

5. Review/Discussion of the SR-4 Integrated Corridor Analysis with Tom Biggs, Atkins, North America, Inc. and TRANSPAC TAC members

Attachments:

- SR-4 Integrated Corridor Analysis (I-680 Interchange Evaluation Study Highlights) performed by Atkins North America
- Excerpt from the July 2011 Measure J Strategic Plan Project I-680/State Route 4 Interchange Improvements Project Fact Sheet

SR-4 Integrated Corridor Analysis

I-680 Interchange Evaluation Study Highlights

November 2011

Objectives

- Conduct a quantitative assessment of traffic operations and safety for a third eastbound mixed-flow lane from West of Pacheco to the HOV lane-add west of Port Chicago Highway.
- Study the benefit of extending the existing HOV lane west of Port Chicago Highway to the I-680 interchange.

Summary of Findings

- Four scenarios were evaluated in addition to the baseline scenario to quantify the benefits of the I-680 interchange improvements along with the revisions to the HOV lane configuration. Analysis of the four build scenarios indicates that implementation of the I-680 interchange improvements and extension of the HOV lane improves operations between I-680 and Port Chicago Highway. The baseline scenario offered the best operations among all scenarios but a bottleneck east of Willow Pass Road and resultant queues were present for all analysis scenarios.
- An additional scenario, Scenario 5, was developed to address the bottleneck east of Willow Pass Road. Results of the analysis indicates that implementation of a fourth mixed flow lane through the San Marco Boulevard interchange (between the eastbound off-ramp and the diagonal on-ramp) along with improved lane transitions for the SR-242 on-ramp lanes will result in elimination of the bottleneck east of Willow Pass Road.

Approach

- Performed a quantitative analysis of traffic operations to allow for a comparative assessment of scenarios.
- Traffic operations for eastbound SR-4 was conducted for the following five scenarios in addition to the baseline scenario (see Attachment A for more detail).

Analysis Scenarios

- **Baseline Condition** – Based on FPI full build-out scenario and includes additional improvements in the form of I-680 interchange build-out and extension of a fourth general purpose lane west of Willow Pass Road.
- **Scenario 1** – Extend HOV lane to east of the I-680/SR-4 interchange to where the future HOV to HOV direct connector would be; no lane extensions through the interchange.
- **Scenario 2** – Extend HOV lane back to Glacier Drive; have all as HOV lane until the future HOV to HOV direct connector is constructed when the segment west of the connector would be eliminated as a throwaway cost.
- **Scenario 3** – Construct a mixed-flow lane from Glacier Drive through the I-680/SR-4 interchange and transition into a HOV lane just east of the Solano Way on-ramp; when the future HOV to HOV direct connector is constructed, the segment west of the connector would be eliminated as a throwaway cost. The remaining lane would be an HOV lane for its entirety.
- **Scenario 4** – Construct an HOV lane where the future HOV to HOV would be, plus a separate mixed-flow lane from Glacier Drive through the I-680/SR-4 interchange which would merge just east of the Solano Way on-ramp; when the HOV to HOV direct connector is constructed, it would not impact the additional mixed-flow lane. This scenario has no throwaway cost and addresses the need to add capacity through the interchange.
- **Scenario 5** – Construct an HOV lane where the future HOV to HOV would be located. Convert eastbound off ramp at San Marco Boulevard from one to two-lane off ramp.

Demand Inputs

- Demand input was obtained from the SR-4 FPI study (obtained from the CCTA travel demand model). FPI study volumes did not account for volumes due to the Naval Weapons Station (NWS) developments. Therefore, volume scenarios with and without NWS volumes in Concord were analyzed to determine the impact of NWS volumes.

Freeway Analysis

- Freeway segment analyses were conducted using the FREQ and HCM2010 softwares.

Freeway (FREQ Model) Analysis Results – *Without NWS Volumes*

- **Scenario 1:** A new bottleneck is created in the vicinity of I-680 due to the elimination of one mixed flow lane (resulting in a two lane cross section at I-680). Queues extend to the Alhambra Avenue interchange. (Attachment A:page 4)
- **Scenario 2:** A new bottleneck is created in the vicinity of I-680 due to the elimination of one mixed flow lane (resulting in a 2 mixed flow and one HOV lane cross section at I-680). Queues extend to the Pine Avenue interchange. (Attachment A:page 5)
- **Scenario 3:** A new bottleneck is created in the vicinity of SR-242 due to the elimination of one mixed flow lane through a complex lane transition area. Queues extend to the Pacheco Boulevard interchange. (Attachment A:page 6)
- **Scenario 4:** A new bottleneck is created in the vicinity of SR-242 due to the elimination of one mixed flow lane through a complex lane transition area. Queues extend to the Pacheco Boulevard interchange. (Attachment A:page 7)
- Queues solely due to the lane drop (ignoring constraints created downstream of and due to the lane drop) is 1.5 miles to 1.6 miles for Scenarios 3 and 4
- **Scenario 5:** Offers the best operations without any queues in the study area. (Attachment A:page 8)

Freeway (FREQ Model) Analysis Results – *With NWS Volumes*

- Volumes from the NWS developments are in addition to the FPI 2030 volumes
- Highest volume additions in the vicinity of Willow Pass Road and San Marco Boulevard interchanges (Attachment A:page 11)
- Highest volume additions occur at the most congested (bottleneck) segment – just east of Willow Pass Road
- Scenarios 1 through 4: Addition of NWS volumes increases queues from the Willow Pass Road bottleneck. Queues extend from Willow Pass Road to SR 242 where it merges with upstream bottleneck and queues (Attachment A:pages 12 and 13)
- Scenario 5: Offers the best operations without any queues in the study area (Attachment A:page 14)

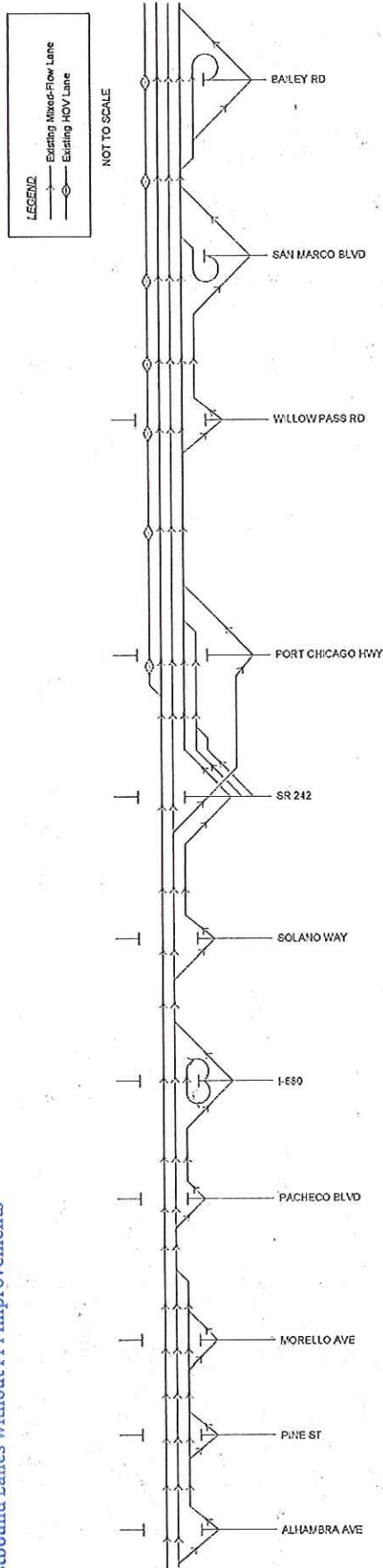
Merge/Diverge and Weave (HCM 2010) Analysis – Segments of SR 4 west and east of the I-680 interchange

