was assumed that the minimum vehicle occupancy requirements will not be changed with the implementation of express lanes on opening day but will be studied and reviewed as the lane fills up. During subsequent detailed project development, each

segment will need to be individually analyzed to determine the best and most feasible occupancy requirement that will maintain desired service levels within the lane and optimize system efficiency and enhance revenue generation to accelerate closure of the HOV lane gaps.

Toll Operations

In both design variations, the toll operating plan remains the same and does not constitute a change in express lane toll system requirements. From a toll collection perspective, the Bay Area express lanes network will operate in the same general manner as that of California express lanes currently in operation (i.e., I-15 by San Diego Association of Governments, SR-91 by Orange County Transportation Authority, and I-680 by Alameda County Congestion Management Agency), and, pending operation in Los Angeles County (I-10 and I-110). In all cases, toll collection is automated through the use of FasTrak®-type, Title-21 compliant, statewide interoperable transponder technology. Unlike various toll facilities in California, cash will not be collected on express lanes. However, the Bay Area Toll Authority (BATA) offers cash-based transponders as a form of payment for choice and convenience.

Prior to and within the access zones, the toll system will include appropriate guide signs with applicable toll rates on static or variable message signs. The express lane pricing and guidance signs are suspended from cantilevered gantries spaced at 2 miles, 1 mile, and ½ mile in advance of the ingress to the express lane. The toll collection system is contained within a discrete "toll zone", located somewhere within the buffer separated, limited access section. The toll zone includes all subsystems relative to toll collection, photographic enforcement for violations, vehicle classification detection, enforcement personnel provision, and communication with the toll integrator's control center.

Electronic toll collection from registered motorists who carry in-vehicle-mounted transponders is currently envisioned as the primary means of tolling on express lanes. Automated enforcement strategies will complement manual activities by focusing the California Highway Patrol (CHP) enforcement responsibilities to occupancy verification and other traffic violations (i.e., illegal buffer crossings). License Plate Recognition (LPR) cameras will capture license plate images of vehicles that do not display a recognizable toll transponder. The use of LPR to perform violation enforcement (or "pay by plate" systems which treats LPR-processed vehicles as unregistered customers) requires that all vehicles carry a toll transponder (including HOVs). Switchable toll transponders will be used to allow vehicles to self-declare their vehicle occupancy using a switching mechanism on the transponder. The toll system will recognize the occupancy setting of these transponders and assess the appropriate toll. Legacy transponders will also work on the express lanes, although they will not allow users to declare as a HOV. Although the use of LPR and switchable toll transponders will automate toll violation enforcement, field personnel will still be required to perform occupancy enforcement and regulations and statutes may need to be updated to require the use of switchable tags by carpoolers.

The toll zone will contain the following equipment serving the toll collection and violation enforcement systems: cantilevered gantry, antenna, toll reader, vehicle sensor, rear-plate facing camera, rear-plate facing light, enforcement beacons, zone controller, hardened and

protected utility cabinet, and appropriate protected pavement areas to support enforcement and maintenance personnel.

Through the use of dynamic congestion pricing, the vehicular volumes within the express lanes can be regulated, providing congestion-free traffic on the express lane network. The toll rate will vary based on total corridor demand and congestion, with rising volumes corresponding to rising prices in order to avoid saturation. For any given segment, the target performance threshold is 1,650 vehicles per lane per hour. Volumes are continuously monitored and adjusted at appropriate intervals (up to 5 minute frequency) to maintain travel speeds.

The Bay Area express lanes network toll pricing structure and operating rules will provide a seamless operation throughout the Bay Area, regardless of the implementing agency (e.g., Sunol JPA, VTA, etc.). The intent, from a customer service perspective, is to have the express lanes network function as one regional network for customers. The BATA will handle all toll transactions and customer service, regardless as to which facilities the customers utilized.

Long Term Gap Closures

Completion of all of the projects listed in Table 10 by year 2035 would leave two physical gaps in the Express Lane network. Gaps would exist on:

- I-680 Northbound, from Livorna Road to North Main Street: Closure of this 4.3-mile gap in Walnut Creek would likely require a long structure elevated over the entire 680/24 interchange. A cost in excess of $200M (including support costs, 2010$) is estimated for closure of this gap. The cost is based on a refinement of a planning level estimate prepared for the Contra Costa Transportation Authority in 2002, updated with 2010 unit costs.
- I-880 Northbound and Southbound, from the 80/580/880 Distribution Structure near the Bay Bridge to Hegenberger Road. This 19.9 directional-mile gap in Oakland includes segments with very constrained right-of-way and non-standard cross sections. Providing a new express lane here would involve major reconstruction of the freeway and/or new structures with extensive viaduct sections. A cost of $1.5B (including support costs, 2010$) has been estimated for closure of this gap segment, which was based on a planning level estimate prepared for MTC in 2010.

In the near term, traffic management strategies would be implemented in these gaps to ensure that express lane users could maintain free flow trips throughout the network. These strategies include ramp metering and enhanced incident management tools, already funded through MTC's Freeway Performance Initiative.

In the long term, physically filling these gaps would provide useful continuity to the network. However, because they involve exceptionally high cost and physical constraints that make implementation by 2035 impractical, they could only be completed beyond the time frame of the long-range Regional Transportation Plan. As a result, these two gap closures were considered for inclusion, but have not been addressed in the full network financial analysis to the same level of detail as the other segments. Recognizing the magnitude of expenditures required, the level of detail in cost estimating is not as rigorous as that applied

to the segments included in the backbone network. Revenue estimates were not prepared for these segments. In addition, unforeseen positive circumstances, such as revenues from the rest of the network that exceed current projections or other additional federal, state, local or private sources of funding, could materialize.

COST ESTIMATING APPROACH

The intent of this PSR is to provide an order of magnitude cost for implementation of the approximately 533 directional-mile express lane network. Various qualifications and assumptions have been established to arrive at the appropriate level of cost detail that is provided in **Attachment 5**. A thorough discussion of the various parameters involved is presented in **Attachment 6**, which includes detailed examples of the cost estimating procedure as applied to selected corridors.

Some of the key points detailed in **Attachments 5** and **6** include:

- Base assumptions for the design variations.
- Design Variation 1 condition assumptions for HOV Lane conversion and new lane (widening) situations
- Design Variation 2 condition assumptions for HOV Lane conversion and new lane (widening) situations
- Design feature assumptions, including (a) lane, shoulder and buffer widths, (b) pavement type, (c) pavement rehabilitation, (d) interchange spacing, (e) vertical clearance, (f) interchange ramps, (g) signage, (h) sound walls, (i) landscape and irrigation, (j) drainage, (k) guard railing, (l) crash cushions, (m) loop detectors, and (n) lighting
- Toll system infrastructure and operation, including (a) back office facilities, (b) toll system design, and (c) enforcement

ESTIMATED COSTS

Any design exceptions previously granted within an existing corridor must be reevaluated in the project-specific PIDs for individual projects. Project costs will not be the sole determining factor for the approval of design exceptions. Cost estimates based on non-standard features do not imply or memorialize any concurrence with design exceptions.

Estimated project costs are presented in the following tables and have been segregated into support costs and capital costs. At this level of detail, project support costs have been estimated as 35% of total capital cost. Support costs have been further allocated to project phases by the following percentages. Two allocations of support cost were used depending on whether or not acquisition of right-of-way parcels is anticipated. Allocations of: R/W - 20%, PA&ED - 25%, PS&E -25%, Construction - 30% were applied if acquisition is expected. Allocations of: R/W - 10%, PA&ED - 30%, PS&E - 30%, Construction - 30% were applied if acquisition is not expected. Costs for Design Variation 1 are listed in **Table 11** and costs for Design Variation 2 are listed in **Table 12**. For project location refer to the Location/Vicinity Map included in **Attachment 1.** Supporting information for these tables is included in **Attachment 7**.The cost estimates assume a single lane in each direction for

most of the segments. There are three deviations from this assumption that are included based on expected demand:

1. For Project 20 (Alameda County I-580 from Hacienda Drive to Greenville Road), dual lanes are assumed for both Design Variation 1 and Design Variation 2 within the portion from Tassajara/Santa Rita Road to Vasco Road.
2. For Project 28 (Santa Clara County SR-85 from US 101 north interchange to US 101 south interchange), within the portion from I-280 to SR-87 a single lane is assumed for Design Variation 1 and dual lanes are assumed for Design Variation 2.
3. For Project 30 (Santa Clara County US 101 from San Mateo County Line to Cochrane Road), single lane is assumed for Design Variation 1 and dual lanes are assumed for Design Variation 2.

Table 11: Estimated Project Costs – Design Variation 1 ($1,000s)

	Support Costs					Capital Costs			
Project	**PA&ED**	**PS&E**	**R/W**	**Const**	**Total[7]**	**R/W**	**Roadway**	**Structures**	**Total[7]**
1	17,605	17,605	5,868	17,604	**59,000**	0	159,309	8,355	**168,000**
2	7,835	7,835	2,612	7,835	**26,000**	0	74,619	0	**75,000**
3	1,328	1,328	443	1,327	**4,000**	0	12,645	0	**13,000**
4	7,535	7,535	6,028	9,041	**30,000**	2,978	79,981	3,151	**86,000**
5	11,292	11,292	3,764	11,292	**38,000**	0	101,574	5,968	**108,000**
6	546	546	182	546	**2,000**	0	5,199	0	**5,000**
7	3,157	3,157	1,053	3,157	**11,000**	0	21,416	8,652	**30,000**
8	7,224	7,224	2,408	7,223	**24,000**	0	398	68,400	**69,000**
9	17,335	17,335	5,778	17,336	**58,000**	0	165,096	0	**165,000**
10[1]	0	0	0	0	**0**	0	0	0	**0**
11	4,396	4,396	3,516	5,275	**18,000**	715	49,522	0	**50,000**
12[1]	0	0	0	0	**0**	0	0	0	**0**
13	12,568	12,568	4,189	12,567	**42,000**	0	119,692	0	**120,000**
14	1,676	1,676	559	1,677	**6,000**	0	15,967	0	**16,000**
15	15,561	15,561	5,187	15,562	**52,000**	0	148,204	0	**148,000**
16	9,452	9,452	3,151	9,450	**32,000**	0	90,013	0	**90,000**
17[2]	0	0	0	0	**0**	0	0	0	**0**
18	13,712	13,712	4,571	13,711	**46,000**	0	685	129,902	**131,000**
19	17,282	17,282	5,761	17,280	**58,000**	0	162,766	1,820	**165,000**
20[3]	2,099	2,099	700	2,099	**7,000**	0	21,662	0	**22,000**
21a	1,059	1,059	353	1,060	**4,000**	0	10,089	0	**10,000**
21b	0	0	0	0	**0**	0	0	0	**0**
22a	2,168	2,168	722	2,168	**7,000**	0	15,294	5,348	**21,000**
22b[4]	9,859	9,859	7,888	11,831	**39,000**	12,253	68,783	17,390	**98,000**
23a	1,916	1,916	639	1,914	**6,000**	0	18,242	0	**18,000**
23b	819	819	273	819	**3,000**	0	7,799	0	**8,000**
24	30,775	30,775	24,620	36,928	**123,000**	54,666	269,882	27,160	**352,000**
25[2]	0	0	0	0	**0**	0	0	0	**0**
26	757	757	252	758	**3,000**	0	4,833	2,380	**7,000**
27	7,380	7,380	5,904	8,856	**30,000**	7,677	48,351	28,314	**84,000**
28[5]	4,725	4,725	1,575	4,725	**16,000**	0	45,000	0	**45,000**
29[6]	91	91	30	90	**0**	0	862	0	**1,000**
30	4,933	4,933	1,644	4,933	**16,000**	0	45,608	1,372	**47,000**
31	1,321	1,321	440	1,322	**4,000**	0	10,174	2,408	**13,000**
32	273	273	91	273	**1,000**	0	2,600	0	**3,000**
33	263	263	88	263	**1,000**	0	2,505	0	**3,000**
Total	**217,821**	**217,821**	**98,530**	**228,921**	**766,000**	**77,574**	**1,779,485**	**310,620**	**2,171,000**
Total capital and support costs									**2,937,000**

1 No modifications to Benicia-Martinez bridge proposed

2 Express Lane already implemented or nearly implemented

3 Based on dual lane cost estimate developed for I-580EB project

4 Includes $131.4M for HOV extension from Central Alameda County Local Alternative Transportation Improvement Program (LATIP) Project Initiation Document

5 Build Alternative 2 cost estimate from SR-85 PSR-4A790K, converted from 2013$ to 2010$

6 Based on VTA estimates for US-101/SR-85 Connectors

7 Totals rounded to nearest $1M (row/column sums may differ)

Table 12: Estimated Project Costs – Design Variation 2 ($1,000s)

	Support Costs					Capital Costs			
Project	**PA&ED**	**PS&E**	**R/W**	**Const**	**Total[5]**	**R/W**	**Roadway**	**Structures**	**Total[5]**
1	40,731	40,731	13,577	40,731	**136,000**	0	322,415	65,499	**388,000**
2	27,044	27,044	9,015	27,042	**90,000**	0	190,219	67,340	**258,000**
3	17,090	17,090	13,672	20,506	**68,000**	794	130,642	63,873	**195,000**
4	13,301	13,301	10,641	15,962	**53,000**	2,780	124,732	24,501	**152,000**
5	16,239	16,239	5,413	16,239	**54,000**	0	101,987	52,671	**155,000**
6	16,754	16,754	5,585	16,752	**56,000**	0	107,078	52,480	**160,000**
7	38,762	38,762	31,009	46,513	**155,000**	6,353	275,038	161,598	**443,000**
8	7,224	7,224	2,408	7,223	**24,000**	0	398	68,400	**69,000**
9	32,825	32,825	10,942	32,826	**109,000**	0	301,842	10,780	**313,000**
10[1]	0	0	0	0	**0**	0	0	0	**0**
11	17,105	17,105	13,684	20,527	**68,000**	1,191	134,743	59,556	**195,000**
12[1]	0	0	0	0	**0**	0	0	0	**0**
13	28,274	28,274	22,619	33,930	**113,000**	8,207	207,127	107,800	**323,000**
14	32,294	32,294	10,765	32,293	**108,000**	0	232,099	75,460	**308,000**
15	26,358	26,358	8,786	26,357	**88,000**	0	240,246	10,780	**251,000**
16	18,417	18,417	14,734	22,101	**74,000**	2,383	159,100	49,000	**210,000**
17[2]	0	0	0	0	**0**	0	0	0	**0**
18	13,712	13,712	4,571	13,711	**46,000**	0	685	129,902	**131,000**
19	27,751	27,751	9,250	27,750	**93,000**	0	262,471	1,820	**264,000**
20	12,126	12,126	9,701	14,550	**49,000**	2,780	108,850	26,950	**139,000**
21a	21,130	21,130	16,904	25,355	**85,000**	7,412	174,781	59,290	**241,000**
21b	14,687	14,687	11,750	17,625	**59,000**	14,838	153,016	0	**168,000**
22a	23,410	23,410	18,728	28,092	**94,000**	3,177	220,759	43,610	**268,000**
22b[3]	12,135	12,135	9,708	14,562	**49,000**	12,253	71,134	17,390	**101,000**
23a	22,073	22,073	17,659	26,488	**88,000**	2,912	199,863	49,490	**252,000**
23b	15,247	15,247	12,198	18,296	**61,000**	12,839	111,922	49,490	**174,000**
24	38,828	38,828	31,063	46,594	**155,000**	54,666	292,905	96,180	**444,000**
25[2]	0	0	0	0	**0**	0	0	0	**0**
26	7,875	7,875	6,300	9,451	**32,000**	529	54,402	35,073	**90,000**
27	13,961	13,961	11,168	16,752	**56,000**	9,133	90,284	60,132	**160,000**
28	78,492	78,492	62,793	94,189	**314,000**	14,361	583,684	299,001	**897,000**
29[4]	91	91	30	90	**0**	0	862	0	**1,000**
30	93,164	93,164	74,531	111,796	**373,000**	24,858	713,507	326,362	**1,065,000**
31	12,351	12,351	9,881	14,822	**49,000**	927	91,484	48,748	**141,000**
32	3,880	3,880	1,293	3,880	**13,000**	0	19,451	17,500	**37,000**
33	2,821	2,821	940	2,821	**9,000**	0	18,885	7,980	**27,000**
Total	**746,152**	**746,152**	**481,318**	**845,827**	**2,821,000**	**182,392**	**5,696,611**	**2,138,656**	**8,020,000**
Total capital and support costs									**10,841,000**

1 No modifications to Benicia-Martinez bridge proposed

2 Hot Lane already implemented or nearly implemented

3 Includes $131.4M for HOV extension from Central Alameda County Local Alternative Transportation Improvement Program (LATIP) Project Initiation Document

4 Based on VTA estimates for US-101/SR-85 Connectors

5 Totals rounded to nearest $1M (row/column sums may differ)

OPERATIONAL ASSESSMENT SUMMARY

An operational assessment of the proposed express lanes network is included as **Attachment 8** and summarized in this section.

Six key operational benefits are associated with the proposed express lane network. Within the context of the existing HOV lane operations, each is addressed in this operational assessment summary.

Connectivity Benefits

The existing Bay Area HOV lane network, constructed through a variety of federal, state, and local agency investments, has provided an essential regional mobility option to connect commuters and employers. Some 40 years after the initial investment, this network contains many critical gaps which cannot be closed in a reasonable time-frame from current revenue sources. The additional revenues that could be generated by express lanes offer an opportunity to more quickly close many of these gaps. The proposed express lane network offers a means of filling approximately 152 lane-miles of existing gaps and providing new freeway-to-freeway direct connectors. The express lane network will enable connectivity to be improved more quickly than would otherwise occur.

Capacity Benefits

Reliance on vehicle occupancy eligibility has provided a reasonably effective means of managing HOV lane capacity to ensure “free-flow” conditions for high-occupancy vehicles but provides only limited capability to maximize facility utilization. Express lanes afford a more flexible means to manage utilization through its ability to offer congestion relief through variable pricing.

Traffic forecasts for the network demonstrate that in a majority of cases congestion is reduced in the adjacent general purpose lanes and enhance utilization of capacity occurs as a result of express lane conversion. However, because the traffic forecasts assume limited access, results indicate that general purpose lane volumes of some segments could increase as some HOVs are precluded from using the express lane. Real-time management of express lane operations and increasing frequency of access would ensure that these effects are minimized or eliminated by setting a price that ensures the lane is sufficiently utilized.

Travel Time Benefits

HOV lanes offer an incentive for carpooling and express bus ridership through an expectation of travel time savings. That incentive and the HOV system benefit diminish greatly, however, if the lane volume exceeds capacity and becomes congested. Allowing the current mix of transit, carpools and exempt low emission vehicles to travel in the region’s HOV lanes could impact meeting the federal statute addressing HOV Facility Management, Operation, and Monitoring (Freeways) - 23 U.S.C. 166 (d). Available capacity in a given lane could be increased by changing the carpool eligibility requirement from 2+ (for example) to 3+.

The net effect is highly variable depending on a variety of geographic and operational characteristics. Such a change can increase HOV lane capacity but may reduce system

efficiency if too many 2+ HOVs are diverted to general purpose lanes. Express lane variable pricing affords a management technique to manage the problem, not otherwise manageable through vehicle occupancy alone.

Reliability Benefits

Another HOV lane benefit, and one consistently ranked highly among reasons for transit use or ride sharing, is a predictable trip time. Overcrowding and congestion of HOV lanes reduces trip reliability just as it does for general purpose lanes. Provision of a properly managed, interconnected express lane system offers a "safety valve" option that may be attractive during off-peak hours as well as during peak hours. This feature can make the express lane toll as attractive to the occasional user as to the full-time commuter and makes it more attractive for those ridesharing as well as those single-occupant vehicles paying a toll. The express lane offers another choice to assure reliability as well as time savings.

Bus Transit Benefits

Bus riders will experience the same travel time and trip reliability HOV lane benefits afforded carpools, but system operators can also benefit by being able to more efficiently operate and manage their equipment fleets. A resulting benefit of this can be increased bus transit availability and convenience which typically increases ridership.

Using the data available in **Figure 2** above and some reasonable assumptions regarding travel speed and vehicle loadings, an order of magnitude of 1500 daily rider hours saved has been estimated with gap closures proposed via the express lane network.

System Performance Benefits

The proposed express lane network affords significant opportunities to better manage the overall freeway network.

- Enhanced real-time functional monitoring via additional surveillance capabilities
- Improved incident response access for emergency personnel via a parallel network
- An expanded changeable message sign network to better inform express lane and general purpose lane users of real-time system status
- Improved overall system management to increase utilization and benefit both express lane and general purpose lanes users
- Augmentation of MTC's Freeway Performance Initiative (FPI) to further enhance overall system operation
- Coordination with Corridor System Management Plans (CSMPs) to optimize network implementation sequencing and net system throughput

It should be noted that conversion of HOV lanes to express lanes is still subject to specific Caltrans required project initiation documents being prepared for each project, which must address the precise ways safety, congestion and travel times in both HOV and GP lanes will be improved when the conversion occurs.

7. COMMUNITY INVOLVEMENT

Extensive community participation was solicited and received in preparation of MTC's *Transportation 2035 Plan*. Numerous public workshops were conducted and one forum drew over 700 attendees. A survey in the fall of 2007 provided input from 1800 respondents and 3,600 voters were polled in the spring of 2008. Nearly two-thirds of respondents (62%) to the latter survey indicated definite or probable support for HOT lanes. (Source: *Transportation 2035 Plan*, pp. 18 & 19)

Thirty-seven federal, state and local agency participants from 15 agencies served on the HOT Lanes Phase 3 Steering Committee for the *Regional HOT Lanes Network Feasibility Study*. Represented agencies included:

- Alameda County Congestion Management Agency (now an agency of Alameda County Transportation Commission)
- Santa Clara Valley Transportation Authority
- Contra Costa Transportation Authority
- San Francisco County Transportation Authority
- Solano Transportation Authority
- Sonoma County Transportation Authority
- Transportation Authority of Marin
- San Mateo City/County Association of Governments
- Napa County Transportation Planning Agency
- West Contra Costa Transportation Advisory Committee
- Bay Area Toll Authority
- Metropolitan Transportation Commission
- California Department of Transportation
- California Highway Patrol
- Federal Highway Administration

(Source: MTC *Regional HOT Lanes Network Feasibility Study*, February 2009)

In addition to the community involvement efforts described above, each of the Congestion Management Agencies will be requested to place the CTC application for tolling authority for the Bay Area express lanes network, sought in conjunction with this PSR approval, on its agenda at a public meeting and a letter of support will be sought.

8. ENVIRONMENTAL DETERMINATION/DOCUMENTATION

A Preliminary Environmental Assessment Report (PEAR) is not suited for the purposes of this programmatic PSR. Instead, a qualitative discussion about potential impacts is provided for the Design Variation 1 and Design Variation 2 cross-section scenarios for each project.

ANTICIPATED LEVEL OF ENVIRONMENTAL DOCUMENT

NEPA: Based on the current scope of the projects, a review of available information, and the anticipation that any significant impacts associated with the project could be minimized

with appropriate design features or the adoption of standard mitigation measures, the anticipated NEPA documents to be prepared for each of the express lanes projects would be an Environmental Assessment/Finding of No Significant Impact (EA/FONSI). Under NEPA, an Environmental Impact Statement (EIS) is prepared when a proposed project *as a whole* has the potential to "significantly affect the quality of the human environment." Based on the current understanding of the scope of the projects, the requirement for the preparation of an EIS for any of the express lane projects is not anticipated at this time, but the final determination of the document type will be determined during the Project Approval and Environmental Document (PA&ED) phase for the individual segment project.

CEQA: Based on the current scope of the projects, a review of available information, and the anticipation that any significant impacts associated with the project could be minimized with appropriate design features or the adoption of standard mitigation measures, the anticipated CEQA documents to be prepared for most of the express lanes projects would be an Initial Study/Mitigated Negative Declaration (IS/MND). In situations that include extensive acquisition of right-of-way, an Environmental Impact Report (EIR) may be appropriate.

ANTICIPATED ENVIRONMENTAL TECHNICAL REPORTS

Various environmental technical reports are likely to be required as part of the environmental evaluation for each of the express lane projects. Anticipated reports include:

- Air Quality Study (AQ)
- Initial Site Assessment (ISA)
- Location Hydraulic Study (LHS)
- Natural Environment Study (NES)
- Noise Study Report (NSR)
- Visual Impact Assessment (VIS)
- Water Quality (WQ)
- Cultural Resource (Historic Property Survey Report [HPSAR], Archaeological Survey Report [ASR], Historical Resources Evaluation Report [HRER])
- Section 4(f) Evaluation

Attachment 9 further describes each of the listed reports and includes a table of which reports are likely to be required for each of the identified Express Lane projects.

9. FUNDING

CORRIDORS WHERE FUNDING IS ALREADY IN PLACE

A number of the projects that have been identified within the backbone express lane network are currently under development. Funding for several of these projects has been partially or fully identified as noted in **Table 13**.

Table 13: Current Project Funding Status

Project No.	Route	County	Project Features	Status of Funding
2	I-80	Solano	Express Lanes	Partial funding for Express Lane PA/ED
3	I-80	Solano	Express Lanes	Partial funding for Express Lane PA/ED
8	I-80 I-680	Solano	I-80/I-680 Direct Connectors (I-80 WB to I-680 SB and I-680 NB to I-80 EB)	Interchange reconstruction partially funded through CMIA
11	I-680	Contra Costa	Express Lane conversion	Partial funding for HOV extension
13	I-680	Contra Costa	Express Lane conversion	Partial funding for HOV extension
16	I-680	Alameda/ Santa Clara	Express Lane conversion	Partial funding for HOV lane construction
18	I-580/ I-680	Alameda	I-580/I-680 Direct Connectors (I-580 WB to I-680 SB and I-680 NB to I-580 EB, including 1.1 miles to connect to start of EB lane at Hacienda)	Partial funding for interchange reconstruction (including HOV direct connectors)
20	I-580	Alameda	Second Express Lane	Single Express Lane conversion fully funded
21	I-580	Alameda	Express Lane conversion and second Express Lane	HOV lane fully funded (CMIA); partial funding for conversion to Express Lane
22b	I-880	Alameda	Express Lane conversion	HOV lane extension from Hegenberger to Lewelling (northbound) partially funded
23a	I-880 SB	Alameda	Express Lane conversion	HOV lane extension from Hegenberger to Marina (southbound) fully funded
23b	I-880	Santa Clara	Express Lane conversion	SR-237 to US 101 HOV lanes fully funded
25	SR-237	Santa Clara	SR-237/I-880 Direct Connector (I-880 SB to SR-237 WB and SR-237 EB to I-880 NB)	Full funding for Express Lane conversion
26	SR-237	Santa Clara	Express Lane conversion	No current funding
28	SR-85	Santa Clara	Express Lane conversion	Partial funding for completion of PA/ED for Express Lane conversion
29	I-85/ US 101	Santa Clara	I-85/US-101 Direct Connectors (x2)	No current funding
30	US 101	Santa Clara	Express Lane conversion	Partial funding for completion of PA/ED for Express Lane conversion
31	US 101	San Mateo	Express Lane conversion	Partial funding for completion of PA/ED for Express Lane conversion

FINANCIAL PLAN

The financial plan examines the projected capital, operational and financing costs in conjunction with the tolling revenues and other funding sources in order to propose a financially achievable network implementation plan. Key aspects of the financial plan include the 20+ year capital funding parameters and the delivery phasing of the various segments.

The base financial plan groups various project segments being financed, constructed and brought into operation progressively in 5-yearly tranches, as shown in Table 14. Operations are scheduled to commence on the first tranche in 2015, with the subsequent tranches commencing operation in 2020, 2025 and 2030. If less favorable financial conditions occur, the pace of the network build-out could be extended beyond 2030.

In general, the financially stronger project segments are prioritized (subject to a variety of project development and operational constraints) to enable a greater proportion of the capital outlays to be funded by operating cash-flows from operating segments of the network (on a pay-as-you-go basis), therefore reducing reliance on debt financing.

The potential sources available to fund these tranches of project segments may include:

- Excess net operating cash-flows arising from express lane toll revenues from network segments under operations – i.e., residual annual cash flows after meeting debt service and other lender requirements;
- Senior toll revenue bonds issued in multiple tranches;
- A programmatic Transportation Infrastructure Finance and Innovation Act (TIFIA) loan, structured in multiple tranches;
- Already committed local funding for selected project segments (as detailed above); and
- Capital grant contributions – which may include: (i) new or extended local sales taxes; (ii) new or future federal, state or local programs; and/or (iii) new or future bridge tolls (with stipulation that such would only be available for capital outlays on certain eligible segments, as defined in statute).

Project-specific PIDs will identify concrete funding plans for individual projects.

10. SCHEDULE

Approval of this PSR is a key milestone in the process of obtaining authorization for and further work toward implementing the express lane network. Another key element of the process is CTC approval of the network. CTC approval must occur before December 31, 2011. If authority for the regional backbone express lane network is granted, implementation of the network would occur incrementally. Each segment of the network, or combinations of segments, would be developed as a separate project.

Precise project schedules will be developed during the respective Project Approval and Environmental Document phases. For the segments as presently envisioned, projections have been made in general terms as to when a segment will be implemented. These projections are broken down into 5-year increments covering the 2010 to 2030 time-frame, as reflected in **Table 14**. The phasing is projected based on operational benefits, HOV lane conversion versus new construction, ease of construction, right of way requirements and availability, design standards conformity, local preferences and cost/revenue considerations.

Table 14: Bay Area Express Lane Network - Segment Phasing

Project No.	Route	County	Begin	End	Operational Year			
					2015	2020	2025	2030
1	I-80	Solano	SOL/YOLO County Line	I-505 IC				X
2	I-80	Solano	I-505 IC	Airbase Pkwy IC		X		
3	I-80	Solano	Airbase Pkwy IC	Red Top Road	X			
4	I-80	Solano	Red Top Road	SR-37		X		
5	I-80	Solano	SR-37	Carquinez Bridge Toll Plaza		X		
6	I-80	Solano/ Contra Costa	Carquinez Bridge			X		
		Contra Costa	Cummings Skyway	SR-4 IC				
7	I-80	Contra Costa Alameda	SR-4 IC	CC/ALA County Line		X		
	I-80	Alameda	ALA/CC County Line	HOV Direct Connector Ramp				
	I-80 EB	Alameda	HOV Direct Connector Ramp	I-880 connector				
	I-80 WB	Alameda	HOV Direct Connector Ramp	Bay Bridge Metering Lights	X			
8	I-80 I-680	Solano	I-80/I-680 Direct Connectors (I-80WB to I-680SB and I-680NB to I-80EB, including 3.8 lane-miles to account for approach to Gold Hill Rd)			X		
9	I-680	Solano	Gold Hill Road	I-780		X		
10	I-680 NB	Solano Contra Costa	HOV bypass and Benicia-Martinez Bridge					
11	I-680 NB	Contra Costa	Marina Vista	SR-242		X		
12	I-680 SB	Solana Contra Costa	Benicia-Martinez Bridge					
13	I-680 SB	Contra Costa	Marina Vista	Livorna Rd		X		
14	I-680	Contra Costa	Livorna Road	Alcosta	X			
15	I-680	Alameda	Alcosta	SR-84 IC			X	
16	I-680 NB	Alameda Contra Costa	SR-84 IC	SR-237 IC		X		
17	I-680 SB	Alameda Santa Clara	SR-84 IC	SR-237 IC	*			
18	I-580 I-680	Alameda	I-580/I-680 Direct Connectors (I-580 WB to I-680 SB and I-680 NB to I-580 EB, including 1.1 miles to connect to start of EB lane at Hacienda)				X	
19	I-580	Alameda	Greenville	ALA/SJQ County Line			X	

Table 14: Bay Area Express Lane Network - Segment Phasing (Continued)

Project No.	Route	County	Begin	End	Operational Year			
					2015	2020	2025	2030
20	I-580 EB single lane	Alameda	Hacienda	Tassajara/ Santa Rita Road	X			
	I-580 EB dual lanes		Tassajara/ Santa Rita Road	Vasco Road				
	I-580 EB single lane		Vasco Road	Greenville				
21a	I-580 WB single lane	Alameda	San Ramon Road/ Foothill Road	Greenville	X			
21b	I-580 WB dual lanes	Alameda	San Ramon Road/ Foothill Road	Greenville		X		
22a	I-880 NB	Alameda Santa Clara	Lewelling	South of Dixon Landing Road	X			
22b	I-880 NB	Alameda	Hegenberger	Lewelling		X		
23a	I-880 SB	Alameda Santa Clara	Hegenberger	South of Dixon Landing Road	X			
23b	I-880	Santa Clara	I-880/SR-237 HOV Connector	US 101 IC		X		
24	I-880	Santa Clara	US 101 IC	I-280 IC				X
	SR-17		I-280 IC	SR-85 IC				
25	SR-237	Santa Clara	SR-237/I-880 Direct Connectors (I-880 SB to SR-237 WB and SR-237 EB to I-880 NB)		*			
26	SR-237 EB	Santa Clara	Mathilda Ave	N First Street	X			
	SR-237 WB		Mathilda Ave	Lawrence Expressway				
27	SR-237	Santa Clara	SR-85 IC	Mathilda Ave				X
28	SR-85 single lane	Santa Clara	US 101 N IC	I-280 IC	X			
	SR-85 dual lanes		I-280 IC	SR 87 IC				
	SR-85 single lane		I-280 IC	SR 87 IC				
29	I-85 US 101	Santa Clara	I-85/US-101 Direct Connectors (x2)		X			
30	US 101 dual lanes	Santa Clara	Cochrane	SCL/SM County Line	X			
31	US 101	San Mateo	SM/SCL County Line	Whipple			X	
32	SR-84 WB	Alameda	Toll Plaza	I-880 IC	X			
33	SR-92 WB	Alameda	Toll Plaza	Hesperian On-ramp	X			

*HOT Lane already implemented or nearly implemented

Gap in express lane network – see page 23 for discussion on other gap sections

11. FHWA COORDINATION

FHWA coordination and concurrence is required for various aspects of the project due to the fact that Interstate routes are involved. Much of the existing HOV lane network has been constructed using federal funding, and federal funding (including Congestion Mitigation and Air Quality Program [CMAQ]) is anticipated for the project. Specific areas of FHWA involvement are expanded on in the following paragraphs.

Imposition of tolling on federal highways requires FHWA authorization. MTC has already submitted a statement of interest to the FHWA with regard to seeking tolling authority for the full 800-mile network. This PSR is proposed to become the supporting document for a formal request of tolling authority on the approximately 533-mile express lane network.

Changes to Interstate highway mainline access require FHWA approval of a New Connection Report (NCR) or Modified Access Report (MAR), depending on whether a change is a new connection or modification of an existing access point. It is anticipated that impacts to existing local road interchanges resulting from the project will be minimal, but addition or modification of HOV/HOT lane freeway-to-freeway direct connectors are expected. In instances where these changes add new connections or modify existing ones on Interstate highways, an NCR or MAR will need to be prepared. On the current project list, projects 8, 18, 25, and 29 involve direct connectors that are likely to require NCR/MAR approval. Those projects were included in the list provided in **Table 13**. Exceptions to Mandatory Design Standards proposed on the Interstate System would also require FHWA approval. Approvals from FHWA will be sought in conjunction with the PA&ED phase of the specific projects rather than through the current PSR effort.

12. RECOMMENDATIONS

It is recommended that this PSR to support the Bay Area Express Lane Network be approved and that permission be given to negotiate cooperative agreements covering the subsequent phases of the individual corridor projects.

13. PROJECT CONTACTS

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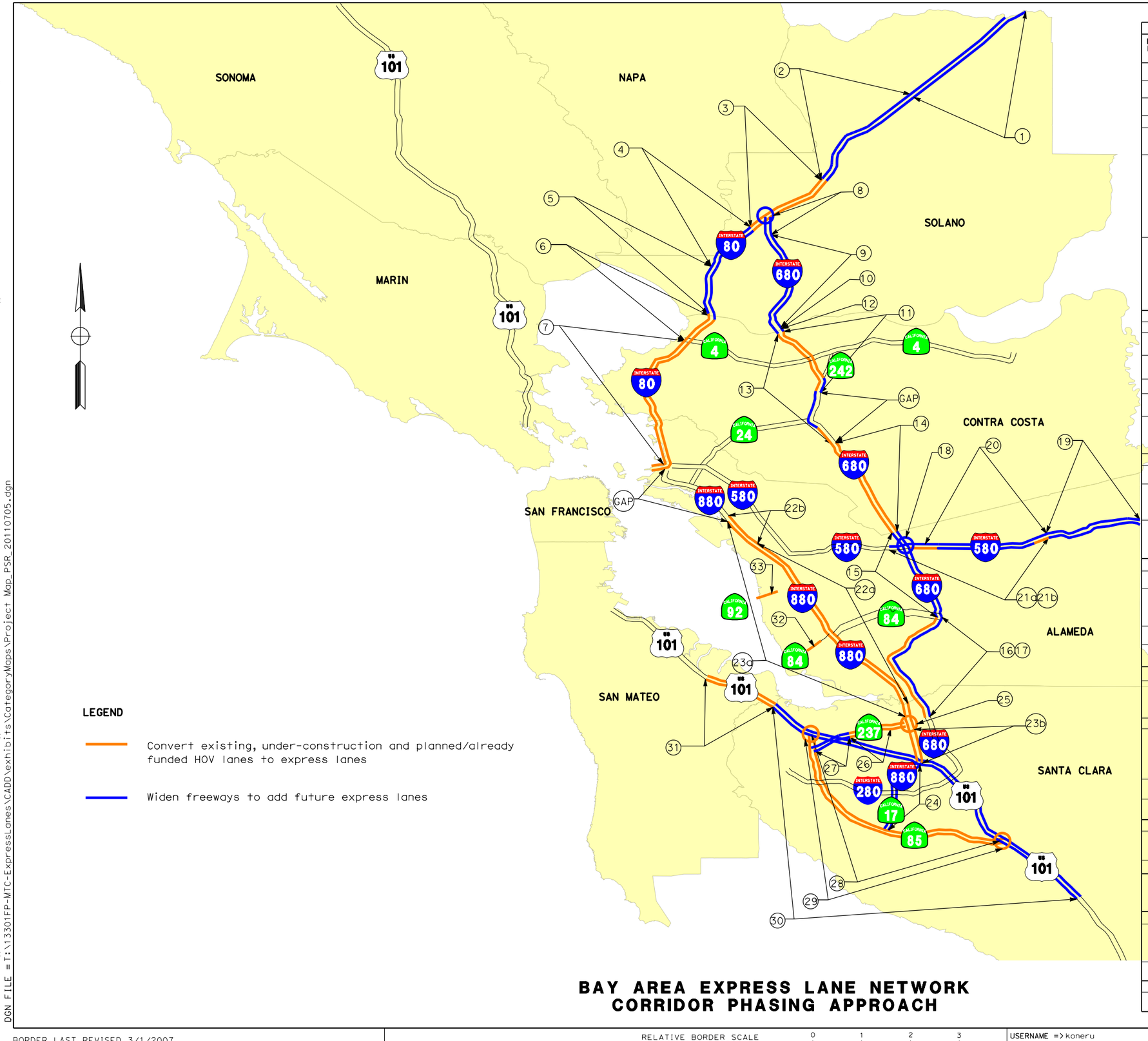
ATTACHMENTS

1 Location/Vicinity Map
2 Typical Cross-Sections (Standard and Non-Standard)
3 Existing Bottleneck Locations
4 Caltrans Traffic Operations Policy Directive 11-02
5 Assumptions for Design Variations 1 and 2 Used for Cost Estimation
6 Cost Estimating Methodology
7 Project Segment Cost Estimates
8 Operational Assessment
9 Preliminary Environmental Analysis

ATTACHMENT 1

LOCATION/VICINITY MAP



LEGEND

Convert existing, under-construction and planned/already funded HOV lanes to express lanes

