2020 Peninsula Gateway Corridor Study

Final Report

Appendices

A: Data Collection and Existing Conditions
B: Public Input
C: Conceptual Definition & Engineering of Alternatives
D: Conceptual Cost Estimates
E: Travel Forecasting
F: ALPS Modeling Assumptions

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Final Report

Appendix A

Data Collection and Existing Conditions

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

REVISED Draft Memorandum
Task 3 – Data Collection and Existing Conditions

Prepared for:

City/County Association of Governments
Of San Mateo County

Prepared by:

Kimley-Horn
and Associates, Inc.

April 23, 2004 (REVISED June 1, 2004)

This memorandum summarizes the procedures and findings of *Task 3 - Data Collection and Existing Conditions* of the 2020 Peninsula Gateway Corridor Study, which is being conducted by Kimley-Horn and Associates (KHA) under contract to the City/County Association of Governments of San Mateo County (C/CAG). This document is organized as follows:

I. Introduction
II. Data Collection and Review
III. Summary of Existing Conditions.

I. Introduction

It is recognized that there has been substantial work conducted in the US 101 Peninsula corridor as part of numerous studies and projects. Each of these studies and projects typically include traffic data and an assessment of existing traffic conditions. Efficiency is achieved through utilizing the substantial effort already exerted in the study area to define and establish existing conditions.

KHA obtained data, reviewed a number of planning and engineering documents, and synthesized this summary of existing conditions. Therefore, this memorandum identifies key traffic related issues in the corridor and identifies sources of recent and relevant data for use in the study's operational analyses. This memorandum, like others produced, will be reviewed by C/CAG staff, the Technical Advisory Committee (TAC), and the Policy Advisory Committee (PAC). It, and feedback received on it, will be integrated into subsequent study tasks.

II. Data Collection and Review Procedure

This section discusses the type of data required and the procedure used to obtain and review pertinent data and information.

A. Type of Data and How Used in Study

The following paragraphs describe the primary information needed for the 2020 Peninsula Gateway Corridor Study.

i. Traffic and Truck Volumes

Traffic volumes are critical to the development of the ALPS2000 model used to evaluate corridor conditions, as they are used to calibrate the model and assess existing operating conditions. Since the ALPS2000 model presents traffic conditions for a 24-hour period in hourly increments, both Average Daily Traffic (ADT) and peak hour traffic volumes are required. Traffic volumes were collected for mainline freeway segments, ramps, surface streets that are State highways and intersections where available.

In addition to vehicular traffic volumes, truck volumes (expressed as percentages of total traffic) are required inputs to the operations analysis. KHA attempted to use a single source of traffic volume data for consistency, and was able to get most of the data required from Caltrans. In addition, data from other sources were obtained to complete gaps as necessary.

ii. Travel Times and Speeds

Travel times and speeds are used to calibrate the ALPS2000 model and to help define general operating conditions throughout the corridor. As with traffic counts, KHA used recent Caltrans travel time surveys as the primary source of information for US 101. These data were augmented with data from other studies and field travel time surveys.

iii. Accidents (TASAS)

The Caltrans Traffic Accident Surveillance and Analysis System (TASAS) is the source of accident data on the State highways within the study corridor. Accident data identifies concentrations of accidents (potential areas for improvements) and are used to derive the types of accidents that could be reduced with certain improvements. Accident rates are used to compare accident experience on corridor highways with similar facilities statewide.

iv. Travel Paths of Traffic in the Corridor

Travel path information defines where traffic is coming from and going to within the corridor, and the volume of traffic on these paths. For example, travel path information can identify the magnitude of travel from the Dumbarton Bridge to southbound US 101 in the morning peak period. This allows the separation of ramp volumes into various components, and the isolation of traffic that might be served with new facilities. Travel path information is critical in developing and calibrating the ALPS2000 model.

The documents obtained and reviewed did not contain any useful travel path information for this study, since no formal travel path surveys have been conducted recently. Therefore, the best source of this information is the C/CAG Countywide Travel Forecasting Model, which will be used extensively in the development of the ALPS2000 model, forecasting future demand, and evaluating changes in travel patterns with various solutions. *[Comment by KHA: This part of the evaluation will be conducted and documented during Task 6, "Conduct Operational Analysis."]*

v. Observed Conditions

KHA conducted original field observations of morning and afternoon traffic conditions within the corridor for several reasons: 1), to generally confirm the conditions presented in the documents reviewed and identify any significant differences; 2), to attempt to identify specific reasons for traffic problems (e.g. bottlenecks), and 3), to familiarize staff with the corridor.

B. Data Collection Procedure

This section briefly describes the methods and procedures KHA used to collect traffic data.

i. Data Available from Others

As described above, the primary source of traffic data are documents, studies and reports prepared for numerous projects within the corridor. These sources and the type of information provided are described below.

ii. New Traffic Counts

KHA will augment traffic data from other sources with new traffic counts at selected locations. The locations will be selected based on gaps in available data and the specific scope of the traffic operations analysis. The scope of services includes new intersection turning movement counts at 30 intersections (one day AM and PM peak hour) and new machine traffic counts at 20 roadway locations (three days - Tuesday through Thursday).

iii. Travel Model Data

KHA is working with Hexagon to develop the appropriate information from the San Mateo Countywide Travel Forecasting Model. The existing data generated by the model will include:

- ❑ Year 2000 AM and PM peak period traffic volumes on all model links within the study area;
- ❑ Year 2000 AM and PM peak period intersection turning movements at all interchange ramps serving US 101 within the study area; and
- ❑ Year 2000 select link analysis of links on all State highways within the study area including US 101, SR 84 (Bayfront Expressway), SR 85, SR 114 (Willow Road), and SR 109 (University Avenue). Select link analyses will provide travel path information for each vehicle trip traversing the specified link.

vi. Field Observations

KHA staff conducted drive-through surveys of all State highways within the study area and recorded observations including congested segments, average travel speed, significant queuing, and bottlenecks where they could be identified. The surveys were conducted between March 31 and April 5, 2004. Each State highway segment was driven both in the AM peak period (between 7:30 AM and 9:00 AM) and in the PM peak period (between 4:30 PM and 6:00 PM).

C. Documents Reviewed

Table 1 lists the documents, reports, studies, and other information reviewed and generally identifies the type of information provided in each. This list is not all-inclusive; rather it reflects inputs received from C/CAG staff and TAC members about relevant reports, studies, and ongoing efforts.

III. Summary of Existing Conditions

This section discusses existing traffic conditions based on reviews of relevant studies and original field observations.

A. Summary of Traffic Issues and Conditions Identified in Documents

KHA staff reviewed planning and engineering documents to identify existing issues and operating conditions in the corridor. The review divided the documents by planning area or type of document. The following sections synthesize existing conditions and issues highlighted in selected documents that were considered representative of the corridor. Figure 1 graphically depicts many of these issues.

Please note that some of the following information is dated and does not match existing conditions. Also note that there may be conflicting statements about common subject areas. Such matters are to be expected in a review of this nature.

i. Regional Planning Reports

San Francisco Bay Crossings Study Final Report, Metropolitan Transportation Commission, July 2002.

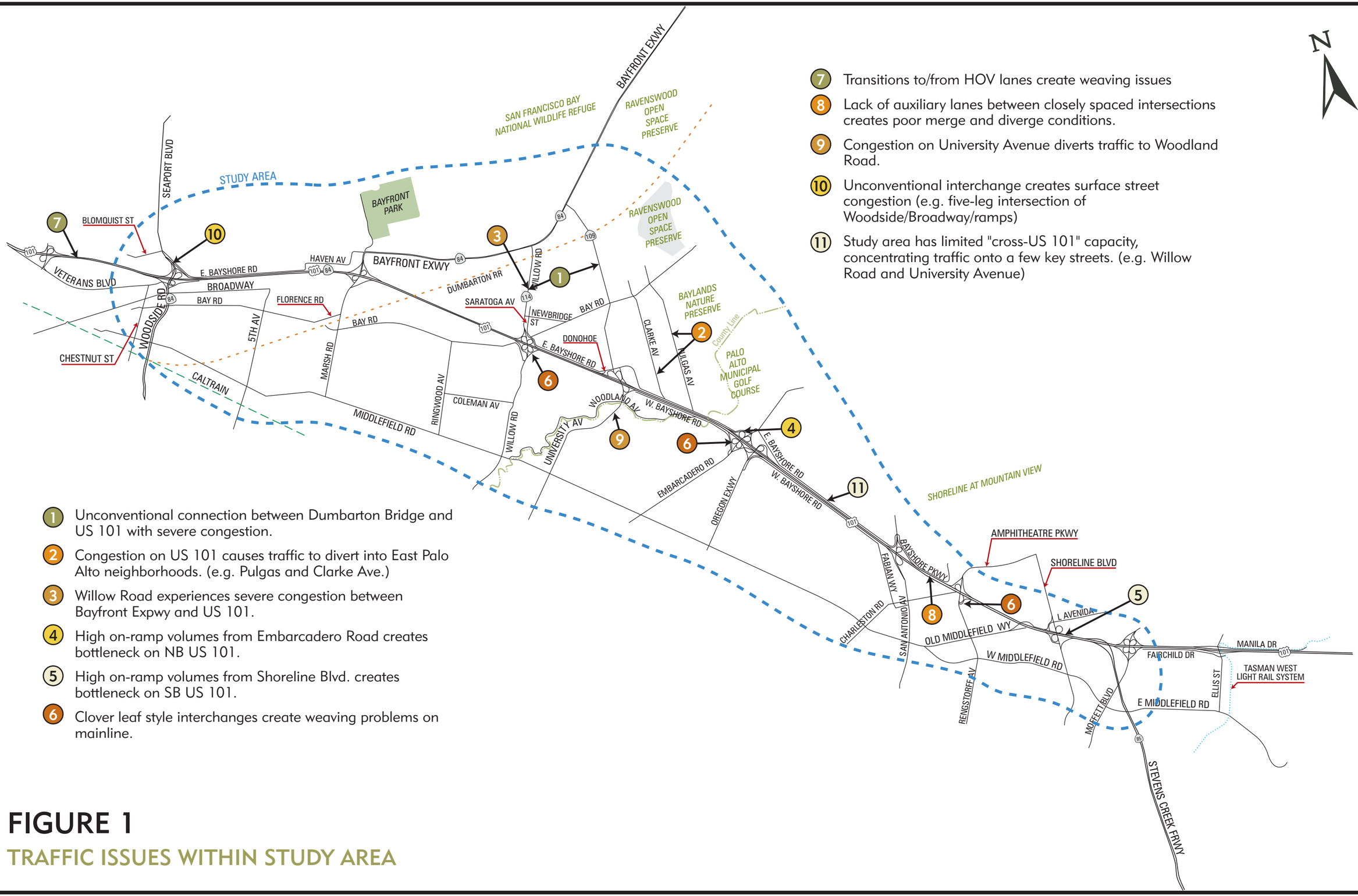
- In the morning peak hour the predominant commute direction on the Dumbarton Bridge is westbound; in the evening peak hour, the predominant commute direction is eastbound.
- Bottleneck #1: In the morning peak commute hour the Dumbarton Bridge toll plaza significantly restricts the flow of westbound traffic. The service capacity of the toll plaza is less than the capacity of the westbound Dumbarton Bridge.
- Bottleneck #2: The University Avenue/SR 84 signalized intersection restricts traffic flow in both the eastbound and westbound directions. The restriction is more severe in the eastbound direction as indicated by the traffic volumes. Even if the toll plaza could deliver more westbound traffic to the Dumbarton Bridge, it is unlikely that the University Avenue intersection could accommodate it.

Table 1
Documents Reviewed and Type of Information Available

			Traffic Volumes			Accident	Existing Cond.	Truck	Travel	OD	Potential
Item No.	**Date**	**Document/Report**	**AADT**	**Peak Hour**	**Forecasts**	**Rates**	**Summary**	**Volumes**	**Times**	**Information**	**Improvements**
1	May-04	C/CAG Travel Demand Model Volume and LOS Plots - Existing and 2025 (C/CAG)		✓	✓					✓	
2	Jul-02	San Francisco Bay Crossings Study (MTC)	✓	✓	✓		✓				✓
3	na	Dumbarton Rail PSR (JPB) -- *not yet issued*									
4	Dec-03	Caltrain Strategic Plan (JPB) -- Draft									
5	Feb-04	Countywide Ramp Metering Study (C/CAG) -- *ongoing effort*	✓	✓	✓		✓		✓		✓
6	na	Countywide ITS Strategic Plan Study (C/CAG) -- *ongoing effort*									✓
7		Charleston Corridor Study (Palo Alto) -- *ongoing effort*	✓	✓			✓				✓
8	Apr-01	Commuter Traffic Mitigation Study (East Palo Alto)		✓			✓				✓
9	Apr-01	San Mateo County - Countywide Transportation Plan (C/CAG)									✓
10		not used									
11	Mar-04	San Mateo County - Draft Congestion Management Program for 2003 (Includes Monitoring Report) (C/CAG)	✓	✓	✓		✓				
12	Dec-00	Santa Clara Valley Transportation Plan 2020 (VTA)									✓
13		not used									
14	Apr-03	Santa Clara County Congestion Management Program Monitoring and Conformance Report (VTA)	✓	✓	✓		✓				
15	Mar-02	San Mateo County Transportation Authority Strategic Plan (SMCTA)									✓
16	Mar-03	D4 Freeway Analysis Project (SCL 101 SB Embarcadero to Lawrence)(Caltrans)	✓	✓			✓	✓			✓
17		Route 101 Ramp Metering Study (C/CAG)	✓	✓	✓		✓		✓		✓
18	Mar-03	Bay Area Freeway Congestion Data 2002 (Caltrans)	✓	✓			✓		✓		
19	Aug-89	Project Study Report - Route 109 from Dumbarton Bridge to Destinations South of the Bridge (Caltrans) 2 copies	✓	✓	✓		✓				✓
20	various	Traffic Impact Analysis Reports (partner agencies)	✓	✓	✓		✓				✓
21	May-04	C/CAG Travel Demand Model Select Link Plots - Existing and 2025 (C/CAG)			✓					✓	
22	na	Woodside Road Interchange EIR (SMCTA, to be released)	✓	✓	✓		✓				✓
23	Jul-03	Draft Report, Contingency Traffic Management Plan for IKEA Opening (East Palo Alto, Kimley-Horn and Associates, July 10, 2003)					✓				✓
24	Sep-03	Draft Existing Conditions Report, Bay Trail Feasibility Study (Callander Associates, September 5, 2003) 2 copies					✓				
25		Ravenswood Open Space Preserve Tidal Marsh Restoration Project (MROSD)									✓
26		San Francisco Bay Area Salt Pond Restoration Project (CA Coastal Conservancy)									✓
27	Oct-02	NASA Ames Development Plan (NASA, October 2002 Draft)									✓
28	Feb-02	Route 101/Willow Interchange Traffic Operations Analysis (SMCTA)	✓	✓	✓		✓				✓
29	Nov-99	Route 84/US 101 Traffic Operation Report (CCS, November 2, 1999)	✓	✓	✓		✓				✓
30		Route 101 Auxiliary Lanes (Marsh to Embarcadero)Traffic Operations Analysis (SMCTA)	✓	✓	✓		✓				✓
31		Route 84 (Bayfront Expressway)(Route 101 to University) Widening Construction Documents (SMCTA)					✓				
32		City of Menlo Park - 2001 - Employee Community Survey					✓				
33		Traffic Data: Florence St/Marsh Road TM Counts - 1 day; Florence St. NB counts - 3 days with speeds		✓							

Table 1
Documents Reviewed and Type of Information Available

			Traffic Volumes			Accident	Existing Cond.	Truck	Travel	OD	Potential
Item No.	**Date**	**Document/Report**	**AADT**	**Peak Hour**	**Forecasts**	**Rates**	**Summary**	**Volumes**	**Times**	**Information**	**Improvements**
34		Traffic Data: University, Willow, Marsh at 84: a.m. and p.m. peak TM counts Woodside/Middlefield a.m. and p.m. peak TM counts El Camino daily counts - various locations	✓	✓							
35	Nov-03	Final Model Validation Report - 101 Corridor between Whipple Avenue and Embarcadero Road (Hexagon, November 21, 2003)	✓	✓	✓						
36	Mar-03	Draft Traffic Forecast Report for Route 101/Route 84 Interchange PR/ED (CCS, March 10, 2003)	✓	✓	✓		✓				
37	Aug-00	PSR (PDS) on Route 101 Woodside Road Interchange Reconstruction (Mark Thomas and Co., August 29, 2000)	✓	✓	✓		✓				✓
38	May-99	PSR Route 84 Extension in San Mateo County Between Marsh Road and Woodside Road/Seaport Boulevard (Mark Thomas and Co., May 7, 1999)	✓	✓	✓		✓				✓
39	Jul-99	3 working papers from Dumbarton Rail Corridor Study (Parsons, July 13, 1999): a. Draft Capital Investments Working Paper (Corridor Rehabilitation) b. Draft Capital Investments Working Paper (Improvements east of NewarkJunction) c. Operating Costs									
40	Jan-02	Average Daily Traffic Volume - 24 Hour Two-way Traffic (City of Menlo Park, 2002)	✓	✓							
41	Jun-02	Traffic Data (AM PM TM counts): Willow/Middlefield 4/17/2002 Marsh/Bay 5/14/2002 Marsh/Bohannon 5/15/2002 Marsh/Scott 5/16/2002 Willow/Bay 5/7/2002 Willow/Newbridge 5/2/2002 Willow/O'Brien 5/9/2002 Willow/Ivy 5/7/2002 Willow/Hamilton 5/8/2002 Willow/Route 84 5/9/2002 University/Bayfont 5/28/2002 University/O'Brien 5/16/2002 Chilco/Bayfront 5/29/2002 Chrysler/Bayfront 5/3//2002 Marsh/Bayfront 5/23/2002 101 SB/Marsh 6/12/2002 101 NB/Marsh 6/11/2002	✓	✓							
42		Ivy Drive Sreetscape Project TIA (Hexagon, December 19,2003)									✓
43	Sep-03	Draft Existing Conditions Report, Bay Trail Feasibility Study (Callander Associates, September 5, 2003)					✓				
44		TASAS Data, Caltrans, 2002-2003				✓					



7 Transitions to/from HOV lanes create weaving issues

8 Lack of auxiliary lanes between closely spaced intersections creates poor merge and diverge conditions.

9 Congestion on University Avenue diverts traffic to Woodland Road.

10 Unconventional interchange creates surface street congestion (e.g. five-leg intersection of Woodside/Broadway/ramps)

11 Study area has limited "cross-US 101" capacity, concentrating traffic onto a few key streets. (e.g. Willow Road and University Avenue)

1 Unconventional connection between Dumbarton Bridge and US 101 with severe congestion.

2 Congestion on US 101 causes traffic to divert into East Palo Alto neighborhoods. (e.g. Pulgas and Clarke Ave.)

3 Willow Road experiences severe congestion between Bayfront Expwy and US 101.

4 High on-ramp volumes from Embarcadero Road creates bottleneck on NB US 101.

5 High on-ramp volumes from Shoreline Blvd. creates bottleneck on SB US 101.

6 Clover leaf style interchanges create weaving problems on mainline.

FIGURE 1

TRAFFIC ISSUES WITHIN STUDY AREA

Year 2002 Bay Area Freeway Congestion Data, Caltrans District 4 Office of Highway Operations.

- ❑ AM peak period of congestion on US 101 from Whipple Road to SR 85 from 7:15 AM to 9:15 AM delay is 1,100 veh-hr in the southbound direction.

ii. Santa Clara County Regional Planning Reports

2002 Monitoring and Conformance Report, Santa Clara Valley Transportation Authority

- ❑ In the morning peak, US 101 northbound from SR 85 to Rengstorff Avenue operates at LOS F with durations of approximately 0.5 hours to 2.5 hours. Southbound from Embarcadero Road to SR 85, US 101 operates at LOS F with durations of 1.0 to 1.5 hours.
- ❑ In the afternoon peak, southbound US 101 exhibits LOS F from San Antonio Road to Shoreline Boulevard with duration of about 1.0 hour.
- ❑ Northbound SR 85 approaching US 101 operates at LOS F in the morning peak with duration of about 1.5 hours.
- ❑ HOV freeway segments on US 101 operate at LOS F in the morning peak on two segments: southbound from Oregon Expressway to Embarcadero Road; and northbound from SR 85 to Rengstorff Avenue. Poor HOV operations are not the result of demand but of weaving movements that could potentially be resolved with direct HOV connections.

District 4 Freeway Analysis Project - SCL 101 Southbound Embarcadero Road to Lawrence Expressway, Caltrans.

- ❑ Existing US 101 Conditions: Current congestion on US 101 as measured with a speed contour map shows US 101 operating below 45 mph starting at 3:15 PM from Oregon Expressway to Shoreline Boulevard, improving about 5:45 PM.

Existing Conditions Report – Bay Trail Feasibility Study, Callendar Associates Landscape Architecture, Inc., September 5, 2003.

- ❑ Isolated trail access near Highway 84.
- ❑ The existing trailhead has a short segment of established trail adjacent to a parking area and is accessible from the Dumbarton Bridge fishing pier.
- ❑ In 1994, the San Mateo County Transportation Authority (SMCTA) purchased the Dumbarton Rail Corridor right-of-way for future transportation purposes and/or to activate rail service.
- ❑ A proposal to reactivate the Dumbarton Rail Corridor to carry nine daily passenger trains across the rail bridge is currently being evaluated by the affected transportation agencies: ACTA, Caltrain, SamTrans, SCVTA. Service would connect the Union City BART station with the Redwood City Caltrain station, with the new stations proposed in East Palo Alto and Menlo Park.

iii. Corridor Studies and Project Study Reports

Traffic Operations Analysis – Route 101/Willow Road Interchange PSR/PDS Draft Final Report," Meyer, Mohaddes Associates, Inc., February 28, 2002.

- The short merge/weave segments between the loop ramps typically create conflicts between entering and exiting traffic, which reduce traffic speed and create some upstream queuing in the number 4 freeway lane. The southbound direction appears to exhibit this constrained operation more often than the northbound direction.
- The existing loop ramps create a weaving section in each direction of Willow Road.
- On Willow Road, the intersection at Newbridge Street is a bottleneck that affects off-ramp traffic in both directions as well as Willow Road traffic approaching the interchange. Northbound off-ramp traffic is routinely queued upstream on the shoulder, and this has a direct effect on the freeway through traffic. The backup on Willow Road caused by the Newbridge bottleneck typically extends across the freeway and constrains southbound to eastbound loop ramp operations, which creates upstream queuing that affects the southbound through traffic on the freeway.

Project Study Report – Route 109 from the Dumbarton Bridge to Destinations South of the Bridge, Caltrans District 4, 1989.

- The western approaches to the Dumbarton Bridge experience some of the worst traffic congestion in the Bay Area. Due to restricted capacity on the Dumbarton Bridge (two lanes in each direction, morning westbound traffic is usually backed up across the bridge through the toll plaza. *[Comment by KHA: two lanes each direction when the referenced PSR was issued.]* Afternoon eastbound traffic backs up on the approaches as far back as US 101.
- Approximately 1/3 of the peak hour trips using the Dumbarton Bridge have origins or destinations south of the Bridge. By providing more direct routing for these trips, congestion on the existing western approaches will be relieved.
- Lack of an adequate regional connection between the Dumbarton Bridge and Route 101 south of University Avenue imposes a considerable amount of through traffic on neighborhoods in East Palo Alto using University Avenue as well as through the industrial area of Menlo Park along Willow Road.

Route 84/US 101 Traffic Operation Report, CCS Planning and Engineering Inc., November 2, 1999.

- The peak direction of US 101 in the vicinity of SR 84 is northbound in the AM peak hours and southbound in the PM peak hours. Northbound mixed flow traffic experiences LOS F in the AM peak hours. Other segments of US 101 operate at LOS E or better during the peak hours. All merging and diverging vehicles at the ramp junctions experience LOS F in the AM or PM peak hours.
- The signalized intersection at US 101 at US 101 Southbound off-ramp/Broadway/Woodside Road and the unsignalized intersection at Seaport Boulevard/East Bayshore are currently operating at LOS F in both peak hours.

Project Study Report – Route 84 Extension in San Mateo County between Marsh Road and Woodside Road/Seaport Boulevard, Caltrans, May 7, 1999.

- ❑ Route 101 and its interchanges in the project vicinity experience heavy congestion in both the AM and PM peak periods. In the AM period the peak direction of travel is southbound and volumes are highest north of Woodside Road. Volumes are slightly lower during the PM peak period with the heaviest volumes observed north of Woodside Road.
- ❑ In the AM peak hour, five of the eleven ramps at the Marsh Road and Woodside Road interchanges operate at LOS E-F; while during the PM peak period three of the eleven ramps operate at LOS E.
- ❑ Traffic operations are constricted on eastbound Woodside Road due to the short distance available between the loop off-ramp and the loop on-ramp for off-ramp traffic to merge into the eastbound Woodside Road traffic stream. A relatively short weaving distance also constricts traffic on eastbound Woodside Road between the northbound-to-eastbound off-ramp and the East Bayshore Road intersection.
- ❑ Weaving occurs on westbound Woodside Road between the northbound-to-westbound off-ramp and the Veterans Boulevard intersection.
- ❑ At the Marsh Road/Route 101 interchange there is a difficult merge from the loop off-ramp onto westbound Marsh Road, which causes back-ups. This problem was eliminated with the new off-ramp as part of the current Marsh Road interchange improvement project.
- ❑ Existing Route 101 ramp volumes at the Woodside and Marsh interchanges are very high.

Peninsula Corridor Ramp Metering Study – No Metering Analysis Results – Final, DKS Associates, CH2MHill, February 27, 2004

- ❑ Major bottlenecks identified in the *existing conditions calibration* tests:
  - o 101 Northbound PM Peak: University to Willow
  - o 101 Southbound AM Peak: Whipple to Seaport, Willow to lane addition, University to County Line
  - o 101 Southbound PM Peak: Seaport to lane addition, Willow to lane addition

iv. Local Traffic Impact Analysis Reports

Commuter Mitigation/Traffic Calming Study – Study Summary and Proposed Improvement Plan Final Report, Fehr and Peers Associates, Inc., April 10, 2001.

- ❑ Portions of Cooley Avenue, Glen Way, Euclid Avenue and Runnymede Street are used as a bypass to northbound University Avenue during the PM peak hour. There are higher than expected volumes on these roadways with limited gaps in traffic, making the roadways unsafe for pedestrians.

Contingency Traffic Management Plan for Ikea Opening, East Palo Alto – Draft Report, Kimley-Horn and Associates, July 10, 2003.

- ❑ Off-site improvements included in the IKEA project:
  - Addition of new right-turn lane westbound between Donohoe/Cooley and East Bayshore/IKEA Entrance Driveway;
  - New traffic signal at Donohoe/Cooley;
  - Creation of a second northbound left-turn lane at University/Donohoe;
  - Modification of traffic signals at Donohoe/East Bayshore and East Bayshore/IKEA Entrance Driveway;
  - Interconnection and coordinated operation of traffic signals between University/Donohoe and East Bayshore/IKEA Entrance Driveway;

B. Summary of Existing Traffic Data

i. Traffic Volumes and Level of Service

Table 2 presents the most recent traffic volume data from Caltrans (year 2002) on State highways within the study area. The data is presented in Average Annual Daily Traffic (AADT) on a typical weekday and for the peak month, and the typical weekday peak hour. These data do not identify AM and PM peak hour volumes, but there are enough peak hour data in the available documents to convert the Caltrans data to AM and PM peak hour by direction.

Table 2 also presents truck volumes and the percentage of trucks where this information was available. As with traffic volumes, the source of truck data is Caltrans. Finally, Table 2 presents roadway Level of Service where this information is available.

Table 3 presents average daily traffic volumes on US 101 and SR 85 interchange ramps throughout the study area. Consistent with traffic volume data, Caltrans is the source of this data. The latest Caltrans ramp volume data is somewhat dated (year 2001). More recent peak hour ramp volume data are available for selected ramps in various traffic studies prepared within the corridor. These will be obtained as needed for the operational analysis.

Figure 2 presents traffic volume data on each segment of the State highway system in the study area.

ii. Travel Time and Speed Data

Table 4 presents Caltrans travel time survey data on two segments of US 101 between SR 85 and Whipple Road (SR 85 to Willow Road and Willow Road to Whipple Road). These data were collected in 2002. It is interesting to note that the southern segment exhibits longer travel times in the PM peak period *in both directions*, while the northern segment exhibits travel times that appear to vary by direction – northbound travel times are longer in the PM peak period, and southbound travel times are longer in the AM peak period.

Table 2
SUMMARY OF TRAFFIC AND TRUCK VOLUMES AND LEVELS OF SERVICE

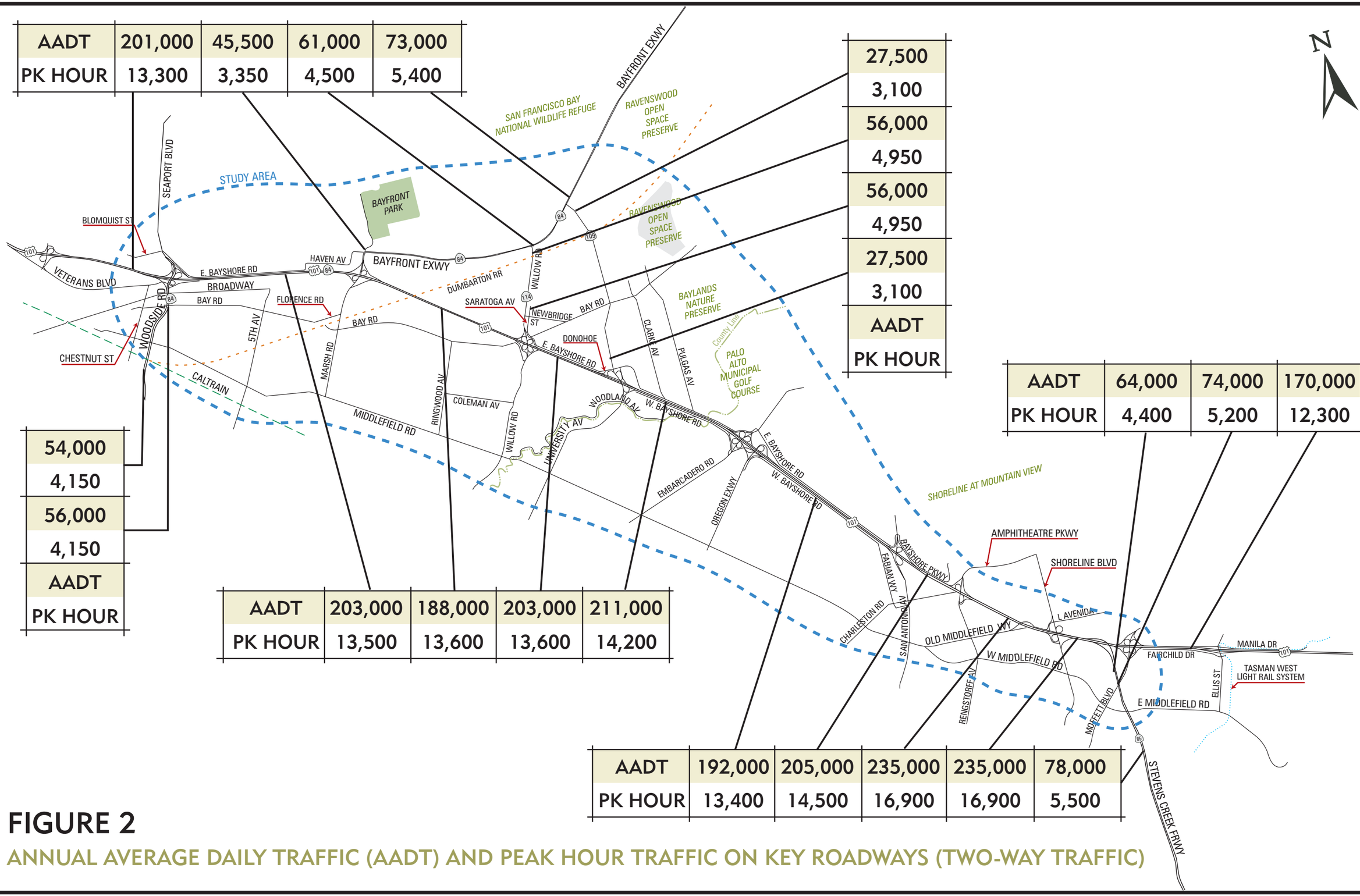
State Highway	Cross Street	County	Postmile	2002 Counts											
				South/West of Cross Street [1]						North/East of Cross Street					
				Peak Hour	Peak Month	AADT	Total Trucks [1]	Total Truck %	Level of Service [2]	Peak Hour	Peak Month	AADT	Total Trucks [1]	Total Truck %	Level of Service [2]
US-101	Moffett Boulevard	SCL	47.89	12,300	174,000	170,000			D	12,500	174,000	171,000			F
US-101	SR-85	SCL	48.10	12,500	174,000	171,000	7,832	4.58%	F	16,900	239,000	235,000	10,575	4.50%	E
US-101	N. Shoreline Boulevard	SCL	48.60						D						F
US-101	N. Rengstorff Avenue/Amphitheatre Parkway	SCL	48.97	16,900	239,000	235,000			F	14,500	208,000	205,000			F
US-101	San Antonio Road	SCL	49.61	14,500	208,000	205,000			F	13,400	195,000	192,000			E
US-101	Oregon Expressway	SCL	50.32	13,400	195,000	192,000			F	14,400	213,000	210,000			D
US-101	Embarcadero Road	SCL	52.17	14,400	213,000	210,000			E	14,200	214,000	211,000			E
US-101	Santa Clara/San Mateo County Line	SCL	52.55	14,200	214,000	211,000			E	14,200	214,000	211,000			F
US-101	University Avenue (SR-109 east of US-101)	SM	0.89	14,200	214,000	211,000			F	13,600	206,000	203,000			F
US-101	Willow Road (SR-114 east of US-101)	SM	1.87	13,600	206,000	203,000	8,587	4.23%	F	12,600	191,000	188,000			F
US-101	Marsh Road (SR-84 east of US-101)	SM	3.59	12,600	191,000	188,000			F	13,500	206,000	203,000			F
US-101	Woodside Road (SR-84 west of US-101)	SM	5.39	13,500	206,000	203,000	9,135	4.50%	F	13,300	204,000	201,000	9,045	4.50%	F
US-101	Whipple Road	SM	6.62	13,300	204,000	201,000			F	14,400	222,000	219,000	10,709	4.89%	F
SR-84 (Woodside Road)	Middlefield Road	SM	25.06	4,150	56,000	54,000			E	3,400	48,500	47,000			E
SR-84 (Woodside Road)	US-101 Southbound Ramps	SM	25.72	4,150	57,000	56,000	1,646	2.94%	E						E
SR-84 (Marsh Road/Bayfront Expy)	US-101 Northbound Ramps	SM	25.81						E	3,350	49,000	45,500	1,320	2.90%	E
SR-84 (Bay Front Expressway)	Willow Road (SR-114 east of US-101))	SM	27.65	3,350	49,000	45,500	1,547	3.40%	F	4,500	65,000	61,000			E
SR-84	University Avenue (SR-109 east of US-101)	SM	28.19	4,500	65,000	61,000	2,751	4.51%	F	5,400	76,000	73,000			F
SR-84	Dumbarton Bridge	SM	29.25						F						F
SR-84	San Mateo County Line	SM	30.15						F						F
SR-84	Dumbarton Bridge Toll Plaza	ALA	3.21	5,400	76,000	73,000			F	5,400	76,000	73,000			
SR-85	Evelyn Avenue/Alama Street	SCL	22.63	5,500	79,000	78,000			F	5,200	75,000	74,000	1,413	1.91%	D
SR-85	Moffett Boulevard	SCL	23.44	5,200	75,000	74,000			D	4,400	65,000	64,000			D
SR-85	Junction, Route 101	SCL	23.87	4,400	65,000	64,000	1,280	2.00%	F						D
SR-114 (Willow Rd east of US-101)	US-101 Junction	SM	5.00						D	4,950	61,000	56,000	3,304	5.90%	D
SR-114 (Willow Rd east of US-101)	SR-84 Junction	SM	5.93	4,950	61,000	56,000	2,318	4.14%	D						D
SR-109	Notre Dame Avenue	SM	1.10						E	3,100	29,500	27,500			E
SR-109	SR-84/Dumbarton Bridge Junction	SM	1.87	3,100	29,500	27,500	710	2.58%	E						E

[1] Source: Caltrans Vehicle and Traffic Data Systems Unit, 2002.
[2] Sources: Draft 2001 Monitoring and Conformance Report, Santa Clara Valley Transportation Authority, 2001.
Draft Congestion Management Program for 2003, City/County Association of Governments of San Mateo County, 2003.

Table 3
SUMMARY OF US 101 AND SR 85 RAMP VOLUMES IN STUDY AREA

State Highway	Interchange	2001 Ramp AADT Counts							
		Off-Ramp				On-Ramp			
		Northbound		Southbound		Northbound		Southbound	
		NB/EB Cross Street	SB/WB Cross Street	NB/EB Cross Street	SB/WB Cross Street	NB/EB Cross Street	SB/WB Cross Street	NB/EB Cross Street	SB/WB Cross Street
US-101	Moffett Boulevard	1,400	2,500	2,800	2,650	2,100	1,750	2,550	1,550
US-101	SR-85	-	-	-	32,000	31,500	-	-	-
US-101	N. Shoreline Boulevard	12,100		8,400		5,000	4,150	6,400	9,000
US-101	N. Rengstorff Avenue/Amphitheatre Parkway	2,600	6,300	7,200		7,200		6,200	
US-101	San Antonio Road	7,500		1,500	12,700	10,000	1,450	12,700	
US-101	Oregon Expressway	-	6,700	-	11,600	11,700	-	6,300	-
US-101	Embarcadero Road	7,100	6,600	2,450	4,300	5,900	2,650	7,700	4,850
US-101	University Avenue (SR-109 east of US-101)	8,800	4,550	6,500	5,400	5,400	5,300	5,100	9,100
US-101	Willow Road (SR-114 east of US-101)	12,100	7,400	7,700	4,650	3,900	5,900	5,900	11,300
US-101	Marsh Road (SR-84 east of US-101)	10,800	6,600	17,700		5,800	13,000	8,700	
US-101	Woodside Road (SR-84 west of US-101)	3,300	16,500	3,900	13,100	14,400	4,350	18,100	
US-101	Whipple Road	11,000		19,900		14,700	1,850	10,300	1,700
SR-85	Evelyn Avenue/Alama Street	4,100		-	-	-	-	3,650	
SR-85	Moffett Boulevard	6,100		-	-	-	-	4,000	

Source: Caltrans Vehicle and Traffic Data Systems Unit, 2002.



AADT	201,000	45,500	61,000	73,000
PK HOUR	13,300	3,350	4,500	5,400

27,500	
3,100	
56,000	
4,950	
56,000	
4,950	
27,500	
3,100	
AADT	
PK HOUR	

54,000	
4,150	
56,000	
4,150	
AADT	
PK HOUR	

AADT	64,000	74,000	170,000
PK HOUR	4,400	5,200	12,300

AADT	203,000	188,000	203,000	211,000
PK HOUR	13,500	13,600	13,600	14,200

AADT	192,000	205,000	235,000	235,000	78,000
PK HOUR	13,400	14,500	16,900	16,900	5,500

FIGURE 2

ANNUAL AVERAGE DAILY TRAFFIC (AADT) AND PEAK HOUR TRAFFIC ON KEY ROADWAYS (TWO-WAY TRAFFIC)

Table 4
SUMMARY OF US 101 TRAVEL TIMES IN STUDY AREA

State Highway	Segment	Peak Period	2002 Travel Time/Speeds				
			Free Flow Speed	Average NB Travel Time	Average Speed (mph)	Average SB Travel Time	Average Speed (mph)
US-101	Route 85 to Willow Road	AM	65	6.75	55	10.49	35
US-101		PM	65	10.42	36	12.36	30
US-101	Willow Road to Whipple Road	AM	65	5.68	50	8.88	32
US-101		PM	65	8.75	32	5.75	50

Source: Caltrans District 4 Office of Highway Operations, March 2003.

Figure 3 illustrates areas of congestion on US 101 during the peak period. This information was derived from Caltrans speed data, levels of service findings from various reports, and observed conditions. This simply corroborates visually the poor conditions cited in Table 2, using information from a different source.

iii. Accident Data

Table 5 compares accident rates for 2003-2004 on the State highways in the study area with statewide averages for similar facilities. These data indicate that corridor accident experience is a significant issue given accident rates are higher than statewide averages on 21 of the 29 segments noted.

iv. Observed Conditions

The following remarks summarize field observations made by KHA staff during driving tours of the corridor. Generally, these field observations confirm the technical information presented in the documents reviewed as part of this task.