- Analysis conducted using Highway Capacity Manual methodologies
- Discrete analysis without regard to downstream bottlenecks (Attachment A:page 15)
 - Scenarios 1 and 2 function worse than other scenarios due to a lesser number of mixed flow lanes between Pacheco Boulevard and I-680
 - Scenarios 3, 4 and 5 offers the best operations at LOS C

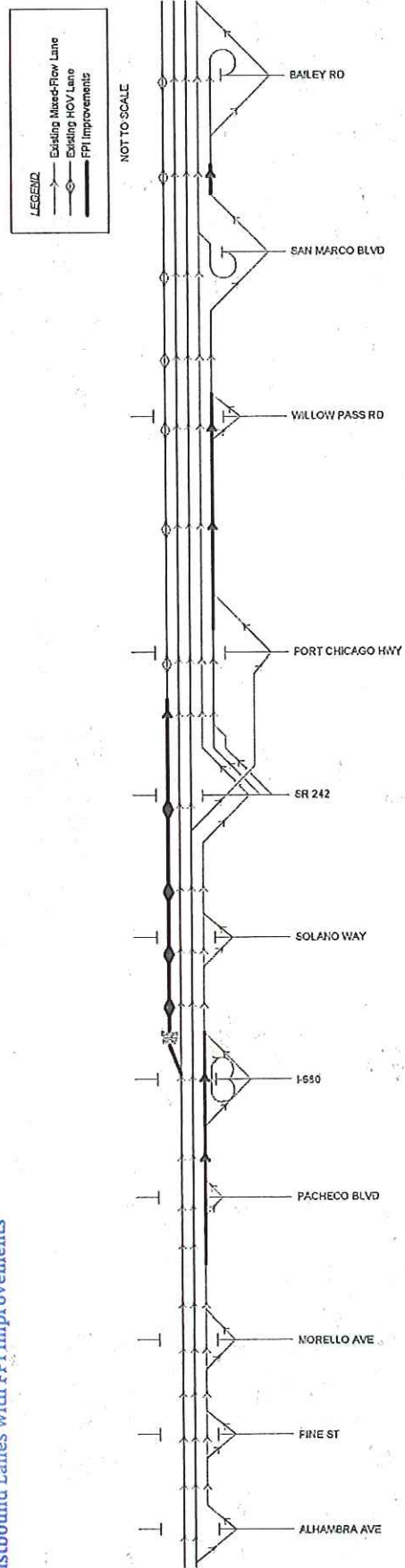
Attachment A
Detailed Analysis Results

2030 Laneage without and with FPI Improvements

Eastbound Lanes without FPI Improvements

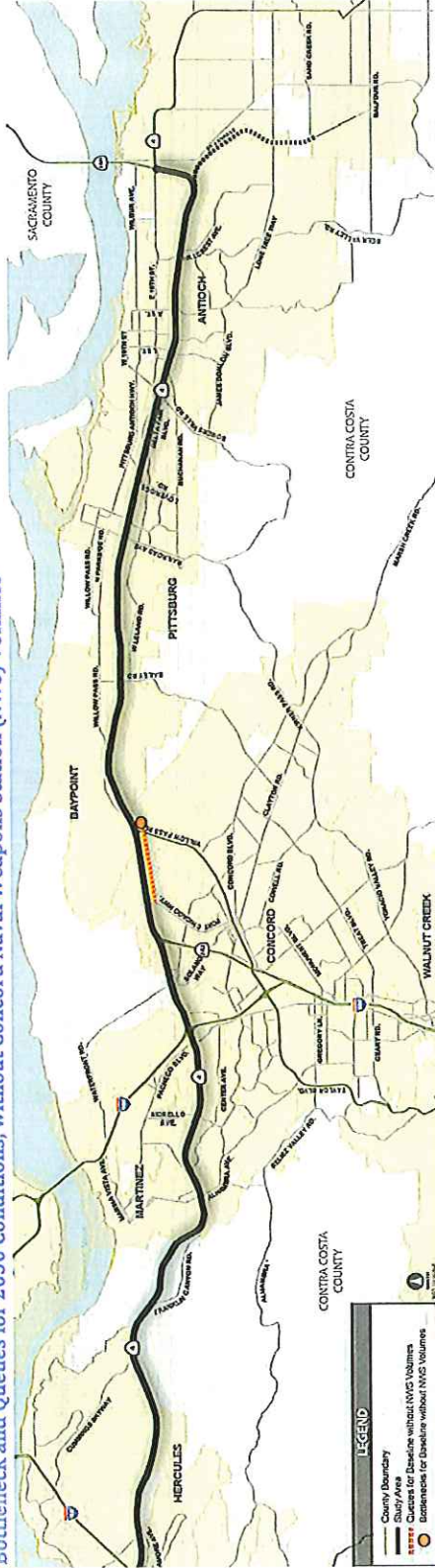


Eastbound Lanes with FPI Improvements

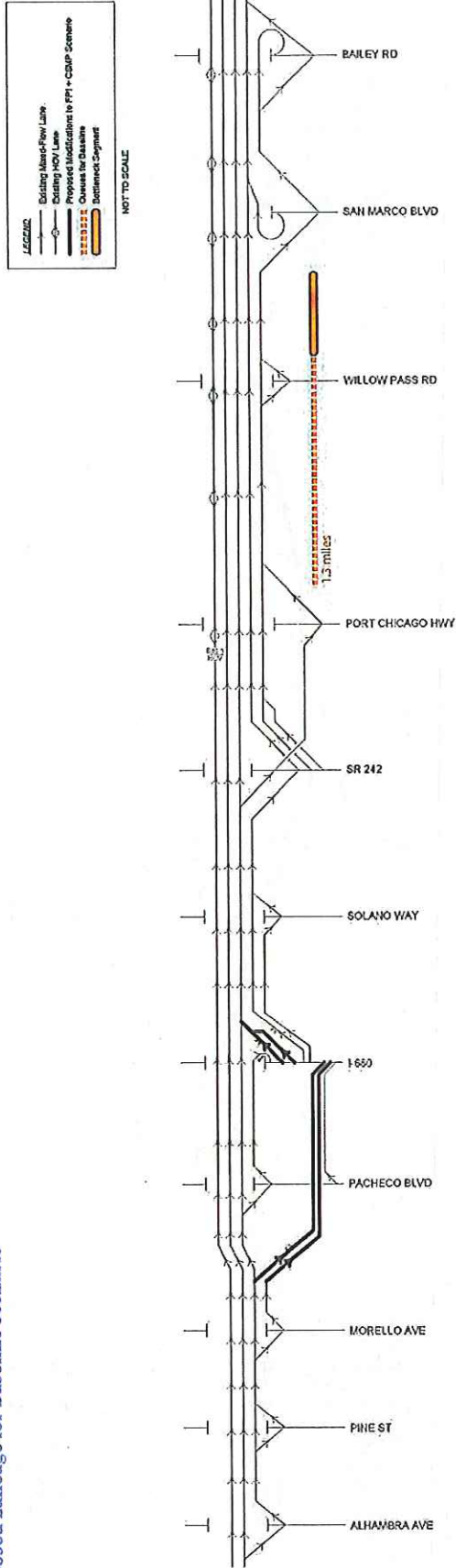


2030 Baseline Conditions (for the SR-4 ICA Study)

Eastbound Bottleneck and Queues for 2030 Conditions, without Concord Naval Weapons Station (NWS) Volumes



