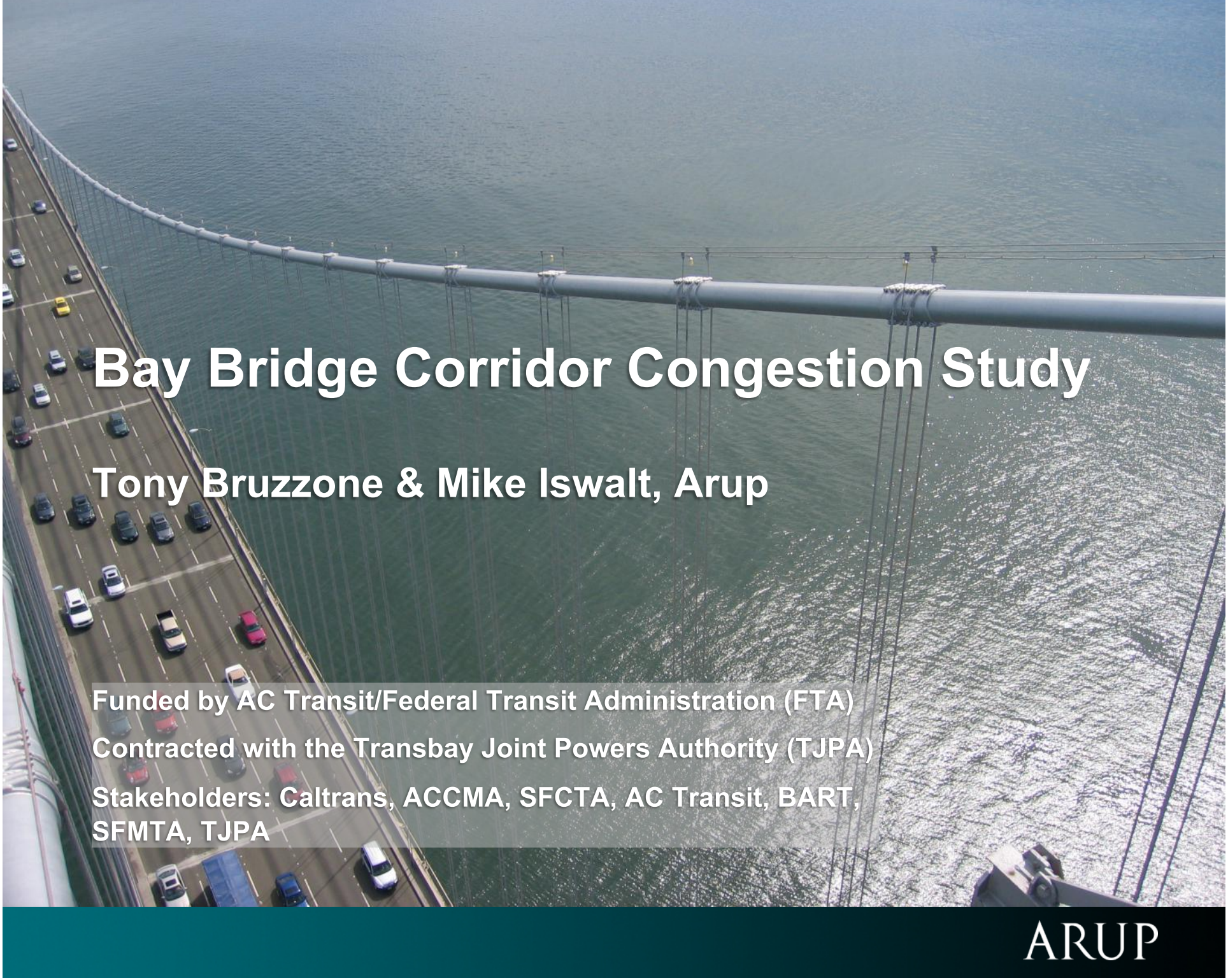


Bay Bridge Corridor Congestion Study

Tony Bruzzone & Mike Iswalt, Arup

Funded by AC Transit/Federal Transit Administration (FTA)

Contracted with the Transbay Joint Powers Authority (TJPA)

Stakeholders: Caltrans, ACCMA, SFCTA, AC Transit, BART, SFMTA, TJPA

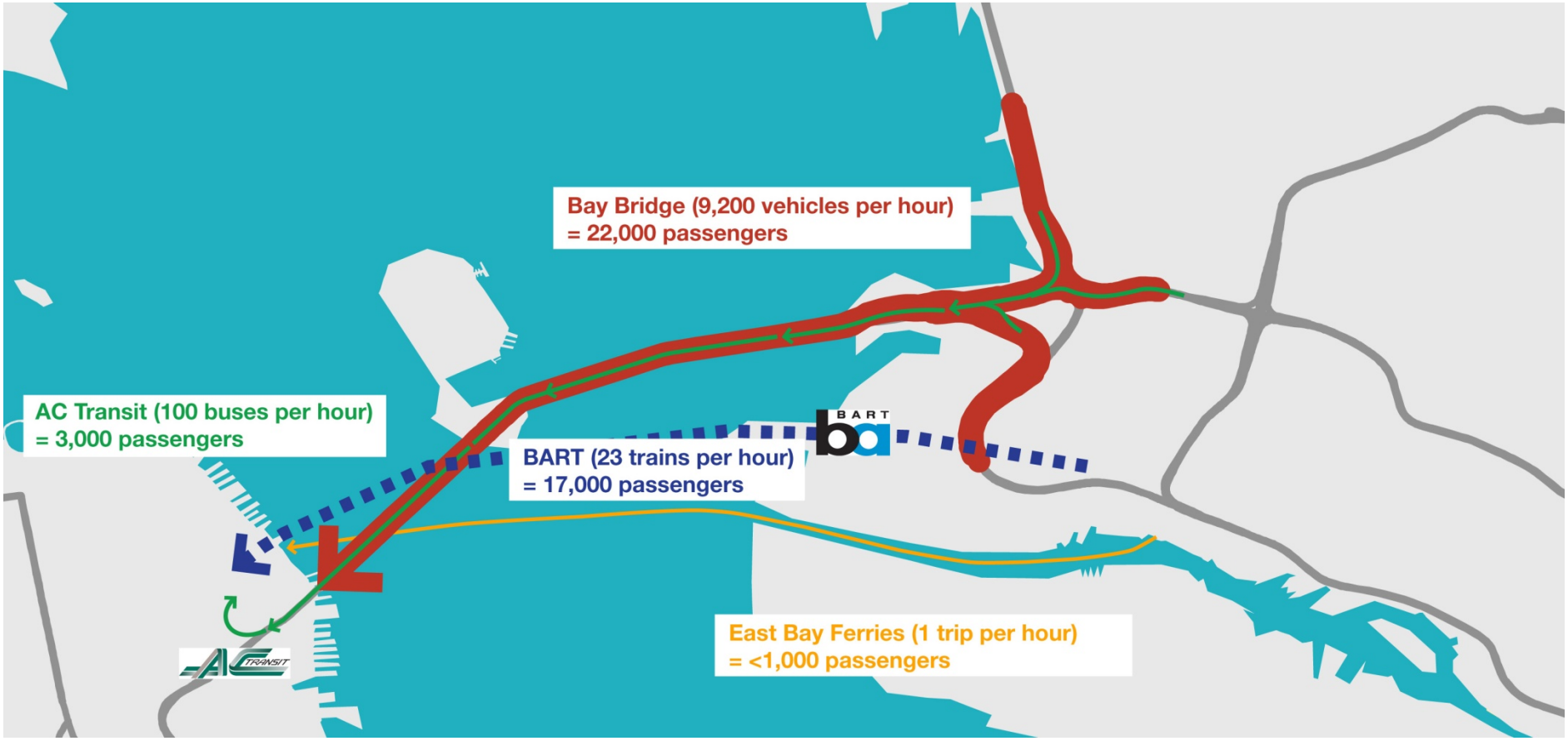
ARUP

San Francisco Bay Area

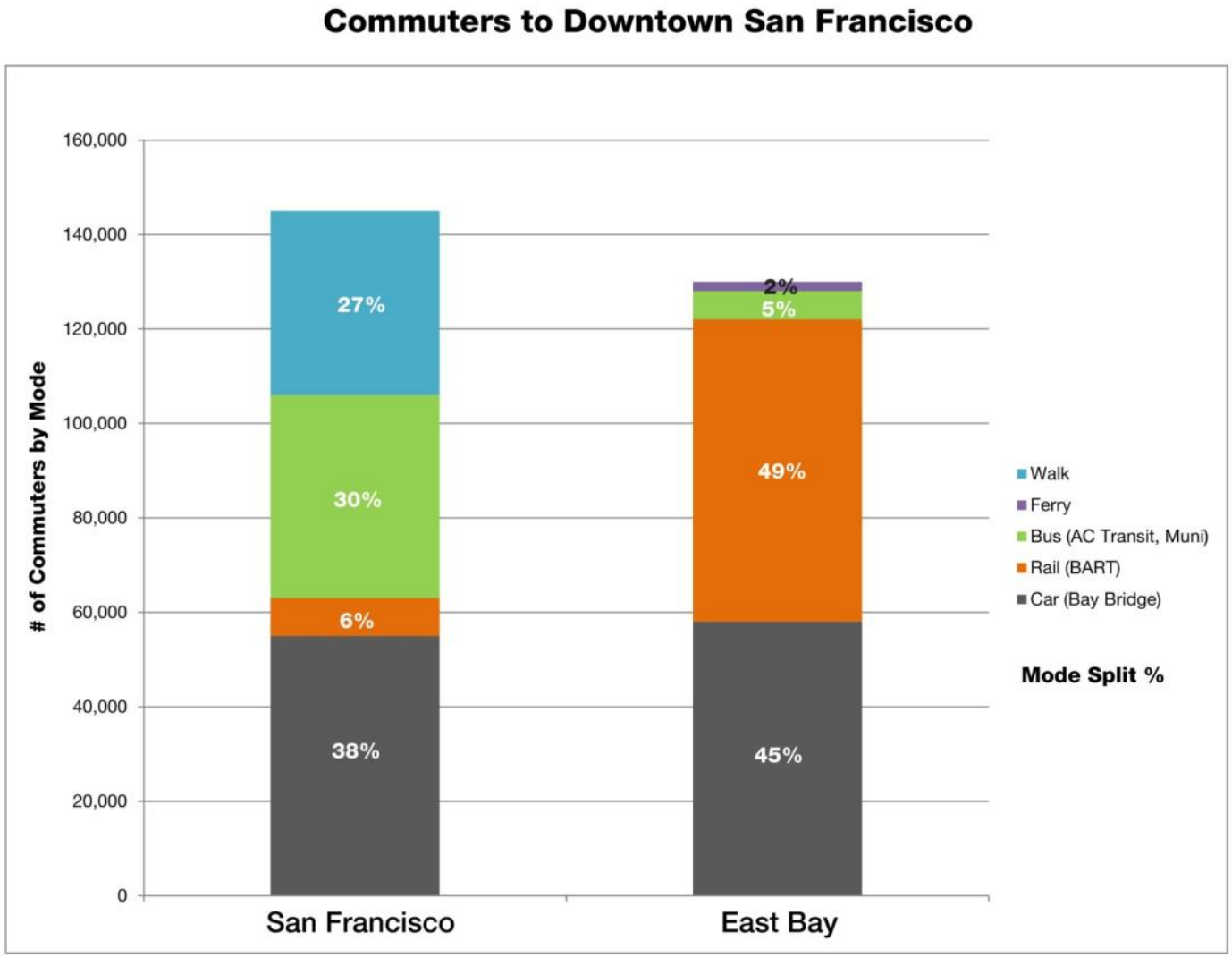
- Nine county area
- Population (2010 est.) = 7.4 million
- Jobs (2010 est.) = 3.6 million
- Bay Bridge is the connection from the East Bay to San Francisco

Bay Bridge Corridor

- East Bay residents commute to San Francisco using four modes
- Approximately 130,000 commuters; 42,000 AM peak hour trips