Morning Peak Period

- **US 101** traffic was observed to be moving at or near the speed limit in both directions in the majority of the study area during the morning peak period. US 101 northbound and southbound and SR 85 traffic experience congestion because of the US 101/SR 85 junction merge. Traffic on northbound SR 85 was observed to have a relatively long vehicular queue waiting to merge with northbound US 101. Both directions of US 101 between Woodside Road and SR 85 include three mixed traffic travel lanes and one high-occupancy vehicle lane. US 101 northbound traffic slows to approximately 40 mph near the Shoreline Boulevard and Amphitheater Parkway interchanges, but resumes a speed at or near the speed limit north of this location. Trucks are advised while traveling on US 101 to use Willow Road to connect to the Dumbarton Bridge. Additionally, northbound US 101 between Marsh Road and Woodside Road routinely travels excessively below the speed limit most likely due to the short merges at each ramp and the subsequent weaving at these locations. The westbound left-turn from Woodside Road to the southbound US 101 on-ramp queues beyond the turn bay due to a large volume of heavy trucks arriving from locations east of the intersection.
- **SR 84** traffic moves at of near the speed limit between its intersections with US 101 and the Dumbarton Bridge. Westbound traffic slows approaching the two westbound left turn lanes onto University Avenue as vehicles attempt to get into the vehicular queue for this movement. Relatively large volumes of traffic exit westbound Bayfront Expressway at the intersections of University Avenue and Willow Road in the two left turn lanes provided at each intersection.

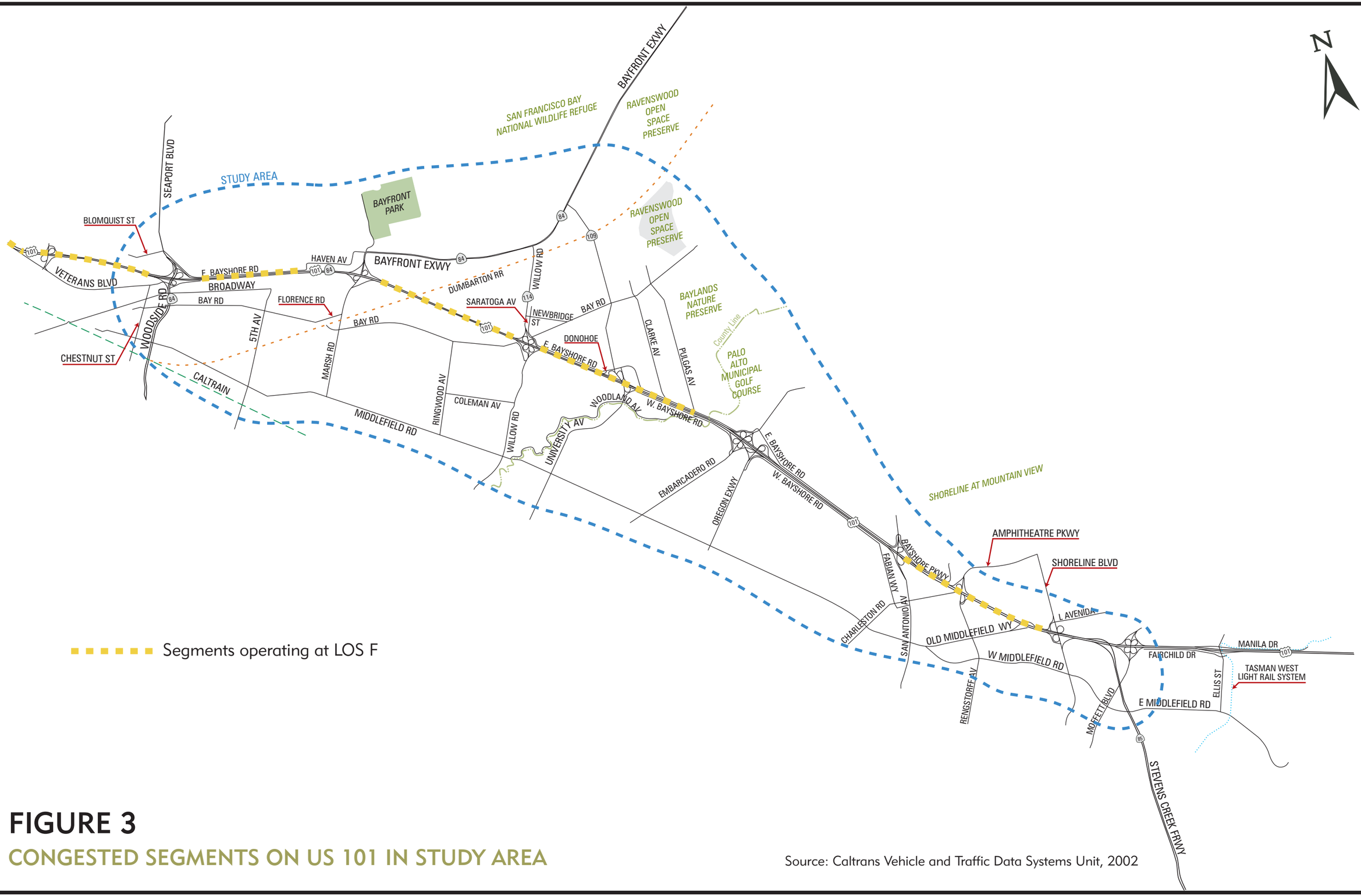


FIGURE 3

CONGESTED SEGMENTS ON US 101 IN STUDY AREA

Source: Caltrans Vehicle and Traffic Data Systems Unit, 2002

Table 5
SUMMARY OF ACCIDENT RATES IN STUDY AREA

State Highway	Cross Street	County	Postmile	2003-04 Accident Rates	
				Accidents Per MVM	Statewide Average for Similar Facility
US-101	Ellis Street	SCL	47.01	**1.70**	0.99
US-101	Moffett Boulevard	SCL	47.89	**1.79**	1.01
US-101	SR-85	SCL	48.10	**1.50**	1.10
US-101	N. Shoreline Boulevard	SCL	48.60	**1.40**	1.22
US-101	N. Rengstorff Avenue/Amphitheatre Parkway	SCL	48.97	0.94	1.17
US-101	San Antonio Road	SCL	49.61	**1.43**	1.10
US-101	Oregon Expressway	SCL	50.32	**2.14**	1.11
US-101	Embarcadero Road	SCL	52.17	**1.35**	1.13
US-101	Santa Clara/San Mateo County Line	SCL	52.55	0.76	1.12
US-101	University Avenue (SR-109 east of US-101)	SM	0.89	**1.32**	1.11
US-101	Willow Road (SR-114 east of US-101)	SM	1.87	**1.89**	1.08
US-101	Marsh Road (SR-84 east of US-101)		3.59	**1.68**	1.07
US-101	Woodside Road (SR-84 west of US-101)	SM	5.39	**2.34**	1.10
US-101	Whipple Road	SM	6.62	**1.77**	1.13
US-101	Holly Street	SM	8.40	**1.17**	
SR-84 (Woodside Road)	Middlefield Road	SM	25.06	**2.73**	1.35
SR-84 (Woodside Road)	US-101 Southbound Ramps	SM	25.72	**4.59**	1.34
SR-84 (Marsh Road/Bayfront Expy)	US-101 Northbound Ramps	SM	25.81		
SR-84 (Bay Front Expressway)	Willow Road (SR-114 east of US-101))	SM	27.65	**2.10**	1.75
SR-84	University Avenue (SR-109 east of US-101)	SM	28.19	1.47	1.75
SR-84	Dumbarton Bridge	SM	29.25	1.02	2.08
SR-84	San Mateo County Line	SM	30.15	1.03	2.40
SR-84	Dumbarton Bridge Toll Plaza	ALA	3.21	**2.52**	0.75
SR-85	Evelyn Avenue/Alama Street	SCL	22.63	0.55	1.16
SR-85	Moffett Boulevard	SCL	23.44	0.96	1.10
SR-85	Junction, Route 101	SCL	23.87	**1.79**	1.05
SR-114 (Willow Rd east of US-101)	US-101 Junction	SM	5	1.30	2.10
SR-114 (Willow Rd east of US-101)	SR-84 Junction	SM	5.93	**2.25**	1.66
SR-109	Notre Dame Avenue	SM	1.1	0.13	1.75
SR-109	SR-84/Dumbarton Bridge Junction	SM	1.87	**1.86**	1.34

Source: Caltrans District 4 Selective Accident Rate Calculation Route Sequence, March 2004.

- **Willow Road** traffic traveling eastbound during the morning peak period moves at or near the speed limit with a moderate to light volume. Mid-Peninsula High School is located midway between Bayfront Expressway and US 101, fronting the south side of Willow Road. Westbound traffic on Willow Road during the morning peak period was observed to be bumper-to-bumper between Bayfront Expressway and US 101. It appears that this is the result of congestion at each of the signalized intersections in this reach.
- **University Avenue** traffic traveling eastbound during the morning peak period moves at approximately 25 to 30 mph between US 101 and Bayfront Expressway. Westbound University Avenue traffic is heavily congested and exhibits a solid backup between the intersections of O'Brien Drive and US 101. Traffic was observed to be traveling as slowly as 5 to 10 mph in this section. It was often noted that westbound queuing extended through two or more intersections, creating a slow metering effect on University Avenue. University Avenue changes to one lane west of US 101, creating further queuing as vehicles wait to merge.

Afternoon Peak Period

- **US 101** has several distinct areas of congestion which affect the entire length of the corridor. Southbound, traffic is slow from University Avenue to Shoreline Boulevard. It was observed that traffic entering southbound US 101 from eastbound Shoreline Boulevard must do so within a relatively short merge distance, thus creating a bottleneck and the resulting southbound backup. Northbound, traffic congestion occurs at the US 101/SR 85 interchange primarily because of the merging conditions at the SR 85 ramp junction. Further north, traffic entering US 101 from Embarcadero Road in a relatively short merge is a primary bottleneck. At the interchange of US 101 and Willow Road, the southbound loop ramps include a very short slip lane length for acceleration/deceleration in this location. Additionally, northbound US 101 between Marsh Road and Woodside Road routinely travels excessively below the speed limit most likely due to the short merges at each ramp and the subsequent weaving at these locations.
- **SR 84** travels at or near the speed limit between its intersection with US 101 and the Dumbarton Bridge. During field observations, traffic on SR 84 was routinely stopped at the T-intersection of SR 84/Chrysler Drive. It was observed that the vehicles exiting Chrysler Drive eastbound used all of the green time provided for side street traffic at this intersection. The traffic volume destined for the Dumbarton Bridge was observed to be dominant during the afternoon peak hour.
- **Willow Road** traffic traveling toward the Dumbarton Bridge queues approximately to the intersection of Ivy Lane and Willow Road in the outside lane, preparing to turn right at the Willow Road/Bayfront Expressway intersection. Traffic in the eastbound inside lane and the two westbound travel lanes on Willow Road travel at or near the speed limit. Class II bike lanes exist on Willow Road between O'Brien Drive and US 101. The northbound left turn lane exiting Bayfront Expressway onto westbound Willow Road is a lagging left turn.
- **University Avenue** At several locations there are "Keep Clear" areas to prevent vehicles traveling in the congestion from blocking westbound left turning vehicles from turning onto side streets.

C. Preliminary Conclusions

i. Overview of Existing Conditions

Clearly, the State highways within the study area all experience substantial traffic demand and poor operating conditions in the commute peak periods. Several important findings from this review are summarized below.

- The unconventional connection between the Dumbarton Bridge (SR 84) and US 101 contributes to the congestion on arterial highways SR 109 (University Avenue) and SR 114 (Willow Road) and the interchanges with US 101.
- Congestion of arterial highways approaching and departing the Dumbarton Bridge creates neighborhood traffic impacts in Menlo Park, Palo Alto and East Palo Alto.
- Older full cloverleaf interchanges without collector-distributor roads create short weave conditions resulting in pockets of congestion, which have upstream effects on traffic flow.
- Where High Occupancy Vehicle (HOV) lanes end or near major interchanges, there is substantial weaving on the mainline resulting in bottlenecks and upstream congestion.
- Select high volume freeway ramps with short merge areas create bottlenecks that cause upstream congestion.
- Lack of auxiliary lanes between closely spaced interchange ramps creates numerous weaving conditions throughout the corridor, exacerbating highly congested conditions.
- Accident rates on certain segments of State highways in the study area are significantly higher than the statewide average for similar facilities.
- Poorly configured off-ramp intersections with surface streets, combined with high traffic volumes, create back-ups that extend onto US 101.

ii. Potential Areas of Emphasis for Study Solutions

Based on the documented problems in the study corridor, some general and specific potential solutions were identified and are listed below. While these concepts would fully or partly address the identified problems in the corridor, they likely represent only a subset of potential solutions that could be considered.

- Ramp metering at all interchanges in the corridor.
- Modification of full cloverleaf interchanges to eliminate weaving sections (e.g. conversion to partial cloverleaf or provision of collector-distributor roads).
- Auxiliary lanes between ramps or lengthening of on-ramp merge areas.
- Additional highway capacity between the Dumbarton Bridge approach and US 101.
- Improved off-ramp intersections with surface streets.
- Direct HOV ramps connecting US 101 to key interchanges.
- Operational improvements to arterial highways including access management, grade separation, widening, and/or signal system upgrades.
- ITS features to help manage traffic operations and enhance emergency response.

2020 Peninsula Gateway Corridor Study

Final Report

Appendix B

Public Input

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Draft Memorandum
Task 2 – Public Input

Prepared for:

City/County Association of Governments
Of San Mateo County

Prepared by:

Kimley-Horn
and Associates, Inc.

May 26, 2004

This memorandum summarizes the procedures and findings of *Task 2 – Public Input* of the 2020 Peninsula Gateway Corridor Study, which is being conducted by Kimley-Horn and Associates (KHA) under contract to the City/County Association of Governments of San Mateo County (C/CAG). This document is organized as follows:

I. Public Input Process
II. Feedback from Community
III. Summary of Potential Solutions Cited

I. Public Input Process

Feedback was obtained from the public during five formal open meetings and from other sources, including written and electronic correspondence. Staff from C/CAG, with assistance from KHA, organized the public forums and received other inputs directly. KHA prepared a PowerPoint presentation and handout that summarized the study objectives, issues, and potential kinds of improvements that might be considered. The formal meetings involved a 25-minute presentation by, and questions and answers. Each meeting lasted approximately two hours. KHA staff participated in 3 of the 5 meetings and C/CAG staff participated in all 5 meetings. Notes were taken by C/CAG and KHA and became the input for this memorandum. Each meeting lasted approximately two hours.

II. Feedback from Community

This section summarizes comments and ideas about potential solutions that were voiced at the public meetings, as well as other communications from individuals.

A. Public Meetings

The following paragraphs describe highlights of public comments and ideas raised during five public meetings.

i. Public Meeting, February 28, 2004

Approximately 34 people attended this meeting, held on a Saturday morning at The Avenidas in Palo Alto. The following points are highlights of comments and ideas.

Comments

1. Communication about the study should be ongoing and easy to access, and should make use of electronic media when possible. There should be opportunities for dialogue about community and social implications of traffic conditions and potential improvements. Perhaps a sub-regional network should be established to aid the dialogue.

2. A simulation model should be created and made available to the public so individuals can study the conditions and potential improvements on their own.
3. Lists of the Technical Advisory Committee (TAC) and the Policy Advisory Committee (PAC) members should be made available to the public.
4. The study should concentrate on traffic flow between US 101 and the Dumbarton Bridge.
5. The study should focus on better use of University Avenue and Willow Road.
6. The study should address better use of I-280.
7. The study should consider preserving value in the corridor.
8. Employers should be responsible for their commuting employees.
9. Jobs need to be closer to residence locations.
10. The study should consider ways to shift local trips from vehicle to pedestrian mode.
11. East Palo Alto is becoming more of a trip destination, and this needs to be considered in the study.
12. Bicycle routes need to be safer.
13. Truck weight limits should be posted.
14. Sensitive areas in the corridor include the Baylands and the Bay Trail.
15. The study should explore ways to mitigate opposition to a new connection through the wetlands in light of the tradeoff between preserving wetlands and reducing air pollution.
16. Growth assumptions need to be specified in the study.
17. The study should consider potential implications of tidal flooding as set forth in a recent study by the Army Corps of Engineers.
18. The implications of a rise in sea level should be considered.
19. The study should consider the implications of increasing gas price on traffic demand.
20. The study should establish a Palo Alto business registry, identifying where employees live.
21. The study should look at how transit could be more effectively used.
22. The study should include the Dumbarton Express Bus.
23. The study should consider cross-bay traffic as well as local traffic.
24. The study should look at *transportation* issues, not just <u>traffic</u> issues. Consider detrimental effects of alternatives on bicycle and pedestrian travel.
25. Include transit only lanes in alternatives.
26. Consider potential for bus improvements such as dedicated bus lanes.
27. Consider harmful effects of roadway solutions on transit service.
28. The Dumbarton Rail Project should include park and ride lots.

29. Consider positive solutions built in Seattle and San Francisco.
30. Consider shared ride services (taxi, limousine, vehicle sharing).
31. The "Smart Growth" philosophy should be incorporated in the study.
32. Consider solutions that improve neighborhoods and bay lands.
33. Middlefield Road should not be considered a "freeway reliever route."
34. Evaluate the harmful effects of freeway reliever routes.
35. Commercial development should be incorporated into alternatives.
36. Underground facilities should be considered only where there is existing development.

Ideas about Potential Improvements

1. na/bp Maximize bike lanes in the corridor.
2. na/bp Construct a bike path connecting Marsh Road and Bayfront Park in Menlo Park.
3. na/bp Construct bike paths in the Dumbarton Railroad right-of-way.
4. na/bp A bike path is needed east of US 101 north of Marsh Road (to connect to Redwood City and points north).
5. na/bp A bike path is needed between the shoreline and the intersection of Willow Road and Bayfront Expressway.
6. na/bp A bike lane should be constructed to connect East Palo Alto and Palo Alto.
7. na/bp Sidewalks should be constructed on Willow Road and University Avenue, from Adams to the Bayfront Expressway.
8. na/bp Sidewalks should be constructed in Menlo Park business parks.
9. na/bp Pedestrian conditions at the Willow Road/US 101 interchange ramps would be improved if turning radii were shortened.
10. na/bp Evaluate additional pedestrian over crossings on US 101.
11. na/bp Sidewalks are needed at the intersection of Willow Road and Bayfront Expressway to better connect adjacent uses.
12. p Congestion pricing and other economic incentives that would reduce traffic should be considered.
13. u There should be less on-street parking on University Avenue in East Palo Alto, to make room for additional traffic capacity. This would be complemented by increasing off-street parking supply by building parking structures.
14. p High occupancy toll lanes should be considered.
15. na/o Consider negative solutions, like reducing capacity by removing lanes on roadways.
16. lc Consider lower cost solutions like signalization.

17. lc Traffic signals are needed in the business park near Adams in Menlo Park.
18. its Traffic adaptive signals should be considered.
19. w Willow Road should be expanded (i.e. increase capacity). One option is to double-deck Willow Road.
20. 101 Add capacity to US 101, either by double-decking it or putting the freeway underground. The latter idea would be complemented by developing housing over the underground facility.
21. 101 The cloverleaf interchange at Willow Road/US 101 should be eliminated in favor of a partial cloverleaf design.
22. o Roundabouts should be used wherever possible.
23. o Consider new under crossings of US 101 to provide better connectivity between communities.
24. nc The "Southern Crossing" should be considered.
25. nc Oregon Expressway should be extended to the Dumbarton Bridge.

ii. Business Community Meeting, March 11, 2004

DPR Corporation in Redwood City was the venue for a meeting of members of the Redwood City-San Mateo County Chamber of Commerce, The Menlo Park Chamber of Commerce, the Silicon Valley Manufacturers' Group and other individuals. Approximately 35 attendees generated the following comments and ideas.

Comments

1. The study area should include El Camino Real, where a lot of US 101 traffic is generated. This would allow concentration of study as well as consideration of grade separation projects on the Caltrain property.
2. The study should be coordinated with the Woodside Road/US 101 Interchange project, particularly in relation to the potential extension of Bayfront Expressway to Woodside Road.
3. Redwood City needs to work with adjacent communities on flood control issues.
4. The study should consider emergency vehicle response needs and impacts during peak periods.
5. The study needs to consider possible impacts of alternatives on mobile homes adjacent to US 101.
6. C/CAG should provide periodic information and updates about the study.
7. During the PM peak period, traffic from Santa Clara saturates the northbound off-ramp at Willow Road/SR 101, causing severe delay.

8. Is the VTA considering reducing US 101 traffic that originates south of the study area? A Southern connection between US 101 and the Dumbarton Bridge would accommodate some of this traffic.
9. The study should consider disaster preparedness, especially what happens if a major highway is closed by a major disaster.
10. The study should consider the impact of the high speed rail project from Los Angeles to San Francisco, and the impact of other transportation improvements (like ferry service from San Francisco to Redwood City) that may be implemented prior to 2020.
11. Double-decking highways could introduce seismic risks.
12. Roundabouts are dangerous and should not be constructed.
13. Provide traffic signal priority for emergency vehicles.
14. Where considering traffic calming measures, bulb outs or roundabouts, rather than stop signs or speed bumps, are favored with respect to emergency vehicle response.
15. Emergency vehicle access must be considered in all alternatives, especially elevated roadways.
16. If a flyover ramp is proposed, it should include a HOV lane.

<u>Ideas about Potential Improvements</u>

1. m & o Increase capacity on Marsh Road (west of US 101) and Middlefield Road to a minimum of four lanes, to improve emergency vehicle response.
2. o Grade separations are needed at street crossings on the Dumbarton Rail line. This improves traffic operations, safety, and emergency vehicle response.
3. o Consider ways to serve Dumbarton Bridge traffic destined for points west of US 101 *that do not connect to US 101.*
4. na/hov A HOV facility constructed above the Southern connection may be possible, and would make best use of limited right-of-way width.
5. nc An extension of Bayfront Expressway should not impede traffic going from the Port of Redwood City to US 101.
6. 101 The interchange at Willow Road and US 101 needs to be upgraded.
7. 101 The interchange at Woodside Road and US 101 needs to be upgraded.
8. its Intelligent Transportation Systems (ITS) should be considered, including cameras, changeable message signs, and communications linkages between public safety dispatch centers and traffic operations centers. These improvements should not distract drivers.

iii. Public Meeting, March 17, 2004

Acterra and the San Francisquito Creek Watershed Council hosted a meeting in Palo Alto. Approximately 35 attendees contributed the following comments and ideas.

Comments

1. Given a choice, living with traffic is preferred over damaging the environment.
2. The study should consider the impact of vehicle size on traffic conditions.
3. Assess the potential traffic impacts of ferry service to Redwood City.
4. Projects that increase the impervious ground surface area *should not be constructed*.
5. Any tunnels that are built should also provide bypass channels for flood control.

Ideas about Potential Improvements

1. na/bp Construct separate facilities for bikes and cars.
2. w Construct pedestrian and bicycle overpasses on Willow Road and reduce the number of traffic signals.
3. na/t Increase the usage of public transit, such as shuttles, on the freeways.
4. its Increase the usage of ITS, such as changeable message signs.
5. u Build a tunnel beneath University Avenue between US 101 and East Palo Alto City Hall (on University Avenue north of Bay Street).
6. 101 Improve the US 101/Marsh Road interchange.
7. na/hov Build a HOV flyover bridges from US 101 to connecting streets.
8. o Build an elevated roadway above the Dumbarton Railroad right-of-way to connect to US 101.
9. o Make East Bayshore an expressway and eliminate some exits from US 101.
10. na/hov Build a HOV bridge as a part of the Dumbarton Rail project.

iv. Public Meeting, March 27, 2004

The East Palo Alto Transportation Academy hosted a meeting in East Palo Alto and 10 people attended. This was a "dress rehearsal" for participation in the subsequent formal meeting on March 31 in East Palo Alto. The following ideas were raised.

Comments

1. Generally, where new elevated roads are considered in East Palo Alto, use space below for "Mom and Pop" businesses that provide jobs and economic prosperity.

2. Provide opportunities and incentives for through traffic to stop and shop in East Palo Alto.
3. Apply the kinds of improvements made on Route 128 in Boston.

Ideas about Potential Improvements

1. tc & u Add an "East Palo Alto Only" traffic lane in each direction on University Avenue that is to be used only for access to East Palo Alto neighborhoods. Prohibit, with signs and enforcement, through traffic on neighborhood streets.
2. tc Give residents the exclusive right to use local neighborhood streets such as Cooley, Pulgas, and Clarke.
3. tc Prohibit left turns from eastbound Bay Road to northbound University Avenue from 3:00 PM to 7:00 PM.
4. na/t Emphasize public transportation on University Avenue, using clean fuel buses.
5. na/bp Build a bike path between the East Bay and East Palo Alto.
6. na/o Reduce traffic flow on University Avenue.
7. na/o Reduce speeding on University Avenue.
8. na/bp Widen sidewalks on University Avenue to make the street more pedestrian friendly.
9. na/bp Create a pedestrian and shopping mall on University Avenue.
10. na/o Reduce capacity on University Avenue by taking away one lane in each direction (leaves a two-lane roadway) between O'Brien Drive to Donohoe Street, a) to force other communities to act on alternatives, and b) to make University Avenue pedestrian friendly.
11. u Place University Avenue underground between US 101 and SR 84, and provide access at Bay Road, Bell Street, and Donohoe Street. An alternative to this would involve building an above-ground roadway over a multi-level housing/retail/office development.
12. w Improve the intersection of Willow Road and Newbridge Street, to reduce the impact of Willow Road traffic on the side street.
13. w Provide a series of grade separations on Willow Road at local intersections. This would increase capacity.
14. w Construct a "fast lane" or tunnel along Willow Road, with no traffic signals.
15. w Construct a double deck or tunnel roadway on the Willow Road alignment.
16. p Require payment of a toll to use a new elevated or buried roadway.
17. na/bp Construct pedestrian/bicycle tunnels beneath US 101 to link East Palo Alto and Palo Alto.

18. nc & bp & na/lu Construct a southern connector between US 101 and SR 84 along the Bay with bike lanes, pedestrian trails and bay front revitalization. This should be an environmentally friendly causeway in the middle of marshland completely away from East Palo Alto. An alternative would be a tunnel. It should reduce traffic on East Bayshore Road and University Avenue by providing an alternate route for commuters going toward San Jose.
19. nc and na/nc Provide a new highway linkage between SR 85 and SR 84 or I-880.
20. 101 Expand US 101/University Avenue interchange to improve traffic on the Donohoe Street between Capitol Avenue and University Avenue.
21. 101 & w Between Embarcadero Road and Willow Road, place US 101 underground and construct a new grade separation at the intersection of Willow Road and Newbridge Street.
22. 101 & na/lu Between Embarcadero Road and Marsh Road, place US 101 in a tunnel and build a park on top and provide affordable housing and office/retail uses on each side of the new facility.

v. Public Meeting, March 31, 2004

The City of East Palo Alto hosted the final public input meeting conducted during this task. Approximately 46 people attended; their comments and ideas are summarized below.

Comments

1. The aerial map is misleading because it shows Willow Road connecting to El Camino Real, which is not correct. Also, one can infer that Willow Road is a major facility with a lot of traffic.
2. There needs to be more input to this study from the Latino community.
3. Queued traffic on University Avenue routinely blocks the Bell Road intersection and creates substantial delay to side street traffic.
4. Large employers should be encouraged to operate flex-time schedules, such as four day work weeks and staggered work start times, to reduce commute travel.
5. Consider options to reduce commuter traffic in the region.
6. Fastrak should be mandatory for all Bay Area residents.
7. There needs to be a public education campaign on transit issues, and a media campaign to increase awareness of transit services, including at the high school level.
8. All transportation projects should be required to practice First Source hiring.
9. East Palo Alto's only remaining open space – occupied by dikes – must be preserved and not used for roadways.
10. Any bike or pedestrian paths should be constructed in an environmentally friendly manner.

11. Open spaces need to be accessible by vehicles and this requires infrastructure.
12. Housing should be built near businesses to reduce commute traffic.
13. The elected officials involved should be asked to conduct a community survey regarding the preliminary results of the study.
14. The Dumbarton Bridge should be classified as a nuclear free zone.
15. All cities and the County should be required to use clean fuel vehicles.
16. All construction should use recycled materials.
17. Old growth trees should be preserved where possible, and ivy removed from them to protect them.
18. There should be an occasional moratorium on auto traffic in favor of exclusive use by transit.
19. Small office/home office ("SOHO") uses should be encouraged.
20. Do not build new roads through the Baylands.
21. Assess the visual and noise impacts on residential and commercial neighborhoods when considering double-decking roadways.
22. Do not construct double-decked roads in residential areas.
23. Convert University Avenue and US 101 into open space plazas.
24. Make all tunnel projects dual use roadway/flood control facilities.

<u>Ideas about Potential Improvements</u>

Note: Many ideas raised during the March 27 meeting were repeated during the March 31 meeting, because many of the same people attended both meetings. Therefore, to eliminate redundancy and simplify the presentation, the following points highlight ideas that differ from those raised March 27.

1. tc Implement traffic calming measures on Pulgas Avenue.
2. na/o Construct new lanes on I-280 to serve trucks that now use US 101.
3. na/bp Incorporate bike and pedestrian access paths in existing and new parking lots.
4. o Make Clarke Avenue one-way.
5. w Construct and operate reversible lanes on Willow Road.
6. 101 Modernize and update interchanges on US 101 between Willow Road and SR 85.
7. na/hov Construct HOV lanes on University Avenue and add another pair of HOV lanes on US 101.
8. na/bp & o Revise the configuration of University Avenue to incorporate a bike path and parking on one side.

9. p Meter traffic based on license plates and variable tolls.
10. na/t Extend Bayfront Expressway to San Antonio Road as a dedicated express bus facility during peak hours.
11. o Install reversible lanes on all extensions considered as well as the freeway.
12. na/oExtend Willow Road to I-280.
13. na/o Extend SR 84 to I-280.
14. nc Construct a new direct connection ramp between Bayfront Expressway and Woodside Road.
15. lc Modify the traffic signal at East Bayshore and Pulgas Avenue to operate three approach phases.
16. o Reconstruct Bay Road as a two lane facility between University Avenue and Cooley Landing.
17. tc Close University Avenue between Michigan Avenue and Sacramento Street.
18. na/t Construct park and ride lots on western side of the Dumbarton Bridge.
19. na/t Develop a "silent helicopter" shuttle service that connects to park and ride lots.
20. na/hov Construct HOV lanes on the Dumbarton Bridge and its approach highways.
21. 101 Improve US 101 on- and off-ramps.
22. na/bp Construct a pedestrian bridge over US 101 between University Avenue and Embarcadero Road.
23. lc Widen the bridge on Woodland Avenue at Newell Road, and install a traffic signal at this intersection.
24. na/o Widen the bridge on University Avenue west of Woodland Avenue.
25. nc & p Construct the southern connector as a toll road.
26. o A possible short-term improvement would extend Pulgas Avenue to University Avenue, join the two roads north of the Dumbarton Railroad tracks, and install new traffic signals and bike lanes on this expanded facility.
27. 101 Construct flyover on- and off-ramp connections at the US 101/Willow Avenue interchange.
28. na/t Construct a reversible transit-only tube beneath University Avenue from US 101 to SR 84.
29. lc Install signage to divert truck traffic away from University Avenue.
30. lc Optimize traffic signal timing on University Avenue between US 101 and SR 84.
31. na/o Provide infrastructure for light motor vehicles (scooters).
32. na/o Provide new access to Jones Mortuary in East Palo Alto.

33. na/bp Construct bike path on bayside dikes from University Avenue to San Antonio Road.
34. nc Construct a northern connection that would start at Woodside Road, proceed directly into the Bay, and then curve east to the Dumbarton Bridge.
35. na/t Implement transit priority measures during the morning and afternoon rush hours.
36. na/o Resurface local streets.
37. tc Prohibit right turns from Bay Road to University Avenue during commute hours.
38. tc Prohibit left turns from University Avenue to Purdue Avenue during morning commute hours.
39. tc Apply traffic calming measures used in Palo Alto to East Palo Alto streets, specifically the Southgate neighborhood.
40. 101 Improve freeway ramps based on needs.
41. nc Construct a one-way reversible tunnel starting at the University Avenue crossing of the Dumbarton Railroad tracks and proceeding beneath the Ravenswood Industrial Area, and then connecting to US 101.
42. o Construct roundabouts at the intersections of Bay Road and Pulgas Avenue, and Pulgas Avenue and O'Connor Street.
43. na/o Build a cross-Peninsula tunnel to I-280.
44. u Construct grade-separated interchanges on University Avenue at Bay Road and Bell Street.
45. p Impose tolls on University Avenue and Willow Road during commute hours.
46. tc Prohibit westbound left turns from University Avenue during the morning commute hours.
47. na/t &bp Construct a designated bus lane on Bayfront Expressway, and allow bicyclists to use it at any time.
48. na/o Construct a roadway connection between Sand Hill Road and Willow Road.
49. 101 Modify the US 101/University Avenue interchange to eliminate the northern loop ramp (northbound US 101 to westbound University Avenue) and create a signalized intersection at the new foot of ramp (at Donohoe Street).
50. na/o Build parking structures at critical locations.
51. 101 Build a new, dedicated, off-ramp from US 101 to the Ravenswood/101 Shopping Center.
52. na/o Improve the Woodland Avenue environment by adding parks or parking.
53. o Transform San Francisquito Creek into a dual use roadway/flood control facility.
54. u Construct a roundabout at the intersection of University Avenue and Donohoe Street.

55. w Implement reversible lanes on Willow Road during morning and evening commute hours.
56. na/hov Restrict usage of University Avenue to HOV (two passengers per vehicle) during commute hours.
57. 101 Increase capacity of US 101 by adding lanes and braiding ramps <u>without removing existing soundwalls</u>.
58. tc Prohibit through (Dumbarton Bridge) traffic on University Avenue.
59. 101 Convert HOV lanes on US 101 to mixed flow lanes – as an experiment.
60. tc Limit or redirect access between neighborhood streets and arterials.
61. its Implement "Smart Corridor" features on US 101 and sell advertising to create a revenue stream.
62. na/t Build a BART extension in a tunnel from the Dumbarton Bridge to Shoreline Boulevard.
63. 101 Expand US 101 capacity between Woodside Road to Shoreline Boulevard by building an elevated (double-deck) roadway above the freeway.
64. na/o Accommodate traffic generated by a potential flea market location at Ravenswood/101 Shopping Center.
65. nc Construct a comprehensive tunnel system, connecting University Avenue or Willow Road in Menlo Park/East Palo Alto with a tunnel beneath US 101, to accommodate through traffic or local retail traffic or both, and to ultimately provide a connection to Oregon Expressway and points west including I-280. This would help reunite the east and west sides of East Palo Alto.
66. w A possible short-term improvement would be to construct double-deck roadway on Willow Road, and provide direct connection from upper deck to US 101. The lower level would serve local traffic.
67. w Build a tunnel along Willow Road from SR 85 to US 101, with grade separated connections at each end.
68. nc Build a thoroughfare that connects the Dumbarton Bridge and the north end of San Antonio Road.
69. nc & p A long-term project would be a new toll bridge connecting SR 85 with SR 84 at a new interchange at the west end of the Dumbarton Bridge.

B. Other Communications

This section summarizes additional communications about the study.

i. E-mail, February 17, 2004 Regarding Ramp Metering

its An individual noted that she routinely observes major back-ups on US 101 at the University/US 101 interchange caused by traffic entering US 101 from University Avenue. She felt that ramp metering should be considered to improve the situation.

ii. E-mail, February 17, 2004 Regarding the Bay Trail

na/bp Regarding the Bay Trail project, this individual noted that there are gaps in the system, including segments between Seaport Boulevard in Redwood City and Marsh Road in Menlo Park, and segments north and south of the Ravenswood Open Space Preserve. This person suggested that trail improvements be considered in these segments. She also suggested that bicycle lanes and sidewalks be constructed on Bay Road, and pedestrian improvements be made on University Avenue, where sidewalks are intermittent.

iii. E-mail, February 24, 2004 Regarding Traffic Conditions in East Palo Alto

This individual, a new homeowner in East Palo Alto, noted that existing heavy traffic congestion that occurs during morning and afternoon commutes will only get worse over time. She made several suggestions:

- lc Adjusting traffic signal timing to increase efficiency;
- Widening roads rather than "double-decking" them;
- na/hov Consideration of HOV lanes and reversible lanes.

iv. E-mail, February 27, 2004 Regarding Economic Development

This individual emphasized the importance of investing in community economic development ("Mom and Pop Businesses") to complement transportation systems and improve the quality of life.

v. E-mail, March 3, 2004 Regarding Study Scope

One individual made several observations about the Study Scope:

- Middlefield Road is not a suitable western boundary for the study;
- Special events facilities, like the Shoreline Amphitheater and Stanford Stadium, should be specifically considered in the study;
- Residential arterials should be recognized in the study;

- The majority of study participants seem to be from San Mateo County, whereas there may be impacts in Santa Clara County;
- There is interest in updated traffic and truck data;
- Neighborhood and business impacts should be treated equally;
- The assessment should consider past actions or inactions that in effect have shifted negative impacts in the study area.

The same individual made some suggestions regarding improvements to be considered:

- u or w Build a tunnel beneath University Avenue or Willow Road, and closure of the tunnel in the event of flooding and resulting creek overflow.
- na/o Provide a direct connection between SR 85 and the East Bay if travel demand studies would support it, and this would not necessarily be a roadway.

vi. E-mail, April 2, 2004 Regarding Transportation Issues and Economic Development

One individual made several observations:

- There is no major traffic issue in the corridor, so major overpasses in East Palo Alto are unnecessary. Rather, technology (chip sensors) can be used to track and manage vehicle traffic.
- Transportation infrastructure can be improved by investing in light power vehicles and bicycles, and supportive networks to link both sides of US 101.
- Parking structures can be built at transport hubs, connected by the light vehicle networks and supporting economic activities.

vii. Memorandum, April 4, 2004 Regarding Alternatives for Dumbarton West Approach

This individual requested that the 2020 Peninsula Gateway Corridor Study team contact Cynthia D'Agosta, Executive Director of the San Francisquito Creek Authority to a), understand the status of planning for flood management, and b) to collect relevant information related to the specific idea below.

w The specific idea was to consider building a dual-purpose flood management and traffic management structure beneath Willow Road. This would provide two to three lanes of traffic (possible limited to peak period, one-way (in commute direction) operation). It would connect to a new flood control channel running from the Creek beneath Menalto Avenue and US 101.

This person also made some suggestions:

- Investigate and comment on the potential for this project to consider the Belle Haven/East Palo Alto planning effort for a new Dumbarton Rail station;

- Investigate the applicability of self-bore, self-caisson tunnel-building technology for a tunnel between the Bayfront Expressway to Ravenswood Business District then to US 101.

III. Summary of Potential Solutions Cited

Similar ideas about solutions were culled from the long lists presented above. These constitute a first-cut listing of potential projects raised by community members. They will be considered by the study team in conjunction with upcoming tasks regarding projected traffic conditions.

Approximately 61% of the 155 ideas listed above are well aligned with the study objective of identifying potential **traffic** improvements **in the corridor**. The remaining 39% is not aligned with the study objective because they either propose improvements for non-traffic modes or improvements outside of the corridor. It is the intent of the project sponsors to refer the latter ideas to the appropriate agencies responsible for improvements of this type.

The ideas were sorted into numerous categories and counted as follows:

- Ideas Aligned with Study Objective
  - US 101 capacity 17
  - Traffic calming 13
  - Willow Road capacity 13
  - Other capacity 13
  - New connection 11
  - University Avenue Capacity 7
  - Pricing 7
  - Low-capital improvements 7
  - ITS 7
  - Marsh Road capacity 1
  - TOTAL 94
- Ideas Not Aligned with Study Objective
  - Bicycle and Pedestrian 23
  - Other improvements 19
  - Transit 9
  - HOV 7
  - Land use 2
  - New connection 1
  - TOTAL 61

The results of this task will be considered in conjunction with analysis of travel forecasts and operational conditions by KHA, with regular feedback with C/CAG, the TAC, and the PAC, as the team begins to define potential improvements and improvement packages.

ORIGINAL DRAFT

DUMBARTON DIALOGUE CREDO

FOR REVIEW

The participants of the Dumbarton Dialogue Project support the following as the overriding criteria in the considerations of any traffic mitigation project along the University Avenue / Highway 101 corridor.

QUALITY OF LIFE

- Protect the environment, safety and welfare of the communities of East Palo Alto and eastern Menlo Park by evaluating mitigation solutions that are not limited to University Avenue and Willow Road as foremost and primary focus.

- Reduce the traffic, pollution and emissions and noise to benefit public health of all the surrounding communities.

REDUCE IMPACT OF COMMUTER TRAFFIC UPON EAST PALO ALTO AND EASTERN MENLO PARK

- Reduce the impact of commuter traffic to East Palo Alto and eastern Menlo Park residents, employees and volunteers.

- Allow for the free movement of residents and reduce the time it takes for autos, buses and shuttles to travel to/from their starting points and final destinations within East Palo Alto and eastern Menlo Park during commute hours.

- Reduce the time to get on/off Highway 101 to/from East Palo Alto and eastern Menlo Park locations.