Proposed Laneage for Baseline Scenario

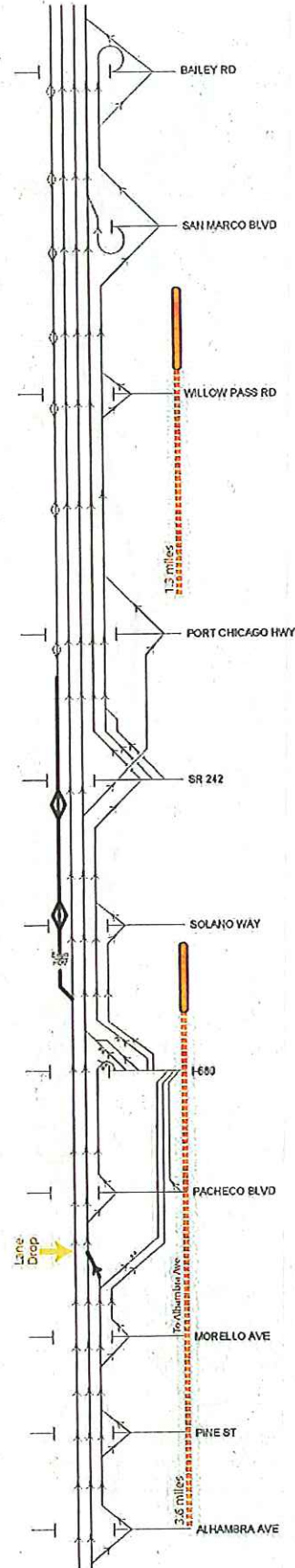
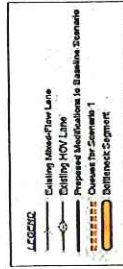


2030 Scenario 1 Conditions

Eastbound Bottleneck and Queues for 2030 Conditions, without Concord Naval Weapons Station (NWS) Volumes

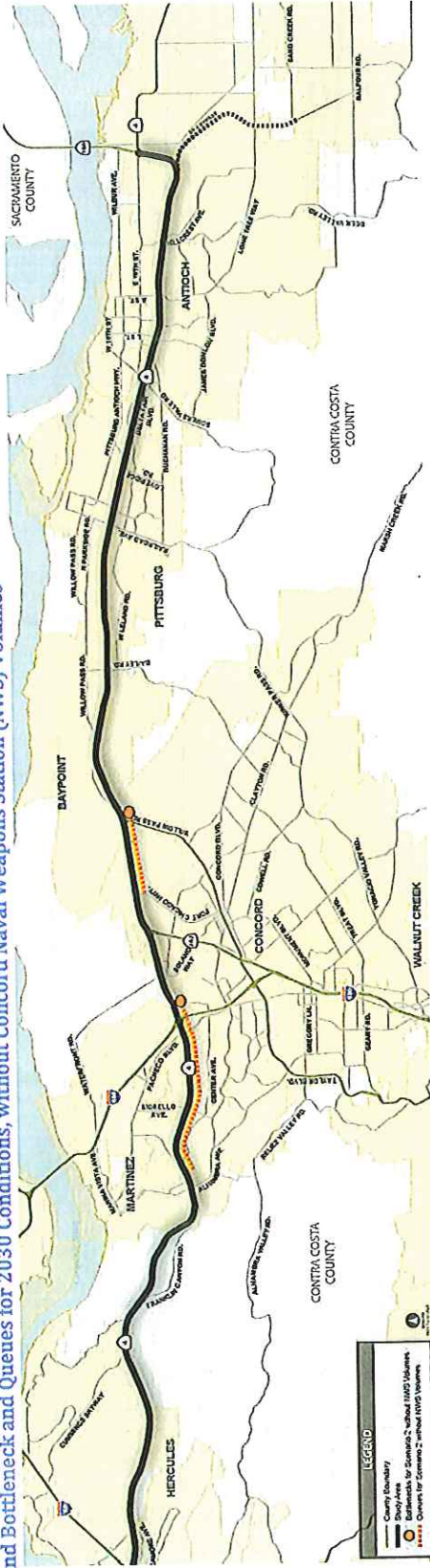


Proposed Laneage for Scenario 1



2030 Scenario 2 Conditions

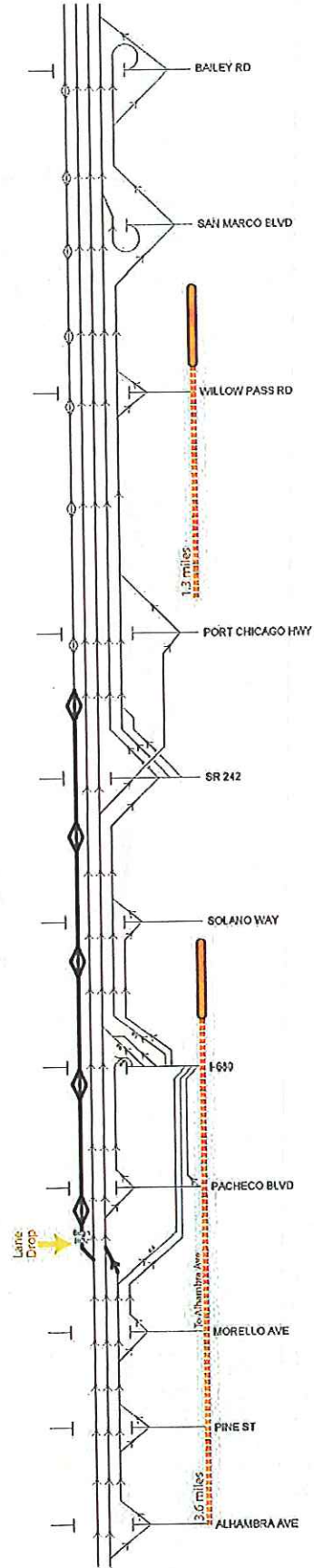
Eastbound Bottleneck and Queues for 2030 Conditions, without Concord Naval Weapons Station (NWS) Volumes