Widen freeways to add future express lanes

BAY AREA EXPRESS LANE NETWORK CORRIDOR PHASING APPROACH

Bay Area Express Lane Backbone Network Project Segmentation							
Project No. for PSR	Route	Direction	County	Begin PM	End PM	Begin	End
1	I-80		Solano	R 44.720	R 28.359	SOL/YOLO County Line	I-505 IC
2	I-80		Solano	R 28.359	19.176	I-505 IC	Airbase PKWY IC
3	I-80		Solano	19.176	R 11.394	Airbase PKWY IC	Red Top Rd
4	I-80		Solano	R 11.394	5.647	Red Top Rd	SR-37
5	I-80		Solano	5.647	0.593	SR-37	Carquinez Bridge Toll Plaza
6	I-80	WB	Solano/Contra Costa	0.593(Solano)	12.753 (Contra Costa)	Carquinez Bridge Westbound	
	I-80	WB	Contra Costa	12.753	10.059	Cummings Skyway	SR-4 IC
	I-80	EB	Solano/Contra Costa	0.593(Solano)	12.753 (Contra Costa)	Carquinez Bridge Eastbound	
	I-80	EB	Contra Costa	12.753	10.059	Cummings Skyway	SR-4 IC
7	I-80		Contra Costa	10.059	0.000	SR-4 IC	CC/ALA County Line
	I-80		Alameda	8.036	3.677	ALA/CC County Line	HOV Direct Conn. Ramp
	I-80	WB	Alameda	3.677	1.800	HOV Direct Conn. Ramp	Bay Bridge Metering
	I-80	EB	Alameda	3.677	2.273	HOV Direct Conn. Ramp	I-880 Conn.
8	I-80/I-680		Solano	I-80/I-680 Direct Connectors			
9	I-680		Solano	R 10.018	M 0.682	Gold Hill Rd	I-780
10	I-680	NB	Solano/Contra Costa	M 0.682 (Solano)	24.264 (Contra Costa)	HOV bypass and Benicia-Martinez Bridge	
11	I-680	NB	Contra Costa	24.264	R 18.707	Marina Vista	SR-242
	I-680	NB	Contra Costa	R 18.707	15.606	SR-242	N. Main Street
GAP	I-680	NB	Contra Costa	15.606	R 11.280	N. Main Street	Livorna Rd
12	I-680	SB	Solano/Contra Costa	M 0.682 (Solano)	24.264 (Contra Costa)	Benicia-Martinez Bridge	
13	I-680	SB	Contra Costa	24.264	15.606	Marina Vista	N. Main
	I-680	SB	Contra Costa	15.606	R 12.613	N. Main Street	Rudgear Rd.
	I-680	SB	Contra Costa	R 12.613	R 11.280	Rudgear Rd	Livorna Rd
14	I-680		Contra Costa	R 11.280	R 0.010	Livorna Rd	Alcosta
15	I-680		Alameda	R 21.879	R 11.845 (RTE 84E)	Alcosta	SR-84 IC
16	I-680	NB	Alameda	R 11.845 (RTE 84E)	M 0.000	SR-84 IC	ALA/ SCL County Line
	I-680	NB	Santa Clara	M 9.935	M 7.647	SCL/ALA County Line	SR-237 IC
17	I-680	SB	Alameda	R 11.845 (RTE 84E)	M 0.000	SR-84 IC	ALA/ SCL County Line
	I-680	SB	Santa Clara	M 9.935	M 7.647	SCL/ALA County Line	SR-237 IC
18	I-580/I-680		Alameda	I-580/I-680 Direct Connectors			
19	I-580		Alameda	R 8.265	0.000	Greenville	ALA/SJO County Line
20	I-580 single lane	EB	Alameda	18.821	R 8.265	Hacienda	Greenville
	I-580 dual-lane	EB	Alameda	17.947	9.683	Tassajara/Santa Rita Rd	Vasco Rd
21a	I-580	WB	Alameda	R 21.427	R 8.265	San Ramon Rd/Foothill	Greenville
21b	I-580 (Second lane)	WB	Alameda	R 21.427	R 8.265	San Ramon Rd/Foothill Rd	Greenville
GAP	I-880		Alameda	34.52	25.497	I-80 IC	Hegenberger
22a	I-880	NB	Alameda	20.324	0.000	Lewelling	SCL/ALA County Line
	I-880	NB	Santa Clara	10.502	9.5 (estimate)	SCL/ALA County Line	South of Dixon Landing Rd
22b	I-880	NB	Alameda	25.497	20.324	Hegenberger	Lewelling
23a	I-880	SB	Alameda	25.497	22.837	Hegenberger	Marina Blvd
	I-880	SB	Alameda	22.837	0.000	Marina Blvd	SCL/ALA County Line
	I-880	SB	Santa Clara	10.502	9.2 (estimate)	SCL/ALA County Line	South of Dixon Landing Rd
23b	I-880		Santa Clara	8.422	4.059	I-880/SR-237 HOV Connector	US 101 IC
24	I-880		Santa Clara	4.059	0.000	US 101 IC	I-280 IC
	SR-17		Santa Clara	13.949	9.354	I-280 IC	SR-85 IC
25	SR-237		Santa Clara	SR-237/I-880 Direct Connectors			
26	SR-237	EB	Santa Clara	2.990	6.905	Mathilda	N. 1st St.
	SR-237	WB	Santa Clara	2.990	R 4.599	Mathilda	Lawrence Expwy
27	SR-237		Santa Clara	R 0.375	2.990	SR-85 IC	Mathilda
28	SR-85 single lane		Santa Clara	23.829	0.000	US 101 N IC (Mtn View)	US 101 S IC (S. San Jose)
	SR-85 dual-lanes		Santa Clara	18.413	5.220	US 280 IC	SR-87 IC
29	SR-85/US-101		Santa Clara	SR-85/US-101 Direct Connectors (x2)			
30	US-101 single lane		Santa Clara	R 52.550	R 17.820	SCL/SM County Line	Cochrane
	US-101 dual-lane		Santa Clara	R 52.550	R 26.779	SCL/SM County Line	SR-85 S IC
31	US-101		San Mateo	0.000	6.623	SM/SCL County Line	Whipple
32	SR-84	WB	Alameda	R 3.180	R 5.984	Toll Plaza	I-880 IC
33	SR-92	WB	Alameda	R 2.594	R 5.757	Toll Plaza	Hesperian On-ramp

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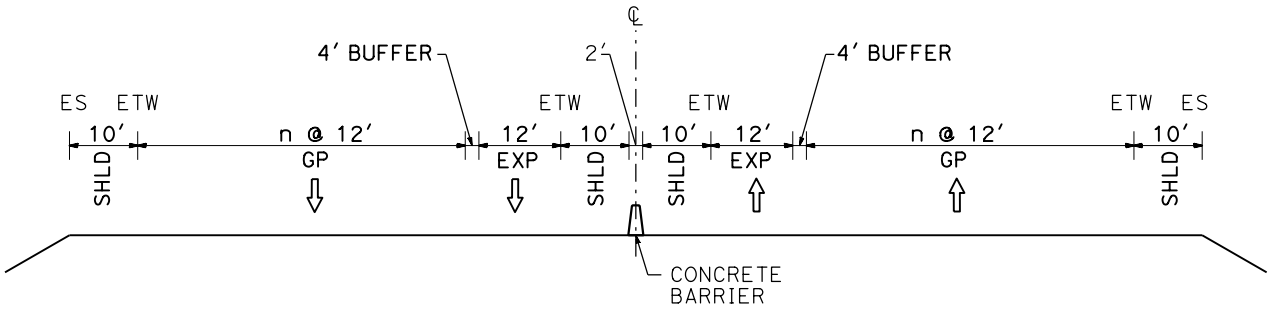
ATTACHMENT 2

TYPICAL CROSS-SECTIONS

(Standard and Non-Standard)



STANDARD SECTION

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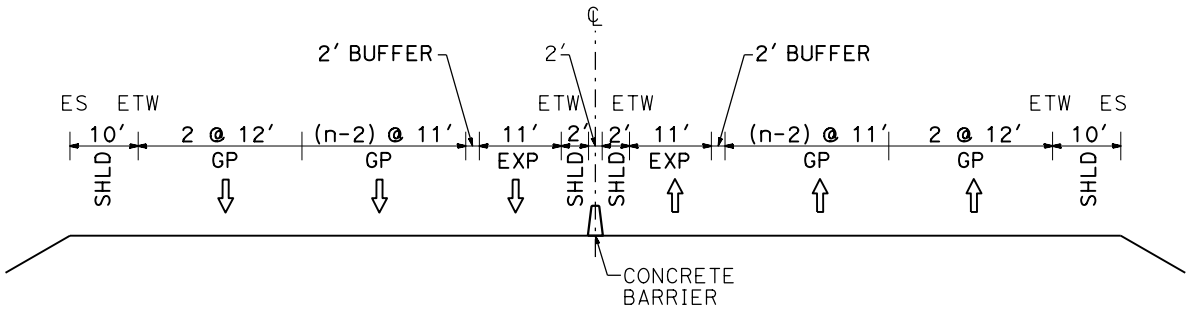

NON-STANDARD SECTION

NOT TO SCALE

TYPICAL SECTIONS DESIGN VARIATION 1 AND DESIGN VARIATION 2

ATTACHMENT 3

Existing Bottleneck Locations

ATTACHMENT 3
SAN FRANCISCO BAY AREA EXPRESS LANES NETWORK
BOTTLENECK EVALUATION

The Metropolitan Transportation Commission (MTC) and the California Department of Transportation (Caltrans) are pursuing development of an integrated Bay Area express lane network to enhance mobility and afford greater user flexibility of the transportation network within the San Francisco Bay Area. Significant daily congestion currently exists on freeways corridors within the express lanes network study limits and will continue to increase with future traffic growth. A high level, qualitative traffic assessment was conducted for the Project Study Report. More detailed traffic studies will be performed in subsequent phases of the project delivery process for individual projects. Existing conditions were evaluated based on bottleneck locations, congestion levels resulting from these bottlenecks, HOV lane system utilization, express transit service and accidents. This attachment details the evaluation of existing bottleneck locations.

Existing bottleneck locations are summarized for each corridor within the express lanes network study limits in **Table 1** through **Table 10**. Bottlenecks were identified from speed profiles conducted by Caltrans District 4 in 2007. The 2007 District 4 State of the System Report was used to identify the extent and quantify the amount of congestion resulting from the bottlenecks. This report was prepared through a collaborative effort between District 4 and the Metropolitan Transportation Commission and includes a listing of congested segments throughout District 4, congestion occurrence periods, as well as quantifiable weekday daily delay that travelers experienced. The deficiency analysis is based on 2007 conditions as those represent high levels of congestion and provide the most recent complete set of data throughout the Bay Area.

In addition to bottleneck locations, weekday daily delay associated with the respective bottlenecks is also presented in **Table 1** through **Table 10** for the directional corridors. Delay is an effective measure in quantifying congestion levels caused by the presence of bottlenecks throughout the Bay Area. Each of the corridors included in the Express Lanes Network experiences recurrent peak period delays. Bottleneck delays range from 100 daily vehicle hours of delay to approximately 12,000 daily vehicle hours of delay throughout the network corridors. Several of the segments with large delays experience minor bottlenecks within a larger overall bottleneck and delays for these segments have been reported in terms of overall delays. The corridor delays presented in **Table 1** through **Table 10** demonstrate that recurrent congestion exists throughout the Express Lanes Network and many of the corridors experience significant delays. In addition, some corridors experience congestion during both peak periods in the same direction.

Table 1: I-80 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Eastbound					
7	ALA	Ashby Avenue on to University Avenue off	PM	MacArthur Maze to Central Ave.	5,570
7	ALA	Gilman St. on to Buchanan St. off			
7	CC	San Pablo Ave on to Solano Ave. off		SR-4 to Central Ave.	
7	CC	Pinole Valley Rd. on to SR-4			
5	SOL	Carquinez Bridge to SR-29			
3	SOL	Truck Scales to SR-12 East			
3	SOL	Travis Blvd. on to Air Base Pkwy. off			
Westbound					
7	CC	SR-4 on to Pinole Valley Rd. off	AM	SR-4 to SFOBB Metering Lights	11890
7	CC	Appian Way on to Richmond Parkway off			
7	CC	Hilltop on to El Portal off			
7	CC	Carlson Blvd. on to Central Ave. off			
7	CC	Central Ave. on to Cleveland Ave. off			
7	ALA	Gilman St. on to University off			
7	ALA	Powell St. on to MacArthur Maze			
7	ALA	SFOBB Metering Lights			
3	SOL	Truck Scales to I-680			
5	SOL	SR-29 on to Carquinez Bridge			
7	ALA	Powell St on to MacArthur Maze	PM	Gilman St. to MacArthur Maze	3,930
7	ALA	SFOBB Metering Lights		MacArthur Maze to SFOBB Metering Lights	

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 2: I-680 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Northbound					
N/A	SCL	Alum Rock on to McKee off	AM	Capitol Expwy to McKee Rd.	950
15	ALA	580/680 I/C & Alcosta Blvd. on to Bollinger Canyon Rd. off		At I-580 and at Alcosta Blvd.	
14	CC	Sycamore Valley Rd on to Diablo Rd. off and El Cerro Blvd. on to El Pintado Rd. off		Sycamore Valley Rd. to El Pintado Rd.	
16	ALA	Washington Blvd. on to Mission Blvd (238) off	PM	Scott Creek Rd to Washington Blvd.	4,110
16	ALA	Andrade Rd. on to Calaveras Blvd. off		Sheridan Rd to N. of Andrade Rd.	
14	CC	Crow Canyon Rd. on to Sycamore Valley Rd. off		N. of Bollinger Canyon Rd. to Crow Canyon Rd.	
14	CC	Diablo Rd.on to El Cerro Rd. off and El Pintado Rd. on to Stone Valley Rd. off		Crow Canyon Rd. to Sycamore Valley Rd and El Pintado Rd. to Stone Valley Rd.	
11	CC	SR-24 on to N. Main St. off		S. of Stone Valley Rd. to north of SR-24	
11	CC	N. Main St.on to Treat Blvd. off		SR-24 to N. Main St and at Treat Blvd.	

Table 2: I-680 Existing Bottleneck Locations, Continued

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
11	CC	Burnett Ave. on to Concord Ave. on	PM	Burnett Ave to Concord Ave.	
Southbound					
13	CC	Contra Costa Blvd. on to Treat Blvd. off	AM	Contra Costa Blvd. to SR-242	3,900
13	CC	N. Main St. Lane Drop to on-ramp		SR-242 to SR-24	
14	CC	Livorna Rd. on to Stone Valley Rd. off		S. Main St. to Stone Valley Rd.	
14	CC	Diablo Rd. on to Sycamore Valley Rd. off		Stone Valley Rd. to Diablo Rd.	
15	ALA	Vargas Rd. to Mission Blvd. (238), Washington Blvd. on to Durham Rd. off and Durham Rd. on to Mission Blvd. (SR-262) off		SR-84 to S. of Durham Rd.	
13	CC	Rudgear Rd. on to Livorna Rd. off	PM	SR-24 to N. of Livorna Rd.	1220
N/A	CC	Berryessa Rd. on to McKee Rd. off		Landess Ave. to S. of Berryessa Rd.	

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 3: I-580 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Eastbound					
20	ALA	Vasco Rd. on to Greenville Rd.off and Santa Rita Rd. on to El Charro Rd. off Vasco Rd. on to	PM	I-680 to Greenville Rd	7410
Westbound					
21a	ALA	Altamont Pass and Airway Blvd. on to Santa Rita Rd. off	AM	I-205 to Hacienda Dr.	5,310
21a	ALA	Hopyard Rd. on to I-680 off		W. of Hacienda Dr. to Hopyard Rd.	

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 4: I-880 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Northbound					
23b	SCL	US-101 on to Gish Rd off	AM	S. of Coleman Ave to N. or US-101	2,200
22a	ALA	Tennyson Rd. on to SR-92 off		Fremont Blvd to Tennyson Rd	
22a	ALA	A St. on Lewelling Blvd. off		SR-92 to A St.	
22a	ALA	Davis St. on to 98th Ave off		Hesperian Blvd. to Davis St.	
22a	ALA	Mission Blvd. on to Fremont Blvd. off	PM	S. of Dixon Landing Rd to N. of Mission Blvd	5650
22a	ALA	Stevenson Blvd.Loop on to Stevenson Blvd. Diag. on		Auto Mall Parkway to Stevenson Blvd.	
22a	ALA	Alvarado-Niles Rd on to Whipple Rd. off, Whipple Rd. on to Industrial Pkwy. Off, Tennyson Rd. on to SR-92 off	PM	Decoto Rd to Alvarado-Niles Rd., at Whipple Rd and Industrial Blvd to Tennyson Rd.	
22a	ALA	A St. on Lewelling Blvd. off		SR-92 to S. of Hesperian Boulevard	

Table 4: I-880 Existing Bottleneck Locations (Continued)

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Southbound					
23a	ALA	Winton Ave. on to SR-92 off and Tennyson Rd. on to Industrial Pkwy off	AM	Marina Blvd. to N. of Industrial Blvd.	6,900
23a	ALA	Fremont Blvd. on to Decoto Rd (SR-84) off		Alvarado Niles Road to Fremont Blvd. (North)	
23a	ALA	Mission Blvd. (262) on to Dixon Landing Rd. off		Thornton Ave to Mission Blvd (262)	
23b	SCL	Brokaw Rd on to Old Bayshore off		O'Toole Ave to S. of Brokaw Rd	
23a	ALA	98th Ave on to Davis St. off, Marina Blvd. on to Washington Ave off and 238 on to A St. off	PM	Hegenberger Rd. to N. of Davis St., S. of Marina Blvd and at I-238	3,660
23a	ALA	SR-92 on to Tennyson Rd. off		Winton Ave. to SR-92	
23a	ALA	Fremont Blvd. S on to Mission Blvd. 262 off		At Fremont Blvd. South	
23a	ALA	Decoto Rd. on to Thornton off and Thornton Ave on to Mowry Ave off a		North of Mowry Ave. and at Decoto Rd	
23a	ALA	Industrial Blvd. on to Whipple Rd. off, Alvarado-Niles Rd. on to Fremont Blvd (North) off and Fremont Blvd. (North) on to Decoto Rd off		At Industrial Blvd., Alvarado-Niles Rd and Freemont Blvd. North	
23b	SCL	Bascom Ave. on to I-280 off		Browkaw Rd. to Bascom Ave.	
23b	SCL	Brokaw Rd on to Old Bayshore off		SR-237 to Browkaw Rd	

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 5: SR-17 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Northbound					
24	SCL	Camden Ave on to Hamilton Ave off	AM	North of Camden Ave.	240

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 6: SR-237 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Eastbound					
26	SCL	Lawrence Expwy on to Great America Pkwy off	AM	US-101 to Lawrence Expressway	100
26	SCL	N. First Street on to Zanker Rd. off	PM	Lawrence Expressway to Zanker Rd.	780
26	SCL	Bottleneck is on I-880 Queue extends onto 237		E. of SR-237 to W. of California Circle	
Westbound					
26	SCL	Zanker Rd. on to N. 1st St. off	AM	I-880 SB off to N. First St.	1,000
26	SCL	Zanker Rd. on to N. 1st St. off	PM	W. of Zanker Rd. to I-880	240

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 7: SR-85 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Northbound					
28	SCL	Bernal Rd diag. on to Cottle Rd. off	AM	At Bernal Rd. on-ramp	1720
28	SCL	Almaden Expwy diag on to Camden Ave off, Union Ave on to Bascom Ave. off		S. of Almaden Expwy to Union Ave.	
28	SCL	Winchester Blvd. on to Saratoga Ave off		SR-17 to N. of Winchester Blvd.	
28	SCL	Stevens Creek Blvd on to I-280 off		Sunnyvale Rd. to S. of Stevens Creek Blvd.	
28	SCL	Bottleneck on I-280		I-280 to Fremont Ave.	
Southbound					
28	SCL	SR-87 on to Blossom Hill Rd. off	PM	Santa Teresa Blvd. to Blossom Hill Rd	2800
28	SCL	Union Ave on to Camden Ave. off		Bascom Ave to Union Ave	
28	SCL	Stevens Creek Blvd on to Sunnyvale Rd. off, Saratoga Ave. on to Winchester Blvd. off		I-280 to N. of Saratoga Ave.	
28	SCL	Fremont Ave on to Homestead Rd. off		Moffett Blvd. to N. of Homestead Rd.	

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 8: US-101 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Northbound					
30	SCL	E. Dunne Ave on to Cochrane Rd off	AM	N. of San Martin to Ave to N. of East Dunne Ave	4050
30	SCL	Tully Rd loop on to Diag on		N. of Hellyer Ave to N. of Tully Rd.	
30	SCL	Trimble Rd. Diag on to Montague Expwy off		280/680 to N. of Trimble Rd.	
30	SCL	SR-85 on to Middlefield Way off		SR-237 to Shoreline Blvd.	
30	SCL	Embarcaderr Rd on to University Ave off		Rengstorff Ave to Embarcaderro Rd.	
30	SCL	N. Rengstorff Ave. diag on to San Antonio Rd. off	PM	Ellis St. to San Antonio Rd	1300
Southbound					
31	SM	University Ave on to Embarcaderro Rd. off	AM	Marsh Rd. to S. of University Ave.	760
31	SM	Willow Rd. on to University Ave. off	PM	Woodside Rd. to Willow Rd.	6510
30	SCL	N. Rengstorff Ave. diag on to Old Middlefield Way on		Willow Rd to S. of Rengstorff Ave	
30	SCL	San Tomas Expwy on to Trimble Rd off and I-880 NB on to N. 13th St. off		Great America Pkwy to Oakland Rd.	
30	SCL	Tully Rd onto Capitol Expwy off		S. of Alum Rock Ave to S. of Tully Rd.	

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 9: SR-84 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Westbound					
32	ALA	Dumbarton Bridge Toll Plaza	AM	Dumbarton Bridge Toll Plaza	220

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

Table 10: SR-92 Existing Bottleneck Locations

Project No.	County	Bottleneck Location	Peak	Congestion Location	Corridor Delay (Veh-Hrs)
Westbound					
33	ALA	San Mateo-Hayward Bridge Toll Plaza	AM	At San Mateo-Hayward Bridge Toll Plaza	130

Source: 2007 Caltrans Speed Profiles and 2007 District 4 State of the System Report
N/A: Not on the Project List
County: ALA=Alameda; CC=Contra Costa; SCL=Santa Clara; SM=San Mateo; SOL=Solano

ATTACHMENT 4

Caltrans Traffic Operations Policy Directive 11-02

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

TRAFFIC OPERATIONS POLICY DIRECTIVE

TR-0011 (REV 08/2009)

ROBERT COPP, DIVISION CHIEF (Signature)	NUMBER 11-02	PAGE 1 OF 12
SUBJECT: Updated Managed Lane Design	DATE ISSUED 3/23/2011	EFFECTIVE DATE 4/7/2011

DISTRIBUTION

- ☒ All District Directors
- ☒ All Deputy District Directors - Traffic Operations
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- ☒ Publications (California MUTCD Website) http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd.htm
- ☒ Headquarters Division Chiefs for: Design, Project Management, Planning

DOES THIS DIRECTIVE AFFECT OR SUPERSEDE ANOTHER DOCUMENT? ☒YES ☐NO	IF YES, DESCRIBE: High Occupancy Vehicle Guidelines for Planning, Design, and Operations
WILL THIS DIRECTIVE BE INCORPORATED IN THE CALIFORNIA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (CA MUTCD) ☒YES ☐NO	IF YES, DESCRIBE: Chapters on preferential lane signing and pavement markings to be included in the next edition of the CA MUTCD

DIRECTIVE

In California, managed lanes include high occupancy vehicle (HOV) lanes, high occupancy/toll (HOT) lanes, and express toll lanes. The latter two are referred to generally as "Express Lanes".

The California Department of Transportation (Department) "2003 High Occupancy Vehicle Guidelines for Planning, Design, and Operations" (HOV Guidelines) and the content of this Policy Directive (Directive) shall be applied during the planning and development of freeway managed lane projects, including conversions of existing managed lanes to incorporate tolling or utilize continuous access. It shall be considered during the planning and development of all other freeway improvement projects (e.g. pavement rehabilitation projects) and during the course of traffic investigations that are addressing operational and safety performance deficiencies.

For ongoing projects, changes to the project design pursuant to this Directive shall be determined by the project manager and project engineer in consultation with the Headquarters' Traffic Operations Liaison (Traffic Liaison) and the district HOV program coordinator. The decision to implement the requirements of this directive will be based on the potential benefits and impacts to the project scope, cost and schedule. **The consultation and recommendations shall be documented in the form of a memorandum for the project files with the signature of the Traffic Liaison indicating concurrence.**

Retrofitting of existing facilities will not be required unless physical conditions for that facility change, such as a change in access type or an HOV-Express Lane conversion.

The technical content of this Directive represents best engineering practices and requirements that will be incorporated into the next edition of the HOV Guidelines. This Directive also incorporates material from the most recent (2009) edition of the federal Manual on Uniform Traffic Control Devices (federal MUTCD). This material will be incorporated into the next edition of the CA MUTCD.

The following principles are expected to guide decision-making on the development and/or operations of managed lanes:

- Employ a systems management approach; managed lane strategies can affect the performance of the entire freeway system. The focus should not just be on the operation of the managed lane and its mobility benefits.
- Balance system performance and overarching goals, including safety, mobility, delivery, stewardship, and customer service when selecting and analyzing project alternatives and key features.
- Consider increasing occupancy requirements if HOV lanes are experiencing severe congestion.
- Consider planning for two managed lanes in each direction of travel if analysis determines it to be practical and beneficial.
- Consider implementing congestion pricing to utilize the full capacity of under-utilized HOV lanes if analysis determines it to be practical and beneficial.
- Ensure uniformity and consistency in the appearance of facilities within a region as much as possible; unique conditions and situations may require unconventional treatment(s).
- Ensure enforcement considerations are taken into account. Consult the California Highway Patrol (CHP) during project development.
- Consult with the Traffic Liaison to ensure that emerging best practices and recent "lessons learned" from collision analysis and research are fully considered and implemented.

MANAGED LANES ACCESS

Managed lanes in California utilize either:

- Limited-access designs (via physical barriers or barrier striping within a buffer space) which may include intermediate access openings.
- Continuous-access designs (contiguous/non-separated).

When planning managed lanes, consideration should be given to both access types. The choice of access type is based on a general evaluation of the performance and management benefits for the entire freeway as well as the capital costs of building anc operating the facility. See Attachment 2 for a summary of design, cost and performance considerations for the two types of access designs. Various research and engineering studies on managed lane facilities have found that the highway features that can have the greatest affect on performance, including safety and throughput, are:

- The frequency, location, type and design of intermediate access openings on limited-access facilities.
- Shoulder widths.
- Traffic control and safety devices that provide positive guidance (usually related to access points and driver decision-making, such as overhead signing, striping, and lighting).

For additional information and reference material, see the Background section of this Directive and Attachment 1.

Managed lanes may also utilize drop ramps to and from local streets and direct connectors to and from managed lanes on other freeways. These provide system connectivity with the least potential for adverse performance impacts by allowing traffic to directly exit or enter the managed lanes without weaving across adjacent general-purpose lanes. Drop ramps and direct connectors should be considered where substantial congestion in the general-purpose lanes exists or is expected and there is a significant local demand for access to or from the managed lanes. Refer to Sections 3.7 and 3.8 of the HOV Guidelines for more information.

MANAGED LANES ENGINEERING STUDY REQUIREMENTS

Section 149 of the Streets and Highways Code requires that competent engineering estimates be made of the effects of a managed lane on safety, congestion, and highway capacity prior to constructing such lanes. **A traffic study shall be performed for all managed lane projects. This study shall be composed of an operational analysis and a safety analysis.** This traffic study replaces the "HOV Report" located in Appendix B of the HOV Guidelines. The objective of the study is to determine if, and to what extent, the design of the managed lane will meet the performance thresholds and guidance provided in this Directive, as well as any other thresholds the district or project sponsor may establish. **For new projects, the traffic study shall be conducted as early as reasonable during project development.** Ideally the study is conducted during development of the project initiation document (PID) to confidently establish an accurate cost, scope and schedule for the project. Alternatively, a more general assessment or technical evaluation may be adequate during the PID phase in order to:

- Identify potential performance problems for further study.

- Identify the scope of (and resources need for) a formal traffic study to be performed at the start of the Project Approval and Environmental Document phase.

The following information and assumptions shall be identified and utilized as part of the traffic study:

- **Design year peak-hour volumes for the managed lane(s), general-purpose lanes, and adjacent general-purpose ramps. The design year shall be 20 years from the date when the project is scheduled to be completed and opened to traffic as per Highway Design Manual (HDM) Index 103.2.**
- **The design year peak-hour volume of vehicles expected to use access locations.**
- **The types of vehicles expected to use the freeway facility (e.g., transit or trucks).**
- **Geometric constraints on the managed lanes and general purpose lanes, including known and expected bottlenecks and associated queues.**

The operational analysis is to be performed using a methodology that is acceptable to the district and the project sponsor. **The operational analysis shall:**

- **Evaluate the characteristics of the entire freeway facility, including both the managed lane(s) and the adjacent general purpose lanes.**
- **Include a merge/diverge analysis of any drop ramps or direct connectors that may be utilized on the managed lane.**
- **Evaluate the operational impacts of intermediate access openings on a limited-access facility.** Section 4.3 of the HOV Guidelines states that the operation of weaving sections at access openings needs to be considered. See the section on limited-access managed lanes design and performance considerations for more details.

The traffic safety analysis shall be performed by or approved by the district traffic safety office. This analysis will focus on the safety impact of the proposed improvements on operating conditions and collision potential by utilizing traffic and collision data and analytical tools and processes. This is especially important when the project proposes a change in the type of access. This safety analysis is independent of the broader safety review process that is required per HDM Index 110.8.

GENERAL MANAGED LANE DESIGN AND PERFORMANCE REQUIREMENTS

Geometric design of managed lane projects, including lane and shoulder widths, shall conform to the HDM. Deviations from the requirements of the HDM shall be evaluated and approved on a case-by-case basis in the manner prescribed in HDM Index 82.2. Section 3.10 of the HOV Guidelines provides a priority listing for reductions in cross-sectional elements for various managed lane geometric configurations. **This priority listing shall be utilized in the development of managed lane projects where reductions to cross-sectional elements are deemed necessary.**

State law mandates that HOT lanes operate at a Level of Service (LOS) of "C" or better (LOS "D" may be used if the Department and the operator agree). In addition, federal law mandates that HOT lanes and HOV lanes that are used by non-carpool decaled clean-air vehicles operate at a minimum speed of 45 miles per hour during the peak hour no less than 90 percent of the time over a 180-day period. **These performance thresholds shall be taken into consideration when designing a managed lane project.**

LIMITED ACCESS MANAGED LANES DESIGN AND PERFORMANCE REQUIREMENTS

Limited access operation can be implemented with the use of physical barriers or "barrier" striping to separate the managed lane from the adjacent general purpose lanes. A buffer space is typically provided to accommodate barrier striping and other traffic control devices or features (e.g. reflective markers or channelizing devices). The recommended buffer width is 4 ft (ft). However, this width may be reduced as outlined in the priority listing in Section 3.10 of the HOV Guidelines.

Limited access may be used for Express Lanes in order to designate access/tolling points and minimize toll evasions.

Access to and from a limited-access managed lane is primarily provided through at-grade access openings. At-grade access openings also referred to as at-grade ingress and egress, allow vehicles to move into the managed lane from the adjacent general-purpose lanes and vice versa. The different types of at-grade access openings (see Attachment 3) include:

- "Weave Zone": Combined ingress and egress created by short breaks in the barrier striping at carefully selected locations.
- "Weave Lane": Combined ingress and egress, which is facilitated by a weave or speed, change lane. The inclusion of a weave lane minimizes the potential for unstable flow or turbulence along the "crown" weave due to the speed differential between the managed lane and mixed flow lanes.
- "Merge Lane": Separated ingress and egress utilizing dedicated merge lanes. This design separates operational maneuvers and provides drivers with a better opportunity to adjust their speed to match that of the traffic stream into which they are merging. This further reduces the potential for unstable flow.

Any one or all three of these types of at-grade access openings may be adequate for a given location. The type of access opening used in a corridor should be consistent to better satisfy driver expectations. Site-specific operating conditions may warrant the use of a different type. Variations will typically require mitigation in the form of additional signing, enhanced pavemen markings, lighting, and/or other traffic control, management, or safety systems.

Existing interchange spacing is the primary consideration for determining the location of access openings. An equally important consideration is the existing and expected location of mainline operational bottlenecks and geometric constraints that produce recurrent congestion and queuing along the general purpose lanes. Access openings should be located and designed such that they will perform at Level of Service (LOS) "C" or "D", as per HDM Index 504.7. They should not produce adverse impacts to managed lane and general purpose lane performance, nor should they be placed where recurrent general purpose lane congestion is expected. This avoids the potential for undesirable conditions that result in operational and safety deficiencies. If the mainline queuing at a proposed access location is limited to a small portion of the overall peak period, then a "weave lane" or "merge lane" configuration might need to be evaluated and provided if it will eliminate or minimize adverse impacts.

Access openings should have a minimum length of 2000 feet (ft). A minimum of 800 ft per lane change should be provided between the opening and the nearest freeway entrance or exit ramp. These lengths should also be utilized at the beginning and ending of managed lanes. These changes supersede the measurements shown in Figure 4.2 of the HOV Guidelines. A figure showing the new measurements for access openings is provided in Attachment 3.

The type and location of proposed access openings shall be determined by the operational analysis. It is expected that a iterative process would be used. For example, an access opening using the simplest design and minimum lengths might be evaluated first. If the analysis supports this concept, then no further analysis of that location is necessary. Otherwise, the proces would continue until an appropriate concept is identified, or all concepts are exhausted. The iterative process may require consideration of the following modifications or features (not necessarily in this order):

- Increased weaving lengths.
- Alternative types of access.
- A second managed lane in the vicinity of the opening.
- Relocation of the access opening.
- The addition of auxiliary lanes connecting ramps on the general purpose lanes.
- The use of drop or direct connector ramps.

Proposed access openings that are estimated to operate below the performance thresholds or use less than the minimum lengths or spacing shall be subject to the review and written concurrence of the Traffic Liaison. Approval will be considered when the need for the opening is justified by traffic data and the safety analysis and if traffic impact mitigation is incorporated. Approval may also require specific system monitoring to identify and correct potential performance deficiencies.

Lighting shall be provided for each access opening to facilitate decision making and lane changing maneuvers during hours of darkness. Deviations from this requirement shall be approved by the Traffic Liaison. Lighting will alert drivers that they are approaching left side weaving sections where lane changing and turbulence may be concentrated. Lighting should also be considered for freeway segments located between an access opening and a freeway-to-freeway interchange when the access serves that interchange. This is due to the higher weaving volumes and higher number of lane changes expected in these areas. Contact the district Electrical Design office for information on lighting requirements and assistance in the location and design of all lighting systems.

CONTINUOUS-ACCESS MANAGED LANES DESIGN AND PERFORMANCE REQUIREMENTS

Continuous-access managed lane facilities are designed to allow vehicles to enter or leave at any point. No specific ingress/egress locations are designated. Instead, vehicles move into and out of the managed lane at any point in the same way, they would change lanes in the general-purpose lanes.

Traditionally, continuous-access facilities have only been employed in areas with shorter durations of directional congestion durin peak commute traffic periods. However, continuous-access operation may be utilized whether the managed lane operates full-time or part-time. Detail M-2 in the HOV Guidelines shows an option for full-time continuous-access managed lanes.

A limited-access facility may be converted to a continuous-access facility if the conversion is funded by the project sponsor requesting the change. **A traffic study, as described in this directive, shall be required for any conversion project.**

If a new or conversion project is on a route where Express Lanes are planned within the next five years, and there is an intent to operate the Express Lane with continuous access, joint consultation shall be conducted between the project

sponsor, the Department and the CHP to identify strategies in limiting violations. Final recommendations from each entity shall be documented in the project file. Frequent toll readers, visible manual enforcement, and other innovative strategies are expected to be considered.

MANAGED LANES STRIPING AND PAVEMENT MARKINGS REQUIREMENTS

When physical barriers are used to limit access, the facility shall be striped in accordance with Section 3B.23 of the CA MUTCD.

When barrier striping is used to limit access, the facility shall be striped in accordance with the requirements of Chapte 5 of the HOV Guidelines. Paint, rather than thermoplastic, should be used. The 2009 edition of the federal MUTCD requires th use of parallel wide solid white stripes on limited access managed lanes to prohibit and restrict lane changing. The Department i in the process of adopting this standard, pending an amendment to the California Vehicle Code. Using paint for the barrier striping will allow for easier conversion to the federal standard once it is adopted.

Continuous-access facilities shall be striped in accordance with the requirements of Section 3B.23 of the CA MUTCD. The 2009 edition of the federal MUTCD provides several different options for continuous access striping. The Department is performing engineering studies that will lead toward the selection and adoption of one of these options.

The diamond symbol pavement marking shall only be used on HOV lanes. An "HOV LANE" pavement marking shall be used on HOV lanes; the "CAR POOL LANE" pavement marking shall not be utilized. For other types of managed lanes, the appropriate pavement marking, such as "BUSES ONLY", "FASTRAK ONLY" (when all users must have an electronic toll collection transponder) or "FASTRAK OR HOV ONLY" (when only vehicles not meeting the occupancy requirement must have a transponder), shall be used. Markings should be placed along the managed lane as shown in Chapter 5 of the HOV Guidelines.

Deviations from these requirements shall require the concurrence of the Traffic Liaison. The Traffic Liaison should be consulted prior to finalizing striping plans for a managed lane in order to receive the latest guidance and direction.

MANAGED LANE SIGNING REQUIREMENTS

Overhead advance guide signs shall be provided at least 0.5 mile prior to the beginning of limited-access HOV facilities. Overhead guide signs shall be provided at the beginning of and at subsequent at-grade access openings to limited-access HOV facilities. These signs shall conform to the E8-3 and E8-2 signs shown in Figures 2G-5 and 2G-6 of the 2009 edition of the federal MUTCD. An overhead advanced guide sign may also be used in advance of at-grade access openings. **The R87-1(CA) overhead sign shall be placed at the beginning of the buffer or barrier separation.** These requirements amend the figures shown in Details M-1 and M-4 of the HOV Guidelines. The additional guide signs and the adjustment of the regulatory signs are expected to help facilitate driver decision making by more clearly identifying access openings, especially for drivers who are eligible to use the HOV lane and have just entered the freeway.

The R86(CA), R86-2(CA) or R86-3(CA) and R93-2(CA) signs shall be repeated as a package at half-mile intervals along th length of a facility and shall be placed just downstream of where drop ramps or direct connectors merge into the facility This requirement amends the figures shown in Details M-1 through M-4 of the HOV Guidelines.

Signing for managed lanes that utilize pricing (Express Lanes) should comply with Sections 2G.16 through 2G.18 of the 2009 edition of the federal MUTCD until the adoption of the next edition of the CA MUTCD.

Deviations from these requirements shall require the concurrence of the Traffic Liaison. The Traffic Liaison should be consulted prior to finalizing signing plans for any managed lane in order to receive the latest guidance and direction.

MANAGED LANE ENFORCEMENT REQUIREMENTS

Enforcement strategies and features shall be considered during the planning, design, and operational phases of all managed lane projects. Enforcement of managed lanes is important to maintain flow, safety, and system management capabilities. Violators could impact flow rates and impact the ability of the operating agency to manage accordingly. With any access type, enforcement requires some investment and strategy for zones, systems, and personnel. Due to the personnel cost and traffic impacts of comprehensive manual enforcement, automated enforcement technology may be used once it is demonstrated to have an acceptable degree of accuracy. Until then, occupancy verification requires manual observation, which can be complex given tinted windows and obscured viewing into vehicles.

Section 6.4 of the HOV Guidelines provides guidance for enforcement area configurations utilizing the median shoulder. **Median shoulder enforcement areas shall only be used when the managed lanes are separated from the general purpose lanes by a physical barrier (such as vertical pylons or a concrete wall).** CHP policy only allows enforcement stops in the median shoulder under these conditions.

Observation areas should be used on the median shoulders of facilities that do not utilize physical separation. They may be used on facilities that utilize physical separation. **The provisions in Section 6.4 of the HOV Guidelines related to the placement of median shoulder enforcement areas shall be applicable to observation areas.** Observation areas should be placed downstream of intermediate access points on limited-access facilities and downstream of drop ramps and direct connectors. The recommended dimensions for an observation area are a width of 14 ft and a length of 100 ft, preceded by a 15:1 taper and followed by a 50:1 taper.

Enforcement plans for Express Lane operations shall be developed jointly between the CHP, the Department, and the project sponsor.

DELEGATION

No new delegations of authority are created under this policy.

BACKGROUND

Managed lanes are lanes that are proactively managed in response to changing conditions and are increasingly used nationwide to deal with the increasing congestion and limited resources. The term "managed lanes" may refer to:

- HOV lanes: Buses, vans, and cars with more than one person use these lanes.
- Express Lanes: Managed lanes that utilize congestion pricing:
  - HOT lanes: An HOV lane that allows vehicles with lower occupancy to have access to the lane by paying a toll. The lanes are kept free-flowing by dynamic and congestion-based tolling, a strategy supported by the Department and the Federal Highway Administration. Tolls may change based on real-time conditions (dynamic) or according to a schedule (static).
  - Express toll lanes: Facilities in which all users are required to pay a toll, although HOVs may be offered a discount. They also utilize electronic tolling and congestion pricing. The 91 Express Toll Lanes are the only such facility in California.

Strategic goals of managed lane projects are:

- Decrease congestion duration and reduce congested locations.
- Increase person-throughput on a corridor by increasing vehicle occupancy, whether through carpooling, vanpooling or transit.
- Decrease per-person air quality impacts.
- Increase congestion avoidance choices for the public.
- Increase predictability of travel by reducing variations in delay.
- For Express Lanes, generate revenue for corridor transportation improvements that include transit and closing gaps in the managed lane network.

The type of managed lane facility utilized will be generally based on regional needs, physical and geographic setting, and unique fiscal circumstances. Due to tolling authority laws in California, Express Lanes are typically initiated by, and jointly operated with, regional transportation agencies. This relationship requires policies and standards that can be applied consistently statewide yet be flexible enough for local needs.

The Division of Traffic Operations is participating in a statewide effort to enhance California's network of managed lanes through improved performance management, partnerships, and design/operation strategies. Regional Transportation Plans contain Express Lanes as congestion management and greenhouse-gas reduction strategies. Regional partners are developing managed lanes projects for imminent use in the San Francisco Bay, Inland Empire and Los Angeles areas. The updated guidance is expected to:

- Improve the performance of managed lanes in a cost effective manner.
- Ensure a system management approach that will include all lanes.

- Mitigate the driver performance impacts resulting from the increased complexity of freeways with managed lanes.
- Provide flexibility for regional decisions.
- Provide needed compliance with federal standards.
- Provide consistent methodology statewide.

While many sections of the HOV Guidelines remain valid, some additions and revisions are needed to communicate updated knowledge and policy to internal and external partners. This Directive addresses only the most-urgently needed guidance updates. Further updates and broader topics will be updated during 2011 and 2012. This effort has been supported by the findings and recommendations of a parallel initiative (Strategic Highway Safety Program Challenge Area 5) which is focused on the impacts of our evolving and increasingly complex metropolitan freeway infrastructure and operating conditions on driver performance and safety outcomes. See Attachment 1 for a summary of this background knowledge.

This Directive is a result of the following developments.

- Increasing congestion has led to a need to coordinate strategies, use all available freeway capacity and resources, and maximize performance of corridors.
- Research and corridor specific engineering studies concerned with performance deficiencies have expanded our understanding of the design, operational and safety features that affect managed lane and freeway system performance.
- Safety research has produced findings that supersede previously established knowledge and practices regarding managed lanes. See Attachment 1 for a summary of findings and recommendations from the 2009 report, "A Comparative Safety Stud of Limited versus Continuous-Access High Occupancy Vehicle (HOV) Facilities", and the research team's collaboration with the Department's traffic safety engineering practitioners and specialists.
- Lessons have been learned from managed lane access conversion projects in southern California.
- The Department has committed to updating technical guidance and increasing statewide consistency and flexibility in managed lane operations.
- The 2009 edition of the federal MUTCD contains new managed lane signing and striping policies. There is a more stringent requirement for California to be in substantial conformance with those policies.
- There is intensifying interest in implementing Express Lanes immediately in many urban areas of the state.
- Express Lanes are relatively new to the nation and California's project development process, and as such little policy guidance exists.
- Lessons have been learned from implementation of Express Lanes in other states in the last three years.

DEFINITIONS

When used in this Traffic Operations Policy Directive, the text shall be defined as follows:

1) **Standard:** A statement of required, mandatory or specifically prohibited practice. All standards text appears in **bold** type The verb **shall** is typically used. Standards are sometimes modified by Options.

2) Guidance: A statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. All Guidance statements text appears in underline type. The verb "should" is typically used. Guidance statements are sometime modified by Options.

3) Option: A statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain allowable modifications to a **Standard** or Guidance. All Option statements text appears in normal type. The verb "may" is typically used.

4) Support: An informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. Support statements text appears in normal type. The verbs "shall", "should", and "may" are not used in Support statements.

ATTACHMENTS

Summary of Background Knowledge

Updating perspective on the performance of freeways with continuous-access HOV lane operation

In 2009, a University of California at Berkeley / Partners for Advanced Transit and Highways research team completed a comprehensive study of California freeways with HOV lanes. The research team compared collision data analyses for large samples of freeway facilities with continuous-access and limited-access HOV lanes. Contrary to the technical opinions presented in the current HOV Guidelines, the research team found that HOV facilities with limited access operation offer no safety advantages over those with continuous-access operation. A higher percentage of collisions were concentrated on the sample set of limited-access HOV lanes, which also had higher collision rates compared to the sample set of continuous-access HOV facilities.

