Plan Bay Area 2040

Agenda Item 5

TO: Commission

DATE: April 22, 2016

FR: Executive Director

RE: Plan Bay Area 2040 Project Performance Assessment and State of Good Repair Performance Assessment: Draft Results & Findings

Later this year, the Commission will be discussing critical tradeoffs between transportation investments – ranging from major expansion projects to strategic efficiency improvements to funding for operations and maintenance. In order to better inform this Plan Bay Area 2040 dialogue, MTC staff has conducted a performance assessment of all major uncommitted transportation investments. Building upon the framework from the first Plan Bay Area, this assessment incorporates state of good repair alongside expansion projects for the first time, given the increasing needs associated with the region's aging infrastructure. This memorandum discusses the overall framework and presents key performance findings based on the draft results.

Objectives and Scope

Given that the Plan must be fiscally constrained, the performance assessment is designed to help determine which projects should be prioritized for inclusion in Plan Bay Area 2040 (Plan). By adopting the Plan committed projects policy in April 2015, the Commission took the first step towards establishing the projects and project types that the region will fund and implement. After the Call for Projects for the Plan in September 2015, MTC Planning staff screened submittals for uncommitted, major capital investments (total cost greater than $100 million) that could be evaluated with the region's travel demand model. Staff determined that approximately 70 expansion, efficiency, and state of good repair investments were eligible for the assessment, adding up to a request for $66 billion in project funding and $49 billion in maintenance funding. Smaller-scale projects will be prioritized by the CMAs later in the planning process, and they too will be subject to the Plan's fiscal constraint.

Assessment Components

The performance assessment includes two primary components, targets score and benefit-cost ratio, as well as several supplemental assessments:

- **Targets assessment.** Using qualitative criteria developed for each of the Plan's adopted performance targets, we evaluate the degree to which each project meets the region's targets. All thirteen targets are weighted equally, meaning that scores can range from +13 (strong support for all targets) to -13 (adverse impacts on all targets).
- **Benefit-cost assessment.** Using the regional travel demand model (Travel Model One), we estimate and monetize a project's impact on regional travel time, travel cost, air quality, safety, health, and noise for the year 2040. The benefit-cost ratio divides these benefits by the project's net annualized life cycle cost to provide an estimate of its cost-effectiveness.
- **Additional assessments.** In addition to the two primary assessments, the performance assessment includes several additional components. The project-level equity assessment explores the project's impacts for equity-related targets and also identifies projects that

benefit communities of concern and lower-income residents. Similarly, the benefit-cost confidence assessment and the sensitivity assessment flag potential limitations of the analysis for the purpose of transparency.

Staff has met with congestion management agencies, project sponsors, and other performance stakeholders over the course of the last month. Based on feedback received, staff has made some initial revisions to the performance results in response; a high-level summary of comments received is included in **Attachment C**.

Key Findings

1. **Maintaining regional transit infrastructure ranks as the top priority, given its high level of cost-effectiveness and strong support of adopted targets.**
   Maintenance of rail and bus systems across the region was identified as one of the most cost-effective and sustainable investments under consideration in the Plan. In addition to shaving times off of transit commutes, achieving a state of good repair for transit infrastructure yields significant greenhouse gas reduction benefits and strongly supports most of the adopted performance targets. While transit efficiency and expansion projects perform quite well, transit maintenance investments perform even better – further emphasizing the imperative behind the region's long standing "Fix It First" policy.

2. **Land use matters – projects that support Plan Bay Area 2013 growth patterns showed strong performance.**
   The project performance assessment for the first Plan Bay Area had to rely on a land use pattern developed prior to passage of SB 375. Relying upon the focused growth pattern laid out by Plan Bay Area 2013, this performance assessment identifies a series of cost-effective transit investments, ranging from BART to Silicon Valley in the South Bay to Geary Bus Rapid Transit (BRT) in San Francisco. Furthermore, projects that boost frequencies on regional rail systems, or expand rapid fixed-guideway service to a growing job center, provide significant benefits; in particular, the BART Metro Program first analyzed in Plan Bay Area 2013 remains a cost-effective project for this planning cycle.

3. **Highly-used highways and transit systems remain the backbone of the region – both efficiency and maintenance investments prove highly cost-effective.**
   Since forecasts indicate that the majority of Bay Area residents will continue to drive in the year 2040, maintaining heavily-used facilities while leveraging advanced technologies to smooth traffic flow, proves to be an effective strategy. Highway pavement maintenance achieved the highest benefit-cost ratio of any investment analyzed for the Plan, given that additional funding to smooth the region's highways would actually decrease maintenance costs relative to today. Furthermore, technological improvements through the Columbus Day Initiative would generate significant time savings at a relatively low cost by taking advantage of ramp metering, signal coordination, and advanced queue warning signs.

4. **Projects in chronically congested corridors generally provide the biggest bang per buck.**
   Similar to the Plan Bay Area 2013 performance assessment, bus rapid transit (BRT) projects are cost-effective ways to significantly improve transit travel times. They generate the highest benefit when they provide a competitive choice to driving within congested corridors, such as Geary BRT in San Francisco, San Pablo BRT in the East Bay, and El Camino BRT in the South Bay. Increasing ferry service from Vallejo and Richmond to San Francisco also

showed a high-level of cost-effectiveness, as it improves transit options within the congested Interstate 80 corridor. At the same time, projects that add either road capacity or transit service in areas with low travel demand relative to available capacity yield some of the lowest benefits.

5. **In general, road efficiency projects outperform road expansion projects, reflecting lower costs and fewer environmental impacts.**
   Among roadway investments, operational efficiency projects generally performed better on both assessments, with higher benefit-cost ratios and stronger targets scores. Investments such as the Columbus Day Initiative, US-101 HOV Lanes, and I-580 ITS Improvements outranked many of the highway widening projects submitted for consideration. The latter set of projects feature significantly higher price tags than road efficiency investments while increasing development pressure far from existing urban centers, leading to low-performing designations on one or both scores.

6. **All of the region's highest-performing projects increase access to Communities of Concern.**
   Every project with a high benefit-cost ratio and a strong support rating for regional targets improves access to at least one Community of Concern in the Bay Area. The notable result reflects the strong equity nexus in the adopted performance targets, with six of the thirteen targets having a clear nexus with social equity. Network-wide bus and rail service increases score the highest on these targets, which help to advance healthy and safe communities, affordable transportation options, access to jobs, and job creation.

Next Steps
As we move towards a preferred scenario for the Plan in the fall, the performance results will play a key role in crafting a transportation investment strategy. Key milestones include:

- **May:** final performance results and staff recommendation for high- and low-performer thresholds under consideration for adoption by MTC Planning Committee
- **June:** deadline for low-performing project sponsors to submit compelling case to MTC staff
- **July:** staff recommendation for final actions on project performance assessment under consideration for adoption by MTC Planning Committee
- **September:** preferred scenario for the Plan slated for adoption by MTC and ABAG, incorporating outcomes of the performance assessment.

Steve Heminger

Attachments:

- **Attachment A:** Draft Performance Bubble Charts – Benefit-Cost and Targets Support
- **Attachment B:** Draft Project & State of Good Repair Performance Summary Table
- **Attachment C:** Summary of Feedback from Sponsors and Stakeholders
- PowerPoint