REDUCE TRAFFIC THROUGH TRANSIT ALTERNATIVES

- Promote mass transit alternatives for Dumbarton Corridor
  - Support non-drivers (e.g. bikes, pedestrians, mass transit riders) and Emphasize safety

- Reduce long-term cost of the repeated need to expand roadway network of Dumbarton Corridor.
  - Prioritize carpool lanes (HOV lanes not HOT – High Occupancy Toll Lanes) to increase vehicle occupancy.

ENVIRONMENTAL PROTECTION

- Consider the whole environment surrounding the proposed traffic mitigations whether they widen roadways or increase the road height in each city / regional area.

- Consider engineering issues such as future levels of the San Francisco Bay 20 years out.
- Consider residents as well as animals as they apply to the environment.

- Consider the regional impact on the environment – noise, emissions, and visual impacts.

- Consider that solutions impact everyone and benefits everyone.

- Reduce the environmental traffic impacts of single occupancy vehicles.

Reviewed and refined by participants on June 2, 2007

2020 Peninsula Gateway Corridor Study

Final Report

Appendix C

Conceptual Definition & Engineering of Alternatives

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Draft Memorandum
Task 4 - Conceptual Definition & Engineering of Alternatives

Prepared for:

City/County Association of Governments
Of San Mateo County

Prepared by:

Kimley-Horn
and Associates, Inc.

May 25, 2005

This memorandum summarizes the procedures and findings of *Task 4 – Conceptual Definition & Engineering of Alternatives* of the 2020 Peninsula Gateway Corridor Study (Study), which is being conducted by Kimley-Horn and Associates (KHA) under contract to the City/County Association of Governments of San Mateo County (C/CAG). This document is organized as follows:

I. Synopsis and Status of Study
II. Alternatives Development Process
III. Descriptions of Improvement Alternatives
IV. Next Actions

I. Synopsis and Status of Study

The objective of the Study is to define and evaluate alternative traffic improvements in the Corridor that address the *Study goals*, which are listed below:

- Facilitate access;
- Enhance economic opportunities;
- Optimize use of existing infrastructure;
- Reduce congestion and local community impacts; and
- Minimize environmental impacts on sensitive resources.

The scope of the Study includes the following tasks (the current task is in **bold** text):

1. Detailed Work Program and Schedule
2. Public Input
3. Data Collection/Current Conditions
4. **Conceptual Definition and Engineering**
5. Review Travel Forecasts
6. Conduct Operational Analysis
7. Assess Environmental/Social Impacts
8. Develop Conceptual Cost Estimates
9. Presentation of Alternatives
10. Public Outreach
11. Draft Study Report
12. Optional Public Outreach
13. Review Findings and Next Steps
14. Prepare Final Study Report.

This memorandum documents **Conceptual Definition and Engineering**. Feedback from the Technical Advisory Committee (TAC) and Policy Advisory Committee (PAC) will be integrated into the description of the alternatives as the analysis phase of the Study begins. The analysis

phase involves travel forecasts for selected alternatives, operational evaluations, an assessment of environmental/social impacts, and development of conceptual cost estimates.

The chart on the following page summarizes the process used in developing alternatives and highlights the current step.

II. Alternatives Development Process

The scope of Task 4 included the following subtasks:

- Identification of a full range of alternatives, large and small;
- An assessment of potential "fatal flaws" that could render alternatives either unacceptable or otherwise impossible to build;
- Development of conceptual line diagram sketches for selected alternatives; and
- Preparation of this Task Memorandum.

Task 4 did not include assessments of potential tradeoffs of the selected alternatives, as these matters will be addressed by other tasks.

As a refresher, the alternatives summarized in this memorandum evolved from a series of interim products describing the possible "universe" of alternatives that could potentially address the traffic issues in the corridor in the context of the Study goals. These interim products are briefly summarized below:

- Initial Improvement Themes and Solutions, presented and discussed at the October 2004 TAC and PAC meetings;
- Potential Capacity-Increasing Improvements, a listing of 46 ideas, presented and discussed at the November 2004 TAC and PAC meetings;
- Draft List of Improvement Alternatives, a chart summarizing 70 alternative improvements with respect to pros and cons, potential fatal flaws, relative costs, and implementation horizon, presented and discussed at the January 2005 TAC and PAC meetings;
- Potential Improvement Alternatives to Analyze in 2020 Study, which distilled the 70 improvements into 9 packages of alternatives to be studied, presented and discussed at the February TAC and PAC meetings.

III. Descriptions of Improvement Alternatives

Ten alternatives were defined in the process described above, as listed below and subsequently discussed:

1. Route 101 Auxiliary Lanes and Interchange Improvements

2. Route 101 Elevated Express Lanes
3. Grade Separations on Bayfront Expressway
4. Short-Term Operational Improvements on Willow Road
5. Willow Road Pedestrian/Bicycle Bridge
6. Willow Road *Elevated* Express Lanes
7. Willow Road *Depressed* Express Lanes
8. Short-Term Operational Improvements on University Avenue
9. University Avenue Depressed Express Lanes
10. Route 101/University Avenue Interchange Improvements.

[Note: This study defines Route 101 as north-south and intersecting streets as east-west. Bayfront Expressway is also defined to be east-west.]

Alternative 1: Route 101 Auxiliary Lanes and Interchange Improvements – As shown in the attached exhibit, this proposed alternative would provide commuters with a new auxiliary lane in each direction along Highway 101 from Oregon Expressway to Shoreline Boulevard. The roadway widening would require ramp modifications at existing interchanges, soundwalls, and the installation of longitudinal storm drain pipes on both sides of the highway to accommodate runoffs. These improvements would succeed the newly constructed auxiliary lanes from Hillsdale Boulevard to Marsh Avenue and also the future extension of the auxiliary lanes to Embarcadero Road proposed by the San Mateo County Transportation Authority.

This alternative will include improvements to the existing 101/San Antonio Road interchange. Currently there are no on-ramps to Highway 101 for south1` commuters to San Jose. Commuters are forced to use Charleston Road, a local road which connects to Highway 101 at Rengstorff Interchange.

One option is to remove the existing southbound loop off-ramp to provide room for a new southbound diagonal on-ramp onto Highway 101. A "T" intersection/ramp connection to San Antonio Road would accommodate a left turn movement for westbound commuters wanting to exit onto the highway. The impacts of this option will include the widening of the existing bridge crossing to allow for the left turn lane. The addition of new storage lanes would require eastbound commuters on San Antonio Road to merge sooner prior to connecting to the southbound diagonal on-ramp to avoid backing up through traffic. Right-of-way would also be required along the west side of Highway 101 to allow room for the diagonal on-ramp connection.

In addition, the existing diagonal off-ramp from Highway 101 would be modified to also have a "T" intersection/ramp connection to the local road to provide left and right turn movements onto San Antonio Road.

Alternative 2: Route 101 Elevated Express Lanes – As shown in the attached exhibit, this proposed alternative would provide commuters with elevated express lanes through the Highway 101 corridor from Woodside Road Interchange to Old Middlefield Way. The elevated structure would run down the center of Highway 101, about 6 meters above grade at stretches between the interchanges, and would raise above all existing interchanges and railroad overcrossing to an approximated grade of 12

meters. The elevated structure would have one lane plus a shoulder in each direction with a concrete median divider.

At the north end connection, commuters going southbound would enter the Highway 101 off ramp to Woodside Road and connect via flyover ramp to the elevated structure. Commuters going northbound on the elevated structure would touch down via flyover ramp to Highway 101 just after the Woodside Road Interchange, merging into the existing auxiliary lane.

At the south end, commuters going northbound would connect via flyover ramp from the Old Middlefield Way Overcrossing to the elevated structure. Commuters going southbound on the elevated structure would touch down via flyover ramp to Highway 101, below the Old Middlefield Way Overcrossing and merging to an existing auxiliary lane.

Additional right-of-way would be required where the flyover ramps touch down and merge to Highway 101.

Alternative 3: Grade Separations on Bayfront Expressway – As shown in the attached exhibit, the proposed elevated lanes along Bayfront Expressway would provide commuters with a direct express connection between the Dumbarton Bridge to west of Willow Road, thus avoiding the existing University Avenue and Willow Road signalized intersections.

The elevated express lanes would begin at grade approximately 800 meters east of University Avenue using the existing outside lanes and would raise up to clear the University Avenue intersection and Willow Road Intersection. The elevated express lanes will touch down to the existing Bayfront Expressway approximately 300 meters west of the Willow Road intersection. By utilizing the existing outside lanes, minimum right-of-way acquisition will be required along the Bayfront Expressway.

Commuters traveling westbound on Bayfront Expressway would be allowed a direct connection to westbound University Avenue and westbound Willow Road via flyover off-ramps.

Eastbound commuters on Willow Road could access the eastbound elevated express lane on Bayfront Expressway from the existing inside lane of Willow Road. This option to connect Willow Road to the elevated express lane would avoid large impacts to existing buildings and homes and would require minimal right-of-way acquisition.

Eastbound commuters on University Avenue could access the eastbound elevated express lane on Bayfront Expressway from a new on-ramp. This option to connect University Avenue to the elevated express lane would require right-of-way acquisition on vacant land.

Existing access to all roads and businesses on Bayfront Expressway, University Avenue and Willow Road, including the Sun Microsystems buildings, would be maintained.

Alternative 4: Short-term Operational Improvements on Willow Road – *The definition of this alternative is in progress.*

An evaluation of existing peak hour traffic conditions confirmed that Willow Road traffic operates satisfactorily (LOS D or better) *between* Newbridge Street and the Bayfront Expressway, although cross-street traffic experiences significant delays at all intersections. However, traffic conditions at Newbridge Street are poor (LOS E) during a.m. and p.m. peak hours, and at Bayfront Expressway are poor (LOS F) during the p.m. peak hour. Traffic signals are coordinated, which provides some benefit in both directions during both peak hours.

Based on these findings, additional focus will be placed on widening cross-street approaches to reduce overall intersection delay, which will require right-of-way acquisition in many cases.

Alternative 5: Willow Road Pedestrian/Bicycle Bridge – This alternative, which has not been drawn up at this time, was defined in conditional terms, assuming that a pedestrian/bicycle bridge across Willow Road at Ivy Drive would benefit Willow Road *traffic if the volume of pedestrian/bicycle traffic is substantial such that it limits green time on the arterial*. However, observations of pedestrian crossings of Willow Road indicated that they do not limit arterial green time significantly. Nevertheless, such a bridge would benefit pedestrians and bicyclists as well, including students at Mid-Peninsula High School, by providing unimpeded crossings of Willow Road.

Alternative 6: Willow Road *Elevated* Express Lanes – As shown in the attached exhibit, an aerial structure would be built over Willow Road to provide two express lanes (one each direction) and shoulders, beginning with an aerial connection at Route 101 and ending with an aerial connection on Bayfront Expressway east of Willow Road. The intent of this improvement is to remove some bridge traffic from Willow Road, which would enhance local traffic access and operations as well as improve travel time for bridge traffic by reducing delay at intersections. The initial definition has the existing Willow Road remaining much the same as it is now (four lanes with turn lanes), which is conservative given that four lanes *at-grade* may not be needed to serve local traffic.

Right-of-way acquisition for this alternative would be minimal along Willow Road, although some property will be required near the Route 101 and Bayfront Expressway conforms to provide for the aerial connections.

Alternative 7: Willow Road *Depressed* Express Lanes – As shown in the attached exhibit, a depressed trench structure would be built below Willow Road to provide two express lanes (one each direction) and shoulders, beginning with underground portals at Route 101 and ending with underground portals on Bayfront Expressway east of Willow Road. The intent of this improvement is to remove some bridge traffic from Willow Road, which would enhance local traffic access and operations as well as improve travel time for bridge traffic by reducing delay at intersections. The initial definition has the existing Willow Road remaining much the same as it is now (four lanes with turn lanes), which is conservative given that four lanes *at-grade* may not be needed to serve local traffic. This cross-section will require acquisition of right-of-way strips

on each side of Willow Road, and near the Route 101 and Bayfront Expressway conforms to provide for the underground connections.

A second option, aimed at reducing right-of-way acquisition, would slide the surface lanes on each side of the viaduct partly over the viaduct via a cantilevered concrete "shelf" atop each retaining wall.

Alternative 8: Short-term Operational Improvements on University Avenue – *The definition of this alternative is in progress.*

The City of East Palo Alto received a grant from MTC under the Regional Signal Timing Program (RTSP) to evaluate the University Avenue corridor. The preliminary findings of this study indicate coordination of all signals on University Avenue is desirable and should be implemented (TY LIN International/CCS, University Avenue Signal Timing Project, Draft Recommendations Report, December 28, 2004). Therefore, signal coordination will be included in this alternative.

KHA focused additional inspection of the a.m. and p.m. peak period traffic analysis on University Avenue between Donohoe Street and O'Brien Drive, where peak hour traffic conditions are generally satisfactory (LOS C or better), with the exception of the Bay Road intersection, which exhibits LOS F in the a.m. peak hour. It was noted that cross-street movements and left turn movements from University Avenue were generally poor (LOS E or worse).

Based on these findings, additional focus will be placed on widening cross-street approaches, and increasing left-turning capacity, to reduce overall intersection delay, which will require right-of-way acquisition in many cases.

Alternative 9: University Avenue *Depressed* Express Lanes – As shown in the attached exhibit, this proposed depressed viaduct alternative through the University Avenue corridor would provide commuters with a direct express connection between the Dumbarton Bridge and Highway 101 south. The depressed viaduct would run down the center of University Avenue, about 6 meters below grade, from the Dumbarton Rail Corridor in the north to Bell Street in the south. At the north end, the depressed viaduct would rise up to grade between the railroad tracks and Bayfront Expressway and connect to Bayfront east via on and off direct-connect flyover ramps. At the south end, the viaduct would rise up to grade between Bell Street and Donohoe Street and connect to Highway 101 south via on and off direct-connect flyover ramps. Local streets would cross over the viaduct on at-grade bridges.

The viaduct would have one lane plus a shoulder in each direction with a concrete median divider. No local access would be provided to the viaduct. Due to the narrow public right-of-way along the University Avenue corridor, the depressed viaduct would require vertical retaining walls on each side. At the surface there would be a second lane in each direction, immediately adjacent to the top of each retaining wall, with shoulder and sidewalk for local traffic traveling along the University Avenue corridor. The local lanes would still connect directly to Bayfront

Expressway and Donohoe Street to allow for local access to the Dumbarton Bridge and Highway 101 as currently exists today.

With this configuration, a narrow strip of additional right-of-way would be required on each side of the existing University Avenue corridor. Right of way would also be required along the West Bayshore frontage road just south of the 101/University Avenue interchange to allow room for the southbound flyover ramp to touch down. East Bayshore Road on the opposite side of 101 would have to be narrowed to allow room for the northbound flyover ramp to exit 101 on its way to the viaduct. At the north end of the viaduct, additional right-of-way would be required in the southeast quadrant of the University/Bayfront intersection for the flyover ramps. Some minor impacts would be expected on property that may be wetland where the flyover ramps touch down on either side of Bayfront Expressway.

A second option, evaluated to eliminate right-of-way take on University Avenue, would slide the surface lane on each side of the viaduct partly over the viaduct via a cantilevered concrete "shelf" atop each retaining wall. With this option, the right-of-way takes along University Avenue could be eliminated, but the right-of-way takes at each end would still be required.

<u>Alternative 10: Route 101/University Avenue Interchange Improvements</u> – *The definition of this alternative is in progress.*

This alternative includes the planned "Phase 2" southbound direct-connect off-ramp, which will skirt the University Circle property and conform to the existing westbound right-turn lane at Woodland Avenue. This will require some bridge widening to provide adequate sight distance.

Additionally, the KHA team is studying potential enhancements to the northbound on- and off-ramp connections on the east side of Route 101, focusing on critical traffic movements at the University Avenue/Donohoe Street intersection, which are eastbound left turn, southbound through, and northbound right turn. The intent of this alternative is to enhance access to/from the freeway without compromising traffic operations on the freeway or University Avenue and Donohoe Street.

IV. Next Actions

KHA anticipates the next actions in the Study to be as follows:

- Review by, and comments from, the TAC, the PAC and C/CAG staff;
- Definition of and request for travel forecasts for selected alternatives;
- Evaluation of alternatives.

2020 Peninsula Gateway Corridor Study

Final Report

Appendix C Exhibits
(Alternatives 1, 2, 3, 6, 7 & 9)

Click in box to view exhibits

Conceptual Definition & Engineering of Alternatives

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Draft Memorandum – Addendum 1
Task 4 – Conceptual Definition & Engineering of Alternatives

Prepared for:

City/County Association of Governments of San Mateo County

Prepared by:

Kimley-Horn
and Associates, Inc.

June 24, 2005

This Addendum 1 summarizes additional information about three alternatives presented in Draft Memorandum, Task 4 – Conceptual Definition & Engineering of Alternatives, dated May 25, 2005. Please refer to the original document for additional details and context regarding this part of the 2020 Peninsula Gateway Corridor Study (Study).

This Addendum 1 presents additional information about three alternatives, as listed below and subsequently discussed:

4. Short-Term Operational Improvements on Willow Road
8. Short-Term Operational Improvements on University Avenue
10. Route 101/University Avenue Interchange Improvements.

[Note: This study defines Route 101 as north-south and intersecting streets as east-west. Bayfront Expressway is also defined to be east-west.]

Alternative 4: Short-term Operational Improvements on Willow Road – An evaluation of existing peak hour traffic conditions confirmed that Willow Road traffic operates satisfactorily (LOS D or better) *between* Newbridge Street and the Bayfront Expressway, although cross-street traffic experiences significant delays at all intersections. However, traffic conditions at Newbridge Street are poor (LOS E) during a.m. and p.m. peak hours, and at Bayfront Expressway are poor (LOS F) during the p.m. peak hour. Traffic signals are coordinated, which provides some benefit in both directions during both peak hours.

Additional operational analysis indicated that signal timing could be modified to reduce delay to certain critical movements at all signalized intersections, thereby improving traffic conditions during the peak periods. Most of the benefit would come from reducing cycle length from 130 seconds to 100 seconds at four intersections (Hamilton, Ivy, O'Brien, and Newbridge). In addition, allowing Willow left turns to operate in permitted mode (i.e. not protected as current) at Hamilton would reduce delay for these movements. Also, restriping and minor widening on the southbound Ivy approach to Willow and implementing overlap phasing would reduce delay for this movement and the Willow left turn movements.

Supplemental details will be provided in a handout at the upcoming Technical Advisory Committee (TAC) and Policy Advisory Committee (PAC) meeting.

Alternative 8: Short-term Operational Improvements on University Avenue – The City of East Palo Alto received a grant from MTC under the Regional Signal Timing Program (RTSP) to evaluate the University Avenue corridor. The preliminary findings of this study indicate coordination of all signals on University Avenue is desirable and should be implemented (TY LIN International/CCS, University Avenue Signal Timing Project, Draft Recommendations Report, December 28, 2004). Therefore, signal coordination will be included in this alternative.

KHA focused additional inspection of the a.m. and p.m. peak period traffic analysis on University Avenue between Donohoe Street and O'Brien Drive, where peak hour traffic conditions are generally satisfactory (LOS C or better), with the exception of the Bay Road

intersection, which exhibits LOS F in the a.m. peak hour. It was noted that cross-street movements and left turn movements from University Avenue were generally poor (LOS E or worse).

Additional operational analysis indicated that signal timing could be modified to reduce delay to certain critical movements at all signalized intersections, thereby improving traffic conditions during the peak periods. Most of the benefit would come from reducing cycle length from 120 seconds to 60 seconds at all intersections except Bay Road, and leaving Bay Road at its current cycle length of 120 seconds. This practice of "half-cycling" some of the intersections is a customary way to improve traffic conditions where long cycles are not necessary to serve relatively small critical traffic movements. In addition, modifying the signal phasing to allow eastbound left turns at O'Brien, Notre Dame, and Kavanaugh to operate in permitted mode would reduce delay for these movements. Finally, at Bay Road, changing the configuration for northbound Bay Road to eliminate the shared through/left lane (replace with a through lane) would reduce delay for westbound movements.

Supplemental details will be provided in a handout at the upcoming Technical Advisory Committee (TAC) and Policy Advisory Committee (PAC) meeting.

Alternative 10: Route 101/University Avenue Interchange Improvements – As illustrated in the attached sketch, this alternative would grade separate the intersection of University Avenue/ Donohoe Street and reconstruct the interchange with revised connections as described below.

Heading Northbound on Route 101:

1. Drivers exiting Route 101 via the diagonal off-ramp would connect to the proposed elevated University Avenue, grade separated from Donohoe Street. At the elevated University intersection, double right turn movements to eastbound University would accommodate traffic wanting to go to East Palo Alto or to Route 84. A left turn movement at the intersection would also be provided for drivers wanting to go westbound on University. This University diagonal ramp structure would elevate above the two ramp connections to Donohoe Street, i.e. ramps from eastbound University and from northbound Route 101.
2. Drivers wanting to go to IKEA, Home Depot, and other stores located east of Route 101 would exit the same northbound diagonal off-ramp. Instead of going up to University, drivers would veer left onto another ramp that connects to Donohoe Street. This Donohoe Street/ramp connection would go under the University diagonal ramp structure.

Heading Southbound on Route 101:

1. Drivers would continue to take the existing exit to University Avenue via the loop ramp that connects to University at a "T" intersection. There drivers would have isolated double right turn movements to go eastbound on University, thus more storage capacity. A 3rd eastbound lane would be added on University that goes over the freeway, then drops down to Donohoe Street, providing drivers with access to IKEA and other

shopping centers east of the freeway. Double isolated left turn lanes would also accommodate traffic wanting to go westbound on University.

2. Southbound Route 101 drivers wanting to go to University City via Woodland Avenue would utilize the proposed diagonal off-ramp to westbound University. This ramp would become the isolated right turn lane at Woodland, thus improving access and also relieving traffic volumes that normally use the loop ramp.

Heading Eastbound on University Avenue:

1. Palo Alto, Menlo Park, and regional traffic from the freeway going eastbound on University would no longer connect directly to Donohoe Street at the intersection, because University and Donohoe would be grade separated roadways. Because of this, the addition of a 3rd eastbound lane on University (the outside lane) would provide access to Donohoe Street, IKEA, and other shopping centers east of the freeway.
2. Eastbound drivers on University would continue to take the existing diagonal on-ramp located east of Woodland to southbound Route 101.
3. Since University east of the freeway would be elevated, a new loop ramp going beneath University would provide access to northbound Route 101.

Heading Westbound on University Avenue:

1. East Palo Alto and regional traffic from Route 84 going westbound on University would no longer connect directly to Donohoe Street at the intersection, because University and Donohoe would be grade separated roadways. Drivers would therefore need to use local streets to get to IKEA and other shopping centers.
2. Since University east of the freeway would be elevated, a proposed loop ramp would provide drivers with access to northbound Route 101. Drivers would make a left turn at the intersection onto the loop ramp.
3. Westbound drivers on University would continue to take the existing diagonal on-ramp located before Woodland to southbound Route 101.

Donohoe Street:

1. Traffic coming from IKEA, Home Depot, other nearby businesses and shopping centers, and local traffic wanting to get on northbound Route 101 would access a proposed diagonal on-ramp located north of University. Northbound drivers on Donohoe would utilize the second left turn lane to go into the on-ramp.
2. Similarly, traffic wanting to get on southbound Route 101 would get onto westbound University via a ramp that connects Donohoe to University. From westbound University drivers would merge to the left to get onto the left turn lanes, then to the existing on-ramp to southbound Route 101. This movement to southbound Route 101 is similar to current conditions. Drivers heading northbound on Donohoe would utilize the inside left turn lane to go into the ramp.
3. Similarly, traffic wanting to go east to Route 84 via University would connect by means of other local roadways.

The existing University/Donohoe intersection is the central connection point for the majority of movements, constricting passageway from Route 84 to Route 101, and visa versa. This alternative would provide relief to regional and local traffic by dividing the existing traffic movements/constrictions at the current intersection to different locations on University and Donohoe. With the introduction of a grade separation at University and Donohoe and modifications to the existing interchange in an effort to try to relieve traffic congestion, there are some trade-offs that would be made. Drivers wanting to go eastbound to Route 84 from IKEA or nearby stores would have to utilize other local roadways to connect to University Avenue, and vice-versa. This alternative would impact the properties in the SE quadrant of the University/Donohoe intersection. Raising University Avenue would impact right of way east of Donohoe and current access to businesses. Some of this impact could be alleviated through partial access under the elevated University Avenue structure.

2020 Peninsula Gateway Corridor Study

Final Report

Appendix C Exhibit (Alternative 10)

Click in box to view exhibit

Conceptual Definition & Engineering of Alternatives

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

Kimley-Horn
and Associates, Inc.

555 12th Street, Suite 1230
Oakland, California
94607

TO: Walter Martone, C/CAG

FROM: Paul Krupka

DATE: February 1, 2006

SUBJECT: Alternative 3.1 – Grade Separations on Bayfront Expressway

We developed a new alternative in response to feedback from TAC and PAC members at past meetings. It is summarized herein for review by you and the TAC and PAC.

Alternative 3.1 – Grade Separations at Bayfront/Willow and Bayfront/University

As summarized in the attached sketch, this alternative would grade separate both Willow Road and University Avenue intersections below the existing expressway, essentially creating a freeway segment with full control of access that would benefit regional traffic connecting between the Dumbarton Bridge and Route 101 in both directions. The alternative would provide a direct express connection on Bayfront Expressway between Route 101 and the Dumbarton Bridge, with uninterrupted traffic flow on the stretches of highway that would normally be delayed by signalized intersections at Willow Road and University Avenue. Also, this alternative would provide a direct connection from westbound Bayfront Expressway to Willow Road and Bayfront to University Avenue via flyover ramps. Although this alternative only includes a railroad grade separation on Willow Road at the Union Pacific/Dumbarton Rail tracks, a similar facility could be included at University. All other traffic would utilize the depressed intersections to make similar movements as they would now.

[Note: This study defines Route 101 as north-south and intersecting streets as east-west. Bayfront Expressway is also defined as east-west.]

Traffic Movements - The revised traffic movements resulting from this alternative are summarized below.

Heading Westbound (WB) from Dumbarton Bridge on Bayfront Expressway:

1. Commuters coming from the Dumbarton Bridge heading to north Route 101 would avoid signalized intersections at both University Avenue and Willow Road as a result of the grade separations.
2. Traffic wanting to go to University Avenue would direct connect via a flyover ramp.
3. Traffic wanting to go to Willow Road would direct connect via a flyover ramp.
4. Commuters heading to Sun Microsystems would exit the second off-ramp prior to University Avenue and continue a new frontage road to access company driveways.

DRAFT

TEL 510 625 0712
FAX 510 625 0714

Heading Eastbound (EB) from north Route 101 on Bayfront Expressway:

1. Commuters coming from Route 101 would avoid signalized intersections at both Willow Road and University Avenue as a result of the grade separations.
2. Traffic wanting to get off to Willow Road would exit the off-ramp and continue down to the depressed intersection. A right turn would lead to Willow Road. A left turn would lead to Sun Microsystems.
3. Traffic wanting to get off to University Avenue would exit the off-ramp prior to Willow Road and continue through to the frontage road that connects to University Avenue.

Heading Northbound (NB) from Route 101 on Willow Road:

1. Commuters heading toward the Dumbarton Bridge on Willow Road would direct connect to EB Bayfront Expressway via a flyover (over the UP/Dumbarton tracks) ramp. This ramp would originate on the inside lane of Willow Road and fly over the existing intersection at Hamilton Avenue, the UP/Dumbarton tracks, and the proposed frontage road.
2. Commuters going to Sun Microsystems would remain on Willow Road and continue through the Willow/Bayfront depressed intersection to the company's main entrance.
3. Traffic wanting to go west on Bayfront Expressway would remain on Willow to make a left turn at the Willow/Bayfront depressed intersection. This leads to the WB Bayfront on-ramp.
4. Traffic wanting to go to University Avenue would make a right turn at the Willow/Bayfront depressed intersection. This leads to the EB frontage road to University Avenue.

Heading NB from Route 101 on University Avenue:

1. Commuters heading toward the Dumbarton Bridge on University Avenue would direct connect via the proposed ramp to EB Bayfront Expressway.
2. Traffic wanting to go west on Bayfront Expressway would remain on University to make a left turn at the University/Bayfront depressed intersection. This leads to the WB frontage road that connects to the expressway after the Willow/Bayfront intersection.
3. Traffic going to Sun Microsystems would take the WB frontage road.

Leaving Sun Microsystems:

1. At the Willow/Bayfront depressed intersection, traffic from Sun Microsystems would make a right turn to go toward north Route 101. Traffic going straight through the intersection would end up on SB Willow, heading toward Route 101. Traffic making a left turn would enter the proposed EB frontage road to University and/or onto the Bayfront Expressway.
2. Commuters leaving Sun Microsystems from the WB frontage road would either get off at Willow Road or continue through to merge onto Bayfront Expressway.

Potential Tradeoffs – The following points summarize the significant tradeoffs of the alternative.

1. This alternative would provide regional traffic relief through the Bayfront Expressway corridor as well as improved connections to Willow Road and University Avenue. The direct connect ramps from Willow and University to Bayfront would accommodate traffic connections between Route 101 and the Dumbarton Bridge.
2. This alternative would require right of way acquisition for the proposed roadway widening, flyover ramps, and the introduction of frontage roads adjacent to Bayfront Expressway.
3. The proposed depressed Willow and University intersections would require drainage pump stations as a result of the grade separations.
4. The entrance to the Sun Microsystems parking lot would be impacted by this alternative.
5. Widening to the south of Bayfront would impact existing overhead electrical lines and large towers, as well as an existing bike path that ran along the expressway.
6. This alternative would extend sidewalk along University to Bayfront to provide a pedestrian connection to existing and future bike paths. The impacted bike paths mentioned above could easily be relocated to the frontage road or adjacent to it.

DRAFT

2020 Peninsula Gateway Corridor Study

Final Report

Appendix C Exhibit (Alternative 3.1)

Click in box to view exhibit

Conceptual Definition & Engineering of Alternatives

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Final Report

Appendix D

Conceptual Cost Estimates

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Draft Memorandum
Task 8 - Conceptual Cost Estimates

Prepared for:

City/County Association of Governments
Of San Mateo County

San Mateo County Transportation Authority

Santa Clara Valley Transportation Authority

Prepared by:

Kimley-Horn
and Associates, Inc.

February 27, 2006

This memorandum summarizes the procedures and findings of *Task 8 – Conceptual Cost Estimates* of the 2020 Peninsula Gateway Corridor Study, which is being conducted by Kimley-Horn and Associates (KHA) for the City/County Association of Governments of San Mateo County (C/CAG), the San Mateo County Transportation Authority, and the Santa Clara Valley Transportation Authority. This document is organized as follows:

I. INTRODUCTION
II. COST ESTIMATE SUMMARY
III. COST ESTIMATE FORMAT
IV. DESCRIPTION OF COST ITEMS
V. CALCULATION OF QUANTITIES.

I. INTRODUCTION

The focus of the 2020 Peninsula Gateway Corridor Study is to identify and evaluate potential traffic projects to improve the connection from the Dumbarton Bridge to Route 101, and to improve traffic flow along the Route 101 corridor between Mountain View and Redwood City. From an initial "universe" of some 320 potential project opportunities, 8 projects were selected for further analysis in this phase of the study. A concept level engineering evaluation and alternatives analysis of these 8 project opportunities resulted in 13 alternative projects for which cost estimates were completed, as follows:

1) Alt. 1.1 - Rte. 101 Auxiliary lanes – Embarcadero to Shoreline
2) Alt. 2.1 - Rte. 101 Elevated Express Lanes (Mix Traffic)
3) Alt. 2.2 - Rte. 101 Elevated Express Lanes (HOV Lanes)
4) Alt. 3.1 - Bayfront Exp. Grade Separations
5) Alt. 4.1 - Willow Rd. Short Term Improvements
6) Alt. 6.1 - Willow Rd. Elevated Express Lanes
7) Alt. 7.1 - Willow Rd. Depressed Express Lanes
8) Alt. 7.2 - Willow Rd. Depressed Express Lanes w/ Cantilever Frontage
9) Alt. 7.3 - Willow Rd. Tunnel
10) Alt. 8.1 - University Ave. Short Term Improvements
11) Alt. 9.1 - University Ave. Depressed Express Lanes
12) Alt. 9.2 - University Ave. Depressed Express Lanes w/ Cantilever Frontage
13) Alt. 9.3 - University Ave. Tunnel

This memorandum presents the concept level cost estimates that were developed for the 13 alternative projects. The memorandum also summarizes the assumptions that were made when preparing the cost estimates.

The information presented herein was developed primarily by Mark Thomas and Company (Alternatives 1, 2, 3 and 9) and Caltrans District 4 (Willow Road alternatives except short term), sub-consultants to KHA.

II. COST ESTIMATE SUMMARY

The following table summarizes the cost estimates for each of the 13 alternative projects in Year 2006 dollars. The cost estimate is broken down into three primary categories: (1) construction cost, (2) right of way cost, and (3) engineering support cost. The total project cost is provided in both Year 2006 and Year 2025 dollars, the latter to coincide with the traffic forecast horizon and to stress the time value of money. The Year 2025 total is based on an assumed escalation rate of 3.5% per year, which it the standard rate used by Caltrans for projecting costs at this early stage of development.

Cost Estimate Summary Table

Alternative Name	Construction Cost	R/W Cost	Support Cost	Total Project Cost 2006 $	Total Project Cost 2025 $
1.1 – Route 101 Auxiliary Lanes	$57 M	$20 M	$28 M	$105 M	$202 M
2.1 – Route 101 Elevated Mixed	$900 M	$80 M	$230 M	$1,210 M	$2,330 M
2.2 – Route 101 Elevated HOV	$850 M	$70 M	$220 M	$1,140 M	$2,190 M
3.1 – Bayfront Exp. Grade Separations	$180 M	$67 M	$86 M	$333 M	$640 M
4.1 – Willow Rd. Short Term	$0.09 M	$0 M	$0.03 M	$0.12 M	$0.24 M
6.1 – Willow Rd. Elevated Express Lanes	$96 M	$33 M	$46 M	$175 M	$336 M
7.1 – Willow Rd. Depressed Express Lanes	$170 M	$40 M	$82 M	$292 M	$561 M
7.2 – Willow Rd. Depressed w/ Cantilever	$230 M	$33 M	$110 M	$373 M	$717 M
7.3 – Willow Rd. Tunnel	$280 M	$33 M	$130 M	$443 M	$852 M
8.1 – University Ave. Short Term	$0.18 M	$ 0 M	$0.09 M	$0.27 M	$0.52 M
9.1 – University Ave. Depressed Express Lanes	$310 M	$72 M	$150 M	$532 M	$1,023 M
9.2 – University Ave. Depressed w/ Cantilever	$440 M	$64 M	$200 M	$704 M	$1,350 M
9.3 – University Ave. Tunnel	$560 M	$64 M	$260 M	$884 M	$1,700 M

III. COST ESTIMATE FORMAT

For the purposes of this study, a standardized, two-page, concept level, cost estimate format was developed to provide a uniform method of comparing costs across the variety of alternatives. The two-page format is loosely based on the Caltrans Project Study Report (PSR) cost estimate format, but is simplified and streamlined to fit the concept level analysis of this study. A separate cost estimate form was completed for each of the 13 alternatives. These cost estimates are attached in the Appendix.

The two-page cost estimate format consists of a heading section and a detail section. The heading section identifies the alternative, briefly describes the proposed improvements, and summarizes the cost estimate for three primary categories: (1) Construction cost; (2) Right of Way cost; and (3) Engineering Support cost. The detail section provides a breakdown of how the three primary categories were calculated.

The Construction cost detail is further divided into 4 subcategories: (a) roadway work; (b) structure work; (c) miscellaneous items; and (d) other additions. Roadway work includes the cost of actual infrastructure improvements on the ground and the associated work to construct them. Structure work includes the cost of the larger, typically concrete, structures. The "miscellaneous items" category includes the cost of specialty work and costs that are associated with construction but are not actual infrastructure improvements. The "other additions" category includes the cost of mobilization of construction equipment to a project and a contingency factor to account for the preliminary, concept level nature of these estimates.

Within each of the categories, a set of representative cost items was developed that could be quantified for each alternative. These representative cost items are used consistently across each of the alternatives so that cost estimates for different alternatives can be easily compared to each other. An appropriate unit of measure and unit cost was developed for each cost item. The observed recent price increases in steel, concrete and asphalt costs were considered in this effort and accounted for by addressing each major construction item separately and adding a small unit price contingency for each. The metric system was used for unit costs and for calculating quantities to conform to current Caltrans standards. The individual cost items are described in the following section.

IV. DESCRIPTION OF COST ITEMS

The cost items and unit costs used in this analysis are summarized in this section. The following abbreviations are used.