The research team and the Department's traffic safety practitioners then identified the various design, operational, and safety features that affect the performance of freeways with limited access operation. The most prominent of these features include: access configurations, weaving sections (i.e. the type and length as determined by the location, spacing, and design of access openings), lighting, shoulder width, overhead signing, and pavement delineation.

Similar studies by the Texas Transportation Institute support these findings. The Department adopted a policy in 2008 that allows for the conversion of limited-access facilities to continuous access and continues to support continuous access as a HOV lane design that provides safety and throughput performance in a more cost-effective manner.

Updating design criteria for the length and location of access openings for limited-access HOV facilities

During the last several years of evaluating safety and mobility performance issues associated with HOV lane access points, substantial changes to access opening location, spacing and geometry have become clearly necessary. Bottlenecks and collision concentrations stem from the complex weaving action of vehicles at these access points, and across all freeway lanes between freeway entrances/exits and the HOV lane access points. As volumes increase, the impact of this weaving activity on freeway and driver performance becomes more intense, and eventually requires remediation through infrastructure adjustments and enhancements:

- General collision studies in California support increasing the weaving length at and between access openings beyond the current practices found in the HOV Guidelines.
- Nationally recognized research findings and products recommend longer openings and longer distances for the weaving along and between successive access openings. Prior and current national practice allows for a 1000-foot minimum access opening, and (two-sided) weaving lengths that are based on providing 500-800 ft per lane change.
- Based on the above research findings, and years of experience managing location-specific operational and safety problems, the Department's freeway operations and traffic safety engineering practitioners recommend the following changes to our standard practices:
  - increase the minimum access opening length from 1300 ft to 2000 ft, and
  - increase the "per-lane change" distance from 650 ft to 800 ft in order to avoid pushing drivers to make consecutive lane change maneuvers across the entire freeway
- Enhancements will include the expanded use of lighting, pavement delineation, and overhead signing (see next section).

While the updated criteria are substantiated, flexibility is needed when applying the criteria at the project level. The aforementioned engineering practitioners should use analytical tools, consult with the Department technical reviewers and specialists, and then exercise engineering judgment to determine the site-specific best fit. This will often be an iterative process.

Updating signing and lighting of limited-access designs

Express Lane signing is new to the industry, was just added to the 2009 edition of the federal MUTCD and in May 2010 was accepted by the California Traffic Control Devices Committee for addition to the next (2011) edition of the CA MUTCD. In addition, the Department's freeway safety team (comprised of district and headquarters traffic safety staff and the Traffic Liaisons) recommended the use of lighting along all limited-access openings. This was based on research and the collision studies performed in support of the Strategic Highway Safety Program Challenge Area 5 Action Plan. Speeds, weaving volumes and density are high and headlight glare prevail especially during the critical periods just prior to the morning peak period, and just beyond the evening peak period. Overhead lighting will mitigate the impact of adverse infrastructure and operating conditions (headlight glare, narrow shoulders, and speed differential) on HOV and Express Lane drivers attempting to execute the complex weaving maneuvers required.

A selection of references:

1. A Comparative Safety Study of Limited Versus Continuous Access High Occupancy Vehicle (HOV) Facilities, University of California at Berkeley UCB-ITS-PRR-2009-22, 2009
2. Assessment and Validations of Managed Lanes Weaving and Access Guidelines, University of Texas at Arlington, 2010, http://www.uta.edu/ce/faculty/williams/report0-5578-1.pdf
3. Managed Lane Ramp and Roadway Design Issues, Texas Transportation Institute, 2003, http://tti.tamu.edu/documents/4160-10.pdf
4. Managed Lanes - Traffic Modeling, Texas Transportation Institute, 2002, http://tti.tamu.edu/documents/4160-4.pdf

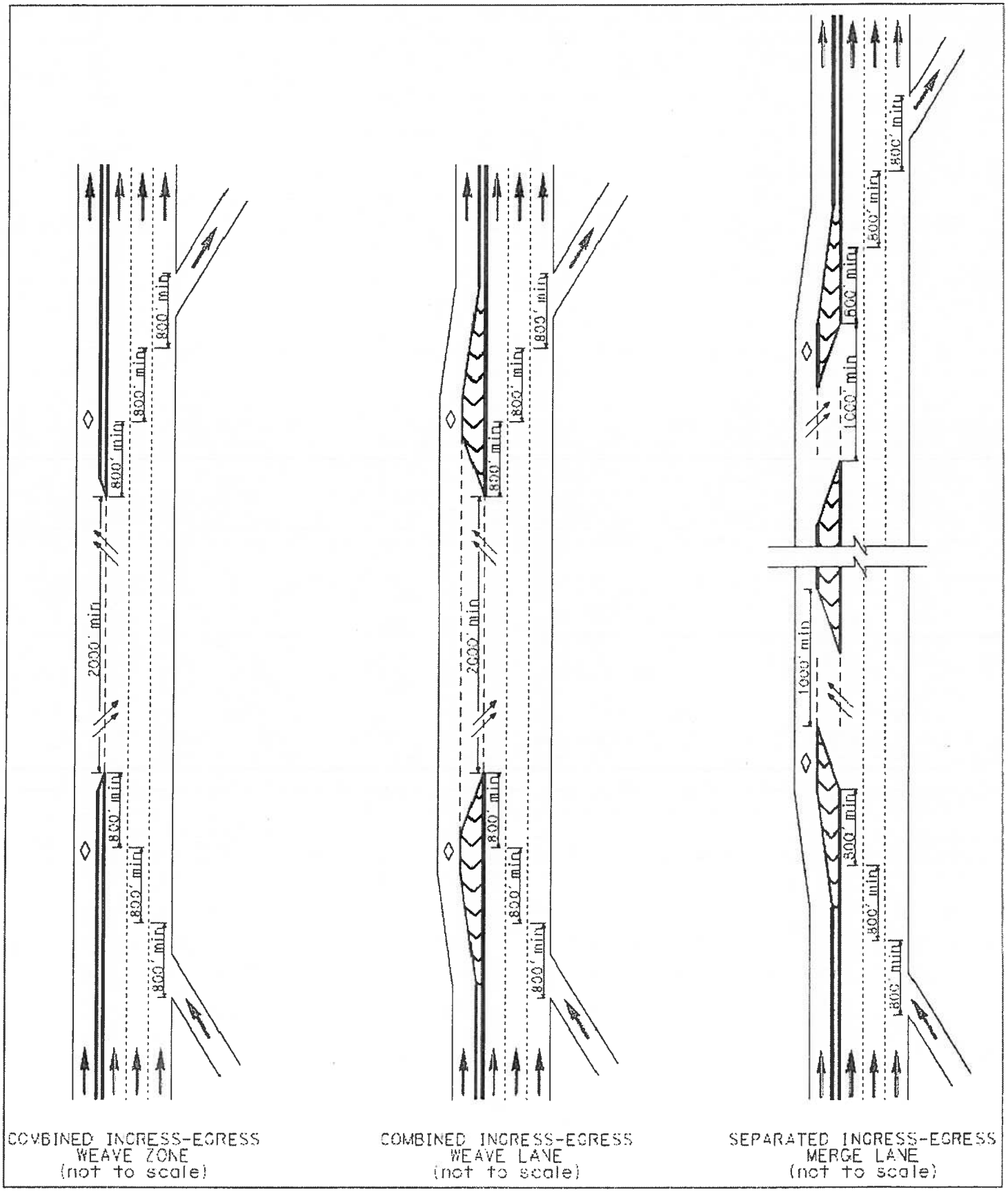
Summary of Design, Cost and Performance Considerations for Continuous and Limited-Access* Facilities

Research and engineering studies show no significant generalized differences in safety and throughput performance between limited and continuous access. The design decision will more appropriately be based on the site-specific types and patterns of traffic and the ability to manage this traffic using the access most appropriate and cost-effective for the corridor.

Criterion	Limited-Access	Continuous-Access
Cost	• Detailed operational analysis and an iterative design process is needed for best placement of access points • May require more roadway width to accommodate the buffer and access openings • Additional pavement markings and overhead signing are required • Investment in monitoring and adjustment of "hot spots" near access points may be needed	• Lower cost for design, analysis, construction, operation, and maintenance • Require less engineering resources to make adjustments
Mobility, Safety and Performance	• Access points can become initial source of unstable flow and queuing in the managed lane, which can trigger the onset of congestion among all lanes • Left-side access openings intensify weaving in the form of concentrated flows and consecutive lane changing across all freeway lanes which may present difficulties for all drivers during periods of congestion. • Drivers are unable to access the managed lane when the need is greatest; this could induce violation of the barrier striping, which may be unexpected by drivers in the managed lane • Can be used to restrict lane changing where demand has produced or may produce a performance deficiency • Accommodates longer-distance trips by discouraging short-term use of lane • Smooth flow, higher speeds can result from limited merging • Greater separation to accommodate lane closure activities in the lane or adjacent lanes • Access to some general purpose ramps is not as convenient	• Users must focus on potential for vehicles to enter or exit the managed lane at any point; this may reduce speeds • Allows last-minute lane changing to reach freeway exit ramps • No concentrated weaving; lane changing occurs along entire corridor when gaps appear • Users can readily access all general purpose ramps • Less complex decision-making by drivers • Easily utilized during off-peak (for part-time facilities) • Less separation to accommodate lane closures • Drivers will not worry about violating barrier striping when managed lane is closed for construction, maintenance, or incidents
Enforcement	• Potentially lower toll evasion and occupancy violation • Ease of enforcement • Express Lane toll collection is simplified due to need for fewer readers	• Greater investment in enforcement activity, systems, and zones to produce the lower violation rates expected with limited-access designs • Potentially higher toll evasion and occupancy violation • Increased cost for Express Lane toll collection due to need for additional readers

*This summary document does not apply to limited-access designs in which managed lane access is provided only via direct ramps to a local or other state highway or freeway

Access Types with Minimum Recommended Opening Lengths and Weaving Distances



COMBINED INGRESS-EGRESS WEAVE ZONE (not to scale)

COMBINED INGRESS-EGRESS WEAVE LANE (not to scale)

SEPARATED INGRESS-EGRESS MERGE LANE (not to scale)

ATTACHMENT 5

Assumptions for Design Variations 1 and 2 Used for Cost Estimation

Assumptions for Design Variations 1 and 2 Used for Cost Estimation

PURPOSE

This cost estimate methodology is intended primarily for use in the preparation of the application to the California Transportation Commission (CTC) and the Caltrans Programmatic PSR for authority to develop and operate high occupancy toll lanes also known as express lanes.

This is an order-of-magnitude estimate and is not intended for programming purposes or for establishing final design criteria. The estimates developed for the two design variations will represent a cost range to be used for the CTC application. Final design criteria and detailed cost estimates will be developed as part of the subsequent project-specific Project Initiation Document (PID) for each project.

Cost estimates that are based on non-standard features do not imply or memorialize any concurrence to design exceptions. Any design exceptions previously granted within an existing corridor must be re-evaluated in the project-specific PIDs for individual projects. Project costs will not be the sole determining factor for the approval of design exceptions.

GENERAL DESCRIPTION

Design Variation 1 (DV1) is intended to represent the lower end of the cost range, reflecting many of the practices commonly used when HOV lanes are retro-fit onto existing freeways. The approach would be to utilize the existing freeway pavement cross-section and existing right of way rather than obtaining additional right of way for outside pavement widening. Caltrans *HOV guidelines* will be used to prioritize lane, shoulder and buffer width reductions as needed. For conversions of existing HOV lanes to express lanes, the only costs incurred will be for re-striping, ITS equipment, and signage related to the express lanes.

Design Variation 2 (DV2) is intended to represent the high end of the cost range. The approach would be to meet Caltrans design standards in almost all locations. However, reduction in design standards may be considered at “pinch point” locations where there would be substantial impacts to achieve standards, such as major structures which cannot be reasonably modified and significant impact to environmental resources which cannot be reasonably mitigated. In these locations, lanes, shoulders and buffer widths may be narrowed, using the prioritization of features in Caltrans *HOV Guidelines*.

DESIGN FEATURES

The cost estimates for Design Variations 1 and 2 incorporate assumptions for a wide variety of design features. The assumptions used for each feature are described below. The design standard is citied where appropriate.

Inside Shoulder – (*Highway Design Manual* Section 302.1, Shoulder Standards, Table 302.1) Minimum of 10ft of paved space.

> DV1: For cases where express lanes will be provided through inside widening or conversion of HOV lanes, provide a minimum inside shoulder of 2 ft. For cases where outside widening is needed, provide 10 ft inside shoulders except at pinch points.
>
> DV2: Provide 10 ft minimum except at pinch points where there would be substantial costs (such as interchanges, major retaining walls, major sound walls).

Outside Shoulder - (*Highway Design Manual* Section 302.1, Shoulder Standards, Table 302.1) Minimum of 10ft of paved space.

DV1: Maintain existing outside shoulder widths except at pinch points. If outside widening is required, then available right-of-way will be used to provide the lane and shoulder widths as close to the Caltrans standard as possible.

DV2: Provide 10 ft minimum except at rare pinch points (such as interchanges, major retaining walls, major sound walls) where building to the standard would incur substantial costs or environmental impacts.

Lane Widths - (*Highway Design Manual* Section 301.1, *HOV Guidelines* Section 3.10) Standard lane width is 12ft. However, 11ft widths are allowable under some circumstances.

DV1: Provide 12 ft lanes in most places. However, all lanes except the right-most through lane may be narrowed to 11 ft per *HOV Guidelines* as needed at constrained locations. In a very few places on I-80 and US-101 the existing lanes are 11ft and these will not be changed.

DV2: Provide 12 ft lanes except at rare pinch points (such as interchanges, major retaining walls, major sound walls) where building to the standard would incur substantial costs or environmental impacts. A 12 ft. right-most through lane will always be maintained.

Median Barriers – (*Traffic Manual* Chapter 7 Traffic safety Systems, Section 4). Current standard for most situations in the Backbone Network is Type 60 concrete barriers

DV1: For new lanes, assume that any existing thrie beam barriers will need to be replaced with Type 60 concrete barriers. Assume Type 50 barriers will be replaced with Type 60 concrete barrier where inside widening requires movement of the existing barrier. Existing Type 60 barriers will not be replaced.

DV2: Assume that any existing thrie beam barriers or Type 50 (“Jersey”) concrete barriers will need to be replaced with Type 60 concrete barriers.

Pavement Rehabilitation – (*Highway Design Manual* Chapter 600, Pavement Engineering; Topic 612 Pavement Design Life) Some portions of the Backbone Network may already be deficient.

DV1: Will be evaluated on a case-by-case basis for existing HOV lanes that are converted to express lanes. Pavement rehabilitation of general purpose lanes will not be considered except that an AC overlay or PCC diamond grinding will be assumed where restriping is required. An overlay or grinding will not be considered in cases where restriping is restricted to the buffer area. This effort will be coordinated with the pavement Life Cycle Cost estimating.

DV2: Same as DV1.

Express Lane Pavement Type

DV1: Assume that the pavement of any new lanes will match the existing pavement type of the adjacent general purpose lanes. For lane conversions, use existing pavement.

DV2: Same as DV1.

Express Lane Access Points

The "weave zone" costs are based on recommendations in the TOPD and current toll lane practices in California. It is recognized that current practice with respect to HOV lane access differs markedly between southern California and northern California. For the former, lane access is typically allowed only at specific locations and does not vary between peak and non-peak periods. By contrast, northern California practice is to allow continuous HOV lane access and general purpose lane usage during non-peak periods. Some variant of such practice could in-theory be applied to Express Lanes as well and the

increased flexibility thereby provided may prove beneficial. Whether or not to implement such policies should be further investigated through a vehicle other than the PSR. The assumptions followed in the preceding paragraph are appropriate to establishing reasonable costs for implementation of the backbone network.

DV1: Assume that access points will be provided at an average spacing of four miles. It is further assumed that 80% of the access points will have a "weave zone" configuration and the remaining 20% will have transition lanes.

DV2: Same as DV1.

CHP Enforcement Areas

DV1: Assume that enforcement areas will be provided at an average spacing of five miles. Costs were estimated based on the design shown in Figure 6.3 of Caltrans' *HOV Guidelines* for directional enforcement areas.

DV2: Same as DV1.

Interchange Spacing – (*Highway Design Manual* Section 501.3 Traffic Interchange Spacing) Current standard is a minimum of 1 mile between local interchanges and 2 miles between local and freeway-to-freeway interchanges. The presence of closely-spaced interchanges may preclude the placement of access points.

DV1: Assume interchange spacing will not be changed.

DV2: Same as DV1.

Overcrossing Bridges Vertical Clearance – (*Highway Design Manual* Chapter 300 Geometric Cross Section; 309.2 Vertical Clearances) Current standard is 16ft 6in for new bridges and 16ft for overlays.

DV1: Project must not worsen clearance for bridges that are currently below standard. Assume that replacement of overcrossings for vertical clearance issues will be required in very few cases. For estimating purposes assume that 20% of the overcrossings with vertical clearances of less than 15 ft. will be replaced. This cost was distributed among the projects by computing the full replacement cost of those overcrossings with vertical clearances of less than 15 ft and applying an 80% reduction, thus leaving an average of 20% of the cost of replacing these bridges.

DV2: Replace bridges as needed to achieve the standard vertical clearance. Caltrans Bridge Log was used to identify overcrossings with nonstandard vertical clearance.

Ramps – (*Highway Design Manual* Chapter 500 Traffic Interchanges; 504.2 Freeway Entrances and Exits, 504.3 Ramps) Widening to the outside may require modification of some ramps. Ramps where metering and/or an HOV bypass lane are being considered as part of the Freeway Performance Initiative will be identified in subsequent PIDs for individual projects.

DV1: Cost estimates include the cost of ramp modifications that are necessary as a result of outside widening. HOV bypass lanes will be provided at metered ramps if outside widening is necessary, except in locations that are targeted for improvements under the Freeway Performance Initiative. No ramp improvements will be assumed where there is no outside widening.

DV2: Same as DV1.

Signage – (*California MUTCD*) Signs installed in earlier eras may not meet current standards for color, font standards, retro-reflectivity, etc.

DV1: Cost estimates include the cost of signs associated with the express lanes. Existing sign structures that are impacted by the express lanes are also included in the cost estimate. Other signs are assumed to be included under Minor Items, which will be accounted for using a line contingency.

DV2: Same as DV1.

Sound Walls - (*Highway Design Manual* Highway Traffic Noise Abatement 1101; 1101.2). Preferred policy entails an analysis of the characteristics of the individual site, which cannot be done on a regional basis.

DV1: For new lanes involving widening to the inside or outside, a planning-level assessment of locations where sound walls would be required was performed based on a visual inspection of aerial photographs of the freeway and nearby residential properties. Assume edge of shoulder walls with an average height of 12 ft. Assume that no new sound walls would be needed for lane conversions.

DV2: Same as DV1.

Landscaping and Irrigation – (*Highway Design Manual* Chapter 900, Landscape Architecture) Guidance is provided regarding sight distance and clear recovery zone. Not easily adapted to region-wide estimation.

DV1: Assume this is covered under the Minor Item markup.

DV2: Same as DV1.

Drainage – (*Highway Design Manual* 800 – 890, Highway Drainage Design). Drainage policies, procedures and standards given are subject to amendment as conditions warrant and are not legal standards. Drainage is difficult to assess using aerial photos because there may be underground pipes.

DV1: Assume that drainage costs would be 30% of earthwork and pavement costs.

DV2: Same as DV1.

Guardrails – (*Traffic Manual*, Chapter 7 Traffic safety Systems, Section 3) Preferred policy entails an analysis of the characteristics of the individual site. Cannot easily be done on a regional basis.

DV1: Assume this is covered under the Minor Item markup.

DV2: Same as DV1.

Crash Cushions – (*Traffic Manual* Chapter 7 Traffic safety Systems, Section 5) Preferred policy entails an analysis of the characteristics of the individual site which cannot be done on a regional basis.

DV1: Assume this is covered under the Minor Item markup.

DV2: Same as DV1.

Loop Detectors – Assume that existing loops do not need to be shifted as long as they remain within their current lanes

DV1: Assume that existing loop detectors will rarely need to be re-located. The cost of the few re-locations is covered under the Minor Item markup.

DV2: Same as DV1.

Lighting - (*Traffic Manual* Chapter 9 Section 7 has warrants). This is not expected to be a high cost item.

DV1: Assume that new lighting would be provided at access points. Any lighting beyond that is covered under the Minor Item markup.

DV2: Same as DV1.

ATTACHMENT 6

Cost Estimating Methodology

Cost Estimating Methodology

The methodology used to develop the capital cost estimates is described below (see attached figure):

Initial Inputs

A) Aerial photographs were used to determine the field conditions by 1/5th-mile segments of each corridor. The condition recorded included such things as the number of lanes, pavement type, space available in the median and between the outside edge of traveled way and the ROW boundary, existence of existing HOV lanes, etc.

B) MTC, in cooperation with Caltrans and the CMAs, developed assumptions regarding the design criteria to be used for Design Variation 1 and 2. These are described in PSR Attachment 5.

Roadway Items Costs

C) The field data was then used in conjunction with the design criteria for each project alternative (see PSR Attachment 5) and other key assumptions (see Table 1) to determine the quantity of each roadway item component needed for each corridor. For example, Project 1 requires 1.9 million square feet of new HMA pavement for Design Variation 1 and 3.2 million square feet for Design Variation 2.

D) The per-unit capital cost of each of the major design components (access points, new lanes, etc.) was developed using data from recent projects (Caltrans' *Contract Prices*, etc.). These unit costs are shown in Table 2.

E) The quantity of each component was then multiplied by the unit cost to generate a line-item cost for each of the roadway item components by corridor.

Structures Items Costs

F) The design criteria for each scenario were used to identify bridges that needed to be replaced due to insufficiencies in horizontal of vertical clearance.

G) In such cases we looked up the size and type of bridge in the Caltrans *Bridge Log* and then estimated its replacement cost using Caltrans' *Comparative Bridge Costs 2010*. It was assumed that each bridge would be replaced by a bridge of similar type.

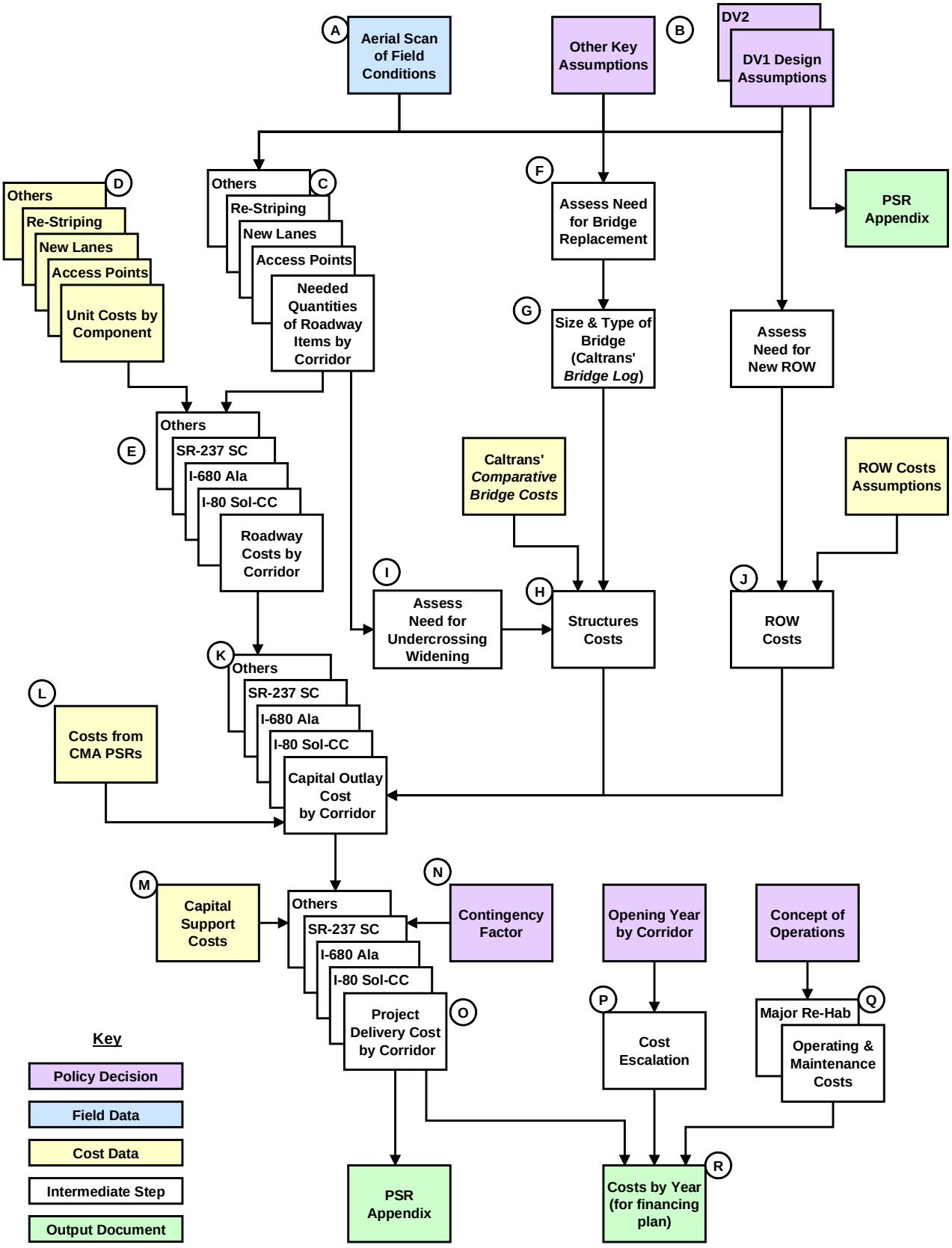
H) The setting (urban or rural) and other factors (skew, lack of construction access, aesthetic treatments, etc.) were then used to factor up the cost, as shown in Table 3. The escalation factors came from comparing past actual total bid prices to the cost of the bridge itself and includes such things as raising the level of the overcrossing street. The results were the estimates of structures costs.

   The procedures described in steps F, G, and H were too detailed to use for the entire network. Instead, it was used for 75 bridges, which was sufficient to determine a reasonable average cost. Thereafter the average cost for the 75 bridges was used to estimate the costs of the remaining 150-some bridges (see Table 4).

I) Wherever the comparison of field conditions to the design standards indicated that an existing undercrossing is too narrow to fit the express lane, we assumed that the undercrossing could be widened at a cost of $420 per square foot (see Table 5).

ROW Items Costs

J) The approach used in this study avoids, to the extent possible, the need to acquire new land. Nevertheless a few projects, particularly for Design Variation 2, require the acquisition of ROW. Because it was not practical to attempt to estimate prices for individual parcels of land spread across the seven counties of the backbone Network, we instead used a uniform figure of $3 million per acre for developed land and $900,000 per acre of undeveloped land. We also assumed an additional 30% for title and escrow fees. These costs came from earlier studies.



Development of Cost Estimates

Capital Outlay Costs

K) The estimated costs for roadway items, structures, and ROW were then combined to form the estimated capital outlay cost for each corridor.

L) In certain cases the CMA had already prepared cost estimates for individual projects. If the CMA cost estimates came from a recent, more detailed study of the corridor than was done for the MTC work then the CMA estimate was used instead. However, these estimates generally required some modification; for example to exclude cost items not related to express lanes or to put the cost estimates into 2010 dollars.

Project Delivery Costs

M) Capital support costs were then estimated at 35% of the sum of roadway, structures, and ROW costs. This figure is consistent with Caltrans experience with previous projects.

N) An overall contingency factor of 40% was then applied. This is consistent with Caltrans' practice for planning studies.

O) The capital outlay cost, support costs, and contingencies were combined to produce the project delivery cost for each corridor. These are found in PSR Attachment 7.

Stream of Costs by Year Incurred

P) The cost by corridor were then matched with the network development timeline, with cost escalation depending on the year the costs are incurred, to produce an estimate of the costs incurred by year during the development of the network.

Q) Other lifecycle costs attributable to the express lanes, such as the costs of routine maintenance and periodic major rehabilitation, were estimated based on the division of responsibilities established in the concept of operations report and life-cycle cost estimating methodology memo.

R) These were combined to produce the stream of estimated costs by year for use as an input into the financing plan.

Table 1: Key Assumptions

Average spacing for project-funded CHP enforcement areas	5	lane-miles
Average spacing for access points	4	lane-miles
Average spacing for access points with transition lanes	20	lane-miles (1/5th of all access points, which are assumed to be 4 miles apart)
Percentage-Based Factors		
Allowance for minor items	5%	of Roadway Sections 1 through 5
Mobilization costs	10%	of Roadway Sections 1 through 6
Roadway additions	5%	of Roadway Sections 1 through 6
Roadway items contingency factor	40%	of Roadway Sections 1 through 9
Structures contingency factor	40%	of Structures construction cost
Title & escrow fees	30%	of ROW acquision costs
ROW contingency factor	40%	of ROW acquision & other costs
Project support costs	35%	of Capital Outlay Costs
Replacement of Overcrossings	20%	of cost of bridges with vertical clearance less than 15ft. Assumes only some will be replaced, but does not identify which bridges will be replaced.

Table 2: Unit Costs for Construction Cost Estimate (2010 costs in 2010 dollars)					
Item Description	**Unit**	**Unit Cost**	**Quantity (per-lane-mile)**	**Total Cost**	**Assumptions & Sources**
SECTION 1: EARTHWORK					
Roadway Excavation	CY	$30.00	0.07	$2.50	Shown on a per-sq-ft basis. Assume the based depth = 2.0', Cost per D4 2009-11
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Sawcut Pavement	LF	$2.50	5,280	$13,200	Cost per D8 2002-07 - use for AC or PCC
Class 2 Aggregate Base (assume 1.5' - w/ HMA)	CY	$70.00	0.06	$3.89	Shown on a per-sq-ft basis. Assume the based depth = 1.5', cost per D4 2010-11
PCC (assume 0.6 ft)					
LCB	CY	155	0.02	3.44	Shown on per-sq-ft basis. Assume 0.6' depth, cost per D4 2010-11
JPCP	CY	200	0.04	8.89	Shown on per-sq-ft basis. Assume 1.2 ' depth, cost per D4 2009-11
			SF	**$12.33**	Shown on a per-sq-ft basis. Assume depth = 0.6', cost per D4 2010-11
AC (Type A) (assume 0.7', see detail below[2])	SF				
Class 2 Aggregate Base (assume 1.5')	CY	$70.00	0.06	$3.89	Shown on a per-sq-ft basis. Assume the based depth = 1.5', cost per D4 2010-11
HMA (Type A) (assume 0.7')	TN	$95.00	0.05	$4.98	Shown on a per-sq-ft basis. Assume depth = 0.7', cost per D4 2010-11
			SF	**$8.87**	Shown on a per-sq-ft basis. Assume depth = 0.7', cost per D4 2010-11
PCC Rehab/HMA Rehab with restripe (see detail below[3,4])					
PCC rehab details					
Remove existing stripe (1 line)	LF	$1.25	5,280	$6,600.00	Shown per lane-mile. Quantity Per Detail 14A STD Plan A20A. Cost Per D8 2002-07
Remove pavement marker (1 line)	Each	$2.00	551	$1,102.00	Shown per lane-mile. Quantity Per Detail 14A STD Plan A20A. Cost Per D4 2010-11
Thermoplastic stripe (1 line)	LF	$1.40	5,280	$7,392.00	Shown per lane-mile
Pavement markers (1 line)	Each	$4.00	551	$2,204.00	Shown per lane-mile
Grind Existing Concrete Pavement (12' width)	SY	$18.00	7,040	$126,720.00	Shown per lane-mile
	Lane-Mile			**$144,018**	
HMA rehab details					
Remove existing stripe (1 line)	LF	$1.25	5,280	$6,600.00	Shown per lane-mile. Quantity Per Detail 14 & 14A STD Plan A20A. Cost Per D8 2002-07
Remove pavement marker (1 line)	Each	$2.00	551	$1,102.00	Shown per lane-mile. Quantity Per Detail 14 & 14A STD Plan A20A. Cost Per D4 2010-11
Thermoplastic stripe (1 line)	LF	$1.40	5,280	$7,392.00	Shown per lane-mile
Pavement markers (1 line)	Each	$4.00	551	$2,204.00	Shown per lane-mile
Cold Plane AC Pavement	SY	$4.50	7,040	$31,680.00	Cost per mile base for 12' lane, D4 2010-11
Rubberized Hot Mix Asphalt Overlay (Gap Graded)	Tn	$115.00	920	$105,800	0.2' depth x 12-foot width, cost per D4 2010-11
	Lane-Mile			**$154,778**	
	Lane-Mile	$150,000	1.00	$150,000	Use average of PCC rehab & HMA Rehab
SECTION 3: DRAINAGE - Level of detail not used for this analysis, cost based on a percentage of items 1 and 2					
				30%	of Roadway Items 1 and 2
SECTION 4: SPECIALTY ITEMS					
10-ft Retaining Wall (Type 1, spread footing, separate detail sheet for quantities, converted from metric)					
Structural Excavation (Retaining Wall)	CY	$50.00	11,007	$550,369	Assume half of structure height to be excavated, cost per D4 2010-11
Structure Backfill (Retaining Wall)	CY	$60.00	6,282	$376,898	cost per D4 2010-11
Pervious Backfill Material	CY	$90.00	1,180	$106,158	cost per D4 2010-11
Cable Railing & Concrete Barrier	LF	$102.00	5,280	$538,560	cost per D4 2010-11 (Type 636A = $80/LF, cable railing = $22/LF)
Structural Concrete, Retaining Wall	CY	$550.00	4,376	$2,406,581	cost per D4 2010-11
Architectural Texture	SY	$80.00	4,691	$375,306	cost per D4 2010-11
Bar Reinforcing Steel (Retaining Wall)	LB	$1.20	268,423	$322,107	Assume 110 lb/yd3, cost per D4 2010-2011
	MI			$4,675,979	
12-ft Soundwall					
1' 4" Cast-In-Drilled-Hole Concrete Piling (SOUNDWALL)	LF	$75.00	11,573	$867,945	Cost per D4 2009-11, 7.3' spacing, 16' length from RSP B15-8, Case 2, He = 2'
Concrete Barrier (Type 736SV)	LF	$160.00	5,280	$844,800	Cost per D4 2008-11
Sound Wall (Barrier) (Masonry Block)	SF	$20.00	65,120	$1,302,400	Cost per D4 2009-11 (Type 736SV)
	MI			$3,015,145	

Note: Assume that an existing outside shoulder will be removed and replaced. Replacement should will be full structural strength
Assume that the inside shoulder traffic stripe and markers are to remain while the traffic stripe and markers between GP lanes will be removed and replaced. .
Assume the the buffer stripe is based on Detail M-9 in High-Occupancy Vehicle Guidelines.

Table 2 Continued: Unit Costs for Construction Cost Estimate (2010 costs in 2010 dollars)					
Item Description	**Unit**	**Unit Cost**	**Quantity (per-lane-mile)**	**Total Cost**	**Assumptions & Sources**
Replace Median Barrier					
Remove Median Concrete Barrier	LF	$20.00	5,280	$105,600	Assume that there is always an existing median barrier, cost per D4 2009-11
Median Concrete Barrier	LF	$95.00	5,280	$501,600	Cost per D4 2010-11 (Type 60)
	MI			$607,200	
CHP Enforcement Areas (5 mi max spacing)					Assume only for minimum build,
Remove Concrete Median Barrier	LF	$20.00	2,500	$50,000	
Remove Traffic Stripe	LF	$1.25	35,000	$43,750	14 stripes for 2 directions
Remove Pavement Marker	LF	$2.00	4,480	$8,960	3 rows at 48', 5 rows at 6' for 2 directions
Cold Plane AC	SY	$4.25	1,200	$5,100	4' strip under existing barrier
Remove AC Pavement	SY	$27.00	4,300	$116,100	Existing outside shoulder, 2 directions, 600 ft taper each end
Roadway Excavation	CY	$30.00	2,900	$87,000	Base under existing outside shoulder - 2 ft depth
Imported Borrow	CY	$35.00	3,400	$119,000	4' depth under outside widening, 9' each side, 600 ft tapers
Cl 2 AB - Outside shoulders	CY	$70.00	1,700	$119,000	1' depth
HMA - Median and Outside shoulders	Ton	$95.00	2,200	$209,000	0.5' depth
LCB - Outside widening	CY	$155.00	700	$108,500	0.6' depth
JPCP - Outside widening	CY	$200.00	1,100	$220,000	1.2 ' depth
Concrete Barrier - Median	LF	$95.00	2,500	$237,500	6 rows for 2 directions
Restripe Median/Express Lane	LF	$1.40	15,000	$21,000	6 stripes for 2 directions
Pavement Markers	EA	$4.00	4,480	$17,920	Replace removed
Restripe Mainline	LF	$1.40	20,000	$28,000	8 stripes for 2 directions
	EA			$1,390,830	
Ingress/Egress Areas (4 mi max spacing)					Assume only for minimum build, costs per side then doubled
Remove Traffic Stripe	LF	$1.25	29,600	$37,000	7 stripes per direction
Remove Pavement Marker	LF	$2.00	3,800	$7,600	3 rows at 48', 5 rows at 6' for each direction
Remove AC Pavement	SY	$27.00	3,600	$97,200	Existing outside shoulder, 1 direction, 1040 ft taper each end
Roadway Excavation	CY	$30.00	2,400	$72,000	Base under existing outside shoulder - 2 ft depth
Imported Borrow	CY	$35.00	4,300	$150,500	4' depth under outside widening, 12 ft, 1000 ft tapers
Cl 2 AB - Outside shoulders	CY	$70.00	2,900	$203,000	1' depth
HMA - Outside shoulders	Ton	$95.00	1,600	$152,000	0.5' depth
LCB - Outside widening	CY	$155.00	800	$124,000	0.6' depth
JPCP - Outside widening	CY	$200.00	2,600	$520,000	1.2 ' depth
Restripe Median/Express Lane	LF	$1.40	12,660	$17,724	3 stripes for each direction
Pavement Markers	EA	$4.00	3,800	$15,200	Replace removed
Restripe Mainline	LF	$1.40	16,880	$23,632	4 stripes for each direction
	EA			$1,419,856	
Ramp Adjustment					
Roadway Excavation	CY	$30.00	800	$24,000	Existing outside shoulder base
Remove AC Pavement	SY	$27.00	1,200	$32,400	Existing outside shoulder
Cl 2 AB	CY	$70.00	3,300	$231,000	Assume 42 ft x 0.2 mi (= 1060 ft) x 2 ft depth
HMA Type A	Tn	$95.00	2,300	$218,500	Assume 0.7 ft depth
Thermoplastic Traffic Stripe	LF	$1.40	3,200	$4,480	3 stripes
Pavement Markers	EA	$4.00	200	$800	1 stripe at 48', 1 stripe at 6'
Lighting	LS	$10,000.00	1	$10,000	
Ramp meter and signal modification	LS	$75,000.00	1	$75,000	
Roadside signs	Ea	$275.00	8	$2,200	
Metal Beam Guard Railing	LF	$45.00	400	$18,000	
Variable Costs (per foot, 4' minimum)					
Imported Borrow	CY/ft	$35.00	160	$5,600	Assume 0.2 mi x 4 ft depth
	EA			$621,980	
Environmental Mitigation					
Lump sum				$100,000	per mile (estimated, assuming soundwalls and other measures are accounted for separately)

Table 2 Continued: Unit Costs for Construction Cost Estimate (2010 costs in 2010 dollars)					
Item Description	**Unit**	**Unit Cost**	**Quantity (per-lane-mile)**	**Total Cost**	**Assumptions & Sources**
SECTION 5: TRAFFIC ITEMS					
ITS Elements (per access point)					
Enforcement: Lighting for pad	EA	$50,000	1	$50,000	
Enforcement: Rear-facing license plate camera	EA	$3,900	1	$3,900	
Enforcement: Rear-facing license plate light	EA	$500	1	$500	
Infrastructure: Gantry cantilever	EA	$165,500	1	$165,500	
Tolling: Vehicle Sensor	EA	$13,200	1	$13,200	
Tolling: AVI antenna and reader	EA	$15,400	1	$15,400	
Tolling: Transaction beacon	EA	$2,900	1	$2,900	
Tolling: Controller and software	EA	$28,200	1	$28,200	
Tolling: Image and records digital storage	EA	$5,000	1	$5,000	
Utilities: Power conductors, junctions, and cabling	EA	$27,100	1	$27,100	
Utilities: Fiber communications	EA	$1,300	1	$1,300	
Utilities: Uninterruptible power supply	EA	$3,900	1	$3,900	
Utilities: Hardened utility cabinet	EA	$8,400	1	$8,400	
Utilities: Pad for utility closet / vehicular access	EA	$9,000	1	$9,000	
Utilities: Attenuation for utility closet protection	EA	$6,000	1	$6,000	
Utilities: Router to communications backbone	EA	$1,400	1	$1,400	
VMS Upstream of Access Point					
Infrastructure: Gantry cantilever	EA	$165,500	3	$496,500	Assume 3 sites (2 miles, 1 mile, 1/2 mile) upstream of each access point
Utilities: Power conductors, junctions, and cabling	EA	$27,100	3	$81,300	Assume 3 sites (2 miles, 1 mile, 1/2 mile) upstream of each access point
Utilities: Fiber communications	EA	$1,300	3	$3,900	Assume 3 sites (2 miles, 1 mile, 1/2 mile) upstream of each access point
Utilities: Router to communications backbone	EA	$1,400	3	$4,200	Assume 3 sites (2 miles, 1 mile, 1/2 mile) upstream of each access point
Signage: Controller and software	EA	$28,200	3	$84,600	Assume 3 sites (2 miles, 1 mile, 1/2 mile) upstream of each access point
Signage: Variable rate sign	EA	$18,400	3	$55,200	Assume 3 sites (2 miles, 1 mile, 1/2 mile) upstream of each access point
				$1,067,400	Per access point
ITS Elements (per lane mile)					
Utilities: Fiber communications (whole facility, per mile)	Lane-Mile	$56,000	1	$56,000	
Utilities: Communications/Router	Lane-Mile	$2,700	1	$2,700	
Vehicle Dector/Controller	Lane-Mile	$4,980	1	$4,980	
CCTV Camera	Route-Mile	$6,940	0.5	$3,470	Attribute half the cost to each direction of travel
Controller	Route-Mile	$8,000	0.5	$4,000	Attribute half the cost to each direction of travel
Pole with lowering device and foundation	Route-Mile	$18,670	0.5	$9,335	Attribute half the cost to each direction of travel
Communications/router	Route-Mile	$3,600	0.5	$1,800	Attribute half the cost to each direction of travel
				$82,285	Per lane-mile
Remove Thermoplastic Stripe	LF	$1.25	5,280	$6,600	Between HOV lane and first GP lane, cost per D4 2010-2011
Remove Pavement Markers	LF	$2.00	110	$220	Cost per D4 2010-11
4" Thermoplastic Stripe	LF	$1.40	21,120	$29,568	3 Buffer lines and 1 ETW (Detail M-9 of HOV Guidelines)
4" Thermoplastic Stripe	LF	$1.40	5,280	$7,392	1 ETW (Detail M-9 of HOV Guidelines), cost per D4 2010-11
Pavement Marker (Reflective)	EA	$4.00	550	$2,200	Cost per D4 2010-11
Pavement Markings for HOT Lane	SF	$7.00	168	$1,176	Cost per D4 2010-11
Misc Sign Allowance	EA	$500.00*	4	$2,000	Install 4 Small Guide Signs Posted on Median Barrier for HOT Lane
Overhead Sign Modification	EA	$10,000.00*	1	$10,000	1 overhead sign per mile
Replace centilever signs					
Remove Cantilever Overhead Sign	LS	$6,000.00	1	$6,000	Cost per D4 2009-11
Structural Steel for 20-ft span & post	Lb	$3.50	20,000	$70,000	Cost per D4 2010-11
Install sign - 20-ft span w/ post	Lb	$0.40	20,000	$8,000	Cost per D4 2010-11
CIDH Pile Footing - 24 ft	LF	$75.00	24	$1,800	Cost per D4 2009-11
Sign panle (8 ft x 18 ft)	SF	$28.00	144	$4,100	Cost per D4 2009-11
Sign lighting	LS	$10,000.00	1	$10,000	Estimated
	EA			$99,900	
Replace full-span signs					
Remove Cantilever Overhead Sign	LS	$18,000.00	1	$18,000	Estimate 3 x cantilever sign removal cost
Structural Steel for 20-ft span & post	Lb	$3.50	60,000	$210,000	Estimate 3 x cantilever sign weight
Install sign - 20-ft span w/ post	Lb	$0.40	60,000	$24,000	Cost per D4 2009-11
CIDH Pile Footing - 2 @ 28 ft	LF	$75.00	56	$4,200	Cost per D4 2009-11
Sign panel (8 ft x 80 ft)	SF	$28.00	640	$18,000	Cost per D4 2009-11
Sign lighting	LS	$25,000.00	1	$25,000	Estimated
	EA			$299,200	