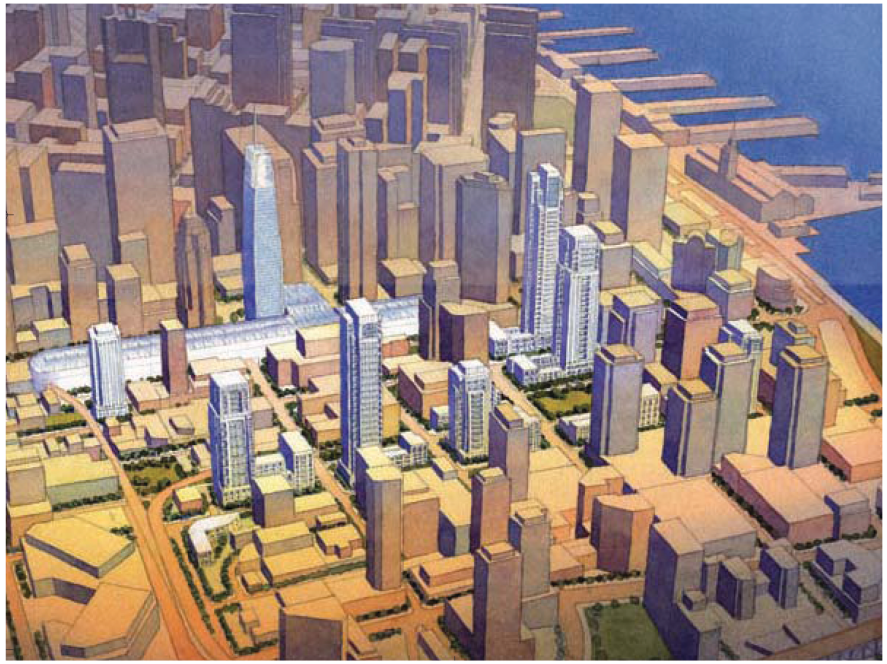


Mode Share for East Bay Commuters

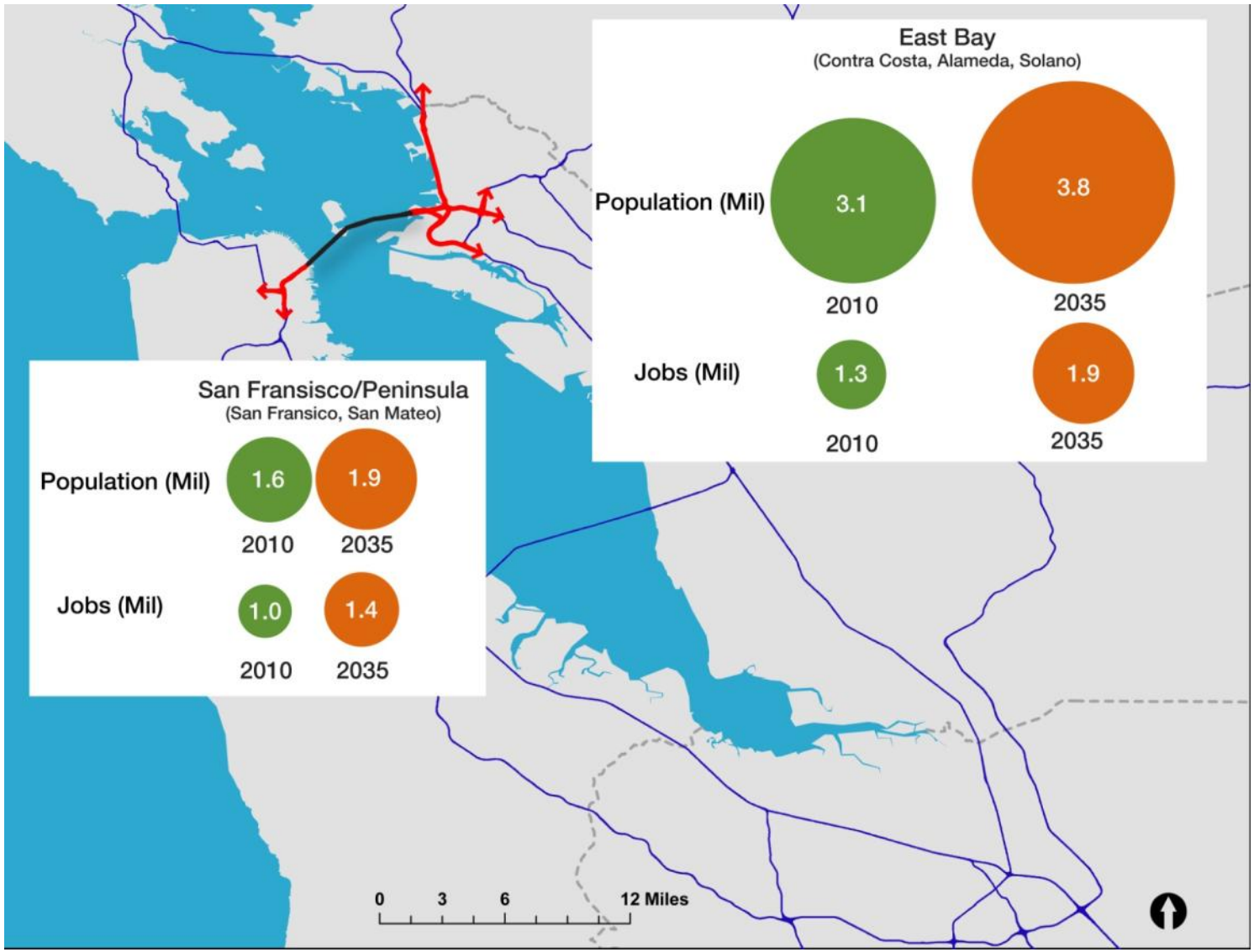


Bay Area Projections

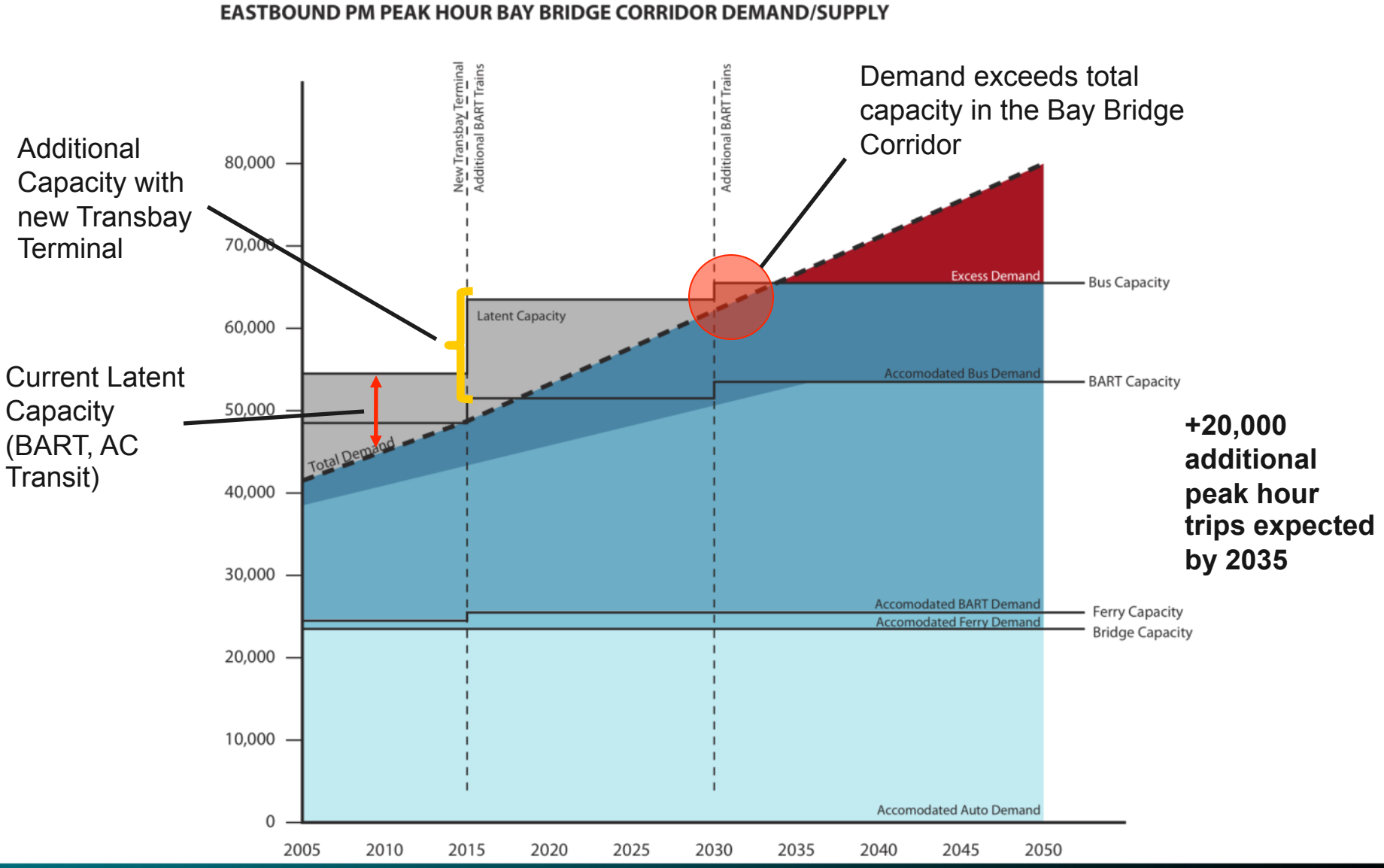
- ABAG is focusing job growth in transit-rich corridors such as San Francisco
- Downtown San Francisco (a “Transit First” city) is a focal point for growth
- Critical for satisfying economic and climate-change goals
- Approximately 200,000 additional jobs are planned for SF
- 100,000 of these new jobs are planned for Downtown



East Bay Commuters Needed to Fill These Jobs



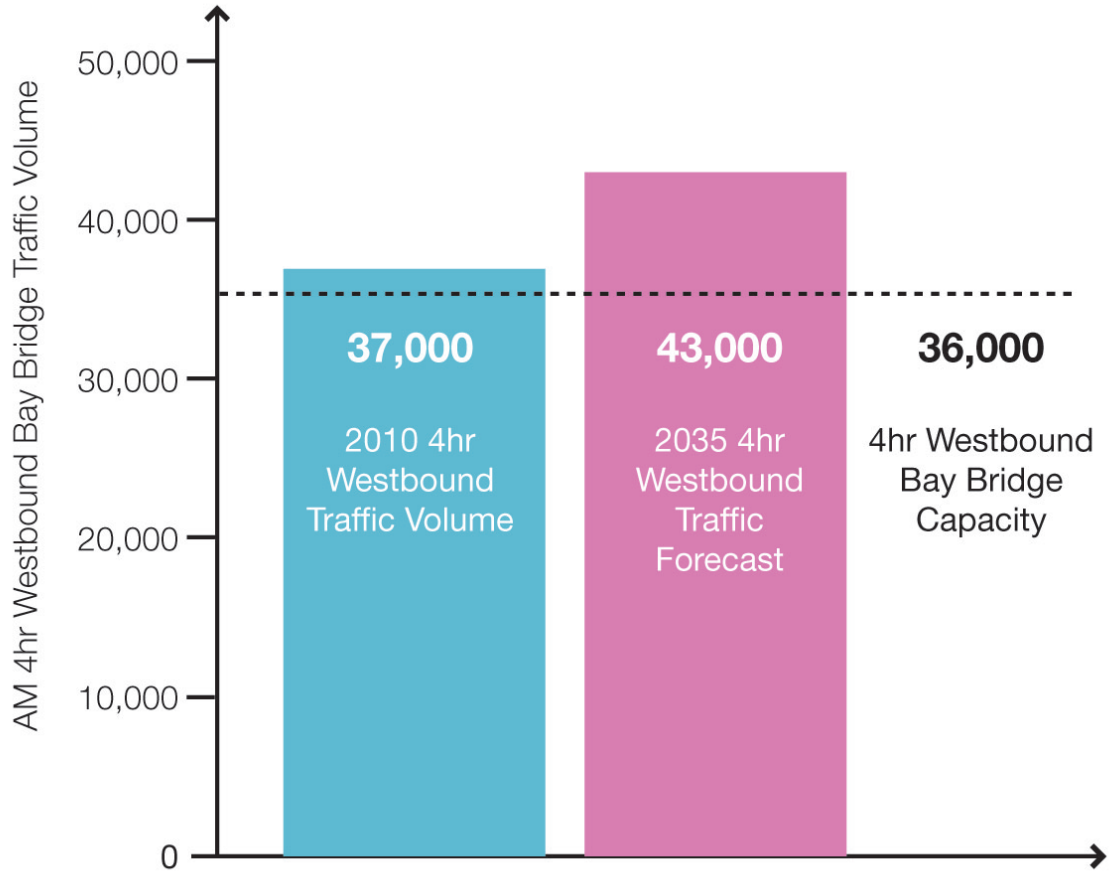
But the Corridor is Close to Exceeding Capacity



ARUP

Auto Demand Already Exceeds Capacity

- Auto demand on the Bay Bridge already exceeds capacity and conditions will only worsen



The Challenge in the Bay Bridge Corridor

How can we increase capacity in the Corridor to serve 20,000 additional peak hour trips?

- **BART**
  - Expects to increase peak hour capacity by 8,000 – 12,000 riders
- **Additional bus service to the new Transbay Terminal Center (TTC)**
  - Bus deck can handle over 300 buses in the peak hour
  - Could serve upwards of 15,000 – 20,000 additional riders
- The **TTC** requires reliable access from the East Bay so it can be fully utilized

Bay Bridge Constraints

- Queuing at the Bay Bridge toll plaza and metering lights lasts from 6:30 to 10:00 AM or later
- Buses and HOVs currently use bypass lanes on most days

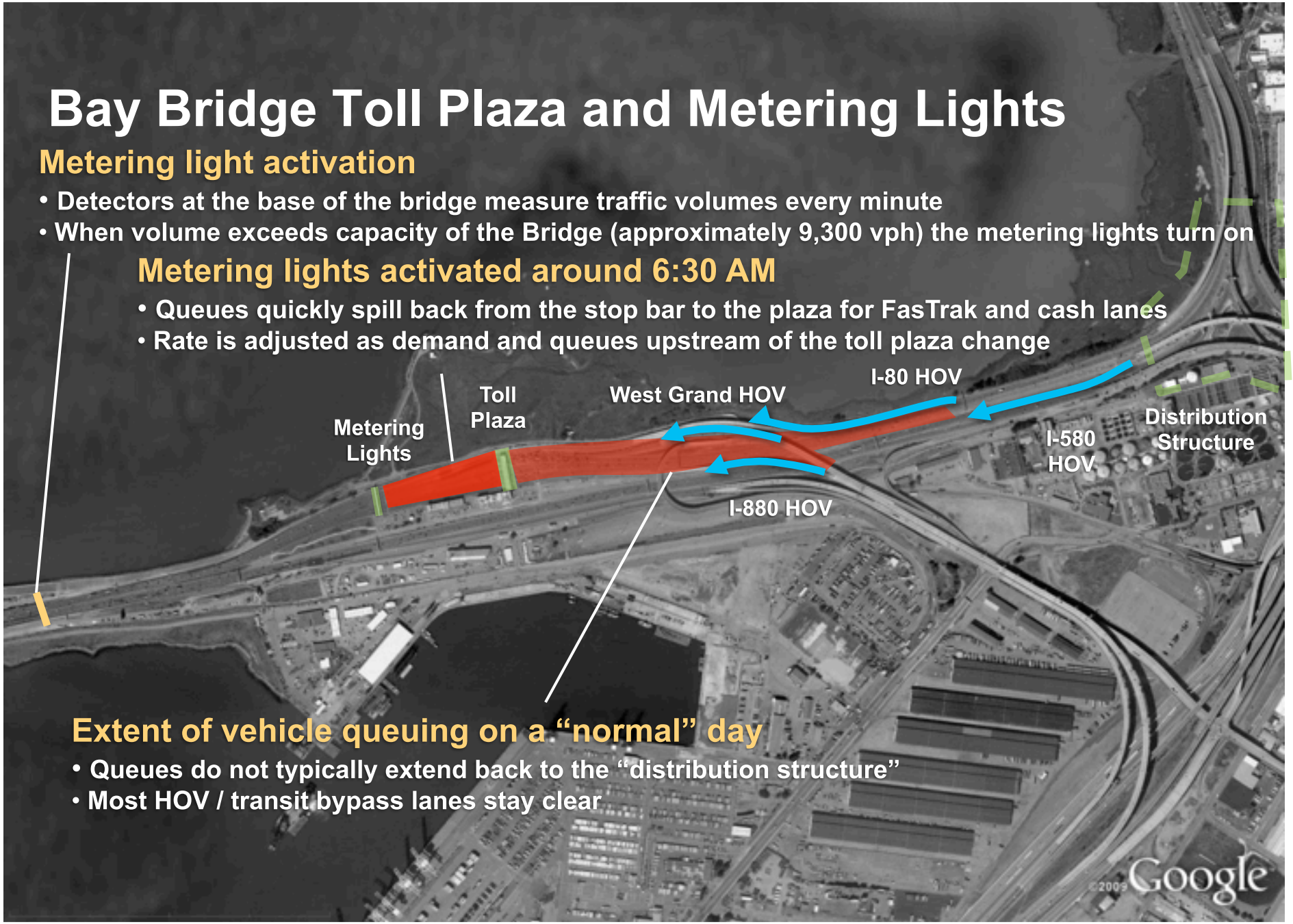
Bay Bridge Toll Plaza and Metering Lights

Metering light activation

- Detectors at the base of the bridge measure traffic volumes every minute
- When volume exceeds capacity of the Bridge (approximately 9,300 vph) the metering lights turn on

Metering lights activated around 6:30 AM

- Queues quickly spill back from the stop bar to the plaza for FasTrak and cash lanes
- Rate is adjusted as demand and queues upstream of the toll plaza change