M = Meter (1 M = 3.3 feet)
M2 = Square meter (1 M2 = 11 square feet)
M3 = Cubic meter (1 M3 = 35 cubic feet)
KM = Kilometer (1 KM = 0.6 miles)
EA = Each
LS = Lump sum
R/W = Right of way
PS&E = Plans, specifications & estimate

CONSTRUCTION COST ITEMS

Roadway Work	**Unit Cost**
Site Preparation: This item includes clearing and grubbing and removal of existing improvements within a project boundary, except buildings, and is calculated based on the total project footprint area of the alternative. The unit cost was derived from averaging recent, local freeway construction project site preparation costs over their total project boundary areas.	$20 per M2 of project footprint area
Building Demolition: This item includes costs of demolishing residential or commercial buildings being impacted by the proposed alternative. An individual lump sum amount was estimated for each alternative based on evaluation of aerial photos overlaid on the proposed project footprint.	Lump Sum, unique for each project
Earthwork: This item includes both roadway excavation work and imported borrow required to complete the project. Structural excavation for depressed structures, U-channel structures, and cut and cover tunnels is also included in this item. The unit cost per cubic meter was derived from bid estimates of recent, local freeway construction projects.	$50 per M3 of proposed earthwork
Pavement Section – Local Roadway & Freeway: Two conservative pavement structural sections were assumed, one that would be typical for a local street and one that would be typical for a freeway. The unit costs were then derived by combining costs for asphalt concrete, aggregate base, and aggregate sub base per square meter of pavement structural section.	Local Road - $60 per M2 of pavement Freeway - $80 per M2 of pavement
Storm drainage: This item includes all standard drainage work for an alternative and is calculated based on the total project footprint area of the alternative. The unit cost was derived from averaging recent, local freeway construction project drainage costs over their total project boundary areas.	$10 per M2 of project footprint area
Special storm drainage: This item accounts for additional storm drainage needs such as pump stations, storage reservoirs, etc., for alternatives that have depressed roadways, intersections or tunnels where water cannot be carried away by standard gravity systems. An individual lump sum amount was estimated for each alternative based on the magnitude of the special drainage needs.	Lump Sum, unique for each project

Concrete barrier: Concrete traffic barriers were assumed on both elevated and depressed roadways along the edges of shoulders and in the medians between the two directions of traffic flow. The unit cost per meter was derived from bid estimates of recent, local freeway construction projects.	$500 per M of proposed barrier length
Curb, gutter and sidewalk: This item includes the cost of constructing sidewalks and street curbs & gutters and is calculated based on the actual area of proposed sidewalk improvements. The unit cost was derived by combining costs for both concrete and aggregate base work per square meter of curb, gutter and sidewalk from recent, local street improvement projects.	$120 per M2 of proposed gutter and sidewalk area
Landscaping and irrigation: This item includes all landscaping and irrigation costs for an alternative and is calculated based on the estimated area of required landscaping. The unit cost was derived from averaging recent, local freeway construction project landscaping and irrigation costs over the respective areas of actual landscaping placed.	$50 per M2 of proposed landscaped area
Signalized intersection: This item includes all associated costs of installing a new traffic signal on a project. Three separate unit costs were calculated based on experience with recent infrastructure projects to allow for more accurate allocation of cost based on size and complexity of a proposed traffic signal.	$100,000 for a small, simple signal $200,000 for a median size signal $300,000 for a large, complex signal
Lighting: This item includes all street lighting and electrical work for an alternative and is calculated based on the total project footprint area of the alternative. The unit cost was derived from averaging recent, local freeway construction project lighting and electrical costs over their total project boundary areas.	$10 per M2 of project footprint area
Minor items: This item accounts for a variety of small, miscellaneous and minor items of work that aren't feasible to itemize separately for a concept level cost estimate, such as guard rails, fencing, striping, signs, etc. This cost is assumed as 20 percent of the combined total cost of all the other roadway work items for a particular alternative.	20% of total roadway work costs

Structure Work	**Unit Cost**
Elevated structure: This item includes the costs of constructing an elevated roadway structure such as bridge crossings, flyover connector ramps, and elevated express lanes and is calculated based on the total plan area of the proposed structure. The unit cost for elevated structures was calculated for three different heights (or complexity) of structure to account for the increased cost of constructing taller or more complex structures: 1-story, 2-story, and complex. The unit cost includes all work associated with constructing the structure such as concrete, steel, forms, false work, columns, foundations & footings, abutments, approach slabs, structural excavation, etc.	$1,500 per M2 for 1-story structure $1,800 per M2 for 2-story structure $2,000 per M2 for complex structures
Excavation shoring, foundation slab, and finish wall: These three items are required to construct a depressed roadway or intersection and are only included on those particular alternatives that include this type of work – the Bayfront Expressway Grade Separations, Willow Road, and University Avenue alternatives (Alts. 3, 7 & 9).	
The excavation shoring item includes the cost of installing a concrete cast in drilled hole shoring system and is calculated based on the total exposed vertical wall area of the excavated trench or basin. The unit cost was derived from recent Bay area project installations of this type of shoring system. This item is also used in conjunction with the Depressed U-channel w/ Cantilever item and the Cut & Cover Box Culvert Tunnel item.	$1,200 per M2 of exposed, vertical wall
The foundation slab item includes the cost of all work associated with placing a concrete "seal course" and a concrete foundation slab for the depressed roadway or intersection and is calculated based on the actual volume of the proposed concrete foundation slab. The unit cost was derived from the cost to complete general structural concrete work in recent, local freeway construction projects.	$600 per M3 of foundation slab
The finish wall item includes the cost of constructing the final, structural concrete support wall in front of the excavation shoring system and is calculated based on the total exposed vertical wall area of the excavated trench or basin. The unit cost was derived from the cost to complete structural concrete retaining walls in recent, local freeway construction projects.	$600 per M2 of exposed, vertical wall

Depressed U-channel w/ cantilever: This item covers the cost of constructing a U-shaped, depressed, concrete structure to contain a depressed roadway with cantilevered "platforms" above on each side for local frontage roads and is calculated based on the actual concrete volume of the proposed structure. The unit cost was derived from the cost for complex structural concrete work on recent, local infrastructure projects and includes all work associated with constructing the structure such as concrete, steel reinforcement, forms, falsework, and a seal course below the U-channel.	$1,100 per M3 of structural concrete
Retaining wall: This item includes the cost of constructing above-grade retaining walls of various types and is calculated based on the proposed vertical wall area. The unit cost per square meter was derived from bid estimates for retaining wall work on recent, local freeway construction projects.	$1,200 per M2 of vertical wall area
Soundwall: This item includes the cost of constructing soundwalls at grade or on elevated roadway structures adjacent to residential areas and is calculated based on the proposed vertical soundwall area. The unit cost per square meter was derived from bid estimates for soundwall work on recent, local freeway construction projects. Soundwalls were assumed to be 4.0 meters high on grade and 1.8 meters high on elevated structures.	$400 per M2 of vertical soundwall area
Tunnel – cut and cover box culvert: This item includes the cost of constructing a reinforced concrete box culvert tunnel structure in an excavated trench and is calculated based on the actual concrete volume of the proposed box structure. The unit cost was derived from the cost for complex structural concrete work on recent, local infrastructure projects and includes all work associated with constructing the box culvert such as concrete, steel reinforcement, forms, falsework, and a seal course below the box. Excavation, shoring and earthwork to fill back over the box are not included in this item but in the items previously discussed.	$1,100 per M3 of structural concrete
Tunnel – single bored tube: This item includes the cost of constructing a mechanically bored tunnel structure for a 2-lane roadway and is calculated based on the plan footprint area of the proposed tunnel structure. The unit cost was derived from recent Caltrans cost estimates for major tunneling projects including the Devil's Slide Tunnel project in San Mateo County and the Coronado Tunnel project in San Diego.	$1,500 per M2 of tunnel plan footprint area

Overhead signs: The unit cost for proposed overhead sign structures was derived from averaging the costs of overhead signs on recent, local freeway construction projects.	$40,000 for each sign
Miscellaneous Items	**Unit Cost**
Traffic control/traffic handling: This item includes the costs of providing construction staging, detours and traffic control during construction. An individual lump sum amount was estimated for each alternative based on the construction complexity of that alternative and the degree of traffic impacts expected. Costs were derived from experience with similar recent construction projects. The exceptions to this method are the two Route 101 elevated express lane alternatives (Alts. 2.1 & 2.2) in which a unit cost per kilometer was used.	Lump Sum, unique for each project $2,000,000 per KM for 101 elevated express lanes
Water Pollution/Erosion Control: This item includes all permanent erosion control features for an alternative and all water pollution control work during construction, and is calculated based on the total project footprint area of the alternative. The unit cost was derived from averaging recent, local freeway construction project water pollution and erosion control costs over their total project boundary areas.	$5 per M2 of project footprint area
Temporary Widening: This item is used specifically for the two Route 101 elevated express lane alternatives (Alts. 2.1 & 2.2) due to the complex nature of temporarily shifting the freeway traffic out to allow for construction of the elevated structure in the median, and is calculated based on the plan area of actual temporary widening required (an 8 meter wide construction zone is needed in the median of the freeway to construct the structure). The unit cost includes all work associated with the temporary widening including excavation, temporary pavement section, drainage relocations, frontage road relocations, and other miscellaneous work.	$200 per M2 of freeway widening required
Tunnel ventilation & lighting: These items are used specifically for the Willow Road and University Avenue tunnel alternatives (Alts. 7.3 & 9.3) due to the special requirements of an enclosed traffic route and are calculated based on the plan footprint area of the proposed tunnel structure. The unit costs were derived from recent Caltrans cost estimates for major tunneling projects including the Devil's Slide Tunnel project in San Mateo County and the Coronado Tunnel project in San Diego.	$1,200 per M2 of plan tunnel area - Ventilation $300 per M2 of plan tunnel area – Lighting

Dewatering: This item includes the costs of dewatering excavated pits, trenches, foundations or drilled holes during construction. An individual lump sum or cost per meter amount was estimated for each alternative based on the specific dewatering requirements of that alternative. Costs were derived from experience with similar recent construction projects.	Lump Sum, unique for each project, or $2,500 per M of linear excavation
Railroad shoefly: This item is used specifically for the alternatives where a depressed roadway section will pass under the Dumbarton Rail Corridor railroad tracks. A temporary railroad "shoefly" detour track would have to be constructed around the crossing location until a new railroad bridge was constructed over the depressed roadway.	Lump Sum, $2,000,000 per shoefly

Other Additions	**Unit Cost**
Mobilization & contingency: This item includes the costs for construction mobilization and project contingency. This cost is assumed as 40 percent of the combined total cost of roadway work, structure work and miscellaneous items for a particular alternative.	40% of total construction costs

RIGHT OF WAY COST ITEMS

Acquisition: This item includes the costs of right of way acquisition and is calculated based on the estimated area of right of way take required to complete the project. It includes the cost for purchasing the land and relocating residents or businesses. Areas of required right of way acquisition were conservatively estimated based on the footprint of the proposed improvements overlaid on aerial photography of the project site. The unit cost per square meter was derived from discussions with local right of way agents working for public agencies.	$1,000 per M2 of right of way take
Utility Relocation: This item includes the cost to relocate existing utilities or install new utilities due to a project's impact. An individual lump sum amount was estimated for each alternative based on the degree of utility impacts expected. Costs were derived from experience with similar recent construction projects.	Lump Sum, unique for each project
Environmental Mitigation: This item includes the cost to create or buy new environmental habitat to mitigate for the loss of existing habitat due to a project's impact. An individual lump sum amount was estimated for each alternative based on the degree of environmental impacts expected. Costs were derived from experience with similar recent construction projects.	Lump Sum, unique for each project

ENGINEERING SUPPORT COST ITEMS

Environmental Documents: This item includes the costs for completing a Project Study Report, Project Report, and the associated environmental studies for a proposed project. This cost is assumed as 15 percent of the total construction cost for a particular alternative.	15% of construction cost
PS&E: This item includes the costs for engineering design and development of the plans, specifications and cost estimates for a proposed project. This cost is assumed as 15 percent of the total construction cost for a particular alternative.	15% of construction cost
R/W Engineering: This item includes the costs for right of way engineering, appraisals, right of way negotiations, and completion of final right of way documents for a proposed project. This cost is assumed as 10 percent of the total right of way costs for a particular alternative.	10% of right of way costs
Construction Management: This item includes the costs for administrating and managing the construction contract for a proposed project. This cost is assumed as 15 percent of the total construction cost for a particular alternative.	15% of construction cost

*Note: reduced percentages are used for support costs on the Route 101 elevated express lane alternatives due to the large scale and the singular, repetitive nature of the project

V. CALCULATION OF QUANTITIES

Quantities were calculated for each individual project alternative based on the exhibits developed during the Alternatives Analysis phase of this study. CADD software was used to calculate areas or lengths of project elements directly from the exhibits. Earthwork and structure volumes were calculated by hand. Project area footprints were superimposed over aerial photography to estimate right of way takes, environmental impacts, and building impacts.

The Appendix contains individual two-page Cost Estimate Forms for each of the 13 project alternatives studied.

2020 Peninsula Gateway Corridor Study

Draft Memorandum
Task 8 - Conceptual Cost Estimates

Appendix - Cost Estimate Worksheets

KEY TO ABBREVIATIONS:

M = Meter (1 M = 3.3 feet)
M2 = Square meter (1 M2 = 11 square feet)
M3 = Cubic meter (1 M3 = 35 cubic feet)
KM = Kilometer (1 KM = 0.6 miles)
EA = Each
LS = Lump sum
R/W = Right of way
PS&E = Plans, specifications & estimate

February 27, 2006

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 1.1 - Route 101 Auxiliary Lanes - Embarcadero to Shoreline

Proposed Improvements: New auxiliary lane in each direction, San Antonio Rd interchange improvements, ramp modifications, drainage improvements, soundwalls, retaining walls, local street improvements

1)	Construction	$57,000,000	
2)	Right of Way	$20,000,000	
3)	Engineering Support	$28,000,000	
	Total Cost:	**$105,000,000**	**Year 2006**
	(Escalated at 3.5% per year)	$202,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	262,000	$5,240,000
Building Demolition	LS	$2,000,000	1	$2,000,000
Earthwork	M3	$50	9,400	$470,000
Pavement Section - Local Road	M2	$60	4,200	$252,000
Pavement Section - Freeway	M2	$80	69,000	$5,520,000
Storm Drainage	M2	$10	262,000	$2,620,000
Special Storm Drainage (Longitud. Box)	LS	$4,000,000	1	$4,000,000
Concrete Barrier	M	$500	600	$300,000
Curb, Gutter and Sidewalk	M2	$120	1,200	$144,000
Landscaping and Irrigation	M2	$50	67,000	$3,350,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	1	$200,000
Signalized Intersection - Large	EA	$300,000	0	-
Lighting	M2	$10	67,000	$670,000
Minor Items (20% of Roadway)	LS	$4,953,000	1	$4,953,000
			Subtotal	$29,700,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	1,700	$2,550,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Depressed U-Channel	M3	$1,100	0	-
Retaining Wall	M2	$1,200	300	$360,000
Soundwall	M2	$400	2,500	$1,000,000
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	16	$640,000
			Subtotal	$4,550,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$5,000,000	1	$5,000,000
Water Pollution/Erosion Control	M2	$5	262,000	$1,310,000
			Subtotal	$6,310,000
Other Additions				
Mobilization & Contingency (40%)	LS	$16,224,000	1	$16,200,000
			Total Construction Cost:	**$56,760,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	5,000	$5,000,000
Utility Relocation	LS	$10,000,000	1	$10,000,000
Environmental Mitigation	LS	$5,000,000	1	$5,000,000
			Total Right of Way Cost:	**$20,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$8,510,000	1	$8,510,000
PS&E (15%)	LS	$8,510,000	1	$8,510,000
R/W Engineering (10% of R/W Cost)	LS	$2,000,000	1	$2,000,000
Construction Management (15%)	LS	$8,510,000	1	$8,510,000
			Total Engineering Support Cost:	**$27,500,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 2.1 - Route 101 Elevated Express Lanes (Mixed Traffic)

Proposed Improvements: Elevated express lanes down freeway median, utility relocations, new and relocated sound walls, frontage road relocations

1)	Construction	$900,000,000	
2)	Right of Way	$80,000,000	
3)	Engineering Support	$230,000,000	
	Total Cost:	**$1,210,000,000**	**Year 2006**
	(Escalated at 3.5% per year)	$2,330,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	705,000	$14,100,000
Building Demolition	LS	$5,000,000	1	$5,000,000
Earthwork	M3	$50	73,000	$3,650,000
Pavement Section - Local Road	M2	$60	40,000	$2,400,000
Pavement Section - Freeway	M2	$80	64,000	$5,120,000
Storm Drainage	M2	$10	705,000	$7,050,000
Special Storm Drainage	LS	$4,000,000	1	$4,000,000
Concrete Barrier	M	$500	46,000	$23,000,000
Curb, Gutter and Sidewalk	M2	$120	10,000	$1,200,000
Landscaping and Irrigation	M2	$50	10,000	$500,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	0	-
Lighting	M2	$10	8,400	$84,000
Minor Items (20% of Roadway)	LS	$13,221,000	1	$13,221,000
			Subtotal	$79,300,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	0	-
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	239,000	$478,000,000
Depressed U-Channel	M3	$1,100	0	-
Retaining Wall	M2	$1,200	3,100	$3,720,000
Soundwall	M2	$400	80,000	$32,000,000
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	40	$1,600,000
			Subtotal	$515,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	KM	$2,000,000	15	$30,000,000
Water Pollution/Erosion Control	M2	$5	705,000	$3,525,000
Temporary Widening	M2	$200	60,000	$12,000,000
Dewatering	LS	$5,000,000	1	$5,000,000
			Subtotal	$50,500,000
Other Additions				
Mobilization & Contingency (40%)	LS	$257,920,000	1	$258,000,000
		Total Construction Cost:		**$902,800,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	30,000	$30,000,000
Utility Relocation	LS	$40,000,000	1	$40,000,000
Environmental Mitigation	LS	$10,000,000	1	$10,000,000
		Total Right of Way Cost:		**$80,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (5%)	LS	$45,140,000	1	$45,140,000
PS&E (10%)	LS	$90,280,000	1	$90,280,000
R/W Engineering (10% of R/W Cost)	LS	$8,000,000	1	$8,000,000
Construction Management (10%)	LS	$90,280,000	1	$90,280,000
		Total Engineering Support Cost:		**$234,000,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 2.2 - Route 101 Elevated Express Lanes (HOV only)

Proposed Improvements: Elevated express lanes down freeway median, utility relocations, new and relocated sound walls, frontage road relocations

1)	Construction	$850,000,000	
2)	Right of Way	$70,000,000	
3)	Engineering Support	$220,000,000	
	Total Cost:	**$1,140,000,000**	**Year 2006**
	(Escalated at 3.5% per year)	$2,190,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	721,000	$14,420,000
Building Demolition	LS	$5,000,000	1	$5,000,000
Earthwork	M3	$50	59,000	$2,950,000
Pavement Section - Local Road	M2	$60	40,000	$2,400,000
Pavement Section - Freeway	M2	$80	59,000	$4,720,000
Storm Drainage	M2	$10	721,000	$7,210,000
Special Storm Drainage	LS	$2,000,000	1	$2,000,000
Concrete Barrier	M	$500	45,000	$22,500,000
Curb, Gutter and Sidewalk	M2	$120	10,000	$1,200,000
Landscaping and Irrigation	M2	$50	10,000	$500,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	0	-
Lighting	M2	$10	6,000	$60,000
Minor Items (20% of Roadway)	LS	$12,592,000	1	$12,592,000
			Subtotal	$75,600,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	0	-
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	224,200	$448,400,000
Depressed U-Channel	M3	$1,100	0	-
Retaining Wall	M2	$1,200	2,500	$3,000,000
Soundwall	M2	$400	77,200	$30,880,000
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	40	$1,600,000
			Subtotal	$484,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	KM	$2,000,000	15	$30,000,000
Water Pollution/Erosion Control	M2	$5	705,000	$3,525,000
Temporary Widening	M2	$200	60,000	$12,000,000
Dewatering	LS	$5,000,000	1	$5,000,000
			Subtotal	$50,500,000
Other Additions				
Mobilization & Contingency (40%)	LS	$244,040,000	1	$244,000,000
		Total Construction Cost:		**$854,100,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	20,000	$20,000,000
Utility Relocation	LS	$40,000,000	1	$40,000,000
Environmental Mitigation	LS	$10,000,000	1	$10,000,000
		Total Right of Way Cost:		**$70,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (5%)	LS	$42,710,000	1	$42,710,000
PS&E (10%)	LS	$85,410,000	1	$85,410,000
R/W Engineering (10% of R/W Cost)	LS	$7,000,000	1	$7,000,000
Construction Management (10%)	LS	$85,410,000	1	$85,410,000
		Total Engineering Support Cost:		**$221,000,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 3.1 - Bayfront Expressway Grade Separations

Proposed Improvements: Grade separations at University Avenue and Willow Road intersections, depressed local street intersections, fly-over ramps, retaining walls

1)	Construction	$180,000,000	
2)	Right of Way	$67,000,000	
3)	Engineering Support	$86,000,000	
	Total Cost:	**$333,000,000**	**Year 2006**
	(Escalated at 3.5% per year)	$640,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	75,000	$1,500,000
Building Demolition	LS	$0	0	-
Earthwork	M3	$50	87,000	$4,350,000
Pavement Section - Local Road	M2	$60	28,000	$1,680,000
Pavement Section - Freeway	M2	$80	30,000	$2,400,000
Storm Drainage	M2	$10	75,000	$750,000
Special Storm Drainage (Pumps)	EA	$4,000,000	2	$8,000,000
Concrete Barrier	M	$500	2,300	$1,150,000
Curb, Gutter and Sidewalk	M2	$120	2,600	$312,000
Landscaping and Irrigation	M2	$50	75,000	$3,750,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	2	$400,000
Signalized Intersection - Large	EA	$300,000	0	-
Lighting	M2	$10	75,000	$750,000
Minor Items (20% of Roadway)	LS	$5,008,000	1	$5,008,000
			Subtotal	$30,100,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	16,000	$24,000,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Excavation Shoring	M2	$1,200	14,000	$16,800,000
Foundation Slab	M3	$600	42,000	$25,200,000
Finish Wall	M2	$600	14,000	$8,400,000
Retaining Wall	M2	$1,200	3,000	$3,600,000
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	5	$200,000
			Subtotal	$78,200,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$15,000,000	1	$15,000,000
Water Pollution/Erosion Control	M2	$5	75,000	$375,000
Dewatering	EA	$1,000,000	2	$2,000,000
			Subtotal	$17,400,000
Other Additions				
Mobilization & Contingency (40%)	LS	$50,280,000	1	$50,300,000
			Total Construction Cost:	**$176,000,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	42,000	$42,000,000
Utility Relocation	LS	$10,000,000	1	$10,000,000
Environmental Mitigation	LS	$15,000,000	1	$15,000,000
			Total Right of Way Cost:	**$67,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$26,400,000	1	$26,400,000
PS&E (15%)	LS	$26,400,000	1	$26,400,000
R/W Engineering (10% of R/W Cost)	LS	$6,700,000	1	$6,700,000
Construction Management (15%)	LS	$26,400,000	1	$26,400,000
			Total Engineering Support Cost:	**$85,900,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Kimley-Horn and Associates, Inc.

February 27, 2006

Alternative: 4.1 - Willow Road Short Term Improvements

Proposed Improvements: Signal modification and minor approach widening at Ivy/Willow. Signal timing at four intersections.

1)	Construction	$92,000	
2)	Right of Way	-	
3)	Engineering Support	$30,000	
	Total Cost:	**$122,000**	**Year 2006**
	(Escalated at 3.5% per year)	$235,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	150	$3,000
Building Demolition	LS	$0	0	-
Earthwork	M3	$50	0	-
Pavement Section - Local Road	M2	$60	90	$5,400
Pavement Section - Freeway	M2	$80	0	-
Storm Drainage	M2	$10	30	$300
Special Storm Drainage	LS	$0	0	-
Concrete Barrier	M	$500	0	-
Curb, Gutter and Sidewalk	M2	$120	60	$7,200
Landscaping and Irrigation	M2	$50	0	-
Signalized Intersection Modification	EA	$25,000	1	$25,000
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	0	-
Lighting	M2	$10	0	-
Minor Items (20% of Roadway)	LS	$8,000	1	$8,000
			Subtotal	$48,900

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Kimley-Horn and Associates, Inc.

February 27, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	0	-
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Depressed U-Channel	M3	$1,100	0	-
Retaining Wall	M2	$1,200	0	-
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	0	-
			Subtotal	$0
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$8,000	1	$8,000
Traffic Signal Timing	EA	$1,500	6	$9,000
Water Pollution/Erosion Control	M2	$5	0	-
			Subtotal	$17,000
Other Additions				
Mobilization & Contingency (40%)	LS	$26,000	1	$26,000
			Total Construction Cost:	**$91,900**

2) RIGHT OF WAY

Acquisition	M2	$1,000	0	-
Utility Relocation	LS	$0	1	-
Environmental Mitigation	LS	$0	1	-
			Total Right of Way Cost:	**$0**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$10,000	1	$10,000
PS&E (15%)	LS	$10,000	1	$10,000
R/W Engineering (10% of R/W Cost)	LS	$0	1	-
Construction Management (15%)	LS	$10,000	1	$10,000
			Total Engineering Support Cost:	**$30,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

Alternative: 6.1 - Willow Road Elevated Viaduct

Proposed Improvements: Elevated Viaduct Structure, Fly-over connecting ramps, local street improvements, utility relocation, engineering support

1)	Construction	$96,000,000	
2)	Right of Way	$33,000,000	
3)	Engineering Support	$46,000,000	
	Total Cost:	**$175,000,000**	**Year 2006**
	(Escalated to 3.5% per year)	$336,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	55,000	$1,100,000
Building Demolition	LS	$0	1	-
Earthwork	M3	$50	2,000	$100,000
Pavement Section - Local Road	M2	$60	0	-
Pavement Section - Freeway	M2	$80	10,000	$800,000
Storm Drainage	M2	$10	55,000	$550,000
Special Storm Drainage (Pumps)	LS	$0	1	-
Concrete Barrier	M	$500	7,000	$3,500,000
Curb, Gutter and Sidewalk	M2	$120	0	-
Landscaping and Irrigation	M2	$50	3,400	$170,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	3	$900,000
Lighting	M2	$10	55,000	$550,000
Minor Items (20% of Roadway)	LS	$1,534,000	1	$1,534,000
			Subtotal	$9,200,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	29,000	$43,500,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Excavation Shoring	M2	$1,200	0	-
Depressed U-Channel w/ Cantilever	M3	$1,100	0	-
Retaining Wall	M2	$1,200	2,000	$2,400,000
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$46,100,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$11,000,000	1	$11,000,000
Water Pollution/Erosion Control	M2	$5	55,000	$275,000
Tunnel Ventilation	M2	$1,200	0	-
Tunnel Lighting	M2	$300	0	-
Dewatering	M	$2,500	0	-
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$13,300,000
Other Additions				
Mobilization & Contingency (40%)	LS	$27,440,000	1	$27,400,000
			Total Construction Cost:	**$96,000,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	5,400	$5,400,000
Utility Relocation	LS	$22,000,000	1	$22,000,000
Environmental Mitigation	LS	$5,000,000	1	$5,000,000
			Total Right of Way Cost:	**$32,400,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$14,400,000	1	$14,400,000
PS&E (15%)	LS	$14,400,000	1	$14,400,000
R/W Engineering (10% of R/W Cost)	LS	$3,240,000	1	$3,240,000
Construction Management (15%)	LS	$14,400,000	1	$14,400,000
			Total Engineering Support Cost:	**$46,400,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

Alternative: 7.1 - Willow Road Depressed Express Lanes

Proposed Improvements: Depressed roadway, bored portal approach tunnels, local street overcrossings, local access frontage roads, utility relocations, street lighting

1)	Construction	$170,000,000	
2)	Right of Way	$40,000,000	
3)	Engineering Support	$82,000,000	
	Total Cost:	**$292,000,000**	**Year 2006**
	(Escalated at 3.5% per year)	$561,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	55,000	$1,100,000
Building Demolition	LS	$0	1	-
Earthwork	M3	$50	325,000	$16,250,000
Pavement Section - Local Road	M2	$60	20,000	$1,200,000
Pavement Section - Freeway	M2	$80	9,300	$744,000
Storm Drainage	M2	$10	55,000	$550,000
Special Storm Drainage (Pumps)	LS	$10,000,000	1	$10,000,000
Concrete Barrier	M	$500	7,000	$3,500,000
Curb, Gutter and Sidewalk	M2	$120	9,000	$1,080,000
Landscaping and Irrigation	M2	$50	3,400	$170,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	3	$900,000
Lighting	M2	$10	55,000	$550,000
Minor Items (20% of Roadway)	LS	$7,209,000	1	$7,209,000
			Subtotal	$43,300,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	1,500	$2,250,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Excavation Shoring	M2	$1,200	12,000	$14,400,000
Foundation Slab	M3	$600	22,000	$13,200,000
Finish Wall	M2	$600	12,000	$7,200,000
Retaining Wall	M2	$1,200	2,000	$2,400,000
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	16,400	$24,600,000
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$64,200,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$11,000,000	1	$11,000,000
Water Pollution/Erosion Control	M2	$5	55,000	$275,000
Dewatering	M	$2,500	1,100	$2,750,000
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$16,000,000
Other Additions				
Mobilization & Contingency (40%)	LS	$49,400,000	1	$49,400,000
			Total Construction Cost:	**$172,900,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	12,600	$12,600,000
Utility Relocation	LS	$22,000,000	1	$22,000,000
Environmental Mitigation	LS	$5,000,000	1	$5,000,000
			Total Right of Way Cost:	**$39,600,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$25,940,000	1	$25,940,000
PS&E (15%)	LS	$25,940,000	1	$25,940,000
R/W Engineering (10% of R/W Cost)	LS	$3,960,000	1	$3,960,000
Construction Management (15%)	LS	$25,940,000	1	$25,940,000
			Total Engineering Support Cost:	**$81,800,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

Alternative: 7.2 - Willow Road Depressed Express Lanes w/ Cantilever Frontage Roads

Proposed Improvements: Depressed roadway with cantilever local access frontage roads, bored portal approach tunnels, local street overcrossings, utility relocations, street lighting

1)	Construction	$230,000,000	
2)	Right of Way	$33,000,000	
3)	Engineering Support	$110,000,000	
	Total Cost:	**$373,000,000**	**Year 2006**
	(Escalated to 3.5% per year)	$717,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	55,000	$1,100,000
Building Demolition	LS	$0	1	-
Earthwork	M3	$50	324,000	$16,200,000
Pavement Section - Local Road	M2	$60	7,500	$450,000
Pavement Section - Freeway	M2	$80	9,300	$744,000
Storm Drainage	M2	$10	55,000	$550,000
Special Storm Drainage (Pumps)	LS	$10,000,000	1	$10,000,000
Concrete Barrier	M	$500	7,000	$3,500,000
Curb, Gutter and Sidewalk	M2	$120	9,000	$1,080,000
Landscaping and Irrigation	M2	$50	3,400	$170,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	3	$900,000
Lighting	M2	$10	55,000	$550,000
Minor Items (20% of Roadway)	LS	$7,049,000	1	$7,049,000
			Subtotal	$42,300,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	1,500	$2,250,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Excavation Shoring	M2	$1,200	12,000	$14,400,000
Depressed U-Channel w/ Cantilever	M3	$1,100	57,000	$62,700,000
Retaining Wall	M2	$1,200	2,000	$2,400,000
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	16,400	$24,600,000
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$107,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$11,000,000	1	$11,000,000
Water Pollution/Erosion Control	M2	$5	55,000	$275,000
Dewatering	M	$2,500	1,100	$2,750,000
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$16,000,000
Other Additions				
Mobilization & Contingency (40%)	LS	$66,120,000	1	$66,100,000
			Total Construction Cost:	**$231,400,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	5,400	$5,400,000
Utility Relocation	LS	$22,000,000	1	$22,000,000
Environmental Mitigation	LS	$5,000,000	1	$5,000,000
			Total Right of Way Cost:	**$32,400,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$34,710,000	1	$34,710,000
PS&E (15%)	LS	$34,710,000	1	$34,710,000
R/W Engineering (10% of R/W Cost)	LS	$3,240,000	1	$3,240,000
Construction Management (15%)	LS	$34,710,000	1	$34,710,000
			Total Engineering Support Cost:	**$107,000,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

Alternative: 7.3 - Willow Road Tunnel

Proposed Improvements: Cut and cover tunnel, bored portal approach tunnels, local street reconstructed, utility relocations, street lighting

1)	Construction	$280,000,000	
2)	Right of Way	$33,000,000	
3)	Engineering Support	$130,000,000	
	Total Cost:	**$443,000,000**	**Year 2006**
	(Escalated to 3.5% per year)	$852,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	55,000	$1,100,000
Building Demolition	LS	$0	1	-
Earthwork	M3	$50	324,000	$16,200,000
Pavement Section - Local Road	M2	$60	35,000	$2,100,000
Pavement Section - Freeway	M2	$80	9,000	$720,000
Storm Drainage	M2	$10	55,000	$550,000
Special Storm Drainage (Pumps)	LS	$5,000,000	1	$5,000,000
Concrete Barrier	M	$500	7,000	$3,500,000
Curb, Gutter and Sidewalk	M2	$120	3,500	$420,000
Landscaping and Irrigation	M2	$50	3,400	$170,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	3	$900,000
Lighting	M2	$10	55,000	$550,000
Minor Items (20% of Roadway)	LS	$6,242,000	1	$6,242,000
			Subtotal	$37,500,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Caltrans

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	0	-
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Excavation Shoring	M2	$1,200	15,000	$18,000,000
Depressed U-Channel w/ Cantilever	M3	$1,100	0	-
Retaining Wall	M2	$1,200	2,000	$2,400,000
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	72,000	$79,200,000
Tunnel - Single Bored Tube	M2	$1,500	16,400	$24,600,000
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$124,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$11,000,000	1	$11,000,000
Water Pollution/Erosion Control	M2	$5	55,000	$275,000
Tunnel Ventilation	M2	$1,200	17,000	$20,400,000
Tunnel Lighting	M2	$300	17,000	$5,100,000
Dewatering	M	$2,500	1,100	$2,750,000
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$41,500,000
Other Additions				
Mobilization & Contingency (40%)	LS	$81,200,000	1	$81,200,000
			Total Construction Cost:	**$284,200,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	5,400	$5,400,000
Utility Relocation	LS	$22,000,000	1	$22,000,000
Environmental Mitigation	LS	$5,000,000	1	$5,000,000
			Total Right of Way Cost:	**$32,400,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$42,630,000	1	$42,630,000
PS&E (15%)	LS	$42,630,000	1	$42,630,000
R/W Engineering (10% of R/W Cost)	LS	$3,240,000	1	$3,240,000
Construction Management (15%)	LS	$42,630,000	1	$42,630,000
			Total Engineering Support Cost:	**$131,000,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Kimley-Horn and Associates, Inc.

February 27, 2006

Alternative: 8.1 - University Avenue Short Term Improvements

Proposed Improvements: Signal modifications at four intersections. Signal timing at six intersections.

1)	Construction	$180,000	
2)	Right of Way	-	
3)	Engineering Support	$90,000	
	Total Cost:	**$270,000**	**Year 2006**
	(Escalated at 3.5% per year)	$519,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	0	-
Building Demolition	LS	$0	0	-
Earthwork	M3	$50	0	-
Pavement Section - Local Road	M2	$60	0	-
Pavement Section - Freeway	M2	$80	0	-
Storm Drainage	M2	$10	0	-
Special Storm Drainage	LS	$0	0	-
Concrete Barrier	M	$500	0	-
Curb, Gutter and Sidewalk	M2	$120	0	-
Landscaping and Irrigation	M2	$50	0	-
Signalized Intersection Modification	EA	$25,000	4	$100,000
Signalized Intersection - Medium	EA	$200,000	0	-
Signalized Intersection - Large	EA	$300,000	0	-
Lighting	M2	$10	0	-
Minor Items (20% of Roadway)	LS	$20,000	1	$20,000
			Subtotal	$120,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Kimley-Horn and Associates, Inc.

February 27, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	0	-
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	0	-
Depressed U-Channel	M3	$1,100	0	-
Retaining Wall	M2	$1,200	0	-
Soundwall	M2	$400	0	-
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	0	-
			Subtotal	$0
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$0	1	-
Traffic Signal Timing	EA	$1,500	6	$9,000
Water Pollution/Erosion Control	M2	$5	0	-
			Subtotal	$9,000
Other Additions				
Mobilization & Contingency (40%)	LS	$52,000	1	$52,000
			Total Construction Cost:	**$181,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	0	-
Utility Relocation	LS	$0	1	-
Environmental Mitigation	LS	$0	1	-
			Total Right of Way Cost:	**$0**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$30,000	1	$30,000
PS&E (15%)	LS	$30,000	1	$30,000
R/W Engineering (10% of R/W Cost)	LS	$0	1	-
Construction Management (15%)	LS	$30,000	1	$30,000
			Total Engineering Support Cost:	**$90,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 9.1 - University Avenue Depressed Express Lanes

Proposed Improvements: Depressed roadway, fly-over ramp connections, local street overcrossings, local access frontage roads, utility relocations, street lighting

1)	Construction	$310,000,000	
2)	Right of Way	$72,000,000	
3)	Engineering Support	$150,000,000	
	Total Cost:	**$532,000,000**	**Year 2006**
	(Escalated at 3.5% per year)	$1,023,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	113,000	$2,260,000
Building Demolition	LS	$4,000,000	1	$4,000,000
Earthwork	M3	$50	425,000	$21,250,000
Pavement Section - Local Road	M2	$60	49,000	$2,940,000
Pavement Section - Freeway	M2	$80	14,000	$1,120,000
Storm Drainage	M2	$10	113,000	$1,130,000
Special Storm Drainage (Pumps)	LS	$20,000,000	1	$20,000,000
Concrete Barrier	M	$500	17,000	$8,500,000
Curb, Gutter and Sidewalk	M2	$120	15,000	$1,800,000
Landscaping and Irrigation	M2	$50	2,000	$100,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	3	$600,000
Signalized Intersection - Large	EA	$300,000	1	$300,000
Lighting	M2	$10	113,000	$1,130,000
Minor Items (20% of Roadway)	LS	$13,026,000	1	$13,026,000
			Subtotal	$78,200,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	9,000	$13,500,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	9,000	$18,000,000
Excavation Shoring	M2	$1,200	26,000	$31,200,000
Foundation Slab	M3	$600	51,000	$30,600,000
Finish Wall	M2	$600	26,000	$15,600,000
Retaining Wall	M2	$1,200	2,400	$2,880,000
Soundwall	M2	$400	500	$200,000
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$112,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$20,000,000	1	$20,000,000
Water Pollution/Erosion Control	M2	$5	113,000	$565,000
Dewatering	M	$2,500	2,100	$5,250,000
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$27,800,000
Other Additions				
Mobilization & Contingency (40%)	LS	$87,200,000	1	$87,200,000
			Total Construction Cost:	**$305,200,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	22,000	$22,000,000
Utility Relocation	LS	$40,000,000	1	$40,000,000
Environmental Mitigation	LS	$10,000,000	1	$10,000,000
			Total Right of Way Cost:	**$72,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$45,780,000	1	$45,780,000
PS&E (15%)	LS	$45,780,000	1	$45,780,000
R/W Engineering (10% of R/W Cost)	LS	$7,200,000	1	$7,200,000
Construction Management (15%)	LS	$45,780,000	1	$45,780,000
			Total Engineering Support Cost:	**$145,000,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 9.2 - University Avenue Depressed Express Lanes w/ Cantilever Frontage Roads

Proposed Improvements: Depressed roadway with cantilever local access frontage roads, fly-over ramps, local street overcrossings, utility relocations, street lighting

1)	Construction	$440,000,000	
2)	Right of Way	$64,000,000	
3)	Engineering Support	$200,000,000	
	Total Cost:	**$704,000,000**	**Year 2006**
	(Escalated to 3.5% per year)	$1,350,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	113,000	$2,260,000
Building Demolition	LS	$2,000,000	1	$2,000,000
Earthwork	M3	$50	425,000	$21,250,000
Pavement Section - Local Road	M2	$60	18,000	$1,080,000
Pavement Section - Freeway	M2	$80	14,000	$1,120,000
Storm Drainage	M2	$10	113,000	$1,130,000
Special Storm Drainage (Pumps)	LS	$20,000,000	1	$20,000,000
Concrete Barrier	M	$500	17,000	$8,500,000
Curb, Gutter and Sidewalk	M2	$120	15,000	$1,800,000
Landscaping and Irrigation	M2	$50	2,000	$100,000
Signalized Intersection - Small	EA	$100,000	0	-
Signalized Intersection - Medium	EA	$200,000	3	$600,000
Signalized Intersection - Large	EA	$300,000	1	$300,000
Lighting	M2	$10	113,000	$1,130,000
Minor Items (20% of Roadway)	LS	$12,254,000	1	$12,254,000
			Subtotal	$73,500,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	9,000	$13,500,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	9,000	$18,000,000
Excavation Shoring	M2	$1,200	26,000	$31,200,000
Depressed U-Channel w/ Cantilever	M3	$1,100	131,000	$144,100,000
Retaining Wall	M2	$1,200	2,400	$2,880,000
Soundwall	M2	$400	500	$200,000
Tunnel - Cut & Cover Box Culvert	M3	$1,100	0	-
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$210,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$20,000,000	1	$20,000,000
Water Pollution/Erosion Control	M2	$5	113,000	$565,000
Dewatering	M	$2,500	2,100	$5,250,000
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$27,800,000
Other Additions				
Mobilization & Contingency (40%)	LS	$124,520,000	1	$125,000,000
			Total Construction Cost:	**$436,300,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	14,000	$14,000,000
Utility Relocation	LS	$40,000,000	1	$40,000,000
Environmental Mitigation	LS	$10,000,000	1	$10,000,000
			Total Right of Way Cost:	**$64,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$65,450,000	1	$65,450,000
PS&E (15%)	LS	$65,450,000	1	$65,450,000
R/W Engineering (10% of R/W Cost)	LS	$6,400,000	1	$6,400,000
Construction Management (15%)	LS	$65,450,000	1	$65,450,000
			Total Engineering Support Cost:	**$203,000,000**

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

Alternative: 9.3 - University Avenue Tunnel

Proposed Improvements: Cut and cover tunnel, fly-over ramp connections, local street reconstructed, utility relocations, street lighting

1)	Construction	$560,000,000	
2)	Right of Way	$64,000,000	
3)	Engineering Support	$260,000,000	
	Total Cost:	**$884,000,000**	**Year 2006**
	(Escalated to 3.5% per year)	$1,700,000,000	Year 2025

1) CONSTRUCTION

	Unit	Unit Price	Quantity	Item Cost
Roadway Work				
Site Preparation	M2	$20	103,000	$2,060,000
Building Demolition	LS	$1,000,000	1	$1,000,000
Earthwork	M3	$50	590,000	$29,500,000
Pavement Section - Local Road	M2	$60	77,000	$4,620,000
Pavement Section - Freeway	M2	$80	14,000	$1,120,000
Storm Drainage	M2	$10	103,000	$1,030,000
Special Storm Drainage (Pumps)	LS	$10,000,000	1	$10,000,000
Concrete Barrier	M	$500	13,000	$6,500,000
Curb, Gutter and Sidewalk	M2	$120	6,400	$768,000
Landscaping and Irrigation	M2	$50	6,300	$315,000
Signalized Intersection - Small	EA	$100,000	4	$400,000
Signalized Intersection - Medium	EA	$200,000	3	$600,000
Signalized Intersection - Large	EA	$300,000	1	$300,000
Lighting	M2	$10	103,000	$1,030,000
Minor Items (20% of Roadway)	LS	$11,849,000	1	$11,849,000
			Subtotal	$71,100,000

2020 PENINSULA GATEWAY STUDY
PRELIMINARY COST ESTIMATE SUMMARY

Mark Thomas & Company, Inc.

February 23, 2006

	Unit	Unit Price	Quantity	Item Cost
Structure Work				
Elevated Structure - 1 Story	M2	$1,500	4,000	$6,000,000
Elevated Structure - 2 Story	M2	$1,800	0	-
Elevated Structure - Complex	M2	$2,000	9,000	$18,000,000
Excavation Shoring	M2	$1,200	34,000	$40,800,000
Depressed U-Channel w/ Cantilever	M3	$1,100	0	-
Retaining Wall	M2	$1,200	2,400	$2,880,000
Soundwall	M2	$400	500	$200,000
Tunnel - Cut & Cover Box Culvert	M3	$1,100	168,000	$184,800,000
Tunnel - Single Bored Tube	M2	$1,500	0	-
Overhead Signs	EA	$40,000	4	$160,000
			Subtotal	$253,000,000
Miscellaneous Items				
Traffic Control/Traffic Handling	LS	$20,000,000	1	$20,000,000
Water Pollution/Erosion Control	M2	$5	103,000	$515,000
Tunnel Ventilation	M2	$1,200	32,000	$38,400,000
Tunnel Lighting	M2	$300	32,000	$9,600,000
Dewatering	M	$2,500	2,100	$5,250,000
Railroad Shoefly	LS	$2,000,000	1	$2,000,000
			Subtotal	$75,800,000
Other Additions				
Mobilization & Contingency (40%)	LS	$159,960,000	1	$160,000,000
			Total Construction Cost:	**$559,900,000**

2) RIGHT OF WAY

Acquisition	M2	$1,000	14,000	$14,000,000
Utility Relocation	LS	$40,000,000	1	$40,000,000
Environmental Mitigation	LS	$10,000,000	1	$10,000,000
			Total Right of Way Cost:	**$64,000,000**

3) ENGINEERING SUPPORT (Percentage of Total Construction Cost)

Environmental Documents (15%)	LS	$83,990,000	1	$83,990,000
PS&E (15%)	LS	$83,990,000	1	$83,990,000
R/W Engineering (10% of R/W Cost)	LS	$6,400,000	1	$6,400,000
Construction Management (15%)	LS	$83,990,000	1	$83,990,000
			Total Engineering Support Cost:	**$258,000,000**

2020 Peninsula Gateway Corridor Study

Final Report

Appendix E

Travel Forecasting

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

2020 Peninsula Gateway Corridor Study

Draft Memorandum
Task 5 – Travel Forecasting

Prepared for:

City/County Association of Governments
Of San Mateo County

San Mateo County Transportation Authority

Santa Clara Valley Transportation Authority

Prepared by:

Kimley-Horn
and Associates, Inc.