Table 3: Replace Costs for Overcrossings												
Project Number	County	Route	Description	Bridge Type	Comparative Bridge Cost[1]	Bridge Area (ft^2)	Estimated Bridge Cost	Skew	Lack of construction access	Aesthic treat-ments	Factor for other costs (bridge approaches)	Estimated Construction Cost
1	Solano	I-80	W80-N113 Connector	605—Continuous prestressed concrete box	$120	14,604 ft^2	$1,753,000	high	low	yes	2.25	$4,000,000
1	Solano	I-80	Pedrick Rd	302—Steel stringer/multi beam or girder	$230	14,158 ft^2	$3,257,000	high	low	no	2.25	$7,400,000
1	Solano	I-80	Dixon Ave	302—Steel stringer/multi beam or girder	$230	13,167 ft^2	$3,029,000	high	low	no	2.25	$6,900,000
1	Solano	I-80	Meridian Road	602—Continuous prestressed concrete	$160	9,694 ft^2	$1,552,000	no	low	no	2.25	$3,500,000
1	Solano	I-80	Midway Road	502/202—Prestressed concrete stringer/multi-	$170	9,068 ft^2	$1,542,000	low	low	no	2.25	$3,500,000
1	Solano	I-80	Pitt School Road	302—Steel stringer/multi beam or girder	$220	12,722 ft^2	$2,799,000	high	low/med	no	2.25	$6,300,000
1	Solano	I-80	Curry Road	302—Steel stringer/multi beam or girder	$230	13,637 ft^2	$3,137,000	med	low	no	2.25	$7,100,000
2	Solano	I-80	North Texas St	602/202—Continuous prestressed concrete	$190	9,347 ft^2	$1,777,000	high	low	no	2.25	$4,000,000
2	Solano	I-80	Nut Tree Rd	205—Continuous concrete box beam or girder	$175	33,523 ft^2	$5,867,000	no	med/high	yes	2.25	$13,300,000
3	Solano	I-80	Green Valley Rd.	302—Steel stringer/multi beam or girder	$220	10,366 ft^2	$2,281,000	med	low	no	2.25	$5,200,000
5	Solano	I-80	Redwood St	504—Prestressed concrete Tee beam	$190	13,645 ft^2	$2,593,000	med	med	no	2.25	$5,900,000
5	Solano	I-80	Tennessee St	504—Prestressed concrete Tee beam	$200	15,788 ft^2	$3,158,000	no	med	no	2.25	$7,200,000
5	Solano	I-80	Springs Rd	504—Prestressed concrete Tee beam	$215	16,080 ft^2	$3,458,000	low	high	no	2.25	$7,800,000
5	Solano	I-80	Georgia St	504—Prestressed concrete Tee beam	$190	11,118 ft^2	$2,113,000	no	med/high	no	2.25	$4,800,000
5	Solano	I-80	Benicia Rd	504—Prestressed concrete Tee beam	$210	9,140 ft^2	$1,920,000	no	high	no	2.25	$4,400,000
5	Solano	I-80	Magazine St	302—Steel stringer/multi beam or girder	$275	9,640 ft^2	$2,652,000	no	high	no	2.25	$6,000,000
7	Alameda	I-80	University Ave. IC	201—Continuous concrete slab	$200	79,283 ft^2	$15,857,000	no	med	no	1.75	$27,800,000
7	Contra Costa	I-80	San Pablo Dam Rd.	205—Continuous concrete box beam or girder	$170	8,031 ft^2	$1,366,000	high	high	no	2.25	$3,100,000
11	Contra Costa	I-680	East Martinez Railroad	303—Steel girder and floorbeam system	$200	1,628 ft^2	$326,000	high	high	no	2.25	$740,000
11	Contra Costa	I-680	SR 4 Interchange	205—Continuous concrete box beam or girder	$140	10,198 ft^2	$1,428,000	low	med/high	no	2.25	$3,300,000
16	Alameda	I-680	Andrade Rd	205/104—Continuous concrete box beam or gi	$130	7,225 ft^2	$940,000	low	low	no	2.25	$2,200,000
16	Alameda	I-680	Sheridan Rd	205—Continuous concrete box beam or girder	$140	6,118 ft^2	$857,000	no	none	no	2.25	$2,000,000
16	Alameda	I-680	Auto Mall Pkwy	605—Continuous prestressed concrete box be	$135	25,054 ft^2	$3,383,000	no	med/high	yes	2.25	$7,700,000
19	Alameda	I-580	Western Pacific RR	111—Concrete arch -deck	$300	1,815 ft^2	$545,000	no	low	no	2.25	$1,300,000
22	Alameda	I-880	Route 112	402—Continuous steel stringer/multi beam or	$250	23,038 ft^2	$5,760,000	med	high	no	2.00	$11,600,000
22	Alameda	I-880	Marina Blvd	402—Continuous steel stringer/multi beam or	$250	18,483 ft^2	$4,621,000	low	med/high	no	2.25	$10,400,000
22	Alameda	I-880	Washington Ave	302—Steel stringer/multi beam or girder	$275	31,244 ft^2	$8,593,000	high	high	no	2.00	$17,200,000
22&23	Alameda	I-880	Paseo Grande Rd	605—Continuous prestressed concrete box	$135	12,946 ft^2	$1,748,000	no	high	no	2.25	$2,000,000
22&23	Alameda	I-880	Winton Ave	605—Continuous prestressed concrete box	$135	25,982 ft^2	$3,508,000	no	med/high	no	2.25	$3,950,000
22&23	Alameda	I-880	SR-92	204—Continuous concrete Tee beam	$150	36,332 ft^2	$5,450,000	high	med/high	no	2.00	$5,450,000
22&23	Alameda	I-880	Eldridge Ave POC	105—Concrete box beam or girder-multiple	$120	3,307 ft^2	$397,000	no	high	no	2.00	$400,000
22&23	Alameda	I-880	Tennyson Rd	204—Continuous concrete Tee beam	$145	18,079 ft^2	$2,622,000	med	med/high	no	2.25	$2,950,000
22&23	Alameda	I-880	Industrial Pkwy	602—Continuous prestressed concrete	$190	27,132 ft^2	$5,156,000	high	med	no	2.00	$5,200,000
24	Santa Clara	I-880	Coleman Avenue	605—Continuous prestressed concrete box	$135	43,305 ft^2	$5,847,000	no	med	yes	2.25	$13,200,000
24	Santa Clara	I-880	SR-82	205/204—Continuous concrete box beam or	$175	18,739 ft^2	$3,280,000	low	high	no	2.25	$7,400,000
24	Santa Clara	I-880	Park Avenue	205/104—Continuous concrete box beam or	$135	9,084 ft^2	$1,227,000	no	high	no	2.25	$2,800,000
24	Santa Clara	I-880	Stevens Creek Blvd	205/105—Continuous concrete box beam or	$175	29,686 ft^2	$5,196,000	low	high	no	2.25	$11,700,000
24	Santa Clara	I-880	Ped Bridge between Moorpark & Hamilton	505/205—Prestressed concrete/Continuous	$120	4,618 ft^2	$555,000	no	med	no	1.75	$1,000,000
24	Santa Clara	I-880	S I-280 / N I-880 Connector	302—Steel stringer/multi beam or girder	$275	42,841 ft^2	$11,782,000	high	high	no	1.75	$20,700,000
24	Santa Clara	I-880	Hamilton Ave	205/104—Continuous concrete box beam or	$175	21,394 ft^2	$3,744,000	med	med/high	no	2.25	$8,500,000
24	Santa Clara	I-880	Campbell Railroad	303—Steel girder and floorbeam system	$200	2,045 ft^2	$410,000	high	high	no	2.25	$1,000,000
24	Santa Clara	I-880	Mozart Ped bridge	205—Continuous concrete box beam or girder	$130	10,414 ft^2	$1,354,000	high	high	yes	1.75	$2,400,000

Table 3 (continued): Replace Costs for Overcrossings												
Project Number	County	Route	Description	Bridge Type	Comparative Bridge Cost[1]	Bridge Area (ft^2)	Estimated Bridge Cost	Skew	Lack of construction access	Aesthic treat-ments	Factor for other costs (bridge approaches)	Estimated Construction Cost
26	Santa Clara	SR237	Ped bridge between Mathilda & Fair Oaks	206—Continuous Concrete box beam or	$130	7,453 ft^2	$969,000	no	high	no	1.75	$1,700,000
26	Santa Clara	SR237	Lawrence Expwy	602/204—Continuous prestressed concrete	$190	13,392 ft^2	$2,545,000	low	med/high	no	2.00	$5,100,000
26	Santa Clara	SR237	Lawrence Expwy	602—Continuous prestressed concrete	$190	12,583 ft^2	$2,391,000	low	med/high	no	2.00	$4,800,000
27	Santa Clara	SR237	Dana St	205—Continuous concrete box beam or girder	$140	19,849 ft^2	$2,779,000	low	high	no	2.25	$6,300,000
27	Santa Clara	SR237	SR-85	204—Continuous concrete Tee beam	$150	43,989 ft^2	$6,599,000	med	high	no	2.00	$13,200,000
28	Santa Clara	SR85	Middlefield Rd	205—Continuous concrete box beam or girder	$135	13,481 ft^2	$1,820,000	no	low	no	2.25	$4,100,000
28	Santa Clara	SR85	Dana St	602—Continuous prestressed concrete	$190	253,484 ft^2	$48,162,000	high	med	no	2.00	$96,400,000
30	Santa Clara	US-101	Tully Rd.	502—Prestressed concrete stringer/multi-	$190	27,551 ft^2	$5,235,000	no	med/high	no	2.25	$11,800,000
30	Santa Clara	US-101	Story Rd.	502—Prestressed concrete stringer/multi-	$200	41,475 ft^2	$8,296,000	no	high	no	2.25	$18,700,000
30	Santa Clara	US-101	Trimble Rd./De La Cruz Blvd.	502/104—Prestressed concrete stringer/multi-	$180	17,637 ft^2	$3,175,000	low	med/high	no	2.25	$7,200,000
30	Santa Clara	US-101	Agnew Railroad	303—Steel girder and floorbeam system	$200	768 ft^2	$154,000	no	low	no	2.25	$350,000
30	Santa Clara	US-101	Lafayette St.	502/104—Prestressed concrete stringer/multi-	$180	8,884 ft^2	$1,600,000	no	high	no	2.25	$3,600,000
30	Santa Clara	US-101	Montague/ San Tomas Expwy Interchange	502/102—Prestressed concrete stringer/multi-	$190	36,512 ft^2	$6,938,000	no	high	no	2.25	$15,700,000
30	Santa Clara	US-101	N. Fair Oaks Ave.	502/104—Prestressed concrete stringer/multi-	$180	14,840 ft^2	$2,672,000	no	med/high	no	2.25	$6,100,000
30	Santa Clara	US-101	N. Mathilda Ave	502/104—Prestressed concrete stringer/multi-	$180	24,308 ft^2	$4,376,000	no	med/high	no	2.25	$9,900,000
30	Santa Clara	US-101	SR-237 O/C	502—Prestressed concrete stringer/multi-	$190	32,231 ft^2	$6,124,000	high	med/high	no	2.25	$13,800,000
30	Santa Clara	US-101	Moffet Blvd.	204—Continuous concrete Tee beam	$140	11,163 ft^2	$1,563,000	no	low	no	2.25	$3,600,000
30	Santa Clara	US-101	Amphitheater Park/Rengstorff Ave.	502/104—Prestressed concrete stringer/multi-	$190	8,205 ft^2	$1,560,000	med	med/high	no	2.25	$3,600,000
30	Santa Clara	US-101	San Antonio Rd.	504/104—Prestressed concrete T beam /	$210	10,211 ft^2	$2,145,000	high	med/high	no	2.25	$4,900,000
30	Santa Clara	US-101	Oregon Ave.	602—Continuous prestressed concrete	$185	14,911 ft^2	$2,759,000	no	med/high	no	2.25	$6,300,000
30	Santa Clara	US-101	Embarcadero Rd.	502/104—Prestressed concrete stringer/multi-	$190	19,580 ft^2	$3,721,000	no	med/high	no	2.25	$8,400,000
31	San Mateo	US-101	Whipple Ave	504—Prestressed concrete Tee beam	$190	13,444 ft^2	$2,555,000	no	med/high	no	2.25	$5,800,000
31	San Mateo	US-101	Maple St	504—Prestressed concrete Tee beam	$190	6,353 ft^2	$1,208,000	no	high	no	2.25	$2,800,000
31	San Mateo	US-101	Henderson Railroad	303—Steel girder and floorbeam system	$200	3,134 ft^2	$627,000	high	high	no	2.25	$1,420,000
31	San Mateo	US-101	Ringwood Ave POC	202/101—Continuous concrete stringer/multi	$100	2,443 ft^2	$245,000	low	high	no	2.00	$500,000
31	San Mateo	US-101	Willow Road	302—Steel stringer/multi beam or girder	$230	17,828 ft^2	$4,101,000	med	med	no	2.25	$9,300,000
31	San Mateo	US-101	University Ave	302—Steel stringer/multi beam or girder	$265	12,062 ft^2	$3,197,000	high	high	no	2.25	$7,200,000
31	San Mateo	US-101	University Ave	302—Steel stringer/multi beam or girder	$265	13,008 ft^2	$3,448,000	high	high	no	2.25	$7,800,000
32	Alameda	SR-84	Thornton Ave	605—Continuous prestressed concrete box	$120	17,424 ft^2	$2,091,000	med	low	no	2.25	$4,800,000
33	Alameda	SR-92	Cawiter Rd	602—Continuous prestressed concrete	$190	13,197 ft^2	$2,508,000	high	med/high	no	2.25	$5,700,000

Average (excluding Dana Street Bridge, which is an unusually expensive case) > $7,196,307.69

Table 4: Bridges Estimated Using Average Cost			
Project No. for PSR	**County**	**Route**	**Description**
2	Solano	I-80	Cherry Glen Rd (South)
2	Solano	I-80	Pleasant valley Rd. Interchange
2	Solano	I-80	Alamo Dr Interchange
2	Solano	I-80	S I-505 / E I-80 Connector
3	Solano	I-80	Railroad crossing
3	Solano	I-80	Suisun Valley Interchange
3	Solano	I-80	SR 12 South
3	Solano	I-80	Travis Blvd Interchange
3	Solano	I-80	Airbase Parkway IC
4	Solano	I-80	E SR-37 / E I-80 Connector
4	Solano	I-80	American Canyon Rd.
6	Contra Costa	I-80	California St.
6	Contra Costa	I-80	Cummings Skyway
7	Alameda	I-80	Ashby Ave. IC (SR-13)
7	Contra Costa	I-80	Solano Ave.
7	Contra Costa	I-80	McBryde Ave.
7	Contra Costa	I-80	Pedestrian Crossing
7	Contra Costa	I-80	Hilltop Dr
7	Contra Costa	I-80	Fitzgerald Dr./Richmond Pkwy.
7	Contra Costa	I-80	Appian Way (West)
7	Contra Costa	I-80	Appian Way (East)
9	Contra Costa	I-680	Marshview Rd. IC
11	Contra Costa	I-680	Pancheco Rd. IC
11	Contra Costa	I-680	S SR-242 / S I-680 Connector
11	Contra Costa	I-680	SR-242 Interchange
11	Contra Costa	I-680	Monument Blvd.
11	Contra Costa	I-680	Oak Park Blvd.
13	Contra Costa	I-680	Pancheco Rd. IC
13	Contra Costa	I-680	Railroad Crossing
13	Contra Costa	I-680	SR 4 Interchange
13	Contra Costa	I-680	S242-S680 Conn
13	Contra Costa	I-680	SR 242 Interchange
13	Contra Costa	I-680	Monument Blvd.
13	Contra Costa	I-680	Geary Rd./Treat Blvd
13	Contra Costa	I-680	N. Main St.
13	Contra Costa	I-680	SR 24 Interchange
13	Contra Costa	I-680	Mt Diablo Blvd

Table 4 (continued): Bridges Estimated Using Average Cost			
Project No. for PSR	**County**	**Route**	**Description**
14	Contra Costa	I-680	Sycamore valley Rd. OC
14	Contra Costa	I-680	Greenbrook Dr. OC
14	Contra Costa	I-680	Fostoria Way OC
14	Contra Costa	I-680	Crow Canyon Rd. OC
14	Contra Costa	I-680	Norris Canyon Rd. OC
14	Contra Costa	I-680	Bollinger Canyon Rd. OC
14	Contra Costa	I-680	Alcosta Blvd (County Line) OC
15	Alameda	I-680	Stoneridge Dr. OC
16	Alameda	I-680	Andrade Rd
16	Alameda	I-680	Sheridan Rd
16	Alameda	I-680	Palm Ave. OC
16	Alameda	I-680	Pasea Padre Pkwy OC
16	Alameda	I-680	Washington Blvd. OC
16	Alameda	I-680	Auto Mall Pkwy
19	Alameda	I-580	Western Pacific RR
20 & 21a	Alameda	I-580	Airway Blvd.
20 & 21a	Alameda	I-580	Portola Ave.
20 & 21a	Alameda	I-580	1st Street
20 & 21a	Alameda	I-580	N Vasco Rd.
21a	Alameda	I-580	I-680 Sinclair Fwy
21a	Alameda	I-580	S I-680 / E I-580 Connector
21a	Alameda	I-580	Tassajara Rd.
21a	Alameda	I-580	E Charro Rd.
21a	Alameda	I-580	Airway Blvd.
21a	Alameda	I-580	Portola Ave.
21a	Alameda	I-580	1st Street
22	Alameda	I-880	Route 112
22	Alameda	I-880	Marina Blvd
22	Alameda	I-880	Washington Ave
22&23	Alameda	I-880	Paseo Grande Rd
22&23	Alameda	I-880	Winton Ave
22&23	Alameda	I-880	SR-92
22&23	Alameda	I-880	Eldridge Ave POC
22&23	Alameda	I-880	Tennyson Rd
22&23	Alameda	I-880	Industrial Pkwy
23	Santa Clara	I-880	Great Mall Pkwy
23	Santa Clara	I-880	Montague Expwy

Table 4 (continued): Bridges Estimated Using Average Cost			
Project No. for PSR	**County**	**Route**	**Description**
14	Contra Costa	I-680	Sycamore valley Rd. OC
14	Contra Costa	I-680	Greenbrook Dr. OC
14	Contra Costa	I-680	Fostoria Way OC
14	Contra Costa	I-680	Crow Canyon Rd. OC
14	Contra Costa	I-680	Norris Canyon Rd. OC
14	Contra Costa	I-680	Bollinger Canyon Rd. OC
24	Santa Clara	I-880	Coleman Avenue
24	Santa Clara	I-880	SR-82
24	Santa Clara	I-880	Park Avenue
24	Santa Clara	I-880	Stevens Creek Blvd
24	Santa Clara	I-880	Ped Bridge between Moorpark & Hamilton
24	Santa Clara	I-880	S I-280 / N I-880 Connector
24	Santa Clara	I-880	Hamilton Ave
24	Santa Clara	I-880	Campbell Railroad
24	Santa Clara	I-880	Mozart Ped bridge
26	Santa Clara	SR237	Ped bridge between Mathilda & Fair Oaks
26	Santa Clara	SR237	Lawrence Expwy
26	Santa Clara	SR237	Lawrence Expwy
27	Santa Clara	SR237	Dana St
27	Santa Clara	SR237	SR-85
28	Santa Clara	SR85	Middlefield Rd
28	Santa Clara	SR85	Dana St
28	Santa Clara	SR85	Lean Ave. OC
28	Santa Clara	SR85	Winchester Blvd. UP
28	Santa Clara	SR85	Winchester Blvd. OC
28	Santa Clara	SR85	Homestead Rd OC
28	Santa Clara	SR85	Pedestrian OC
30	Santa Clara	US-101	Metcalf Rd.
30	Santa Clara	US-101	N US-101 / N SR-85 Connector
30	Santa Clara	US-101	HOV Direct Connector
30	Santa Clara	US-101	Hellyer Ave.
30	Santa Clara	US-101	Capitol Expwy
30	Santa Clara	US-101	Tully Rd.
30	Santa Clara	US-101	Story Rd.
30	Santa Clara	US-101	US-101/I-680/I-280 Interchange
30	Santa Clara	US-101	Railroad O/C
30	Santa Clara	US-101	E. Hedding St./Berryessa Rd.

Table 4 (continued): Bridges Estimated Using Average Cost			
Project No. for PSR	**County**	**Route**	**Description**
14	Contra Costa	I-680	Sycamore valley Rd. OC
14	Contra Costa	I-680	Greenbrook Dr. OC
14	Contra Costa	I-680	Fostoria Way OC
14	Contra Costa	I-680	Crow Canyon Rd. OC
14	Contra Costa	I-680	Norris Canyon Rd. OC
14	Contra Costa	I-680	Bollinger Canyon Rd. OC
30	Santa Clara	US-101	Railroad O/C
30	Santa Clara	US-101	10th Street
30	Santa Clara	US-101	Trimble Rd./De La Cruz Blvd.
30	Santa Clara	US-101	Agnew Railroad
30	Santa Clara	US-101	Lafayette St.
30	Santa Clara	US-101	Montague/ San Tomas Expwy Interchange
30	Santa Clara	US-101	N. Fair Oaks Ave.
30	Santa Clara	US-101	N. Mathilda Ave
30	Santa Clara	US-101	SR-237 O/C
30	Santa Clara	US-101	Moffet Blvd.
30	Santa Clara	US-101	N SR-85 / N US-101
30	Santa Clara	US-101	N SR-85 / N US-101 Truck Bypass
30	Santa Clara	US-101	N. Shoreline Blvd.
30	Santa Clara	US-101	Old Middlefield Way
30	Santa Clara	US-101	Amphitheater Park/Rengstorff Ave.
30	Santa Clara	US-101	San Antonio Rd.
30	Santa Clara	US-101	Oregon Ave.
30	Santa Clara	US-101	Embarcadero Rd.
31	San Mateo	US-101	Whipple Ave
31	San Mateo	US-101	Maple St
31	San Mateo	US-101	Henderson Railroad
31	San Mateo	US-101	Ringwood Ave POC
31	San Mateo	US-101	Willow Road
31	San Mateo	US-101	University Ave
31	San Mateo	US-101	University Ave
32	Alameda	SR-84	Lake Blvd OC
32	Alameda	SR-84	Thornton Ave
33	Alameda	SR-92	Cawiter Rd

Table 5: Undercrossing Widening Costs (2010 costs in 2010 dollars)

Widening Undercrossings

Based on Caltrans' Comparative Bridges Costs - January 2010:

High-end average costs for the most common bridge types (80% of bridges on state highways) is $200/sq.ft. However, costs are 25%-150% higher for widenings of less than 15 ft. (assume 100% higher).

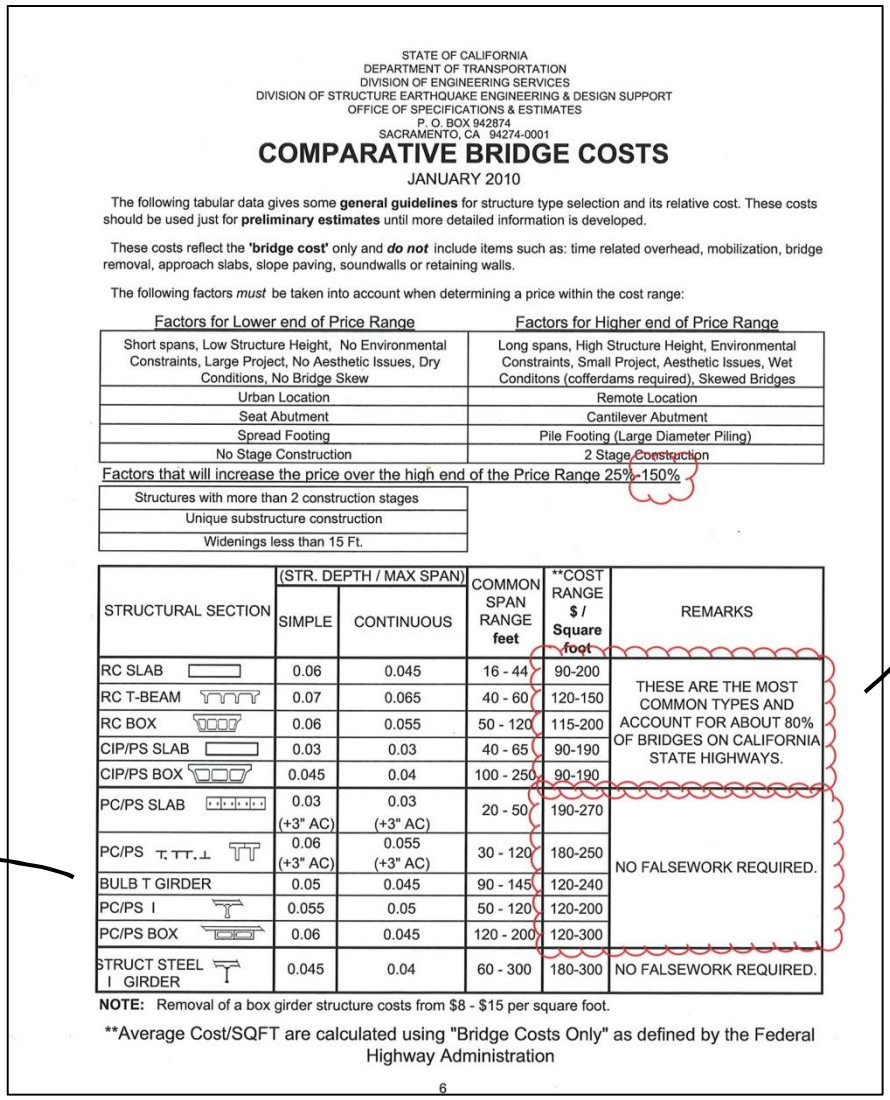
The high-end cost for other types of bridges (20% of bridges) is $250/sq.ft., with the same escalation for narrow widenings.

These are raw costs and do not include mobilization, retaining walls, sound walls, etc.

80% * $200 + 20% * $250 = $210

100% escalation for narrow widenings

$420 / sq.ft.



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
DIVISION OF STRUCTURE EARTHQUAKE ENGINEERING & DESIGN SUPPORT
OFFICE OF SPECIFICATIONS & ESTIMATES
P. O. BOX 942874
SACRAMENTO, CA 94274-0001

COMPARATIVE BRIDGE COSTS

JANUARY 2010

The following tabular data gives some **general guidelines** for structure type selection and its relative cost. These costs should be used just for **preliminary estimates** until more detailed information is developed.

These costs reflect the **'bridge cost'** only and ***do not*** include items such as: time related overhead, mobilization, bridge removal, approach slabs, slope paving, soundwalls or retaining walls.

The following factors *must* be taken into account when determining a price within the cost range:

Factors for Lower end of Price Range	Factors for Higher end of Price Range
Short spans, Low Structure Height, No Environmental Constraints, Large Project, No Aesthetic Issues, Dry Conditions, No Bridge Skew	Long spans, High Structure Height, Environmental Constraints, Small Project, Aesthetic Issues, Wet Conditons (cofferdams required), Skewed Bridges
Urban Location	Remote Location
Seat Abutment	Cantilever Abutment
Spread Footing	Pile Footing (Large Diameter Piling)
No Stage Construction	2 Stage Construction

Factors that will increase the price over the high end of the Price Range 25%-150%

Structures with more than 2 construction stages
Unique substructure construction
Widenings less than 15 Ft.

STRUCTURAL SECTION	(STR. DEPTH / MAX SPAN) SIMPLE	CONTINUOUS	COMMON SPAN RANGE feet	**COST RANGE $ / Square foot	REMARKS
RC SLAB	0.06	0.045	16 - 44	90-200	THESE ARE THE MOST COMMON TYPES AND ACCOUNT FOR ABOUT 80% OF BRIDGES ON CALIFORNIA STATE HIGHWAYS.
RC T-BEAM	0.07	0.065	40 - 60	120-150	
RC BOX	0.06	0.055	50 - 120	115-200	
CIP/PS SLAB	0.03	0.03	40 - 65	90-190	
CIP/PS BOX	0.045	0.04	100 - 250	90-190	
PC/PS SLAB	0.03 (+3" AC)	0.03 (+3" AC)	20 - 50	190-270	NO FALSEWORK REQUIRED.
PC/PS	0.06 (+3" AC)	0.055 (+3" AC)	30 - 120	180-250	
BULB T GIRDER	0.05	0.045	90 - 145	120-240	
PC/PS I	0.055	0.05	50 - 120	120-200	
PC/PS BOX	0.06	0.045	120 - 200	120-300	
STRUCT STEEL I GIRDER	0.045	0.04	60 - 300	180-300	NO FALSEWORK REQUIRED.

NOTE: Removal of a box girder structure costs from $8 - $15 per square foot.

**Average Cost/SQFT are calculated using "Bridge Costs Only" as defined by the Federal Highway Administration

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ATTACHMENT 7

Project Segment Cost Estimates

Project No.	Project Limits*	Postmile Limits	Estimated Project Cost ($Millions)	
			Design Variation 1	Design Variation 2
1	Yolo Co. Line to I-505 IC	R44.72 to R28.36	$227	$524
2	I-505 IC to Airbase Pkwy	R28.36 to 19.18	$101	$348
3	Airbase Pkwy to Red Top Rd	19.18 to R11.39	$17	$263
4	Red Top Rd to SR-37	R11.39 to 5.65	$116	$205
5	SR-37 to Carquinez Toll Plaza	5.65 to 0.59	$146	$209
6	Carquinez Toll Plaza to SR-4	0.59 (SOL) to 10.06 (CC)	$7	$216
7	SR-4 to Bay Bridge	10.06 to 1.80	$41	$598
8	I-80/I-680 Direct Connectors		$93	$93
9	I-80 to I-780	R18.71 to M0.68	$223	$422
10	Benicia-Martinez Bridge (NB, with HOT bypass)	M0.68 (SOL) to 24.26 (CC)	$0	$0
11	Marina Vista to N. Main St (NB)	24.26 to 15.60	$68	$263
12	Benicia-Martinez Bridge (SB)	M0.68 (SOL) to 24.26 (CC)	$0	$0
13	Marina Vista to Livorna (SB)	24.26 to R11.28	$162	$436
14	Livorna to Alcosta	R11.28 to R0.01	$22	$416
15	Alcosta to SR-84	R21.88 to R11.85	$200	$339
16	SR-84 to SR-237 (NB)	R11.85 to M7.68	$122	$284
17	SR-84 to SR-237 (SB)	R11.85 to M7.68	$0	$0
18	I-580/I-680 Direct Connectors		$177	$177
19	San Joaquin Co. Line to Greenville	R8.27 to 0.00	$223	$357
20	Greenville to Hacienda (EB, dual lanes Vasco to Tassajara)	18.82 to R8.27	$29	$188
21a	Greenville to San Ramon/Foothill Rd (WB, single lane)	R8.27 to R21.43	$14	$326
21b	Greenville to San Ramon/Foothill Rd (WB, second lane)	R8.27 to R21.43	$0	$227
22a	Lewelling to SR-237 (NB)	20.3 to 9.5	$28	$362
22b	Hegenberger to Lewelling (NB)	25.50 to 20.3	$137	$150
23a	Hegenberger to Dixon Landing (SB)	25.50 to 9.2	$24	$340
23b	I-880/SR-237 HOV Connector to US-101	8.42 to 4.06	$11	$235
24	US-101 to SR-85	4.06 to 9.35	$475	$599
25	SR-237/I-880 Direct Connectors		$0	$0
26	I-880 to Mathilda	6.91 to 2.99	$10	$121
27	Mathilda to SR-85	2.99 to R0.37	$114	$216
28[1]	US-101N to US-101S	23.83 to 0.00	$61	$1,211
29	Direct Connectors at both ends of SR-85		$1	$1
30[1]	San Mateo Co. Line to Cochrane	R52.55 to R17.82	$63	$1,438
31	Whipple to Santa Clara Co. Line	6.623 to 0.00	$17	$190
32	I-880 to Dumbarton Bridge Toll Plaza (WB)	R5.98 to R3.18	$4	$50
33	Hesperian to San Mateo Bridge Toll Plaza (WB)	R5.75 to R2.59	$4	$36
Total Cost			**$2,937**	**$10,841**

*Both directions, unless noted

Table 1: Cost Estimate for Design Variation 1
Project 1: I-80 from Yolo County Line to I-505 Interchange

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	32.8			100%
		32.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	3.4	$2,222,222	$7,629,013	8%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	32.8	$13,200	$432,960	0%
Variable costs for new HMA pavement	Sq. Ft.	1,950,432	$8.87	$17,301,580	17%
Variable costs for new PCC pavement	Sq. Ft.	1,482,624	$12.33	$18,285,696	18%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$13,094,775	13%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	16.4	$607,200	$9,958,080	10%
Environmental Mitigation	miles	32.8	$100,000	$3,280,000	3%
HOV Enforcement	Site	6	$1,390,830	$8,344,980	8%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	9	$1,067,400	$9,606,600	10%
ITS equipment (monitoring)	Lane-Miles	32.8	$82,285	$2,698,948	3%
Striping of express lanes	Lane-Miles	32.8	$36,388	$1,193,526	1%
Signs for express lanes	Lane-Miles	32.8	$12,000	$393,600	0%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,711,901	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$9,894,992	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$4,947,496	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$45,516,961	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	14,208	$420	$5,967,500	6%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$2,387,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$167,663,864	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$58,682,353	
Total Project Cost				$226,346,217	
Cost per lane-mile of express lane				$6,900,799	

Table 2: Cost Estimate for Design Variation 2
Project 1: I-80 from Yolo County Line to I-505 Interchange

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	32.8			100%
		32.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	6.2	$2,222,222	$13,817,173	6%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	63.2	$13,200	$834,240	0%
Variable costs for new HMA pavement	Sq. Ft.	3,170,112	$8.87	$28,120,923	12%
Variable costs for new PCC pavement	Sq. Ft.	3,047,616	$12.33	$37,587,264	16%
Overlay of existing lanes	Lane-Miles	90.0	$150,000	$13,500,000	6%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$28,157,880	12%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.2	$4,675,979	$5,611,175	2%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	16.4	$607,200	$9,958,080	4%
Environmental Mitigation	miles	32.8	$100,000	$3,280,000	1%
HOV Enforcement	Site	6	$1,390,830	$8,344,980	4%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	38	$621,980	$23,635,240	10%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	9	$1,067,400	$9,606,600	4%
ITS equipment (monitoring)	Lane-Miles	32.8	$82,285	$2,698,948	1%
Striping of express lanes	Lane-Miles	32.8	$36,388	$1,193,526	1%
Signs for express lanes	Lane-Miles	32.8	$12,000	$393,600	0%
Replacement of cantilever signs	Site	13	$99,900	$1,298,700	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	0%
Re-striping of GP lanes	Lane-Miles	90.0	$7,392	$665,280	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$9,536,093	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$20,025,796	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$10,012,898	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$92,118,661	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	19,250	$420	$8,085,000	3%
Replacement of overcrossings					
W80-N113 Connector	Site	1	$4,000,000	$4,000,000	2%
Pedrick Rd	Site	1	$7,400,000	$7,400,000	3%
Dixon Ave	Site	1	$6,900,000	$6,900,000	3%
Meridian Road	Site	1	$3,500,000	$3,500,000	1%
Midway Road	Site	1	$3,500,000	$3,500,000	1%
Pitt School Road	Site	1	$6,300,000	$6,300,000	3%
Curry Road		1	$7,100,000	$7,100,000	3%
Contingency factor for structures	40%			$18,714,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$387,914,314	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$135,770,010	
Total Project Cost				$523,684,324	
Cost per lane-mile of express lane				$15,965,985	

Table 3: Cost Differences

Difference	% of Difference
$10,461,084	4.7%
$678,364	0.3%
$18,290,098	8.3%
$32,629,301	14.8%
$22,821,750	10.4%
$25,464,179	11.6%
$9,485,692	4.3%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$39,955,373	18.1%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,195,452	1.0%
$0	0.0%
$1,124,656	0.5%
$2,964,500	1.3%
$5,600,000	2.5%
$10,360,000	4.7%
$9,660,000	4.4%
$4,900,000	2.2%
$4,900,000	2.2%
$8,820,000	4.0%
$9,940,000	4.5%
$0	0.0%
$220,250,450	100.0%
$77,087,657	
$297,338,107	131%
	increase

Table 4: Cost Estimate for Design Variation 1
Project 2: I-80 from I-505 to Airbase Parkway

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	16.4			100%
		16.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.6	$2,222,222	$3,510,613	8%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	16.4	$13,200	$216,480	0%
Variable costs for new HMA pavement	Sq. Ft.	1,579,776	$8.87	$14,013,624	32%
Variable costs for new PCC pavement	Sq. Ft.	0	$3.89	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$5,322,215	12%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.6	$4,675,979	$2,805,588	6%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	8.2	$607,200	$4,979,040	11%
Environmental Mitigation	miles	16.4	$100,000	$1,640,000	4%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	9%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	12%
ITS equipment (monitoring)	Lane-Miles	16.4	$82,285	$1,349,474	3%
Striping of express lanes	Lane-Miles	16.4	$36,388	$596,763	1%
Signs for express lanes	Lane-Miles	16.4	$12,000	$196,800	0%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$2,207,004	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$4,634,709	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$2,317,355	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$21,319,662	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$74,618,819	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$26,116,587	
Total Project Cost				$100,735,405	
Cost per lane-mile of express lane				$6,142,403	

Table 5: Cost Estimate for Design Variation 2
Project 2: I-80 from I-505 to Airbase Parkway

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	16.4			100%
		16.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	3.0	$2,222,222	$6,763,093	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	31.2	$13,200	$411,840	0%
Variable costs for new HMA pavement	Sq. Ft.	3,043,392	$8.87	$26,996,835	17%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	44.4	$150,000	$6,660,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$12,249,531	8%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	3.8	$4,675,979	$17,768,722	11%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	8.2	$607,200	$4,979,040	3%
Environmental Mitigation	miles	16.4	$100,000	$1,640,000	1%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	3%
Access point (with transition lane)	Site	4	$1,419,856	$5,679,424	4%
Ramp Modifications	Site	27	$621,980	$16,793,460	10%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	3%
ITS equipment (monitoring)	Lane-Miles	16.4	$82,285	$1,349,474	1%
Striping of express lanes	Lane-Miles	16.4	$36,388	$596,763	0%
Signs for express lanes	Lane-Miles	16.4	$12,000	$196,800	0%
Replacement of cantilever signs	Site	6	$99,900	$599,400	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	44.4	$7,392	$328,205	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$5,626,104	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$11,814,818	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$5,907,409	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$54,348,163	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
North Texas St	Site	2		$4,000,000	2%
Cherry Glen Rd (South)	Site	5		$7,700,000	5%
Pleasant valley Rd. Interchange	Site	5		$7,700,000	5%
Alamo Dr Interchange	Site	5		$7,700,000	5%
Nut Tree Rd	Site	2		$13,300,000	8%
S I-505 / E I-80 Connector	Site	0		$7,700,000	5%
Contingency factor for structures	40%			$19,240,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		40%		$0	0%
Contingency factor for ROW		30%		$0	
Total Project Capital Outlay Costs				$257,558,571	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$90,145,500	
Total Project Cost				$347,704,071	
Cost per lane-mile of express lane				$21,201,468	

Table 6: Cost Differences

Difference	% of Difference
$5,498,317	3.0%
$330,256	0.2%
$21,948,118	12.0%
$0	0.0%
$11,258,730	6.2%
$11,710,626	6.4%
$25,295,178	13.8%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$9,601,066	5.2%
$28,389,344	15.5%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$1,013,286	0.6%
$0	0.0%
$554,830	0.3%
$0	0.0%
$5,600,000	3.1%
$10,780,000	5.9%
$10,780,000	5.9%
$10,780,000	5.9%
$18,620,000	10.2%
$10,780,000	5.9%
$0	0.0%
$182,939,753	100.0%
$64,028,913	
$246,968,666	245%
	increase

Table 7: Cost Estimate for Design Variation 1
Project 3: I-80 from Red Top Road to Air Base Pkwy

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	16.4			100%
New Lanes	Lane-Miles	0.0			0%
		16.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	71%
ITS equipment (monitoring)	Lane-Miles	16.4	$82,285	$1,349,474	18%
Striping of express lanes	Lane-Miles	16.4	$36,388	$596,763	8%
Signs for express lanes	Lane-Miles	16.4	$12,000	$196,800	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$374,002	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$785,404	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$392,702	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$3,612,858	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$12,645,003	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$4,425,751	
Total Project Cost				$17,070,754	
Cost per lane-mile of express lane				$1,040,900	

Table 8: Cost Estimate for Design Variation 2
Project 3: I-80 from Red Top Road to Air Base Pkwy