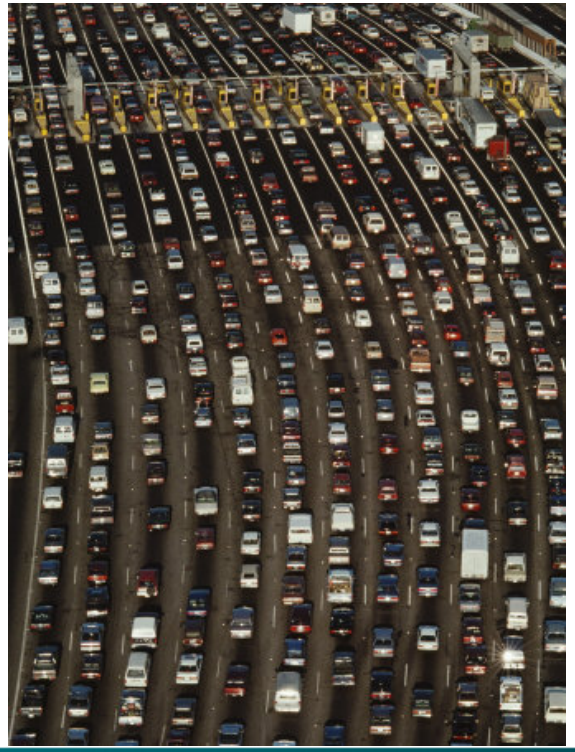
Extent of vehicle queuing on a "normal" day

- Queues do not typically extend back to the "distribution structure"
- Most HOV / transit bypass lanes stay clear

The Challenge in the Bay Bridge Corridor

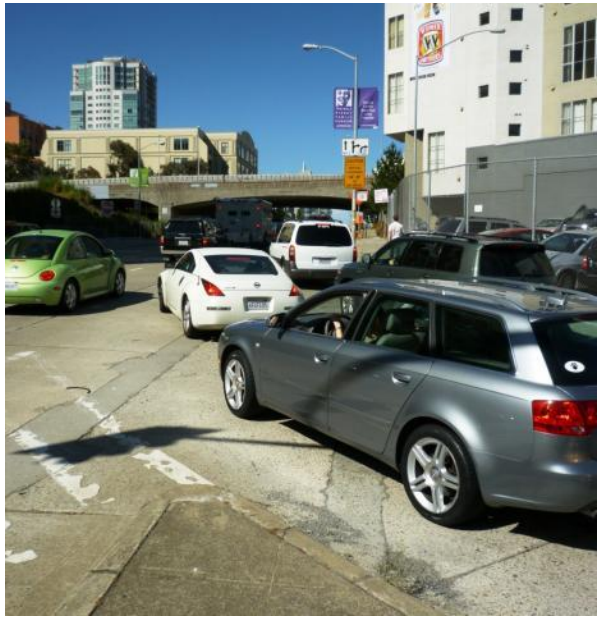
However, an increase in future traffic congestion could block the HOV bypass lanes that buses use to jump the toll plaza queues

- This could degrade bus operations and limit transit capacity



The Bay Bridge Corridor Congestion Study

- A first look at the Corridor's projected freeway performance between the East Bay and San Francisco
- **East Bay to San Francisco during the morning commute**
  - *Investigate* if the existing bus/HOV priority measures at the Bay Bridge toll plaza will continue to allow buses to bypass queues as conditions worsen in the future
- **San Francisco "South-of-Market" (SoMa) to the East Bay during the afternoon commute**
  - *Investigate* how to better manage Bay Bridge bound traffic that queues on local SoMa streets during the afternoon



Study Limitations

- Improvements recommended in the study have undergone a basic feasibility review by Arup's engineering staff
- However, they are considered *conceptual* at this stage of the analysis (further study is required)
- Congestion pricing is not considered
- BART capacity is not constrained
- The effects of *induced demand* are not considered

Study Approach

- Build two separate peak period VISSIM microsimulation models to analyze the traffic and transit constraints along the corridor

Bay Bridge AM Analysis

- Developed performance metrics
- Base year (2009) VISSIM model calibration/validation
- Developed traffic forecasts for 2020 and 2035
- Analyzed future “No Project” (i.e., no improvement) scenarios
- Developed improvement options
  - Metering alternative
  - Physical improvements (contraflow lane, entry and exit improvements)
- Analyzed improvement options

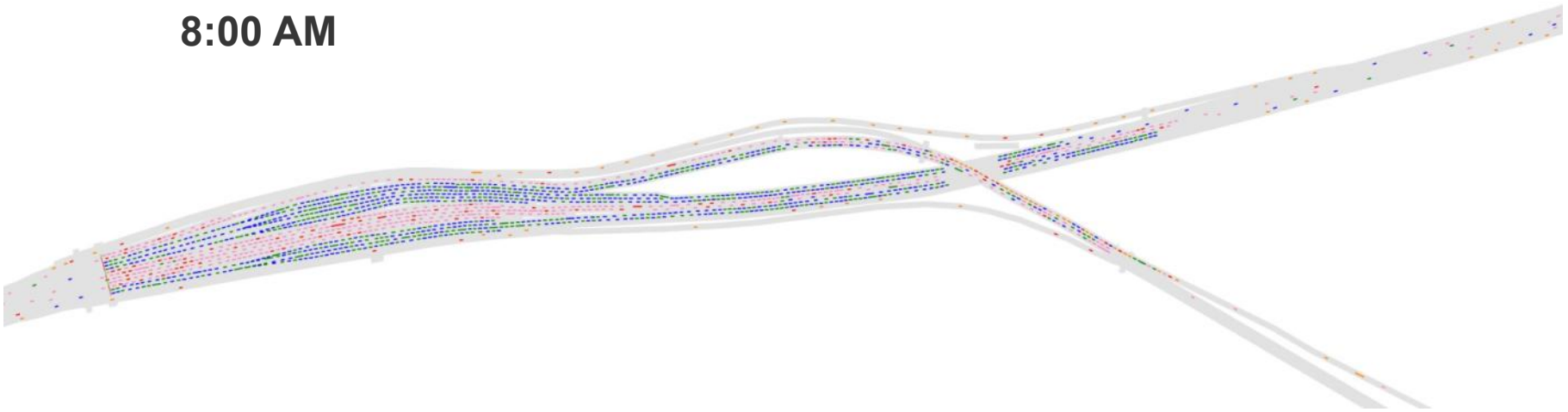
Bay Bridge AM Model – Performance Measures

- **Congestion**
  - The length of the Toll Plaza queue *should not* extend beyond the distribution structure
  - Total vehicle-hours of delay and person-hours of delay in each 2035 improvement scenario *should be less* than the 2020 and 2035 No Project condition
- **Transit Travel**
  - Transit speeds should average *not less* than 42 miles-per hour (mph) between the distribution structure and the TTC
  - Notes: The distance from the distribution structure to the TTC is approximately seven miles. A bus traveling at 42 mph will cover this distance in about 10 minutes.
- **Transit Reliability**
  - No individual peak period transit trip *should exceed* 14 minutes between the distribution structure and the TTC.

Bay Bridge AM Model – Calibrated Model Queues

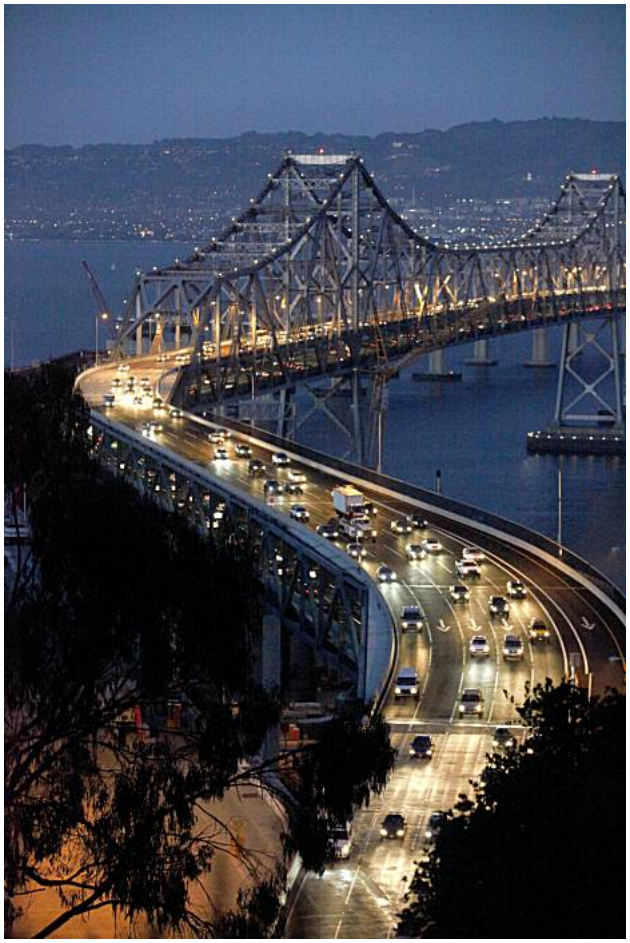
7:00 AM

8:00 AM



Bay Bridge AM Model – Forecasting

- Considered several Bay Area travel models
  - MTC, SFCTA, ACCMA
- Compared forecasts across the models
  - Overall demand increases 10 to 16 percent by 2035 (only 0.42 percent/annually)
  - On the Bay Bridge, traffic increases varied by only 5 percent
- Selected the SFCTA model for developing 2020 / 2035 forecasts



Bay Bridge AM Model – No Project Results

Performance Measures (8-9AM) Summary				
Category	Measure	2009 Base Year	2020 No Project Target Met?	2035 No Project Target Met?
Congestion	Toll Plaza queue – Not Beyond Dist Structure	Pass	Pass	Fail
	Total Vehicle Hrs of Delay	2,350	2,725	3,208
	Chg from 2009 Base Year (%)	N/A	16%	37%
	Chg from 2035 Base Case (%)	N/A	N/A	N/A
	Total Person Hrs of Delay	3,583	3,937	4,720
	Chg from 2009 Base Year (%)	N/A	10%	32%
	Chg from 2035 Base Case (%)	N/A	N/A	N/A
Transit Travel	Transit speeds should average not less than 42 mph (measured from I-80)	47 mph = Pass	46 mph = Pass	37 mph = Fail
Transit Reliability	No individual peak period transit trip should exceed 14 minutes (measured from I-80)	11.5 min = Pass	12 min = Pass	15 min = Fail

Bay Bridge AM – No Project VISSIM Video

Bay Bridge Improvement Options

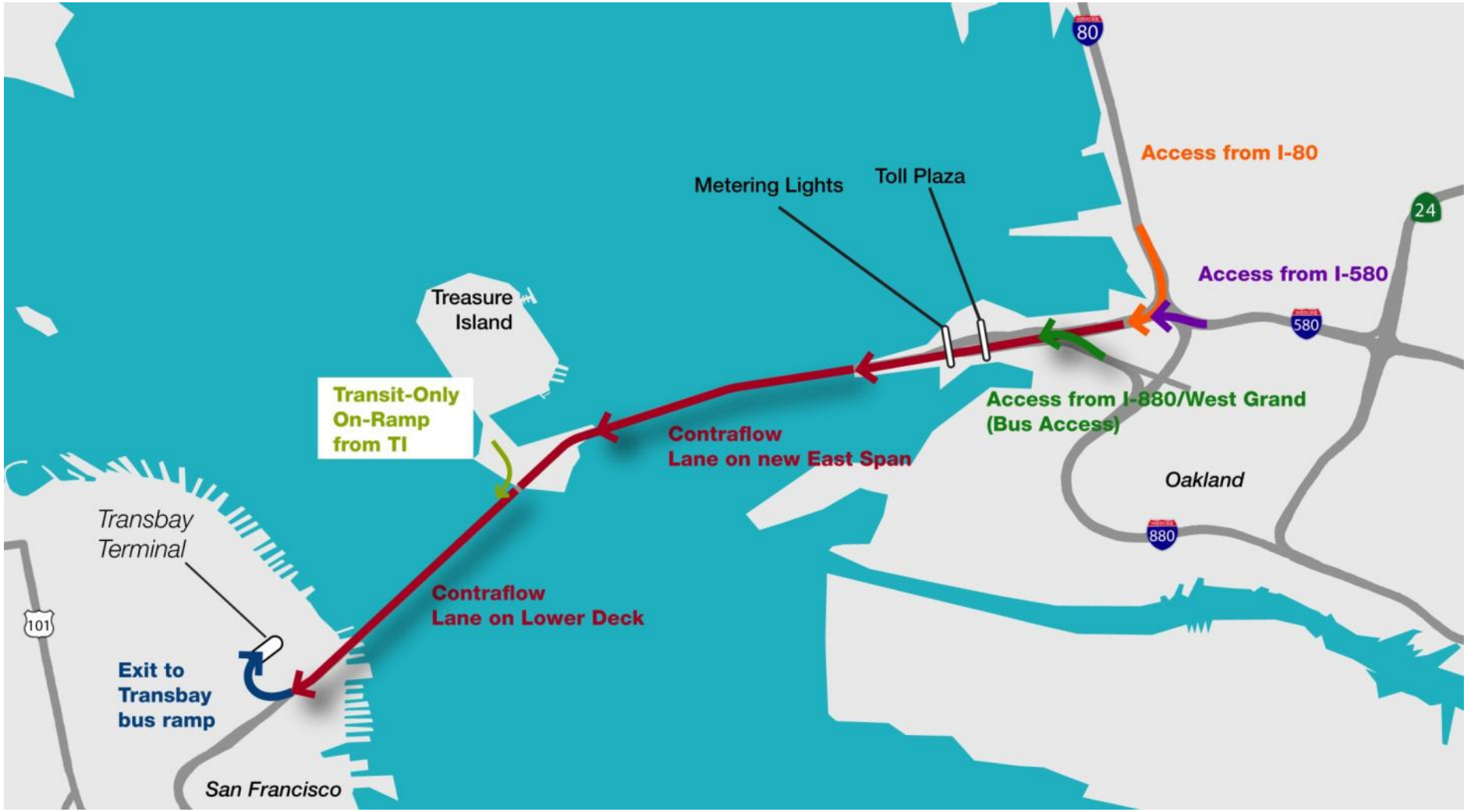
Option 1: Alternative Metering

- Increase the metering rate
- Shifts queues from toll plaza to the bridge structure