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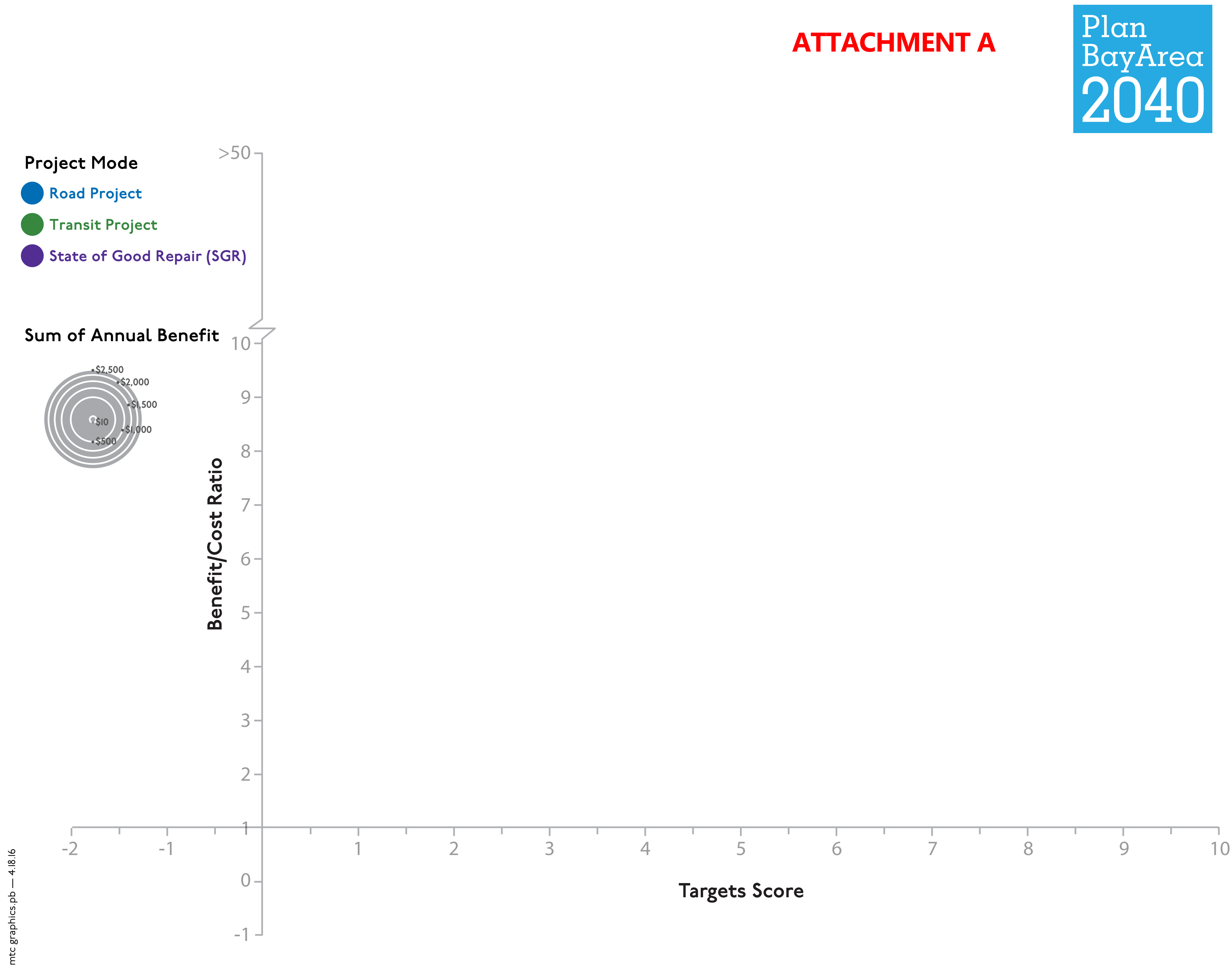
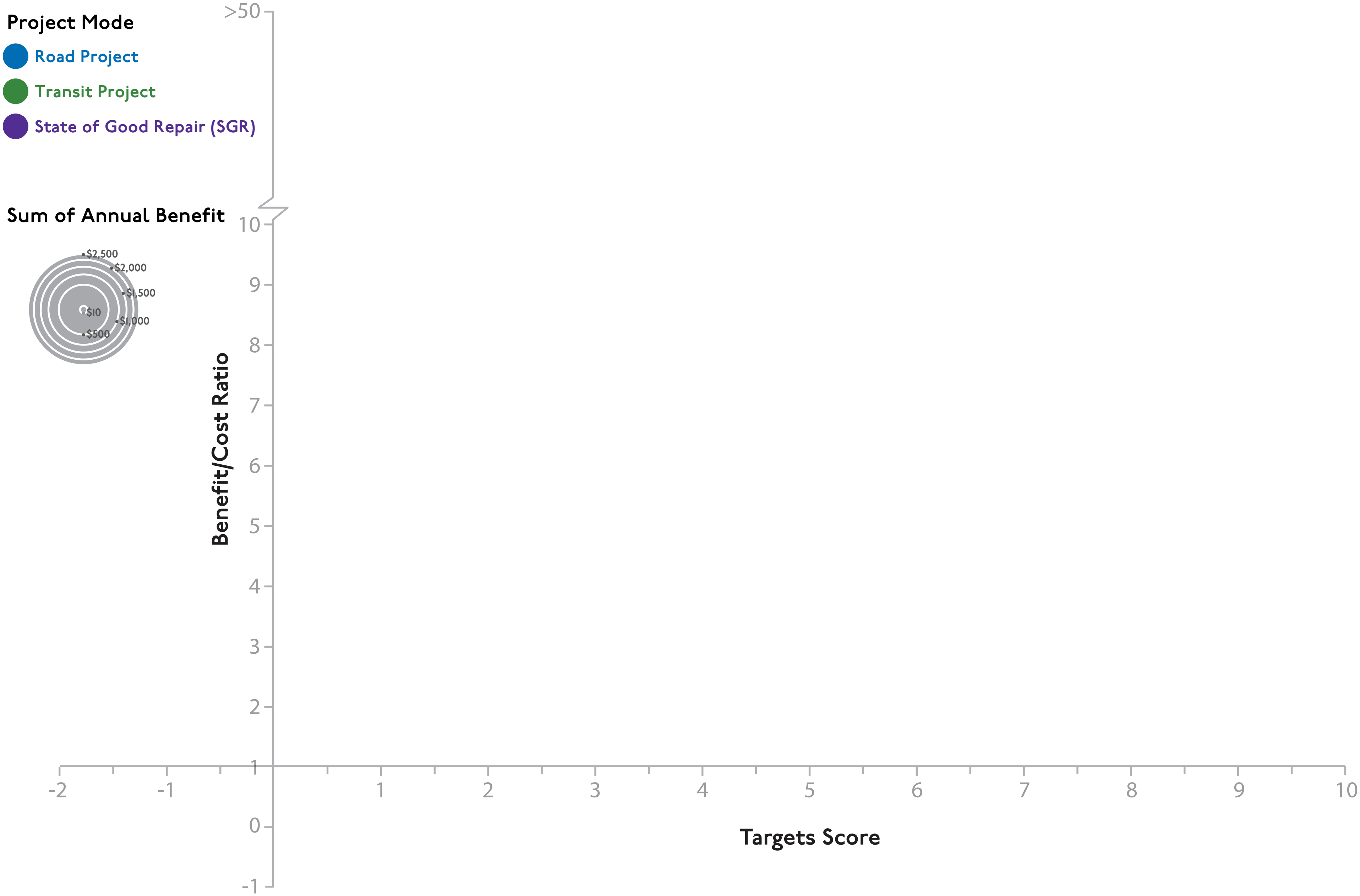
ATTACHMENT A



Plan Bay Area 2040



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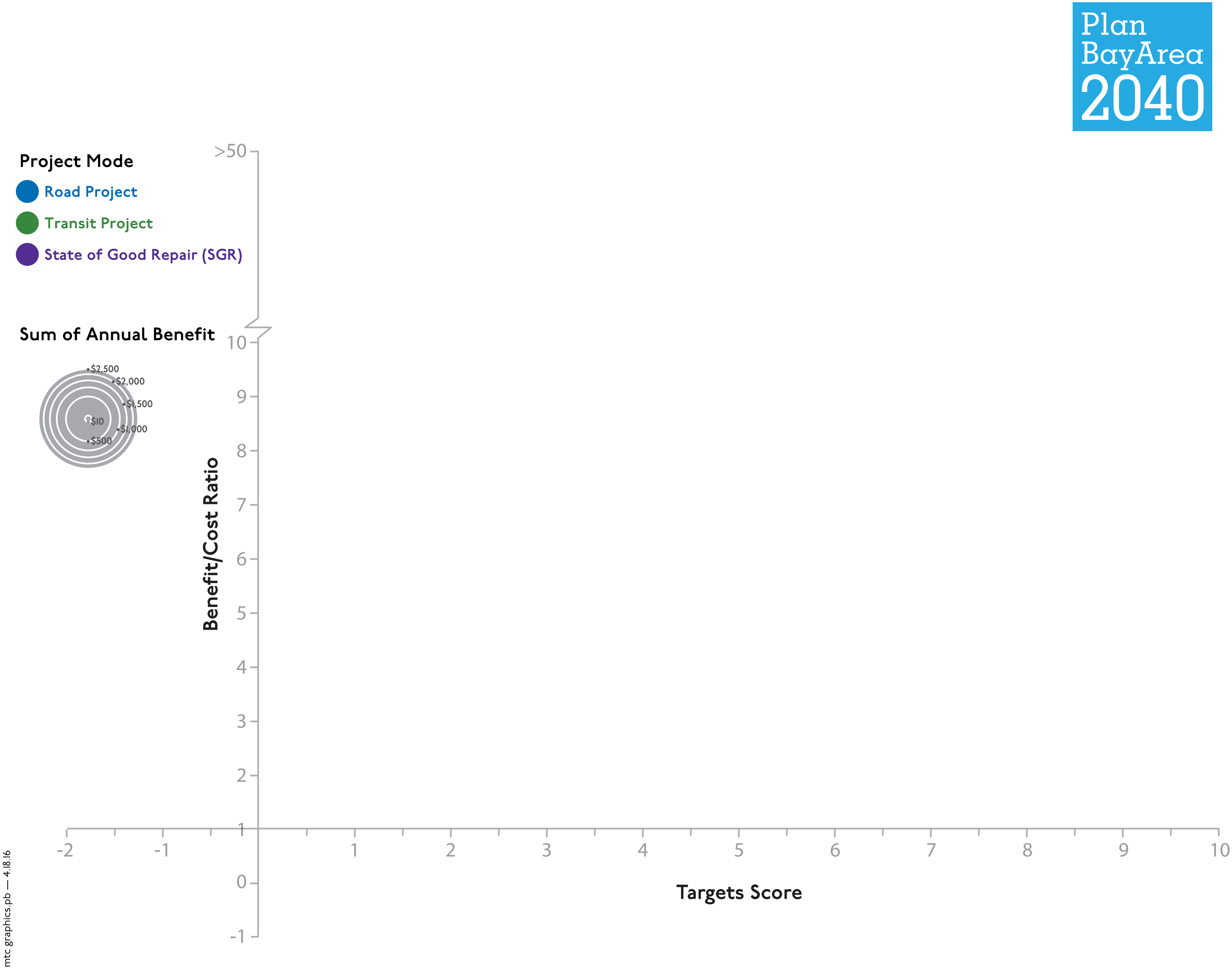
Plan BayArea 2040
Project Mode
Road Project
Transit Project
State of Good Repair (SGR)
Sum of Annual Benefit
$2,500
$2,000
$1,500
$10
$1,000
$500
>50
10
9
8
7
6
5
4
3
2
1
0
-1
Benefit/Cost Ratio
-2
-1
1
2
3
4
5
6
7
8
9
10
Targets Score
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Plan Bay Area 2040