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	16.4			100%
New Lanes	Lane-Miles	0.0			0%
		16.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.6	$2,222,222	$3,520,000	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	15.2	$13,200	$200,640	0%
Variable costs for new HMA pavement	Sq. Ft.	1,584,000	$8.87	$14,051,094	11%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	62.4	$150,000	$9,360,000	8%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$8,139,520	7%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.8	$4,675,979	$8,416,763	7%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	31	$621,980	$19,281,380	16%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	4%
ITS equipment (monitoring)	Lane-Miles	16.4	$82,285	$1,349,474	1%
Striping of express lanes	Lane-Miles	16.4	$36,388	$596,763	0%
Signs for express lanes	Lane-Miles	16.4	$12,000	$196,800	0%
Replacement of cantilever signs	Site	16	$99,900	$1,598,400	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	0%
Re-striping of GP lanes	Lane-Miles	62.4	$7,392	$461,261	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,863,999	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$8,114,398	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$4,057,199	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$37,326,233	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	4,580	$420	$1,923,484	2%
Replacement of overcrossings					
Railroad crossing	Site	1	$7,700,000	$7,700,000	6%
Green Valley Rd.	Site	1	$5,200,000	$5,200,000	4%
Suisun Valley Interchange	Site	1	$7,700,000	$7,700,000	6%
SR 12 South	Site	1	$7,700,000	$7,700,000	6%
Travis Blvd Interchange	Site	1	$7,700,000	$7,700,000	6%
Airbase Parkway IC	Site	1	$7,700,000	$7,700,000	6%
Contingency factor for structures	40%			$18,249,394	
TOTAL ROW ITEMS					
Acquisition	Acres	0.15	$3,000,000	$436,364	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$130,909	0%
Contingency factor for ROW		40%		$226,909	
Total Project Capital Outlay Costs				$195,308,875	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$68,358,106	
Total Project Cost				$263,666,981	
Cost per lane-mile of express lane				$16,077,255	

Table 9: Cost Differences

Difference	% of Difference
$5,950,560	3.3%
$339,182	0.2%
$23,753,374	13.0%
$0	0.0%
$15,823,080	8.7%
$13,759,859	7.5%
$14,228,538	7.8%
$0	0.0%
$0	0.0%
$0	0.0%
$7,053,594	3.9%
$0	0.0%
$32,595,173	17.8%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,702,095	1.5%
$1,011,595	0.6%
$779,761	0.4%
$2,692,878	1.5%
$10,780,000	5.9%
$7,280,000	4.0%
$10,780,000	5.9%
$10,780,000	5.9%
$10,780,000	5.9%
$10,780,000	5.9%
$794,182	0.4%
$182,663,872	100.0%
$63,932,355	
$246,596,227	1445%
	increase

Table 10: Cost Estimate for Design Variation 1
Project 4: I-80 from Red Top Road to SR-37

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	10.8			100%
		10.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.4	$2,222,222	$3,024,853	6%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	11.6	$13,200	$153,120	0%
Variable costs for new HMA pavement	Sq. Ft.	1,361,184	$8.87	$12,074,573	23%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	17.6	$150,000	$2,640,000	5%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$5,367,764	10%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	2.7	$4,675,979	$12,718,664	25%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	2.8	$607,200	$1,700,160	3%
Environmental Mitigation	miles	10.8	$100,000	$1,080,000	2%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	5%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	2	$621,980	$1,243,960	2%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,017,400	$3,052,200	6%
ITS equipment (monitoring)	Lane-Miles	10.8	$82,285	$888,678	2%
Striping of express lanes	Lane-Miles	10.8	$6,820	$73,656	0%
Signs for express lanes	Lane-Miles	10.8	$3,176	$34,301	0%
Replacement of cantilever signs	Site	2	$99,900	$199,800	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	17.6	$29,568	$520,397	1%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$2,377,689	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$4,993,148	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$2,496,574	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$22,968,479	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	5,002	$420	$2,100,827	4%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$840,331	
TOTAL ROW ITEMS					
Acquisition	Acres	0.51	$3,000,000	$1,527,273	3%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$458,182	1%
Contingency factor for ROW		40%		$794,182	
Total Project Capital Outlay Costs				$86,110,470	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$30,138,664	
Total Project Cost				$116,249,134	
Cost per lane-mile of express lane				$10,763,809	

Table 11: Cost Estimate for Design Variation 2
Project 4: I-80 from Red Top Road to SR-37

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	10.8			100%
		10.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.5	$2,222,222	$3,294,720	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	12.0	$13,200	$158,400	0%
Variable costs for new HMA pavement	Sq. Ft.	1,482,624	$8.87	$13,151,824	14%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	20.8	$150,000	$3,120,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$5,917,483	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	7.8	$4,675,979	$36,472,640	39%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	2.8	$607,200	$1,700,160	2%
Environmental Mitigation	miles	10.8	$100,000	$1,080,000	1%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	2	$621,980	$1,243,960	1%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,017,400	$3,052,200	3%
ITS equipment (monitoring)	Lane-Miles	10.8	$82,285	$888,678	1%
Striping of express lanes	Lane-Miles	10.8	$6,820	$73,656	0%
Signs for express lanes	Lane-Miles	10.8	$3,176	$34,301	0%
Replacement of cantilever signs	Site	2	$99,900	$199,800	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	20.8	$29,568	$615,014	1%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,689,225	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$7,747,372	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,873,686	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$35,637,912	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	5,002	$420	$2,100,827	2%
Replacement of overcrossings					
E SR-37 / E I-80 Connector	Site	1		$7,700,000	8%
American Canyon Rd.	Site	1		$7,700,000	8%
Contingency factor for structures	40%			$7,000,331	
TOTAL ROW ITEMS					
Acquisition	Acres	0.51	$3,000,000	$1,527,273	2%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$458,182	0%
Contingency factor for ROW		40%		$794,182	
Total Project Capital Outlay Costs				$152,013,485	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$53,204,720	
Total Project Cost				$205,218,204	
Cost per lane-mile of express lane				$19,001,686	

Table 12: Cost Differences

Difference	% of Difference
$456,210	0.7%
$8,926	0.0%
$1,821,092	2.8%
$0	0.0%
$811,440	1.2%
$929,300	1.4%
$40,156,096	60.9%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$159,951	0.2%
$0	0.0%
$10,780,000	16.4%
$10,780,000	16.4%
$0	0.0%
$65,903,015	100.0%
$23,066,055	
$88,969,070	77%
	increase

Table 13: Cost Estimate for Design Variation 1
Project 5: I-80 from SR-37 to Carquinez Bridge

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	10.4			100%
		10.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.2	$2,222,222	$2,769,067	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	17.6	$13,200	$232,320	0%
Variable costs for new HMA pavement	Sq. Ft.	1,246,080	$8.87	$11,053,527	17%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	27.0	$150,000	$4,050,000	6%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$5,431,474	8%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	3.0	$4,675,979	$14,027,938	22%
Sound walls	miles	0.8	$3,015,145	$2,412,116	4%
New median barrier	miles	3.2	$607,200	$1,943,040	3%
Environmental Mitigation	miles	10.4	$100,000	$1,040,000	2%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	4%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	13	$621,980	$8,085,740	13%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	5%
ITS equipment (monitoring)	Lane-Miles	10.4	$82,285	$855,764	1%
Striping of express lanes	Lane-Miles	10.4	$36,388	$378,435	1%
Signs for express lanes	Lane-Miles	10.4	$12,000	$124,800	0%
Replacement of cantilever signs	Site	9	$99,900	$899,100	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	27.0	$7,392	$199,584	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,004,258	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$6,308,942	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,154,471	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$29,021,135	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	3,626	$420	$1,522,913	2%
Replacement of overcrossings			$0		
Redwood St	Site	1	$1,180,000	$1,180,000	2%
Springs Rd	Site	1	$1,560,000	$1,560,000	2%
Contingency factor for structures	40%			$1,705,165	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$107,542,052	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$37,639,718	
Total Project Cost				$145,181,770	
Cost per lane-mile of express lane				$13,959,786	

Table 14: Cost Estimate for Design Variation 2
Project 5: I-80 from SR-37 to Carquinez Bridge

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	10.4			100%
		10.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.3	$2,222,222	$2,830,080	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	15.8	$13,200	$208,560	0%
Variable costs for new HMA pavement	Sq. Ft.	1,273,536	$8.87	$11,297,080	12%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	26.4	$150,000	$3,960,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$5,488,716	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	3.0	$4,675,979	$14,027,938	14%
Sound walls	miles	0.8	$3,015,145	$2,412,116	2%
New median barrier	miles	3.2	$607,200	$1,943,040	2%
Environmental Mitigation	miles	10.4	$100,000	$1,040,000	1%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	13	$621,980	$8,085,740	8%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	3%
ITS equipment (monitoring)	Lane-Miles	10.4	$82,285	$855,764	1%
Striping of express lanes	Lane-Miles	10.4	$36,388	$378,435	0%
Signs for express lanes	Lane-Miles	10.4	$12,000	$124,800	0%
Replacement of cantilever signs	Site	9	$99,900	$899,100	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	26.4	$7,392	$195,149	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,016,439	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$6,334,522	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,167,261	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$29,138,800	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	3,626	$420	$1,522,913	2%
Replacement of overcrossings					
Redwood St	Site	1	$5,900,000	$5,900,000	6%
Tennessee St	Site	1	$7,200,000	$7,200,000	7%
Springs Rd	Site	1	$7,800,000	$7,800,000	8%
Georgia St	Site	1	$4,800,000	$4,800,000	5%
Benicia Rd	Site	1	$4,400,000	$4,400,000	4%
Magazine St	Site	1	$6,000,000	$6,000,000	6%
Contingency factor for structures	40%			$15,049,165	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$154,657,878	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$54,130,257	
Total Project Cost				$208,788,135	
Cost per lane-mile of express lane				$20,075,782	

Table 15: Cost Differences

Difference	% of Difference
$103,143	0.2%
-$40,166	-0.1%
$411,725	0.9%
$0	0.0%
-$152,145	-0.3%
$96,767	0.2%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
-$7,498	0.0%
$0	0.0%
$6,608,000	14.0%
$7,896,000	16.8%
$10,920,000	23.2%
$6,720,000	14.3%
$6,160,000	13.1%
$8,400,000	17.8%
$0	0.0%
$47,115,826	100.0%
$16,490,539	
$63,606,365	44%
	increase

Table 16: Cost Estimate for Design Variation 1
Project 6: I-80 from Carquinez Bridge to SR-4

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	7.2			100%
New Lanes	Lane-Miles	0.0			0%
		7.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	69%
ITS equipment (monitoring)	Lane-Miles	7.2	$82,285	$592,452	19%
Striping of express lanes	Lane-Miles	7.2	$36,388	$261,994	9%
Signs for express lanes	Lane-Miles	7.2	$12,000	$86,400	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$153,782	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$322,943	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$161,471	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$1,485,537	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$5,199,379	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$1,819,783	
Total Project Cost				$7,019,161	
Cost per lane-mile of express lane				$974,884	

Table 17: Cost Estimate for Design Variation 2
Project 6: I-80 from Carquinez Bridge to SR-4

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	7.2			100%
New Lanes	Lane-Miles	0.0			0%
		7.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.8	$2,222,222	$1,677,867	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	7.2	$13,200	$95,040	0%
Variable costs for new HMA pavement	Sq. Ft.	120,384	$8.87	$1,067,883	1%
Variable costs for new PCC pavement	Sq. Ft.	634,656	$12.33	$7,827,424	8%
Overlay of existing lanes	Lane-Miles	25.2	$150,000	$3,780,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$4,334,464	4%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	6.0	$4,675,979	$28,055,877	28%
Sound walls	miles	0.2	$3,015,145	$603,029	1%
New median barrier	miles	3.6	$607,200	$2,185,920	2%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	1%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	12	$621,980	$7,463,760	7%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	2%
ITS equipment (monitoring)	Lane-Miles	7.2	$82,285	$592,452	1%
Striping of express lanes	Lane-Miles	7.2	$36,388	$261,994	0%
Signs for express lanes	Lane-Miles	7.2	$12,000	$86,400	0%
Replacement of cantilever signs	Site	10	$99,900	$999,000	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	25.2	$7,392	$186,278	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,167,071	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$6,650,849	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,325,424	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$30,593,905	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	52,585	$420	$22,085,551	22%
Replacement of overcrossings					
California St.	Site	1		$7,700,000	8%
Cummings Skyway	Site	1		$7,700,000	8%
Contingency factor for structures	40%			$14,994,220	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$159,558,438	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$55,845,453	
Total Project Cost				$215,403,892	
Cost per lane-mile of express lane				$29,917,207	

Table 18: Cost Differences

Difference	% of Difference
$2,836,434	1.8%
$160,665	0.1%
$1,805,256	1.2%
$13,232,260	8.6%
$6,390,090	4.1%
$7,327,412	4.7%
$47,428,460	30.7%
$1,019,421	0.7%
$3,695,298	2.4%
$0	0.0%
$2,351,198	1.5%
$0	0.0%
$12,617,486	8.2%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$1,688,810	1.1%
$1,011,595	0.7%
$314,904	0.2%
$30,919,772	20.0%
$10,780,000	7.0%
$10,780,000	7.0%
$0	0.0%
$154,359,059	100.0%
$54,025,671	
$208,384,730	2969%
	increase

Table 19: Cost Estimate for Design Variation 1
Project 7: I-80 from SR-4 to Bay Bridge Toll Plaza

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	31.6			100%
New Lanes	Lane-Miles	0.0			0%
		31.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	8	$1,067,400	$8,539,200	45%
ITS equipment (monitoring)	Lane-Miles	31.6	$82,285	$2,600,206	14%
Striping of express lanes	Lane-Miles	31.6	$36,388	$1,149,861	6%
Signs for express lanes	Lane-Miles	31.6	$12,000	$379,200	2%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$633,423	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$1,330,189	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$665,095	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$6,118,869	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
University Avenue	Site	1	$5,560,000	$5,560,000	29%
San Pablo Dam Rd	Site	1	$620,000	$620,000	3%
Contingency factor for structures	40%			$2,472,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$30,068,043	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$10,523,815	
Total Project Cost				$40,591,858	
Cost per lane-mile of express lane				$1,284,552	

Table 20: Cost Estimate for Design Variation 2
Project 7: I-80 from SR-4 to Bay Bridge Toll Plaza

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	31.6			100%
New Lanes	Lane-Miles	0.0			0%
		31.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.0	$2,222,222	$4,338,987	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	19.0	$13,200	$250,800	0%
Variable costs for new HMA pavement	Sq. Ft.	1,952,544	$8.87	$17,320,315	6%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	68.4	$150,000	$10,260,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$9,651,031	3%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	11.0	$4,675,979	$51,435,774	18%
Sound walls	miles	4.2	$3,015,145	$12,663,610	4%
New median barrier	miles	15.8	$607,200	$9,593,760	3%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	6	$1,390,830	$8,344,980	3%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	34	$621,980	$21,147,320	7%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	8	$1,067,400	$8,539,200	3%
ITS equipment (monitoring)	Lane-Miles	31.6	$82,285	$2,600,206	1%
Striping of express lanes	Lane-Miles	31.6	$36,388	$1,149,861	0%
Signs for express lanes	Lane-Miles	31.6	$12,000	$379,200	0%
Replacement of cantilever signs	Site	22	$99,900	$2,197,800	1%
Replacement of full-span signs	Site	3	$299,200	$897,600	0%
Re-striping of GP lanes	Lane-Miles	68.4	$7,392	$505,613	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$8,134,796	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$17,083,071	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$8,541,535	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$78,582,125	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	54,589	$420	$22,927,480	8%
Replacement of overcrossings					
Ashby Ave. IC (SR-13)	Site	1		$7,700,000	3%
University Ave. IC	Site	1		$27,800,000	10%
Solano Ave.	Site	1		$7,700,000	3%
McBryde Ave.	Site	1		$7,700,000	3%
Pedestrian Crossing	Site	1		$7,700,000	3%
San Pablo Dam Rd.	Site	1		$3,100,000	1%
Hilltop Dr	Site	1		$7,700,000	3%
Fitzgerald Dr./Richmond Pkwy.	Site	1		$7,700,000	3%
Appian Way (West)	Site	1		$7,700,000	3%
Appian Way (East)	Site	1		$7,700,000	3%
Contingency factor for structures	40%			$46,170,992	
TOTAL ROW ITEMS					
Acquisition	Acres	1.16	$3,000,000	$3,490,909	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$1,047,273	0%
Contingency factor for ROW		40%		$1,815,273	
Total Project Capital Outlay Costs				$442,989,366	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$155,046,278	
Total Project Cost				$598,035,644	
Cost per lane-mile of express lane				$18,925,179	

Table 21: Cost Differences

Difference	% of Difference
$7,335,057	1.8%
$423,977	0.1%
$29,279,993	7.1%
$0	0.0%
$17,344,530	4.2%
$16,315,067	4.0%
$86,952,176	21.1%
$21,407,832	5.2%
$16,218,251	3.9%
$0	0.0%
$14,107,189	3.4%
$2,400,267	0.6%
$35,749,544	8.7%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$3,715,381	0.9%
$1,517,393	0.4%
$854,738	0.2%
$32,098,472	7.8%
$2,996,000	0.7%
$38,052,000	9.2%
$10,780,000	2.6%
$10,780,000	2.6%
$10,780,000	2.6%
$4,340,000	1.1%
$10,780,000	2.6%
$10,780,000	2.6%
$10,780,000	2.6%
$10,780,000	2.6%
$6,353,455	1.5%
$412,921,323	100.0%
$144,522,463	
$557,443,786	1373%
	increase

Table 22: Cost Estimate for Design Variation 1
Project 8: I-80 / I-680 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	1.8			100%
		1.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0.0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0.0	$1,419,856	$0	0%
Ramp Modifications	Site	0.0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0.0	$1,067,400	$0	0%
ITS equipment (monitoring)	Lane-Miles	1.8	$82,285	$148,113	0%
Striping of express lanes	Lane-Miles	1.8	$36,388	$65,498	0%
Signs for express lanes	Lane-Miles	1.8	$12,000	$21,600	0%
Replacement of cantilever signs	Site	0.0	$99,900	$0	0%
Replacement of full-span signs	Site	0.0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$11,761	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$24,697	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$12,349	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$113,607	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Viaducts	Sq.Ft.	285,000	$240	$68,400,000	100%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$68,797,625	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$24,079,169	
Total Project Cost				$92,876,794	
Cost per lane-mile of express lane				$51,598,219	

Table 23: Cost Estimate for Design Variation 2
Project 8: I-80 / I-680 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	1.8			100%
		1.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0.0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0.0	$1,419,856	$0	0%
Ramp Modifications	Site	0.0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0.0	$1,067,400	$0	0%
ITS equipment (monitoring)	Lane-Miles	1.8	$82,285	$148,113	0%
Striping of express lanes	Lane-Miles	1.8	$36,388	$65,498	0%
Signs for express lanes	Lane-Miles	1.8	$12,000	$21,600	0%
Replacement of cantilever signs	Site	0.0	$99,900	$0	0%
Replacement of full-span signs	Site	0.0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$11,761	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$24,697	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$12,349	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$113,607	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Viaducts	Sq.Ft.	285,000	$240	$68,400,000	100%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$68,797,625	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$24,079,169	
Total Project Cost				$92,876,794	
Cost per lane-mile of express lane				$51,598,219	

Table 24: Cost Differences

Cost Components	Difference	% of Difference
Excavation, etc.	$0	
Fixed costs for pavement modification	$0	
Variable costs for new HMA pavement	$0	
Variable costs for new PCC pavement	$0	
Overlay of existing lanes	$0	
As a percentage of Sections 1 & 2	$0	
Retaining walls	$0	
Sound walls	$0	
New median barrier	$0	
Environmental Mitigation	$0	
HOV Enforcement	$0	
Access point (with transition lane)	$0	
Ramp Modifications	$0	
ITS equipment (access points)	$0	
ITS equipment (monitoring)	$0	
Striping of express lanes	$0	
Signs for express lanes	$0	
Replacement of cantilever signs	$0	
Replacement of full-span signs	$0	
Re-striping of GP lanes	$0	
Widening of undercrossings	$0	
None for this corridor	$0	
Viaducts	$0	
Acquisition	$0	
Total Project Capital Outlay Costs	$0	0.0%
Support Costs	$0	
Total Project Cost	$0	0%
Cost per lane-mile of express lane		increase

Table 25: Cost Estimate for Design Variation 1
Project 9: I-680 from I-80 to I-780

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	24.4			100%
		24.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	3.1	$2,222,222	$6,929,707	7%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	26.0	$13,200	$343,200	0%
Variable costs for new HMA pavement	Sq. Ft.	2,921,952	$8.87	$25,919,585	27%
Variable costs for new PCC pavement	Sq. Ft.	196,416	$12.33	$2,422,464	2%
Overlay of existing lanes	Lane-Miles	10.4	$150,000	$1,560,000	2%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$11,152,487	11%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	3.4	$4,675,979	$15,898,330	16%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	11.0	$607,200	$6,679,200	7%
Environmental Mitigation	miles	24.4	$100,000	$2,440,000	2%
HOV Enforcement	Site	4	$1,390,830	$5,563,320	6%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	9	$621,980	$5,597,820	6%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	7	$1,067,400	$7,471,800	8%
ITS equipment (monitoring)	Lane-Miles	24.4	$82,285	$2,007,754	2%
Striping of express lanes	Lane-Miles	24.4	$36,388	$887,867	1%
Signs for express lanes	Lane-Miles	24.4	$12,000	$292,800	0%
Replacement of cantilever signs	Site	4	$99,900	$399,600	0%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	10.4	$7,392	$76,877	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,883,053	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$10,254,412	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$5,127,206	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$47,170,295	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$165,096,032	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$57,783,611	
Total Project Cost				$222,879,644	
Cost per lane-mile of express lane				$9,134,412	

Table 26: Cost Estimate for Design Variation 2
Project 9: I-680 from I-80 to I-780

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	24.4			100%
		24.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	4.5	$2,222,222	$10,015,573	5%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	45.2	$13,200	$596,640	0%
Variable costs for new HMA pavement	Sq. Ft.	4,310,592	$8.87	$38,237,710	21%
Variable costs for new PCC pavement	Sq. Ft.	196,416	$12.33	$2,422,464	1%
Overlay of existing lanes	Lane-Miles	48.8	$150,000	$7,320,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$17,577,716	9%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	12.4	$4,675,979	$57,982,145	31%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	12.2	$607,200	$7,407,840	4%
Environmental Mitigation	miles	24.4	$100,000	$2,440,000	1%
HOV Enforcement	Site	4	$1,390,830	$5,563,320	3%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	25	$621,980	$15,549,500	8%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	7	$1,067,400	$7,471,800	4%
ITS equipment (monitoring)	Lane-Miles	24.4	$82,285	$2,007,754	1%
Striping of express lanes	Lane-Miles	24.4	$36,388	$887,867	0%
Signs for express lanes	Lane-Miles	24.4	$12,000	$292,800	0%
Replacement of cantilever signs	Site	4	$99,900	$399,600	0%
Replacement of full-span signs	Site	2	$299,200	$598,400	0%
Re-striping of GP lanes	Lane-Miles	48.8	$7,392	$360,730	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$8,927,586	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$18,747,930	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$9,373,965	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$86,240,479	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Marshview Rd. IC	Site	1		$7,700,000	4%
Contingency factor for structures	40%			$3,080,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$312,621,676	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$109,417,587	
Total Project Cost				$422,039,263	
Cost per lane-mile of express lane				$17,296,691	

Table 27: Cost Differences

Difference	% of Difference
$5,216,658	3.5%
$428,440	0.3%
$20,823,792	14.1%
$0	0.0%
$9,737,280	6.6%
$10,861,851	7.4%
$71,142,689	48.2%
$0	0.0%
$1,231,766	0.8%
$0	0.0%
$0	0.0%
$0	0.0%
$16,823,315	11.4%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$479,853	0.3%
$0	0.0%
$10,780,000	7.3%
$0	0.0%
$147,525,644	100.0%
$51,633,975	
$199,159,619	89%
	increase

Table 28: Cost Estimate for Design Variation 1
Project 10: I-680 Benicia-Martinez Bridge NB

Lane-miles set to zero. No changes are expected on the bridge.

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			
New Lanes	Lane-Miles	0.0			
		0.0			
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	
Sound walls	miles	0.0	$3,015,145	$0	
New median barrier	miles	0.0	$607,200	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	
Ramp Modifications	Site	0.0	$621,980	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0	$1,067,400	$0	
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	
Striping of express lanes	Lane-Miles	0.0	$36,388	$0	
Signs for express lanes	Lane-Miles	0.0	$12,000	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0.0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.0	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

Table 29: Cost Estimate for Design Variation 2
Project 10: I-680 Benicia-Martinez Bridge NB

Lane-miles set to zero. No changes are expected on the bridge.

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			
New Lanes	Lane-Miles	0.0			
		0.0			
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	
Sound walls	miles	0.0	$3,015,145	$0	
New median barrier	miles	0.0	$607,200	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	
Ramp Modifications	Site	0.0	$621,980	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0	$1,067,400	$0	
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	
Striping of express lanes	Lane-Miles	0.0	$36,388	$0	
Signs for express lanes	Lane-Miles	0.0	$12,000	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0.0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.0	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

Table 30: Cost Differences

Difference	% of Difference
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	0.0%
$0	
$0	0%
	increase

Table 31: Cost Estimate for Design Variation 1
Project 11: I-680 NB from N. Main Street to Marina Vista Avenue

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	6.0			68%
New Lanes	Lane-Miles	2.8			32%
		8.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.3	$2,222,222	$687,573	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	3.4	$13,200	$44,880	0%
Variable costs for new HMA pavement	Sq. Ft.	186,912	$8.87	$1,658,029	6%
Variable costs for new PCC pavement	Sq. Ft.	122,496	$12.33	$1,510,784	5%
Overlay of existing lanes	Lane-Miles	10.0	$150,000	$1,500,000	5%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$1,620,380	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	2.0	$4,675,979	$9,351,959	31%
Sound walls	miles	1.0	$3,015,145	$3,015,145	10%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	2.8	$100,000	$280,000	1%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	5%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	5	$621,980	$3,109,900	10%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	11%
ITS equipment (monitoring)	Lane-Miles	8.8	$82,285	$724,108	2%
Striping of express lanes	Lane-Miles	8.8	$36,388	$320,214	1%
Signs for express lanes	Lane-Miles	8.8	$12,000	$105,600	0%
Replacement of cantilever signs	Site	4	$99,900	$399,600	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	1%
Re-striping of GP lanes	Lane-Miles	10.0	$7,392	$73,920	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$1,464,716	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$3,075,904	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$1,537,952	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$14,149,158	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
East Martinez Railroad	Site		$0	$0	0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.44	$900,000	$392,727	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$117,818	0%
Contingency factor for ROW		40%		$204,218	
Total Project Capital Outlay Costs				$50,236,816	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$17,582,886	
Total Project Cost				$67,819,702	
Cost per lane-mile of express lane				$7,706,784	

Table 32: Cost Estimate for Design Variation 2
Project 11: I-680 NB from N. Main Street to Marina Vista Avenue

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	7.6			86%
New Lanes	Lane-Miles	1.2			14%
		8.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.2	$2,222,222	$2,698,667	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	10.6	$13,200	$139,920	0%
Variable costs for new HMA pavement	Sq. Ft.	1,013,760	$8.87	$8,992,700	7%
Variable costs for new PCC pavement	Sq. Ft.	200,640	$12.33	$2,474,560	2%
Overlay of existing lanes	Lane-Miles	38.2	$150,000	$5,730,000	5%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$6,010,754	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	4.4	$4,675,979	$20,574,310	17%
Sound walls	miles	1.4	$3,015,145	$4,221,203	3%
New median barrier	miles	3.8	$607,200	$2,307,360	2%
Environmental Mitigation	miles	1.2	$100,000	$120,000	0%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	1%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	28	$621,980	$17,415,440	14%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	3%
ITS equipment (monitoring)	Lane-Miles	8.8	$82,285	$724,108	1%
Striping of express lanes	Lane-Miles	8.8	$36,388	$320,214	0%
Signs for express lanes	Lane-Miles	8.8	$12,000	$105,600	0%
Replacement of cantilever signs	Site	21	$99,900	$2,097,900	2%
Replacement of full-span signs	Site	3	$299,200	$897,600	1%
Re-striping of GP lanes	Lane-Miles	38.2	$7,392	$282,374	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,985,287	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$8,369,103	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$4,184,551	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$38,497,873	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Pancheco Rd. IC	Site	1		$7,700,000	6%
East Martinez Railroad	Site	1		$740,000	1%
SR 4 Interchange	Site	1		$3,300,000	3%
S SR-242 / S I-680 Connector	Site	1		$7,700,000	6%
SR-242 Interchange	Site	1		$7,700,000	6%
Monument Blvd.	Site	1		$7,700,000	6%
Oak Park Blvd.	Site	1		$7,700,000	6%
Contingency factor for structures	40%			$17,016,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.73	$900,000	$654,545	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$196,364	0%
Contingency factor for ROW		40%		$340,364	
Total Project Capital Outlay Costs				$195,489,827	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$68,421,439	
Total Project Cost				$263,911,267	
Cost per lane-mile of express lane				$29,989,917	

Table 33: Cost Differences

Difference	% of Difference
$3,399,753	2.3%
$160,665	0.1%
$12,399,261	8.5%
$1,629,263	1.1%
$7,150,815	4.9%
$7,421,927	5.1%
$18,971,384	13.1%
$2,038,841	1.4%
$3,900,592	2.7%
-$270,480	-0.2%
$0	0.0%
$0	0.0%
$24,183,515	16.6%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,870,976	2.0%
$1,011,595	0.7%
$352,392	0.2%
$0	0.0%
$10,780,000	7.4%
$1,036,000	0.7%
$4,620,000	3.2%
$10,780,000	7.4%
$10,780,000	7.4%
$10,780,000	7.4%
$10,780,000	7.4%
$476,509	0.3%
$145,253,011	100.0%
$50,838,554	
$196,091,564	289%
	increase

Table 34: Cost Estimate for Design Variation 1
Project 12: I-680 Benicia-Martinez Bridge SB

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			
New Lanes	Lane-Miles	0.0			
		0.0			
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	
Sound walls	miles	0.0	$3,015,145	$0	
New median barrier	miles	0.0	$607,200	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	
Ramp Modifications	Site	0.0	$621,980	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0	$1,067,400	$0	
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	
Striping of express lanes	Lane-Miles	0.0	$36,388	$0	
Signs for express lanes	Lane-Miles	0.0	$12,000	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0.0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.0	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

Lane-miles set to zero. No changes are expected on the bridge.

Table 35: Cost Estimate for Design Variation 2
Project 12: I-680 Benicia-Martinez Bridge SB

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			
New Lanes	Lane-Miles	0.0			
		0.0			
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	
Sound walls	miles	0.0	$3,015,145	$0	
New median barrier	miles	0.0	$607,200	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	
Ramp Modifications	Site	0.0	$621,980	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0	$1,067,400	$0	
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	
Striping of express lanes	Lane-Miles	0.0	$36,388	$0	
Signs for express lanes	Lane-Miles	0.0	$12,000	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0.0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.0	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

Lane-miles set to zero. No changes are expected on the bridge.

Table 36: Cost Differences

Cost Components	Difference	% of Difference
Excavation, etc.	$0	
Fixed costs for pavement modification	$0	
Variable costs for new HMA pavement	$0	
Variable costs for new PCC pavement	$0	
Overlay of existing lanes	$0	
As a percentage of Sections 1 & 2	$0	
Retaining walls	$0	
Sound walls	$0	
New median barrier	$0	
Environmental Mitigation	$0	
HOV Enforcement	$0	
Access point (with transition lane)	$0	
Ramp Modifications	$0	
ITS equipment (access points)	$0	
ITS equipment (monitoring)	$0	
Striping of express lanes	$0	
Signs for express lanes	$0	
Replacement of cantilever signs	$0	
Replacement of full-span signs	$0	
Re-striping of GP lanes	$0	
Widening of undercrossings	$0	
None for this corridor	$0	
	$0	
Acquisition	$0	
Total Project Capital Outlay Costs	$0	0.0%
Support Costs (computed as a percentage of Capital Outlay Costs)	$0	
Total Project Cost	$0	0%
Cost per lane-mile of express lane		increase

Table 37: Cost Estimate for Design Variation 1
Project 13: I-680 SB from Marina Vista Avenue to Livorna Road

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	8.0			61%
New Lanes	Lane-Miles	5.2			39%
		13.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.6	$2,222,222	$1,250,773	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	6.8	$13,200	$89,760	0%
Variable costs for new HMA pavement	Sq. Ft.	425,568	$8.87	$3,775,061	5%
Variable costs for new PCC pavement	Sq. Ft.	137,280	$12.33	$1,693,120	2%
Overlay of existing lanes	Lane-Miles	21.4	$150,000	$3,210,000	5%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$3,005,614	4%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	5.4	$4,675,979	$25,250,289	36%
Sound walls	miles	3.4	$3,015,145	$10,251,494	14%
New median barrier	miles	0.2	$607,200	$121,440	0%
Environmental Mitigation	miles	5.2	$100,000	$520,000	1%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	4%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	14	$621,980	$8,707,720	12%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	6%
ITS equipment (monitoring)	Lane-Miles	13.2	$82,285	$1,086,162	2%
Striping of express lanes	Lane-Miles	13.2	$36,388	$480,322	1%
Signs for express lanes	Lane-Miles	13.2	$12,000	$158,400	0%
Replacement of cantilever signs	Site	22	$99,900	$2,197,800	3%
Replacement of full-span signs	Site	6	$299,200	$1,795,200	3%
Re-striping of GP lanes	Lane-Miles	21.4	$7,392	$158,189	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,540,130	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$7,434,273	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,717,137	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$34,197,657	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$119,691,801	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$41,892,130	
Total Project Cost				$161,583,931	
Cost per lane-mile of express lane				$12,241,207	

Table 38: Cost Estimate for Design Variation 2
Project 13: I-680 SB from Marina Vista Avenue to Livorna Road

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	8.0			61%
New Lanes	Lane-Miles	5.2			39%
		13.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.6	$2,222,222	$3,663,147	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	14.6	$13,200	$192,720	0%
Variable costs for new HMA pavement	Sq. Ft.	1,291,488	$8.87	$11,456,325	6%
Variable costs for new PCC pavement	Sq. Ft.	356,928	$12.33	$4,402,112	2%
Overlay of existing lanes	Lane-Miles	56.2	$150,000	$8,430,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$8,443,291	4%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	5.6	$4,675,979	$26,185,485	13%
Sound walls	miles	4.4	$3,015,145	$13,266,639	6%
New median barrier	miles	7.6	$607,200	$4,614,720	2%
Environmental Mitigation	miles	5.2	$100,000	$520,000	0%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	1%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	44	$621,980	$27,367,120	13%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	2%
ITS equipment (monitoring)	Lane-Miles	13.2	$82,285	$1,086,162	1%
Striping of express lanes	Lane-Miles	13.2	$36,388	$480,322	0%
Signs for express lanes	Lane-Miles	13.2	$12,000	$158,400	0%
Replacement of cantilever signs	Site	24	$99,900	$2,397,600	1%
Replacement of full-span signs	Site	8	$299,200	$2,393,600	1%
Re-striping of GP lanes	Lane-Miles	56.2	$7,392	$415,430	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$6,126,217	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$12,865,055	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$6,432,527	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$59,179,253	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Pancheco Rd. IC	Site	1		$7,700,000	4%
Railroad Crossing	Site	1		$7,700,000	4%
SR 4 Interchange	Site	1		$7,700,000	4%
S242-S680 Conn	Site	1		$7,700,000	4%
SR 242 Interchange	Site	1		$7,700,000	4%
Monument Blvd.	Site	1		$7,700,000	4%
Geary Rd./Treat Blvd	Site	1		$7,700,000	4%
N. Main St.	Site	1		$7,700,000	4%
SR 24 Interchange	Site	1		$7,700,000	4%
Mt Diablo Blvd	Site	1		$7,700,000	4%
Contingency factor for structures	40%			$30,800,000	
TOTAL ROW ITEMS					
Acquisition	Acres	1.67	$2,695,652	$4,509,091	2%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$1,352,727	1%
Contingency factor for ROW		40%		$2,344,727	
Total Project Capital Outlay Costs				$323,133,930	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$113,096,876	
Total Project Cost				$436,230,806	
Cost per lane-mile of express lane				$33,047,788	

Table 39: Cost Differences

Difference	% of Difference
$4,078,117	2.0%
$174,054	0.1%
$12,985,178	6.4%
$4,579,551	2.3%
$8,824,410	4.3%
$9,192,393	4.5%
$1,580,949	0.8%
$5,097,103	2.5%
$7,595,890	3.7%
$0	0.0%
$0	0.0%
$0	0.0%
$31,543,716	15.5%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$337,762	0.2%
$1,011,595	0.5%
$434,867	0.2%
$0	0.0%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$10,780,000	5.3%
$8,206,545	4.0%
$203,442,130	100.0%
$71,204,745	
$274,646,875	170%
	increase

Table 40: Cost Estimate for Design Variation 1
Project 14: I-680 from Livorna Road to Alcosta Boulevard

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	23.2			100%
New Lanes	Lane-Miles	0.0			0%
		23.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	6	$1,067,400	$6,404,400	68%
ITS equipment (monitoring)	Lane-Miles	23.2	$82,285	$1,909,012	20%
Striping of express lanes	Lane-Miles	23.2	$36,388	$844,202	9%
Signs for express lanes	Lane-Miles	23.2	$12,000	$278,400	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	1.2	$7,392	$8,870	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$472,244	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$991,713	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$495,856	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$4,561,879	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$15,966,576	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$5,588,302	
Total Project Cost				$21,554,878	
Cost per lane-mile of express lane				$929,090	

Table 41: Cost Estimate for Design Variation 2
Project 14: I-680 from Livorna Road to Alcosta Boulevard

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	23.2			100%
New Lanes	Lane-Miles	0.0			0%
		23.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.6	$2,222,222	$3,642,027	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	23.2	$13,200	$306,240	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	1,638,912	$12.33	$20,213,248	11%
Overlay of existing lanes	Lane-Miles	83.4	$150,000	$12,510,000	7%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$11,001,454	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	4.8	$4,675,979	$22,444,701	12%
Sound walls	miles	4.6	$3,015,145	$13,869,668	7%
New median barrier	miles	11.6	$607,200	$7,043,520	4%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	4	$1,390,830	$5,563,320	3%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	38	$621,980	$23,635,240	12%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	6	$1,067,400	$6,404,400	3%
ITS equipment (monitoring)	Lane-Miles	23.2	$82,285	$1,909,012	1%
Striping of express lanes	Lane-Miles	23.2	$36,388	$844,202	0%
Signs for express lanes	Lane-Miles	23.2	$12,000	$278,400	0%
Replacement of cantilever signs	Site	56	$99,900	$5,594,400	3%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	83.4	$7,392	$616,493	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$6,864,809	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$14,416,099	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$7,208,049	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$66,314,055	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Sycamore valley Rd. OC	Site	1		$7,700,000	4%
Greenbrook Dr. OC	Site	1		$7,700,000	4%
Fostoria Way OC	Site	1		$7,700,000	4%
Crow Canyon Rd. OC	Site	1		$7,700,000	4%
Norris Canyon Rd. OC	Site	1		$7,700,000	4%
Bollinger Canyon Rd. OC	Site	1		$7,700,000	4%
Alcosta Blvd (County Line) OC	Site	1		$7,700,000	4%
Contingency factor for structures	40%			$21,560,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$307,559,194	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$107,645,718	
Total Project Cost				$415,204,911	
Cost per lane-mile of express lane				$17,896,763	

Table 42: Cost Differences

Difference	% of Difference
$6,156,846	2.1%
$517,699	0.2%
$0	0.0%
$34,170,496	11.7%
$21,148,155	7.3%
$18,597,959	6.4%
$37,942,768	13.0%
$23,446,674	8.0%
$11,907,071	4.1%
$0	0.0%
$9,404,792	3.2%
$2,400,267	0.8%
$39,955,373	13.7%
$0	0.0%
$0	0.0%
$0	0.0%
$9,457,333	3.2%
$0	0.0%
$1,027,186	0.4%
$0	0.0%
$10,780,000	3.7%
$10,780,000	3.7%
$10,780,000	3.7%
$10,780,000	3.7%
$10,780,000	3.7%
$10,780,000	3.7%
$10,780,000	3.7%
$0	0.0%
$291,592,617	100.0%
$102,057,416	
$393,650,033	1826%
	increase

Table 43: Cost Estimate for Design Variation 1
Project 15: I-680 from Alcosta Boulevard to SR 84

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	20.0			100%
		20.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.9	$2,222,222	$4,151,253	5%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	21.6	$13,200	$285,120	0%
Variable costs for new HMA pavement	Sq. Ft.	295,680	$8.87	$2,622,871	3%
Variable costs for new PCC pavement	Sq. Ft.	1,572,384	$12.33	$19,392,736	
Overlay of existing lanes	Lane-Miles	7.2	$150,000	$1,080,000	1%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$8,259,594	9%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	3.6	$4,675,979	$16,833,526	19%
Sound walls	miles	3.0	$3,015,145	$9,045,436	10%
New median barrier	miles	3.6	$607,200	$2,185,920	2%
Environmental Mitigation	miles	20.0	$100,000	$2,000,000	2%
HOV Enforcement	Site	4	$1,390,830	$5,563,320	6%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	2%
Ramp Modifications	Site	6	$621,980	$3,731,880	4%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	6%
ITS equipment (monitoring)	Lane-Miles	20.0	$82,285	$1,645,700	2%
Striping of express lanes	Lane-Miles	20.0	$36,388	$727,760	1%
Signs for express lanes	Lane-Miles	20.0	$12,000	$240,000	0%
Replacement of cantilever signs	Site	10	$99,900	$999,000	1%
Replacement of full-span signs	Site	7	$299,200	$2,094,400	2%
Re-striping of GP lanes	Lane-Miles	7.2	$7,392	$53,222	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,383,430	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$9,205,202	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$4,602,601	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$42,343,931	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$148,203,759	78%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$51,871,316	
Total Project Cost				$200,075,074	
Cost per lane-mile of express lane				$10,003,754	

Table 44: Cost Estimate for Design Variation 2
Project 15: I-680 from Alcosta Boulevard to SR 84