December 22, 2006

This memorandum summarizes forecasts of traffic volumes and volume/capacity (v/c) ratios for the alternatives under study. It is part of *Task 5 – Travel Forecasting* of the 2020 Peninsula Gateway Corridor Study, which is being conducted by Kimley-Horn and Associates (KHA) for the City/County Association of Governments of San Mateo County (C/CAG), the San Mateo County Transportation Authority, and the Santa Clara Valley Transportation Authority. This memorandum effectively synthesizes a series of traffic forecasts, prepared by C/CAG through its Consultant, Hexagon Transportation Consultants, into simple graphics containing no-build and build peak period traffic volumes and volume-to-capacity ratios for year 2025. The intent is to provide enough data to help evaluate the relative differences between alternatives and not provide all the details of the travel model network that Caltrans, for example, would need to evaluate no-build and build conditions for specific improvements in a formal Project Study Report (PSR) or Project Report/ Environmental Document (PR/ED) process. For reference the Appendix discusses the travel model results in the context of validation of base year conditions and future year 2025 results.

The Technical Advisory Committee (TAC) is requested to review and provide feedback and comments on the information provided herein, especially the relative changes noted between no-build and build cases for each alternative, which will be shared with the Policy Advisory Committee. The results of this cycle of production and reviews will be used in *Task 6 -- Operational Analysis*, which will summarize these findings and other analytical results with respect to measures of effectiveness by alternative.

This memo has been updated to incorporate comments from Caltrans as well as issues discussed by TAC members at the last TAC meeting. The Caltrans evaluation also identified three items that will require additional modeling analysis:

- Increased traffic on Bayfront Expressway as a result of Alternative 1
- Origin and destination of express lane traffic
- Increased traffic on University Ave. as a result of Alternatives 6 and 7.

Year 2025 Forecasts

Year 2025 travel forecasts, in the form of peak period (AM 3 hour and PM 3 hour) traffic volumes and peak period (AM 3 hour and PM 3 hour) v/c ratios, were prepared by C/CAG for the following alternatives under study:

- 1 US 101 Auxiliary Lanes and Interchange Improvements
- 2A US 101 Elevated Express Lanes
- 3 Grade Separations on Bayfront Expressway
- 6 Willow Road *Elevated* Express Lanes
- 7 Willow Road *Depressed* Express Lanes
- 9 University Avenue Depressed Express Lanes.

The alternatives were described in previous technical memoranda.

Individual forecasts were prepared for each alternative with the exception of Alternatives 6 and 7, for which a single forecast was prepared given the layouts of the elevated and depressed elements are considered identical from a modeling perspective. The traffic forecasts are presented in the following figures.

Alternative 1: US 101 Auxiliary Lanes and Interchange Improvements:

1. Year 2025 AM Peak Period Traffic Volumes
2. Year 2025 PM Peak Period Traffic Volumes
3. Year 2025 AM Peak Period V/C Ratios
4. Year 2025 PM Peak Period V/C Ratios

Alternative 2A: US 101 Elevated Express Lanes

5. Year 2025 AM Peak Period Traffic Volumes
6. Year 2025 PM Peak Period Traffic Volumes
7. Year 2025 AM Peak Period V/C Ratios
8. Year 2025 PM Peak Period V/C Ratios

Alternative 3: Grade Separations on Bayfront Expressway

9. Year 2025 AM Peak Period Traffic Volumes
10. Year 2025 PM Peak Period Traffic Volumes
11. Year 2025 AM Peak Period V/C Ratios
12. Year 2025 PM Peak Period V/C Ratios

Alternative 6: Willow Road *Elevated* Express Lanes and
Alternative 7: Willow Road *Depressed* Express Lanes

13. Year 2025 AM Peak Period Traffic Volumes
14. Year 2025 PM Peak Period Traffic Volumes
15. Year 2025 AM Peak Period V/C Ratios
16. Year 2025 PM Peak Period V/C Ratios

Alternative 9: University Avenue Depressed Express Lanes

17. Year 2025 AM Peak Period Traffic Volumes
18. Year 2025 PM Peak Period Traffic Volumes
19. Year 2025 AM Peak Period V/C Ratios
20. Year 2025 PM Peak Period V/C Ratios.

Discussion

The following points highlight the forecasted volumes and volume/capacity ratio changes under each “Build” alternative relative to “No-Build” conditions.

- Alternative 1 would increase traffic volumes on US 101 where the auxiliary lanes are added and the net increase in capacity there would result in small reductions in v/c ratios. On balance, this indicates a net benefit.
- Alternative 2A would increase US 101 traffic demand by 8,000 to 9,000 peak period vehicles in each direction -- in the express lanes -- and draw additional traffic demand to

US 101. Like in the at-grade lanes, volumes would exceed capacity in the express lanes. Small changes in volumes and v/c ratios are shown for the at-grade lanes on US 101. The increase in throughput would be a benefit, but the v/c ratios indicate continued delay for all vehicles. There is evidence that the model diverted some traffic from cross streets to the express lanes, which is to be expected given the express lanes provide enhanced travel time through a long segment of US 101 (see University Avenue, Embarcadero Road, and Oregon Expressway).

- Alternative 3 would increase in peak period traffic on Bayfront Expressway east of University, on Willow Road during both peak periods, and on University Avenue in the a.m. peak period. The model also projected increases in peak period traffic on Clarke and Pulgas, which is evidence that additional capacity at the Bayfront Expressway intersections will draw traffic through residential streets as well as University Avenue. Corresponding changes in v/c ratios were noted.
- Alternatives 6/7 would result in a net increase in traffic on Willow Road due to the express lanes but decreases or small increases in at-grade. Corresponding improvements are shown in v/c ratios for the at-grade facility. The express lanes do generate strong peak direction demands that exceed capacity, which suggests that additional capacity should be considered in the peak direction. Also noted are the reductions in peak period traffic and v/c ratios on University under these alternatives, which would be beneficial. Also notable are some small numerical increases in peak period traffic on Clarke and Pulgas.
- Alternative 9 shows similar impacts on University as found for Willow under Alternatives 6/7 – net increases in total peak period traffic due to the express lanes and reductions in peak period traffic for the at-grade facility. Also noted are the reductions in traffic volumes and v/c ratios on Willow, which also are seen as beneficial, and more important to East Palo Alto, the minimal changes or reductions in peak period traffic on Clarke and Pulgas.

Generally, each alternative shows beneficial impacts compared to the no-build condition. Additional analysis will address these findings with respect to measures of effectiveness, which in turn will provide the basis for comparison of alternatives.

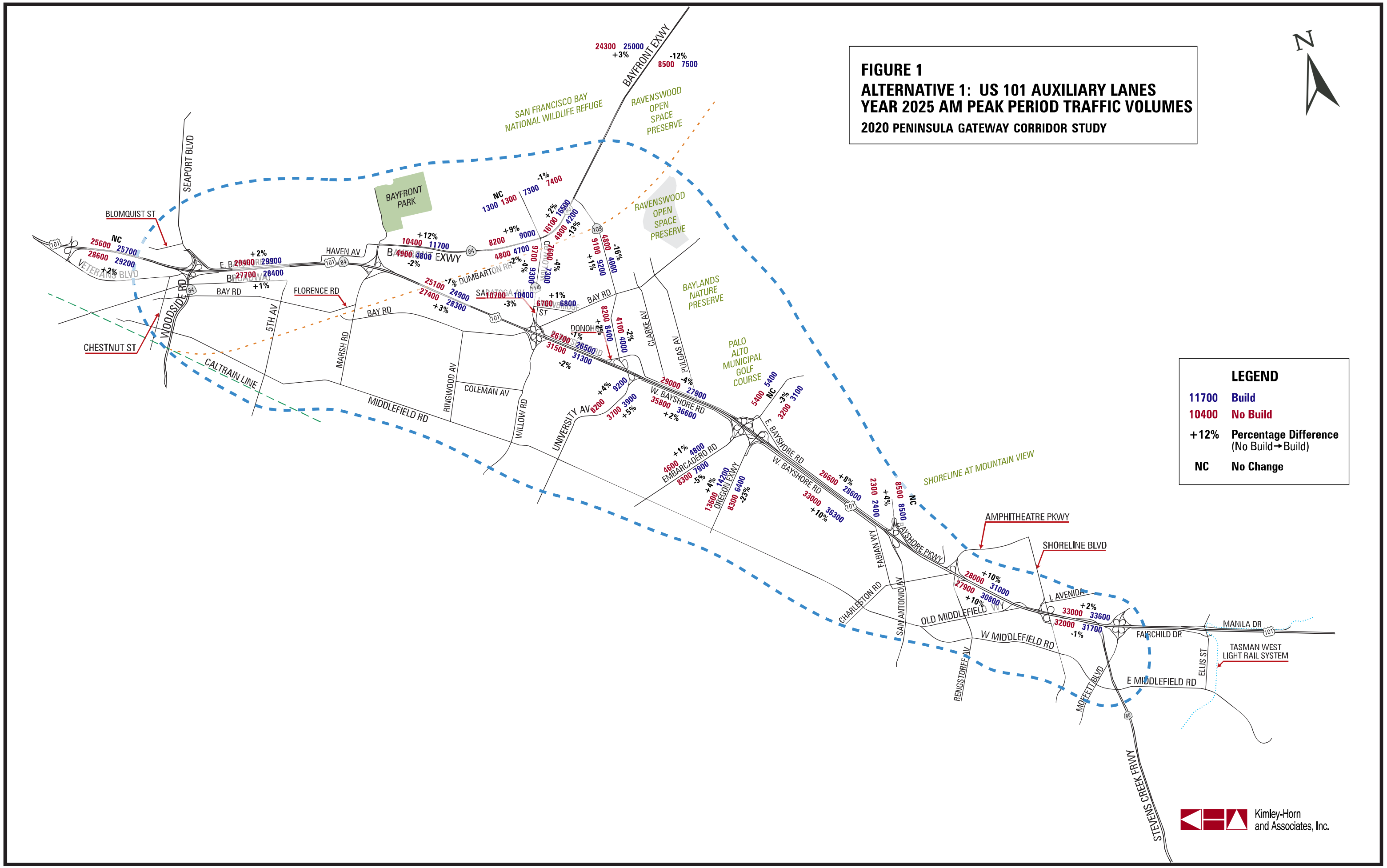


FIGURE 1
ALTERNATIVE 1: US 101 AUXILIARY LANES
YEAR 2025 AM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
+12% Percentage Difference (No Build→Build)
NC No Change
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RR
SARATOGA AV
DONOHOE ST
BAYLANDS NATURE PRESERVE
CLARKE AV
PULGAS AV
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
FABIAN WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
L AVENIDA
FAIRCHILD DR
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
ELLIS ST
E MIDDLEFIELD RD
MOFFETT BLVD
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

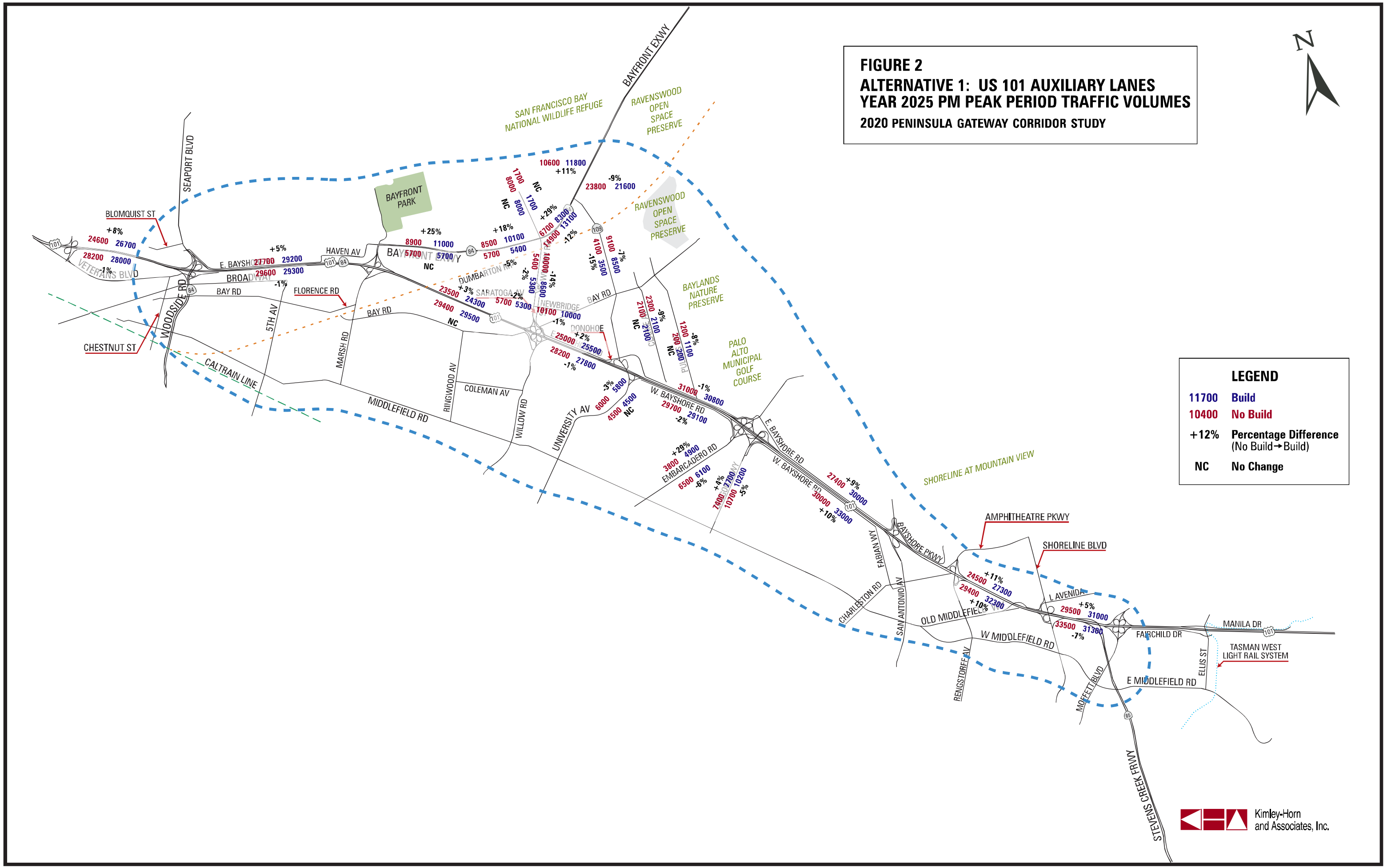


FIGURE 2
ALTERNATIVE 1: US 101 AUXILIARY LANES
YEAR 2025 PM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
+12% Percentage Difference (No Build→Build)
NC No Change
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RD
SARATOGA AV
NEWBRIDGE
DONOHOE
EMBARCADERO RD
W. BAYSHORE RD
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FABIAN WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
L AVENIDA
RENGSTORFF AV
MOFFETT BLVD
E MIDDLEFIELD RD
FAIRCHILD DR
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

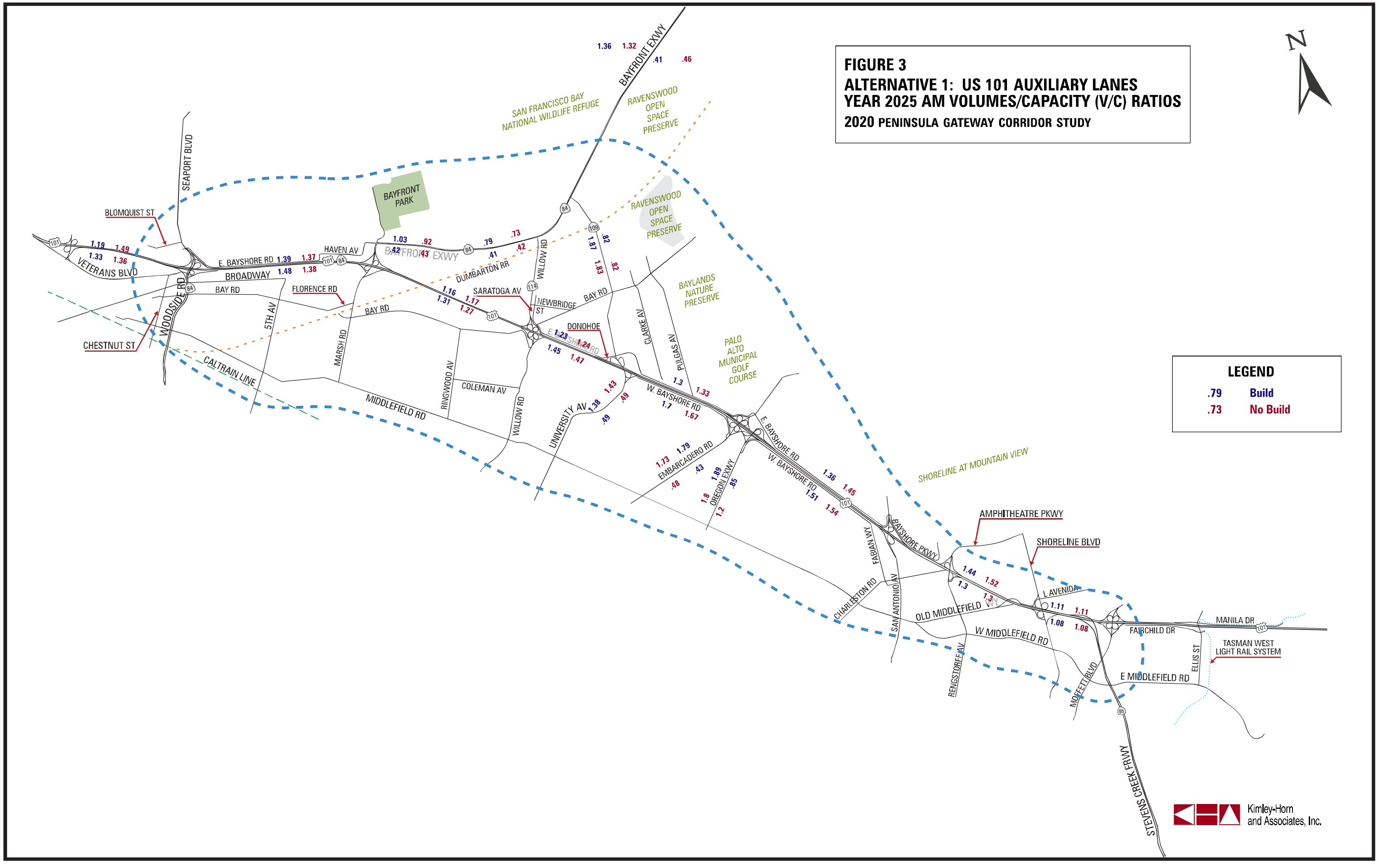
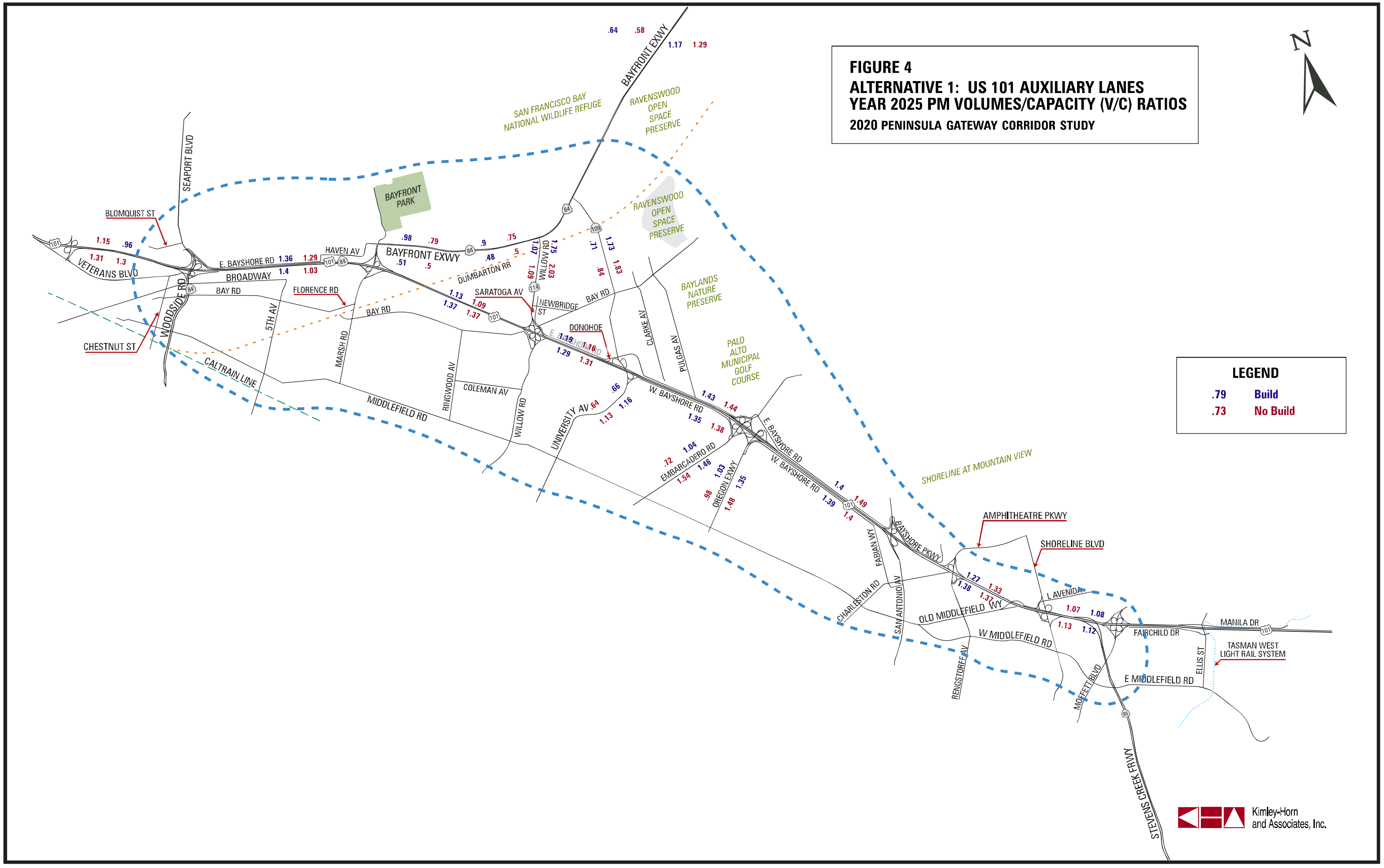


FIGURE 3
ALTERNATIVE 1: US 101 AUXILIARY LANES
YEAR 2025 AM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
SHORELINE AT MOUNTAIN VIEW
BAYFRONT PARK
BAYFRONT EXWY
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
CLARKE AV
PULGAS AV
UNIVERSITY AV
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
FABIAN WY
BAYSHORE PKWY
AMPHITHEATRE PKWY
SHORELINE BLVD
CHARLESTON RD
SAN ANTONIO AV
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
FAIRCHILD DR
E MIDDLEFIELD RD
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

FIGURE 4
ALTERNATIVE 1: US 101 AUXILIARY LANES
YEAR 2025 PM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY



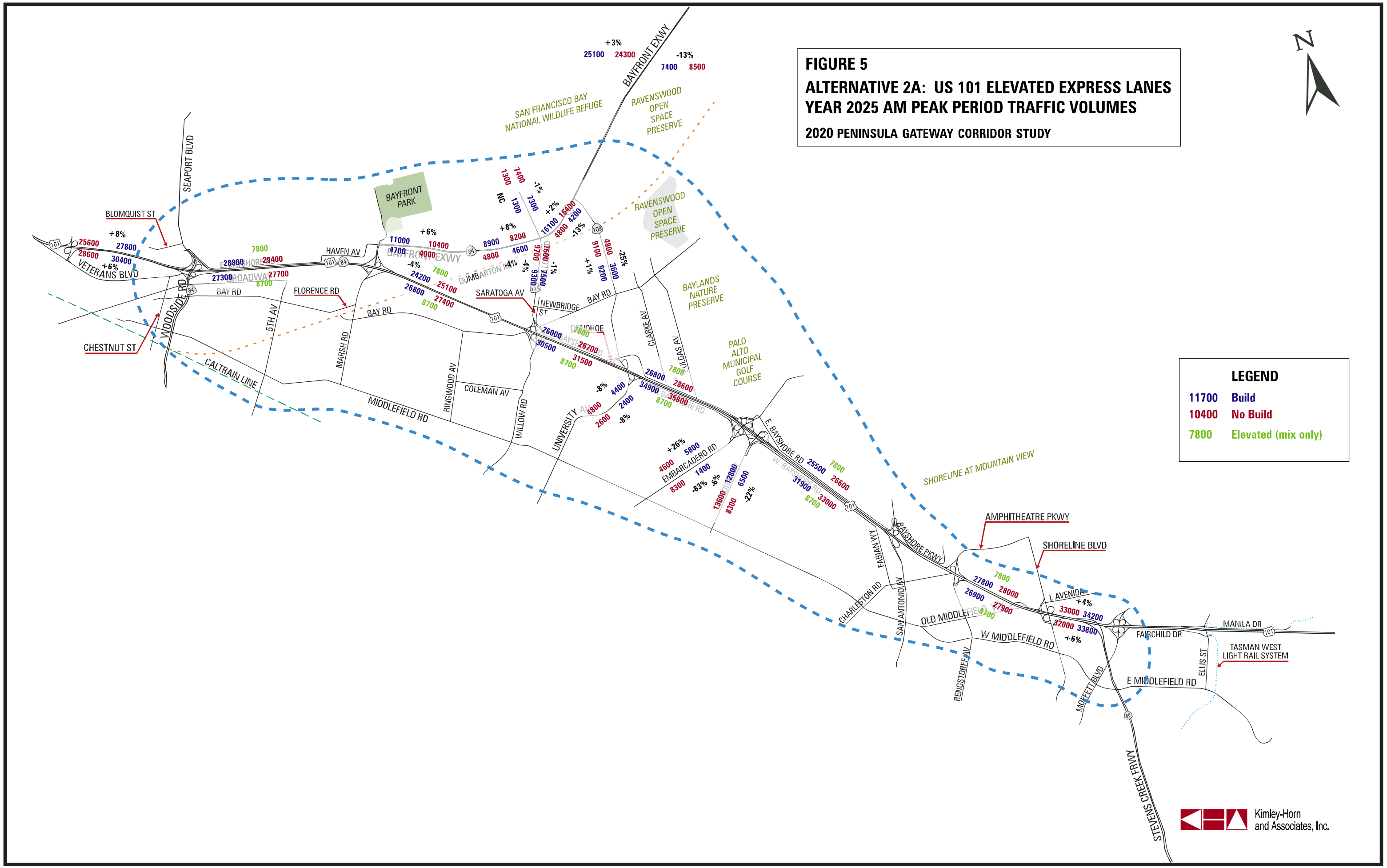
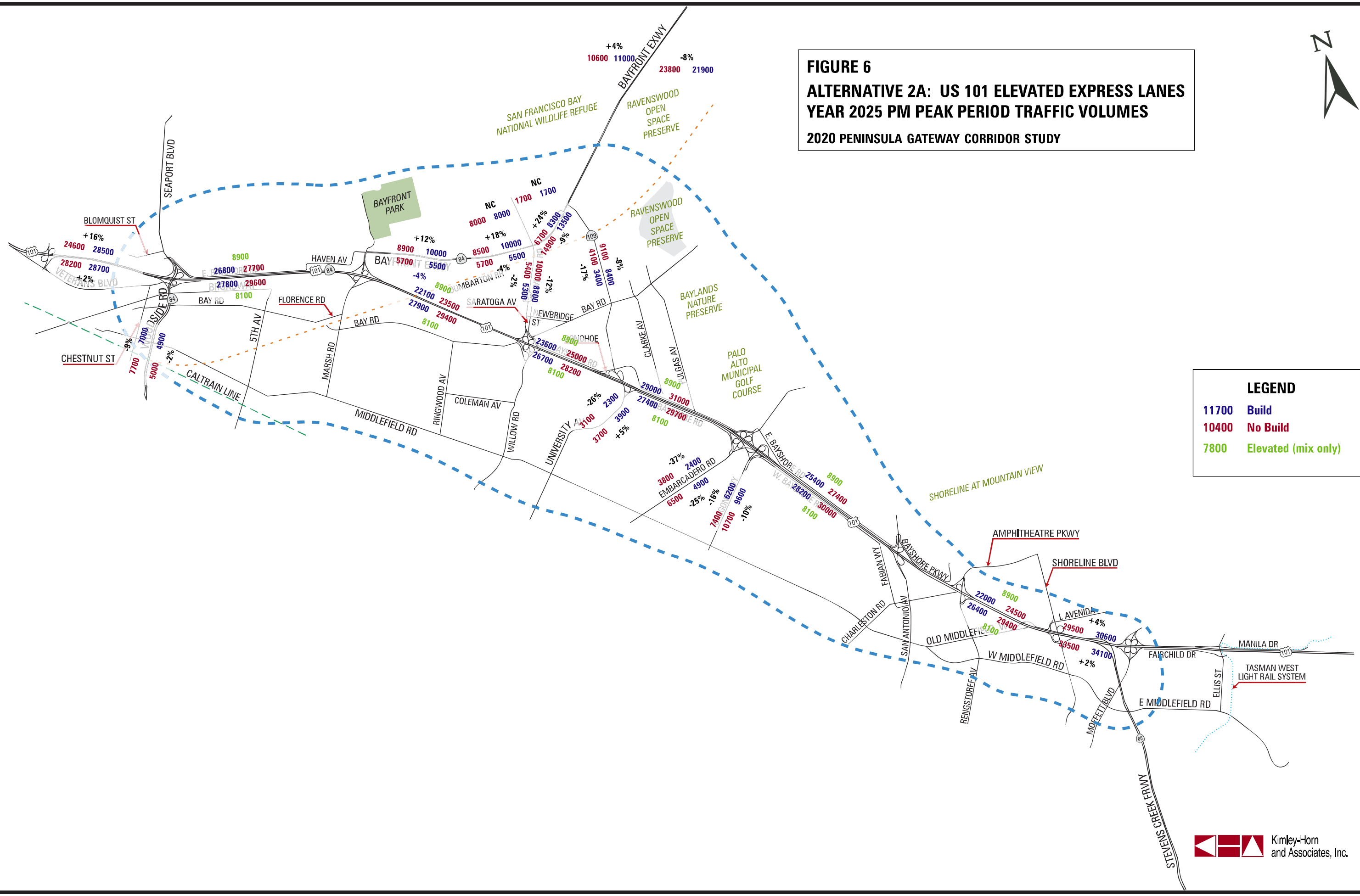


FIGURE 5
ALTERNATIVE 2A: US 101 ELEVATED EXPRESS LANES
YEAR 2025 AM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
7800 Elevated (mix only)
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
HAVEN AV
BAY RD
FLORENCE RD
SARATOGA AV
NEWBRIDGE ST
DUMBARTON RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
EMBARCADERO RD
E. BAYSHORE RD
W. BAYSHORE RD
CLARKE AV
JUGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FABIAN WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
L AVENIDA
MOFFETT BLVD
FAIRCHILD DR
E MIDDLEFIELD RD
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

FIGURE 6
ALTERNATIVE 2A: US 101 ELEVATED EXPRESS LANES
YEAR 2025 PM PEAK PERIOD TRAFFIC VOLUMES

2020 PENINSULA GATEWAY CORRIDOR STUDY



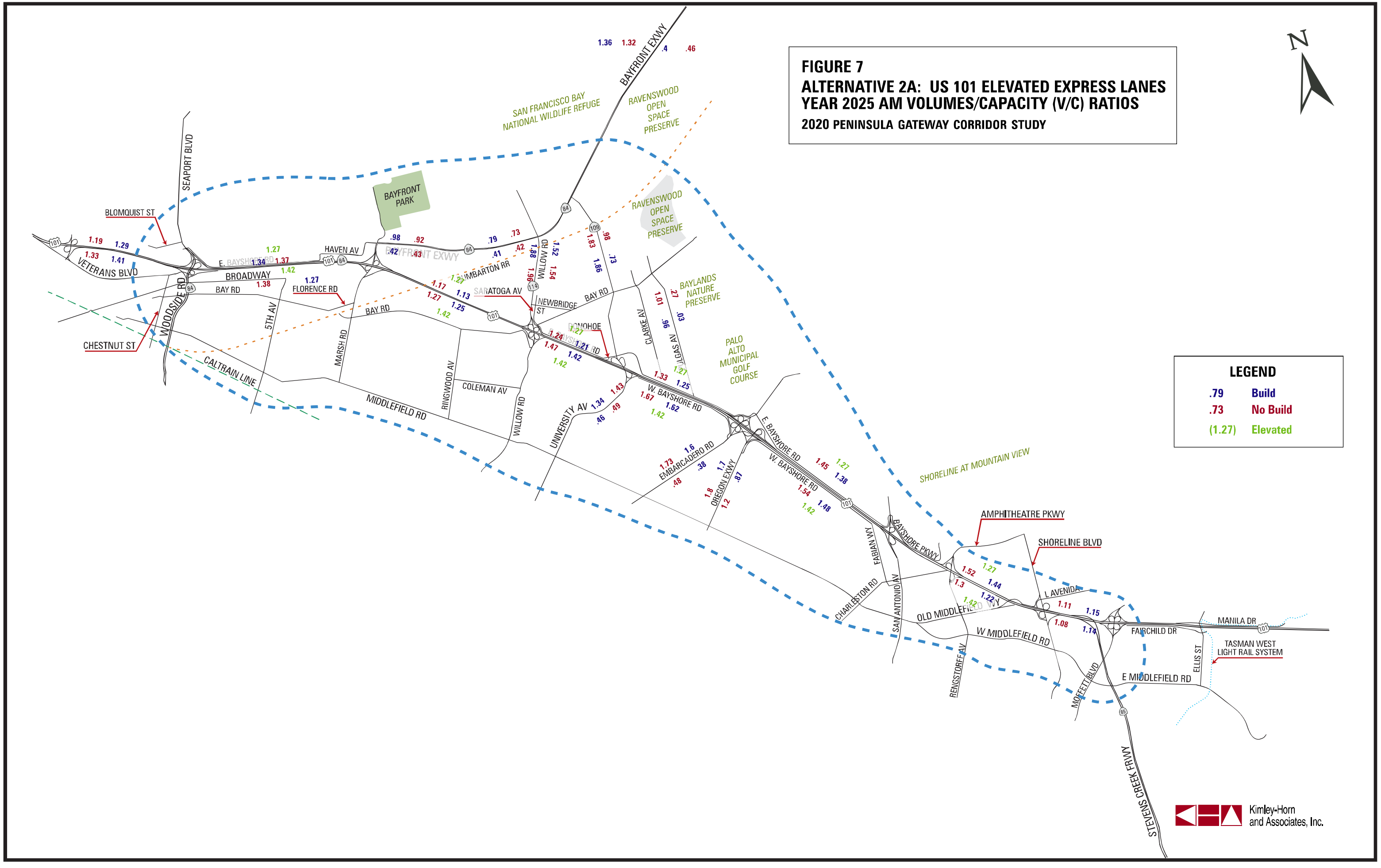
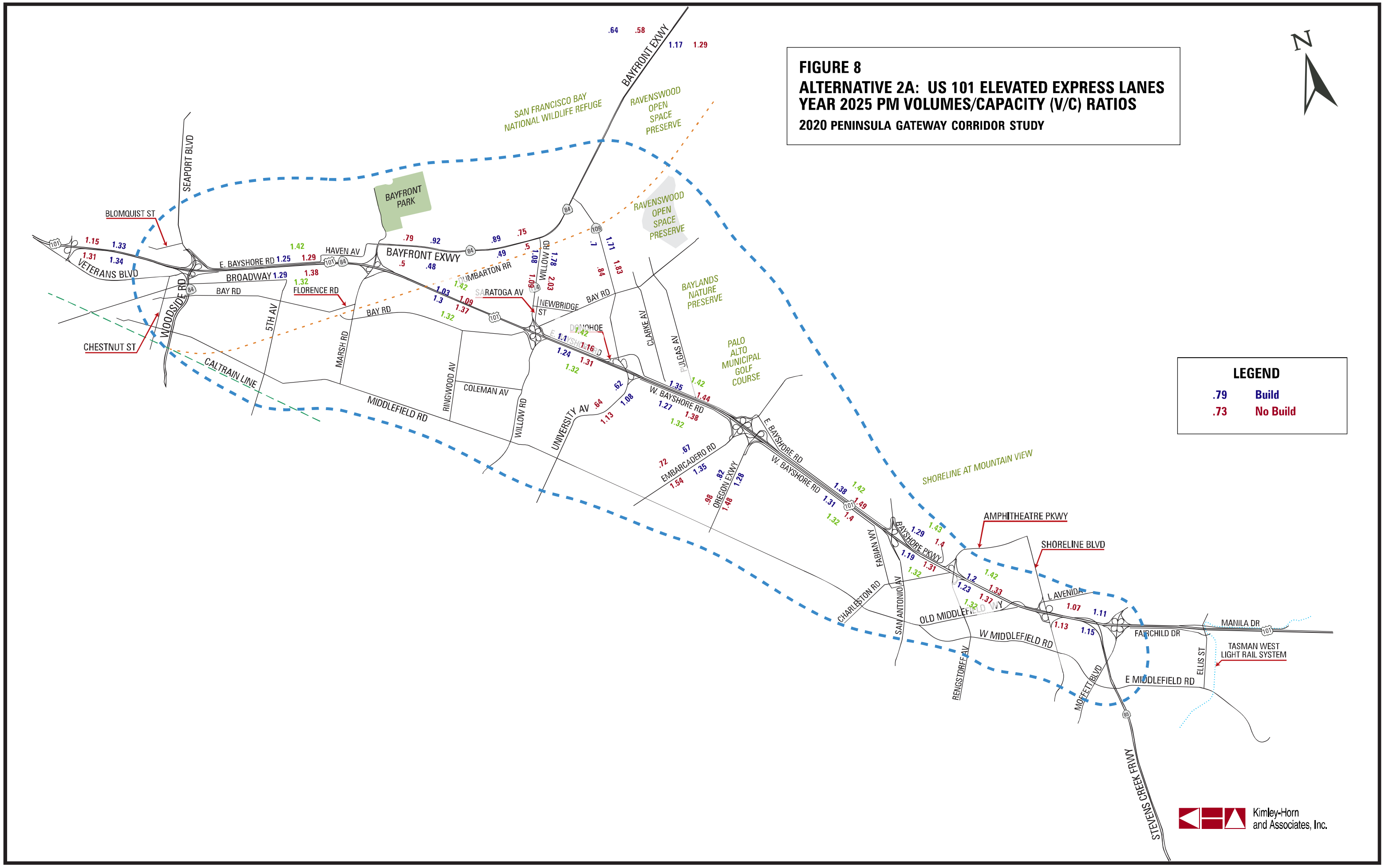


FIGURE 7
ALTERNATIVE 2A: US 101 ELEVATED EXPRESS LANES
YEAR 2025 AM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
(1.27) Elevated
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
IMBARTON RR
SARATOGA AV
NEWBRIDGE ST
WILLOW RD
UNIVERSITY AV
BONOHOE
CLARKE AV
LOLETA AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
E. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FARRAN AV
CHARLESTON RD
SAN ANTONIO AV
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
E MIDDLEFIELD RD
FAIRCHILD DR
MANILA DR
ELLIS ST
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

FIGURE 8
ALTERNATIVE 2A: US 101 ELEVATED EXPRESS LANES YEAR 2025 PM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY