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
REVISED DRAFT RESULTS

ATTACHMENT B

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
1	1503	**Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)**	Multi-County	Highway Maintenance	$638	($1)	>50	2.5
2	1502	**Highway Pavement Maintenance (Preserve Conditions vs. No Funding)**	Multi-County	Highway Maintenance	$2,433	$144	17	2.5
3	302	**Treasure Island Congestion Pricing (Toll + Transit Improvements)**	San Francisco	Congestion Pricing	$56	$4	14	4.5
4	1301	**Columbus Day Initiative**	Multi-County	ITS	$421	$38	11	4.0
5	209	**SR-84 Widening + I-680/SR-84 Interchange Improvements (Livermore to I-680)**	Alameda	Intraregional Road Expansion	$116	$13	9	1.0
6	501	**BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)**	Santa Clara	Rail Expansion	$472	$62	8	8.0
7	306	**Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)**	San Francisco	Congestion Pricing	$84	$11	7	7.0
8	1651	**Public Transit Maintenance - Rail Operators (Preserve Conditions vs. No Funding)**	Multi-County	Rail Maintenance	$1,351	$198	7	9.5
9	506	**El Camino Real BRT (Palo Alto to San Jose)**	Santa Clara	BRT	$85	$13	7	6.5
10	207	**San Pablo BRT (San Pablo to Oakland)**	Multi-County	BRT	$106	$16	6	7.0
11	301	**Geary BRT**	San Francisco	BRT	$124	$20	6	7.0
12	505	**Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)**	Santa Clara	Rail Expansion	$77	$12	6	5.5
13	518	**ACE Alviso Double-Tracking**	Santa Clara	Rail Efficiency	$36	$6	6	1.5
14	1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	Bus Maintenance	$623	$103	6	8.0
15	1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	Ferry	$29	$5	6	4.5
16	1001	**BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)**	Multi-County	Rail Efficiency	$430	$80	5	9.0
17	203	**Irvington BART Infill Station**	Alameda	Rail Efficiency	$30	$6	5	3.5
18	101	**Express Lane Network (US-101 San Mateo/San Francisco)**	Multi-County	Express Lanes	$48	$10	5	0.5
19	903	**Sonoma County Service Frequency Improvements**	Sonoma	Bus Frequency Improvements	$75	$15	5	5.0
20	523	**VTA Service Frequency Improvements (15-Minute Frequencies)**	Santa Clara	Bus Frequency Improvements	$103	$23	4	5.0
21	211	**SR-262 Connector (I-680 to I-880)**	Alameda	Intraregional Road Expansion	$22	$5	4	-0.5
22	1403	**Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)**	Multi-County	Local Streets Maintenance	$1,875	$428	4	3.5
23	210	**I-580 ITS Improvements**	Alameda	ITS	$44	$11	4	1.0
24	504	**Stevens Creek LRT**	Santa Clara	Rail Expansion	$144	$38	4	5.5
25	1101	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)**	Multi-County	Rail Efficiency	$195	$56	3	6.5

all benefits and costs are in millions of 2017 dollars

April 2016

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
26	605	**Jepson Parkway (Fairfield to Vacaville)**	Solano	Intraregional Road Expansion	$17	$5	3	1.0
27	1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	Ferry	$16	$5	3	2.5
28	1102	**Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capacity Expansion)**	Multi-County	Rail Efficiency	$236	$77	3	6.5
29	411	**SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)**	Contra Costa	Intraregional Road Expansion	$44	$15	3	2.0
30	507	**Vasona LRT – Phase 2 (Winchester to Vasona Junction)**	Santa Clara	Rail Expansion	$30	$11	3	5.0
31	515	**Tasman West LRT Realignment (Fair Oaks to Mountain View)**	Santa Clara	Rail Expansion	$48	$18	3	5.0
32	517	**Stevens Creek BRT**	Santa Clara	BRT	$29	$11	3	5.5
33	102	**US-101 HOV Lanes (San Francisco + San Mateo Counties)**	Multi-County	Express Lanes	$63	$25	3	2.0
34	503	**SR-152 Tollway (Gilroy to Los Banos)**	Multi-County	Interregional Road Expansion	$95	$37	3	-1.5
35	307	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Transit Center**	Multi-County	Rail Expansion	$290	$113	3	7.0
36	331	**Better Market Street**	San Francisco	BRT	$32	$13	3	4.5
37	1206	**Alameda Point-San Francisco Ferry**	Multi-County	Ferry	$12	$5	2	3.0
38	1204	**Berkeley-San Francisco Ferry**	Multi-County	Ferry	$10	$4	2	5.0
39	1302	**Express Lane Network (East and North Bay)**	Multi-County	Express Lanes	$214	$91	2	3.0
40	206	**AC Transit Service Frequency Improvements**	Multi-County	Bus Frequency Improvements	$248	$120	2	6.5
41	513	**North Bayshore LRT (NASA/Bayshore to Google)**	Santa Clara	Rail Expansion	$42	$22	2	4.0
42	604	**Solano County Express Bus Network**	Multi-County	Express Bus Network	$21	$12	2	2.5
43	522	**VTA Service Frequency Improvements (10-Minute Frequencies)**	Santa Clara	Bus Frequency Improvements	$177	$99	2	7.0
44	402	**eBART – Phase 2 (Antioch to Brentwood)**	Contra Costa	Rail Expansion	$21	$12	2	4.0
45	311	**Muni Forward Program**	San Francisco	Bus Frequency Improvements	$60	$36	2	6.5
46	901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Multi-County	Intraregional Road Expansion	$31	$19	2	3.0
47	409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	Intraregional Road Expansion	$42	$27	2	3.0
48	103	**El Camino Real Rapid Bus (Daly City to Palo Alto)**	San Mateo	Bus Frequency Improvements	$54	$36	2	2.0
49	401	**TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)**	Multi-County	Interregional Road Expansion	$75	$51	1	-0.5
50	801	**Golden Gate Transit Frequency Improvements**	Multi-County	Express Bus Network	$11	$8	1	4.5

all benefits and costs are in millions of 2017 dollars

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
51	313	**Muni Service Frequency Improvements**	San Francisco	Bus Frequency Improvements	$89	$79	**1**	**6.0**
52	312	**19th Avenue Subway (West Portal to Parkmerced)**	San Francisco	Rail Efficiency	$30	$27	**1**	**7.5**
53	502	**Express Lane Network (Silicon Valley)**	Santa Clara	Express Lanes	$43	$38	**1**	**3.0**
54	1413	**Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)**	Multi-County	Local Streets Maintenance	$194	$198	**1**	**3.5**
55	516	**VTA Express Bus Frequency Improvements**	Santa Clara	Express Bus Network	$18	$19	**0.9**	**4.5**
56	202	**East-West Connector (Fremont to Union City)**	Alameda	Intraregional Road Expansion	$10	$12	**0.9**	**1.5**
57	304	**Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Services)**	San Francisco	Express Bus Network	$16	$27	**0.6**	**6.0**
58	410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Multi-County	Ferry	$9	$16	**0.6**	**1.5**
59	403	**I-680 Express Bus Frequency Improvements**	Multi-County	Express Bus Network	$12	$21	**0.6**	**2.5**
60	404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	Interregional Road Expansion	$9	$17	**0.5**	**-0.5**
61	510	**Downtown San Jose Subway (Japantown to Convention Center)**	Santa Clara	Rail Efficiency	$10	$18	**0.5**	**6.5**
62	104	**Geneva-Harney BRT + Corridor Improvements**	Multi-County	BRT	$15	$46	**0.3**	**5.0**
63	508	**SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)**	Multi-County	Interregional Road Expansion	$57	$200	**0.3**	**1.0**
64	519	**Lawrence Freeway**	Santa Clara	Intraregional Road Expansion	$7	$34	**0.2**	**2.0**
65	601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	Intraregional Road Expansion	$5	$32	**0.2**	**2.5**
66	1304	**Bay Bridge West Span Bike Path**	San Francisco	Bike/Ped	$4	$30	**0.1**	**2.0**
67	205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	Express Bus Network	$0	$10	**0**	**5.0**
68	905	**SMART – Phase 3 (Santa Rosa Airport to Cloverdale)**	Sonoma	Rail Expansion	$0	$12	**0**	**4.0**
69	1201	**San Francisco-Redwood City + Oakland-Redwood City Ferry**	Multi-County	Ferry	$0	$8	**0**	**2.0**
70	1407	**Local Streets and Roads Maintenance (Ideal Conditions vs. Preserve Conditions)**	Multi-County	Local Streets Maintenance	TBD	TBD	**TBD**	**3.5**

all benefits and costs are in millions of 2017 dollars

April 2016

Plan Bay Area 2040 Project Performance Assessment
Summary of Feedback from Sponsors and Stakeholders
April 18, 2016

ATTACHMENT C

Staff released preliminary draft results to stakeholders in mid-March and solicited feedback on the assessment methodology and results. Staff have since made revisions to performance results, which are reflected in the results release for the MTC Commission Workshop. The bulk of the revisions have been on project-specific targets scores where sponsors provided additional information relevant to qualitative criteria. Other changes include project consolidations, rescoping of projects, and incorporation of benefit-cost results for express lane projects. This document summarizes general feedback on the results and limitations of the two primary assessments.

1. Generally, there is broad support for the six overarching findings of the assessment. Stakeholders agree that funding transit maintenance remains a high priority for the Plan update. There is also general support for the current rankings of the top performing projects, both on benefit-cost and targets score.

2. Given that performance is ultimately defined by considering both cost-effectiveness and targets performance, some stakeholders recommend a higher weight for the benefit-cost ratio, while others think the targets score should be the primary definition of performance. Some stakeholders argue that the benefit-cost assessment is model-driven and thus a more objective calculation of benefits. Other stakeholders support the targets score approach, arguing that the benefit-cost framework is missing important project benefits that are better captured in a qualitative assessment. Staff will consider these comments when recommending thresholds based on both scores to define high- and low-performers. That discussion will occur at the May Planning Committee.