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.4			2%
New Lanes	Lane-Miles	19.6			98%
		20.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.7	$2,222,222	$6,063,787	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	32.6	$13,200	$430,320	0%
Variable costs for new HMA pavement	Sq. Ft.	549,120	$8.87	$4,871,046	3%
Variable costs for new PCC pavement	Sq. Ft.	2,179,584	$12.33	$26,881,536	
Overlay of existing lanes	Lane-Miles	46.2	$150,000	$6,930,000	5%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$13,553,007	9%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	6.2	$4,675,979	$28,991,073	19%
Sound walls	miles	2.4	$3,015,145	$7,236,348	5%
New median barrier	miles	9.8	$607,200	$5,950,560	4%
Environmental Mitigation	miles	19.6	$100,000	$1,960,000	1%
HOV Enforcement	Site	4	$1,390,830	$5,563,320	4%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	31	$621,980	$19,281,380	13%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	4%
ITS equipment (monitoring)	Lane-Miles	20.0	$82,285	$1,645,700	1%
Striping of express lanes	Lane-Miles	20.0	$36,388	$727,760	0%
Signs for express lanes	Lane-Miles	20.0	$12,000	$240,000	0%
Replacement of cantilever signs	Site	23	$99,900	$2,297,700	2%
Replacement of full-span signs	Site	8	$299,200	$2,393,600	2%
Re-striping of GP lanes	Lane-Miles	46.2	$7,392	$341,510	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$7,105,775	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$14,922,128	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$7,461,064	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$68,641,788	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Stoneridge Dr. OC		Site	$1	$7,700,000	5%
Contingency factor for structures	40%			$3,080,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$251,026,257	82%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$87,859,190	
Total Project Cost				$338,885,447	
Cost per lane-mile of express lane				$16,944,272	

Table 45: Cost Differences

Difference	% of Difference
$3,233,138	3.1%
$245,461	0.2%
$3,800,540	3.7%
$12,659,816	12.3%
$9,889,425	9.6%
$8,948,514	8.7%
$20,552,332	20.0%
-$3,058,262	-3.0%
$6,364,124	6.2%
-$67,620	-0.1%
$0	0.0%
$0	0.0%
$26,286,430	25.6%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,195,452	2.1%
$505,798	0.5%
$487,351	0.5%
$0	0.0%
$10,780,000	10.5%
$0	0.0%
$102,822,499	100.0%
$35,987,874	
$138,810,373	69%
	increase

Table 46: Cost Estimate for Design Variation 1
Project 16: I-680 NB from SR 237 to SR 84

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	14.0			100%
		14.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.7	$2,222,222	$3,686,613	7%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	14.2	$13,200	$187,440	0%
Variable costs for new HMA pavement	Sq. Ft.	796,224	$8.87	$7,063,017	13%
Variable costs for new PCC pavement	Sq. Ft.	862,752	$12.33	$10,640,608	20%
Overlay of existing lanes	Lane-Miles	12.2	$150,000	$1,830,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$7,022,303	13%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.1	$4,675,979	$5,143,577	10%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	4.4	$607,200	$2,671,680	5%
Environmental Mitigation	miles	14.0	$100,000	$1,400,000	3%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	5%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	6	$621,980	$3,731,880	7%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	8%
ITS equipment (monitoring)	Lane-Miles	14.0	$82,285	$1,151,990	2%
Striping of express lanes	Lane-Miles	14.0	$36,388	$509,432	1%
Signs for express lanes	Lane-Miles	14.0	$12,000	$168,000	0%
Replacement of cantilever signs	Site	6	$99,900	$599,400	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	1%
Re-striping of GP lanes	Lane-Miles	12.2	$7,392	$90,182	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$2,662,329	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$5,590,891	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$2,795,446	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$25,718,100	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$90,013,349	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$31,504,672	
Total Project Cost				$121,518,021	
Cost per lane-mile of express lane				$8,679,859	

Table 47: Cost Estimate for Design Variation 2
Project 16: I-680 NB from SR 237 to SR 84

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	6.2			44%
New Lanes	Lane-Miles	7.8			56%
		14.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.0	$2,222,222	$4,486,827	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	17.8	$13,200	$234,960	0%
Variable costs for new HMA pavement	Sq. Ft.	1,026,432	$8.87	$9,105,109	7%
Variable costs for new PCC pavement	Sq. Ft.	992,640	$12.33	$12,242,560	9%
Overlay of existing lanes	Lane-Miles	23.4	$150,000	$3,510,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$8,873,837	7%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	4.8	$4,675,979	$22,444,701	17%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	14.0	$607,200	$8,500,800	6%
Environmental Mitigation	miles	7.8	$100,000	$780,000	1%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	2%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	22	$621,980	$13,683,560	10%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	3%
ITS equipment (monitoring)	Lane-Miles	14.0	$82,285	$1,151,990	1%
Striping of express lanes	Lane-Miles	14.0	$36,388	$509,432	0%
Signs for express lanes	Lane-Miles	14.0	$12,000	$168,000	0%
Replacement of cantilever signs	Site	9	$99,900	$899,100	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	0%
Re-striping of GP lanes	Lane-Miles	23.4	$7,392	$172,973	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,705,715	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$9,882,002	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$4,941,001	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$45,457,211	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Andrade Rd	Site	1		$2,200,000	2%
Sheridan Rd	Site	1		$2,000,000	2%
Palm Ave. OC	Site	1		$7,700,000	6%
Pasea Padre Pkwy OC	Site	1		$7,700,000	6%
Washington Blvd. OC	Site	1		$7,700,000	6%
Auto Mall Pkwy	Site	1		$7,700,000	6%
Contingency factor for structures	40%			$14,000,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.44	$3,000,000	$1,309,091	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$392,727	0%
Contingency factor for ROW		40%		$680,727	
Total Project Capital Outlay Costs				$210,482,784	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$73,668,974	
Total Project Cost				$284,151,758	
Cost per lane-mile of express lane				$20,296,554	

Table 48: Cost Differences

Difference	% of Difference
$1,352,761	1.1%
$80,333	0.1%
$3,452,157	2.9%
$2,708,100	2.2%
$2,840,040	2.4%
$3,130,017	2.6%
$29,247,550	24.3%
$0	0.0%
$9,854,127	8.2%
-$1,048,110	-0.9%
$0	0.0%
$0	0.0%
$16,823,315	14.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$506,643	0.4%
$0	0.0%
$139,957	0.1%
$0	0.0%
$3,080,000	2.6%
$2,800,000	2.3%
$10,780,000	8.9%
$10,780,000	8.9%
$10,780,000	8.9%
$10,780,000	8.9%
$2,382,545	2.0%
$120,469,435	100.0%
$42,164,302	
$162,633,737	134%
	increase

Table 49: Cost Estimate for Design Variation 1
Project 17: I-680 SB from SR 84 to SR 237

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	14.0			100%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	0.0			0%
		14.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	-	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	-	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	-	$8.87	$0	
Variable costs for new PCC pavement	Sq. Ft.	-	$12.33	$0	
Overlay of existing lanes	Lane-Miles	-	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	-	$4,675,979	$0	
Sound walls	miles	-	$3,015,145	$0	
New median barrier	miles	-	$607,200	$0	
Environmental Mitigation	miles	-	$100,000	$0	
HOV Enforcement	Site	-	$1,390,830	$0	
Access point (with transition lane)	Site	-	$1,419,856	$0	
Ramp Modifications	Site	-	$621,980	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	-	$1,067,400	$0	
ITS equipment (monitoring)	Lane-Miles	-	$82,285	$0	
Striping of express lanes	Lane-Miles	-	$36,388	$0	
Signs for express lanes	Lane-Miles	-	$12,000	$0	
Replacement of cantilever signs	Site	-	$99,900	$0	
Replacement of full-span signs	Site	-	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	-	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

HOT lane already exists. No costs needed

Table 50: Cost Estimate for Design Variation 2
Project 17: I-680 SB from SR 84 to SR 237

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	14.0			100%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	0.0			0%
		14.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	-	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	-	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	-	$8.87	$0	
Variable costs for new PCC pavement	Sq. Ft.	-	$12.33	$0	
Overlay of existing lanes	Lane-Miles	-	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	-	$4,675,979	$0	
Sound walls	miles	-	$3,015,145	$0	
New median barrier	miles	-	$607,200	$0	
Environmental Mitigation	miles	-	$100,000	$0	
HOV Enforcement	Site	-	$1,390,830	$0	
Access point (with transition lane)	Site	-	$1,419,856	$0	
Ramp Modifications	Site	-	$621,980	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	-	$1,067,400	$0	
ITS equipment (monitoring)	Lane-Miles	-	$82,285	$0	
Striping of express lanes	Lane-Miles	-	$36,388	$0	
Signs for express lanes	Lane-Miles	-	$12,000	$0	
Replacement of cantilever signs	Site	-	$99,900	$0	
Replacement of full-span signs	Site	-	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	-	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

HOT lane already exists. No costs needed

Table 51: Cost Differences

Cost Components	Difference	% of Difference
Excavation, etc.	$0	
Fixed costs for pavement modification	$0	
Variable costs for new HMA pavement	$0	
Variable costs for new PCC pavement	$0	
Overlay of existing lanes	$0	
As a percentage of Sections 1 & 2	$0	
Retaining walls	$0	
Sound walls	$0	
New median barrier	$0	
Environmental Mitigation	$0	
HOV Enforcement	$0	
Access point (with transition lane)	$0	
Ramp Modifications	$0	
ITS equipment (access points)	$0	
ITS equipment (monitoring)	$0	
Striping of express lanes	$0	
Signs for express lanes	$0	
Replacement of cantilever signs	$0	
Replacement of full-span signs	$0	
Re-striping of GP lanes	$0	
Widening of undercrossings	$0	
None for this corridor	$0	
	$0	
Acquisition	$0	
Total Project Capital Outlay Costs	$0	0.0%
Support Costs (computed as a percentage of Capital Outlay Costs)	$0	
Total Project Cost	$0	0%
Cost per lane-mile of express lane		increase

Table 52: Cost Estimate for Design Variation 1
Project 18: I-580 / I-680 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	3.1			100%
		3.1			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0.0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0.0	$1,419,856	$0	0%
Ramp Modifications	Site	0.0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0.0	$0	$0	0%
ITS equipment (monitoring)	Lane-Miles	3.1	$82,285	$255,084	0%
Striping of express lanes	Lane-Miles	3.1	$36,388	$112,803	0%
Signs for express lanes	Lane-Miles	3.1	$12,000	$37,200	0%
Replacement of cantilever signs	Site	0.0	$99,900	$0	0%
Replacement of full-span signs	Site	0.0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$20,254	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$42,534	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$21,267	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$195,657	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Viaducts	Sq.Ft.	541,260	$240	$129,902,400	100%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$130,587,198	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$45,705,519	
Total Project Cost				$176,292,718	
Cost per lane-mile of express lane				$56,868,619	

Table 53: Cost Estimate for Design Variation 2
Project 18: I-580 / I-680 Direct Express Lane Connectors

Table 54: Cost Differences

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total	Difference	% of Difference
Type of Project							
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%		
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%		
New Lanes	Lane-Miles	3.1			100%		
		3.1			100%		
TOTAL ROADWAY ITEMS							
SECTION 1: EARTHWORK							
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION							
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%	$0	
SECTION 3: DRAINAGE							
As a percentage of Sections 1 & 2	30%			$0	0%	$0	
SECTION 4: SPECIALTY ITEMS							
Retaining walls	miles	0.0	$4,675,979	$0	0%	$0	
Sound walls	miles	0.0	$3,015,145	$0	0%	$0	
New median barrier	miles	0.0	$607,200	$0	0%	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	0%	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	0%	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	0%	$0	
Ramp Modifications	Site	0.0	$621,980	$0	0%	$0	
SECTION 5: TRAFFIC ITEMS							
ITS equipment (access points)	Access point	0.0	$0	$0	0%	$0	
ITS equipment (monitoring)	Lane-Miles	3.1	$82,285	$255,084	0%	$0	
Striping of express lanes	Lane-Miles	3.1	$36,388	$112,803	0%	$0	
Signs for express lanes	Lane-Miles	3.1	$12,000	$37,200	0%	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	0%	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	0%	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%	$0	
SECTION 6: MINOR ITEMS							
As a percentage of Sections 1 through 5	5%			$20,254			
SECTION 7: MOBILIZATION							
As a percentage of Sections 1 through 6	10%			$42,534			
SECTION 8: ROADWAY ADDITIONS							
As a percentage of Sections 1 through 6	5%			$21,267			
SECTION 9: CONTINGENCIES							
As a percentage of Sections 1 through 8	40%			$195,657			
TOTAL STRUCTURES ITEMS							
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%	$0	
Replacement of overcrossings							
None for this corridor					0%	$0	
Viaducts	Sq.Ft.	541,260	$240	$129,902,400	100%	$0	
Contingency factor for structures	40%			$0			
TOTAL ROW ITEMS							
Acquisition	Acres	0.00	$0	$0	0%	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%		
Contingency factor for ROW		40%		$0			
Total Project Capital Outlay Costs				$130,587,198	100%	$0	0.0%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$45,705,519		$0	
Total Project Cost				$176,292,718		$0	0%
Cost per lane-mile of express lane				$56,868,619			increase

Table 55: Cost Estimate for Design Variation 1
Project 19: I-580 from Greenville to San Joaquin County Line

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	17.6			100%
		17.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.6	$2,222,222	$5,770,453	6%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	18.8	$13,200	$248,160	0%
Variable costs for new HMA pavement	Sq. Ft.	607,200	$8.87	$5,386,253	6%
Variable costs for new PCC pavement	Sq. Ft.	1,989,504	$12.33	$24,537,216	25%
Overlay of existing lanes	Lane-Miles	28.8	$150,000	$4,320,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$12,078,625	12%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	4.3	$4,675,979	$20,200,231	21%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	6.4	$607,200	$3,886,080	4%
Environmental Mitigation	miles	17.6	$100,000	$1,760,000	2%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	4%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	8	$621,980	$4,975,840	5%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	5%
ITS equipment (monitoring)	Lane-Miles	17.6	$82,285	$1,448,216	1%
Striping of express lanes	Lane-Miles	17.6	$36,388	$640,429	1%
Signs for express lanes	Lane-Miles	17.6	$12,000	$211,200	0%
Replacement of cantilever signs	Site	5	$99,900	$499,500	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	28.8	$7,392	$212,890	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,814,149	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$10,109,713	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$5,054,857	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$46,504,680	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Western Pacific RR	Site	1		$1,300,000	1%
Contingency factor for structures	40%			$520,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$164,586,382	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$57,605,234	
Total Project Cost				$222,191,615	
Cost per lane-mile of express lane				$12,624,524	

Table 56: Cost Estimate for Design Variation 2
Project 19: I-580 from Greenville to San Joaquin County Line

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	17.6			100%
		17.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.6	$2,222,222	$5,793,920	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	18.4	$13,200	$242,880	0%
Variable costs for new HMA pavement	Sq. Ft.	607,200	$8.87	$5,386,253	3%
Variable costs for new PCC pavement	Sq. Ft.	2,000,064	$12.33	$24,667,456	16%
Overlay of existing lanes	Lane-Miles	28.8	$150,000	$4,320,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$12,123,153	8%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	16.2	$4,675,979	$75,750,867	48%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	11.4	$607,200	$6,922,080	4%
Environmental Mitigation	miles	17.6	$100,000	$1,760,000	1%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	8	$621,980	$4,975,840	3%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	3%
ITS equipment (monitoring)	Lane-Miles	17.6	$82,285	$1,448,216	1%
Striping of express lanes	Lane-Miles	17.6	$36,388	$640,429	0%
Signs for express lanes	Lane-Miles	17.6	$12,000	$211,200	0%
Replacement of cantilever signs	Site	7	$99,900	$699,300	0%
Replacement of full-span signs	Site	2	$299,200	$598,400	0%
Re-striping of GP lanes	Lane-Miles	28.8	$7,392	$212,890	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$7,763,119	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$16,302,549	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$8,151,275	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$74,991,726	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Western Pacific RR	Site	1		$1,300,000	1%
Contingency factor for structures	40%			$520,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$264,291,041	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$92,501,864	
Total Project Cost				$356,792,906	
Cost per lane-mile of express lane				$20,272,324	

Table 57: Cost Differences

Difference	% of Difference
$39,670	0.0%
-$8,926	0.0%
$0	0.0%
$220,171	0.2%
$0	0.0%
$75,275	0.1%
$93,908,350	94.2%
$0	0.0%
$5,132,358	5.1%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$337,762	0.3%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$99,704,660	100.0%
$34,896,631	
$134,601,291	61%
	increase

Table 58: Cost Estimate for Design Variation 1
Project 20: EB I-580 from Hacienda to Greenville

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	10.6			100%
New Lanes	Lane-Miles	0.0			0%
		10.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.			$260,454	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles			$0	0%
Variable costs for new HMA pavement	Sq. Ft.			$0	0%
Variable costs for new PCC pavement	Sq. Ft.			$0	0%
Overlay of existing lanes	Lane-Miles			$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$983,772	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles			$0	0%
Sound walls	miles			$0	0%
New median barrier	miles			$974,181	6%
Environmental Mitigation	miles			$1,699,467	11%
HOV Enforcement	Site			$0	0%
Access point (with transition lane)	Site			$0	0%
Ramp Modifications	Site			$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point			$8,305,000	55%
ITS equipment (monitoring)	Lane-Miles			$0	0%
Striping of express lanes	Lane-Miles			$307,000	2%
Signs for express lanes	Lane-Miles			$2,630,300	17%
Replacement of cantilever signs	Site			$0	0%
Replacement of full-span signs	Site			$0	0%
Re-striping of GP lanes	Lane-Miles			$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5				$684,373	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6				$1,437,184	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6				$718,592	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8				$3,661,387	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.			$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures				$0	
TOTAL ROW ITEMS					
Acquisition	Acres			$0	0%
Title & Escrow fees (as a percentage of acquisition costs)				$0	0%
Contingency factor for ROW				$0	
Total Project Capital Outlay Costs				$21,661,710	100%
Support Costs (computed as a percentage of Capital Outlay Costs)				$6,997,118	
Total Project Cost				$28,658,828	
Cost per lane-mile of express lane				$2,703,663	

These figures are from the CMA's PSR, factored up to include $10.33M for a related aux lane project. Cost items from CMA PSR are distributed into the MTC cost categories

Table 59: Cost Estimate for Design Variation 2
Project 20: EB I-580 from Hacienda to Greenville

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	10.6			56%
New Lanes	Lane-Miles	8.4			44%
		19.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.6	$2,222,222	$3,602,133	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	15.2	$13,200	$200,640	0%
Variable costs for new HMA pavement	Sq. Ft.	517,440	$8.87	$4,590,024	5%
Variable costs for new PCC pavement	Sq. Ft.	1,103,520	$12.33	$13,610,080	16%
Overlay of existing lanes	Lane-Miles	32.8	$150,000	$4,920,000	6%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$8,076,863	9%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.2	$4,675,979	$5,611,175	7%
Sound walls	miles	0.6	$3,015,145	$1,809,087	2%
New median barrier	miles	5.0	$607,200	$3,036,000	4%
Environmental Mitigation	miles	8.4	$100,000	$840,000	1%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	13	$621,980	$8,085,740	9%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	4%
ITS equipment (monitoring)	Lane-Miles	19.0	$82,285	$1,563,415	2%
Striping of express lanes	Lane-Miles	19.0	$36,388	$691,372	1%
Signs for express lanes	Lane-Miles	19.0	$12,000	$228,000	0%
Replacement of cantilever signs	Site	13	$99,900	$1,298,700	2%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	32.8	$7,392	$242,458	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,219,477	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$6,760,903	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,380,451	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$31,100,152	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Airway Blvd.	Site	1		$3,850,000	4%
Portola Ave.	Site	1		$3,850,000	4%
1st Street	Site	1		$3,850,000	4%
N Vasco Rd.	Site	1		$7,700,000	9%
Contingency factor for structures	40%			$7,700,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.68	$2,250,000	$1,527,273	2%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$458,182	1%
Contingency factor for ROW		40%		$794,182	
Total Project Capital Outlay Costs				$138,580,167	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$48,503,058	
Total Project Cost				$187,083,225	
Cost per lane-mile of express lane				$9,846,486	

Table 60: Cost Differences

Difference	% of Difference
$5,774,909	4.9%
$339,182	0.3%
$7,759,436	6.6%
$23,007,840	19.7%
$8,317,260	7.1%
$12,466,032	10.7%
$9,485,692	8.1%
$3,058,262	2.6%
$3,956,035	3.4%
-$632,086	-0.5%
$4,702,396	4.0%
$0	0.0%
$13,668,943	11.7%
-$4,614,968	-3.9%
$2,642,953	2.3%
$798,062	0.7%
-$2,790,653	-2.4%
$2,195,452	1.9%
$0	0.0%
$409,875	0.4%
$0	0.0%
$5,390,000	4.6%
$5,390,000	4.6%
$5,390,000	4.6%
$10,780,000	9.2%
$2,779,636	2.4%
$116,918,457	102.9%
$41,505,940	
$158,424,397	553%
	increase

Table 61: Cost Estimate for Design Variation 1
Project 21a: I-580 WB from Greenville to San Ramon (single lane)

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	13.0			100%
New Lanes	Lane-Miles	0.0			0%
		13.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	72%
ITS equipment (monitoring)	Lane-Miles	13.0	$82,285	$1,069,705	18%
Striping of express lanes	Lane-Miles	13.0	$36,388	$473,044	8%
Signs for express lanes	Lane-Miles	13.0	$12,000	$156,000	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$298,417	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$626,677	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$313,338	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$2,882,713	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$10,089,494	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$3,531,323	
Total Project Cost				$13,620,817	
Cost per lane-mile of express lane				$1,047,755	

Table 62: Cost Estimate for Design Variation 2
Project 21a: I-580 WB from Greenville to San Ramon (single lane)

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	13.0			100%
New Lanes	Lane-Miles	0.0			0%
		13.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.9	$2,222,222	$4,224,000	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	23.0	$13,200	$303,600	0%
Variable costs for new HMA pavement	Sq. Ft.	1,089,792	$8.87	$9,667,153	6%
Variable costs for new PCC pavement	Sq. Ft.	811,008	$12.33	$10,002,432	7%
Overlay of existing lanes	Lane-Miles	52.0	$150,000	$7,800,000	5%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$9,599,155	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	4.8	$4,675,979	$22,444,701	15%
Sound walls	miles	1.0	$3,015,145	$3,015,145	2%
New median barrier	miles	8.6	$607,200	$5,221,920	3%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	2%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	31	$621,980	$19,281,380	13%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	3%
ITS equipment (monitoring)	Lane-Miles	13.0	$82,285	$1,069,705	1%
Striping of express lanes	Lane-Miles	13.0	$36,388	$473,044	0%
Signs for express lanes	Lane-Miles	13.0	$12,000	$156,000	0%
Replacement of cantilever signs	Site	21	$99,900	$2,097,900	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	0%
Re-striping of GP lanes	Lane-Miles	52.0	$7,392	$384,384	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$5,169,509	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$10,855,969	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$5,427,984	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$49,937,457	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
I-680 Sinclair Fwy	Site	1		$7,700,000	5%
S I-680 / E I-580 Connector	Site	1		$7,700,000	5%
Tassajara Rd.	Site	1		$7,700,000	5%
E Charro Rd.	Site	1		$7,700,000	5%
Airway Blvd.	Site	1		$3,850,000	3%
Portola Ave.	Site	1		$3,850,000	3%
1st Street	Site	1		$3,850,000	3%
Contingency factor for structures	40%			$16,940,000	
TOTAL ROW ITEMS					
Acquisition	Acres	1.36	$3,000,000	$4,072,727	3%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$1,221,818	1%
Contingency factor for ROW		40%		$2,117,818	
Total Project Capital Outlay Costs				$241,483,462	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$84,519,212	
Total Project Cost				$326,002,674	
Cost per lane-mile of express lane				$25,077,129	

Table 63: Cost Differences

Difference	% of Difference
$7,140,672	3.1%
$513,236	0.2%
$16,342,322	7.1%
$16,909,111	7.3%
$13,185,900	5.7%
$16,227,372	7.0%
$37,942,768	16.4%
$5,097,103	2.2%
$8,827,656	3.8%
$0	0.0%
$4,702,396	2.0%
$0	0.0%
$32,595,173	14.1%
$0	0.0%
$0	0.0%
$0	0.0%
$3,546,500	1.5%
$1,011,595	0.4%
$649,801	0.3%
$0	0.0%
$10,780,000	4.7%
$10,780,000	4.7%
$10,780,000	4.7%
$10,780,000	4.7%
$5,390,000	2.3%
$5,390,000	2.3%
$5,390,000	2.3%
$7,412,364	3.2%
$231,393,968	100.0%
$80,987,889	
$312,381,857	2293%
	increase

Table 64: Cost Estimate for Design Variation 1
Project 21b: I-580 WB from Greenville to San Ramon (dual lane)

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			
New Lanes	Lane-Miles	0.0			
		0.0			
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0		$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0		$0	
Variable costs for new HMA pavement	Sq. Ft.	0		$0	
Variable costs for new PCC pavement	Sq. Ft.	0		$0	
Overlay of existing lanes	Lane-Miles	0.0		$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0		$0	
Sound walls	miles	0.0		$0	
New median barrier	miles	0.0		$0	
Environmental Mitigation	miles	0.0		$0	
HOV Enforcement	Site	0		$0	
Access point (with transition lane)	Site	0		$0	
Ramp Modifications	Site	0		$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0		$0	
ITS equipment (monitoring)	Lane-Miles	0.0		$0	
Striping of express lanes	Lane-Miles	0.0		$0	
Signs for express lanes	Lane-Miles	0.0		$0	
Replacement of cantilever signs	Site	0		$0	
Replacement of full-span signs	Site	0		$0	
Re-striping of GP lanes	Lane-Miles	0.0		$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0		$0	
Replacement of overcrossings					
None for this corridor					
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00		$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane					

Note: DV1 assumes a single lane network. Therefore, costs for Project 21b, which represents the addition of a second lane, are set to zero for DV1.

Table 65: Cost Estimate for Design Variation 2
Project 21b: I-580 WB from Greenville to San Ramon (dual lane)

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	13.0			100%
		13.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.8	$2,222,222	$3,928,320	4%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	13.0	$13,200	$171,600	0%
Variable costs for new HMA pavement	Sq. Ft.	998,976	$8.87	$8,861,557	9%
Variable costs for new PCC pavement	Sq. Ft.	768,768	$12.33	$9,481,472	9%
Overlay of existing lanes	Lane-Miles	52.0	$150,000	$7,800,000	8%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$9,072,885	9%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	5.0	$4,675,979	$23,379,897	23%
Sound walls	miles	1.0	$3,015,145	$3,015,145	3%
New median barrier	miles	0.4	$607,200	$242,880	0%
Environmental Mitigation	miles	13.0	$100,000	$1,300,000	1%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	31	$621,980	$19,281,380	19%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	0	$1,067,400	$0	0%
ITS equipment (monitoring)	Lane-Miles	13.0	$82,285	$1,069,705	1%
Striping of express lanes	Lane-Miles	13.0	$36,388	$473,044	0%
Signs for express lanes	Lane-Miles	13.0	$12,000	$156,000	0%
Replacement of cantilever signs	Site	13	$99,900	$1,298,700	1%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	52.0	$7,392	$384,384	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,525,768	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$9,504,114	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$4,752,057	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$43,718,923	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	2.84	$2,874,359	$8,152,727	8%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$2,445,818	2%
Contingency factor for ROW		40%		$4,239,418	
Total Project Capital Outlay Costs				$167,854,194	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$58,748,968	
Total Project Cost				$226,603,162	
Cost per lane-mile of express lane				$17,431,012	

Table 66: Cost Differences

Difference	% of Difference
$6,640,825	4.0%
$290,090	0.2%
$14,980,461	8.9%
$16,028,428	9.5%
$13,185,900	7.9%
$15,337,711	9.1%
$39,523,716	23.5%
$5,097,103	3.0%
$410,589	0.2%
$2,197,650	1.3%
$0	0.0%
$0	0.0%
$32,595,173	19.4%
$0	0.0%
$1,808,336	1.1%
$799,681	0.5%
$263,718	0.2%
$2,195,452	1.3%
$1,011,595	0.6%
$649,801	0.4%
$0	0.0%
$0	0.0%
$14,837,964	8.8%
$167,854,194	100.0%
$58,748,968	
$226,603,162	

Table 67: Cost Estimate for Design Variation 1 Project 22a: I-880 NB from Lewelling to Dixon Landing						Table 68: Cost Estimate for Design Variation 2 Project 22a: I-880 NB from Lewelling to Dixon Landing						Table 69: Cost Differences	
Cost Components	**Unit**	**Number of Units**	**Unit Cost**	**Line Item Cost**	**% of Total**	**Cost Components**	**Unit**	**Number of Units**	**Unit Cost**	**Line Item Cost**	**% of Total**	**Difference**	**% of Difference**
Type of Project						**Type of Project**							
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%	Existing or CMA-funded express lanes	Lane-Miles	0.0			0%		
Conversion of existing or planned HOV lanes	Lane-Miles	20.2			100%	Conversion of existing or planned HOV lanes	Lane-Miles	20.2			100%		
New Lanes	Lane-Miles	0.0			0%	New Lanes	Lane-Miles	0.0			0%		
		20.2			100%			20.2			100%		
TOTAL ROADWAY ITEMS						**TOTAL ROADWAY ITEMS**							
SECTION 1: EARTHWORK						**SECTION 1: EARTHWORK**							
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%	Excavation, etc.	M Sq. Ft.	1.5	$2,222,222	$3,257,173	2%	$3,257,173	1.3%
SECTION 2: PAVEMENT STRUCTURAL SECTION						**SECTION 2: PAVEMENT STRUCTURAL SECTION**							
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%	Fixed costs for pavement modification	Miles	23.0	$13,200	$303,600	0%	$303,600	0.1%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%	Variable costs for new HMA pavement	Sq. Ft.	1,465,728	$8.87	$13,001,946	9%	$13,001,946	5.3%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%	Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%	$0	0.0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%	Overlay of existing lanes	Lane-Miles	68.0	$150,000	$10,200,000	7%	$10,200,000	4.1%
SECTION 3: DRAINAGE						**SECTION 3: DRAINAGE**							
As a percentage of Sections 1 & 2				$0	0%	As a percentage of Sections 1 & 2	30%			$8,028,816	5%	$8,028,816	3.3%
SECTION 4: SPECIALTY ITEMS						**SECTION 4: SPECIALTY ITEMS**							
Retaining walls	miles	0.0	$4,675,979	$0	0%	Retaining walls	miles	8.0	$4,675,979	$37,407,836	25%	$37,407,836	15.2%
Sound walls	miles	0.0	$3,015,145	$0	0%	Sound walls	miles	1.2	$3,015,145	$3,618,174	2%	$3,618,174	1.5%
New median barrier	miles	0.0	$607,200	$0	0%	New median barrier	miles	5.0	$607,200	$3,036,000	2%	$3,036,000	1.2%
Environmental Mitigation	miles	0.0	$100,000	$0	0%	Environmental Mitigation	miles	0.0	$100,000	$0	0%	$0	0.0%
HOV Enforcement	Site	0	$1,390,830	$0	0%	HOV Enforcement	Site	4	$1,390,830	$5,563,320	4%	$5,563,320	2.3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%	Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%	$1,419,856	0.6%
Ramp Modifications	Site	0	$621,980	$0	0%	Ramp Modifications	Site	51	$621,980	$31,720,980	21%	$31,720,980	12.8%
SECTION 5: TRAFFIC ITEMS						**SECTION 5: TRAFFIC ITEMS**							
ITS equipment (access points)	Access point	6	$1,067,400	$6,404,400	50%	ITS equipment (access points)	Access point	6	$1,067,400	$6,404,400	4%	$0	0.0%
ITS equipment (monitoring)	Lane-Miles	20.2	$82,285	$1,662,157	13%	ITS equipment (monitoring)	Lane-Miles	20.2	$82,285	$1,662,157	1%	$0	0.0%
Striping of express lanes	Lane-Miles	20.2	$36,388	$735,038	6%	Striping of express lanes	Lane-Miles	20.2	$36,388	$735,038	0%	$0	0.0%
Signs for express lanes	Lane-Miles	20.2	$12,000	$242,400	2%	Signs for express lanes	Lane-Miles	20.2	$12,000	$242,400	0%	$0	0.0%
Replacement of cantilever signs	Site	0	$99,900	$0	0%	Replacement of cantilever signs	Site	17	$99,900	$1,698,300	1%	$1,698,300	0.7%
Replacement of full-span signs	Site	0	$299,200	$0	0%	Replacement of full-span signs	Site	1	$299,200	$299,200	0%	$299,200	0.1%
Re-striping of GP lanes	Lane-Miles	0.4	$7,392	$2,957	0%	Re-striping of GP lanes	Lane-Miles	68.0	$7,392	$502,656	0%	$499,699	0.2%
SECTION 6: MINOR ITEMS						**SECTION 6: MINOR ITEMS**							
As a percentage of Sections 1 through 5	5%			$452,348		As a percentage of Sections 1 through 5	5%			$6,636,979		$6,184,631	2.5%
SECTION 7: MOBILIZATION						**SECTION 7: MOBILIZATION**							
As a percentage of Sections 1 through 6	10%			$949,930		As a percentage of Sections 1 through 6	10%			$13,937,656		$12,987,726	5.3%
SECTION 8: ROADWAY ADDITIONS						**SECTION 8: ROADWAY ADDITIONS**							
As a percentage of Sections 1 through 6	5%			$474,965		As a percentage of Sections 1 through 6	5%			$6,968,828		$6,493,863	2.6%
SECTION 9: CONTINGENCIES						**SECTION 9: CONTINGENCIES**							
As a percentage of Sections 1 through 8	40%			$4,369,678		As a percentage of Sections 1 through 8	40%			$64,113,217		$59,743,540	24.2%
TOTAL STRUCTURES ITEMS						**TOTAL STRUCTURES ITEMS**							
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%	Widening of undercrossings	Sq.Ft.	0	$420	$0	0%	$0	0.0%
Replacement of overcrossings						Replacement of overcrossings							
						Paseo Grande Rd	Site	1		$2,000,000	1%	$2,000,000	0.8%
Winton Ave	Site	1	$1,580,000	$1,580,000	12%	Winton Ave	Site	1		$3,950,000	3%	$2,370,000	1.0%
						SR-92	Site	1		$5,450,000	4%	$5,450,000	2.2%
Eldridge Ave POC	Site	1	$160,000	$160,000	1%	Eldridge Ave POC	Site	1		$400,000	0%	$240,000	0.1%
						Tennyson Rd	Site	1		$2,950,000	2%	$2,950,000	1.2%
Industrial Pkwy	Site	1	$2,080,000	$2,080,000	16%	Industrial Pkwy	Site	1		$5,200,000	3%	$3,120,000	1.3%
Contingency factor for structures				$1,528,000		Contingency factor for structures				$23,660,000		$22,132,000	9.0%
TOTAL ROW ITEMS						**TOTAL ROW ITEMS**							
Acquisition	Acres	0.00	$0	$0	0%	Acquisition	Acres	0.58	$3,000,000	$1,745,455	1%	$1,745,455	0.7%
Title & Escrow fees (as a percentage of acquisition costs)				$0	0%	Title & Escrow fees (as a percentage of acquisition costs)				$523,636	0%	$523,636	0.2%
Contingency factor for ROW				$0		Contingency factor for ROW				$907,636		$907,636	0.4%
Total Project Capital Outlay Costs				$20,641,871	100%	Total Project Capital Outlay Costs				$267,545,259	100%	$246,903,388	100.0%
Support Costs (computed as a percentage of Capital Outlay Costs)				$7,224,655		Support Costs (computed as a percentage of Capital Outlay Costs)				$93,640,841		$86,416,186	
Total Project Cost				$27,866,526		Total Project Cost				$361,186,100		$333,319,573	1196%
Cost per lane-mile of express lane				$1,379,531		Cost per lane-mile of express lane				$17,880,500			increase

Table 70: Cost Estimate for Design Variation 1
Project 22b: I-880 NB Hegenberger Road to Lewelling Rd

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project				Totals in this column include $131.4M cost of HOV widening from LATIP PID	
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	5.2			100%
		5.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$3,853,200	6%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$9,464,000	14%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2				$4,056,000	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$3,650,400	5%
Sound walls	miles	0.0	$3,015,145	$1,554,800	2%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$13,984,750	20%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	3%
ITS equipment (monitoring)	Lane-Miles	5.2	$82,285	$427,882	1%
Striping of express lanes	Lane-Miles	5.2	$36,388	$189,218	0%
Signs for express lanes	Lane-Miles	5.2	$12,000	$62,400	0%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5				$4,196,715	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6				$295,501	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6				$147,751	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8				$24,765,807	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Elevated Structure	Site	1	$17,390,100	$17,390,100	25%
Contingency factor for structures					
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$12,252,500	18%
Title & Escrow fees (as a percentage of acquisition costs)				$0	0%
Contingency factor for ROW				$0	
Total Project Capital Outlay Costs				$98,425,823	100%
Support Costs (computed as a percentage of Capital Outlay Costs)				$39,436,651	
Total Project Cost				$137,862,474	
Cost per lane-mile of express lane				$26,512,014	

Table 71: Cost Estimate for Design Variation 2
Project 22b: I-880 NB Hegenberger Road to Lewelling Rd

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project				Totals in this column include $131.4M cost of HOV widening from LATIP PID	
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	5.2			100%
		5.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$3,853,200	5%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$9,464,000	13%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
				$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$4,056,000	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$3,650,400	5%
Sound walls	miles	0.0	$3,015,145	$1,554,800	2%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$13,984,750	20%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	2%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	3%
ITS equipment (monitoring)	Lane-Miles	5.2	$82,285	$427,882	1%
Striping of express lanes	Lane-Miles	5.2	$36,388	$189,218	0%
Signs for express lanes	Lane-Miles	5.2	$12,000	$62,400	0%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$4,266,256	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$441,539	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$220,769	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$25,437,578	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Elevated Structure	Site	1	$17,390,100	$17,390,100	25%
Contingency factor for structures					
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$12,252,500	17%
Title & Escrow fees (as a percentage of acquisition costs)				$0	0%
Contingency factor for ROW				$0	
Total Project Capital Outlay Costs				$100,777,022	100%
Support Costs (computed as a percentage of Capital Outlay Costs)				$48,540,570	
Total Project Cost				$149,317,592	
Cost per lane-mile of express lane				$28,714,921	

Table 72: Cost Differences

Difference	% of Difference
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$1,390,830	59.2%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$69,542	3.0%
$146,037	6.2%
$73,019	3.1%
$671,771	28.6%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,351,198	100.0%
$9,103,919	
$11,455,117	8%
	increase

Table 73: Cost Estimate for Design Variation 1
Project 23a: I-880 SB from Hegenberger Road to SR-237

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	25.4			100%
New Lanes	Lane-Miles	0.0			0%
		25.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	7	$1,067,400	$7,471,800	69%
ITS equipment (monitoring)	Lane-Miles	25.4	$82,285	$2,090,039	19%
Striping of express lanes	Lane-Miles	25.4	$36,388	$924,255	9%
Signs for express lanes	Lane-Miles	25.4	$12,000	$304,800	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$539,545	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$1,133,044	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$566,522	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$5,212,002	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$18,242,007	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$6,384,702	
Total Project Cost				$24,626,709	
Cost per lane-mile of express lane				$969,555	

Table 74: Cost Estimate for Design Variation 2
Project 23a: I-880 SB from Hegenberger Road to SR-237

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	25.4			100%
New Lanes	Lane-Miles	0.0			0%
		25.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.3	$2,222,222	$2,942,720	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	21.8	$13,200	$287,760	0%
Variable costs for new HMA pavement	Sq. Ft.	1,324,224	$8.87	$11,746,715	8%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	64.4	$150,000	$9,660,000	6%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$7,391,158	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	5.6	$4,675,979	$26,185,485	17%
Sound walls	miles	1.2	$3,015,145	$3,618,174	2%
New median barrier	miles	5.0	$607,200	$3,036,000	2%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	5	$1,390,830	$6,954,150	4%
Access point (with transition lane)	Site	1	$1,419,856	$1,419,856	1%
Ramp Modifications	Site	51	$621,980	$31,720,980	20%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	7	$1,067,400	$7,471,800	5%
ITS equipment (monitoring)	Lane-Miles	25.4	$82,285	$2,090,039	1%
Striping of express lanes	Lane-Miles	25.4	$36,388	$924,255	1%
Signs for express lanes	Lane-Miles	25.4	$12,000	$304,800	0%
Replacement of cantilever signs	Site	17	$99,900	$1,698,300	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	0%
Re-striping of GP lanes	Lane-Miles	64.4	$7,392	$476,045	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$5,911,372	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$12,413,881	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$6,206,940	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$57,103,852	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Paseo Grande	Site	1		$2,000,000	1%
W Winton Ave.	Site	1		$3,950,000	3%
SR 92	Site	1		$5,450,000	4%
Pedestrian Bridge	Site	1		$400,000	0%
W Tennyson Rd.	Site	1		$2,950,000	2%
Industrial Pkwy W OC	Site	1		$5,200,000	3%
Great Mall Pkwy	Site	1		$7,700,000	5%
Montague Expwy	Site	1		$7,700,000	5%
Contingency factor for structures	40%			$14,140,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.53	$3,000,000	$1,600,000	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$480,000	0%
Contingency factor for ROW		40%		$832,000	
Total Project Capital Outlay Costs				$252,265,482	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$88,292,919	
Total Project Cost				$340,558,401	
Cost per lane-mile of express lane				$13,407,811	

Table 75: Cost Differences

Difference	% of Difference
$4,974,668	2.1%
$486,458	0.2%
$19,857,821	8.5%
$0	0.0%
$16,330,230	7.0%
$12,494,753	5.3%
$44,266,562	18.9%
$6,116,524	2.6%
$5,132,358	2.2%
$0	0.0%
$11,755,991	5.0%
$2,400,267	1.0%
$53,624,317	22.9%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,870,976	1.2%
$505,798	0.2%
$804,754	0.3%
$0	0.0%
$2,800,000	1.2%
$5,530,000	2.4%
$7,630,000	3.3%
$560,000	0.2%
$4,130,000	1.8%
$7,280,000	3.1%
$10,780,000	4.6%
$10,780,000	4.6%
$2,912,000	1.2%
$234,023,476	100.0%
$81,908,217	
$315,931,692	1283%
	increase

Table 76: Cost Estimate for Design Variation 1
Project 23b: I-880 from SR-237 to US 101

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	10.8			100%
New Lanes	Lane-Miles	0.0			0%
		10.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	69%
ITS equipment (monitoring)	Lane-Miles	10.8	$82,285	$888,678	19%
Striping of express lanes	Lane-Miles	10.8	$36,388	$392,990	9%
Signs for express lanes	Lane-Miles	10.8	$12,000	$129,600	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$230,673	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$484,414	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$242,207	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$2,228,305	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$7,799,068	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$2,729,674	
Total Project Cost				$10,528,742	
Cost per lane-mile of express lane				$974,884	

Table 77: Cost Estimate for Design Variation 2
Project 23b: I-880 from SR-237 to US 101