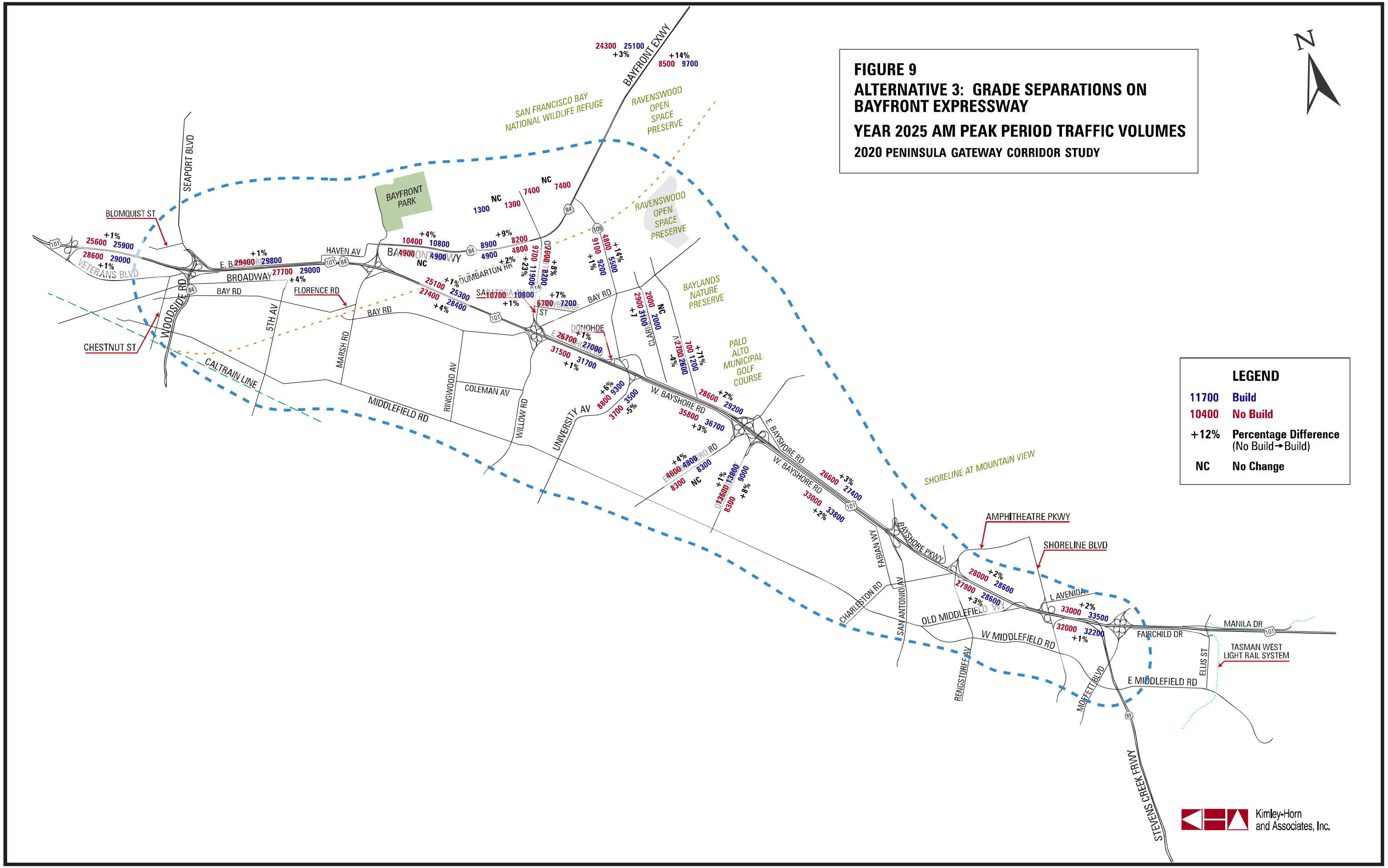


FIGURE 9
ALTERNATIVE 3: GRADE SEPARATIONS ON BAYFRONT EXPRESSWAY
YEAR 2025 AM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
+12% Percentage Difference (No Build→Build)
NC No Change
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
DUMBARTON RR
SARATOGA
DONOHOE
UNIVERSITY AV
CLARK AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
E. BAYSHORE RD
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FABIAN WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
L AVENIDA
MOFFETT BLVD
FAIRCHILD DR
E MIDDLEFIELD RD
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

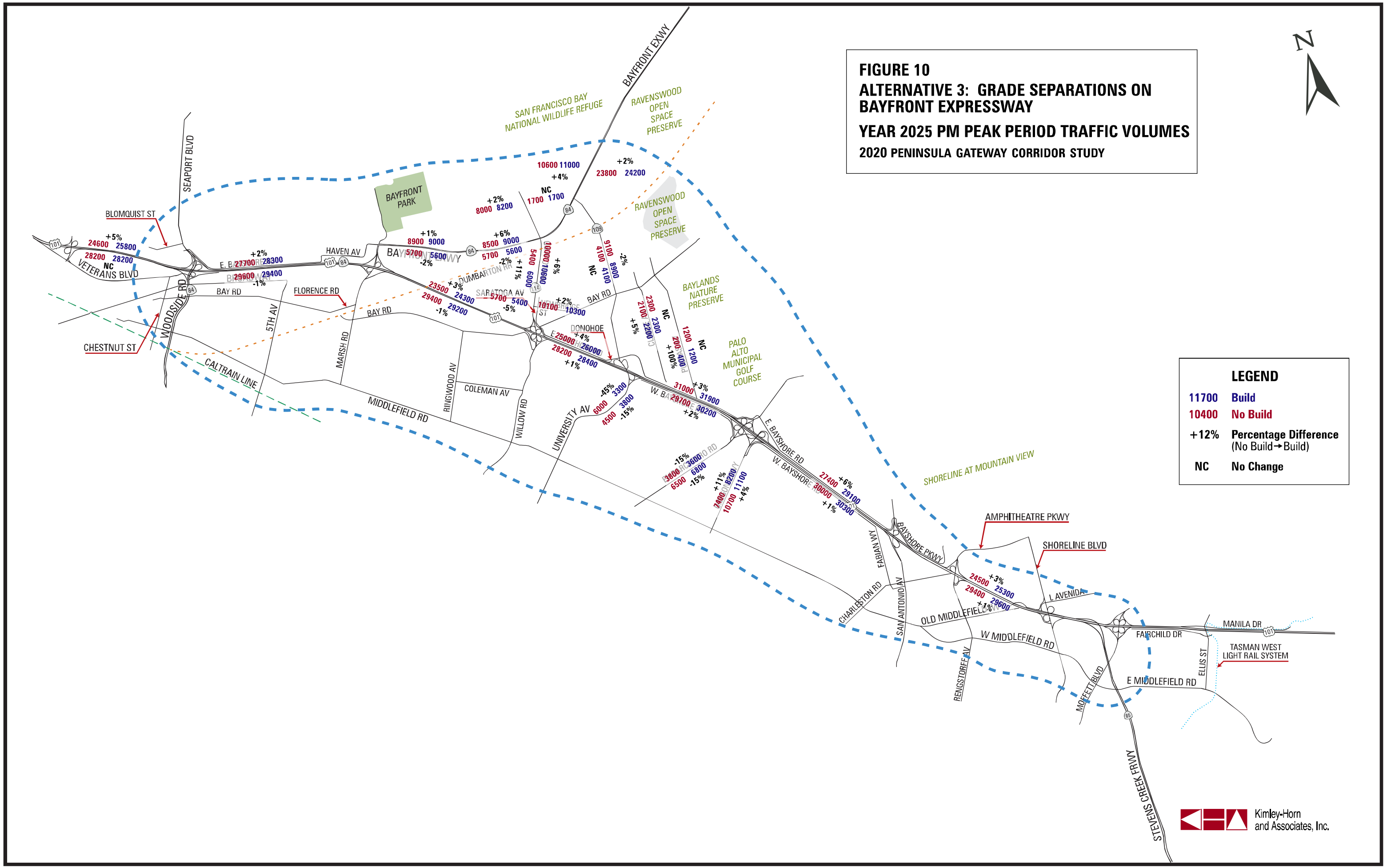


FIGURE 10
ALTERNATIVE 3: GRADE SEPARATIONS ON BAYFRONT EXPRESSWAY
YEAR 2025 PM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
+12% Percentage Difference (No Build→Build)
NC No Change
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
SHORELINE AT MOUNTAIN VIEW
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RD
SARATOGA AV
DONOHOE
E. BAYSHORE RD
W. BAYSHORE RD
BAYSHORE PKWY
FABIAN WY
SAN ANTONIO AV
CHARLESTON RD
AMPHITHEATRE PKWY
SHORELINE BLVD
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
E MIDDLEFIELD RD
FAIRCHILD DR
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

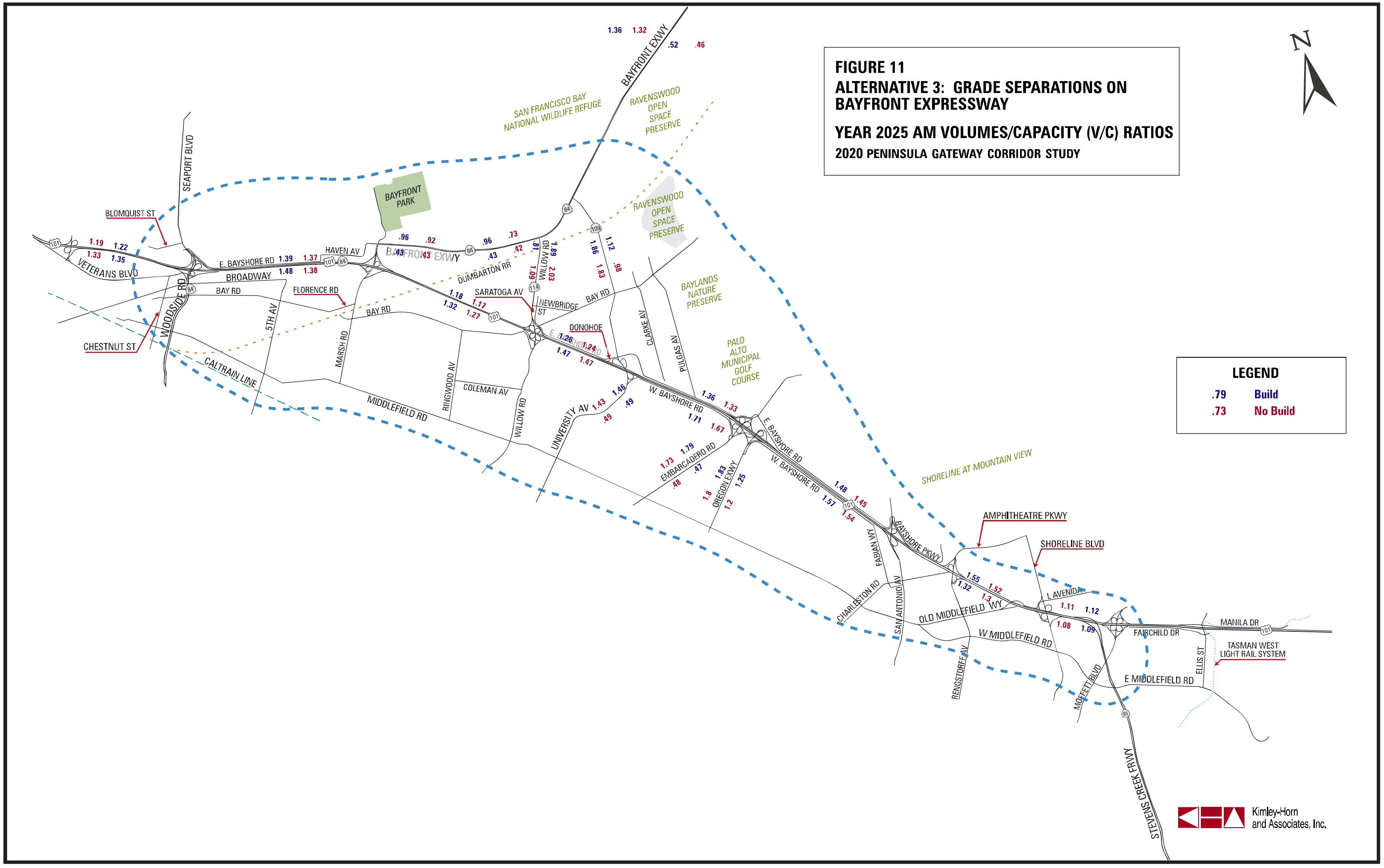


FIGURE 11
ALTERNATIVE 3: GRADE SEPARATIONS ON BAYFRONT EXPRESSWAY
YEAR 2025 AM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
HAVEN AV
BROADWAY
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
E. HOMER RD
UNIVERSITY AV
CLARKE AV
PULGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
E. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
FABIAN WY
BAYSHORE PKWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
L AVENIDA
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
E MIDDLEFIELD RD
FAIRCHILD DR
MANILA DR
ELLIS ST
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

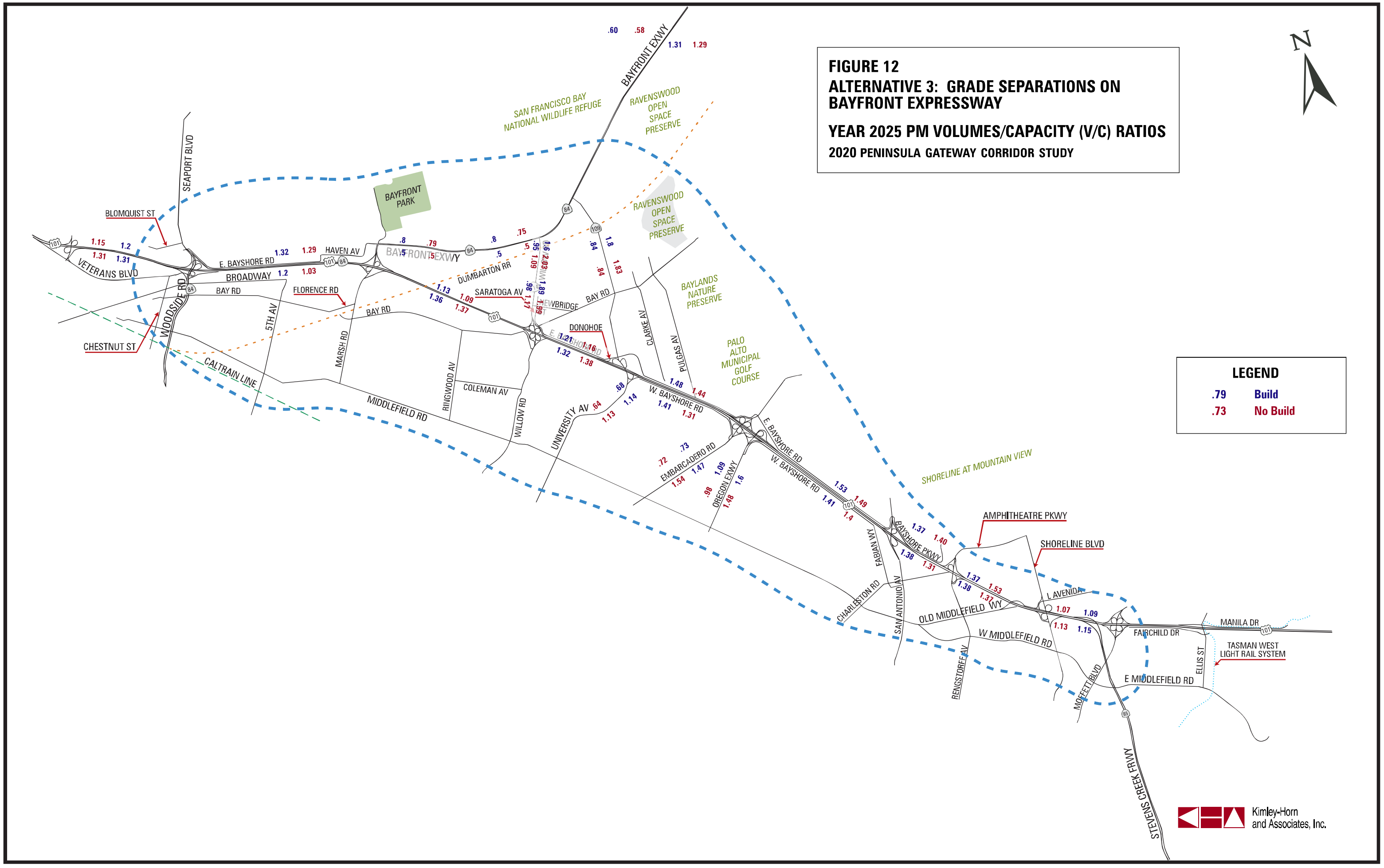


FIGURE 12
ALTERNATIVE 3: GRADE SEPARATIONS ON BAYFRONT EXPRESSWAY
YEAR 2025 PM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
HAVEN AV
BROADWAY
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RR
SARATOGA AV
DUMBARTON BRIDGE
DONOHOE
CLARKE AV
PULGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FARRAH WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
L AVENIDA
FAIRCHILD DR
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
ELLIS ST
E MIDDLEFIELD RD
MOFFETT BLVD
RENGSTORFF AV
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

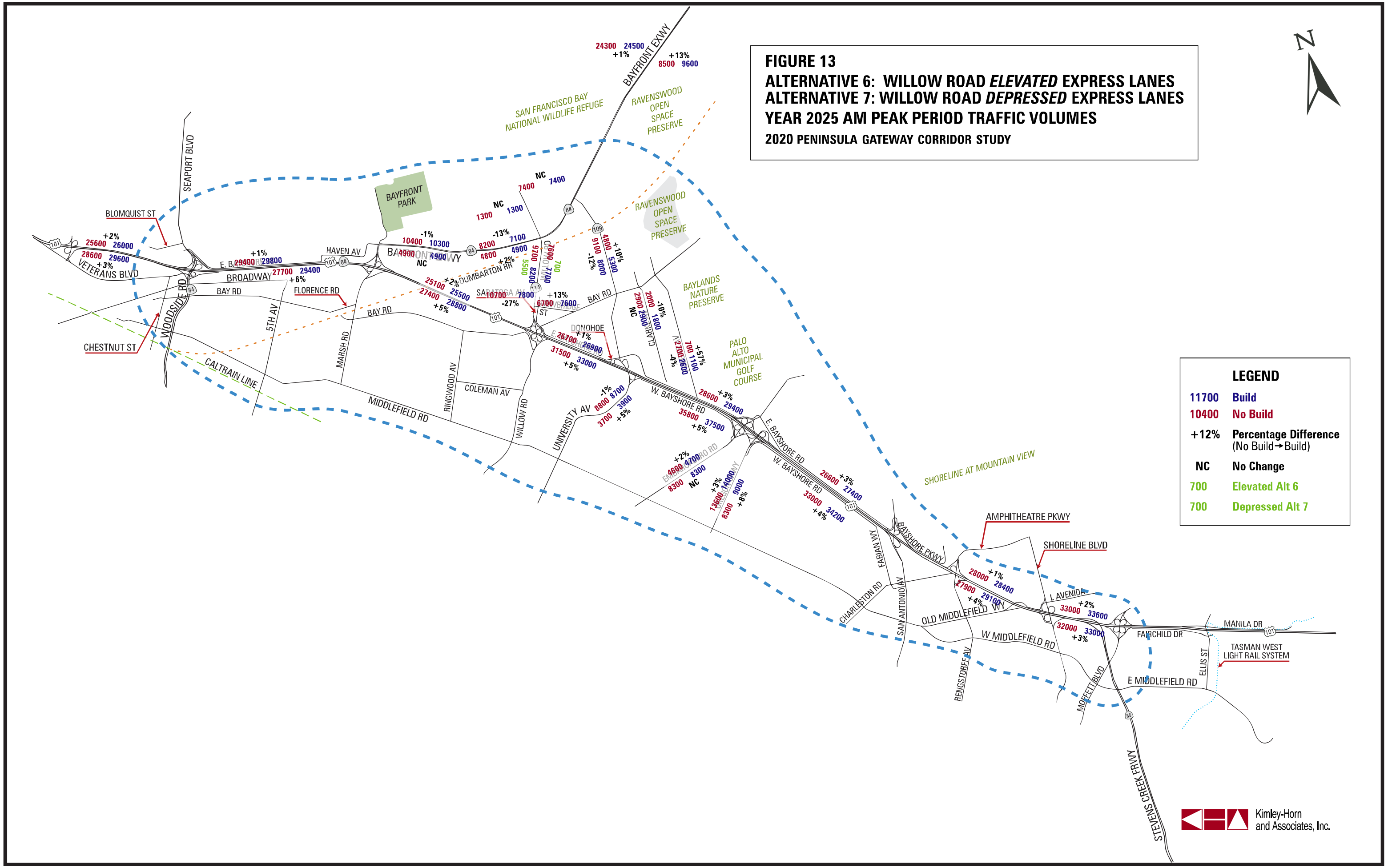


FIGURE 13
ALTERNATIVE 6: WILLOW ROAD ELEVATED EXPRESS LANES
ALTERNATIVE 7: WILLOW ROAD DEPRESSED EXPRESS LANES
YEAR 2025 AM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
+12% Percentage Difference (No Build→Build)
NC No Change
700 Elevated Alt 6
700 Depressed Alt 7
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
DUMBARTON RD
SARATOGA AV
DONOHOE ST
UNIVERSITY AV
CLARK AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
E. BAYSHORE RD
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FABIAN WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
L AVENIDA
FAIRCHILD DR
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
ELLIS ST
E MIDDLEFIELD RD
MOFFETT BLVD
RENGSTORFF AV
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

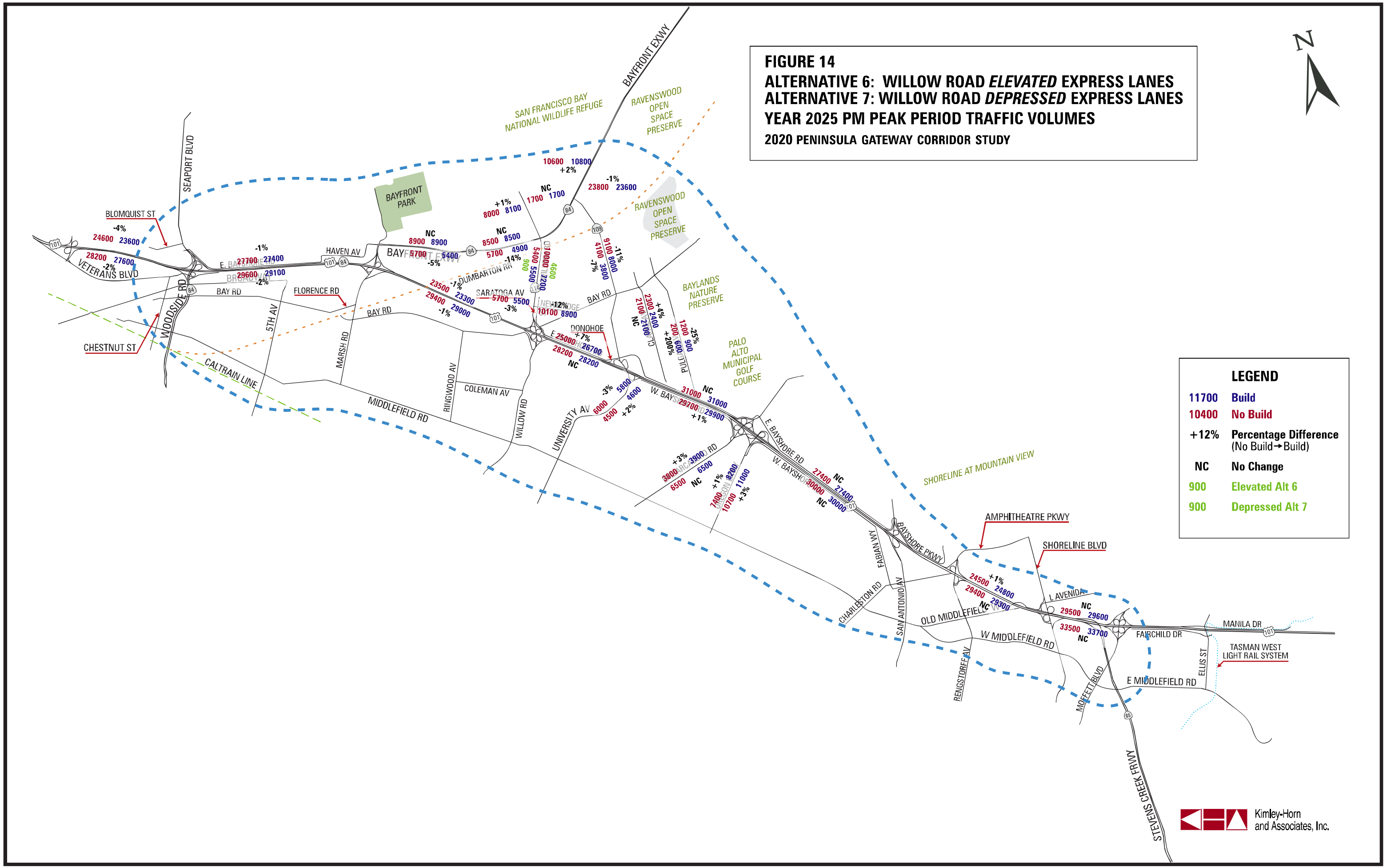


FIGURE 14
ALTERNATIVE 6: WILLOW ROAD ELEVATED EXPRESS LANES
ALTERNATIVE 7: WILLOW ROAD DEPRESSED EXPRESS LANES
YEAR 2025 PM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
+12% Percentage Difference (No Build→Build)
NC No Change
900 Elevated Alt 6
900 Depressed Alt 7
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
SHORELINE AT MOUNTAIN VIEW
BAYFRONT PARK
BAYFRONT EXWY
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
WOODSIDE RD
CHESTNUT ST
HAVEN AV
E. BAYSHORE RD
BROADWAY
BAY RD
FLORENCE RD
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RR
SARATOGA AV
DONOHOE
CL
PULGAS
W. BAYSHORE RD
E. BAYSHORE RD
BAYSHORE PKWY
FABIAN WY
CHARLESTON RD
SAN ANTONIO AV
AMPHITHEATRE PKWY
SHORELINE BLVD
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
FAIRCHILD DR
E MIDDLEFIELD RD
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

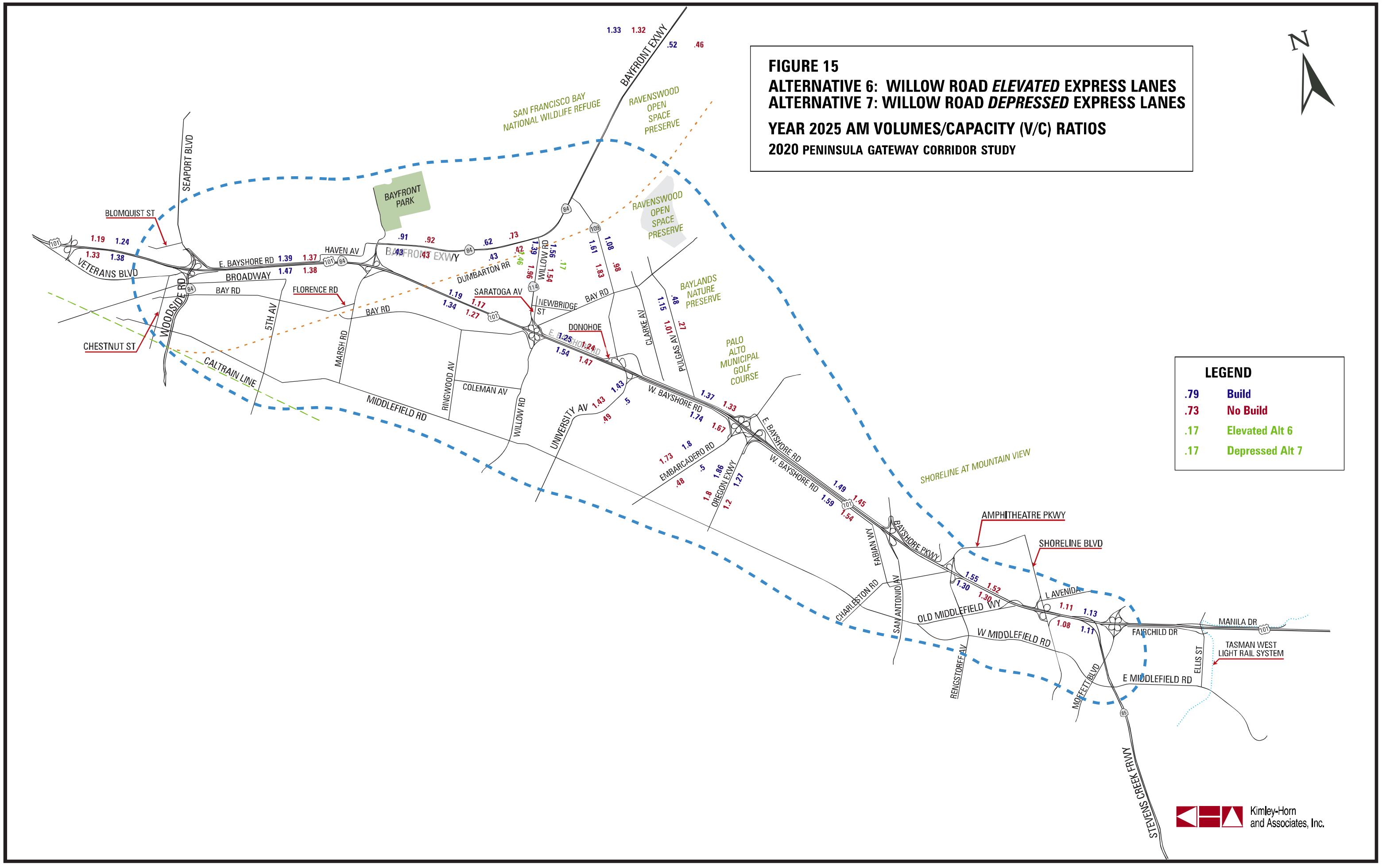


FIGURE 15
ALTERNATIVE 6: WILLOW ROAD ELEVATED EXPRESS LANES
ALTERNATIVE 7: WILLOW ROAD DEPRESSED EXPRESS LANES
YEAR 2025 AM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
.17 Elevated Alt 6
.17 Depressed Alt 7
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
BAYFRONT EXWY
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
WILLOW RD
UNIVERSITY AV
CLARKE AV
PULGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FARRAH WY
CHARLESTON RD
SAN ANTONIO AV
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
E MIDDLEFIELD RD
FAIRCHILD DR
MANILA DR
ELLIS ST
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

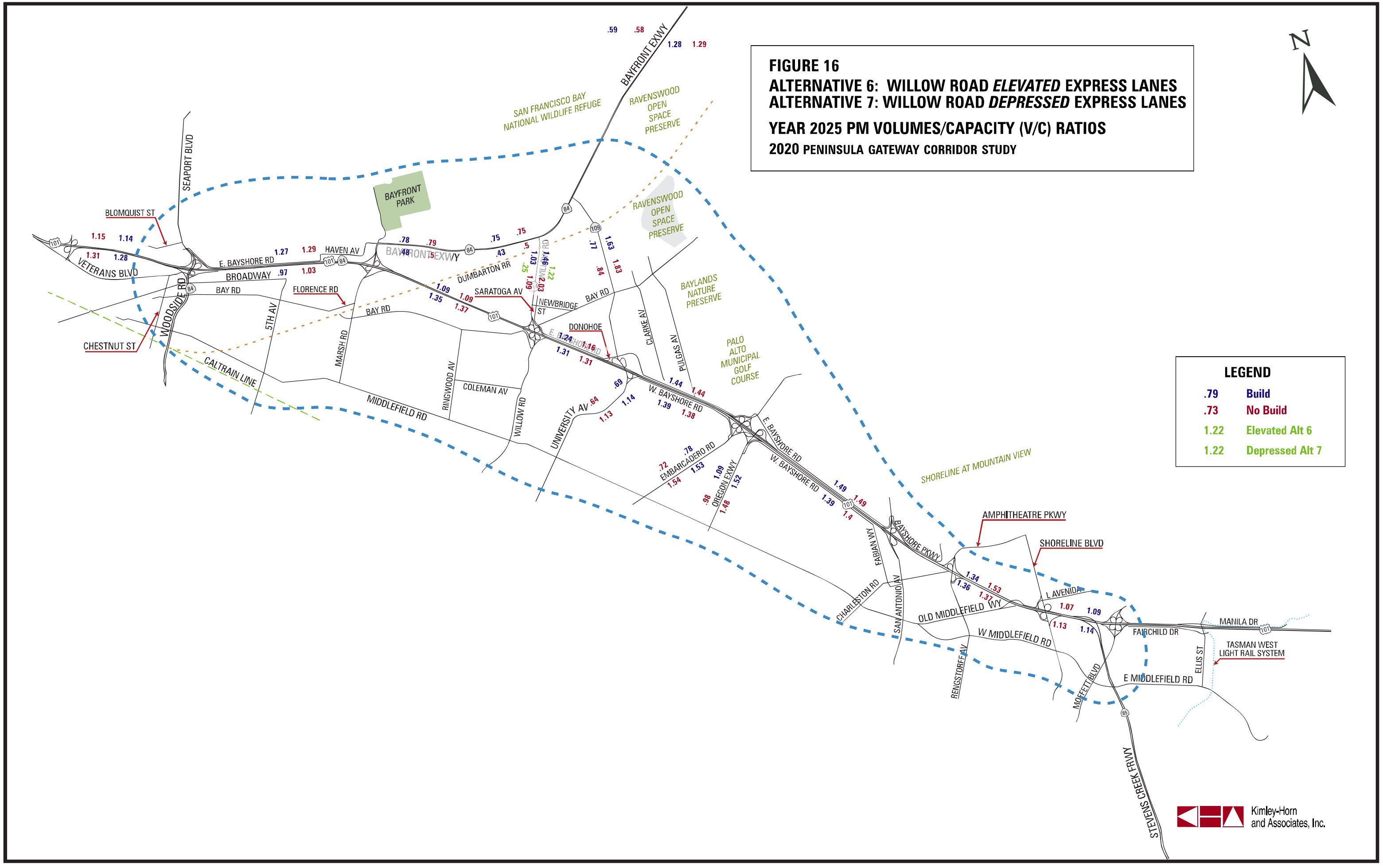
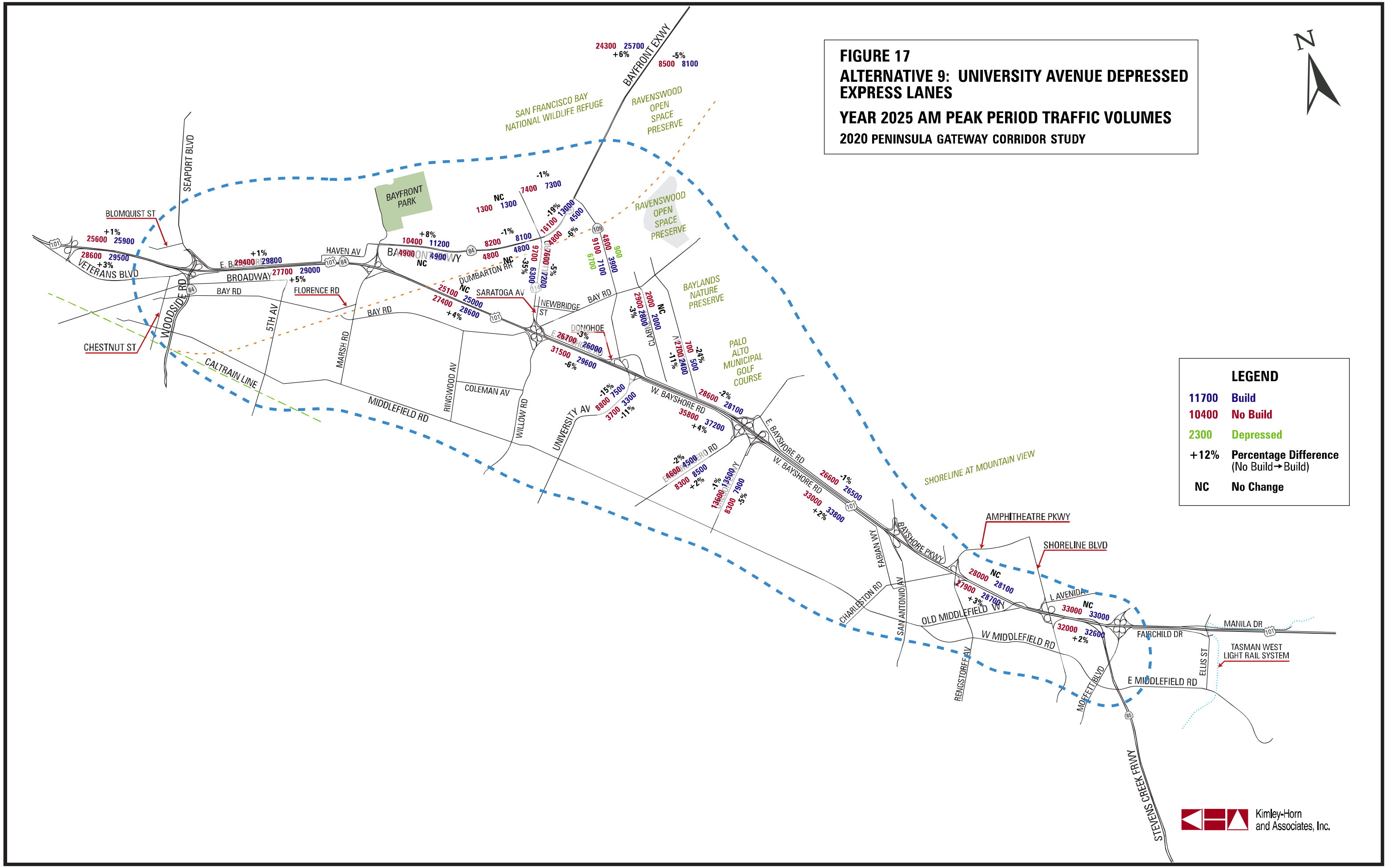


FIGURE 16
ALTERNATIVE 6: WILLOW ROAD ELEVATED EXPRESS LANES
ALTERNATIVE 7: WILLOW ROAD DEPRESSED EXPRESS LANES
YEAR 2025 PM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
1.22 Elevated Alt 6
1.22 Depressed Alt 7
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
BAYFRONT EXWY
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
HAVEN AV
BROADWAY
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
CLARKE AV
PULGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
BAYSHORE PKWY
FARRAH WY
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
L AVENIDA
FAIRCHILD DR
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
ELLIS ST
E MIDDLEFIELD RD
MOFFETT BLVD
RENGSTORFF AV
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

FIGURE 17
ALTERNATIVE 9: UNIVERSITY AVENUE DEPRESSED EXPRESS LANES
YEAR 2025 AM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY



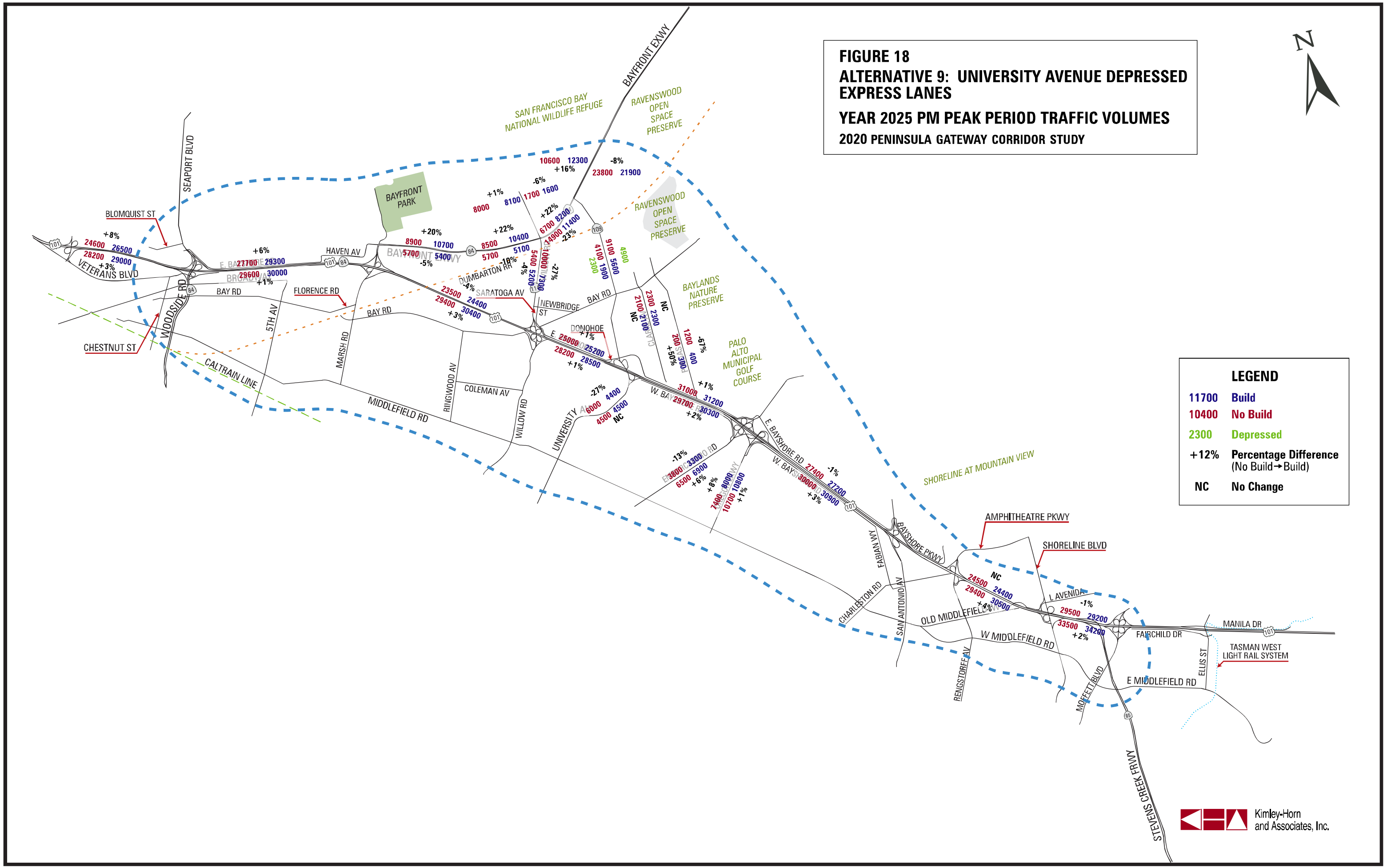


FIGURE 18
ALTERNATIVE 9: UNIVERSITY AVENUE DEPRESSED EXPRESS LANES
YEAR 2025 PM PEAK PERIOD TRAFFIC VOLUMES
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
11700 Build
10400 No Build
2300 Depressed
+12% Percentage Difference (No Build→Build)
NC No Change
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT EXWY
BAYFRONT PARK
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
SHORELINE AT MOUNTAIN VIEW
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
WOODSIDE RD
CHESTNUT ST
HAVEN AV
BAY RD
FLORENCE RD
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
E. BAYSHORE RD
W. BAYSHORE RD
CLARK
BAYSHORE PKWY
FABIAN WY
SAN ANTONIO AV
CHARLESTON RD
AMPHITHEATRE PKWY
SHORELINE BLVD
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
E MIDDLEFIELD RD
FAIRCHILD DR
ELLIS ST
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