Option 2: Physical Improvements

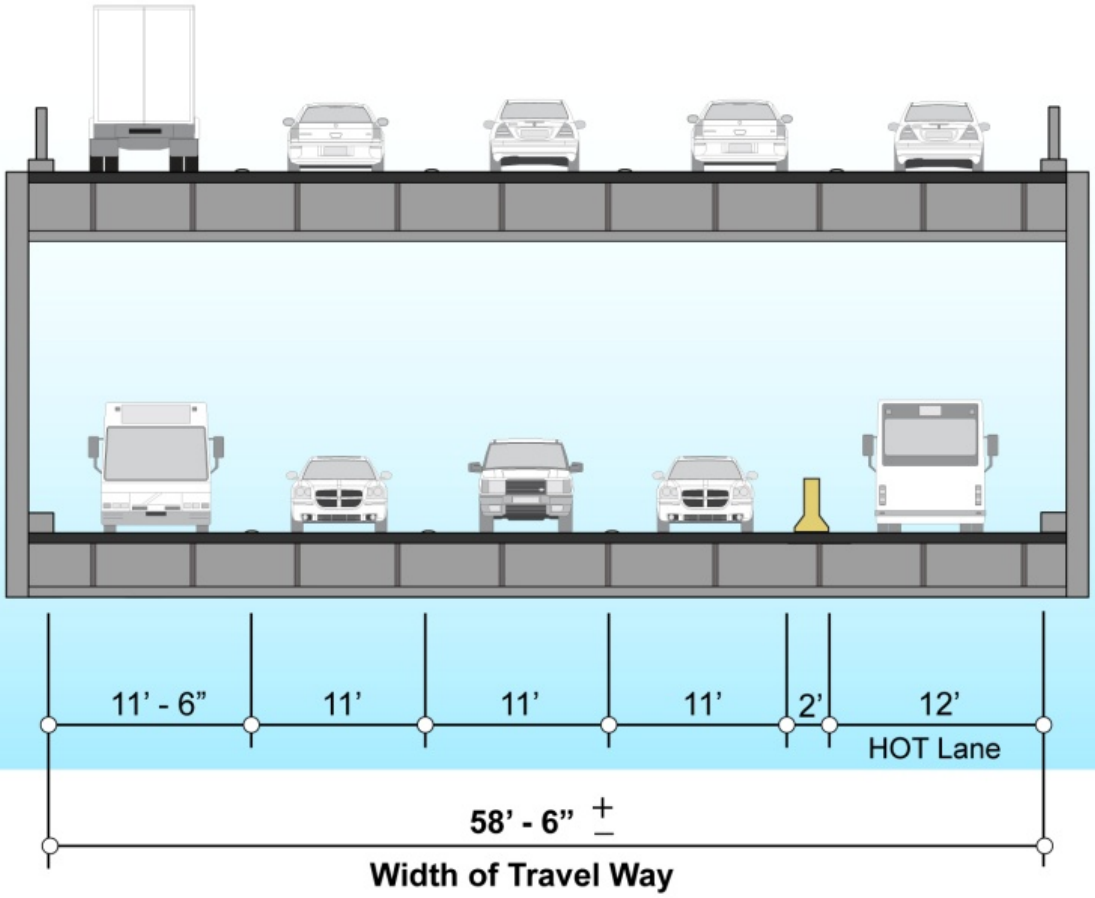
- Contraflow lane on the eastbound Bay Bridge
- Lane would serve buses (300 / hr) and either HOT (1,000 cars / hr) or trucks (200 / hr)
- Entry points to the lane from I-80, I-580, and I-880 (minimal cost)
- New bridge / ramp structure from West Grand (expensive)
- Major improvements in San Francisco to provide exit from lane to the Transbay bus ramps (expensive)

Bay Bridge Physical Improvements

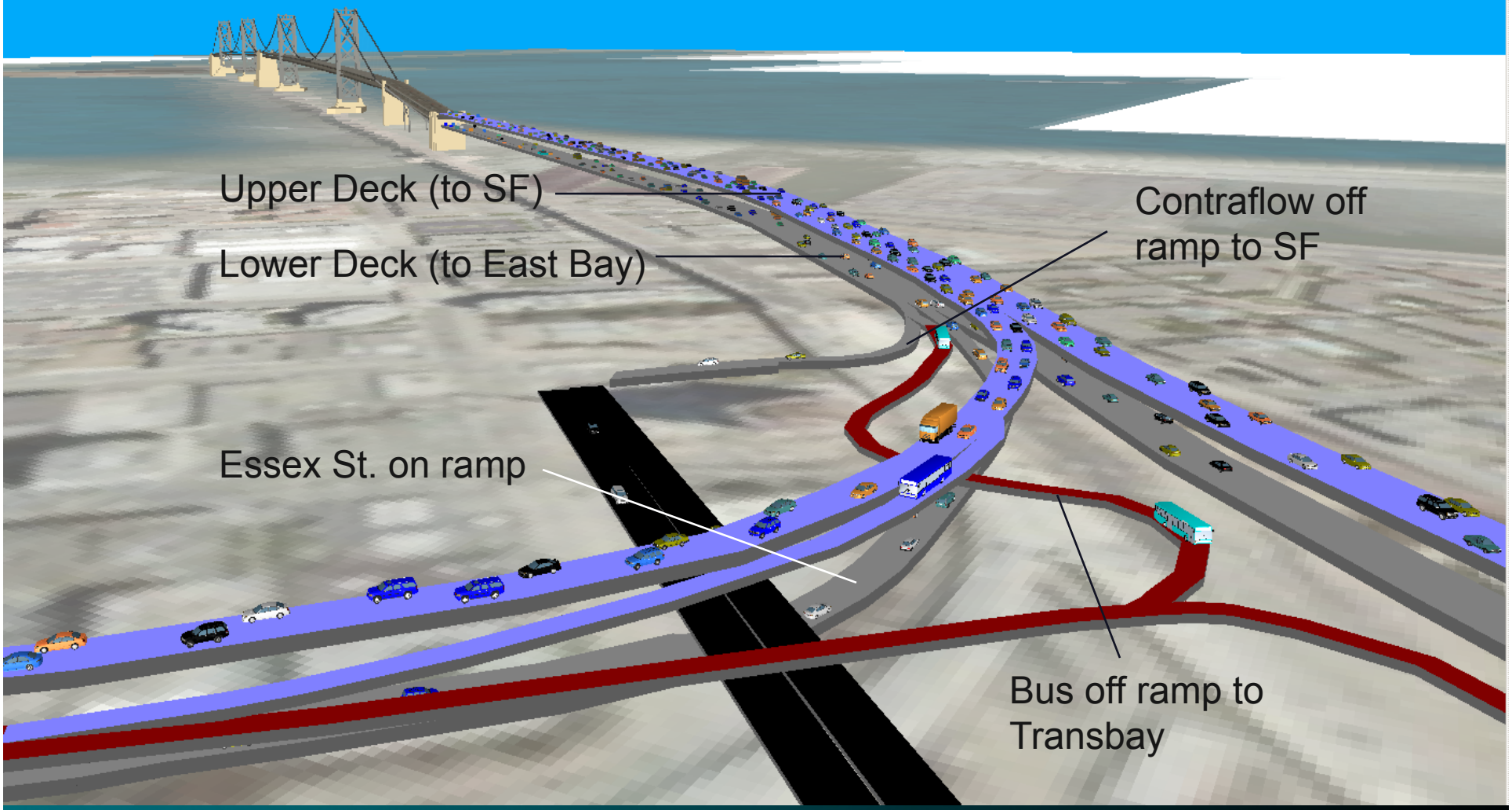


Bay Bridge Improvements – Contraflow Lane

2. Contra-Flow Configuration
(AM Peak)



Bay Bridge Improvements – SF Exit



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Bay Bridge Improvements – Cost Estimates
(add 25% for contingencies)

Improvement Option	Low Range Cost	High Range Cost
Core Items (Contraflow Lane, access from I-80/580/880, HOV extensions)	$40,300,000	$73,400,000
East Bay Options		
West Grand Option A	$12,300,000	$19,700,000
West Grand Option B	$8,200,000	$19,700,000
West Grand Option C	$17,500,000	$28,000,000
West Grand Option D	$31,700,000	$60,300,000
San Francisco Options		
Exit Option A/B	$25,400,000	$42,900,000
Total Improvement Costs		
Total Low Range Improvement Cost	$73,900,000	
Total High Range Improvement Cost	$176,700,000	

Source: Arup, 2010

Bay Bridge AM Model – Future Scenario Analysis

Performance Measures (8-9AM) Summary							
Category	Measure	2009 Base Year	2020 No Project Target Met?	2035 No Project Target Met?	2035 Alternative Metering Target Met?	2035 With Physical Improvements Target Met?	2035 With Reduced Set of Physical Improvements Target Met?
Congestion	Toll Plaza queue - Not Beyond Dist Structure	Pass	Pass	Fail	Pass	Pass	Pass
	Total Vehicle Hrs of Delay	2,350	2,725	3,208	3,680	2,168	2,288
	Chg from 2009 Base Year (%)	N/A	16%	37%	57%	-8%	-3%
	Chg from 2035 Base Case (%)	N/A	N/A	N/A	15%	-32%	-29%
	Total Person Hrs of Delay	3,583	3,937	4,720	6,256	3,254	3,426
	Chg from 2009 Base Year (%)	N/A	10%	32%	75%	-9%	-4%
	Chg from 2035 Base Case (%)	N/A	N/A	N/A	33%	-31%	-27%
Transit Travel	Transit speeds should average not less than 42 mph (measured from I-80)	47 mph = Pass	46 mph = Pass	37 mph = Fail	27 mph = Fail	53 mph = Pass	53 mph = Pass
Transit Reliability	No individual peak period transit trip should exceed 14 minutes (measured from I-80)	11.5 min = Pass	12 min = Pass	15 min = Fail	20 min = Fail	10 min = Pass	10 min = Pass

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Bay Bridge AM Summary

- Bay Bridge corridor is approaching capacity for all modes
- Capacity for 20,000 additional peak hour trips from the East Bay is required to meet the regional job forecasts
- Additional bus service to the new Transbay Terminal would provide the necessary capacity
- But future traffic growth will block bypass lanes, degrade transit operations, and limit bus capacity to San Francisco
- *A contraflow lane with entry/exit improvements would maintain bus operations*

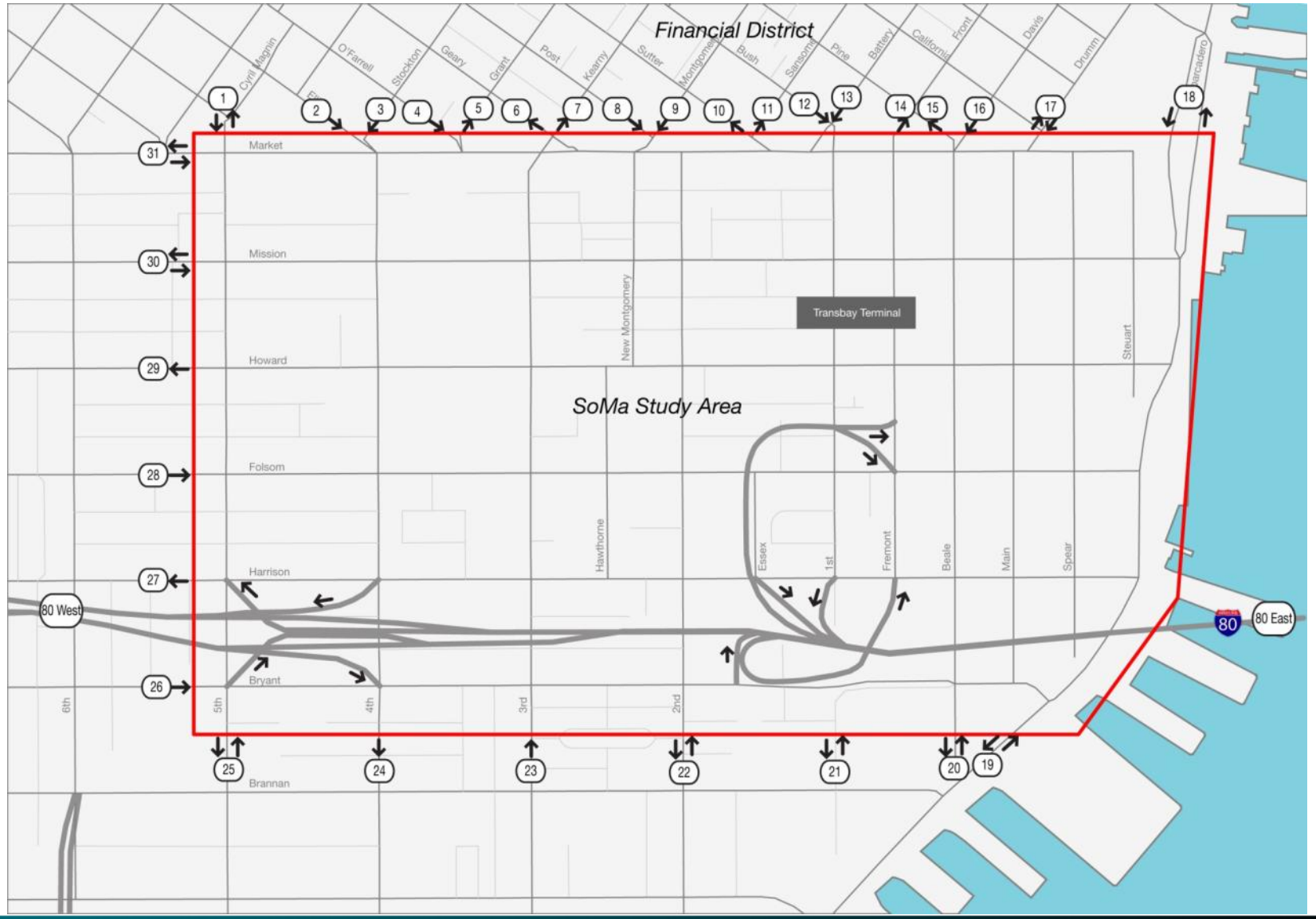
SoMa PM Model Introduction

- The “South-of-Market” street network serves many functions
- “Flip-side” of the AM problem: queue storage for vehicles using the Bay Bridge to exit San Francisco
- Traffic conditions vary considerably from day-to-day

SoMa PM Analysis – Purpose

- Identify improvements that better manage Bay Bridge queues
- Keep Bridge queues from blocking transit service
- Improvements should mesh with AM contraflow project
- The modeling has limitations and requires additional work beyond this study

SoMa PM Analysis – Study Area



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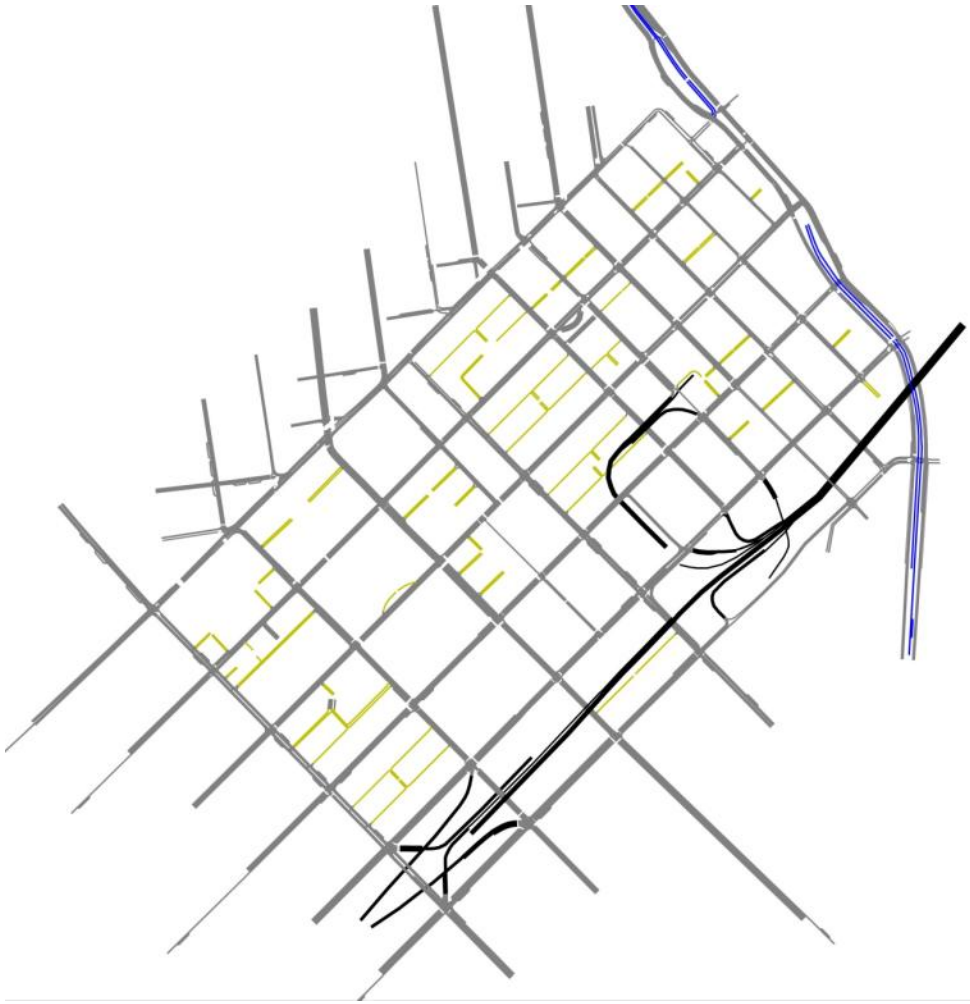
SoMa PM Model