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	6.4			59%
New Lanes	Lane-Miles	4.4			41%
		10.8			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.6	$2,222,222	$3,524,693	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	16.0	$13,200	$211,200	0%
Variable costs for new HMA pavement	Sq. Ft.	1,586,112	$8.87	$14,069,829	13%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	46.4	$150,000	$6,960,000	6%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$7,429,717	7%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.4	$4,675,979	$6,546,371	6%
Sound walls	miles	0.2	$3,015,145	$603,029	1%
New median barrier	miles	2.2	$607,200	$1,335,840	1%
Environmental Mitigation	miles	4.4	$100,000	$440,000	0%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	25	$621,980	$15,549,500	14%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	3	$1,067,400	$3,202,200	3%
ITS equipment (monitoring)	Lane-Miles	10.8	$82,285	$888,678	1%
Striping of express lanes	Lane-Miles	10.8	$36,388	$392,990	0%
Signs for express lanes	Lane-Miles	10.8	$12,000	$129,600	0%
Replacement of cantilever signs	Site	15	$99,900	$1,498,500	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	0%
Re-striping of GP lanes	Lane-Miles	46.4	$7,392	$342,989	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$3,310,300	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$6,951,630	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,475,815	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$31,977,496	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Paseo Grande	Site	1		$2,000,000	2%
W Winton Ave.	Site	1		$3,950,000	4%
SR 92	Site	1		$5,450,000	5%
Pedestrian Bridge	Site	1		$400,000	0%
W Tennyson Rd.	Site	1		$2,950,000	3%
Industrial Pkwy W OC	Site	1		$5,200,000	5%
Great Mall Pkwy	Site	1		$7,700,000	7%
Montague Expwy	Site	1		$7,700,000	7%
Contingency factor for structures	40%			$14,140,000	
TOTAL ROW ITEMS					
Acquisition	Acres	2.35	$3,000,000	$7,054,545	6%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$2,116,364	2%
Contingency factor for ROW		40%		$3,668,364	
Total Project Capital Outlay Costs				$174,250,509	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$60,987,678	
Total Project Cost				$235,238,188	
Cost per lane-mile of express lane				$21,781,314	

Table 78: Cost Differences

Difference	% of Difference
$5,958,494	3.6%
$357,034	0.2%
$23,785,046	14.3%
$0	0.0%
$11,765,880	7.1%
$12,559,936	7.5%
$11,066,641	6.6%
$1,019,421	0.6%
$2,258,238	1.4%
$743,820	0.4%
$4,702,396	2.8%
$0	0.0%
$26,286,430	15.8%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$2,533,214	1.5%
$505,798	0.3%
$579,823	0.3%
$0	0.0%
$2,800,000	1.7%
$5,530,000	3.3%
$7,630,000	4.6%
$560,000	0.3%
$4,130,000	2.5%
$7,280,000	4.4%
$10,780,000	6.5%
$10,780,000	6.5%
$12,839,273	7.7%
$166,451,441	100.0%
$58,258,004	
$224,709,445	2134%
	increase

Table 79: Cost Estimate for Design Variation 1
Project 24: I-880 from US-101 to SR-85

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	17.2			100%
		17.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.5	$2,222,222	$5,458,347	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	25.6	$13,200	$337,920	0%
Variable costs for new HMA pavement	Sq. Ft.	2,456,256	$8.87	$21,788,563	10%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	47.4	$150,000	$7,110,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$10,408,449	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	10.6	$4,675,979	$49,565,382	23%
Sound walls	miles	5.8	$3,015,145	$17,487,842	8%
New median barrier	miles	2.4	$607,200	$1,457,280	1%
Environmental Mitigation	miles	17.2	$100,000	$1,720,000	1%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	2%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	46	$621,980	$28,611,080	13%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	2%
ITS equipment (monitoring)	Lane-Miles	17.2	$82,285	$1,415,302	1%
Striping of express lanes	Lane-Miles	17.2	$36,388	$625,874	0%
Signs for express lanes	Lane-Miles	17.2	$12,000	$206,400	0%
Replacement of cantilever signs	Site	21	$99,900	$2,097,900	1%
Replacement of full-span signs	Site	5	$299,200	$1,496,000	1%
Re-striping of GP lanes	Lane-Miles	47.4	$7,392	$350,381	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$7,982,310	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$16,762,852	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$8,381,426	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$77,109,119	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Coleman Avenue	Site			$13,200,000	6%
Park Avenue	Site			$2,800,000	1%
Pedestrian Bridge between Moorpark & Hamilton	Site			$1,000,000	0%
Pedestrian Bridge just north of SR-85	Site			$2,400,000	1%
Contingency factor for structures	40%			$7,760,000	
TOTAL ROW ITEMS					
Acquisition	Acres	10.01	$3,000,000	$30,036,364	13%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$9,010,909	4%
Contingency factor for ROW		40%		$15,618,909	
Total Project Capital Outlay Costs				$351,708,099	99%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$123,097,835	
Total Project Cost				$474,805,934	
Cost per lane-mile of express lane				$27,604,996	

Table 80: Cost Estimate for Design Variation 2
Project 24: I-880 from US-101 to SR-85

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	17.2			100%
		17.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	2.6	$2,222,222	$5,688,320	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	22.6	$13,200	$298,320	0%
Variable costs for new HMA pavement	Sq. Ft.	2,559,744	$8.87	$22,706,568	8%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	47.4	$150,000	$7,110,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$10,740,962	4%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	11.4	$4,675,979	$53,306,166	19%
Sound walls	miles	6.8	$3,015,145	$20,502,987	7%
New median barrier	miles	7.6	$607,200	$4,614,720	2%
Environmental Mitigation	miles	17.2	$100,000	$1,720,000	1%
HOV Enforcement	Site	3	$1,390,830	$4,172,490	1%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	49	$621,980	$30,477,020	11%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	5	$1,067,400	$5,337,000	2%
ITS equipment (monitoring)	Lane-Miles	17.2	$82,285	$1,415,302	1%
Striping of express lanes	Lane-Miles	17.2	$36,388	$625,874	0%
Signs for express lanes	Lane-Miles	17.2	$12,000	$206,400	0%
Replacement of cantilever signs	Site	19	$99,900	$1,898,100	1%
Replacement of full-span signs	Site	7	$299,200	$2,094,400	1%
Re-striping of GP lanes	Lane-Miles	47.4	$7,392	$350,381	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$8,663,250	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$18,192,826	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$9,096,413	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$83,687,000	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Coleman Avenue	Site	1		$13,200,000	5%
SR-82	Site	1		$7,400,000	3%
Park Avenue	Site	1		$2,800,000	1%
Stevens Creek Blvd	Site	1		$11,700,000	4%
Ped Bridge between Moorpark & Hamilton	Site	1		$1,000,000	0%
S I-280 / N I-880 Connector	Site	1		$20,700,000	7%
Hamilton Ave	Site	1		$8,500,000	3%
Campbell Railroad	Site	1		$1,000,000	0%
Mozart Ped bridge	Site	1		$2,400,000	1%
Contingency factor for structures	40%			$27,480,000	
TOTAL ROW ITEMS					
Acquisition	Acres	10.01	$3,000,000	$30,036,364	10%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$9,010,909	3%
Contingency factor for ROW		40%		$15,618,909	
Total Project Capital Outlay Costs				$443,750,681	99%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$155,312,738	
Total Project Cost				$599,063,419	
Cost per lane-mile of express lane				$34,829,269	

Table 81: Cost Differences

Difference	% of Difference
$388,770	0.4%
-$66,944	-0.1%
$1,551,887	1.7%
$0	0.0%
$0	0.0%
$562,114	0.6%
$6,323,795	6.9%
$5,097,103	5.5%
$5,337,652	5.8%
$0	0.0%
$0	0.0%
$0	0.0%
$3,154,372	3.4%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
-$337,762	-0.4%
$1,011,595	1.1%
$0	0.0%
$0	0.0%
$10,360,000	11.3%
$0	0.0%
$16,380,000	17.8%
$0	0.0%
$28,980,000	31.5%
$11,900,000	12.9%
$1,400,000	1.5%
$0	0.0%
$0	0.0%
$92,042,582	100.0%
$32,214,904	
$124,257,486	26%
	increase

Table 82: Cost Estimate for Design Variation 1
Project 25: I-880 / SR-237 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	8.5			100%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	0.0			0%
		8.5			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$0.00	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$0.00	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	
Sound walls	miles	0.0	$3,015,145	$0	
New median barrier	miles	0.0	$607,200	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	
Ramp Modifications	Site	0.0	$3,000,000	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	EA	0.0	$2,600,000	$0	
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	
Striping of express lanes	Lane-Miles	0.0	$36,388	$0	
Signs for express lanes	Lane-Miles	0.0	$12,000	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	0%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	0%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Viaducts	Sq.Ft.	0	$240	$0	
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		0%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

Cost is zero since project is already under construction

Table 83: Cost Estimate for Design Variation 2
Project 25: I-880 / SR-237 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	8.5			100%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	0.0			0%
		8.5			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	
Variable costs for new HMA pavement	Sq. Ft.	0	$0.00	$0	
Variable costs for new PCC pavement	Sq. Ft.	0	$0.00	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	
Sound walls	miles	0.0	$3,015,145	$0	
New median barrier	miles	0.0	$607,200	$0	
Environmental Mitigation	miles	0.0	$100,000	$0	
HOV Enforcement	Site	0.0	$1,390,830	$0	
Access point (with transition lane)	Site	0.0	$1,419,856	$0	
Ramp Modifications	Site	0.0	$3,000,000	$0	
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	EA	0.0	$2,600,000	$0	
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	
Striping of express lanes	Lane-Miles	0.0	$36,388	$0	
Signs for express lanes	Lane-Miles	0.0	$12,000	$0	
Replacement of cantilever signs	Site	0.0	$99,900	$0	
Replacement of full-span signs	Site	0.0	$299,200	$0	
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	0%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	0%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	
Replacement of overcrossings					
None for this corridor					
Viaducts	Sq.Ft.	0	$240	$0	
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$0	0%
Support Costs (computed as a percentage of Capital Outlay Costs)		0%		$0	
Total Project Cost				$0	
Cost per lane-mile of express lane				$0	

Cost is zero since project is already under construction

Table 84: Cost Differences

Difference	% of Difference
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	
$0	0.0%
$0	
$0	0%
	increase

Table 85: Cost Estimate for Design Variation 1
Project 26: SR-237 from I-880 Connector to Mathilda

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	5.2			100%
New Lanes	Lane-Miles	0.0			0%
		5.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	47%
ITS equipment (monitoring)	Lane-Miles	5.2	$82,285	$427,882	9%
Striping of express lanes	Lane-Miles	5.2	$36,388	$189,218	4%
Signs for express lanes	Lane-Miles	5.2	$12,000	$62,400	1%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	6.0	$7,392	$44,352	1%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$142,933	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$300,158	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$150,079	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$1,380,729	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Ped bridge between Mathilda & Fair Oaks		1	$1,700,000	$1,700,000	37%
Contingency factor for structures	40%			$680,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$7,212,551	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$2,524,393	
Total Project Cost				$9,736,943	
Cost per lane-mile of express lane				$1,872,489	

Table 86: Cost Estimate for Design Variation 2
Project 26: SR-237 from I-880 Connector to Mathilda

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	5.2			100%
New Lanes	Lane-Miles	0.0			0%
		5.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.8	$2,222,222	$1,694,293	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	8.2	$13,200	$108,240	0%
Variable costs for new HMA pavement	Sq. Ft.	762,432	$8.87	$6,763,260	12%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	12.8	$150,000	$1,920,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$3,145,738	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.6	$4,675,979	$7,481,567	13%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	1.8	$607,200	$1,092,960	2%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	2%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	8	$621,980	$4,975,840	9%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	4%
ITS equipment (monitoring)	Lane-Miles	5.2	$82,285	$427,882	1%
Striping of express lanes	Lane-Miles	5.2	$36,388	$189,218	0%
Signs for express lanes	Lane-Miles	5.2	$12,000	$62,400	0%
Replacement of cantilever signs	Site	4	$99,900	$399,600	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	1%
Re-striping of GP lanes	Lane-Miles	12.8	$7,392	$94,618	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$1,609,022	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$3,378,947	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$1,689,473	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$15,543,155	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	32,030	$420	$13,452,402	23%
Replacement of overcrossings					
Ped bridge between Mathilda & Fair Oaks	Site	1		$1,700,000	3%
Ped bridge between Mathilda & Fair Oaks	Site	1		$5,100,000	9%
Ped bridge between Mathilda & Fair Oaks	Site	1		$4,800,000	8%
Contingency factor for structures	40%			$10,020,961	
TOTAL ROW ITEMS					
Acquisition	Acres	0.10	$3,000,000	$290,909	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$87,273	0%
Contingency factor for ROW		40%		$151,273	
Total Project Capital Outlay Costs				$90,003,860	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$31,501,351	
Total Project Cost				$121,505,211	
Cost per lane-mile of express lane				$23,366,387	

Table 87: Cost Differences

Difference	% of Difference
$2,864,203	3.5%
$182,980	0.2%
$11,433,291	13.8%
$0	0.0%
$3,245,760	3.9%
$5,317,870	6.4%
$12,647,589	15.3%
$0	0.0%
$1,847,649	2.2%
$0	0.0%
$2,351,198	2.8%
$0	0.0%
$8,411,658	10.2%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$675,524	0.8%
$505,798	0.6%
$84,974	0.1%
$18,833,362	22.7%
$0	0.0%
$7,140,000	8.6%
$6,720,000	8.1%
$529,455	0.6%
$82,791,309	100.0%
$28,976,958	
$111,768,268	1148%
	increase

Table 88: Cost Estimate for Design Variation 1
Project 27: SR-237 from Mathilda to SR-85

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	6.0			100%
		6.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.8	$2,222,222	$1,783,467	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	7.0	$13,200	$92,400	0%
Variable costs for new HMA pavement	Sq. Ft.	802,560	$8.87	$7,119,221	13%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	4.4	$150,000	$660,000	1%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$2,896,526	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	1.0	$4,675,979	$4,675,979	9%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	2.6	$607,200	$1,578,720	3%
Environmental Mitigation	miles	6.0	$100,000	$600,000	1%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	7	$621,980	$4,353,860	8%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	4%
ITS equipment (monitoring)	Lane-Miles	6.0	$82,285	$493,710	1%
Striping of express lanes	Lane-Miles	6.0	$36,388	$218,328	0%
Signs for express lanes	Lane-Miles	6.0	$12,000	$72,000	0%
Replacement of cantilever signs	Site	2	$99,900	$199,800	0%
Replacement of full-span signs	Site	1	$299,200	$299,200	1%
Re-striping of GP lanes	Lane-Miles	4.4	$7,392	$32,525	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$1,430,068	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$3,003,143	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$1,501,572	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$13,814,460	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	48,153	$420	$20,224,144	37%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$8,089,657	
TOTAL ROW ITEMS					
Acquisition	Acres	1.41	$3,000,000	$4,218,182	8%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$1,265,455	2%
Contingency factor for ROW		40%		$2,193,455	
Total Project Capital Outlay Costs				$84,341,502	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$29,519,526	
Total Project Cost				$113,861,027	
Cost per lane-mile of express lane				$18,976,838	

Table 89: Cost Estimate for Design Variation 2
Project 27: SR-237 from Mathilda to SR-85

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	0.0			0%
New Lanes	Lane-Miles	6.0			100%
		6.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.0	$2,222,222	$2,304,427	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	10.0	$13,200	$132,000	0%
Variable costs for new HMA pavement	Sq. Ft.	1,036,992	$8.87	$9,198,783	9%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	10.4	$150,000	$1,560,000	2%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$3,958,563	4%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	4.2	$4,675,979	$19,639,114	19%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	3.0	$607,200	$1,821,600	2%
Environmental Mitigation	miles	6.0	$100,000	$600,000	1%
HOV Enforcement	Site	1	$1,390,830	$1,390,830	1%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	14	$621,980	$8,707,720	8%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	2	$1,067,400	$2,134,800	2%
ITS equipment (monitoring)	Lane-Miles	6.0	$82,285	$493,710	0%
Striping of express lanes	Lane-Miles	6.0	$36,388	$218,328	0%
Signs for express lanes	Lane-Miles	6.0	$12,000	$72,000	0%
Replacement of cantilever signs	Site	5	$99,900	$499,500	0%
Replacement of full-span signs	Site	2	$299,200	$598,400	1%
Re-striping of GP lanes	Lane-Miles	10.4	$7,392	$76,877	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$2,670,333	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$5,607,698	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$2,803,849	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$25,795,412	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	55,837	$420	$23,451,516	23%
Replacement of overcrossings					
Dana St				$6,300,000	6%
SR-85				$13,200,000	13%
Contingency factor for structures	40%			$17,180,606	
TOTAL ROW ITEMS					
Acquisition	Acres	1.67	$3,000,000	$5,018,182	5%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$1,505,455	1%
Contingency factor for ROW		40%		$2,609,455	
Total Project Capital Outlay Costs				$159,549,156	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$55,842,205	
Total Project Cost				$215,391,361	
Cost per lane-mile of express lane				$35,898,560	

Table 90: Cost Differences

Difference	% of Difference
$880,683	1.2%
$66,944	0.1%
$3,515,499	4.7%
$0	0.0%
$1,521,450	2.0%
$1,795,373	2.4%
$25,295,178	33.6%
$0	0.0%
$410,589	0.5%
$0	0.0%
$0	0.0%
$0	0.0%
$7,360,200	9.8%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$506,643	0.7%
$505,798	0.7%
$74,977	0.1%
$4,518,321	6.0%
$8,820,000	11.7%
$18,480,000	24.6%
$1,456,000	1.9%
$75,207,655	100.0%
$26,322,679	
$101,530,334	89%
	increase

Table 91: Cost Estimate for Design Variation 1
Project 28: SR-85 from US-101 (Mountain View) to US-101 (San Jose)

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	47.2			100%
New Lanes	Lane-Miles	0.0			0%
		47.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.			$1,959,087	7%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles			$0	0%
Variable costs for new HMA pavement	Sq. Ft.			$4,632,482	17%
Variable costs for new PCC pavement	Sq. Ft.			$0	0%
Overlay of existing lanes	Lane-Miles			$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$814,119	3%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles			$0	0%
Sound walls	miles			$0	0%
New median barrier	miles			$0	0%
Environmental Mitigation	miles			$1,986,958	7%
HOV Enforcement	Site			$0	0%
Access point (with transition lane)	Site			$0	0%
Ramp Modifications	Site			$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point			$4,274,123	16%
ITS equipment (monitoring)	Lane-Miles			$1,445,061	5%
Striping of express lanes	Lane-Miles			$1,017,648	4%
Signs for express lanes	Lane-Miles			$11,143,249	41%
Replacement of cantilever signs	Site			$0	0%
Replacement of full-span signs	Site			$0	0%
Re-striping of GP lanes	Lane-Miles			$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$2,727,273	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$3,000,000	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$3,000,000	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$9,000,000	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.			$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres			$0	0%
Title & Escrow fees (as a percentage of acquisition costs)				$0	0%
Contingency factor for ROW				$0	
Total Project Capital Outlay Costs				$45,000,000	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$15,750,000	
Total Project Cost				$60,750,000	
Cost per lane-mile of express lane				$1,287,076	

These figures are from the CMA's PSR, Alternative 2 .

Table 92: Cost Estimate for Design Variation 2
Project 28: SR-85 from US-101 (Mountain View) to US-101 (San Jose)

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	47.2			64%
New Lanes	Lane-Miles	26.4			36%
		73.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	6.4	$2,222,222	$14,284,160	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	67.6	$13,200	$892,320	0%
Variable costs for new HMA pavement	Sq. Ft.	811,008	$8.87	$7,194,160	1%
Variable costs for new PCC pavement	Sq. Ft.	5,616,864	$12.33	$69,274,656	12%
Overlay of existing lanes	Lane-Miles	120.4	$150,000	$18,060,000	3%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$32,911,589	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	10.6	$4,675,979	$49,565,382	9%
Sound walls	miles	9.8	$3,015,145	$29,548,423	5%
New median barrier	miles	23.4	$607,200	$14,208,480	2%
Environmental Mitigation	miles	26.4	$100,000	$2,640,000	0%
HOV Enforcement	Site	9	$1,390,830	$12,517,470	2%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	99	$621,980	$61,576,020	11%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	12	$1,067,400	$12,808,800	2%
ITS equipment (monitoring)	Lane-Miles	73.6	$82,285	$6,056,176	1%
Striping of express lanes	Lane-Miles	73.6	$36,388	$2,678,157	0%
Signs for express lanes	Lane-Miles	73.6	$12,000	$883,200	0%
Replacement of cantilever signs	Site	51	$99,900	$5,094,900	1%
Replacement of full-span signs	Site	14	$299,200	$4,188,800	1%
Re-striping of GP lanes	Lane-Miles	120.4	$7,392	$889,997	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$17,263,634	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$36,253,632	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$18,126,816	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$166,766,709	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	177,553	$420	$74,572,323	13%
Replacement of overcrossings					
Middlefield Rd	Site	1		$4,100,000	1%
Dana St	Site	1		$96,400,000	17%
Lean Ave. OC	Site	1		$7,700,000	1%
Winchester Blvd. UP	Site	1		$7,700,000	1%
Winchester Blvd. OC	Site	1		$7,700,000	1%
Homestead Rd OC	Site	1		$7,700,000	1%
Pedestrian OC	Site	1		$7,700,000	1%
Contingency factor for structures	40%			$85,428,929	
TOTAL ROW ITEMS					
Acquisition	Acres	2.88	$2,735,294	$7,890,909	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$2,367,273	0%
Contingency factor for ROW		40%		$4,103,273	
Total Project Capital Outlay Costs				$897,046,189	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$313,966,166	
Total Project Cost				$1,211,012,355	
Cost per lane-mile of express lane				$16,453,972	

Table 93: Cost Differences

Difference	% of Difference
$20,835,536	2.4%
$1,508,467	0.2%
$4,330,517	0.5%
$117,108,806	13.7%
$30,530,430	3.6%
$54,260,773	6.4%
$83,790,279	9.8%
$49,951,609	5.9%
$24,019,435	2.8%
$1,103,967	0.1%
$21,160,783	2.5%
$0	0.0%
$104,094,262	12.2%
$14,427,871	1.7%
$7,795,091	0.9%
$2,807,090	0.3%
-$17,344,613	-2.0%
$8,612,928	1.0%
$7,081,166	0.8%
$1,504,540	0.2%
$104,401,252	12.3%
$5,740,000	0.7%
$134,960,000	15.8%
$10,780,000	1.3%
$10,780,000	1.3%
$10,780,000	1.3%
$10,780,000	1.3%
$10,780,000	1.3%
$14,361,455	1.7%
$852,046,189	99.9%
$298,216,166	
$1,150,262,355	1893%
	increase

Table 94: Cost Estimate for Design Variation 1
Project 29: US-101 / SR-85 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	4.0			100%
New Lanes	Lane-Miles	0.0			0%
		4.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0.0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0.0	$1,419,856	$0	0%
Ramp Modifications	Site	1.0	$668,168	$668,168	78%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	1.0	$0	$0	0%
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	0%
Striping of express lanes	Lane-Miles	4.0	$36,388	$145,552	17%
Signs for express lanes	Lane-Miles	4.0	$12,000	$48,000	6%
Replacement of cantilever signs	Site	0.0	$99,900	$0	0%
Replacement of full-span signs	Site	0.0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	0%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	0%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Viaducts	Sq.Ft.	0	$240	$0	0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$861,720	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$301,602	
Total Project Cost				$1,163,321	
Cost per lane-mile of express lane				$290,830	

Costs based on VTA estimates for US-101/SR-85 Connectors

Table 95: Cost Estimate for Design Variation 2
Project 29: US-101 / SR-85 Direct Express Lane Connectors

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	4.0			100%
New Lanes	Lane-Miles	0.0			0%
		4.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0.0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0.0	$1,419,856	$0	0%
Ramp Modifications	Site	1.0	$668,168	$668,168	78%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	1.0	$0	$0	0%
ITS equipment (monitoring)	Lane-Miles	0.0	$82,285	$0	0%
Striping of express lanes	Lane-Miles	4.0	$36,388	$145,552	17%
Signs for express lanes	Lane-Miles	4.0	$12,000	$48,000	6%
Replacement of cantilever signs	Site	0.0	$99,900	$0	0%
Replacement of full-span signs	Site	0.0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	0%			$0	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	0%			$0	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	0%			$0	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Viaducts	Sq.Ft.	0	$240	$0	0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$861,720	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$301,602	
Total Project Cost				$1,163,321	
Cost per lane-mile of express lane				$290,830	

Costs based on VTA estimates for US-101/SR-85 Connectors

Table 96: Cost Differences

Cost Components	Difference	% of Difference
Excavation, etc.	$0	
Fixed costs for pavement modification	$0	
Variable costs for new HMA pavement	$0	
Variable costs for new PCC pavement	$0	
Overlay of existing lanes	$0	
As a percentage of Sections 1 & 2	$0	
Retaining walls	$0	
Sound walls	$0	
New median barrier	$0	
Environmental Mitigation	$0	
HOV Enforcement	$0	
Access point (with transition lane)	$0	
Ramp Modifications	$0	
ITS equipment (access points)	$0	
ITS equipment (monitoring)	$0	
Striping of express lanes	$0	
Signs for express lanes	$0	
Replacement of cantilever signs	$0	
Replacement of full-span signs	$0	
Re-striping of GP lanes	$0	
Widening of undercrossings	$0	
None for this corridor	$0	
Viaducts	$0	
Acquisition	$0	
Total Project Capital Outlay Costs	$0	0.0%
Support Costs	$0	
Total Project Cost	$0	0%
Cost per lane-mile of express lane		increase

Table 97: Cost Estimate for Design Variation 1
Project 30: US-101 Cochrane to San Mateo County Line

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	67.6			100%
New Lanes	Lane-Miles	0.0			0%
		67.6			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	17	$1,067,400	$18,145,800	65%
ITS equipment (monitoring)	Lane-Miles	67.6	$82,285	$5,562,466	20%
Striping of express lanes	Lane-Miles	67.6	$36,388	$2,459,829	9%
Signs for express lanes	Lane-Miles	67.6	$12,000	$811,200	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	0.0	$7,392	$0	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$1,348,965	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$2,832,826	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$1,416,413	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$13,030,999	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
San Antonio Rd.	Site	1		$980,000	4%
0	Site	1		$0	0%
0	Site	1		$0	0%
Contingency factor for structures	40%			$392,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$46,980,498	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$16,443,174	
Total Project Cost				$63,423,672	
Cost per lane-mile of express lane				$938,220	

Table 98: Cost Estimate for Design Variation 2
Project 30: US-101 Dual lanes from Cochrane to San Mateo County Line

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	67.6			50%
New Lanes	Lane-Miles	67.6			50%
		135.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	8.7	$2,222,222	$19,320,107	3%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	104.0	$13,200	$1,372,800	0%
Variable costs for new HMA pavement	Sq. Ft.	3,482,688	$8.87	$30,893,672	5%
Variable costs for new PCC pavement	Sq. Ft.	5,211,360	$12.33	$64,273,440	10%
Overlay of existing lanes	Lane-Miles	165.2	$150,000	$24,780,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$42,192,006	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	13.7	$4,675,979	$64,247,958	10%
Sound walls	miles	4.4	$3,015,145	$13,266,639	2%
New median barrier	miles	32.6	$607,200	$19,794,720	3%
Environmental Mitigation	miles	67.6	$100,000	$6,760,000	1%
HOV Enforcement	Site	13	$1,390,830	$18,080,790	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	120	$621,980	$74,637,600	11%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	17	$1,067,400	$18,145,800	3%
ITS equipment (monitoring)	Lane-Miles	135.2	$82,285	$11,124,932	2%
Striping of express lanes	Lane-Miles	135.2	$36,388	$4,919,658	1%
Signs for express lanes	Lane-Miles	120.4	$12,000	$1,444,800	0%
Replacement of cantilever signs	Site	44	$99,900	$4,395,600	1%
Replacement of full-span signs	Site	4	$299,200	$1,196,800	0%
Re-striping of GP lanes	Lane-Miles	165.2	$7,392	$1,221,158	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$21,103,424	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$44,317,190	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$22,158,595	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$203,859,075	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	27,061	$420	$11,365,768	2%
Replacement of overcrossings					
Metcalf Rd.	Site	1		$7,700,000	1%
N US-101 / N SR-85 Connector	Site	1		$7,700,000	1%
HOV Direct Connector	Site	1		$7,700,000	1%
Hellyer Ave.	Site	1		$7,700,000	1%
Capitol Expwy	Site	1		$7,700,000	1%
Tully Rd.	Site	1		$11,800,000	2%
Story Rd.	Site	1		$18,700,000	3%
US-101/I-680/I-280 Interchange	Site	1		$7,700,000	1%
Railroad O/C	Site	1		$7,700,000	1%
E. Hedding St./Berryessa Rd.	Site	1		$7,700,000	1%
Railroad O/C	Site	1		$7,700,000	1%
10th Street	Site	1		$7,700,000	1%
Trimble Rd./De La Cruz Blvd.	Site	1		$7,200,000	1%
Agnew Railroad	Site	1		$350,000	0%
Lafayette St.	Site	1		$3,600,000	1%
Montague/ San Tomas Expwy Interchange	Site	1		$15,700,000	2%
N. Fair Oaks Ave.	Site	1		$6,100,000	1%
N. Mathilda Ave	Site	1		$9,900,000	1%
SR-237 O/C	Site	1		$13,800,000	2%
Moffet Blvd.	Site	1		$3,600,000	1%
N SR-85 / N US-101	Site	1		$7,700,000	1%
N SR-85 / N US-101 Truck Bypass	Site	1		$7,700,000	1%
N. Shoreline Blvd.	Site	1		$7,700,000	1%
Old Middlefield Way	Site	1		$7,700,000	1%
Amphitheater Park/Rengstorff Ave.	Site	1		$3,600,000	1%
San Antonio Rd.	Site	1		$4,900,000	1%
Oregon Ave.	Site	1		$6,300,000	1%
Embarcadero Rd.	Site	1		$8,400,000	1%
Contingency factor for structures	40%			$93,246,307	
TOTAL ROW ITEMS					
Acquisition	Acres	4.82	$2,831,156	$13,658,182	2%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$4,097,455	1%
Contingency factor for ROW		40%		$7,102,255	
Total Project Capital Outlay Costs				$1,064,726,729	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$372,654,355	
Total Project Cost				$1,437,381,084	
Cost per lane-mile of express lane				$10,631,517	

Table 99: Cost Differences

Difference	% of Difference
$32,660,640	3.2%
$2,320,718	0.2%
$52,225,752	5.1%
$108,654,250	10.7%
$41,890,590	4.1%
$71,325,585	7.0%
$108,611,172	10.7%
$22,427,253	2.2%
$33,462,974	3.3%
$11,427,780	1.1%
$30,565,575	3.0%
$0	0.0%
$126,174,863	12.4%
$0	0.0%
$9,403,349	0.9%
$4,158,341	0.4%
$1,071,101	0.1%
$7,430,762	0.7%
$2,023,190	0.2%
$2,064,368	0.2%
$15,912,075	1.6%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$16,520,000	1.6%
$26,180,000	2.6%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$10,080,000	1.0%
$490,000	0.0%
$5,040,000	0.5%
$21,980,000	2.2%
$8,540,000	0.8%
$13,860,000	1.4%
$17,948,000	1.8%
$5,040,000	0.5%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$10,780,000	1.1%
$5,040,000	0.5%
$6,860,000	0.7%
$8,820,000	0.9%
$11,760,000	1.2%
$24,857,891	2.4%
$1,017,746,231	100.0%
$356,211,181	
$1,373,957,412	2166%
	increase

Table 100: Cost Estimate for Design Variation 1
Project 31: US 101 Santa Clara County Line to Whipple

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	13.2			100%
New Lanes	Lane-Miles	0.0			0%
		13.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	55%
ITS equipment (monitoring)	Lane-Miles	13.2	$82,285	$1,086,162	14%
Striping of express lanes	Lane-Miles	13.2	$36,388	$480,322	6%
Signs for express lanes	Lane-Miles	13.2	$12,000	$158,400	2%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	3.2	$7,392	$23,654	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$300,907	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$631,904	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$315,952	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$2,906,761	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Whipple Avenue	Site			$1,160,000	15%
Maple Street	Site			$560,000	7%
Contingency factor for structures	40%			$688,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$12,581,662	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$4,403,582	
Total Project Cost				$16,985,244	
Cost per lane-mile of express lane				$1,286,761	

Table 101: Cost Estimate for Design Variation 2
Project 31: US 101 Santa Clara County Line to Whipple

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	13.2			100%
New Lanes	Lane-Miles	0.0			0%
		13.2			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	1.0	$2,222,222	$2,133,120	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	15.6	$13,200	$205,920	0%
Variable costs for new HMA pavement	Sq. Ft.	375,936	$8.87	$3,334,793	4%
Variable costs for new PCC pavement	Sq. Ft.	583,968	$12.33	$7,202,272	8%
Overlay of existing lanes	Lane-Miles	39.0	$150,000	$5,850,000	7%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$5,617,831	6%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	6.6	$607,200	$4,007,520	4%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	2	$1,390,830	$2,781,660	3%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	23	$621,980	$14,305,540	16%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	4	$1,067,400	$4,269,600	5%
ITS equipment (monitoring)	Lane-Miles	13.2	$82,285	$1,086,162	1%
Striping of express lanes	Lane-Miles	13.2	$36,388	$480,322	1%
Signs for express lanes	Lane-Miles	13.2	$12,000	$158,400	0%
Replacement of cantilever signs	Site	9	$99,900	$899,100	1%
Replacement of full-span signs	Site	5	$299,200	$1,496,000	2%
Re-striping of GP lanes	Lane-Miles	39.0	$7,392	$288,288	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$2,705,826	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$5,682,235	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$2,841,118	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$26,138,283	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Whipple Ave	Site			$5,800,000	6%
Maple St	Site			$2,800,000	3%
Henderson Railroad	Site			$1,420,000	2%
Ringwood Ave POC	Site			$500,000	1%
Willow Road	Site			$9,300,000	10%
University Ave	Site			$7,200,000	8%
University Ave	Site			$7,800,000	9%
Contingency factor for structures	40%			$13,928,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.17	$3,000,000	$509,091	1%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$152,727	0%
Contingency factor for ROW		40%		$264,727	
Total Project Capital Outlay Costs				$141,158,536	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$49,405,488	
Total Project Cost				$190,564,024	
Cost per lane-mile of express lane				$14,436,668	

Table 102: Cost Differences

Difference	% of Difference
$3,606,039	2.8%
$348,108	0.3%
$5,637,468	4.4%
$12,175,441	9.5%
$9,889,425	7.7%
$9,496,944	7.4%
$0	0.0%
$0	0.0%
$6,774,713	5.3%
$0	0.0%
$4,702,396	3.7%
$0	0.0%
$24,183,515	18.8%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$1,519,929	1.2%
$2,528,988	2.0%
$447,363	0.3%
$0	0.0%
$6,496,000	5.1%
$3,136,000	2.4%
$1,988,000	1.5%
$700,000	0.5%
$13,020,000	10.1%
$10,080,000	7.8%
$10,920,000	8.5%
$926,545	0.7%
$128,576,874	100.0%
$45,001,906	
$173,578,780	1022%
	increase

Table 103: Cost Estimate for Design Variation 1
Project 32: WB SR-84 from I-880 to Bridge Toll Plaza

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	3.4			100%
New Lanes	Lane-Miles	0.0			0%
		3.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	1	$1,067,400	$1,067,400	69%
ITS equipment (monitoring)	Lane-Miles	3.4	$82,285	$279,769	18%
Striping of express lanes	Lane-Miles	3.4	$36,388	$123,719	8%
Signs for express lanes	Lane-Miles	3.4	$12,000	$40,800	3%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	3.6	$7,392	$26,611	2%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$76,915	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$161,521	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$80,761	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$742,999	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$2,600,495	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$910,173	
Total Project Cost				$3,510,668	
Cost per lane-mile of express lane				$1,032,550	

Table 104: Cost Estimate for Design Variation 2
Project 32: WB SR-84 from I-880 to Bridge Toll Plaza

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	2.6			76%
New Lanes	Lane-Miles	0.8			24%
		3.4			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.2	$2,222,222	$549,120	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	2.8	$13,200	$36,960	0%
Variable costs for new HMA pavement	Sq. Ft.	247,104	$8.87	$2,191,971	9%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	7.0	$150,000	$1,050,000	4%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$1,148,415	5%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.4	$4,675,979	$1,870,392	8%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	1.4	$607,200	$850,080	4%
Environmental Mitigation	miles	0.8	$100,000	$80,000	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	3	$621,980	$1,865,940	8%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	1	$1,067,400	$1,067,400	4%
ITS equipment (monitoring)	Lane-Miles	3.4	$82,285	$279,769	1%
Striping of express lanes	Lane-Miles	3.4	$36,388	$123,719	1%
Signs for express lanes	Lane-Miles	3.4	$12,000	$40,800	0%
Replacement of cantilever signs	Site	3	$99,900	$299,700	1%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	7.0	$7,392	$51,744	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$575,300	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$1,208,131	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$604,066	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$5,557,403	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Lake Blvd OC	Site	1		$7,700,000	32%
Thornton Ave OC	Site	1		$4,800,000	20%
Contingency factor for structures	40%			$5,000,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$36,950,910	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$12,932,818	
Total Project Cost				$49,883,728	
Cost per lane-mile of express lane				$14,671,685	

Table 105: Cost Differences

Difference	% of Difference
$928,287	2.7%
$62,481	0.2%
$3,705,526	10.8%
$0	0.0%
$1,775,025	5.2%
$1,941,396	5.7%
$3,161,897	9.2%
$0	0.0%
$1,437,060	4.2%
$135,240	0.4%
$0	0.0%
$0	0.0%
$3,154,372	9.2%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$506,643	1.5%
$0	0.0%
$42,487	0.1%
$0	0.0%
$10,780,000	31.4%
$6,720,000	19.6%
$0	0.0%
$34,350,415	100.0%
$12,022,645	
$46,373,060	1321%
	increase

Table 106: Cost Estimate for Design Variation 1
Project 33: SR-92 from Hesperian to Bridge Toll Plaza

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	3.0			100%
New Lanes	Lane-Miles	0.0			0%
		3.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.0	$2,222,222	$0	0%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	0.0	$13,200	$0	0%
Variable costs for new HMA pavement	Sq. Ft.	0	$8.87	$0	0%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	0.0	$150,000	$0	0%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$0	0%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.0	$4,675,979	$0	0%
Sound walls	miles	0.0	$3,015,145	$0	0%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	0	$621,980	$0	0%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	1	$1,067,400	$1,067,400	72%
ITS equipment (monitoring)	Lane-Miles	3.0	$82,285	$246,855	17%
Striping of express lanes	Lane-Miles	3.0	$36,388	$109,164	7%
Signs for express lanes	Lane-Miles	3.0	$12,000	$36,000	2%
Replacement of cantilever signs	Site	0	$99,900	$0	0%
Replacement of full-span signs	Site	0	$299,200	$0	0%
Re-striping of GP lanes	Lane-Miles	3.0	$7,392	$22,176	1%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$74,080	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$155,567	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$77,784	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$715,610	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
None for this corridor					0%
Contingency factor for structures	40%			$0	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$2,504,636	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$876,623	
Total Project Cost				$3,381,259	
Cost per lane-mile of express lane				$1,127,086	

Table 107: Cost Estimate for Design Variation 2
Project 33: SR-92 from Hesperian to Bridge Toll Plaza

Cost Components	Unit	Number of Units	Unit Cost	Line Item Cost	% of Total
Type of Project					
Existing or CMA-funded express lanes	Lane-Miles	0.0			0%
Conversion of existing or planned HOV lanes	Lane-Miles	3.0			100%
New Lanes	Lane-Miles	0.0			0%
		3.0			100%
TOTAL ROADWAY ITEMS					
SECTION 1: EARTHWORK					
Excavation, etc.	M Sq. Ft.	0.1	$2,222,222	$309,760	2%
SECTION 2: PAVEMENT STRUCTURAL SECTION					
Fixed costs for pavement modification	Miles	3.0	$13,200	$39,600	0%
Variable costs for new HMA pavement	Sq. Ft.	139,392	$8.87	$1,236,496	7%
Variable costs for new PCC pavement	Sq. Ft.	0	$12.33	$0	0%
Overlay of existing lanes	Lane-Miles	6.2	$150,000	$930,000	6%
SECTION 3: DRAINAGE					
As a percentage of Sections 1 & 2	30%			$754,757	4%
SECTION 4: SPECIALTY ITEMS					
Retaining walls	miles	0.6	$4,675,979	$2,805,588	17%
Sound walls	miles	0.2	$3,015,145	$603,029	4%
New median barrier	miles	0.0	$607,200	$0	0%
Environmental Mitigation	miles	0.0	$100,000	$0	0%
HOV Enforcement	Site	0	$1,390,830	$0	0%
Access point (with transition lane)	Site	0	$1,419,856	$0	0%
Ramp Modifications	Site	4	$621,980	$2,487,920	15%
SECTION 5: TRAFFIC ITEMS					
ITS equipment (access points)	Access point	1	$1,067,400	$1,067,400	6%
ITS equipment (monitoring)	Lane-Miles	3.0	$82,285	$246,855	1%
Striping of express lanes	Lane-Miles	3.0	$36,388	$109,164	1%
Signs for express lanes	Lane-Miles	3.0	$12,000	$36,000	0%
Replacement of cantilever signs	Site	2	$99,900	$199,800	1%
Replacement of full-span signs	Site	1	$299,200	$299,200	2%
Re-striping of GP lanes	Lane-Miles	6.2	$7,392	$45,830	0%
SECTION 6: MINOR ITEMS					
As a percentage of Sections 1 through 5	5%			$558,570	
SECTION 7: MOBILIZATION					
As a percentage of Sections 1 through 6	10%			$1,172,997	
SECTION 8: ROADWAY ADDITIONS					
As a percentage of Sections 1 through 6	5%			$586,498	
SECTION 9: CONTINGENCIES					
As a percentage of Sections 1 through 8	40%			$5,395,786	
TOTAL STRUCTURES ITEMS					
Widening of undercrossings	Sq.Ft.	0	$420	$0	0%
Replacement of overcrossings					
Cawiter Rd	Site	1		$5,700,000	34%
Contingency factor for structures	40%			$2,280,000	
TOTAL ROW ITEMS					
Acquisition	Acres	0.00	$0	$0	0%
Title & Escrow fees (as a percentage of acquisition costs)		30%		$0	0%
Contingency factor for ROW		40%		$0	
Total Project Capital Outlay Costs				$26,865,250	100%
Support Costs (computed as a percentage of Capital Outlay Costs)		35%		$9,402,838	
Total Project Cost				$36,268,088	
Cost per lane-mile of express lane				$12,089,363	

Table 108: Cost Differences

Difference	% of Difference
$523,649	2.1%
$66,944	0.3%
$2,090,297	8.6%
$0	0.0%
$1,572,165	6.5%
$1,275,917	5.2%
$4,742,846	19.5%
$1,019,421	4.2%
$0	0.0%
$0	0.0%
$0	0.0%
$4,205,829	17.3%
$0	0.0%
$0	0.0%
$0	0.0%
$0	0.0%
$337,762	1.4%
$505,798	2.1%
$39,988	0.2%
$0	0.0%
$7,980,000	32.8%
$0	0.0%
$24,360,614	100.0%
$8,526,215	
$32,886,829	973%
	increase

ATTACHMENT 8

Operational Assessment

MTC Traffic Operational Assessment
San Francisco Bay Area Express Lanes Network

Six key operational benefits are associated with the proposed express lane network. Within the context of the existing HOV lane operations, each are addressed in this operational assessment, along with an explanation of supporting conditions for each. They include:

1. **Connectivity Benefits**: Addressing gaps earlier in the existing network of HOV lanes
2. **Capacity Benefits**: Underutilization creates opportunities to balance the usage of all lanes and move more traffic, thereby easing congestion in the general purpose lanes
3. **Travel Time Benefits**: Overutilization threatens the ability to maintain an acceptable speed and level-of-service on the region's HOV lanes, and variable pricing offers a means of addressing this problem
4. **Reliability Benefits**: The ability for commuters to make a predictable trip.
5. **Bus Transit Benefits**: Providing more opportunities to Bay Area transit providers
6. **System Performance Benefits**: Providing a better means of managing the overall freeway system can improve performance and congestion

1. Connectivity Benefits

Investments in the Bay Area HOV lane system by various federal, state and local agencies have provided an essential regional mobility option connecting commuters with employment centers. This option has greatly increased and sustained regional ridesharing and transit use, promoted mobility choices and resulted in lower overall congestion and reduced delays in the general purpose lanes than would have otherwise occurred. A connected network of HOV lanes was envisioned and adopted into the region's long range plan. But some 40 years after the first HOV lanes were implemented, the system is still incomplete. Many gaps exist in critical parts of the planned network. These gaps impair connectivity and exist due to lack of funding that will stretch out completion of the network for many years to come. Congestion frequently occurs in these gaps and weaving at the HOV lane termini can adversely affect traffic operations. One recent gap closure project on US 101 in Marin County documents the benefits of addressing congestion in HOV lane gaps and maximum delays were reduced 50-70% in the general purpose lanes, and HOV lane delays were reduced approximately 75%.