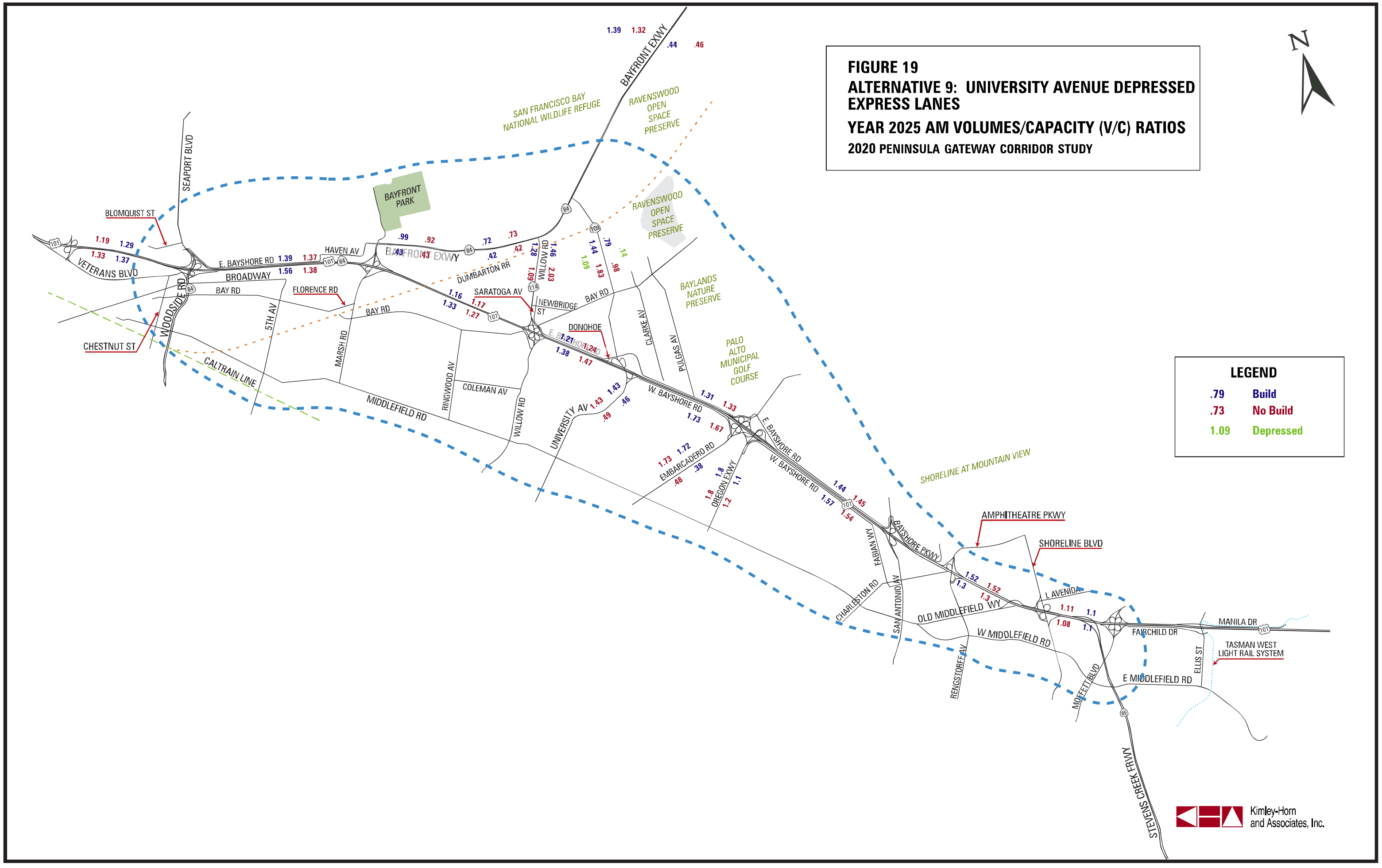


FIGURE 19
ALTERNATIVE 9: UNIVERSITY AVENUE DEPRESSED EXPRESS LANES
YEAR 2025 AM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
1.09 Depressed
BAYFRONT EXWY
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
WILLOW RD
UNIVERSITY AV
CLARKE AV
PULGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
FABIAN WY
BAYSHORE PKWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
CHARLESTON RD
SAN ANTONIO AV
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
L AVENIDA
RENGSTORFF AV
MOFFETT BLVD
FAIRCHILD DR
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
ELLIS ST
E MIDDLEFIELD RD
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

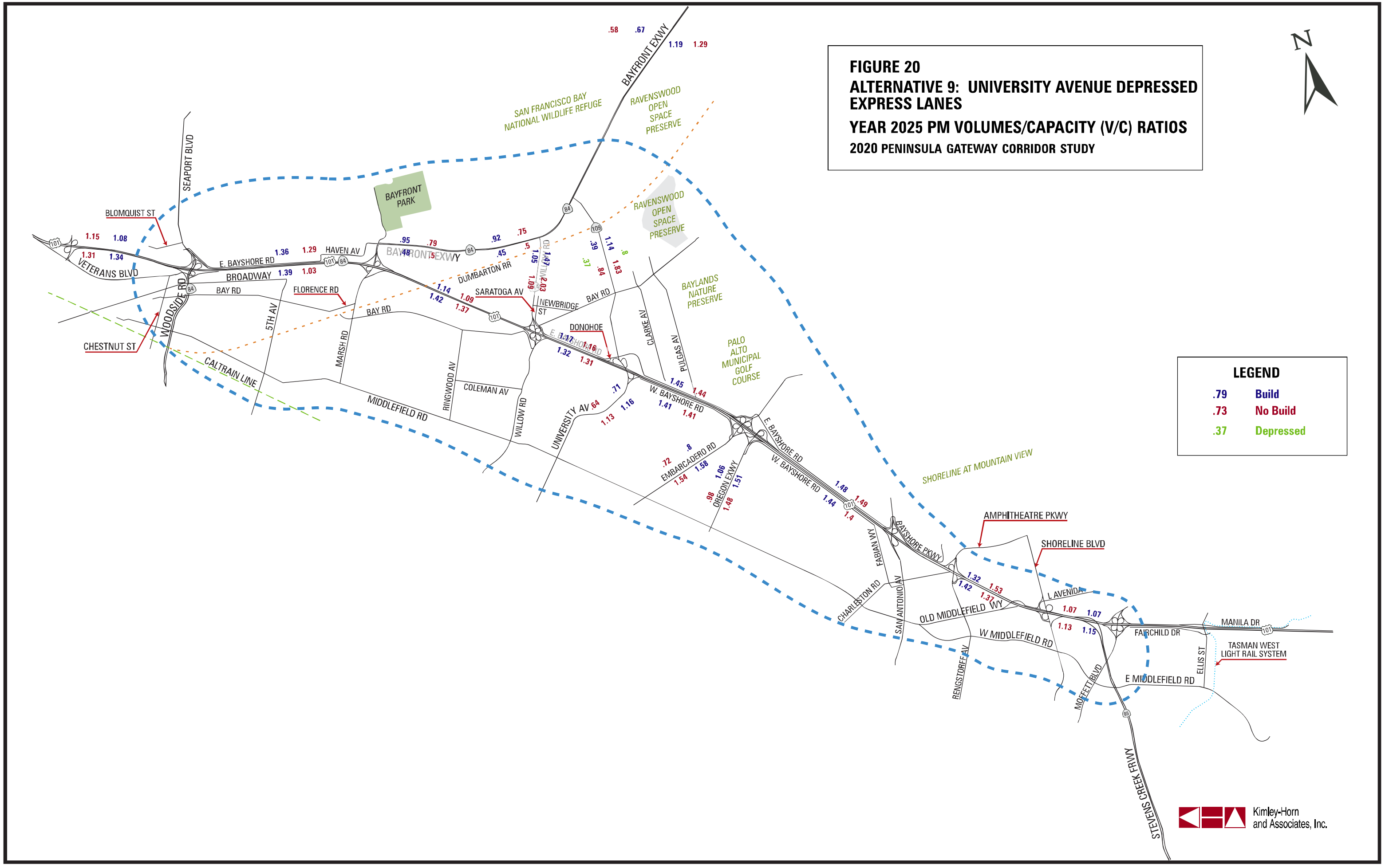


FIGURE 20
ALTERNATIVE 9: UNIVERSITY AVENUE DEPRESSED EXPRESS LANES
YEAR 2025 PM VOLUMES/CAPACITY (V/C) RATIOS
2020 PENINSULA GATEWAY CORRIDOR STUDY
N
LEGEND
.79 Build
.73 No Build
.37 Depressed
SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
RAVENSWOOD OPEN SPACE PRESERVE
BAYFRONT PARK
BAYFRONT EXWY
SEAPORT BLVD
BLOMQUIST ST
VETERANS BLVD
E. BAYSHORE RD
BROADWAY
HAVEN AV
BAY RD
FLORENCE RD
WOODSIDE RD
CHESTNUT ST
5TH AV
MARSH RD
CALTRAIN LINE
MIDDLEFIELD RD
RINGWOOD AV
COLEMAN AV
WILLOW RD
UNIVERSITY AV
DUMBARTON RR
SARATOGA AV
NEWBRIDGE ST
DONOHOE
CLARKE AV
PULGAS AV
BAYLANDS NATURE PRESERVE
PALO ALTO MUNICIPAL GOLF COURSE
W. BAYSHORE RD
EMBARCADERO RD
OREGON EXWY
FABIAN WY
BAYSHORE PKWY
SHORELINE AT MOUNTAIN VIEW
AMPHITHEATRE PKWY
SHORELINE BLVD
CHARLESTON RD
SAN ANTONIO AV
L AVENIDA
OLD MIDDLEFIELD WY
W MIDDLEFIELD RD
RENGSTORFF AV
MOFFETT BLVD
FAIRCHILD DR
MANILA DR
TASMAN WEST LIGHT RAIL SYSTEM
ELLIS ST
E MIDDLEFIELD RD
STEVENS CREEK FRWY
Kimley-Horn and Associates, Inc.

2020 Peninsula Gateway Corridor Study

Draft Memorandum
Task 5 – Travel Forecasting

Appendix – Discussion of Model Results

Prepared for:

City/County Association of Governments
Of San Mateo County

San Mateo County Transportation Authority

Santa Clara Valley Transportation Authority

Prepared by:

Kimley-Horn
and Associates, Inc.

December 22, 2006

MEMORANDUM

TO: Walter Martone

FROM: Jill Hough

COPIES TO: Paul Krupka, Kimley Horn
Jim Daisa, Kimley Horn

DATE: October 13, 2004

SUBJECT: ***Revised Discussion of Model Results for Peninsula Gateway 2000 Baseline and 2025 No Build***

The purpose of this memorandum is to discuss the results of the Peninsula Gateway Model Volumes for years 2000 and 2025. The year 2025 forecast represents a no-build condition in the context of the Peninsula Gateway Transportation Study and will be the basis of comparison for the Peninsula Gateway Atlernatives that will be defined in the future. The information presented herein represents a broadened discussion from the original memorandum dated August 13, 2004.

Year 2000 Model-Estimated Volumes and Link V/C Ratios

The year 2000 (and year 2025) travel demand model for the Peninsula Gateway Transportation Study embodies the ABAG Projections 2003 data sets. The following table (Table 1) presents a summary of households, employed residents, and total employment by county for existing and future conditions. As indicated in Table 1, growth in both workers and jobs will be significant in the future. The starting point for this model was the C/CAG subarea model for the 101 corridor between Whipple Road and Embarcadero Road. In addition to updating the land use data from ABAG Projections 2000 to ABAG Projections 2003, the model zone system was refined slightly in the Route 101 area in Mountain View. The model validation was improved for the Dumbarton Bridge and Route 101 between Embarcadero Road and Route 85.

The validation refinement was accomplished using hourly count data from Caltrans (obtained through Kimley-Horn). The Caltrans count data consisted of ramp volumes for 101 within the study corridor. Essentially all the ramps were represented, and there were no mainline count volumes. The mainline count volumes were obtained by appropriately adding and subtracting the ramp counts to the mainline counts that were estimated for Route 101 between University Avenue and Embarcadero Road.

The traffic assignments are for a three-hour peak period, both for AM and PM conditions. As such, the calculations taking place during the assignment algorithm are based on three-hour volumes versus three-hour capacity. The resulting V/C ratios represent the average ratio over the entire three-hour period.

The model assignment procedure employs a capacity-constraint equilibrium highway assignment algorithm, which means that the resulting assignment is capacity-constrained. The speed-capacity relationships (also

called volume-delay functions) that are coded for the links ensure that as congestion becomes a factor on the freeways (during the assignment process), some trips will get assigned to paths that use less or none of the freeway in order to accomplish the trip. However, the algorithm will assign all the demand in the AM and PM trip tables to the network, sometimes resulting in very high volume-to-

capacity (V/C) ratios on some of the freeway links. Some examples of locations with high V/C ratios are northbound Route 101 between San Antonio Road and Embarcadero Road (V/C=1.24) in the AM peak

Table 1
Summary of ABAG Projections

	P '00 Households			P '00 Employed Residents			P '00 Total Jobs		
County	2000	2025	% Growth	2000	2025	% Growth	2000	2025	% Growth
San Francisco	315,550	335,447	6.3%	422,100	464,998	10.2%	628,860	747,291	18.8%
San Mateo	254,370	283,799	11.6%	393,700	485,506	23.3%	380,370	470,291	23.6%
Santa Clara	567,080	681,379	20.2%	928,700	1,187,219	27.8%	1,077,220	1,353,591	25.7%
Alameda	514,620	591,291	14.9%	694,600	909,708	31.0%	725,790	991,191	36.6%
Contra Costa	338,860	435,445	28.5%	475,900	680,507	43.0%	360,090	537,386	49.2%

	P '03 Households			P '03 Employed Residents			P '03 Total Jobs		
County	2000	2025	% Growth	2000	2025	% Growth	2000	2025	% Growth
San Francisco	329,700	381,810	15.8%	444,851	519,300	16.7%	634,430	786,020	23.9%
San Mateo	254,104	296,520	16.7%	403,083	483,300	19.9%	395,890	506,470	27.9%
Santa Clara	565,863	733,350	29.6%	959,071	1,254,000	30.8%	1,092,330	1,418,810	29.9%
Alameda	523,366	642,210	22.7%	697,882	1,007,400	44.4%	751,680	1,028,620	36.8%
Contra Costa	344,129	444,920	29.3%	483,898	681,730	40.9%	361,110	505,440	40.0%

period; and northbound Route 101 between San Antonio Road and Embarcadero Road (V/C=1.13) in the PM peak period. A summary of the validation results on some of the key freeway segments are presented in Table 2.

Year 2025 Model Forecast Volumes and Link V/C Ratios

The year 2025 travel demand model for the Peninsula Gateway Transportation Study also embodies the ABAG Projections 2003 data sets. The growth assumptions associated with ABAG Projections 2003, with respect to jobs and households is presented in Table 1 above.

The traffic forecasts are for a three-hour peak period, both for AM and PM conditions. As such, the calculations taking place during the assignment algorithm are based on three-hour volumes versus three-hour capacity. The resulting V/C ratios represent the average ratio over the entire three-hour period.

The 2025 model assignment procedure is predicated on the identical equilibrium highway assignment algorithm, volume-delay functions, and condition that all the demand in the AM and PM trip tables must be assigned to the network, sometimes resulting in very high volume-to-capacity (V/C) ratios on some of the

freeway links. Some examples of locations with high V/C ratios are northbound Route 101 between Route 85 and Shoreline Road (V/C=1.26) in the AM peak period; and southbound Route 101 between Embarcadero Road and San Antonio Road (V/C=1.05) in the PM peak period.

Table 2
Comparison Of Model Estimated Volumes Versus Counts

			AM PEAK PERIOD					PM PEAK PERIOD				
Corridor	Segment	Direction	Existing	2000 Model	Model - Existing	Model - Ex Per Hour	% Differ (mod v ex)	Existing	2000 Model	Model - Existing	Model - Ex Per Hour	% Differ (mod v ex)
US 101	between Redwood Shores & Whipple1	NB	22,903	26,899	3,996	1,332	17.4%	23,361	27,780	4,419	1,473	18.9%
		SB	26,008	27,349	1,341	447	5.2%	24,380	26,917	2,537	846	10.4%
	between Whipple & Woodside	NB	21,896	25,961	4,065	1,355	18.6%	23,435	26,617	3,182	1,061	13.6%
		SB	23,149	26,233	3,084	1,028	13.3%	22,004	26,075	4,071	1,357	18.5%
	between Woodside & Marsh	NB	22,083	25,006	2,923	974	13.2%	23,144	26,114	2,970	990	12.8%
		SB	21,564	23,393	1,829	610	8.5%	20,350	22,866	2,516	839	12.4%
	between Marsh & Willow	NB	19,756	19,315	-441	-147	-2.2%	21,295	23,886	2,591	864	12.2%
		SB	19,741	22,883	3,142	1,047	15.9%	19,414	20,411	997	332	5.1%
	between Willow & University	NB	21,370	17,810	-3,560	-1,187	-16.7%	23,765	26,224	2,459	820	10.3%
		SB	22,569	22,147	-422	-141	-1.9%	20,654	21,049	395	132	1.9%
	between University & Embarcadero	NB	20,775	19,222	-1,553	-518	-7.5%	23,765	29,461	5,696	1,899	24.0%
		SB	24,897	24,953	56	19	0.2%	20,654	21,936	1,282	427	6.2%
Rte 84	Dumbarton Bridge	EB	3,936	3,320	-616	-205	-15.7%	13,039	17,298	4,259	1,420	32.7%
		WB	10,649	13,182	2,533	844	23.8%	4,414	5,681	1,267	422	28.7%
Bayfront	between Marsh & Crysler	NB	5,855	10,393	4,538	1,513	77.5%	3,521	4,629	1,108	369	31.5%
		SB	4,026	4,821	795	265	19.7%	3,522	8,120	4,598	1,533	130.6%
	between Crysler & Chilco	NB	_	10,393	_	_		_	4,629	_	_	
		SB	_	4,821	_	_		_	8,120	_	_	
	between Chilco & Willow	NB	5,142	9,532	4,390	1,463	85.4%	2,498	3,613	1,115	372	44.6%
		SB	2,324	2,359	35	12	1.5%	3,424	7,473	4,049	1,350	118.3%
	between Willow & University	NB	8,044	11,475	3,431	1,144	42.7%	3,535	5,086	1,551	517	43.9%
		SB	2,770	2,373	-397	-132	-14.3%	9,752	11,879	2,127	709	21.8%
	between University & Dumbarton	NB	_	13,182	_	_		_	5,681	_	_	
		SB	_	3,320	_	_		_	17,298	_	_	
Marsh	between Bayfront & 101 NB ramps	EB	4,425	1,396	-3,029	-1,010	-68.5%	3,224	2,516	-708	-236	-22.0%
		WB	5,531	5,597	66	22	1.2%	3,623	2,880	-743	-248	-20.5%
	between 101 SB- & 101 NB-ramps	EB	4,383	1,243	-3,140	-1,047	-71.6%	2,819	2,404	-415	-138	-14.7%

Corridor	Segment	Direction	Existing	2000 Model	Model - Existing	Model - Ex Per Hour	% Differ (mod v ex)	Existing	2000 Model	Model - Existing	Model - Ex Per Hour	% Differ (mod v ex)
Marsh		WB	3,162	301	-2,861	-954	-90.5%	3,529	602	-2,927	-976	-82.9%
	between 101 SB ramps & Scott	EB	3,727	1,658	-2,069	-690	-55.5%	2,507	549	-1,958	-653	-78.1%
		WB	4,329	678	-3,651	-1,217	-84.3%	4,153	1,139	-3,014	-1,005	-72.6%
	between Scott & Bohannon	EB	_	1,510	_	_		_	967	_	_	
		WB	_	879	_	_		_	950	_	_	
	west of Bohannon	EB	_	863	_	_		_	672	_	_	
Willow	between Bayfront & Hamilton	EB	2,741	2,223	-518	-173	-18.9%	6,030	5,044	-986	-329	-16.4%
		WB	3,934	2,253	-1,681	-560	-42.7%	2,848	3,148	300	100	10.5%
	between Hamilton & O'Brien	EB	3,755	2,804	-951	-317	-25.3%	4,137	5,128	991	330	24.0%
		WB	3,525	2,609	-916	-305	-26.0%	3,503	3,471	-32	-11	-0.9%
	between O'Brien & New Bridge	EB	4,761	2,618	-2,143	-714	-45.0%	4,247	5,070	823	274	19.4%
		WB	4,462	2,582	-1,880	-627	-42.1%	4,544	3,424	-1,120	-373	-24.6%
	between New Bridge & Bay	EB	5,593	3,050	-2,543	-848	-45.5%	2,174	5,829	3,655	1,218	168.1%
		WB	6,355	4,285	-2,070	-690	-32.6%	5,534	3,961	-1,573	-524	-28.4%
	between Bay & Durham	EB	3,143	1,536	-1,607	-536	-51.1%	5,975	2,314	-3,661	-1,220	-61.3%
		WB	3,040	2,962	-78	-26	-2.6%	3,227	1,636	-1,591	-530	-49.3%
	between Durham & Coleman	EB	_	1,556	_	_		_	2,393	_	_	
		WB	_	2,852	_	_		_	1,566	_	_	
	between Colemand & Gilbert	EB	_	1,536	_	_		_	2,314	_	_	
		WB	_	2,962	_	_		_	1,636	_	_	
	between Gilbert & Middlefield	EB	_	971	_	_		_	1,985	_	_	
		WB	_	2,331	_	_		_	1,248	_	_	

Footnotes/Notes:
1 SB Segment is between Brittan Ave and Whipple
Other Notes:
1. "*" Indicates that a count was not available.
2. "-" Indicates that a segment or ramp is not applicable in the given direction.
3. The majority of Arterial Volumes under "Existing Volumes" were factored from a 1-hour count volume using a factor of 2.7.
4. The model estimated volumes are within one-half a lane of traffic capacity for the respective roadway segment, which was the model validation criterion that was followed.
5. One half a lane of traffic capacity is roughly 1150 per hour for freeways; 925 per hour for expressways; and 750 and 900 for minor and major arterials, respectively.

Increased Traffic Congestion

As shown in the tables above, Route 101 is and will continue to be operating at capacity. Instances of calculated volume-to-capacity ratios of greater than 1.0 can be complicated to interpret and are the result of many contributing factors. Some of the more significant factors are summarized as follows:

- The model V/C ratios are based on approximate link capacities; actual V/C ratios are based on operational capacity, which can vary from segment to segment,

- The model is validated against freeway counts that have been estimated from a count station to the north of the study area and a series of ramp counts which fluctuate significantly on a daily basis; an actual count taken within the study are might yield a different observed result than the estimated count upon which the validation is based, and

- The forecasts are based on growth trends indicated in the ABAG Projections 2003 land use and socio-economic projections. Unlike previous forecasts that showed higher job growth rates (than worker growth rates) in Alameda and Contra Costa Counties, the recent forecasts show the job growth rates in these counties to be lower than the growth rate in employed residents (workers); So the net effect could be increased in-commuting to San Mateo and Santa Clara Counties and increased demands on the Dumbarton Bridge and Highway 101.

For purposes of operational analysis, depending on how capacities are modeled, it might be desirable to strip some of the trips (associated with the very congested links) out of the trip tables. This could be done with simple factoring until capacity is reached on the most critical link of the system. The important things to consider in this factoring process is whether the operations model reflects an accurate profile of capacity along the corridor (in which case the operations model could be used to determine the critical link). Alternately, the critical link could be measured by observing conditions in the field and/or conducting speed surveys. Virtually all the methods mentioned have some inherent margin of error or shortcoming but any of them can provide a sufficient means of arriving at a baseline set of operations by which the alternatives can be reasonably measured.

Kimley-Horn
and Associates, Inc.

555 12th Street, Suite 1230
Oakland, California
94607

By e-mail

TO: John Hoang, C/CAG

FROM: Paul Krupka

DATE: February 1, 2007, revised March 7, 2007
SUBJECT: Responses to Comments on *Draft Memorandum Task 5 – Travel Forecasting* (Kimley-Horn and Associates, Inc., December 22, 2006)

This memorandum summarizes our responses to comments raised by three reviewers of the subject document. It was revised to incorporate additional information requested by Caltrans at our meeting of February 2, 2007 (see underlined text below).

Chip Taylor, City of Menlo Park, January 4, 2007

I think I stated my main concerns at the meeting regarding Bayfront, Willow and University. The percent changes are very high for certain projects (mainly changes to 101), when intuitively the change would be minor. Also, the number of vehicles entering and exiting the model need to be verified. Basically, any change that is greater than 10% should be looked at more closely to make sure the change makes sense.

The model results presented were based on forecasts prepared by Hexagon Transportation Consultants for C/CAG and were checked by Hexagon early in the process using customary screenline procedures that compared No Build and Build conditions at four screenlines for each alternative. We believe the screenline comparisons (see AM and PM peak period tables attached (prepared by Hexagon)) indicate differences between No-Build and Build volumes that are within acceptable ranges of variation.

With respect to one issue of concern, the variation in traffic volume on Bayfront Expressway, please see "Caltrans Comment 4 (Traffic Forecasting Branch) and City of Menlo Park Comment" in the attached memorandum from Jill Hough of Hexagon dated January 31, 2007. We believe this adequately addresses this concern.

Caltrans Traffic Forecasting Branch (not dated)

With respect to Comments 1, 4, 5, and 10, please see Jill Hough's aforementioned memorandum. <u>With respect to Caltrans' question about the centroid connector effect (as discussed in the response to Comment 4), Jill Hough explained that changes in traffic flows between facilities are typically noted where traffic is displaced from one link because it is competing for capacity on another link. This affects the apparent traffic loading near centroid connectors. Caltrans also requested additional detail to support Jill Hough's response to Comment 5; the attached model plots provide the added detail</u>

TEL 510 625 0712
FAX 510 625 0714

and confirm the volumes in the traffic forecast table. The following are responses to Comments 9 and 11.

9. Figure 18, Alt.9, PM, due to the addition of express lane on University Avenue, the 67% lower traffic on eastbound at Pulgas doesn't seem reasonable.

This comment was discussed at our meeting with Caltrans on December 18, 2006. Derek Man indicated that the noted change was actually small in value and reasonable given there should be a reduction on Pulgas eastbound with increased capacity on University Avenue.

11. Figure 5, Alt. 2A, AM. Please show volume on Woodside Road.

The noted volumes will be shown.

Lance Hall, Caltrans Office of Traffic Operations

Previous comments:

1. Figure 3: The V/C ratios were not changed from my previous comments at the December 18, 2006 meeting. My comments were as follows.(a) Northbound U.S. 101 between Whipple Ave. and Woodside Rd. and southbound U.S. 101 between Woodside Rd. and Marsh Rd.; the V/C ratios do not match the volumes on Figure 1. (b) Eastbound University Ave. east and west of U.S. 101, the V/C ratios do not match the volumes on Figure 1. (c)There are no V/C ratios shown for Willow Rd.

2. Figure 4: The V/C ratios were not changed from my previous comments at the December 18, 2006 meeting. My comments were as follows. (a) Northbound U.S. 101 between Whipple Ave. and Woodside Rd. and southbound U.S. 101 between Woodside Rd. and Marsh Rd., the V/C ratios do not match the volumes on Figure 2. (b) Eastbound University Ave. west of U.S. 101, the V/C ratios do not match the volumes on Figure 2.

3. Figure 7: The V/C ratios were not changed from my previous comment at the December 18, 2006 meeting. My comment was as follows. Southbound U.S. 101 between Woodside Rd. and Marsh Rd., the V/C ratios do not match the volumes on Figure 5.

Comment 1 (a): Typo found and corrected; (b) Volumes changed and now match v/c ratios; (c): v/c ratios added.

Comment 2 (a): v/c ratios corrected; (b): v/c ratios were changed to match

Comment 3: v/c ratios corrected.

Additional comments:

4. Figure 5: No-build volume on eastbound Embarcadero Rd. has greatly increase from previous submittal, why? Comparing No Build to Build the % change in volume is now –83%.

5. Figure 10: The volumes are missing from U.S. 101 between Shoreline Rd. and SR 85.

6. Figure 11: The V/C ratios do not match the volumes on Figure 9 for Willow Rd.

7. Figure 12: There are two sets of V/C ratios on Willow Rd. neither of which matches the volumes shown on Figure 10. V/C ratios are shown on U.S. 101 between San Antonio Rd. and Charleston Rd. however there are no volumes associated with this V/C data. V/C ratios on northbound U.S. 101 between Rengstorff Ave. and Old Middlefield Way do not match the volumes on Figure 10. V/C ratios on southbound U.S. 101 and on University west of U.S. 101 do not match the volumes shown on Figure 10.

I have stopped my review at Figure 12 due to the same comments appearing on each figure. All the figures need to be re-evaluated.

Comment 4: Typo found and fixed.

Comment 5: Volumes added.

Comment 6: v/c ratios corrected

Comment 7: Figure 12 v/c ratios were corrected (Willow Road; US 101 between Rengstorff and Old Middlefield Way; University Avenue). Volumes were added on US 101 between San Antonio and Charleston.

Final general comment: All remaining figures were rechecked and corrected in the same manner as the specific location comments cited above.

We intend to publish a final version of the subject memorandum to incorporate the information presented above. Please call me if you have any questions or other requests.

Attachments (as stated)

cc: Jill Hough, Hexagon Transportation Consultants (with Attachments)

2020 Peninsula Gateway Transportation Study
Screenline Volumes - AM

Screenline 1: Gateway Between Alameda and San Mateo

	Easbound/Southbound						Westbound/Northbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Bayfront Expressway	7,060	6,915	6,392	4,737	4,883	4,754	8,223	8,969	8,512	5,239	6,861	6,326
Bayfront Grade Sep	-	-	-	1	-	-	-	-	-	2,266	-	-
Willow Road	7,588	7,313	7,770	7,078	7,687	7,196	8,223	8,969	8,512	7,172	7,058	8,109
Willow Grade Sep	-	-	-	1,328	-	-	-	-	-	4,093	-	-
Willow Express Ln	-	-	-	-	658	-	-	-	-	-	5,506	-
University Avenue	4,848	4,048	4,074	5,538	5,330	3,899	9,050	9,246	8,914	9,201	7,951	7,097
University Express Ln	-	-	-	-	-	870	-	-	-	-	-	6,710
Total	**19,496**	**18,276**	**18,236**	**18,682**	**18,558**	**16,719**	**25,496**	**27,184**	**25,938**	**27,971**	**27,376**	**28,242**
		-6%	-7%	-4%	-5%	-15%		7%	2%	10%	7%	10%

Screenline 2: Gateway Between Santa Clara and San Mateo

	Northbound						Southbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Bayshore Boulevard	3,232	3,139	2,475	3,438	3,445	3,154	5,360	5,411	4,980	5,677	5,416	5,258
Route 101	36,170	35,360	46,459	36,945	37,086	35,567	45,542	45,995	58,408	46,348	46,980	46,885
Middlefield Road	6,389	6,210	5,508	6,685	6,671	6,372	8,885	8,785	7,731	9,090	9,004	8,715
Alma Street	7,060	6,915	6,392	7,134	7,366	7,011	2,642	2,521	1,608	2,494	2,745	2,765
El Camino Real	18,311	17,999	16,234	18,556	18,748	18,654	13,098	12,841	10,674	13,019	13,456	13,154
Total	**71,162**	**69,623**	**77,068**	**72,758**	**73,316**	**70,758**	**75,527**	**75,553**	**83,401**	**76,628**	**77,601**	**76,777**
		-2%	8%	2%	3%	-1%		0%	10%	1%	3%	2%

Screenline 3: Northern Gateway of Study Area

	Northbound						Southbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Route 101	37,243	37,927	47,229	37,727	37,707	37,771	35,067	35,842	46,971	36,008	36,819	36,606
Broadway	2,694	2,859	2,179	2,872	2,867	3,013	13,591	14,213	2,793	3,331	3,389	3,330
Bay Street	4,694	4,595	3,987	4,926	4,867	4,760	5,119	5,425	4,018	5,040	5,262	4,907
Middlefield Road	3,151	3,174	2,776	3,232	3,195	3,261	3,645	3,257	2,784	3,611	3,468	3,375
El Camino Real	13,591	14,213	8,502	11,617	11,993	11,372	17,537	17,357	15,429	17,702	18,085	17,910
Total	**61,373**	**62,768**	**64,673**	**60,374**	**60,629**	**60,177**	**74,959**	**76,094**	**71,995**	**65,692**	**67,023**	**66,128**
		2%	5%	-2%	-1%	-2%		2%	-4%	-13%	-12%	-13%

Screenline 4: North-South Cut Line on the East Side of Route 101

	Northbound						Southbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Marsh Road	4,255	3,973	4,154	4,287	4,384	4,386	5,282	5,676	5,465	5,562	5,886	6,005
Willow Road	4,332	4,041	4,201	4,145	4,148	4,244	5,510	5,779	5,335	5,535	5,805	5,655
University Ave	7,840	8,569	8,007	8,319	7,633	5,663						
Clarke Avenue	383	296	81	858	786	323	3,542	3,505	3,221	3,671	3,693	3,432
Embarcadero Road	8,261	7,899	7,506	8,293	8,315	8,495	3,643	3,866	3,438	3,986	3,744	4,247
Oregon Expressway	9,023	6,408	6,734	9,461	9,558	8,290	27,182	28,426	24,434	27,660	28,056	27,076
Total	**34,094**	**31,186**	**30,683**	**35,363**	**34,824**	**31,401**	**45,159**	**47,252**	**41,893**	**46,414**	**47,184**	**46,415**
		-9%	-11%	4%	2%	-8%		5%	-7%	3%	4%	3%

SOURCE: HEXAGON TRANSPORTATION CONSULTANTS, INC., 2006

2020 Peninsula Gateway Transportation Study
Screenline Volumes - PM

Screenline 1: Gateway Between Alameda and San Mateo

	Easbound/Southbound						Westbound/Northbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Bayfront Expressway	3,555	3,419	1,897	3,571	4,870	5,071	8,506	10,133	8,379	4,593	5,090	5,205
Bayfront Grade Sep	-	-	-	1,620	-	-	-	-	-	4,197	-	-
Willow Road	10,026	8,562	9,453	7,884	7,203	7,252	8,506	10,133	8,379	4,679	8,471	10,358
Willow Grade Sep	-	-	-	3,429	-	-	-	-	-	1,207	-	-
Willow Express Ln	-	-	-	-	4,606	-	-	-	-	-	933	-
University Avenue	9,054	8,546	9,188	8,876	8,045	5,631	4,144	3,526	3,800	4,130	3,826	1,906
University Express Ln	-	-	-	-	-	4,917	-	-	-	-	-	2,264
Total	**22,635**	**20,527**	**20,538**	**25,380**	**24,724**	**22,871**	**21,156**	**23,792**	**20,558**	**18,806**	**18,320**	**19,733**
		-9%	-10%	13%	8%	1%		12%	-3%	-11%	-15%	-8%

Screenline 2: Gateway Between Santa Clara and San Mateo

	Northbound						Southbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Bayshore Boulevard	3,954	4,001	3,804	4,281	4,106	4,055	3,447	3,535	2,717	3,679	3,584	3,346
Route 101	39,410	39,024	49,220	40,216	39,517	39,555	37,727	37,095	48,253	38,408	38,214	38,550
Middlefield Road	6,611	6,327	5,740	6,897	6,875	6,503	5,959	6,178	5,057	6,136	6,245	6,186
Alma Street	3,555	3,419	1,897	3,051	3,089	3,058	5,694	5,678	5,131	5,849	5,973	5,846
El Camino Real	12,554	11,819	9,821	11,587	12,393	12,049	17,188	17,448	14,868	17,420	17,773	17,422
Total	**66,084**	**64,590**	**70,482**	**66,032**	**65,980**	**65,220**	**70,015**	**69,934**	**76,026**	**71,492**	**71,789**	**71,350**
		-2%	7%	0%	0%	-1%		0%	9%	2%	2%	2%

Screenline 3: Northern Gateway of Study Area

	Northbound						Southbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Route 101	35,263	37,079	44,600	35,973	35,120	37,085	37,666	37,357	47,851	37,458	37,213	38,103
Broadway	2,643	3,283	1,821	2,883	2,508	3,293	7,403	7,738	2,717	3,338	3,260	3,495
Bay Street	5,023	4,786	3,314	4,840	4,883	5,155	4,929	5,008	3,934	5,619	5,357	5,308
Middlefield Road	3,266	3,551	2,694	3,104	3,189	3,853	3,394	3,646	2,886	3,554	3,506	3,683
El Camino Real	7,403	7,738	13,504	15,239	15,787	15,487	14,329	14,620	12,355	14,782	14,931	14,964
Total	**53,598**	**56,437**	**65,933**	**62,039**	**61,487**	**64,873**	**67,721**	**68,369**	**69,743**	**64,751**	**64,267**	**65,553**
		5%	22%	13%	13%	18%		1%	3%	-4%	-5%	-3%

Screenline 4: North-South Cut Line on the East Side of Route 101

	Northbound						Southbound					
	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9	No Build	Alt 1	Alt 2	Alt 3	Alt 6/7	Alt 9
Marsh Road	4,741	4,965	4,600	4,658	4,622	4,659	3,961	5,309	3,646	4,113	4,216	5,094
Willow Road	5,516	5,440	5,565	6,149	5,804	5,807	4,505	4,869	4,377	4,502	4,045	4,914
University Ave	7,162	6,834	7,395	7,665	6,898	5,304						
Clarke Avenue	1,540	1,251	246	1,387	1,636	619	266	220	64	327	664	484
Embarcadero Road	6,509	6,133	5,678	6,826	6,483	6,893	2,008	1,630	1,608	2,631	1,844	1,842
Oregon Expressway	11,171	10,172	9,862	12,036	11,476	11,394	14,806	15,476	13,070	16,424	16,396	15,966
Total	**36,639**	**34,795**	**33,346**	**38,721**	**36,919**	**34,676**	**25,546**	**27,504**	**22,765**	**27,997**	**27,165**	**28,300**
		-5%	-9%	6%	1%	-5%		8%	-10%	11%	6%	10%

SOURCE: HEXAGON TRANSPORTATION CONSULTANTS, INC., 2006

HEXAGON TRANSPORTATION CONSULTANTS, INC.

MEMORANDUM

From: Jill Hough

To: John Hoang

Date: January 31, 2007

Subject: *Explanation of Travel Demand Forecast Results: 2020 Peninsula Gateway*

Caltrans Comment 1 (Traffic Forecasting Branch)

What are the No Build Network Assumptions?

The transportation network for year 2020 consists of added transportation improvements that are included in the Metropolitan Transportation Commission (MTC) Regional Transportation Plan (RTP). In the Peninsula Gateway Study area, the coded RTP improvements were the reconfiguration/reconstruction of the Route 101/Willow Road interchange and the addition of Route 101 auxiliary lanes between Marsh Road and the southern county line.

Caltrans Comment 4 (Traffic Forecasting Branch) and City of Menlo Park Comment

Alternative 1, Bayfront Expressway westbound traffic increased 12 percent in the AM and 25 percent in the PM. Why does the addition of auxiliary lanes on US 101 south of Embardcadero Road contribute to this increase?

The addition of the auxiliary lanes (Alternative 1) has the effect of increasing the attractiveness of the Route 101 corridor in the Peninsula Gateway study area. Consequently, traffic increases on Bayfront Expressway, Willow Road, and University Avenue westbound.