Proposed Laneage for Scenario 2

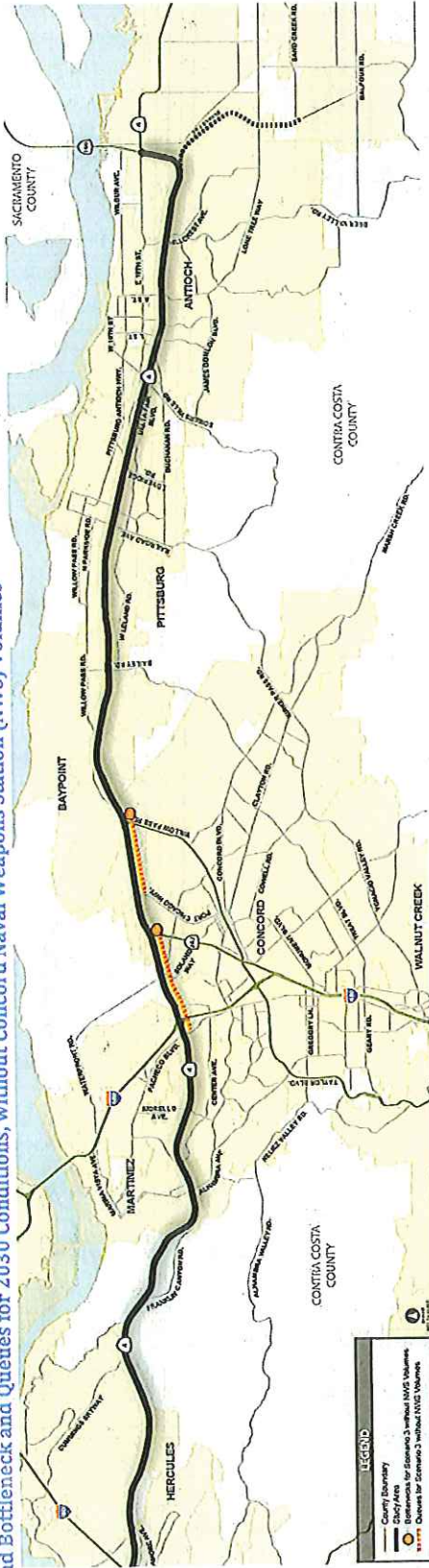


NOT TO SCALE

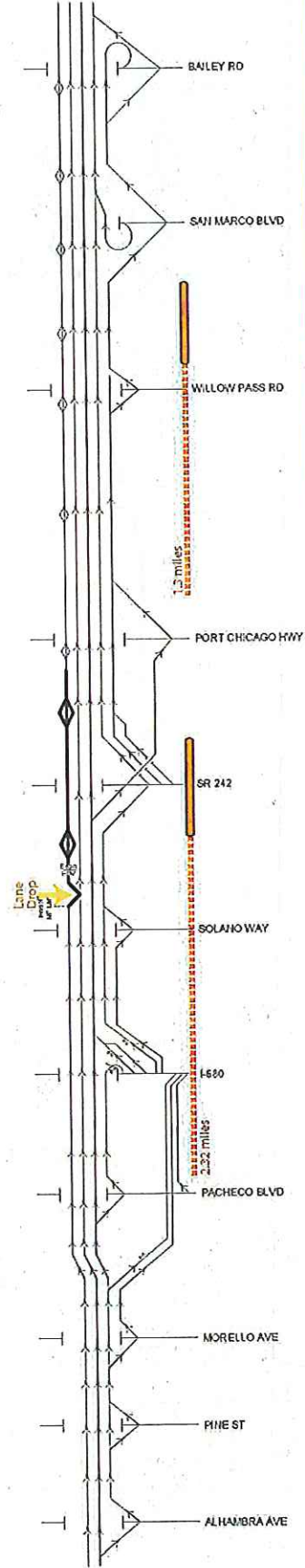


2030 Scenario 3 Conditions

Eastbound Bottleneck and Queues for 2030 Conditions, without Concord Naval Weapons Station (NWS) Volumes



Proposed Laneage for Scenario 3



2030 Scenario 4 Conditions

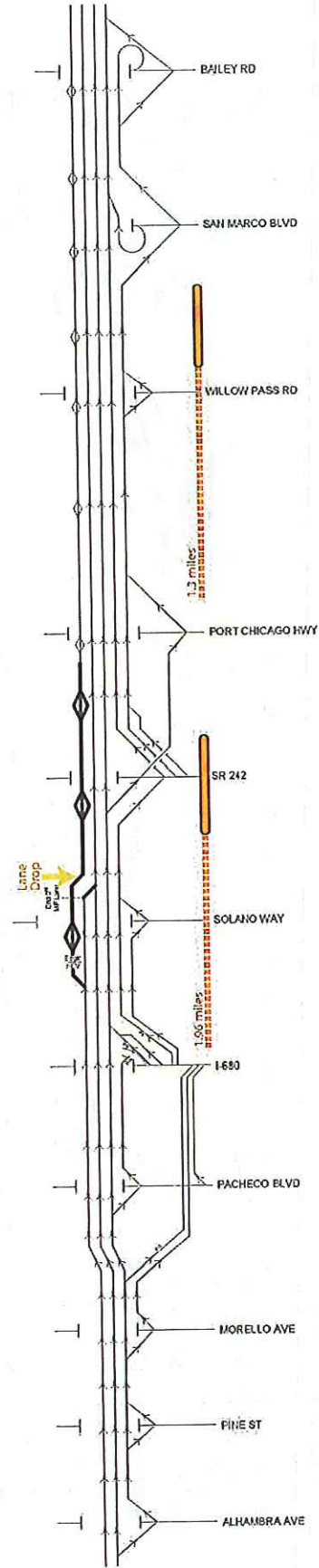
Eastbound Bottleneck and Queues for 2030 Conditions, without Concord Naval Weapons Station (NWS) Volumes



Proposed Laneage for Scenario 4

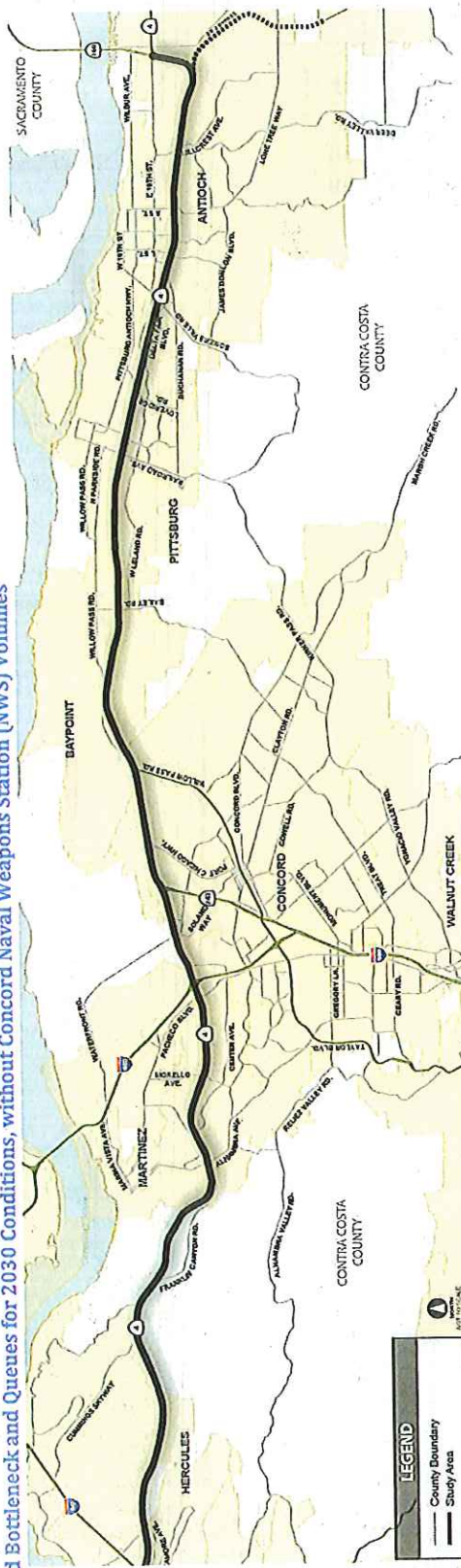


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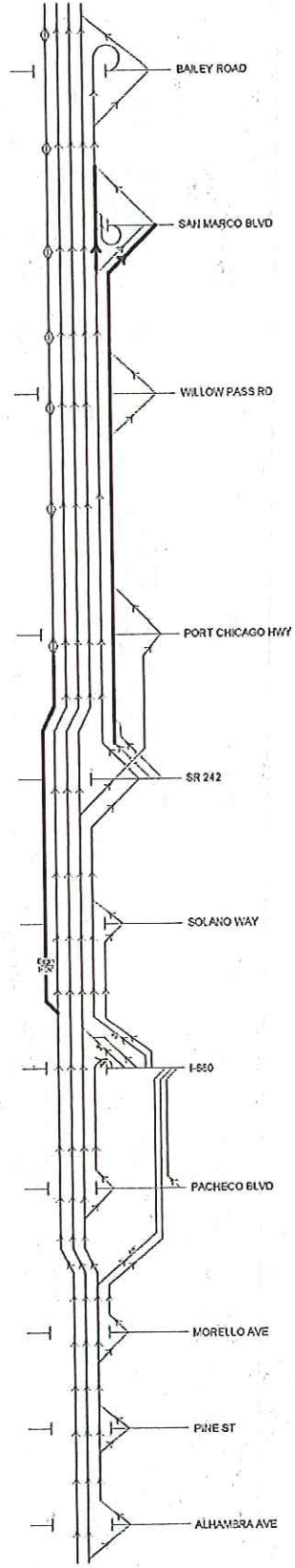


2030 Scenario 5 Conditions

Eastbound Bottleneck and Queues for 2030 Conditions, without Concord Naval Weapons Station (NWS) Volumes