- Developed from previous modeling efforts done by SFMTA and by Arup for Transbay
- 80 signalized intersections
- 9 freeway ramps
- Two-hour model (4-6 PM)
- Develop a set of “desired outcomes”
- Calibrate model
- Test potential improvements

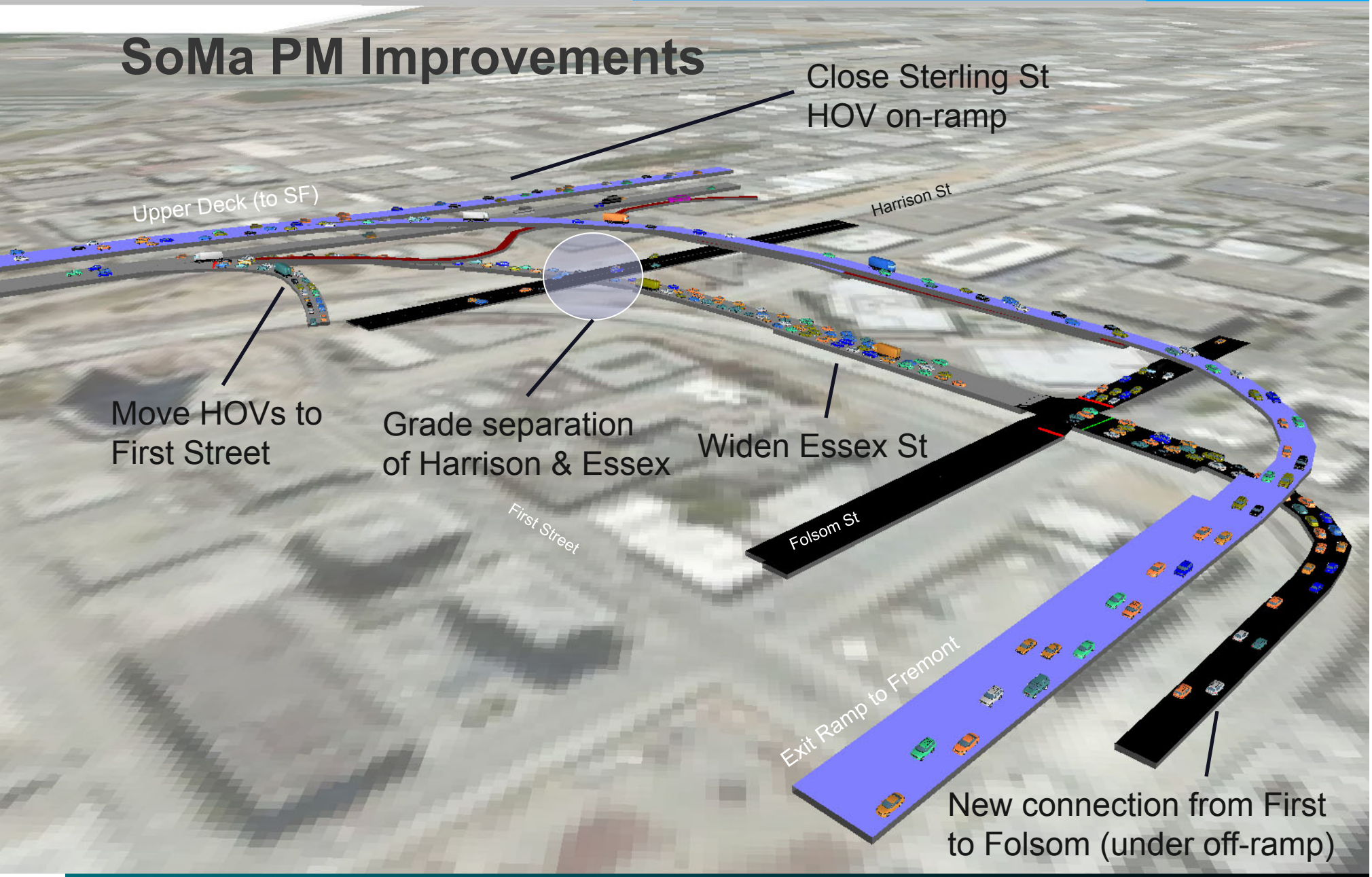


SoMa PM Model: Desired Outcomes

- The following desired outcomes will become performance measures when the model is further developed
- **Congestion**:
  - Bridge queue on 1st Street/ 2nd Street, and Beale should not extend beyond Howard at any time.
  - Bridge queues on 1st Street/2nd Street, and Beale should be reduced in the improvement option (compared to the base alternative).
  - The total vehicle-hours/person-hours of delay should be reduced in the improvement option.
- **Transit Travel**:
  - Transit travel times on Mission Street, First Street, 2nd Street and Folsom Street should decrease with any improvement option.

SoMa PM Existing Conditions VISSIM

SoMa PM Improvements



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SoMa PM Model Summary

- Improvements and circulation changes show promise (results still preliminary)
- The exit options proposed in the AM contraflow scheme will help afternoon conditions
- Grade separation and other changes at Essex could provide sufficient queuing capacity during the PM peak hour

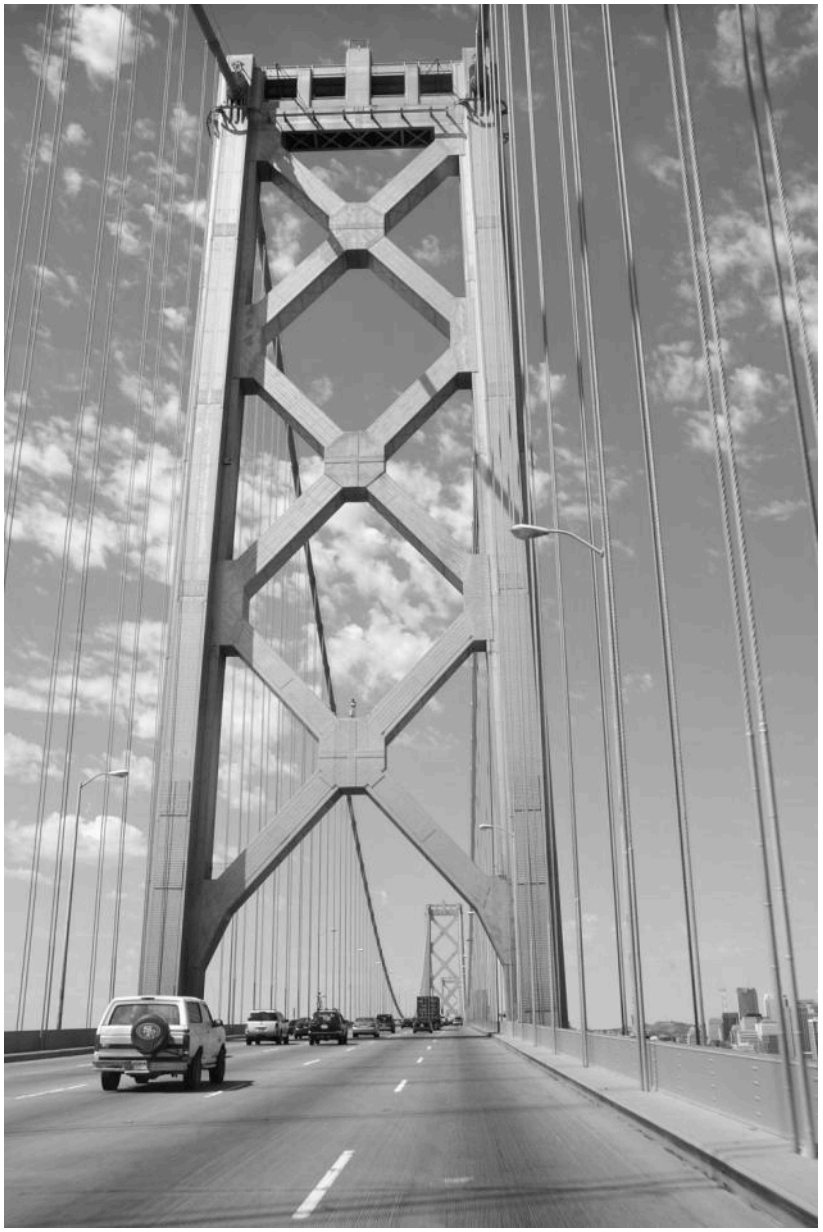
Next Steps

- Better understanding of operational issues related to the contraflow lane
- Survey of Best Practices
- Transit and overall corridor demand
- Continue feasibility analysis of improvement options
- Eastbound analysis
- Implementation options
- Further development and refinement of SoMa model

Questions

- Tony Bruzzone (anthony.bruzzone@arup.com)
- Mike Iswalt (michael.iswalt@arup.com)

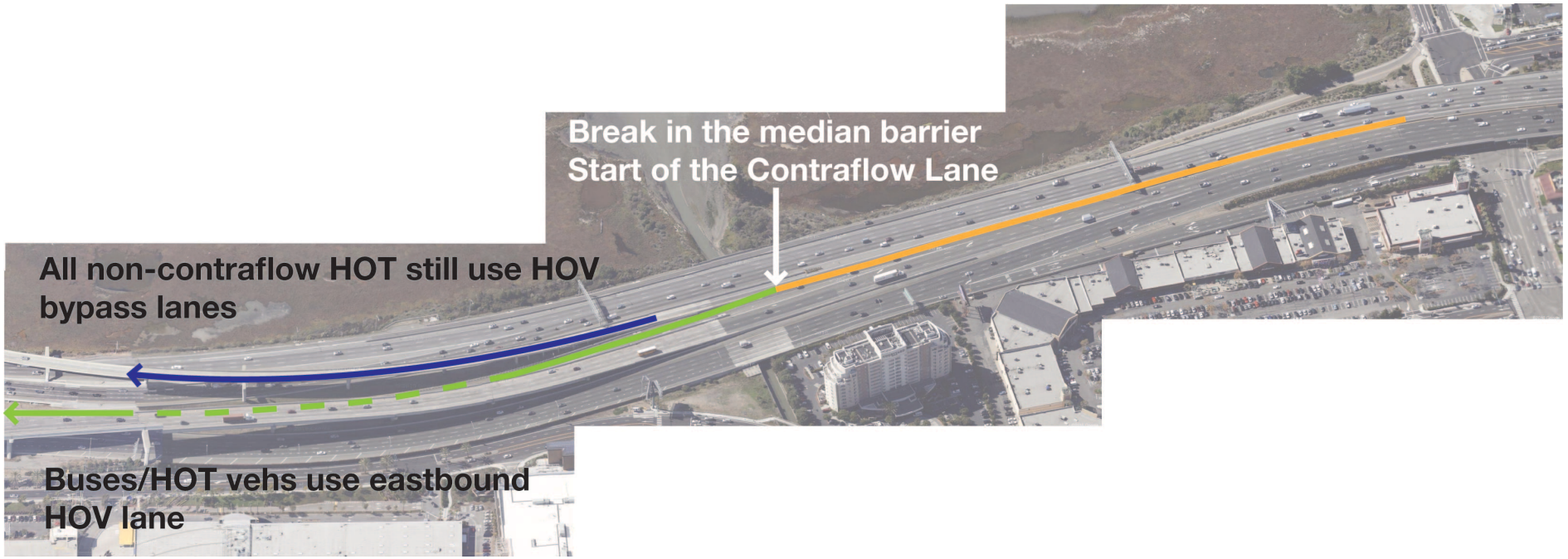
- Report Link:
- www.actransit.org/
- www.transbaycenter.org/



Additional Slides

Bay Bridge Improvements – I-80 Entry

- Entry point for buses/HOT from I-80 HOV lane (w/o Powell)
- Break in the median barrier
- Vehicles use the eastbound HOV lane



Bay Bridge Improvements – I-580 Entry

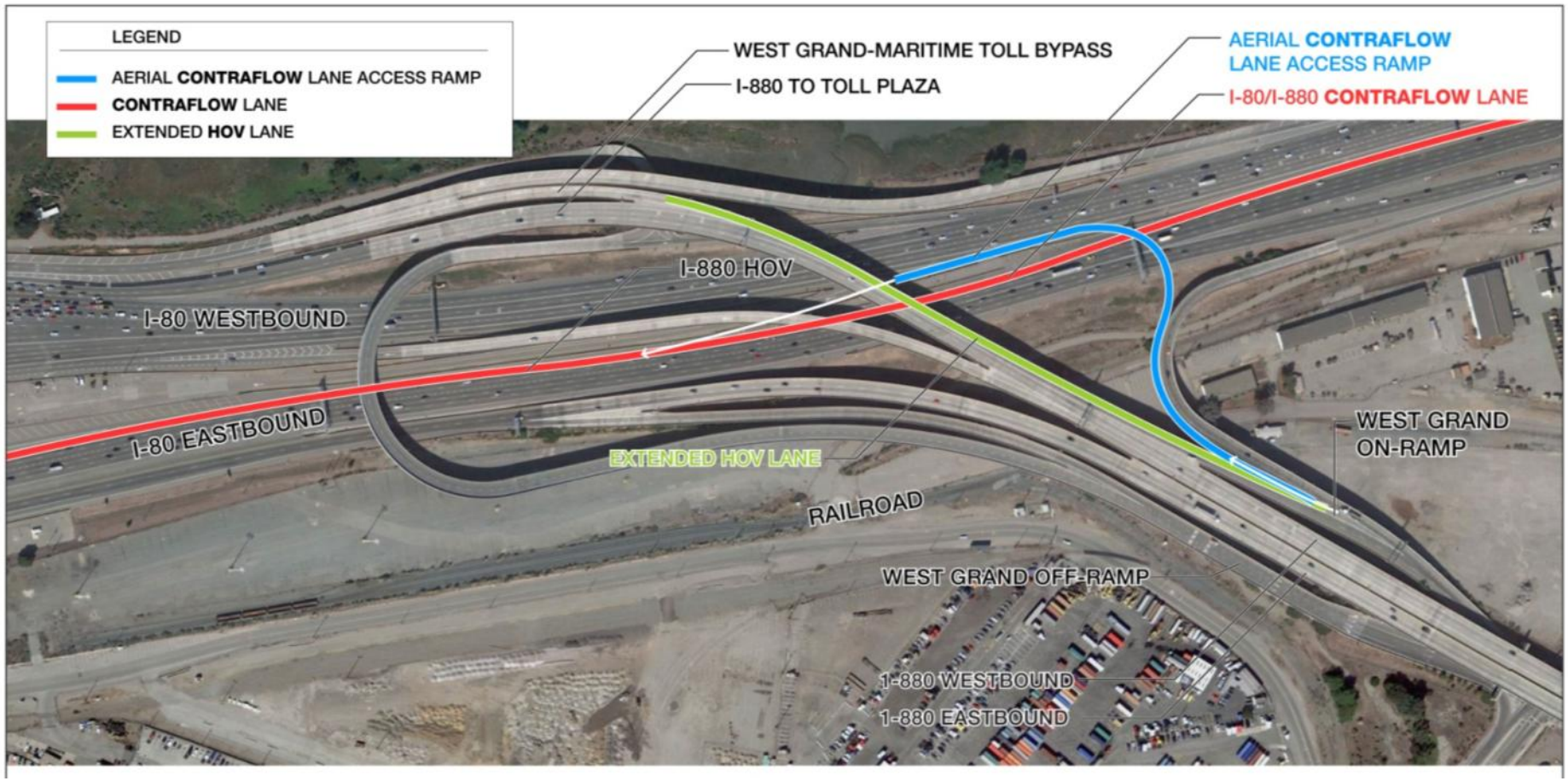
- I-580 merges with the I-80 segment of the Contraflow Lane
- Merge happens with a break in the barrier just after I-580 touches down