3. Stakeholders and MTC staff have noted several limitations to the benefit-cost methodology. These arise mostly due to the application of a single tool, the regional travel demand model, to evaluate many different types of projects across the region. Staff have started to note several of the following limitations in the draft benefit-cost confidence assessment:
    a. The assessment does not explicitly evaluate the benefits related to relieving traffic bottlenecks caused by weaving and merging behavior at interchanges.
    Projects affected: highway operational projects like the 80/680/12 Interchange, 680/SR-4 Interchange, and SR-4 Auxiliary Lanes
    b. The benefit-cost framework does not evaluate the benefits of relieving transit crowding and reliability, which may be higher than the travel time savings associated with service improvements.
    Projects affected: transit projects in the Transbay Corridor, capacity-increasing projects in San Francisco (Muni Forward, 19th Avenue Subway)
    c. The travel model simplistically estimates freight travel behavior, meaning that it may be underestimating the freight benefits of projects, either in terms of the number of truck trips or impacts of freight-specific infrastructure like truck scales.
    Projects affected: highway projects with freight components like the 80/680/12 Interchange or the SR-152 Alignment
    d. The travel model simplistically applies an average toll when simulating the operations of express lanes. This assumption influences the performance of express lane projects that would otherwise use price signals to dynamically manage demand throughout the peak period.
    Projects affected: all express lane projects

4. Stakeholders have commented on target-specific criteria used to qualitatively evaluate projects against the 13 adopted targets for Plan Bay Area 2040. The targets that have received the most attention are the displacement risk and job creation targets:
    a. **Displacement risk** performance is defined by past displacement outcomes and anticipated future risk, as estimated by forecasted growth in Plan Bay Area. Projects that serve jurisdictions in the urban core are most affected as they will be in areas with both existing and future displacement issues. Staff notes that this is a simplistic application of the target based on available data; however, staff did not want to preempt ongoing policy conversation related to displacement risk in the context of Plan scenarios and OBAG 2.
    b. **Job creation** performance is estimated by considering the type of jobs that each transportation project would be likely to directly create. A project would support this target if it would create short-term construction jobs and long-term operations jobs required to operate new transit service or operate a transportation management center. No project in the assessment received a negative score for this target. Staff notes that this is a narrow application of the job creation target but notes that it is a consistent method for generally differentiating amongst transportation projects that all may lead to some level of indirect job creation.

Plan Bay Area 2040

PROJECT PERFORMANCE ASSESSMENT: DRAFT RESULTS & KEY FINDINGS

Image Source: https://www.flickr.com/photos/jseita/4651127555

Dave Vautin and Kristen Carnarius

April 28, 2016 – ***Commission Workshop***

What's the role of project performance?

Plan BayArea 2040

To inform a robust dialogue about regional priorities and trade-offs in a fiscally-constrained environment

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To evaluate proposed transportation investments on **a level playing field** using the same methodologies

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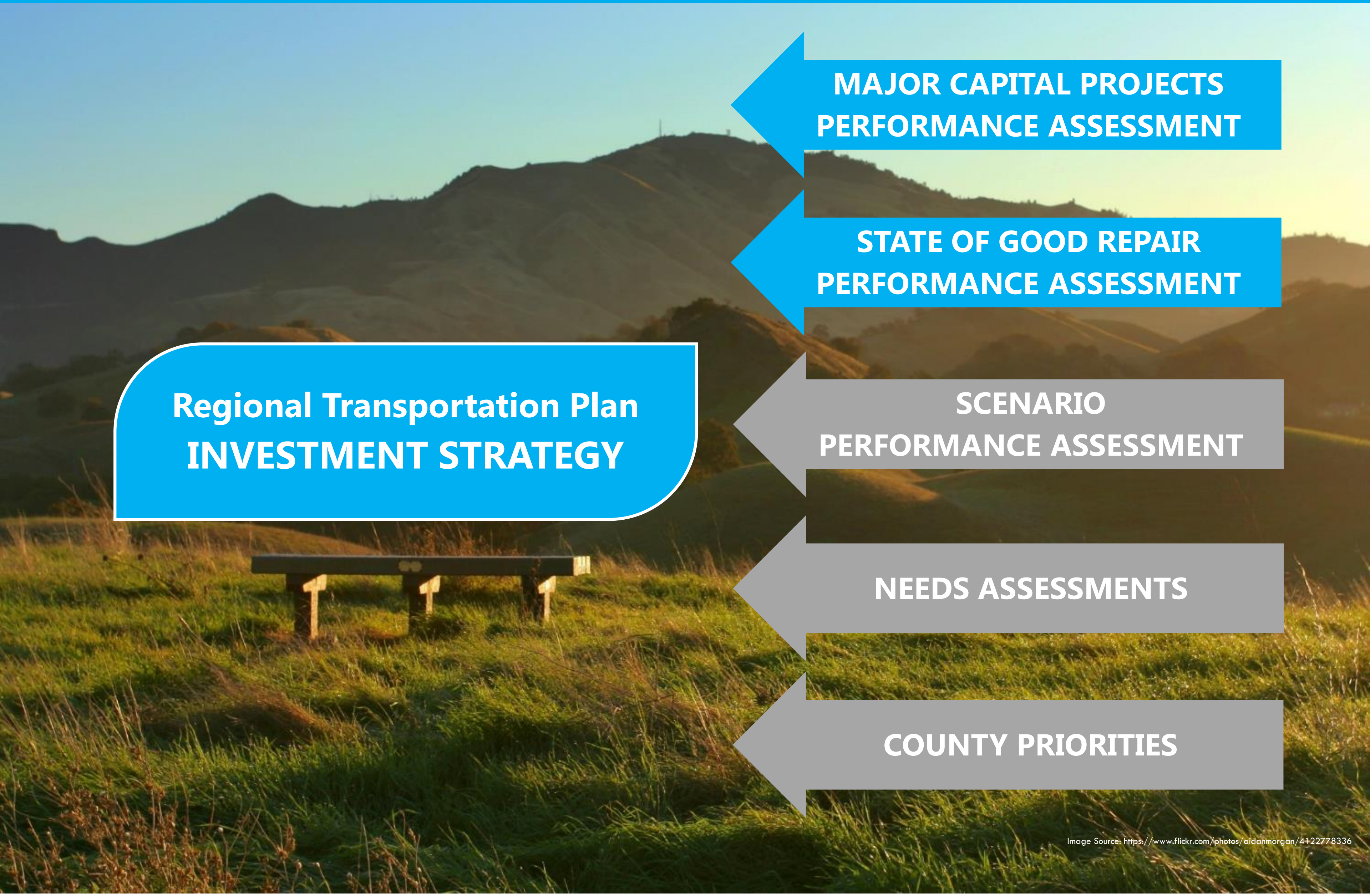
To understand how specific projects support – or adversely impact – **targets adopted by the Commission**

Image Source: https://www.flickr.com/photos/thomashawk/2442392997

The Big Picture

Plan Bay Area 2040



Regional Transportation Plan
INVESTMENT STRATEGY

- MAJOR CAPITAL PROJECTS PERFORMANCE ASSESSMENT
- STATE OF GOOD REPAIR PERFORMANCE ASSESSMENT
- SCENARIO PERFORMANCE ASSESSMENT
- NEEDS ASSESSMENTS
- COUNTY PRIORITIES

Image Source: https://www.flickr.com/photos/aidanmorgan/4122778336

How do we evaluate projects?

Plan Bay Area 2040

Rely upon the framework established in Plan Bay Area.

1. Consistently evaluate uncommitted major transportation investments
2. Identify **outliers** in performance
3. Prioritize funding for high-performing projects

Which projects?

Plan BayArea 2040

Does the project…

- Need regional funding <u>AND</u>
- Cost more than $100M <u>AND</u>
- Increase capacity or address state of good repair?

If so, then the project is evaluated as part of the performance assessment!