The proposed express lane network offers a means of filling approximately 152 lane-miles of existing gaps and providing new freeway-to-freeway direct connectors at the I-80/I-680 and I-680/I-580 interchanges. Connectivity can be improved more quickly than will otherwise occur because funding can be augmented through revenues generated, thus addressing the performance shortcomings associated with gaps.

2. Capacity Benefits

While reliance on vehicle occupancy eligibility restrictions alone as a means of managing HOV lane capacity has generated "free-flow" conditions for a majority of HOV lane projects during peak hours, the inability to fill these lanes with more vehicles during peak periods and optimize use of these lanes leaves excess capacity unused. This underutilized condition during peak periods represents a real and perceived inefficiency during the hours of greatest overall corridor demand. Such conditions do not contribute to public perceptions of effective use. Augmenting eligibility restrictions with variable pricing provides a means of filling up this available capacity. Solo vehicles from adjacent general purpose lanes can utilize available capacity for a toll, thereby reducing traffic demand and congestion in the general purpose lanes. Available

capacity varies throughout the system and can change throughout the day. Peak hour HOV forecasts for affected routes in the planned express lane network show an average of 10% capacity available. The amount of unutilized capacity during other hours of the peak periods and during shoulder hours is much higher.

While expected capacity enhancement is a major benefit of implementing express lanes, results will vary from one corridor to the next and sometimes from segment to segment within a corridor. Traffic forecasts demonstrate that in a majority of cases congestion is reduced in the adjacent general purpose lanes as a result of express lane conversion. This finding has been similarly reported on single express lane projects (like the proposed Bay Area lane configuration) in Seattle on SR 167 and for I-394 in Minneapolis. However, because the traffic forecasts assume limited access, results indicate that general purpose lane volumes of some segments could increase as some HOVs are precluded from using the express lane. Real-time management of express lane operations and increasing frequency of access would ensure that these effects are minimized or eliminated by setting a price that ensures the lane is sufficiently utilized.

In those isolated corridors or segments where the impact may be negative, mitigation includes implementing one or a combination of design, operation and pricing strategies that can effectively address the identified operational impact. In particular, negative impacts might be expected to occur where demand is greatest within an isolated segment and at project termini. This condition is not exclusive to an express lane definition; it exists under the HOV base condition today. Such mitigating measures include:

- Restricting access between the general purpose and express lane so as to reduce demand for the express lane and eliminate weaving conflicts
- Filling a gap sooner
- Adding another lane (environmentally and/or financially infeasible for most corridors)
- Implementing general purpose lane improvements to address negatively impacted segments (i.e., auxiliary lanes, adjusting ramp metering rates in the impacted vicinity, etc.)
- Implementing pricing strategies that encourage some shifting of demand into fringes of the peak period so as to smooth the sharp demand peaking that is observed or forecast at the subject location. In the latter strategy, the augmentation of pricing provides a real-time management tool to the existing HOV lane operation that would not otherwise exist in addressing this problem.

3. Travel Time Benefits

The basis for 40 years of investment in HOV lanes throughout the Bay Area has been creating a system of lanes that affords transit, HOVs and other specified exempt low emission vehicles a travel time advantage over adjacent congested traffic. In doing so, transit use and ridesharing are encouraged. This benefit is reduced when HOV lanes become too crowded, essentially victims of their own success. The tools to manage demand on an HOV lane are limited. Either the lane must be expanded (which is often infeasible), access must be made more restricted (but can only work for modest reductions in demand) or minimum occupancy requirements need to be raised.

Data from the most recent Caltrans HOV lane monitoring report shows that some HOV lane facilities are already reaching capacity in parts of some corridors in the Bay Area. More projects will become congested as traffic demand grows. Allowing the current mix of transit, carpools and exempt low emission vehicles to travel in the region's HOV lanes could impact meeting the

federal statute addressing HOV Facility Management, Operation, and Monitoring (Freeways) - 23 U.S.C. 166 (d).

> "If States implement low emission and energy-efficient and/or HOT vehicle exception(s), they must operate in accordance with the restrictions and requirements of 23 U.S.C. 166 (d) which established a minimum average operating speed that HOV facilities with exempted vehicles must maintain. ….a State should provide or ensure a high level of service to preserve the primary purpose of HOV facilities to offer significant travel time and reliability benefits… The minimum average operating speed is defined… as 45 miles per hour (mph)."

The prescribed speed threshold will not be able to be achieved on all area HOV lanes at all times looking forward without taking actions to preserve performance.

The typical distribution of traffic on Bay Area freeways includes about 15 to 20 percent as 2+ carpools, but only 3 to 5 percent as 3+ carpools. Raising minimum occupancy requirements to 3+ to meet this statute without the application of variable pricing would require the majority of currently eligible HOVs on most HOV lanes to be moved back into the general purpose lanes. This shift, if not properly mitigated through the application of variable pricing, would pose the potential of further degradation on general purpose lanes as previous eligible carpools are forced out.

The ability to apply variable pricing and convert existing HOV lanes to express lanes is an opportunity both to ensure compliance with the federal statute and maintain an acceptable level of vehicle throughput and reliability, while at the same time not creating congestion in the express lane or adjacent general purpose lanes. The key to this strategy is in raising or lowering the toll in real time such that express lane demand is regulated just below capacity. This approach can thus preserve benefits to encourage greater person movement in transit and carpools while also maximizing vehicle flow in real-time.

Converting from 2+ to 3+

The stated objective of HOV lanes in the first place was to encourage the formation of carpools. The Federal Highway Administration originally required states to adopt a 3+ HOV occupancy policy when seeking federal funds. They eventually relaxed this requirement to 2+ in 1987 under the auspices that over time occupancy restrictions would need to be increased as demand filled up the HOV lanes. This operational change would thereby encourage more 3+ carpool formation. In reality, making this transition has been difficult and few US projects, until recently, undertook this action.

Converting all HOV lanes from 2+ to 3+ without the introduction of variable pricing may have adverse impacts on congestion in the general purpose lanes. Mitigating and managing any negative impacts would be critical from day one. The impacts associated with raising minimum occupancy requirements from 2+ to 3+ can be largely mitigated by applying pricing at the same time (or before) occupancies are raised. This is possible because, unlike rigid eligibility restrictions, real-time tolls can dynamically respond to changing conditions and be applied to balance vehicle demand, so that whoever becomes ineligible is simultaneously replaced by a user willing to pay.

The potential shifting of 2+ vehicles from the HOV lane to the general purpose lanes after conversion to a 3+ occupancy policy could and should be addressed with a tolling policy and

algorithm that avoids an "empty lane" and the possibility of increased congestion in the general purpose lanes. As evidenced in the capacity benefit discussion, the ability to take advantage of excess HOV lane capacity will allow a net influx of new users in a majority of locations which will more than offset any segments where corridor imbalance could occur. Experiences in raising occupancies from 2+ to 3+ when tolling was added on I-95 in Miami support this approach and have reflected no net negative impacts two years after the conversion to 3+ and pricing occurred. The Bay Area recently implemented variable tolling on the Bay Bridge and changed the tolling policy for carpools. Previous policy allowed carpools with 3 or more occupants to use the Bay Bridge HOV bypass and travel on the bridge without paying a toll. The policy change implemented on July 1, 2010 requires passenger vehicles with 3 or more occupants to pay a reduced toll of $2.50 and only allows registered passenger vanpools with 11 or more occupants and buses to travel without paying a toll.

Other considerations relevant to the conversion from 2+ to 3+ include:

- Notwithstanding the addition of variable tolling, the impacts of 2+ to 3+ conversion would still exist as Caltrans is required to address federal statutes to preserve level of service in the HOV lanes as they reach or exceed capacity, per 23 U.S.C. 166 (d). A rigid removal of two-occupant carpools, without a managed pricing strategy in place, would create these negative impacts without the ability to mitigate.
- Various network factors will influence the timing of conversions so that the system may not convert at the same time, including presence of congestion in the HOV lanes today, status of projects that fill gaps, consistency in corridors like I-80 where 2+ and 3+ occupancy policies may exist in different parts of the corridor until gaps are filled, and financing requirements to fill gaps.
- While most converted segments will experience net improvement in congestion in the general purpose lanes, mitigation strategies which can be applied to address any impacted segments would include:
    - Timing of occupancy change to coincide with activation of variable pricing so that no net loss in vehicle throughput occurs on day one.
    - Design features that do not overly restrict access and trip demand onto and off of the express lanes at high volume locations, such as maintaining an open access environment currently afforded to users, so that more users may take advantage of the time savings and reliability benefits
    - Providing real-time customer information (toll rates and travel times) that encourage advance decision making and a toll value proposition that encourages express lane users to stay in the lane can cut down on traffic weaves and erratic movements
    - Expansion of operation hours that provide greater flexibility to address commute needs and travel time and reliability benefits, thereby reducing peak demand currently associated with some HOV lane operations
    - Applying technology now and as it becomes available to reduce reliance on CHP field presence for infractions that can be more efficiently and safely addressed remotely
    - Phasing implementation to more quickly fill in gaps that currently experience congestion

It should be noted that conversion is still subject to specific Caltrans required project initiation documents being prepared for each project which must address the precise ways safety, congestion and travel times in both HOV and GP lanes will be improved when the conversion occurs.

4. Reliability Benefits

The companion benefit provided by HOV and express lanes is the ability to offer users a predictable trip. Reliability has consistently been ranked in surveys as one of the top reasons why transit and ridesharing have been popular to HOV users. Transit agencies can be assured of making their schedules, and in many cases be assured of reduced headways, making multiple round trips with the same vehicle during peak periods and reducing fleet size and maintenance facility requirements possible. Rideshare users can depend on meeting and arriving predictably. Similar to travel time savings, reliability is lost if HOV lanes become overcrowded and congestion is experienced. Reliability is applicable for both peak and off-peak periods, because users are willing to pay for it even when there is no significant congestion in off-peak periods and/or to serve as a "safety valve" for non-recurrent incidents.

For express lanes in the Bay Area, preserving reliability is the implied guarantee associated with the user charge incurred. Experiences from other express lanes in California confirm this and define the market served for many customers:

- On SR 91 express lanes in Orange County, tolls have increased fourfold in the mid-day off-peak period due to increasing levels of use since the project opened in 1995 (see Figure 1). Recurring congestion is rarely experienced during the mid-day. Meanwhile, tolls during the peak periods have increased less than two-fold. This is because the traffic growth in off-peak periods has grown more rapidly than during the traditional peak periods when the lanes were largely filled the first year (Figure 2). Off-peak customers are using the express lanes to avoid the potential for non-recurring congestion that results from occasional incidents and slow-downs. For these users, reliability is the primary reason for choosing express lanes. They are willing to pay a toll which is still considerably less than the maximum peak toll to avoid surprises on the general purpose lanes. The choice provided is worth the price paid, even if that price for value of time saved is commensurately higher than in the peak period.
- On the I-15 express lanes in San Diego, ongoing research (to be published in 2012) is similarly finding that travel time savings can be quite modest during certain time periods. Yet, demand for the lanes remains relatively high during these same periods. Researchers are finding that a customer decision to take the express lanes is made as much to ensure a reliable trip as to gain time savings.

Offering commuters more choices and providing them with price and travel time information to make informed decisions can both enhance the current and future investment in Bay Area HOV/express lanes and benefit users who have different values of travel time.

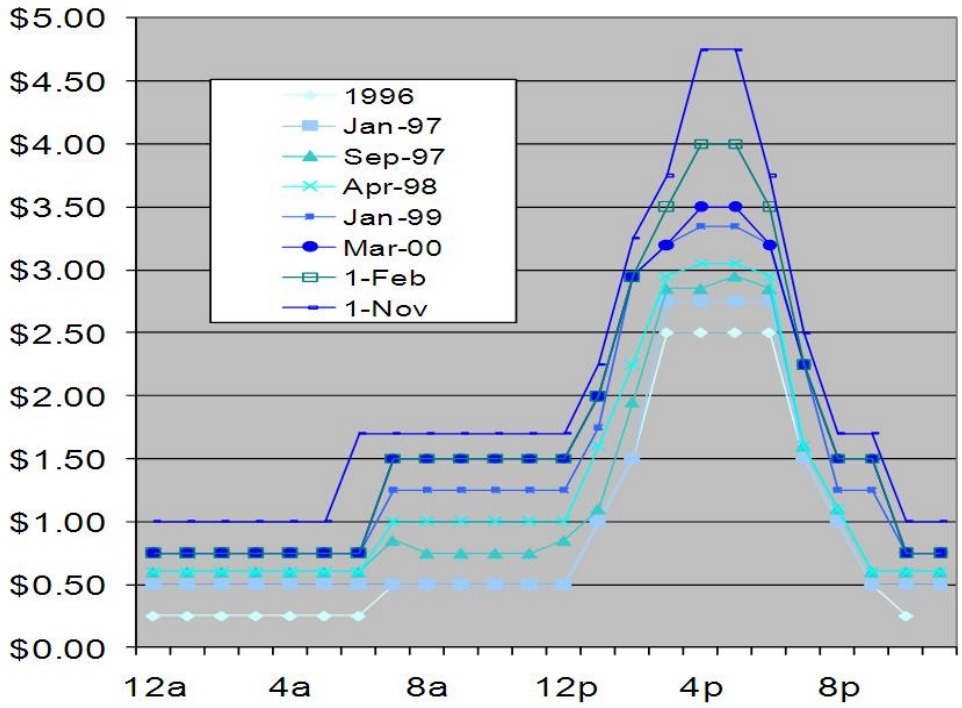

Figure 1: SR-91 Toll Rates (1995-2001)

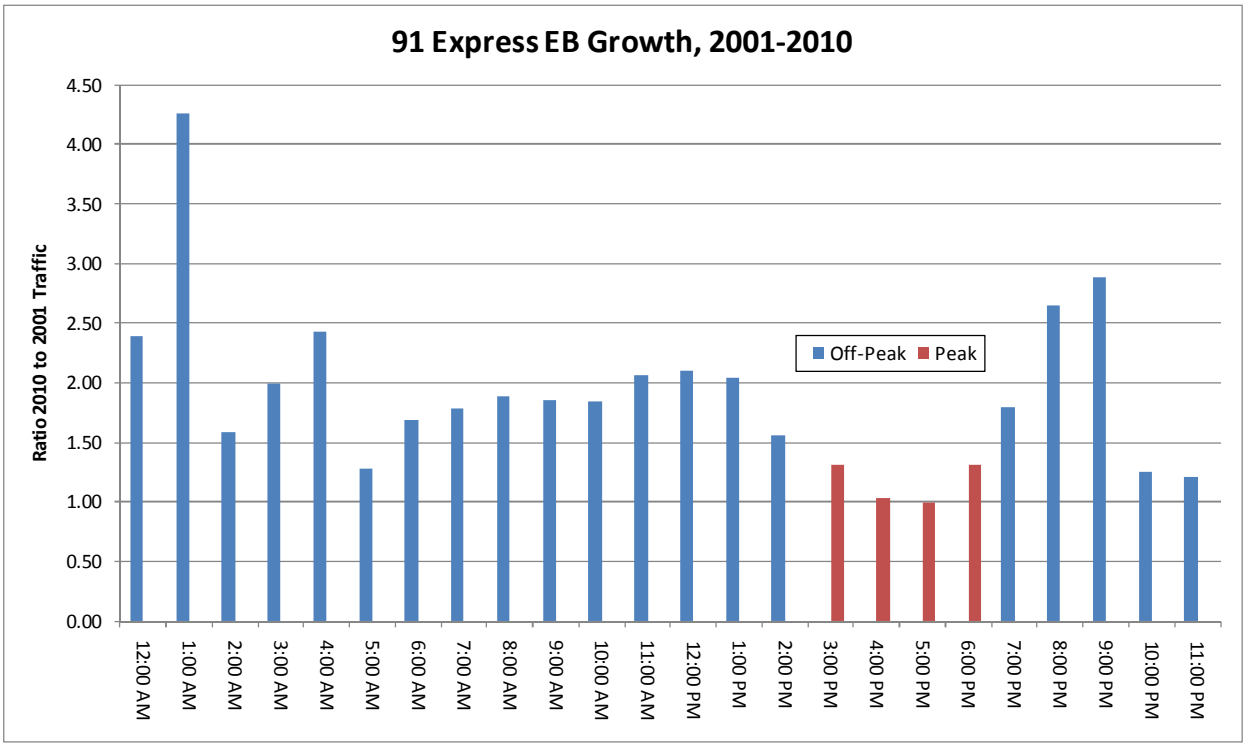

Figure 2: Dampening of Peak Hour Growth Rates on SR-91

5. Bus Transit Benefits

The improvements and benefits to transit as a result of HOV and Express Lanes positively impact the congestion and highway capacity of the entire system. Benefits to transit providers and overall operation of the system include the following:

- Substantially enhanced connectivity of the system makes transit a much more viable regional mode choice
- Improved reliability associated with revenue funding a more closely monitored and enforced lane system assures better transit schedule adherence, thereby removing unreliability as a major deterrent to transit use
- Ability to reduce headways and maximize the number of bus trips with existing fleets, thereby possibly reducing capital and maintenance facility requirements
- More transit ridership resulting from greater connectivity (with fewer gaps) and schedule reliability decreases reliance on SOV travel, and can result in a higher average vehicle occupancy in the affected corridors and the region as a whole
- Net benefits of reduced SOV reliance provides congestion relief and air quality benefits

Taking a Closer Look at Closing the Gaps

Transit benefits are expected as a result of closing gaps in the current HOV system. Travel time savings associated with express bus routes that currently experience deteriorated levels of service due to freeway system bottlenecks and congestion would be improved with the availability of a continuous express lane facility that could serve as a bypass to bottleneck related congestion, reduce travel times and increase reliability. The Bay Area's large population and workforce, much of it commuting during peak periods, constitute a major market for public transportation. Over 20 bus systems serve the region, and at 10.1%[1] the region's transit mode share for work trips is high relative to many regions. Figure 3 presents the regional express bus system service locations throughout the express lanes network study limits and identifies current and funded HOV lanes that would be converted to express lanes. Figure 3 also highlights areas where freeway bus service is provided on routes that do not offer HOV lanes currently but would upon completion of the express lanes network (yellow highlights).

[1] 2009 American Community Survey

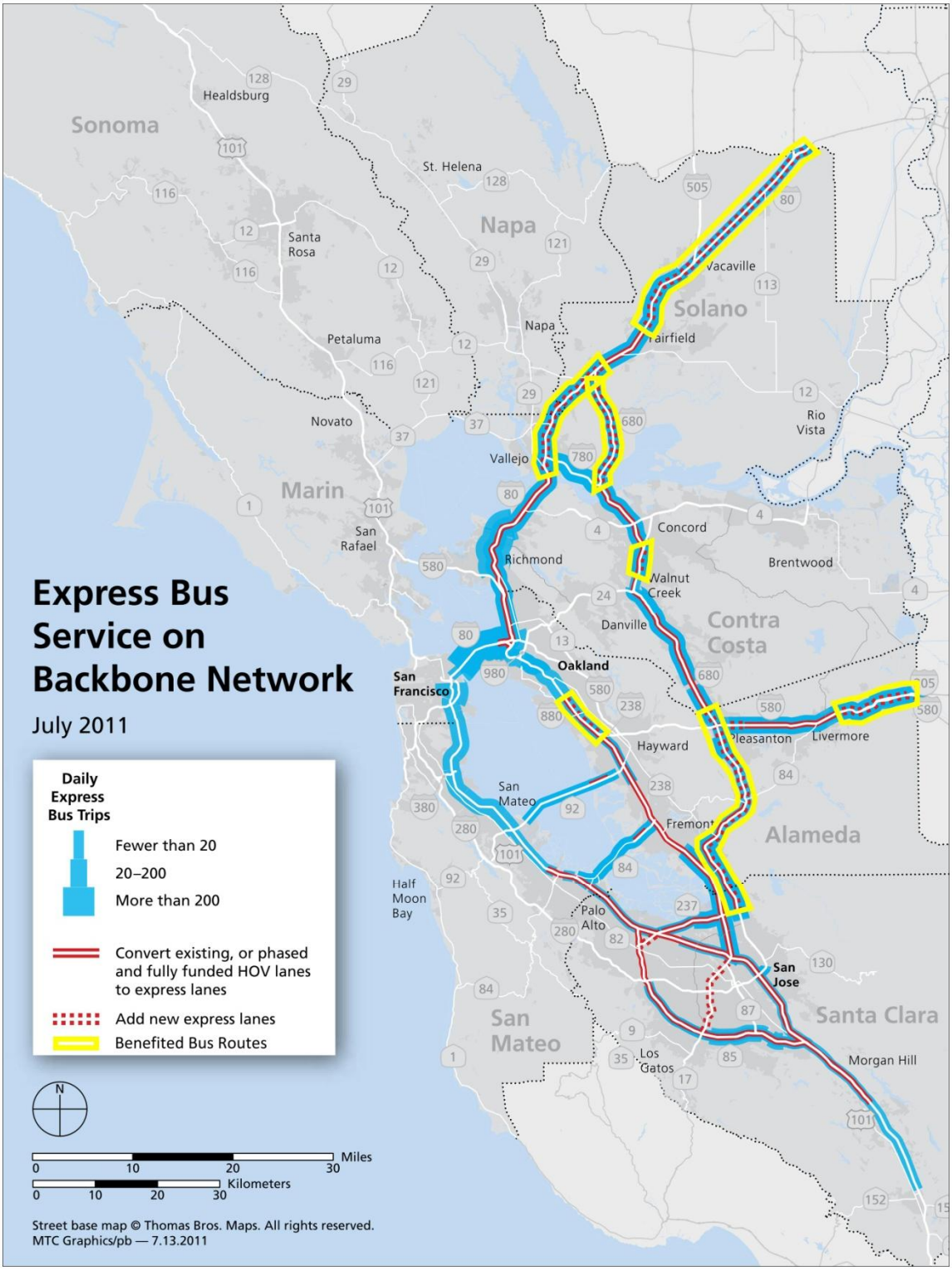

Figure 3: Bay Area Express Bus System Service Levels

Transit agencies currently operate over 100 express bus routes (region-wide) which include freeway bus service, rail feeder services operating express buses to BART and Caltrain stations, and cross-county and cross-region limited-stop routes. The majority of express bus routes operate primarily during peak periods in the peak direction to serve commuters. Growth in express bus ridership is dependent upon service levels, travel times and reliability. Currently available data does not provide information on the proportion of express bus routes that are on freeways.

After accounting for currently planned HOV projects that are fully funded, the Bay Area's HOV network will contain gaps that serve existing express bus routes. Express lane implementation is expected to advance completion of gap closures and therefore enhance corridor transit operations.

Available data on bus ridership is limited, but reasonable approximations of rider benefits can be made using the following general assumptions:

- Peak hour daily bus trips were estimated based on the data available from MTC as reflected in **Figure 3**
- Express buses typically provide seating for 50 passengers
- The average speed of express buses is expected to increase from an assumed congested freeway speed of 25 mph to the federally mandated HOV lane speed of 45 mph on the gap closure segments with completion of the respective express lane segment.
- Express buses are projected to operate with 30 occupied seats (60% load factor, compared to approximately 50% under existing conditions) after completion of the express lane network
- Express busses will benefit from network completion but these estimates assign no additional time savings related to existing HOV lanes sections

The resulting rider benefits, in terms of weekday daily time savings, are listed by project segment in **Table 1** and predict daily bus rider savings of about 1580 passenger-hours. These projected savings are estimated based on areas where express bus service is currently provided. Implementation of the Backbone Express Lane Network will create the incentive for transit agencies to provide more express service, opportunities for increased interagency cooperation between transit agencies which is likely to result in additional expansion of express bus service and improve reliability of travel and speeds within the existing HOV lane system. The net result would be to make express bus service a much more attractive option for travelers on the region's freeway system.

Table 1: Projected Express Bus Rider Time Savings [1]

Route[2]	Project Number[3]	Project Limits	Lane Miles	Peak Hr Bus Trips[4]	Rider Hours		
					Existing	With Project	Savings
I-80	1	Sol/Yolo Co. Line to I-505	32.7	4	190	100	**90**
I-80	2	I-505 to Airbase Pkwy	18.4	40	880	490	**390**
I-80	4	Red Top Rd to SR-37	11.5	40	550	310	**240**
I-80	5	SR-37 to Carquinez Bridge toll plaza	10.1	40	480	270	**210**
I-680	9	Gold Hill Rd to I-780	20.2	4	100	50	**50**
I-680 NB	11	SR-242 to N. Main St	3.1	40	150	80	**70**
I-680	15	Alcosta to SR-84	20.1	4	100	50	**50**
I-680 NB	16	SR-237 to SR-84	13.7	4	70	40	**30**
I-580	19	Greenville to Ala/SJQ Co. Line	16.8	40	810	450	**360**
I-880 NB	22b	Hegenberger to Lewelling	5.2	30	190	100	**90**
Total			**151.8**	**246**	**3520**	**1940**	**1580**

1 Upon construction of HOV lane
2 Both directions unless noted
3 As described in Section 6, Alternatives
4 Weekdays (AM and PM)

6. System Performance Benefits

A goal of the project is to optimize the freeway system management and traffic operations. Just as HOV lanes have not been a stand-alone investment in each freeway corridor through the past three decades, neither will be enhancements made to augment current freeway management practice through real-time pricing management on express lanes. Both strategies involve responding to dynamic changes in roadway demand and performance more efficiently. Specifically:

- The functional monitoring of both express and general purpose lanes will be enhanced through more cameras and freeway monitoring capability that is maintained to a high standard of reliability. All freeway users will benefit from these investments and enhancements.
- Monitoring and incident response will continue to reside in a single unified location (Caltrans traffic management center) to assure that the entire roadway is monitored and managed to achieve the most effective use, particularly during major incidents and special events. The ability to have a parallel express lane network gives operations personnel a redundancy in emergency response capability as well as an escape valve for traffic handling around major incidents.

- More opportunities will be available to provide information to all motorists, including express lane users, with the frequent installation of changeable signing at spacing that will average every three miles. Maintenance of such signing will reside with the tolling operator.
- The ability to more fully utilize existing HOV lanes will alleviate congestion on the adjacent general purpose lanes, as users choose to leave the general purpose lanes for the advantages of the express lanes. With improved management capability, all users will see benefits.
- MTC's Freeway Performance Initiative (FPI) will be relied on to address overall operation efficiency, particularly where express lanes transition back to general purpose lanes. The express lane system will augment throughput in some linkages, while in others FPI will be the primary backbone strategy to overall performance. The two strategies are planned to work together to be effective. For the I-80 ICM project, its elements will be used for monitoring and incident response. The project includes ramp metering to augment overall vehicle throughput. The biggest advance from current practice is the application of variable speed limit signs and lane management that are activated during incidents and accidents. The express lanes do not impact this project, but both will be managed to best promote overall traffic flow from the regional traffic management center.
- The Corridor System Management Plans (CSMPs) identify a priority list of freeway improvements that would provide further congestion relief if implemented. All projects are being regionally coordinated to assure opportunities for cost sharing and integrated scheduling.

In summary, the operational benefits of the Express Lanes Project are many. In accordance with the HOT Lanes Guidelines, the project is consistent with State Highway System requirements and with the established standards, requirements, and limitations that apply to those facilities in Sections 149, 149.1, 149.3, 149.4, 149.5, 149.6, and 149.7 of the Streets and Highways Code.

ATTACHMENT 9

Preliminary Environmental Analysis

PRELIMINARY ENVIRONMENTAL ANALYSIS

This section provides a summary of the types of environmental technical reports that would likely be required as part of the environmental evaluation for each of the express lane projects as described.

Air Quality Study (AQ): All of the express lane projects will require Air Quality Studies to determine direct, indirect, temporary, and permanent impacts of the project on air quality. The Air Quality Study will also document project-level conformity under the Federal Clean Air Act.

Initial Site Assessment (ISA): All of the projects will include ground disturbance. Therefore, all projects will require completion of hazardous waste Initial Site Assessments to document the presence of contamination within and adjacent to existing right-of-way. The ISA will be used to determine requirements for additional soils and ground water testing.

Location Hydraulic Study (LHS): A Location Hydraulic Study will be required for all express lane projects that encroach into the base floodplain. The LHS will ensure that the projects minimize the impacts to the base floodplain, restore and preserve the natural and beneficial floodplain values, and that the projects are consistent with the standards/criteria of the National Flood Insurance Program of the Federal Emergency Management Agency (FEMA). Based on an initial review of Flood Insurance Rate Maps (FIRMs), most projects will encroach into the base floodplain.

Natural Environment Study (NES): Depending on the project setting, a Natural Environment Study (NES) may or may not be required for projects that are limited to median widening. However, an NES will be required for projects that include outside widening, bridge widening, and/or the acquisition of right-of-way. The NES will document potential impacts to biological resources (wildlife, plants, wetlands, aquatic, endangered species, etc.). Because most of the express lane projects include only minor widening and little acquisition of right-of-way, it is anticipated that all potential biological impacts will be mitigated to a level of less than significant with standard best management practices and mitigation measures. Projects that have the potential to impact endangered species may require resource agency consultation under Section 7 of the Endangered Species Act, including the preparation of a Biological Assessment (BA).

Noise Study Report (NSR): All of the express lane projects will require a Noise Study Report to document the potential for noise impacts on sensitive receptors. The NSR will also determine appropriate noise abatement requirements including noise abatement reasonableness allowances. A Noise Abatement Decision Report (NADR) may also be required during the environmental process to determine if noise barriers are to be included in the project. Effects of abatement on other environmental resources (i.e., scenic views, biological) will also be considered.

Visual Impact Assessment (VIS): Visual Impact Assessments will be required for express lane projects that include construction of retaining walls, replacement overcrossings, freeway to freeway connectors, and/or sounds walls as well as projects that would result in extensive removal of existing landscaping.

Water Quality (WQ): All of the projects will include ground disturbance. Therefore, all projects will require documentation of potential effects to water quality and stormwater and document compliance with state and federal regulation, appropriate best management practices, and mitigation measures.

Cultural Resources: Documentation of potential effects on cultural resources will be required for all the express lane projects in compliance with the *Programmatic Agreement Among the Federal Highway Administration, the Advisory Council on Historic Preservation, the California State Historic Preservation Officer, and the California Department of Transportation Regarding Compliance with Section 106 of the National Historic Preservation Act, as it Pertains to the Administration of the Federal-Aid Highway Program in California* (hereafter, the PA). The level of documentation necessary for compliance will vary depending on project features. Express lane projects that include existing HOV lane conversion and addition of new lanes (under both design variations) to be constructed within the existing right-of-way may be "screened" under Attachment 2 of the PA if there is no potential to affect cultural resources. Projects that require acquisition of new right-of-way and the relocation of structures may require more extensive documentation (Historic Property Survey Report [HPSR], Archaeological Survey report [ASR], Historical Resources Evaluation Report [HRER]) if they do not meet the requirements of screening under Attachment 2 of the PA.

Section 4(f): Section 4(f) documentation will be required for express lane projects that have the potential to impact publicly owned park, recreation area, or wildlife and waterfowl refuge and/or lands from historic sites of national, state, or local significance. In addition, projects with the potential to result in temporary or proximity (constructive use) impacts to Section 4(f) resources may require documentation related to Section 4(f).

Paleontology: Paleontology is the study of life in past geologic time based on fossil plants and animals. Any project-related ground disturbance that occurs within a geologically sensitive area will require the preparation of a Paleontological Identification Report (PIR). If it is determined that paleontological resources will be impacted by the project, a Paleontological Evaluation Report (PER) will also need to be prepared.

SUMMARY OF REQUIRED ENVIRONMENTAL DOCUMENTATION

The following table provides a summary of the potential environmental issues, environmental technical reports, and types of environmental documents anticipated for each of the express lane projects. The determinations are based on a review of

anticipated roadway design features (widening, structure replacement, right-of-way requirements, etc.) and aerial photography of the freeway corridors.

Preliminary Environmental Analysis

Project No.	Route	County	Begin - End	Potential Environmental Issues	Environmental Technical Reports Required	Anticipated Environmental Approval (CEQA/NEPA)
1	I-80	Solano	SOL/YOLO County Line - I-505 IC	Adjacent residential land uses; Creek crossings; new retaining walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA (DV 2 only), WQ	IS/EA
2	I-80	Solano	I-505 IC - Airbase Pkwy IC	Adjacent residential and park land uses; creeks crossing; interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, WQ	IS/EA
3	I-80	Solano	Airbase Pkwy IC - Red Top Rd	Conversion of existing HOV lane, no additional widening	AQ, NSR	IS/EA
4	I-80	Solano	Red Top Rd - SR-37	Adjacent lands are primarily undeveloped, with some residential and commercial properties, new retaining walls, Interchange replacements (DV 2 only)	AQ, ISA, NES, NSR, Section 106, VIA, WQ	IS/EA
5	I-80	Solano	SR-37 - Carquinez Bridge	Adjacent residential and commercial properties, new retaining walls, new and replacement sound walls, Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
6	I-80	Solano/ Contra Costa	Toll Plaza - SR-4 IC	Adjacent residential and commercial properties, new retaining walls (DV 2 only), new sound walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA (DV 2 only), NES (DV 2 only), NSR, Section 106, VIA (DV 2 only), WQ	IS/EA
7	I-80	Contra Costa/ Alameda	SR-4 IC – Bay Bridge	Adjacent residential and commercial properties, ROW acquisition, potential commercial and residential relocation	AQ, ISA (DV 2 only), NES (DV 2 only), NSR, Section 106 (DV 2 only), VIA (DV 2 only), WQ (DV 2 only)	IS/EA
8	I-80 I-680	Solano	I-80/I-680 Direct Connectors	Adjacent residential and commercial properties, Creek crossing, new retaining walls, Interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
9	I-680	Solano	Gold Hill Road - I-780	Adjacent residential and commercial properties, new retaining walls, Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
10	I-680 NB	Solano Contra Costa	I-780 - Marina Vista			
11	I-680 NB	Contra Costa	Marina Vista - N. Main Street	Adjacent residential and commercial properties, Creek crossings, ROW acquisition for undeveloped land, new retaining walls, new sound walls, Interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
12	I-680 SB	Solano Contra Costa	I-780 - Marina Vista			
13	I-680 SB	Contra Costa	Marina Vista - Livorna Road	Adjacent residential and commercial properties, Creek crossings, new retaining walls, new sound walls, Interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA

Preliminary Environmental Analysis (Continued)

Project No.	Route	County	Begin - End	Potential Environmental Issues	Environmental Technical Reports Required	Anticipated Environmental Approval (CEQA/NEPA)
14	I-680	Contra Costa	Livorna Road - Alcosta	Adjacent residential and commercial properties, Creek crossing, new retaining walls (DV 2 only), replacement sound walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA, LHS (DV 2 only), NES (DV 2 only), NSR, Section 106, VIA (DV 2 only), WQ	IS/EA
15	I-680	Contra Costa	Alcosta - SR-84 IC	Adjacent residential and commercial properties, Creek crossing, new retaining walls, new and replacement sound walls, Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
16	I-680 NB	Alameda/ Santa Clara	SR-84 IC - SR-237 IC	Adjacent residential and commercial properties, Creek crossing, new retaining walls, Interchange replacements (DV 2 only), ROW acquisition for residential properties (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA (May require and EIR due to public opposition.)
17	I-680 SB	Alameda/ Santa Clara	SR-84 IC - SR-237 IC	Adjacent residential and commercial properties, Creek crossing, new retaining walls, Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	CE Approved on 1/4/06
Gap	I-680 NB	Contra Costa	Livorna Rd – Main Street	TBD	TBD	EIR/EIS
18	I-580/ I-680	Alameda	I-580/I-680 Direct Connectors	Adjacent commercial properties, ROW acquisition of park land, new retaining walls, new sound walls	AQ, ISA, NES, NSR, Section 106, Section 4(f), VIA, WQ	IS/EA
19	I-580	Alameda	Greenville - ALA/SJQ County Line	Adjacent undeveloped properties, new retaining walls, Interchange replacements	AQ, ISA, NES, Section 106, VIA, WQ	IS/EA
20	I-580 EB	Alameda	Hacienda - Greenville	Adjacent commercial and residential properties, Creek crossings, new retaining walls, new sound walls, ROW acquisition of undeveloped land, residential, and frontage road (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
21a	I-580 WB	Alameda	San Ramon Rd/ Foothill Road - Greenville	Adjacent commercial and residential properties, Creek crossings, ROW acquisition of park land, ROW acquisition of commercial property and frontage road (DV 2 only), new retaining walls, new sound walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA, LHS, NES, NSR, Section 106, Section 4(f), VIA, WQ	IS/EA
21b	I-580 WB second lane	Alameda	San Ramon Rd/ Foothill Road - Greenville	Adjacent commercial and residential properties, Creek crossings, ROW acquisition of park land, ROW acquisition of commercial property, undeveloped land, and frontage road, new retaining walls, new sound walls, Interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, Section 4(f), VIA, WQ	EIR/EA

Preliminary Environmental Analysis (Continued)

Project No.	Route	County	Begin - End	Potential Environmental Issues	Environmental Technical Reports Required	Anticipated Environmental Approval (CEQA/NEPA)
22	I-880 NB	Alameda	Hegenberger - South of Dixon Landing Road	Adjacent commercial and residential properties, Creek crossings, ROW acquisition of residential and commercial property (DV 2 only), new retaining walls (DV 2 only), replacement sound walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA (DV 2 only), LHS (DV 2 only), NES (DV 2 only), NSR, Section 106 (DV 2 only), VIA (DV 2 only), WQ (DV 2 only)	IS/EA
23	I-880 SB	Alameda/ Santa Clara	Hegenberger - US 101 IC	Adjacent commercial and residential properties, Creek crossings, ROW acquisition of commercial property, ROW acquisition of residential and frontage road (DV 2 only), new retaining walls, replacement sound walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA, LHS (DV 2 only), NES, NSR, Section 106, VIA, WQ	IS/EA
Gap	I-880	Alameda	SFO Bay Bridge – Hegenberger Rd	TBD	TBD	EIR/EIS
24	I-880/ SR 17	Santa Clara	US 101 IC - SR-85 IC	Adjacent commercial and residential properties, ROW acquisition of residential and commercial property, new retaining walls, replacement sound walls, Interchange replacements	AQ, ISA, NES, NSR, Section 106, VIA, WQ	EIR/EA
25	SR-237	Santa Clara	SR-237/I-880 Direct Connector			
26	SR-237	Santa Clara	Mathilda Avenue - N. First Street (EB)/ Lawrence Expressway (WB)	Adjacent commercial and residential properties, ROW acquisition of commercial properties (DV 2 only), new retaining walls, Interchange replacements	AQ, ISA, NES (DV 2 only), NSR, Section 106, VIA, WQ	IS/EA
27	SR-237	Santa Clara	SR-85 IC - Mathilda Avenue	Adjacent commercial and residential properties, ROW acquisition of commercial properties, new retailing walls, Interchange replacements (DV 2 only)	AQ, ISA, NES, NSR, Section 106, VIA, WQ	IS/EA
28	SR-85	Santa Clara	US 101 N IC (Mountain View) - US 101 IC - (San Jose)	Adjacent commercial and residential properties, ROW acquisition of commercial, and undeveloped lands and frontage road (DV 2 only), new retaining walls (DV 2 only), new sound walls (DV 2 only), Interchange replacements (DV 2 only)	AQ, ISA (DV 2 only), NES (DV 2 only), NSR, Section 106 (DV 2 only), VIA (DV 2 only), WQ (DV 2 only)	IS/EA
29	I-85/ US-101	Santa Clara	I-85/US-101 Direct Connectors (x2)	Adjacent commercial and residential properties, Interchange replacements (DV 2 only)	AQ, ISA (DV 2 only), NES (DV 2 only), NSR, Section 106 (DV 2 only), VIA (DV 2 only), WQ (DV 2 only)	IS/EA
30	US-101	Santa Clara	Cochrane - SCL/SM County Line	Adjacent commercial and residential properties, Creek crossings, ROW acquisition of residential and commercial properties, new retaining walls, new sound walls, Interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA

Preliminary Environmental Analysis (Continued)

Project No.	Route	County	Begin - End	Potential Environmental Issues	Environmental Technical Reports Required	Anticipated Environmental Approval (CEQA/NEPA)
31	US-101	San Mateo	SM/SCL County Line - Whipple	Adjacent commercial and residential properties, Creek crossings, ROW acquisition commercial property (DV 2 only), Interchange replacements	AQ, ISA, LHS, NES, NSR, Section 106, VIA, WQ	IS/EA
32	SR-84 WB	Alameda	Toll Plaza - I-880 IC			
33	SR-92 WB	Alameda	Toll Plaza - Hesperian On-ramp			