Bay Bridge Improvements – I-880 Entry

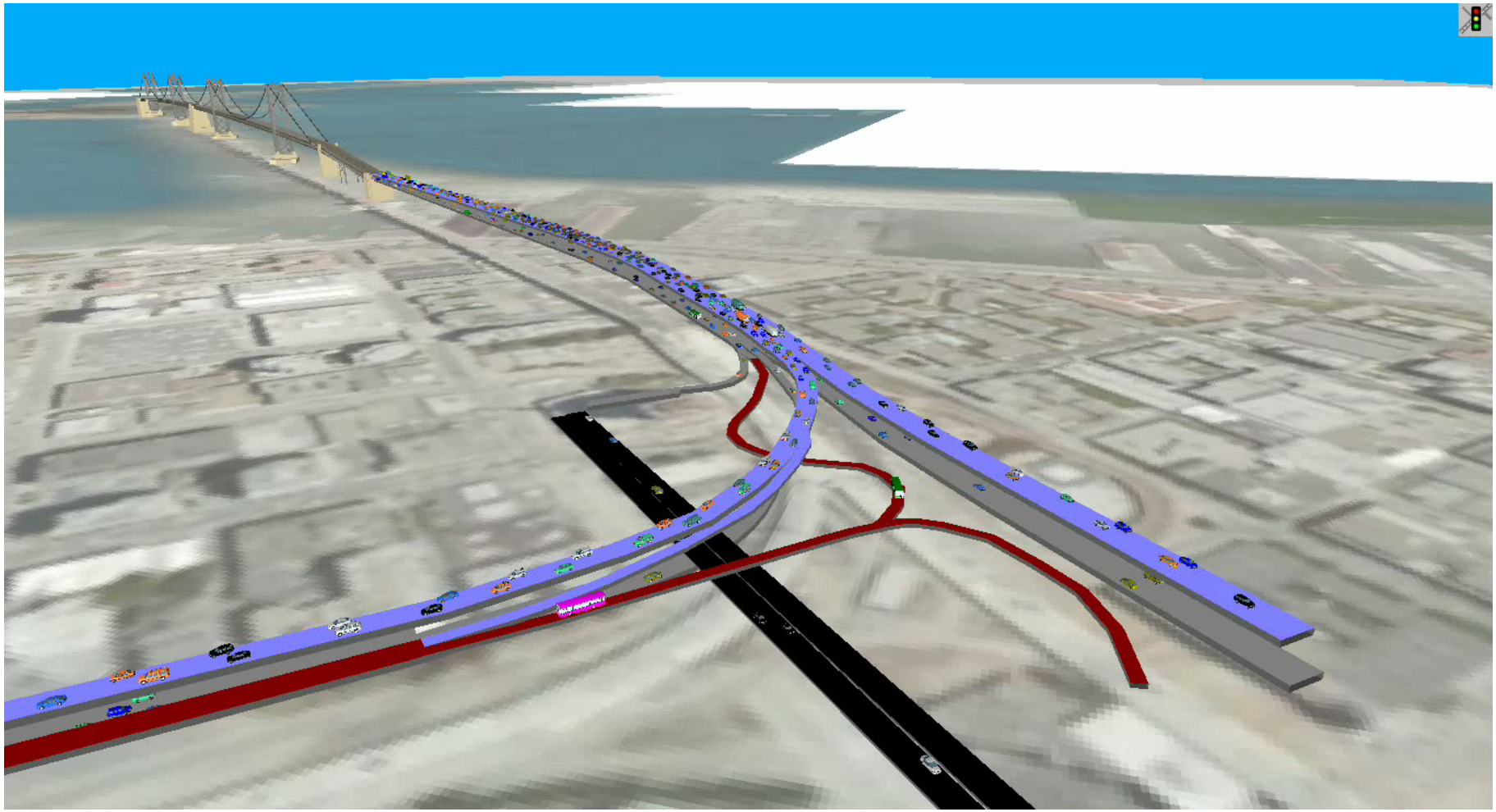
- I-880 access occurs just after the HOV ramp touches down
- West Grand includes a new aerial structure to span the eastbound lanes

Bay Bridge Improvements – West Grand Entry

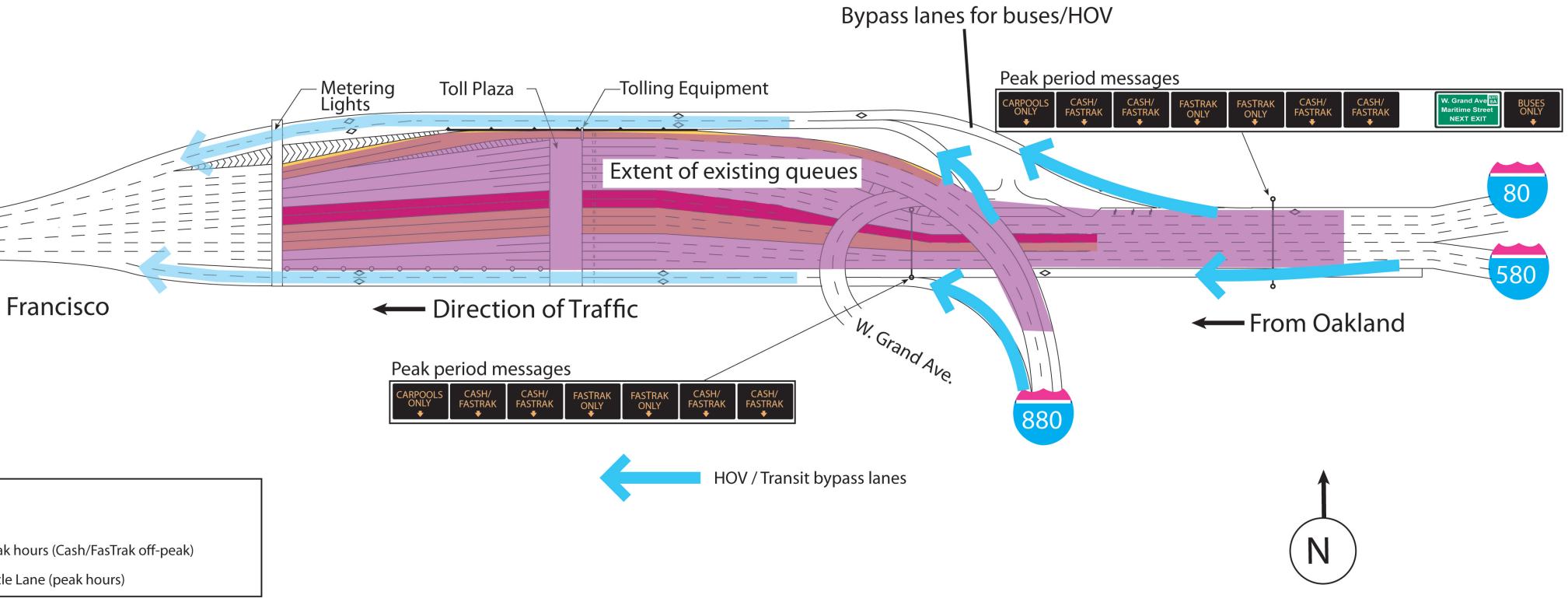
- **Four options (Option B shown)**



San Francisco Exit – VISSIM Video



Bay Bridge Toll Plaza and Metering Lights



ak hours (Cash/FasTrak off-peak)
tle Lane (peak hours)

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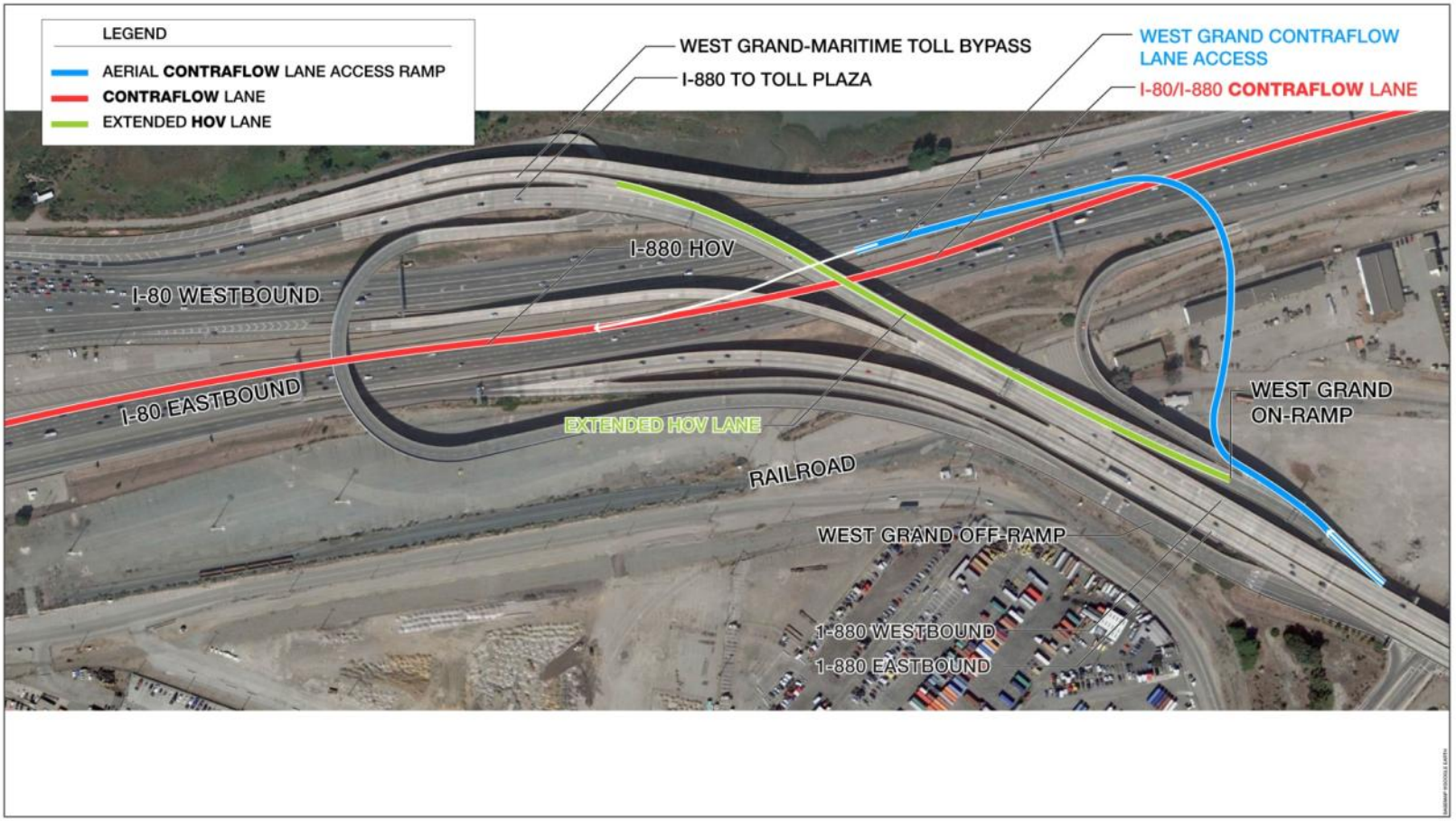
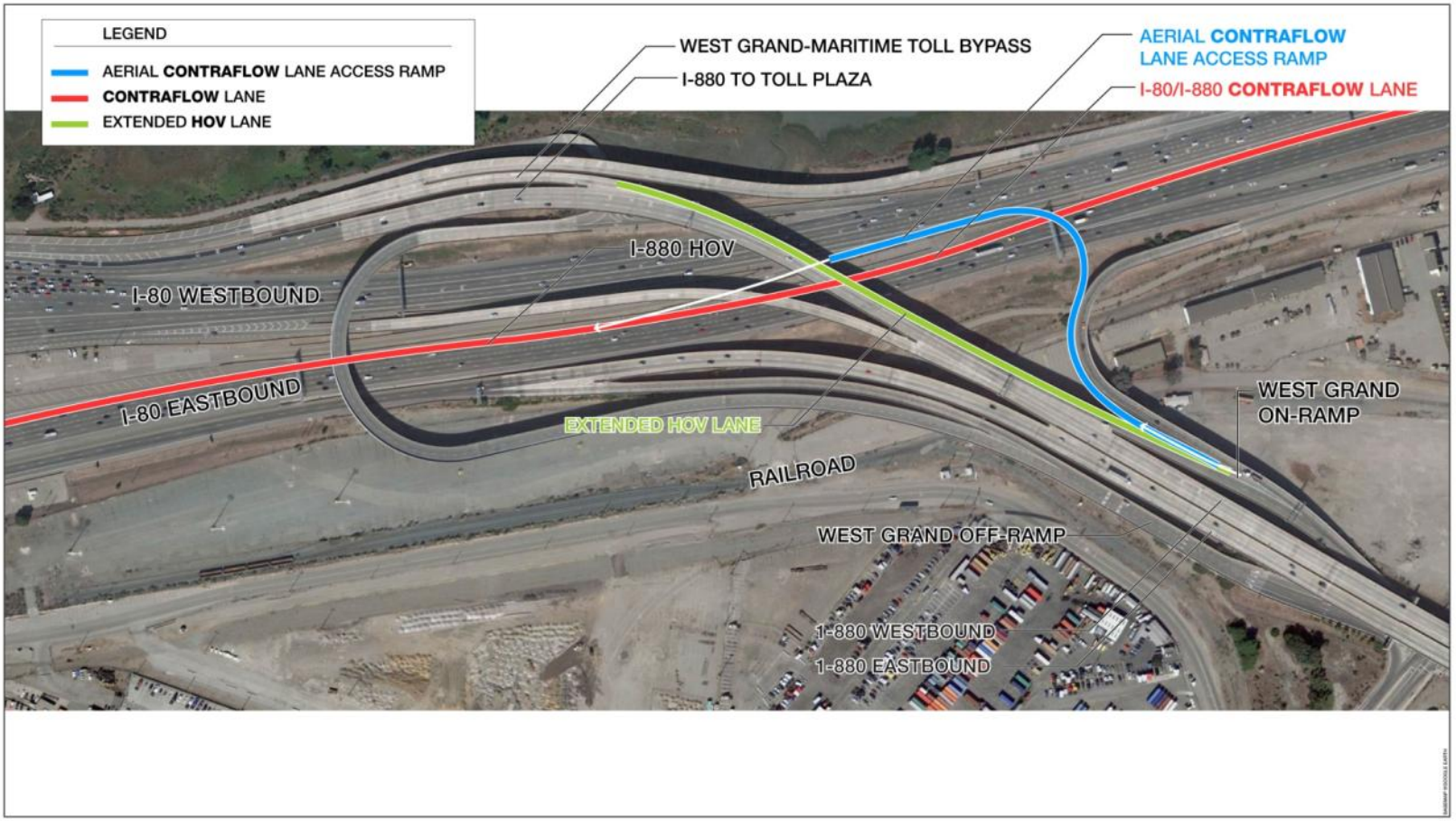
Bay Bridge AM Model – Analysis Scenarios