Road Efficiency

Transit Efficiency

Transit Expansion

Road Expansion

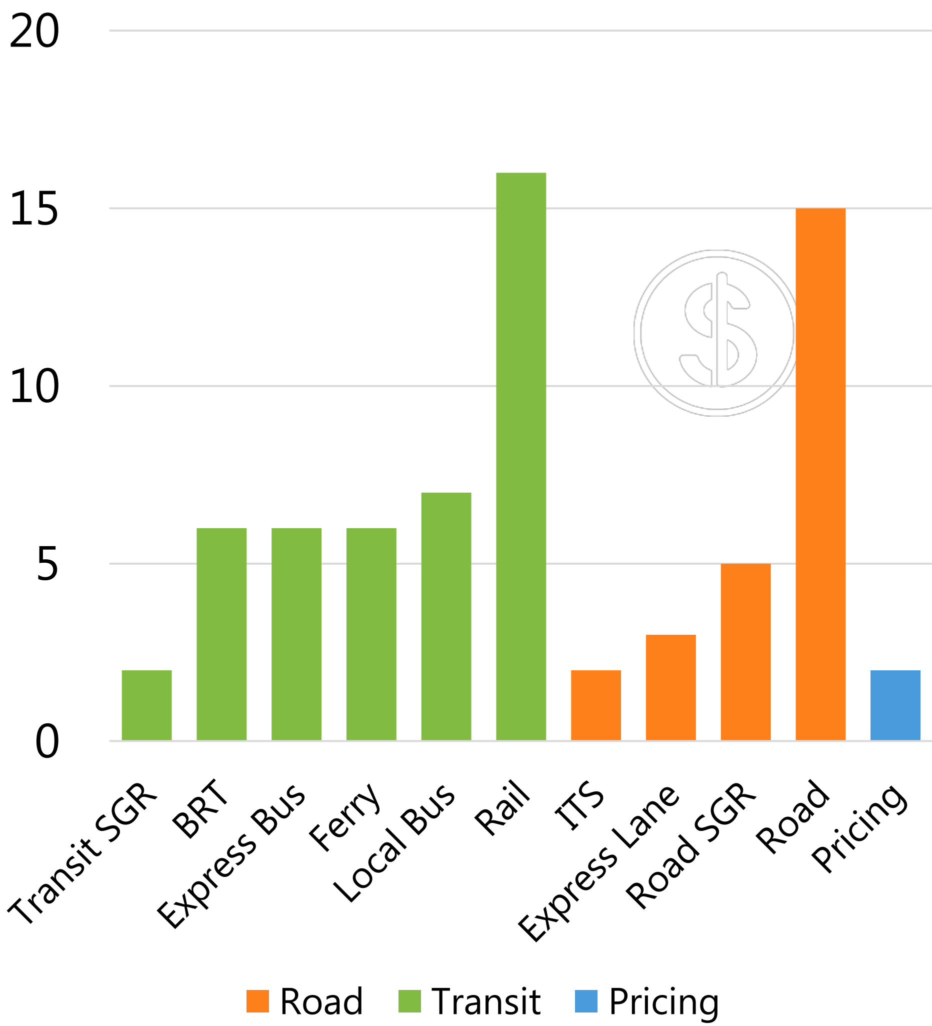
Regional Transit Maintenance

Regional Road Maintenance

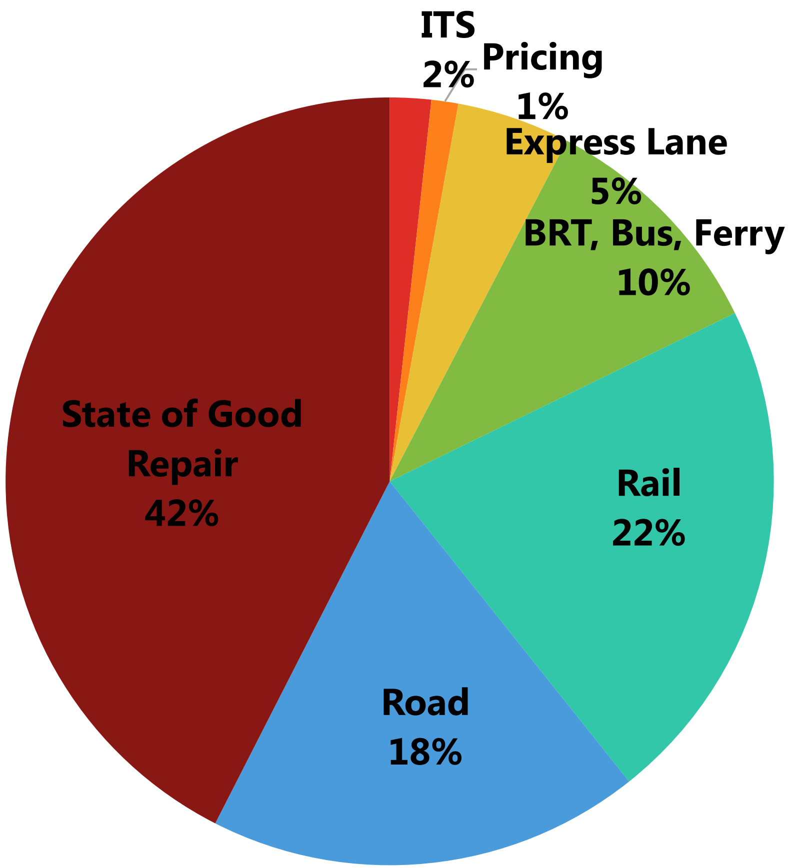
Project Performance List

Plan Bay Area 2040

Number of Projects by Type (total ~ 70)

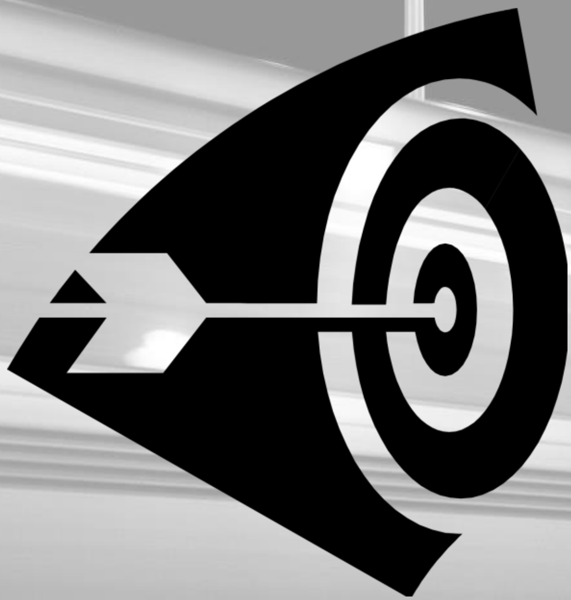


Project Cost by Type



Total Cost = $115 billion

Analysis Components



TARGETS ASSESSMENT

Assessed qualitatively using targets scores

Determine impact on adopted targets

BENEFIT-COST ASSESSMENT

Assessed quantitatively using MTC Travel Model

Evaluate relative cost-effectiveness

Image Source: https://www.flickr.com/photos/thomashawk/368102715/in/photostream/

TARGETS ASSESSMENT

Assessed qualitatively using target scores

Plan BayArea 2040

Climate Protection

Adequate Housing

Healthy & Safe Communities

Open Space & Agricultural Preservation

Housing & Transportation Costs

Affordable Housing

Displacement Risk

Access to Jobs

Job Creation

Goods Movement

Non-Auto Mode Share

Road State of Good Repair

Transit State of Good Repair

Maximum score:

13

if the project supports all 13 targets strongly

BENEFIT – COST ASSESSMENT

Assessed quantitatively using MTC Travel Model One

Plan BayArea 2040

Benefits ($)

Travel time + cost
Emissions
Collisions
Health

Costs ($)

Capital
Net operating & maintenance

Key Assumptions:

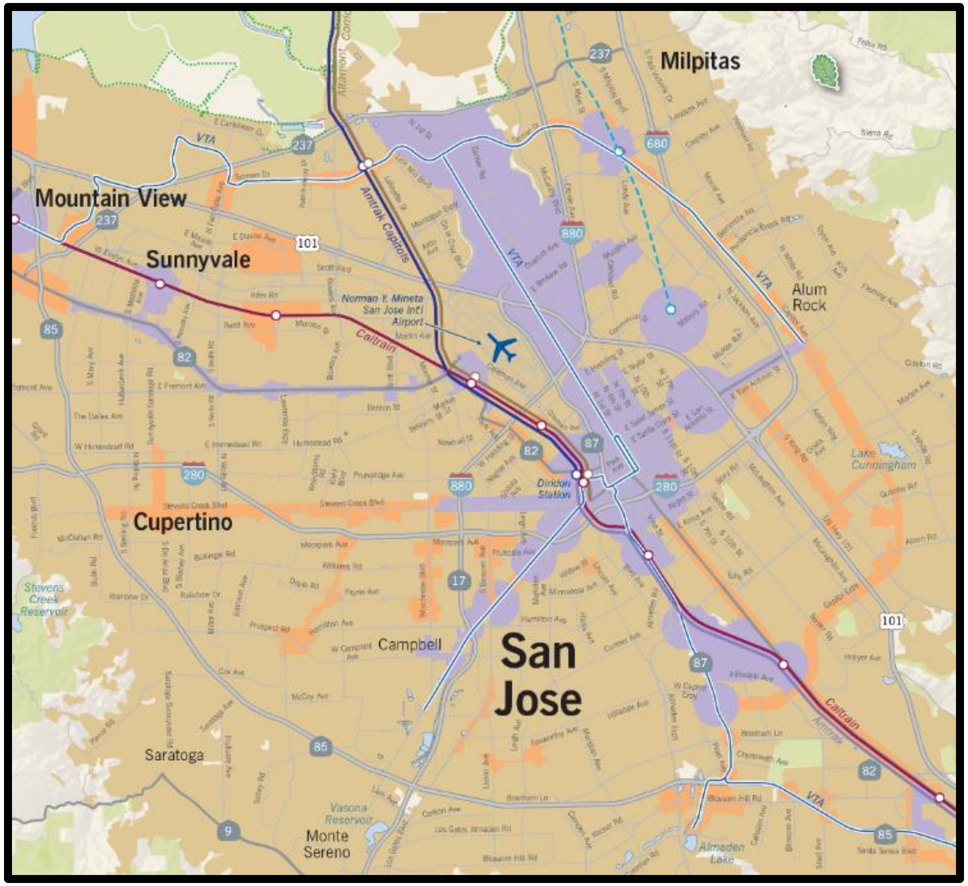
- Baseline transportation network ~ 2018
- Adopted 2040 land pattern from Plan Bay Area