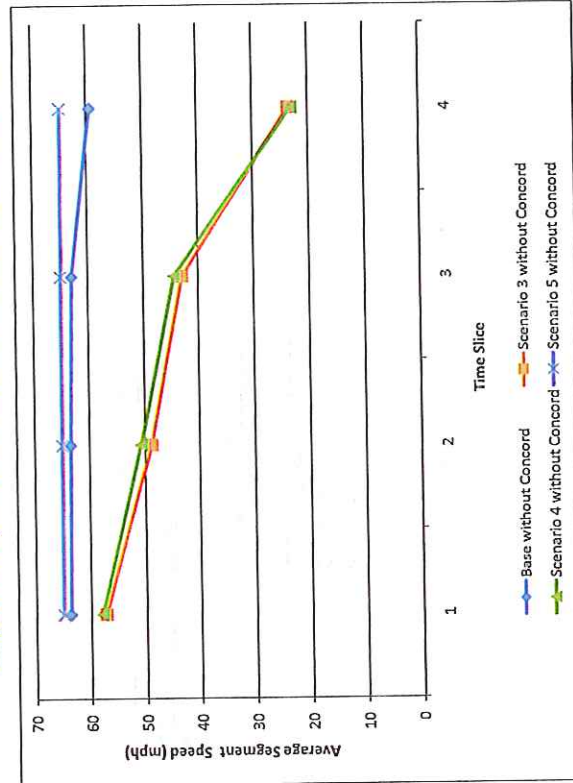


Proposed Laneage for Scenario 5



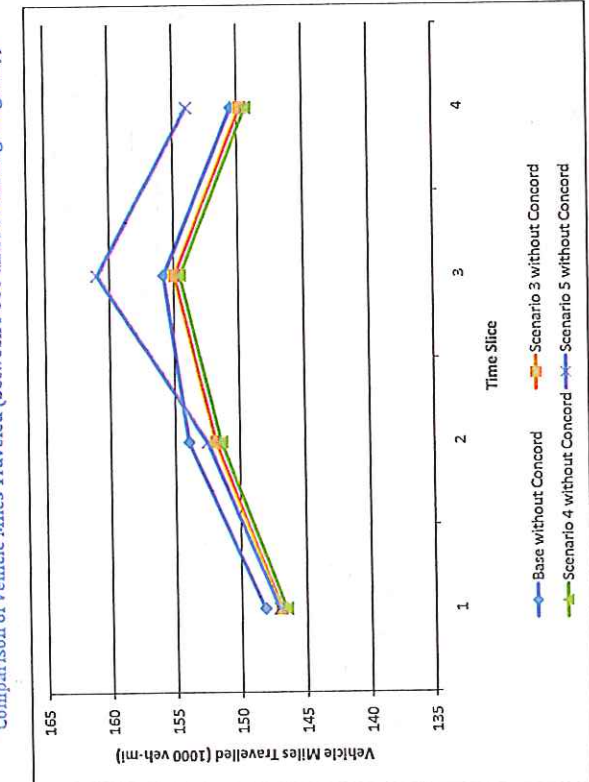
Measures of Effectiveness

Comparison of Speeds for SR 4 between I-680 and Port Chicago Highway



	Baseline Speed (mph)	Scenario 3 Speed (mph)	Scenario 4 Speed (mph)	Scenario 5 Speed (mph)
Time Slice 1	63	57	57	65
Time Slice 2	63	48	50	65
Time Slice 3	62	42	44	65
Time Slice 4	59	23	22	65

Comparison of Vehicle Miles Travelled (between I-680 and Port Chicago Highway)



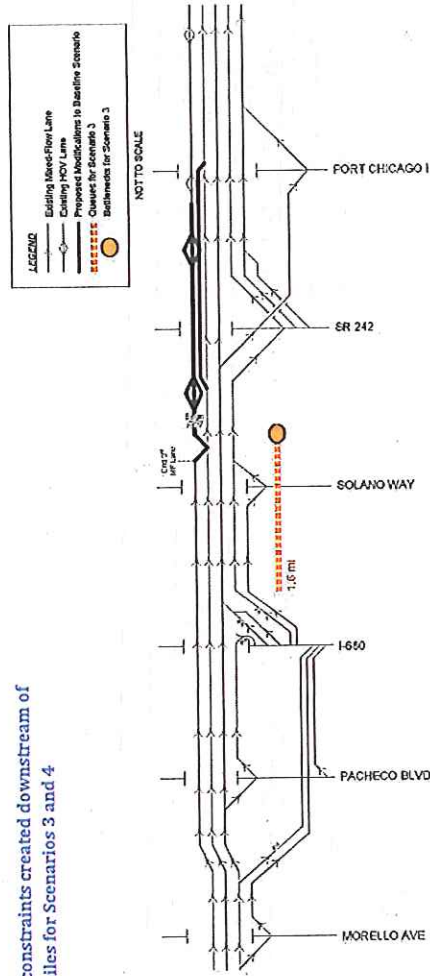
	Baseline VMT (veh-mi.)	Scenario 3 VMT (veh-mi.)	Scenario 4 VMT (veh-mi.)	Scenario 5 VMT (veh-mi.)
Time Slice 1	148,146	146,912	146,490	147,045
Time Slice 2	153,896	151,838	151,382	152,475
Time Slice 3	155,754	154,930	154,499	160,933
Time Slice 4	150,444	149,775	149,328	153,920

Note: Each time slice is one hour duration. Time Slice 1 starts at 3:00 pm and Time Slice 4 from 6 pm.

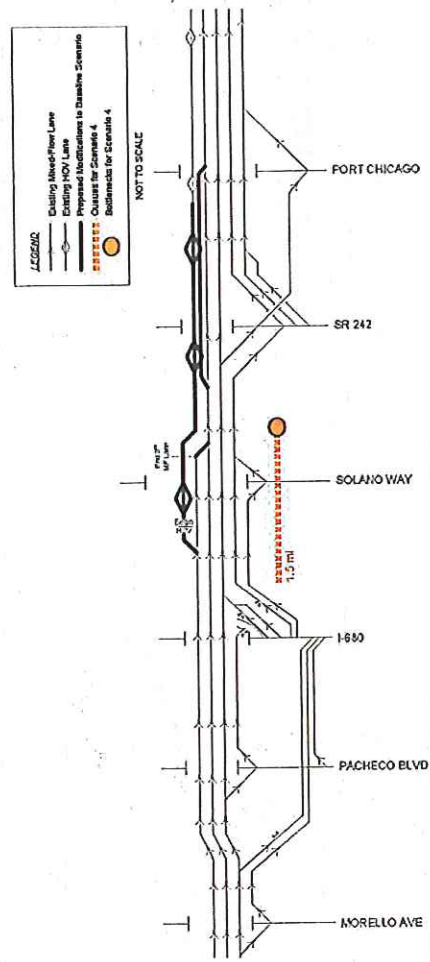
Lane Drop Analysis

Bottleneck and Queues due to Lane Drop for Scenario 3

- Queues solely due to the lane drop (ignoring constraints created downstream of and due to the lane drop) is 1.5 miles to 1.6 miles for Scenarios 3 and 4