Scenario	Assumptions
Base Year (Calibrated Model)	• October 2009 traffic volumes and existing bus frequencies (approximately 100 peak hour bus trips) • October 2009 roadway network
Future (2020) No Project	• 2020 traffic volumes interpolated from 2035 SFCTA travel demand model and 2035 bus frequencies (approximately 300 peak hour bus trips) • No changes or improvements to the roadway network
Future (2035) No Project	• 2035 traffic volumes and bus frequencies • No changes or improvements to the roadway network
Future (2035) With Alternative Metering	• 2035 traffic volumes and bus frequencies • Increased metering rate, no changes to the network
Future (2035) With Physical Improvements	• 2035 traffic volumes and bus frequencies • Full set of physical improvements, no metering change • Assumes contraflow lane operates as a HOT lane with 1,000 vehicles per hour
Future (2035) With Reduced Set of Physical Improvements	• October 2009 traffic volumes • No I-580 HOV lane, no metering change • Assumes contraflow lane operates as a HOT lane with 1,000 vehicles per hour

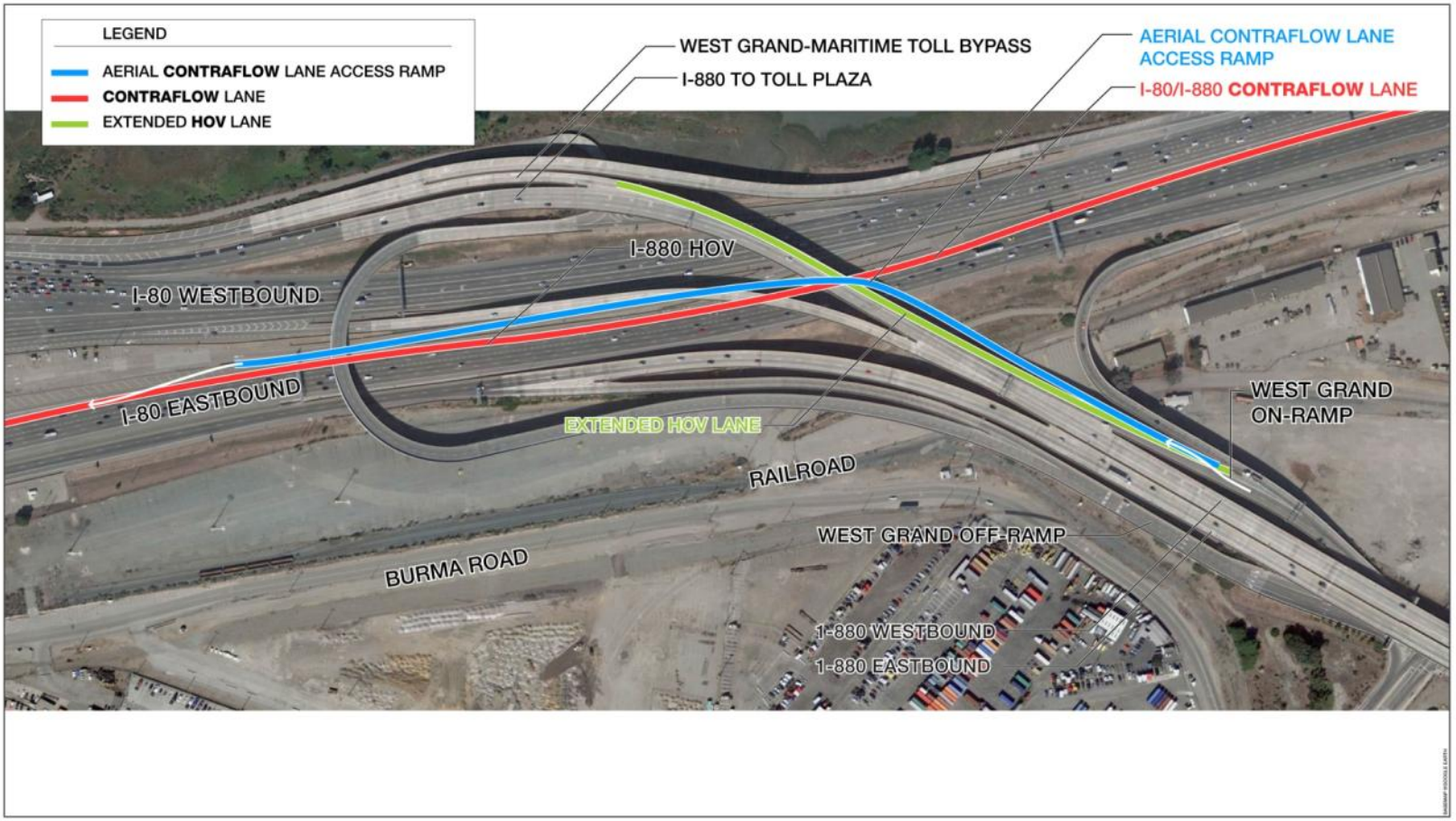
West Grand Option A



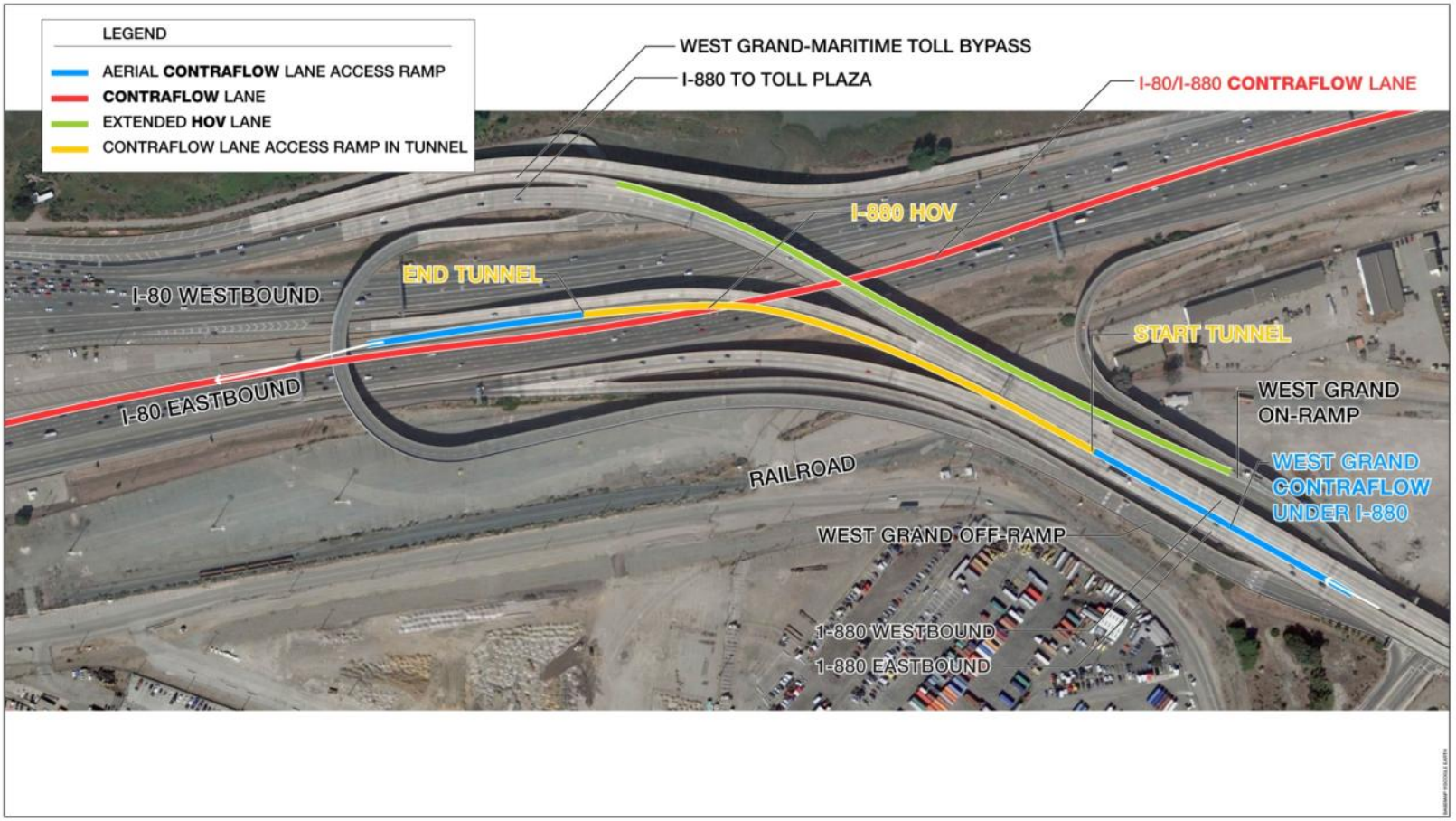
West Grand Option B



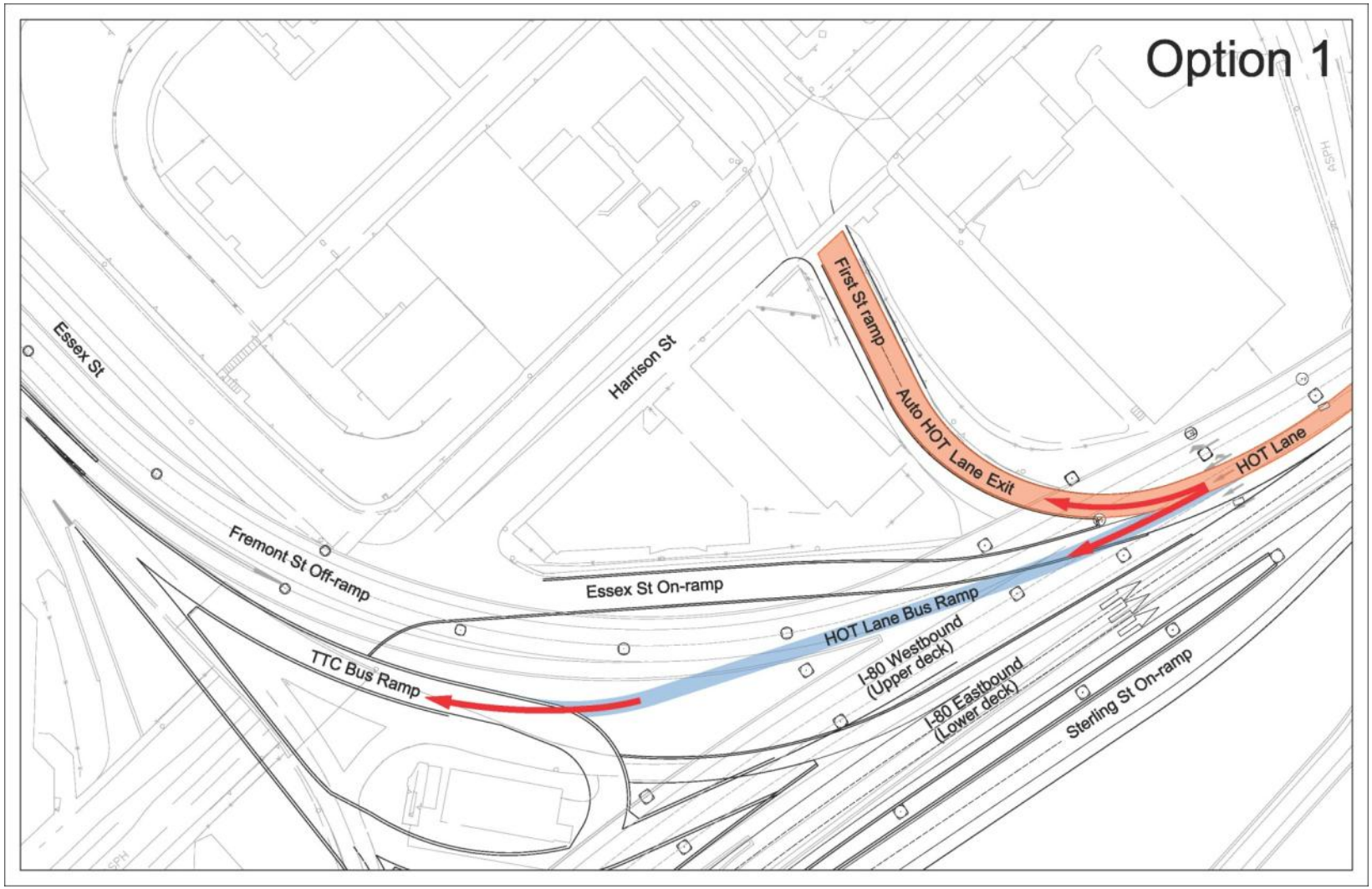
West Grand Option C



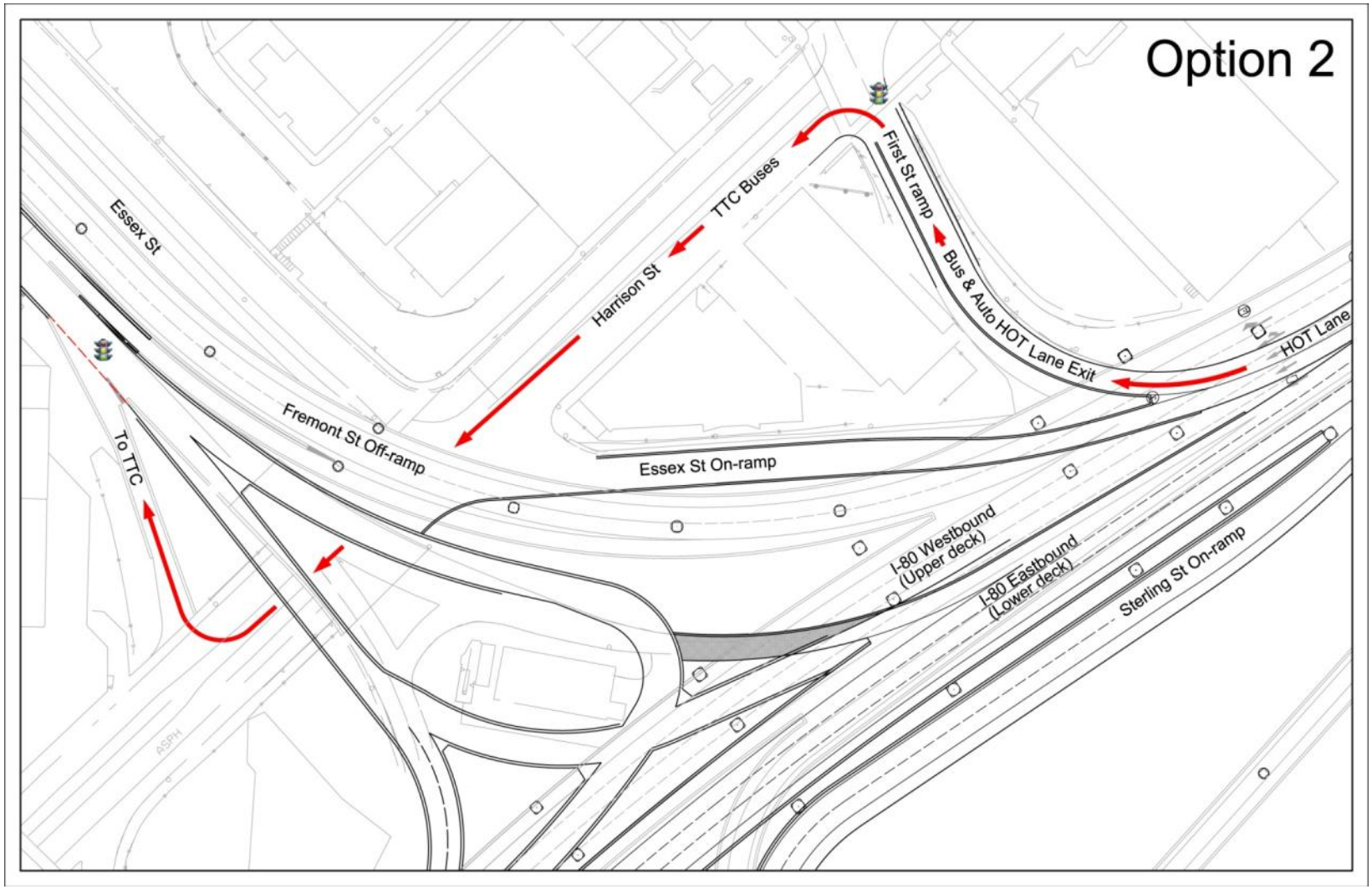
West Grand Option D



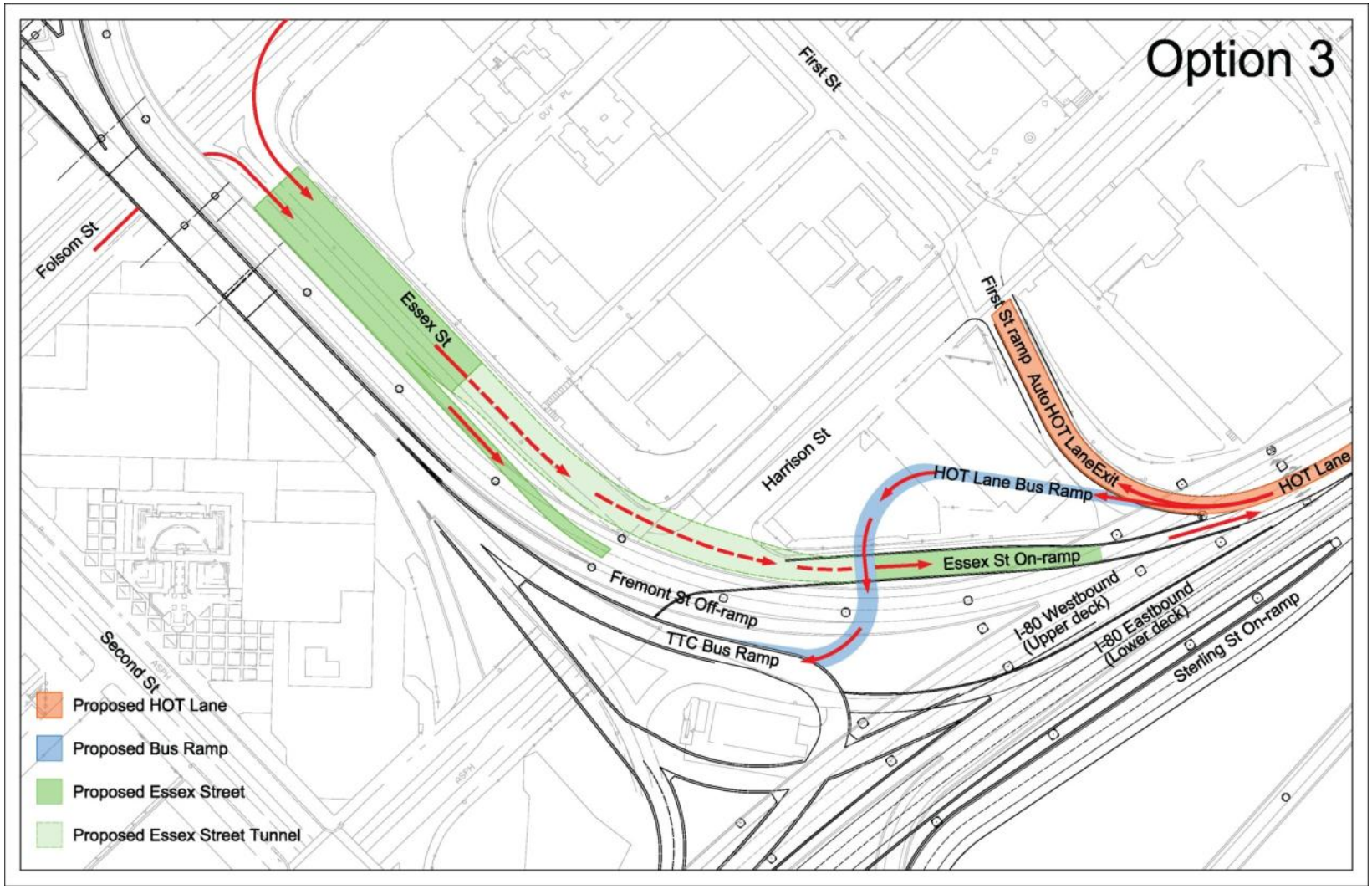
SF Options


Option 1
Essex St
Harrison St
First St ramp