The overall AM Peak Period increase on these three facilities combined is approximately 7 percent. The Bayfront Expressway link for which a 12 percent increase was noted, is located near a centroid connector: since the loading patterns on Bayfront are fairly approximate from the perspective of the travel demand model (compared to actual practice), the increase is more likely in the 9 percent range, which is indicated west of Willow Road (9,000 vehicles for Alternative 1 versus 8200 vehicles for No Build).

The overall PM Peak Period increase on these three facilities combined is approximately 12 percent. The Bayfront Expressway link for which a 25 percent increase was noted, is located near a centroid connector: since the loading patterns on Bayfront are fairly approximate from the perspective of the model (compared to actual practice), the increase is more likely in the 19 percent range, which is indicated west of Willow Road (10,100 vehicles for Alternative 1 versus 8,500 vehicles for No Build).

40 South Market Street, Suite 600 • San Jose, California 95113
phone 408.971.6100 • fax 408.971.6102 • www.hextrans.com

Caltrans Comment 5 (Traffic Forecasting Branch)

Alternative 2A Build Scnenario PM, for Route 101 north of Woodside Road, traffic decreases by almost the same amount as the added express lane, and traffic on Woodside Road also decreases. Where does the traffic go?

The following table outlines the forecasted traffic volumes on Route 101 (mixed-flow only) for the PM peak 3-hour period with Alternative 2A (Express Lanes on Route 101):

Traffic Forecast Volumes on Route 101 in the Vicinity of Woodside Road (Alt. 2A)

Location	Mainline Volume	Express Lane	Mainline HOV Volume	Mainline Total (HOV + Mixed Flow)
South of Woodside Rd	26,800 nb 27,800 sb	8,700 nb 8,100 sb	7,400 nb 7,700 sb	34,200 nb 35,500 sb
Center of Woodside I/C	19,900 nb 17,700 sb	8,700 nb 8,100 sb	6,100 nb 5,700 sb	26,000 nb 23,400 sb
North of Woodside Rd (south of Express Lane Terminus)	25,800 nb 28,700 sb	8,700 nb 0 sb	1,300 nb 7,700 sb	27,100 nb 36,400 sb
North of Woodside Rd (north of Express Lane Terminus)	28,500 nb 28,700 sb	0 nb 0 sb	7,300 nb 7,700 sb	35,800 nb 36,400 sb

Traffic volumes increase in the northbound direction from the "center" of the Woodside Road interchange (i.e., the location between the off ramps and on ramps) to immediately north of Woodside Road. Similarly, northbound traffic volumes increase from the point immediately north of the Woodside Road interchange to north of the merge point of the Route 101 northbound express lane. The proportion of HOV traffic along each segment of Route 101, which is not included in the column labeled "Mainline Volume", increases significantly north of the express lane terminus (see column "Mainline HOV Volume).

The traffic forecast volumes in the northbound direction decrease from south of Woodside Road to the Woodside Road interchange underpass. The decrease is explained by the volume of traffic that exits Route 101 Northbound to Woodside Road (Route 84) westbound and proceeds northwest on Veterans Boulevard and northwest on Broadway. In addition, there is a net increase in volumes that exit Route 101 northbound to Woodside Road (Route 84) westbound and proceed northwest on Veterans Boulevard and northwest on Broadway, compared to the No Build Alternative.

Traffic volumes in the southbound direction, starting at north of Woodside Road, decrease (from 28,700 LOV volumes to 17,700 LOV volumes) at the Woodside Road interchange "underpass". Some of this decrease is due to the volume that enters the southbound express lane (8,100 vehicles). The remaining vehicles use the off ramp at Woodside Road. Continuing southbound, traffic forecast volumes increase from the Woodside Road interchange to south of Woodside Road. The proportion of southbound HOV traffic along each segment of Route 101, which is not included in the column labeled "Mainline Volume", decreases slightly south of the express lane introduction, then increase again south of Woodside Road (see column "Mainline HOV Volume).

In summary, the results of the travel demand model suggests that the effect of the express lane in the PM period is to produce a net increase in traffic volumes with destinations in Redwood City, primarily downtown. Also, the results in the above table demonstrate that the Route 101 volumes north and south of the express lanes are consistent with one another and that the network coding of the express lanes functions correctly.

Caltrans Comment 10 (Traffic Forecasting Branch)

For the No Build scenarios, comparing the forecast of Willow Interchange project to this forecast, the 4-hour peak period forecasts of Willow Interchange project atually show lower volumes than the 3-hour peak period forecasts for the 2020 Peninsula Gateway Study (AM northbound and PM southbound). Need explanation.

The travel demand forecasts for the 2020 Peninsula Gateway Study are based on the *ABAG Projections 2003 Series* for Year 2025. For the Route 101/Willow Road Interchange PSR, the travel demand forecasts are based on the *ABAG Projections 2005 Series*, which are lower compared to the earlier series of land use projections produced by ABAG.

Although the *ABAG Projections 2005* land use forecasts are high, the 2020 Peninsula Gateway alternatives can still be evaluated on a relative scale against the No Build, since both the No Build and the Alternatives are based on the same set of land use projections.

AUTO VOLUMES

emme/2

LINKS:
mod=eao

WINDOW:
49949/ 36299
50508/ 36718

EMME/2 PROJECT: 2020 Peninsula Gateway Corridor Study
SCENARIO 2: Alt2a-Rt101 Elevated Exp Lanes (mix only): PM Peak 3 Hr

Hexagon Transportation Consultants

07-02-07 11:24
MODULE: 6.12
HEXAGON.....jl

AUTO VOLUMES

emme/2

LINKS:
mod=eao

WINDOW:
49949/ 36299
50508/ 36718

EMME/2 PROJECT: 2020 Peninsula Gateway Corridor Study
SCENARIO 20522: No Build: PM Peak 3hr

Hexagon
Transportation Consultants

07-02-07 11:25
MODULE: 6.12
HEXAGON.....jl

2020 Peninsula Gateway Corridor Study

Final Report

Appendix F

ALPS Modeling Assumptions

Prepared for:

C/CAG
City/County Association of Governments of San Mateo County

SAN MATEO COUNTY Transportation Authority

VTA
SANTA CLARA Valley Transportation Authority

Prepared by:

Kimley-Horn and Associates, Inc.

July 29, 2008

Kimley-Horn
and Associates, Inc.

555 12th Street, Suite 1230
Oakland, California
94607

To: John Hoang, C/CAG

From: Paul Krupka

Date: September 18, 2007

Re: 2020 Peninsula Gateway Corridor Study:
ALPS2000 Model Assumptions

This memorandum summarizes the ALPS2000 analysis tool with respect to its fundamental assumptions as applied in the 2020 Peninsula Gateway Corridor Study, which is being conducted by Kimley-Horn and Associates for the City/County Association of Governments, San Mateo County Transportation Authority, and Santa Clara Valley Transportation Authority. A subsequent memorandum will detail findings of the analysis of a No-Build case and alternative improvements.

ALPS2000 Model Assumptions

The ALPS2000 model inputs were derived from peak period outputs from the C/CAG Travel Demand Model (macroscopic analysis tool), called traversal matrices, which essentially are matrices detailing vehicle trips by origin-destination (OD) paths. These data were loaded into the No-Build network and the five discrete alternative networks shown in the attachments.

Within a time step of 15 minutes, a specific amount of vehicles are generated from the OD matrix and distributed across the network with pre-defined routes. Most routes are automatically built based on travel time but some competing routes are manually created. Every roadway segment has user defined capacity. For example, the freeway type segment has a lane capacity of 2,400 vehicles per hour per lane (vphpl). The lane capacity times the number of lanes equals the segment capacity. If in a particular segment the volume in this time step is higher than the capacity, then congestion occurs and a queue builds upstream. ALPS keeps track of how many vehicles are stored in this queue and reduces the segments volume downstream.

Figure 1 illustrates the dynamic nature of the ALPS2000 mesoscopic model when simulating capacity constrained conditions, and is an example from another study. As indicated in the figure legend, the traffic demand (light green line) exceeds the capacity (yellow line) during most of the afternoon hours. The capacity constrained traffic volumes that are able to flow (shown as the brown graph line) are capped at the segment's capacity limit, while the travel speeds correspondingly drop (green graph line with speed values given on the right-hand axis). All of the demand that exceeds the capacity is stacked back through the network as congestion queues build, which in effect forms "latent" demand. This demand, in subsequent time intervals, extends the duration of capacity constrained operations throughout the period of time required to dissipate the congestion queues.

TEL 510 625 0712
FAX 510 625 0714

12:00 am

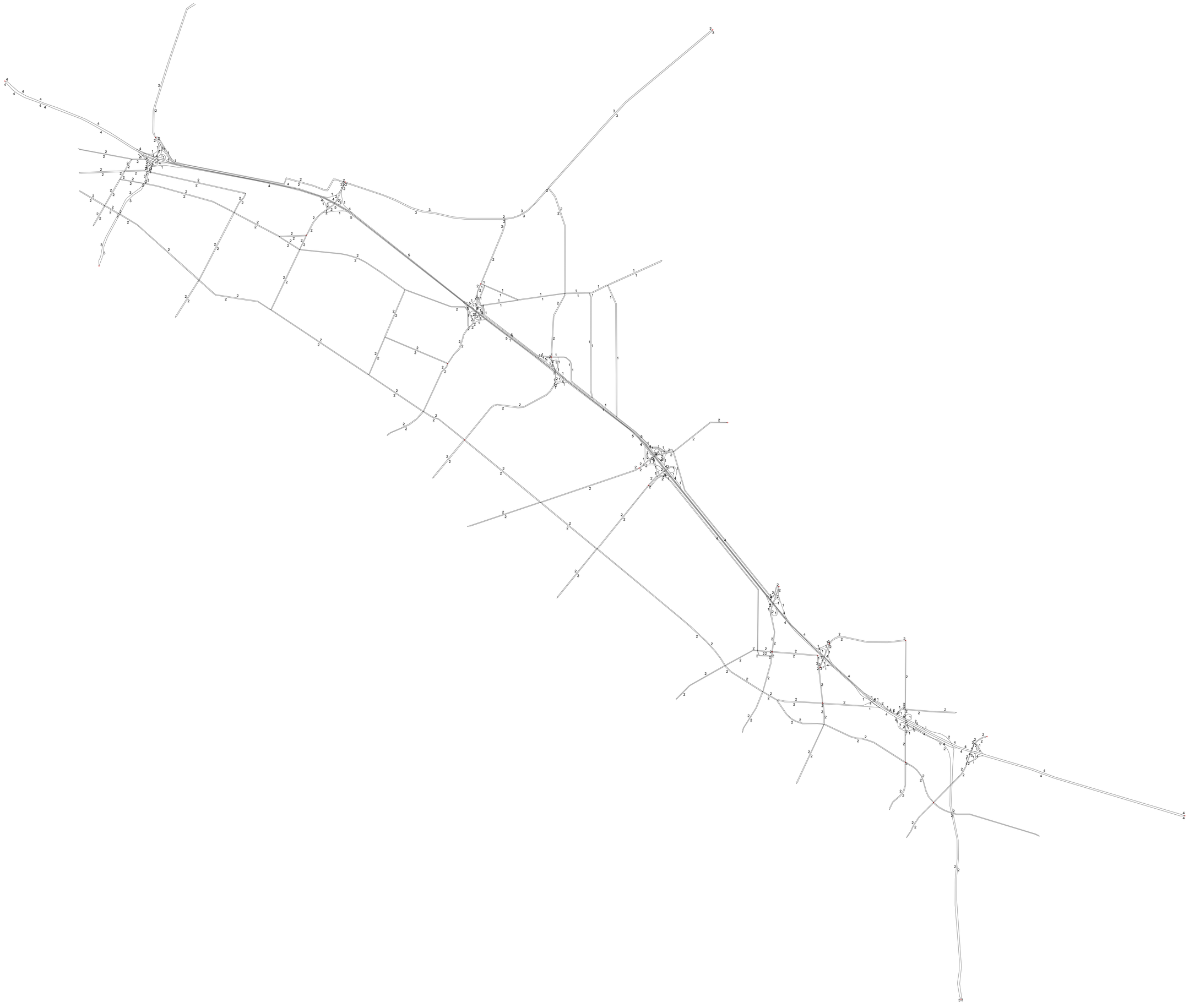
Baseline
ALPS2000 Network
9/7/07

12:00 am

Alternative 1
ALPS2000 Network
9/7/07

12:00 am

Alternative 2
ALPS2000 Network
9/7/97



12:00 am

Alternative 3
ALPS2000 Network
9/7/07

12:00 am

Alternative 6&7
ALPS2000 Network
9/7/07

12:00 am

Alternative 9
ALPS2000 Network
9/7/07

Figure 2, also from another study, shows the congestion queues that cascade back through the network from the segment that imposes the capacity constraint shown in **Figure 1**. As illustrated, the congestion queuing can be presented as either color coded network elements, or as animated traffic simulations.

The analysis described above is in effect a hybrid analysis between a travel demand model and a detailed "operational" model. This is because within the continuous flow model at locations where capacity constraints are reached (Demand/Capacity > 1.0), the individual vehicles are discretely accounted for to calculate total queue length, as well as each individual segment's queue "volume" (i.e., occupancy).

Further, as an integral part of the holistic analysis tools that make up ALPS2000, the overall travel time performance and operational state of the multimodal network is used by the trip assignment logic to determine the distribution of trips within each time interval. This includes mode splits where defined as part of the competing travel paths. Logit algorithms calculated the trip assignments directly from the comparative travel time and cost impedances of alternate travel paths, including the total effect of breakdown flows from cascading congestion queues.

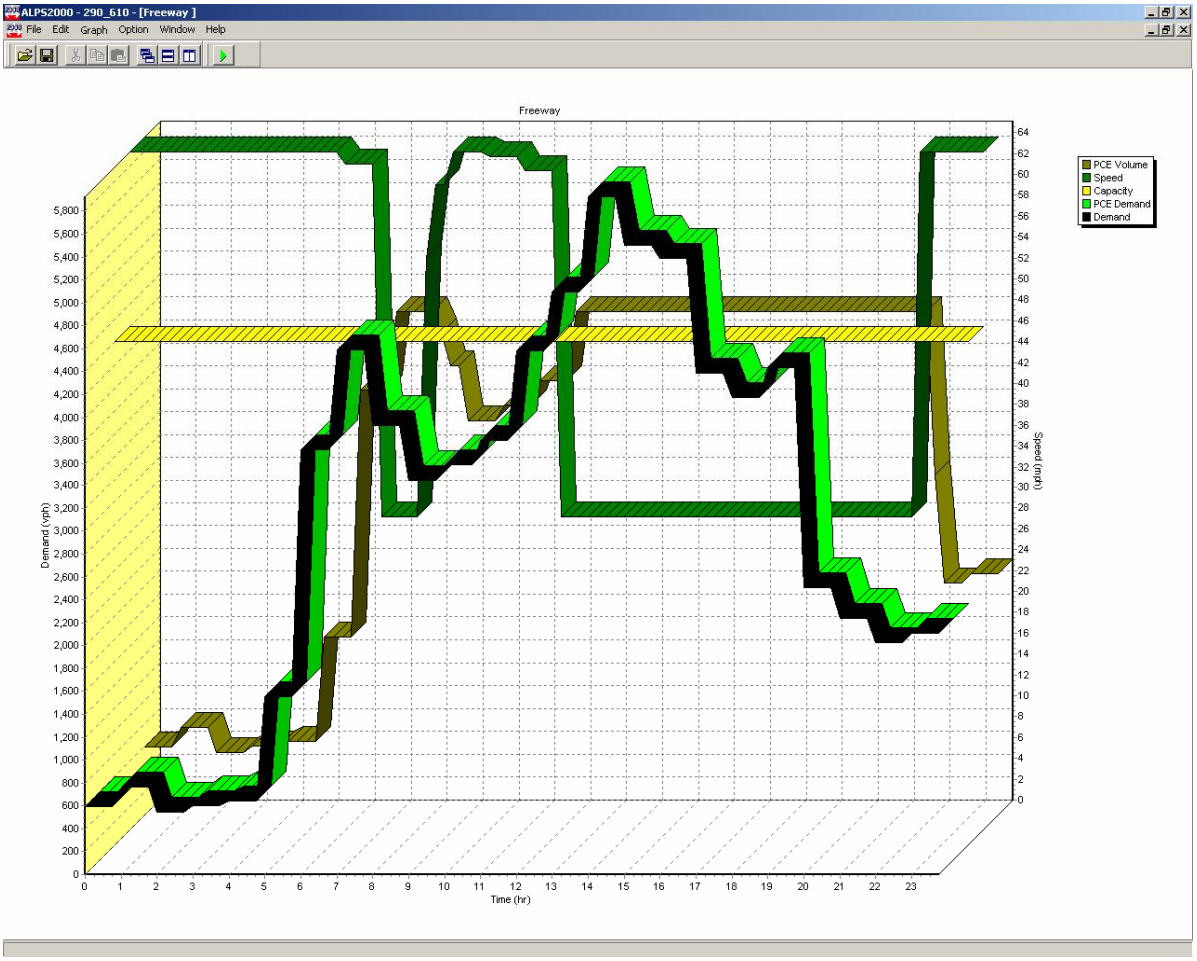


Figure 1. Capacity Constrained Segment Graph Showing Demand Flow, Constrained Volume Flow, and Travel Speed

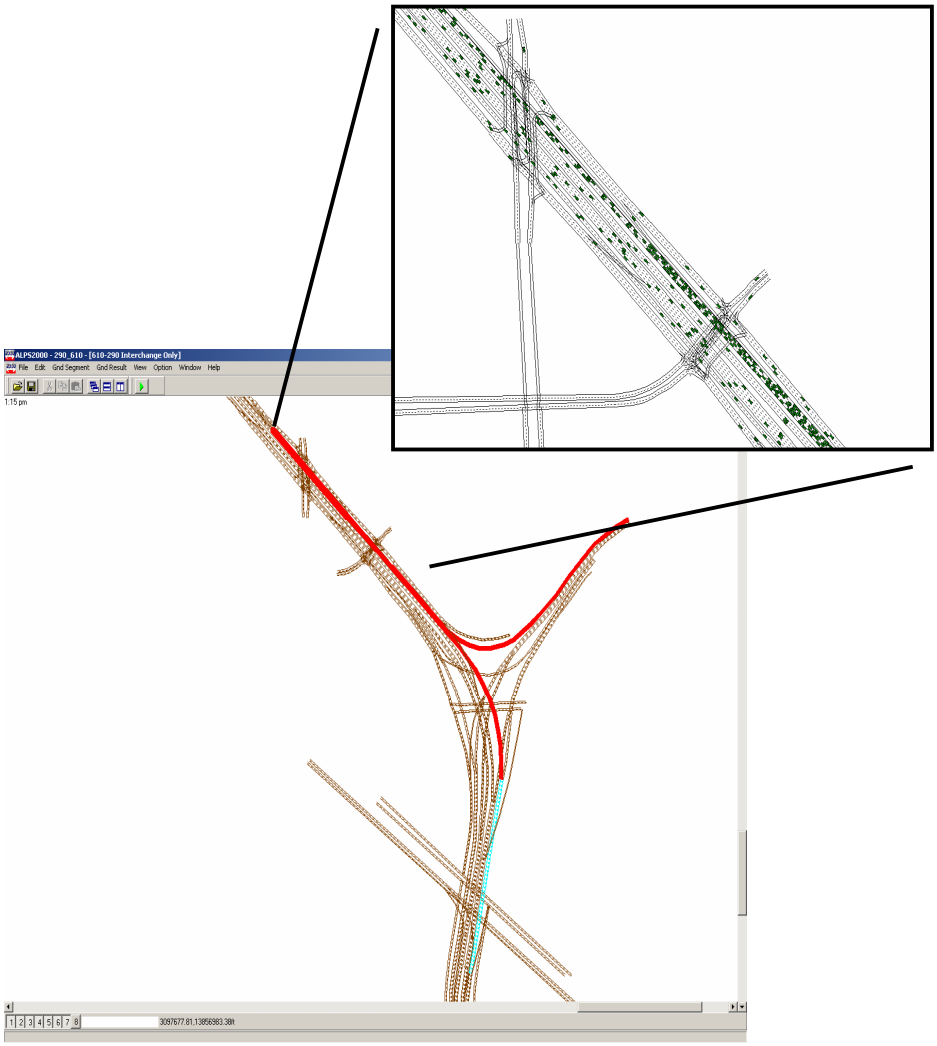
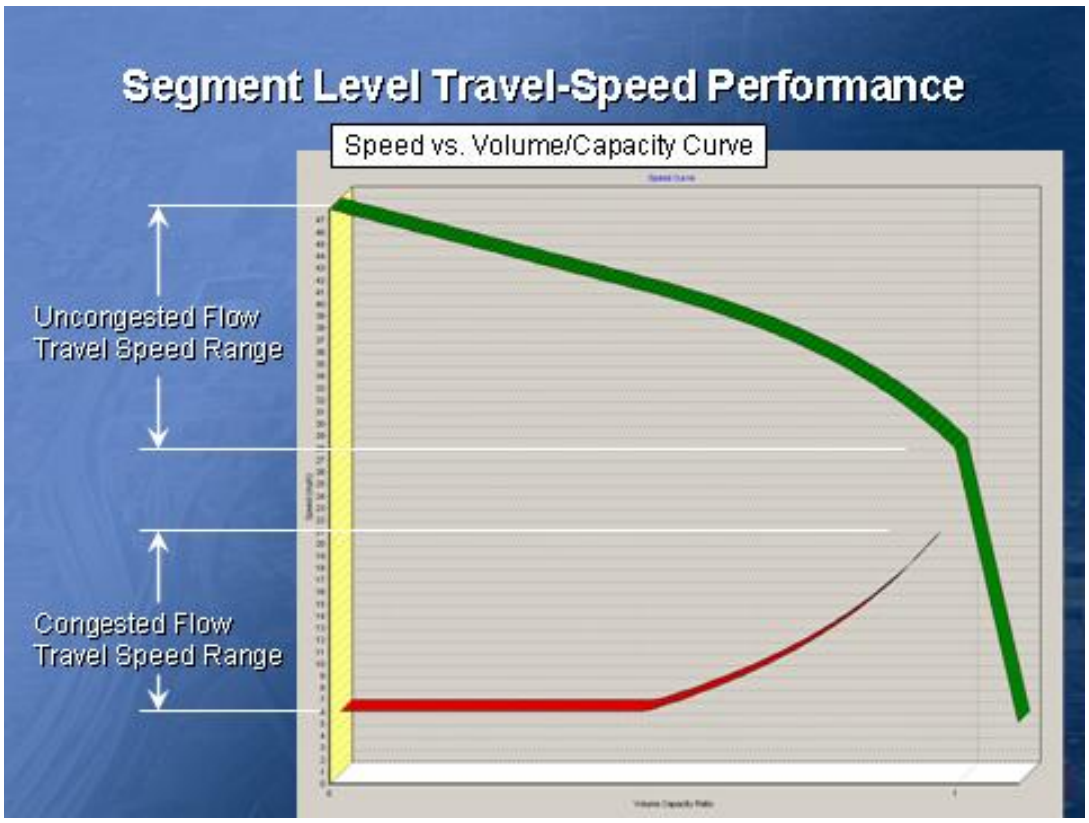


Figure 2. Cascading Congestion Analysis with Density of Traffic Shown

A typical speed curve is shown below. The speed curve is dependent on volume/capacity (v/c) ratio. If the segment is not congested, then speed is determined by the upper half green colored curve. If the segment is congested and in queue from a downstream segments' congestion, then the speed is determined by the lower half red colored curve at the point corresponding to vehicle flow rate that can travel thru the downstream bottleneck segment's capacity.



In this model, the OD matrix provides AM peak demand period and PM peak period demand. A time of day ratio curve was derived based on the average of all the Caltrans ramp volumes data. The demand from the OD matrix times this ratio curve will generate the same amount of vehicles in the AM and PM peak periods, as well as off-peak period demand, which determine the duration of the congestion queues.

ALPS uses the following primary performance measures.

- *Vehicle Miles Travel (VMT)* = number of vehicles traveled in a segment (section of roadway) times the segment length in miles.

- *Vehicle Hour Travel (VHT)* = number of vehicles traveling in a segment times the travel time in hours. The travel time is determined by the length of the segment divided by the average speed. The average speed of the segment is determined from speed curves and whether the traffic in the segment is congested or not.

- *Vehicle Hour Delay (VHD)* = number of vehicles traveling in a segment times the delay time, which is the difference between the travel time in current conditions and the travel time in free flow conditions.

- *Average Speed* across a path is calculated by the sum of segments' speed times number of vehicles traveling in these segments divided by the sum of the segments' vehicles traveling these segments.

- *Travel Time Index (TTI)* is the ratio of average peak travel time to travel time in free flow conditions (see FHWA-HOP-05-018). As defined in the Urban Mobility Report, the free flow speed is fixed at 60 mph for freeway, and peak periods are from 6 to 9 AM and 4 to 7 PM. This value is an average by vehicle, similar to the average speed calculation.

Conversion of C/CAG Travel Demand Forecasts to ALPS2000 Inputs.

The following steps summarize the conversion from the traversal matrices derived from the C/CAG Travel Demand Model to the OD matrices used in ALPS (the traversal matrices were derived from travel forecasts presented in Draft Memorandum, Task 5 – Travel Forecasting (Kimley-Horn, December 22, 2006). Given the nature of the study area, it was necessary to create two cordon lines and therefore two traversal matrices for each scenario (No-Build and alternatives). Two attachments illustrate the cordons for the No-Build network , which are similar to the cordons for each of the improvements. Also included for reference is a draft set of traversal matrices for the No-Build case (only AM matrices included).

1) The cordon 1 traversal matrices files were imported into a single spreadsheet and rearranged so as to assemble the OD matrix. The cordon 2 data were then appended to this matrix.

2) The OD zones were merged. Separated entry and exit zones were combined into one source node. In some intersections, multiple entry or exit ramps were combined.

3) The diagonal cells were changed to zero volumes. There should be no volume going from the same origin to the same destination.

4) The Cordon 2 trips were subtracted from Cordon 1 trips to avoid double-counting or double-assigning trips.

5) Finally, given the vehicle trips from the traversal matrix represent low-occupant vehicles (i.e. single occupant vehicles), they were factored to convert them to total vehicle trips.

6) The result was a complete OD matrix that was translated into a 24-hour matrix and loaded into the ALPS2000 model.

CORDON 1 GATES-NB

2020 PENINSULA GATEWAY PROJECT

emme/2

LINKS:
mod=eao

THRESHOLD:
LOWER: -99999
UPPER: 99999

LAYERS:
Gate Index
Gates

SCALE: 950

2000
4000
6000
8000
10000

WINDOW:
49481/ 32764
55181/ 37039

EMME/2 PROJECT: 2020 Peninsula Gateway Corridor Study
SCENARIO 11: No Build: AM Peak 3hr

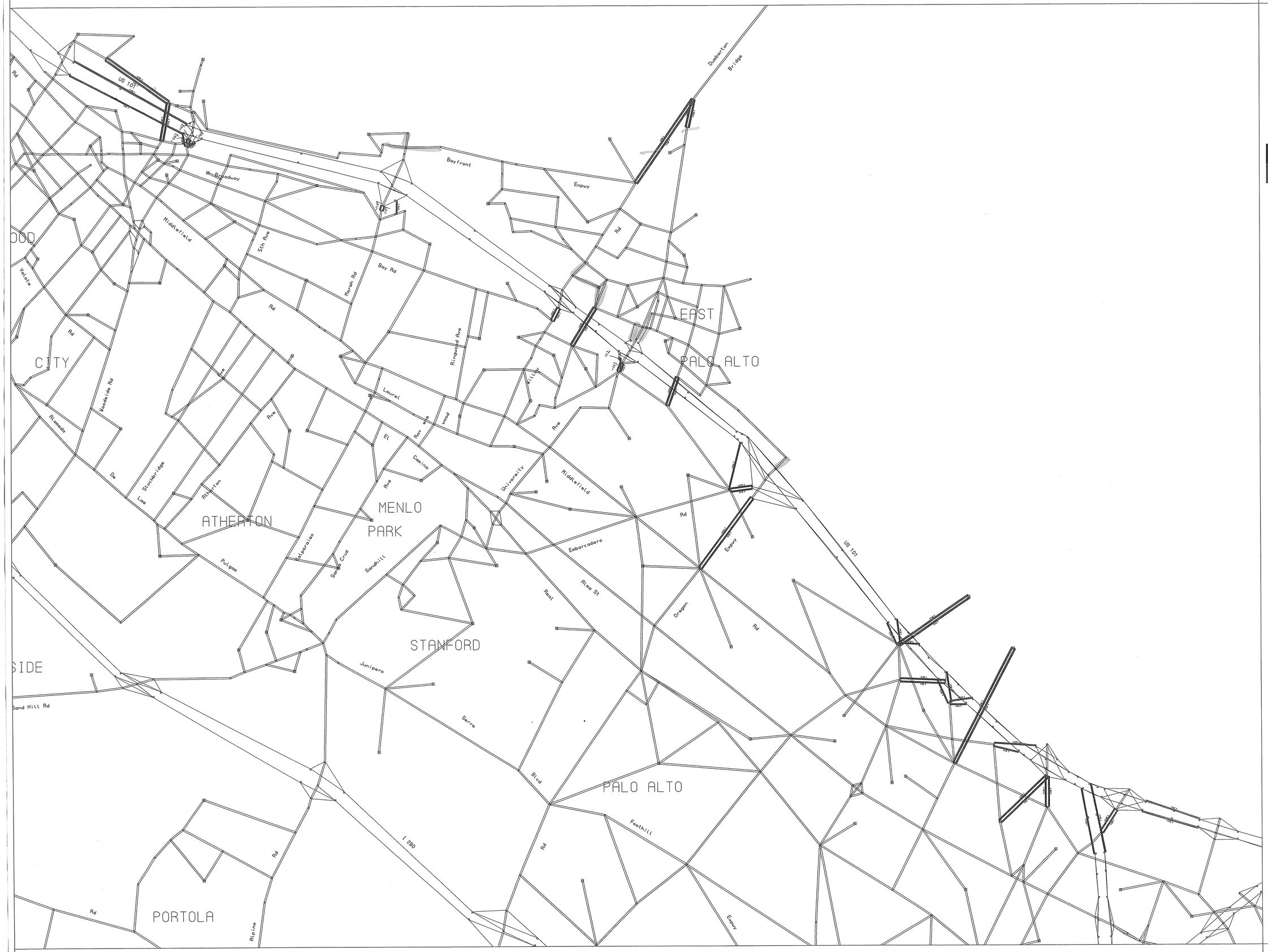
Hexagon
Transportation Consultants

07-04-26 16:27
MODULE: 2.13
HEXAGON.....JL

CORDON 2 GATES-NB

2020 PENINSULA GATEWAY PROJECT

emme/2



LINKS:
mod=eao

THRESHOLD:
LOWER: -99999
UPPER: 99999

LAYERS:
Gate Index
Gates

SCALE: 950

2000
4000
6000
8000
10000

WINDOW:
49481/ 32764
55181/ 37039

EMME/2 PROJECT: 2020 Peninsula Gateway Corridor Study
SCENARIO 1: No Build: AM Peak 3hr

Hexagon
Transportation Consultants

07-04-26 16:27
MODULE: 2.13
HEXAGON.....JL

Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

destination zones

origin zones	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1101	2	0	4041	0	7118	0	4646	0	0	174	0	324	0	64	1356
1102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1103	3506	0	0	0	0	0	0	283	0	40	0	239	0	75	0
1104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	8370	0	0	0	0	0	0	506	0	54	0	395	0	63	0
1106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	1739	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	0	0	351	0	693	0	0	0	0	793	0	46	0	24	45
1109	38	0	201	0	653	0	0	1	0	0	0	9	0	0	591
1110	0	0	10	0	17	0	0	0	0	0	0	7	0	2	16
1111	525	0	65	0	101	0	0	39	0	0	0	0	0	3	112
1112	0	0	315	0	564	0	0	0	0	0	0	0	0	0	200
1113	141	0	78	0	141	0	0	49	0	21	0	110	0	0	189
1114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1115	472	0	252	0	1492	0	0	56	0	8					

0	85	0	17	0										
	1116	1793	0	51	0	126	0	0	175	0	126	0	331	0
56	0													
	1117	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0													
	1118	821	0	0	0	0	0	0	224	0	61	0	293	0
45	0													
	1119	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0													
	1120	0	0	899	0	3153	0	0	0	0	0	0	0	0
0	0													
	1121	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0													
	1122	1720	0	0	0	0	0	0	213	0	13	0	205	0
37	0													
	1123	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0													
	1124	0	0	168	0	486	0	0	0	0	0	0	0	0
0	0													

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3357
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

destination zones

origin zones	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1101	0	3867	796	0	0	0	1516	0	0	0	0	0	5	171	0
1102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1103	467	39	0	0	1314	0	0	0	1098	0	626	0	4	0	0
1104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	884	60	0	0	2346	0	0	0	2306	0	4217	0	131	50	2229
1106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1108	0	112	121	0	0	0	58	0	0	0	0	0	0	32	0
1109	0	16	117	0	0	0	8	0	0	0	0	0	0	14	0
1110	0	38	35	0	0	0	16	0	0	0	0	0	0	5	0
1111	0	107	135	0	0	0	41	0	0	0	0	0	2	24	0
1112	0	623	227	0	0	0	200	0	0	0	0	0	1	53	0
1113	0	309	278	0	0	0	77	0	0	0	0	0	1	27	0
1114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1115	0	0	2770	0	0	0	1069	0	0	0	0	0	3	38	0
1116	0	0	371	0	0	0	27	0	0	0	0	0	2	13	0
1117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1118	702	331	0	0	0	0	0	0	0	0	0	0	0	0	0
1119	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1120	0	0	0	0	0	0	0	0	0	0	0	0	0	87	0
1121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1122	130	16	0	0	1253	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3359
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

destination zones

origin zones	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144
1100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1101	0	0	0	13	28	1470	1076	0	0	285	0	0	0	0	0
1102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1103	226	105	0	529	1	47	0	2	0	139	0	0	0	0	0
1104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1105	251	77	0	537	0	43	0	2	0	153	0	0	0	0	0
1106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1107	0	0	0	0	0	0	0	0	0	2600	0	0	0	0	0
1108	0	0	0	1	9	229	576	0	0	0	0	0	0	0	0
1109	0	0	0	1	7	190	2792	0	0	1	0	0	0	0	0
1110	0	0	0	0	5	115	0	0	0	0	0	0	0	0	0
1111	0	0	0	2	91	1989	0	2	0	45	0	0	0	0	0
1112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1113	0	0	0	701	0	115	0	1	0	32	0	0	0	0	0
1114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1115	0	57	0	126	0	9	0	0	0	68	0	0	0	0
1116	1651	64	0	818	0	32	0	3	0	920	0	0	0	0
1117	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1118	187	80	0	201	0	21	0	1	0	261	0	0	0	0
1119	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1120	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1121	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1122	112	17	0	255	0	30	0	1	0	680	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1124	0	0	0	0	0	0	0	0	0	0	0	0	0	0

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3361
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

origin zones	destination zones 1145	1146	1147	1148	sum
1100	0	0	0	0	0
1101	0	0	0	0	26954
1102	0	0	0	0	0
1103	0	0	0	0	8739
1104	0	0	0	0	0
1105	0	0	0	0	22673
1106	0	0	0	0	0
1107	0	0	0	0	4339
1108	0	0	0	0	3090
1109	0	0	0	0	4639
1110	0	0	0	0	266
1111	0	0	0	0	3283
1112	0	0	0	0	2183
1113	0	0	0	0	2270
1114	0	0	0	0	0
1115	0	0	0	0	6521
1116	0	0	0	0	6558
1117	0	0	0	0	0
1118	0	0	0	0	3228
1119	0	0	0	0	0
1120	0	0	0	0	4139
1121	0	0	0	0	0
1122	0	0	0	0	4684

1123	0	0	0	0	0
1124	0	0	0	0	654

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3363
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

destination zones

origin zones	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114
1125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1126	0	0	120	0	3509	0	0	0	0	0	0	0	0	0	
1127	18	0	0	0	137	0	0	6	0	0	0	9	0	3	0
1128	472	0	0	0	173	0	0	65	0	8	0	44	0	8	0
1129	0	0	0	0	2761	0	0	0	0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1132	581	0	2	0	2	0	0	135	0	4	0	304	0	0	9
1133	0	0	0	0	0	0	0	0	0	0	0	0	0	4492	0
1134	139	0	4	0	4	0	0	51	0	22	0	151	0	0	6
1135	108	0	565	0	924	0	0	18	0	0	0	721	0	6	227
1136	4083	0	0	0	0	0	0	587	0	3322	0	0	0	0	0
1137	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
1138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	106	0	0	0	0	0	0	3081	0	0	0	0	0	0	0

1140	0	0	46	0	289	0	0	0	0	7	0	25	0	13	36
1141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sum	24632	0	7168	0	22345	0	4646	5490	0	4655	0	3297	0	4909	2787

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3365
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

destination zones

origin zones	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129
1125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0
1127	19	2	0	0	20	0	0	0	11	0	0	0	0	59	0
1128	56	2	0	0	95	0	0	0	105	0	443	0	21	0	0
1129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	0	3548	0	0	0	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1132	0	7	2	0	0	0	1	0	0	0	0	0	0	1	0
1133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	0	10	7	0	0	0	3	0	0	0	0	0	0	1	0
1135	0	502	134	0	0	0	207	0	0	0	0	0	1	68	0
1136	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1140	0	62	92	0	0	0	63	0	0	0	0	0	1	8	0
1141	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1144	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sum	2258	9651	5084	0	5028	0	3285	0	3520	0	5286	0	172	675	2229

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3367
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

destination zones

origin zones	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144
1125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1127	0	3	0	4	0	2	0	0	0	2	0	0	0	0	0
1128	11	12	0	64	0	8	0	0	0	26	0	0	0	0	0
1129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1132	0	0	0	0	0	0	0	0	0	56	0	0	0	0	0
1133	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1134	0	0	0	0	0	54	0	0	0	17	0	0	0	0	0
1135	0	0	0	0	6	0	0	0	0	18	0	0	0	0	0
1136	0	0	0	0	0	0	0	4	0	528	0	0	0	0	0
1137	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
1138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

1140	0	0	0	3	16	491	138	0	0	0	0	0	0	0
1141	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1142	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1143	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1144	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1145	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1146	0	0	0	0	0	0	0	0	0	0	0	0	866	0
1147	0	0	0	0	0	0	0	0	0	0	0	0	298	0
1148	0	0	0	0	0	0	0	0	0	0	0	0	88	0
sum	2438	413	0	3254	166	4845	4588	17	0	5829	0	0	1253	0

EMME/2 Module: 3.14 Date: 07-04-25 11:28 User: E718/HEXAGON....JL Page: 3369
Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

origin zones	destination zones 1145	1146	1147	1148	sum
1125	0	0	0	0	0
1126	0	0	0	0	3653
1127	0	0	0	0	295
1128	0	0	0	0	1611
1129	0	0	0	0	2761
1130	0	0	0	0	3548
1131	0	0	0	0	0
1132	0	0	0	0	1105
1133	0	0	0	0	4492
1134	0	0	0	0	468
1135	0	0	0	0	3506
1136	0	0	0	0	8524
1137	0	0	0	0	6
1138	0	0	0	0	0
1139	0	0	0	0	3186
1140	0	0	0	0	1290
1141	0	0	0	0	0
1142	0	0	0	0	0
1143	0	0	0	0	0
1144	0	444	197	9	651
1145	0	0	0	0	0
1146	0	0	0	122	988
1147	0	0	0	0	298

1148	0	130	0	0	218
sum	0	574	197	131	140820

Project: 2020 Peninsula Gateway Corridor Study
Matrix mf99: amtrav AM traversal matrix

---

origin zones	destination zones 1149	1150
1100	0	0
1101	0	1586
1102	0	0
1103	427	0
1104	0	0
1105	395	0
1106	0	0
1107	0	0
1108	0	414
1109	0	1568
1110	0	5
1111	0	391
1112	0	0
1113	61	0
1114	0	0
1115	16	0
1116	906	0
1117	0	0
1118	102	0
1119	0	0
1120	0	0
1121	0	0
1122	159	0
1123	0	0

1124	0	0

---

destination zones

origin zones	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114
1149	0	0	0	0	0	0	0	0	0	2	0	0	0	2390	0
1150	2995	0	498	0	849	0	0	368	0	1680	0	214	0	90	160

---

destination zones

origin zones	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129
1149	0	2006	0	0	0	0	0	0	0	0	0	0	0	0	0
1150	0	616	52	0	0	0	170	0	0	0	0	0	1	57	0

---

destination zones

origin zones	1149	1150	1151
1125	0	0	
1126	0	0	

1127							1	0	
1128							27	0	
1129							0	0	
1140							0	155	
1141							0	0	
1142							0	0	
1143							3	0	
1144							16	56	
1145							0	0	
1149	0	0	0	1456	3	0	0	0	0
1150	0	0	0	110	127	0	0	0	276
1151	0	0	0	0	0	1704	0	0	
sum	0	0	0	1721	201	1704	2113	4176	