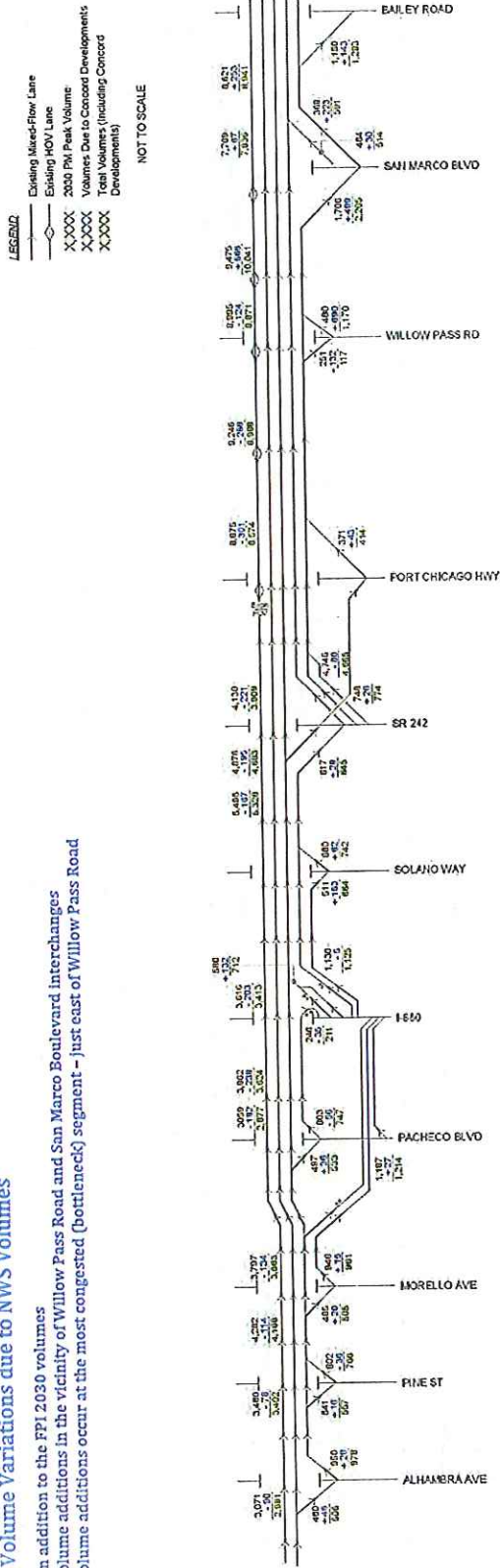
Bottleneck and Queues due to Lane Drop for Scenario 4



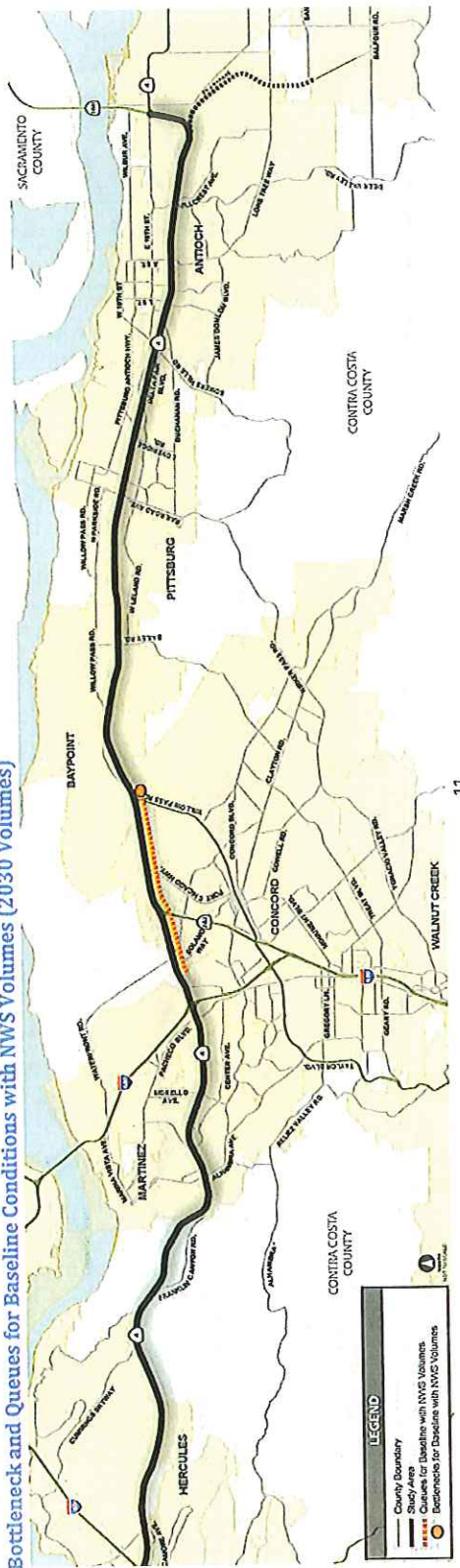
2030 Volume Revisions Due to Naval Weapons Station Developments (NWS)

Eastbound Volume Variations due to NWS Volumes

- Volumes in addition to the FPI 2030 volumes
- Highest volume additions in the vicinity of Willow Pass Road and San Marco Boulevard interchanges
- Highest volume additions occur at the most congested (bottleneck) segment – just east of Willow Pass Road



Eastbound Bottleneck and Queues for Baseline Conditions with NWS Volumes (2030 Volumes)



2030 Conditions with NWS Volumes

Eastbound Bottleneck and Queues for Scenario 1 Conditions with NWS Volumes (2030 Volumes)

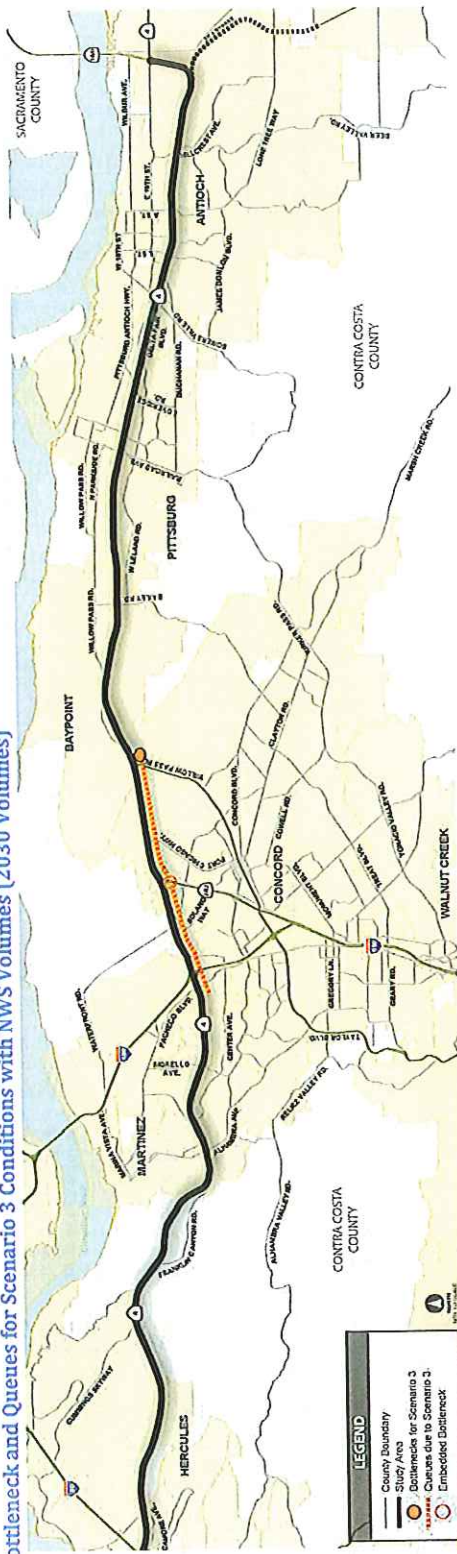


Eastbound Bottleneck and Queues for Scenario 2 Conditions with NWS Volumes (2030 Volumes)