Image Source: https://www.flickr.com/photos/bike/16039884863

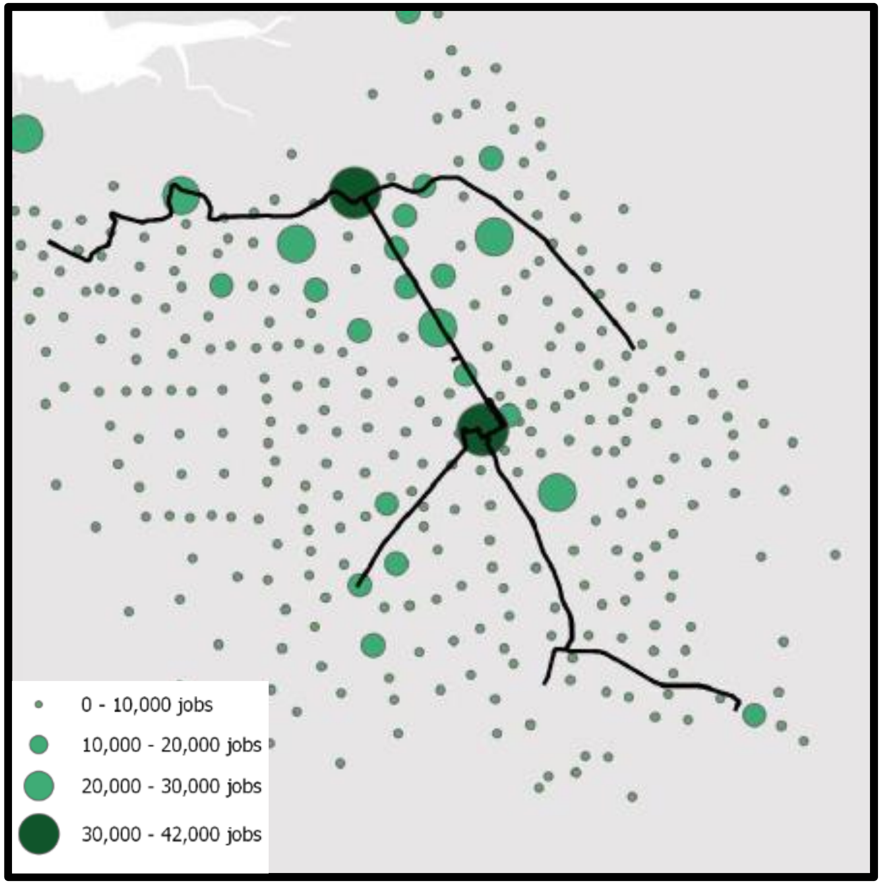
The Bay Area in 2040

From Plan Bay Area:

Almost **40%** of the **jobs** and **housing units** added from 2010 to 2040 will be in the region's 3 largest cities: **San Jose, San Francisco, and Oakland**



San Jose job distribution in year 2040



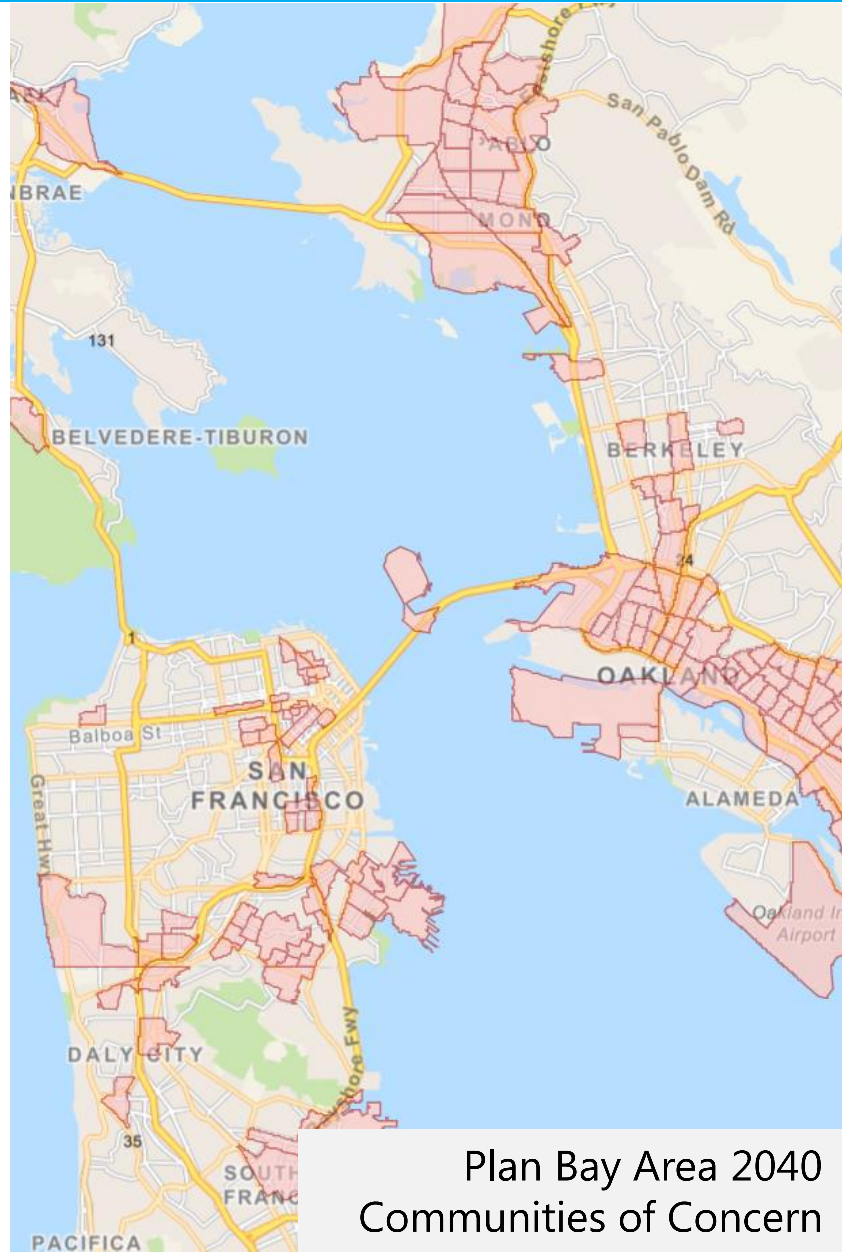
Additional Assessments

Project-Level Equity Assessment

- Equity Targets Score
- Relationship to Communities of Concern

Benefit-Cost Supplemental Assessments

- Sensitivity Testing *(testing input assumptions)*
- Confidence Assessment *(disclosing limitations)*



Plan Bay Area 2040
Communities of Concern

Key Findings

Plan Bay Area 2040

1

Maintaining regional transit infrastructure ranks as the **top priority**, given its high level of cost-effectiveness and strong support of adopted targets.

Source: Peter Beeler

2

Land use matters – projects that support Plan Bay Area growth patterns showed strong performance.

Source: CAHSR

Key Findings

Plan BayArea 2040

3

Highly-used highways and transit systems remain the **backbone of the region** – both efficiency and maintenance investments prove highly cost-effective.

Source: John Huseby

4

Projects in **chronically congested corridors** generally provide the biggest bang per buck.

Source: Noah Berger

Key Findings

Plan BayArea 2040

5 In general, road efficiency projects **outperform road expansion projects**, reflecting lower costs and fewer environmental impacts.