Auto HOT Lane Exit
HOT Lane
Fremont St Off-ramp
Essex St On-ramp
HOT Lane Bus Ramp
TTC Bus Ramp
I-80 Westbound (Upper deck)
I-80 Eastbound (Lower deck)
Sterling St On-ramp

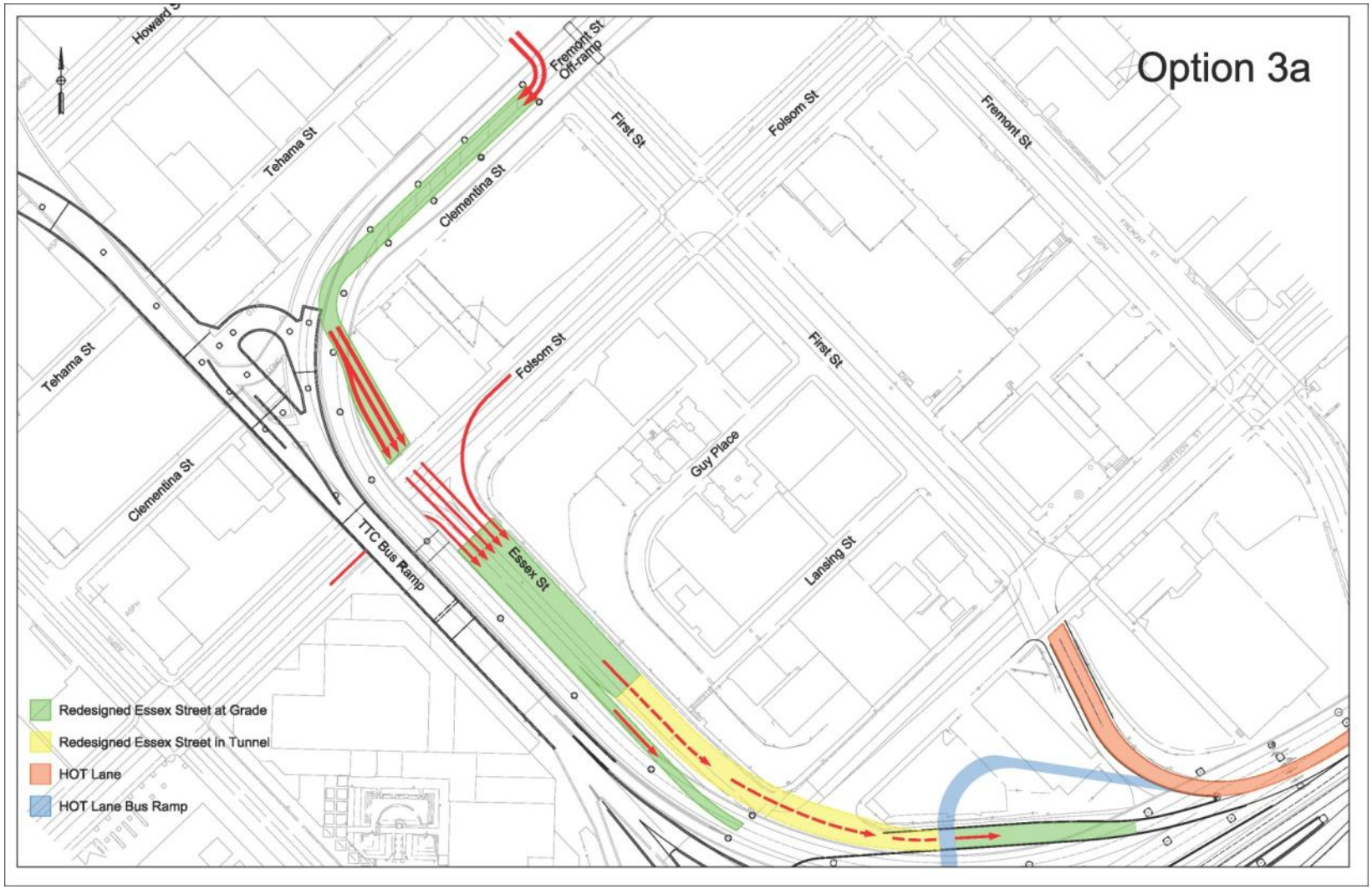
SF Options


Option 2
Essex St
TTC Buses
Harrison St
First St ramp
Bus & Auto HOT Lane Exit
HOT Lane
Fremont St Off-ramp
Essex St On-ramp
To TTC
I-80 Westbound (Upper deck)
I-80 Eastbound (Lower deck)
Sterling St On-ramp
ASPH

SF Options


Option 3
First St
Folsom St
Essex St
Harrison St
First St ramp Auto HOT Lane Exit
HOT Lane
HOT Lane Bus Ramp
Essex St On-ramp
Fremont St Off-ramp
TTC Bus Ramp
I-80 Westbound (Upper deck)
I-80 Eastbound (Lower deck)
Sterling St On-ramp
Second St
Proposed HOT Lane
Proposed Bus Ramp
Proposed Essex Street
Proposed Essex Street Tunnel

SF Options


Option 3a
Howard St
Fremont St Off-ramp
Tehama St
Clementina St
First St
Folsom St
Fremont St
Tehama St
Folsom St
First St
Guy Place
Clementina St
TTC Bus Ramp
Essex St
Lansing St
Redesigned Essex Street at Grade
Redesigned Essex Street in Tunnel
HOT Lane
HOT Lane Bus Ramp

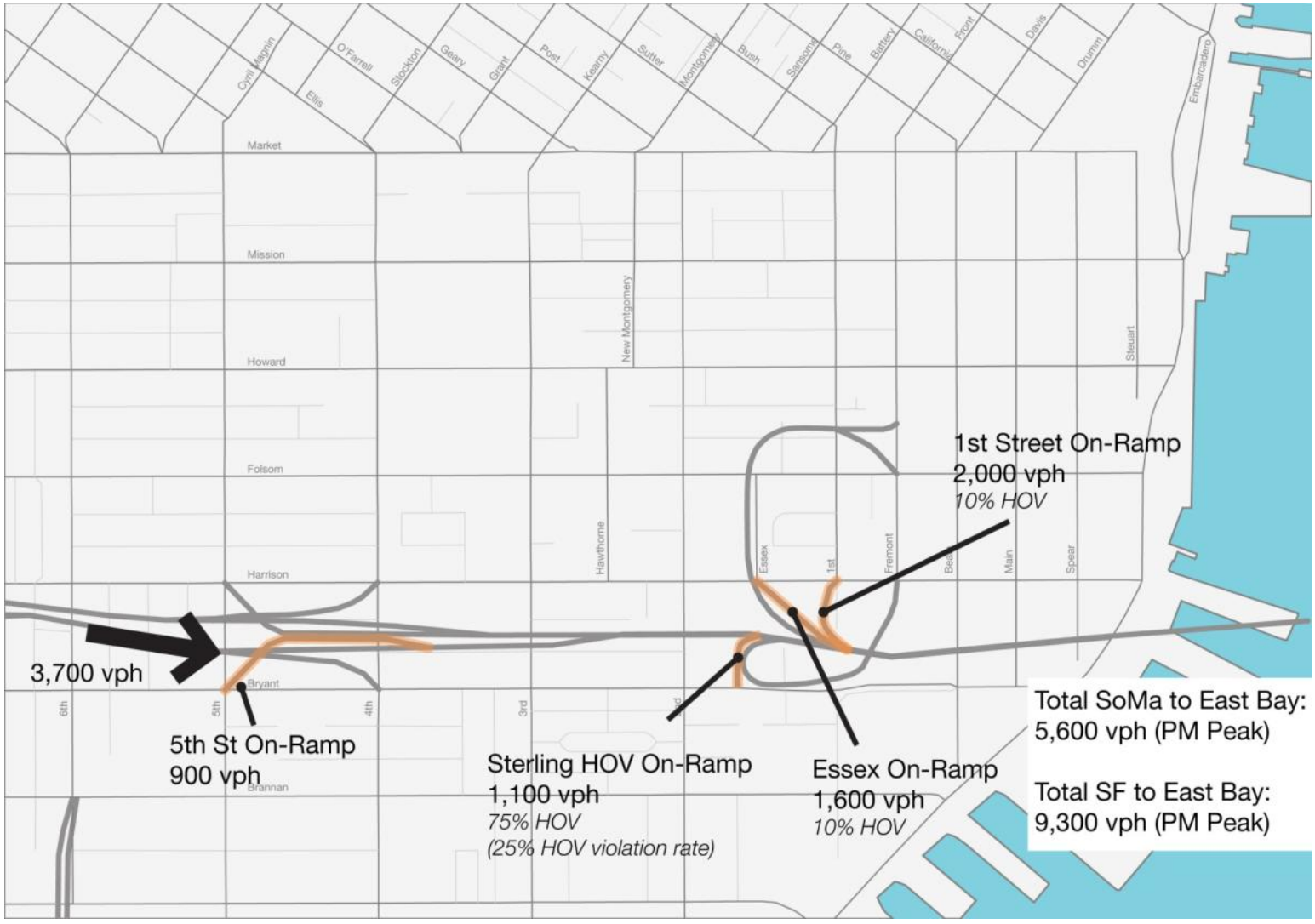
Treasure Island Improvements

Source: Yerba Buena Island Internal Road Network and Connection with Treasure Island Final Report, AECOM, 2009

Note: 1. Eastbound off-ramp reopened in Fall 2009.

Treasure Island and Yerba Buena Island Redevelopment Plan TIS

SoMa PM Model – Bay Bridge Ramps



SoMa PM Model Improvements