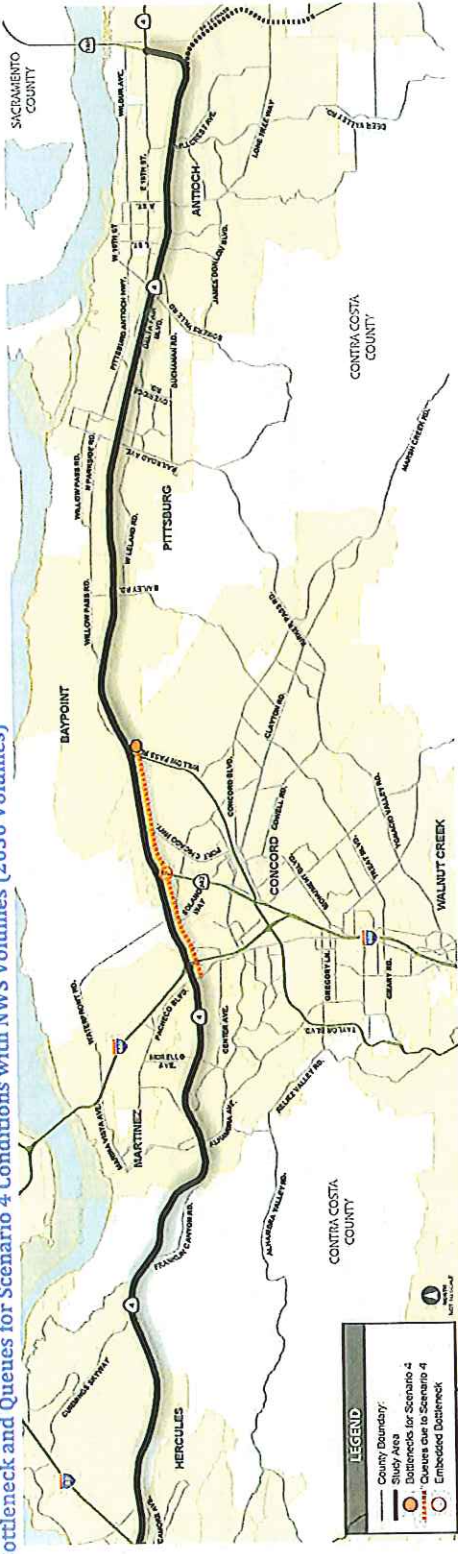


2030 Conditions with NWS Volumes

Eastbound Bottleneck and Queues for Scenario 3 Conditions with NWS Volumes (2030 Volumes)

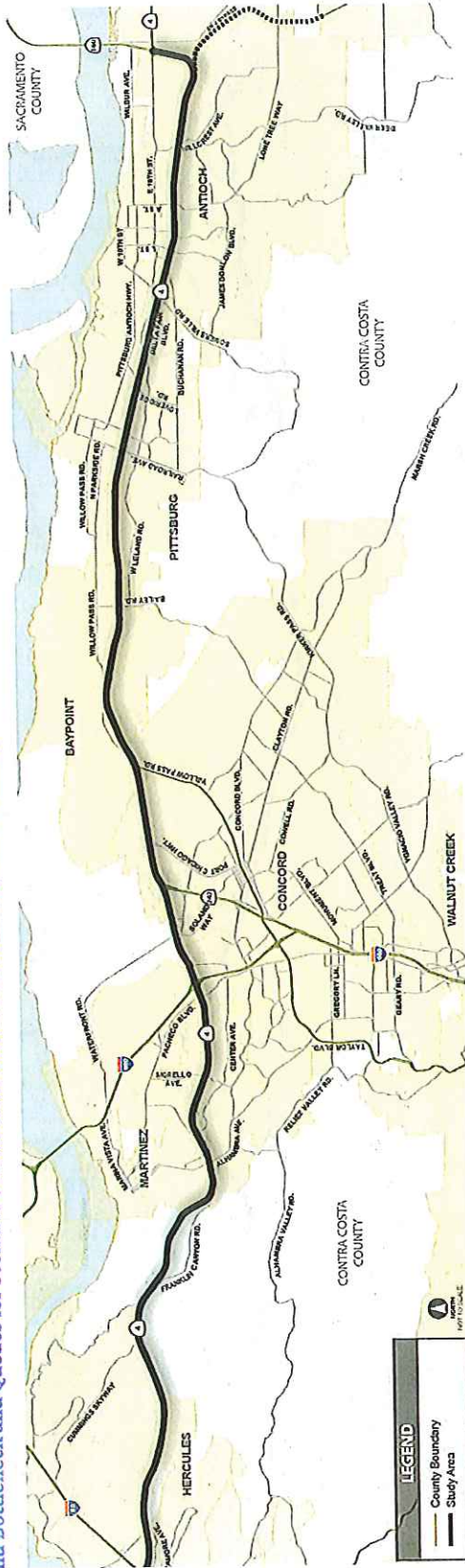


Eastbound Bottleneck and Queues for Scenario 4 Conditions with NWS Volumes (2030 Volumes)



2030 Conditions with NWS Volumes

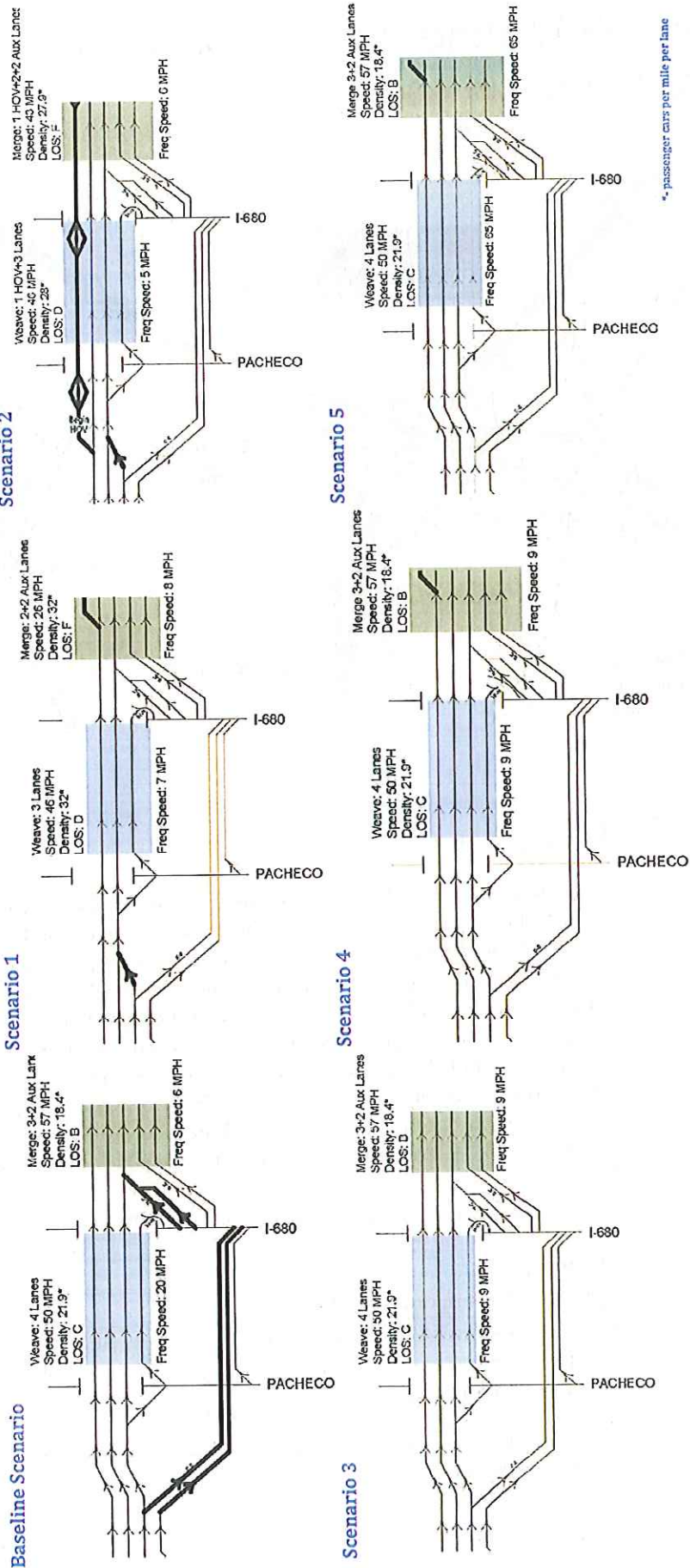
Eastbound Bottleneck and Queues for Scenario 5 Conditions with NWS Volumes (2030 Volumes)