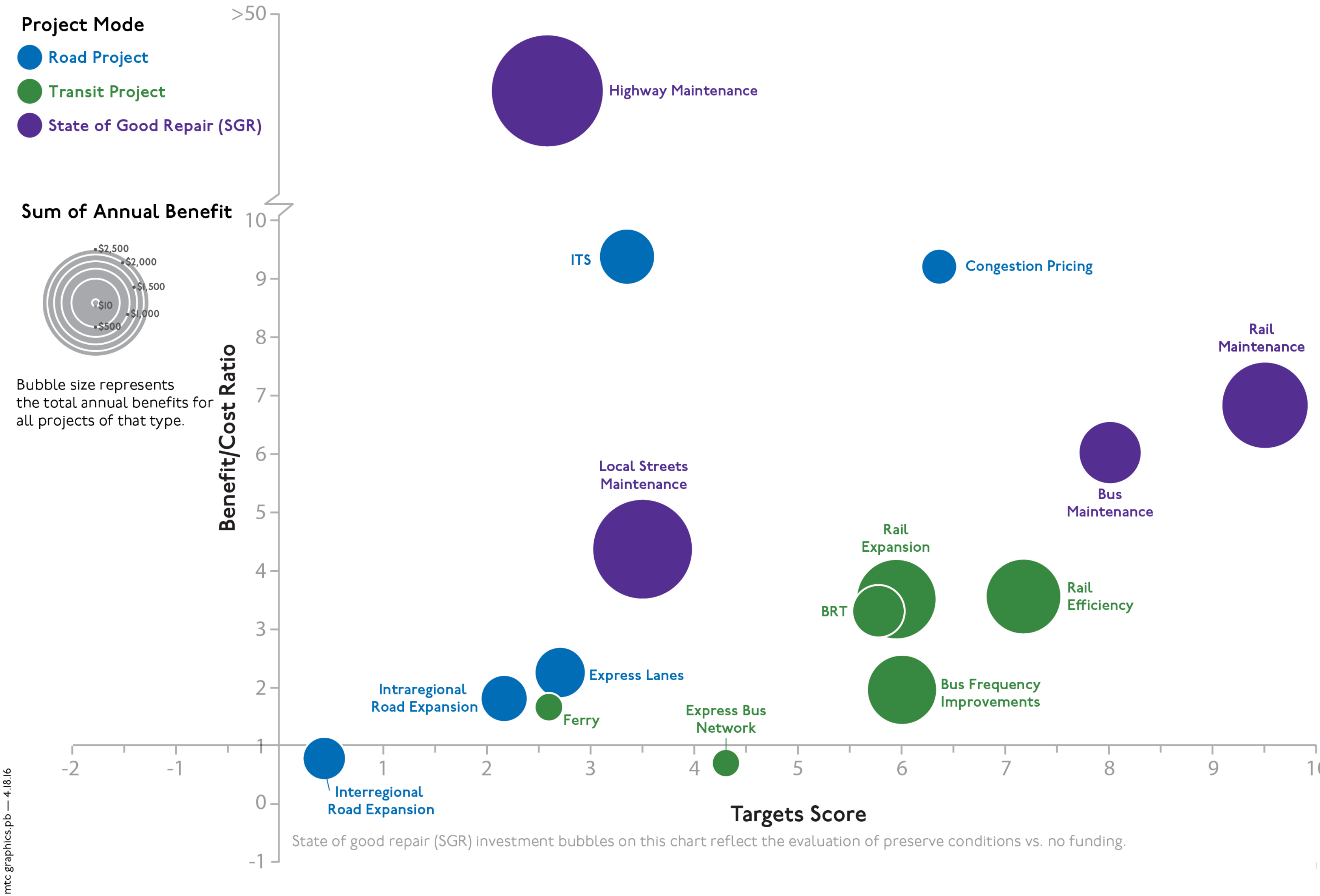
Source: Flickr/Michael Munaz

6 All of the region's highest-performing projects **increase access to Communities of Concern**.

Source: Santa Rosa City Bus

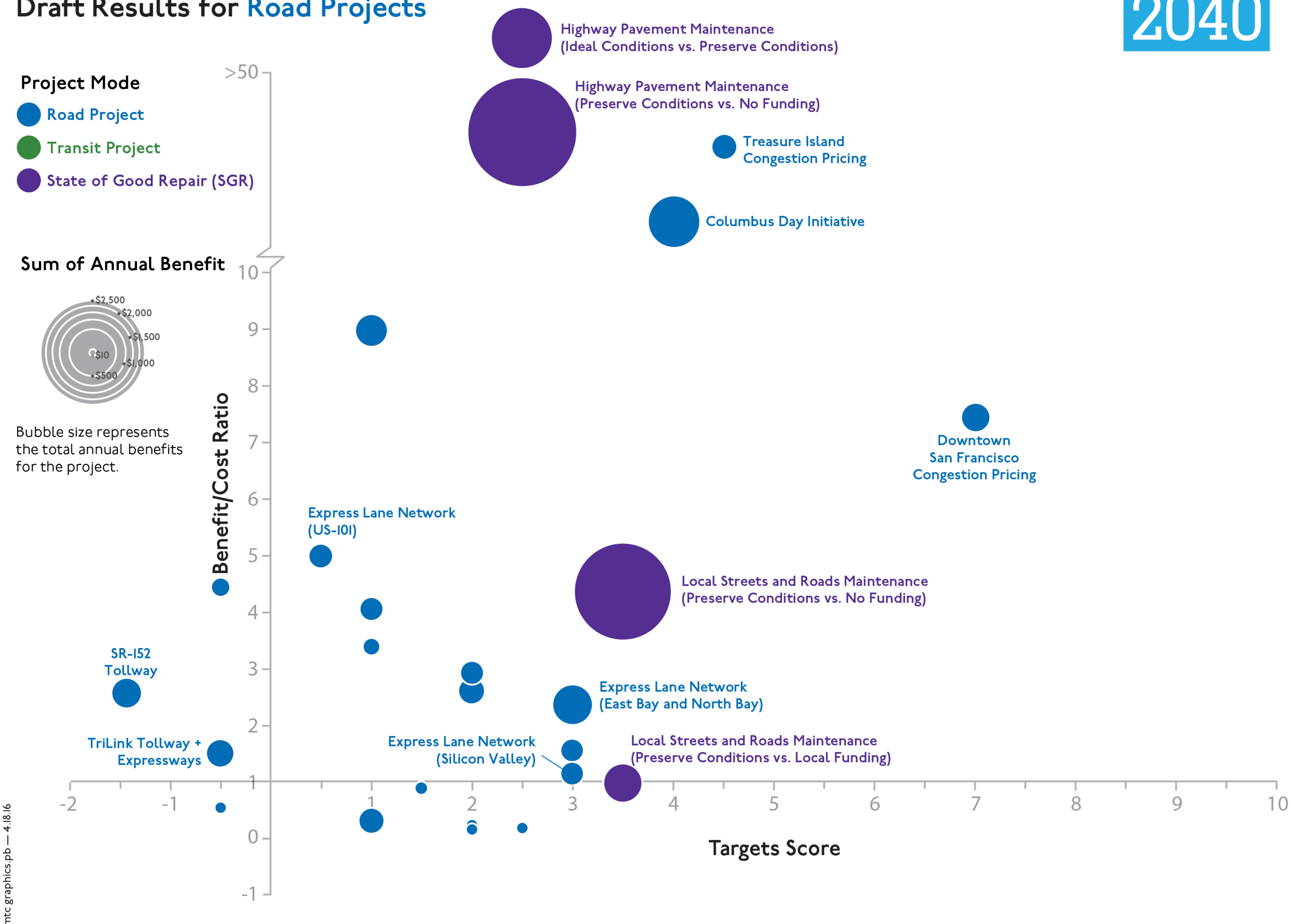
Plan Bay Area 2040

Project Performance Assessment: Overall Draft Results by Project Type



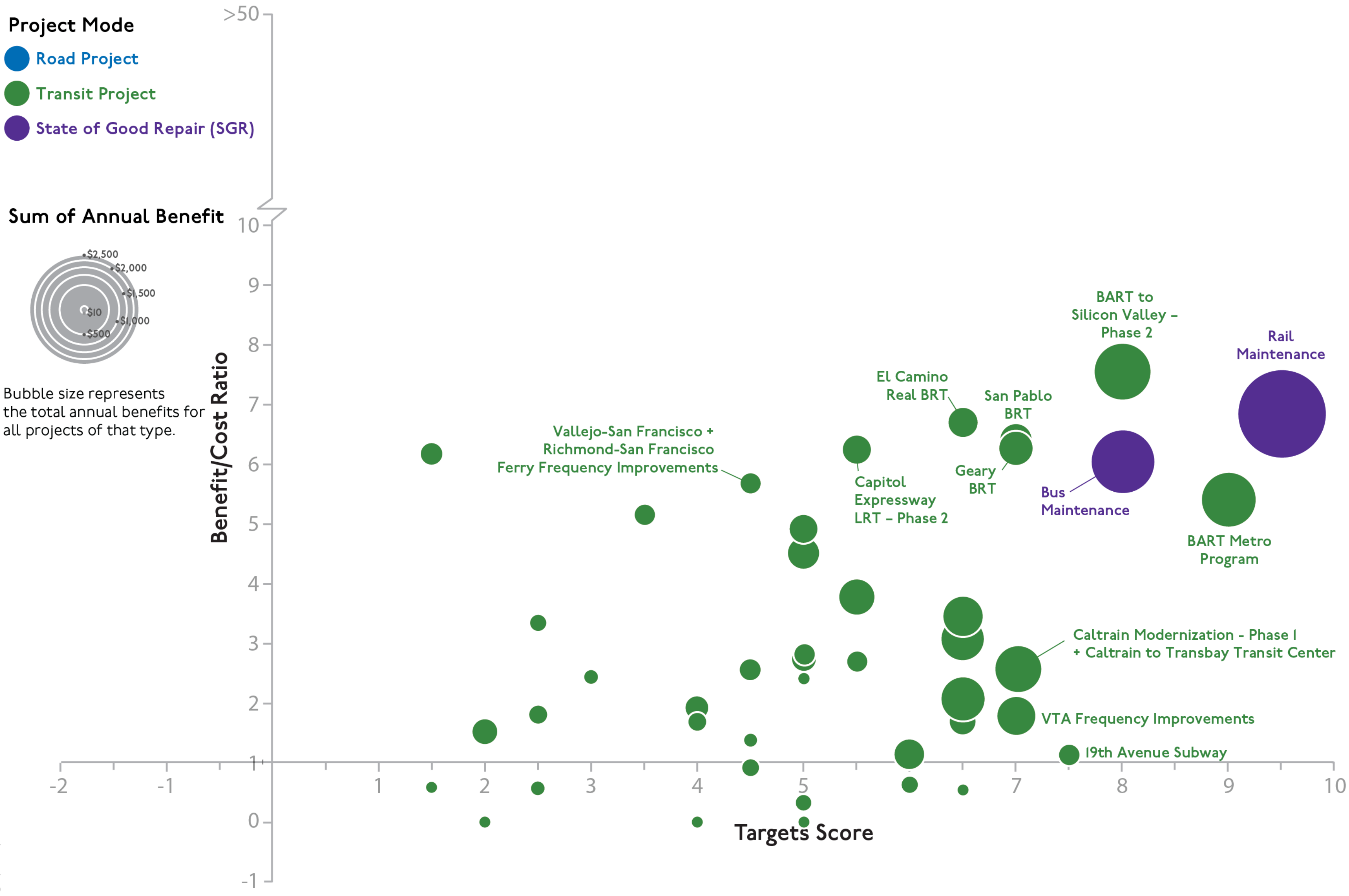
Plan Bay Area 2040

Project Performance Assessment: Draft Results for Road Projects



Plan Bay Area 2040

Project Performance Assessment: Draft Results for Transit Projects



mtc graphics.pb — 4.18.16

What have we heard from sponsors?

Plan BayArea 2040

1. Generally, **there is broad support for the six overarching findings** of the assessment.
2. Some stakeholders recommend weighting **benefit-cost ratio** more than **targets score**, while others think that targets score should be the primary definition of performance.
3. The **benefit-cost assessment has limitations**, mostly due to the application of a single tool to assess all investments.
4. Targets score criteria have caught the attention of stakeholders across the region; in particular, scores for **displacement risk** and **middle-wage jobs** have spurred conversation about how to appropriately assess projects.