Summary of Bottleneck and Queue Analysis

- Impacts of revisions to lane geometry
 - Scenario 3: A new bottleneck is created in the vicinity of SR-242 due to the elimination of one mixed flow lane through a complex lane transition area. Queues extend to the Pacheco Boulevard interchange.
 - Scenario 4: A new bottleneck is created in the vicinity of SR-242 due to the elimination of one mixed flow lane through a complex lane transition area. Queues extend to the Pacheco Boulevard interchange.
 - Scenario 5: Offers the best operations without any queues in the study area
 - Queues solely due to the lane drop (ignoring constraints created downstream of and due to the lane drop) is 1.5 miles to 1.6 miles for Scenarios 3 and 4
- Impacts of volume additions due to NWS
 - Volumes from the NWS developments are in addition to the FPI 2030 volumes
 - Highest volume additions in the vicinity of Willow Pass Road and San Marco Boulevard interchanges
 - Highest volume additions occur at the most congested (bottleneck) segment – just east of Willow Pass Road
 - Scenarios 1 through 4: Addition of NWS volumes increases queues from Willow Pass Road bottleneck. Queues extend from Willow Pass Road to SR-242 where it merges with upstream Bottleneck and Queues
 - Scenario 5: Offers the best operations without any queues in the study area

Localized Weave and Merge/Diverge Analysis (HCM Analysis)



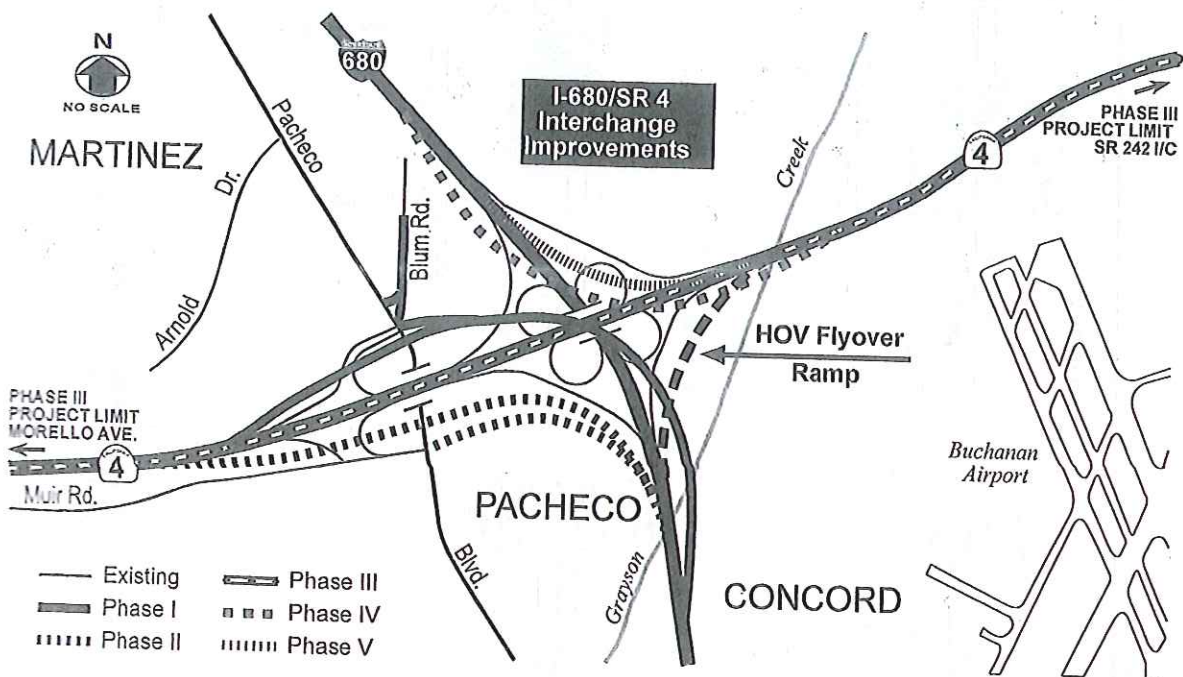
* passenger cars per mile per lane

Summary of Weave and Merge/Diverge Analysis

- Analysis conducted using Highway Capacity Manual methodologies
- Discrete analysis without regard to downstream bottlenecks
- Scenarios 3, 4 and 5 offers the best operations at LOS C
- Scenarios 1 and 2 function worse than other scenarios due to a lesser number of mixed flow lanes between Pacheco Boulevard and I-680
- Inclusion of downstream bottlenecks indicate that all scenarios except Scenario 5 function at speeds below 10 mph as indicated by Freq analysis



Interstate 680 / State Route 4 Interchange Improvements - Phase 1



Project Number

6001

Project Sponsor

Contra Costa Transportation Authority

Project Type

Transit

Highway

Local Streets

Major Arterial

Bike Pedestrian

Other

Project Scope

Construct a three-level interchange with two-lane direct connector ramps for the high-demand Northbound to Westbound (Phase 1) and Eastbound to Southbound (Phase 2) movements. Retain loop ramp configuration for the Westbound to Southbound and Eastbound to Northbound movements. Provide all other ramp movements by diagonal ramps. Widen State Route 4 from four to six lanes, eliminating the current Eastbound lane drop on State Route 4, west of the Pacheco Boulevard interchange; and construct auxiliary lanes to the adjacent interchange ramps at Morello Avenue and Solano Way on State Route 4, and Pacheco Boulevard and Concord Avenue on Interstate 680 (Phase 3). Construct a two-lane direct-connector flyover ramp from

(continued on next page)

Funding Sources (\$ in million) - Phase 1 Only

Total	76.2
Measure J Transportation Sales Tax ¹	6.9
State Transportation Improvement Program - Regional (STIP-RIP)	1.3
Other (TBD)	68.0

¹Measure J funds shown in escalated dollars. Actual commitment is in 2004 dollars as shown in Appendix A.

I-680 / State Route 4 Interchange Improvements - Phase 1 (cont.)

Project Scope (cont.)

Southbound to Eastbound (Phase 4) and construct a two-lane connector from Westbound to Northbound (Phase 5) to improve operational efficiencies by decreasing weaving movements.

Need/Purpose

The purpose of this project is to increase the capacity and safety of the Interstate 680/State Route 4 Interchange. The State Route 4 East corridor serves as the only major east-west transportation link joining the communities of Antioch, Bay Point, Pittsburg and Brentwood with Central County and the Bay Area. This corridor provides access to major industrial facilities (including refineries) in both northern and western Contra Costa County.

Project Location



By the year 2025, travel time through the corridor is projected to increase tenfold, if no improvements are constructed.

The Interstate 680 corridor serves as the main artery through central Contra Costa County connecting it with Solano County to the north and Alameda and Santa Clara Counties to the south. The proposed project provides congestion relief and improves the level of service within the interchange area.

Possible Segmentation

Construction phasing is anticipated, dependent upon available funding, as follows:

Phase 1- northbound Interstate 680 to westbound State Route 4 connector

Phase 2- eastbound State Route 4 to southbound Interstate 680 connector

Phase 3- State Route 4 widening between Morello Avenue and State Route 242

Phase 4- southbound Interstate 680 to eastbound State Route 4 connector

Phase 5- westbound State Route 4 to northbound Interstate 680 connector

Each phase of the project is designed as an independent segment.

Issues

Project has a substantial funding shortfall.

Current Status

Project received environmental clearance in November 2008. Study is underway to examine the possibility of advancing Phase 3.

Project Schedule