Image Source: https://www.flickr.com/photos/photographingtravis/16179477606

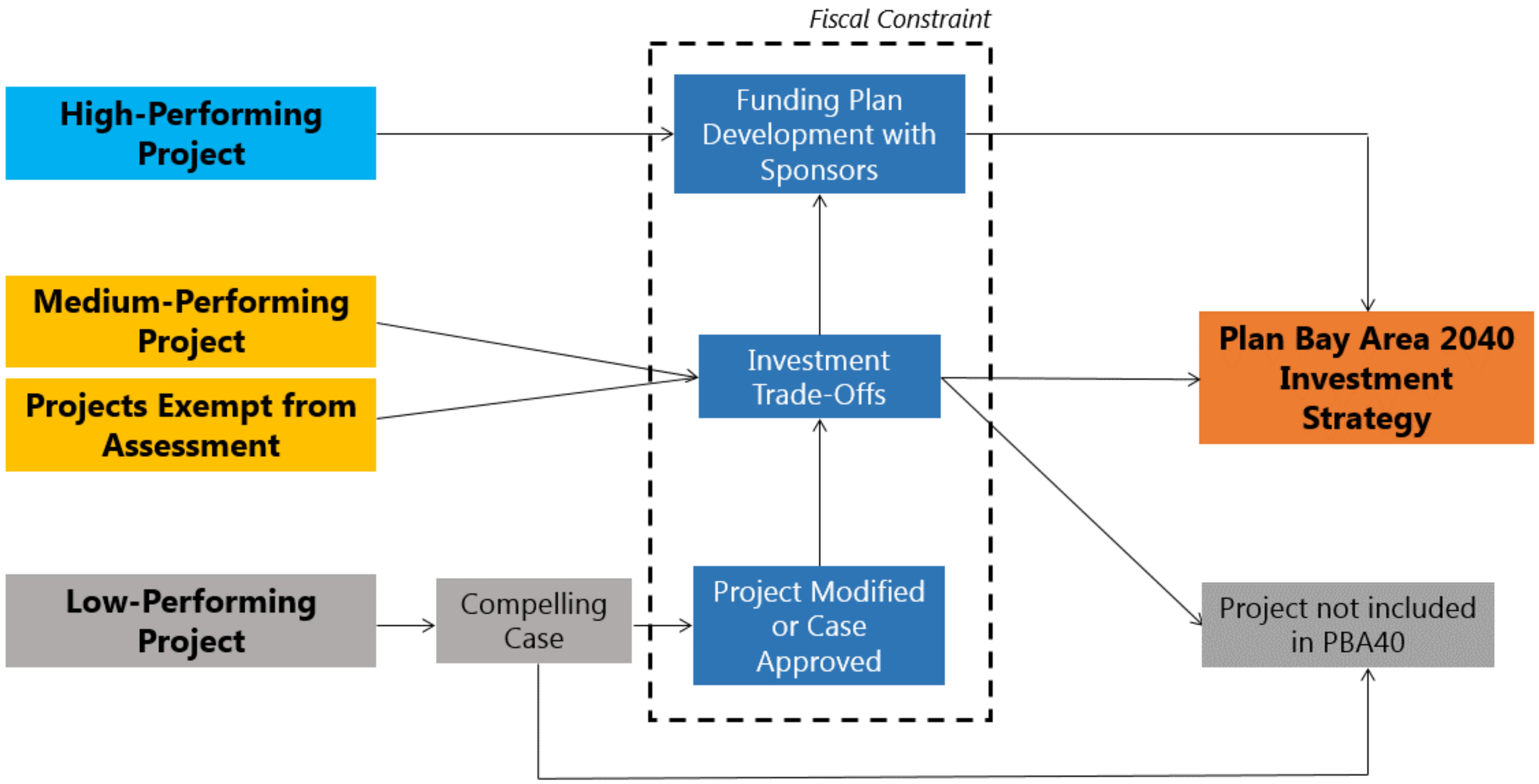
What's Next?

Plan BayArea 2040

At May Planning Committee:

How do we define a **"high-performing" project**?

How do we define a **"low-performing" project**?



What's Next?

Plan Bay Area 2040

MAY	Final performance results and staff recommendation for high- and low-performer thresholds to the MTC Planning Committee
JUNE	Deadline for low-performing project sponsors to submit compelling case to MTC staff
JULY	Staff recommendation for final actions on project performance assessment to the MTC Planning Committee
SEPTEMBER	Preferred scenario for Plan Bay Area 2040 slated for adoption by MTC and ABAG, incorporating outcomes of the performance assessment

Agenda Item 3a

METROPOLITAN
TRANSPORTATION
COMMISSION

Bay Area Metro Center
375 Beale Street
San Francisco, CA 94105
TEL 415.778.6700
WEB www.mtc.ca.gov

Memorandum

TO: Planning Committee DATE: May 6, 2016

FR: Executive Director

RE: Plan Bay Area 2040 Project Performance Assessment: Final Performance Results and Guidelines for Applying Results

At the April 2016 MTC Commission Workshop, staff presented performance results for major uncommitted transportation projects and state of good repair investments. This memorandum presents final performance results and proposes guidelines for applying the results in the transportation investment element of the preferred scenario for Plan Bay Area (PBA) 2040, which is slated for adoption in September 2016. Staff requests that the Commission approve the proposed Project Performance Assessment guidelines, which lay out thresholds for defining high and low performance results.

Background
All major uncommitted investments, including projects that expand transit and road facilities, improve road or transit efficiency, and state of good repair investments, are subject to performance assessment per MTC Resolution No. 4182 and prioritization for the investment strategy of PBA 2040. This assessment applies the same framework as PBA 2013, the currently adopted plan, with updated targets and benefit-cost methodology. Staff worked with stakeholders (congestion management agencies, transit agencies, state agencies, local jurisdictions and non-profit organizations) across multiple months in 2015 to update the project performance methodology. For the first time, staff also extended the benefit-cost methodology to state of good repair investments of highways, local streets and roads, rail and bus networks.

The assessment evaluates the degree to which potential transportation investments:

1. Are cost-effective, based on best practices for benefit-cost analysis in which the aim is to consistently quantify and monetize as many reasonably related benefits as possible.
2. Advance the thirteen performance targets adopted by MTC and ABAG in November 2015 (MTC Resolution No. 4204, Revised); and

Staff released draft results to congestion management agencies, project sponsors, and stakeholders in mid-March and presented revised results to the Commission at the end of April. Staff made additional revisions to five projects between the end of April and the May Planning Committee. Final results, reflecting the last set of revisions, are included in Attachment A and a summary of changes are included in Attachment B.

Proposed Guidelines for Incorporating Performance Results for Plan Bay Area 2040

For PBA 2013, the Planning Committee approved the following application guidelines for project performance:

1. Project performance assessment should be used to identify the highest and lowest performing projects.
2. The highest performing projects should be included in the preferred PBA 2040, subject to financial feasibility.
    a. High performance requires high B/C and moderate targets score *or* high targets score and moderate B/C
3. The lowest performing projects may be considered if the sponsor or the congestion management agency (CMA) can make a compelling case and the project has a realistic funding plan.
    a. Low performance requires low B/C *or* low targets score

Medium-performing projects and those not evaluated in the assessment are not subject to these guidelines; their inclusion in the draft preferred investment strategy will be based on county priorities, subject to financial feasibility. Attachment C illustrates the connection between performance status and inclusion in the draft preferred investment strategy.

Staff proposes to retain the framework and compelling case process from PBA 2013 and update the thresholds for defining high- and low-performance to reflect changes in performance results between PBA 2013 and PBA 2040. Attachment D includes the performance thresholds from PBA 2013 and the proposed updates for PBA 2040. Attachment E includes a draft list of the high- and low-performing projects using the thresholds in this memo.

Staff further proposes that a CMA or project **sponsor must make a compelling case in writing by June 10, 2016** why a low-performing project should be considered. Sponsors of low-performing projects have several options within the compelling case process:

- A project sponsor could drop their low-performing project.
- A project sponsor could modify their project into something that would be exempt from project assessment (e.g. funded with 100% local monies, request study funding or for a non-capacity increasing phase, scope the project to cost less than $100 million).
- A project sponsor could submit a Compelling Case for consideration by the Planning Committee under a set of eligible Compelling Case criteria. Attachment F includes a more detailed description of the proposed Compelling Case criteria.

For the latter two options, it is important to note that all projects must eventually fit within the revenue envelope of PBA 2040 (e.g. subject to fiscal constraint).

Next Steps

If the Committee approves this performance process and thresholds, staff will notify CMAs and sponsors of these guidelines and of the opportunity to submit a compelling case if project sponsors seek to include the “low performing” projects in the preferred transportation investment strategy. At the same time MTC staff will continue to work with CMAs and transit operators to develop funding plans for the “high performing” projects for inclusion in the draft preferred investment strategy. Key, near-term milestones for PBA 2040 include:

- May 2016 – MTC Planning Committee approve guidelines

- June 2016 – CMAs/Sponsors submit compelling cases in writing by June 10, 2016
- July 2016 – MTC staff reviews cases and presents recommendations to the Planning Committee for approval
- September 2016 – MTC/ABAG approves the preferred scenario for PBA 2040

Recommendation
Staff requests that this Committee adopt the proposed performance guidance, performance thresholds to be forwarded to the Commission for approval, which will allow sponsors to start the compelling case process.

Steve Heminger

Attachments
- Attachment A: Final Performance Results Table
- Attachment B: Documentation of Revisions between April and May
- Attachment C: Connection between performance results and the investment strategy
- Attachment D: Proposed Performance Thresholds
- Attachment E: Project Performance Assessment: High-Performers and Low-Performers
- Attachment F : Plan Bay Area 2040 Compelling Case Criteria
- PowerPoint

SH:kc&dv
Attachments

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Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
FINAL RESULTS

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
1	1503	**Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)**	Multi-County	Highway Maintenance	$638	($1)	>50	2.5
2	1502	**Highway Pavement Maintenance (Preserve Conditions vs. No Funding)**	Multi-County	Highway Maintenance	$2,433	$144	17	2.5
3	302	**Treasure Island Congestion Pricing (Toll + Transit Improvements)**	San Francisco	Congestion Pricing	$56	$4	14	4.5
4	1301	**Columbus Day Initiative**	Multi-County	ITS	$421	$38	11	4.0
5	209	**SR-84 Widening + I-680/SR-84 Interchange Improvements (Livermore to I-680)**	Alameda	Intraregional Road Expansion	$116	$13	9	1.0
6	501	**BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)**	Santa Clara	Rail Expansion	$472	$62	8	8.0
7	306	**Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)**	San Francisco	Congestion Pricing	$84	$11	7	7.0
8	1651	**Public Transit Maintenance - Rail Operators (Preserve Conditions vs. No Funding)**	Multi-County	Rail Maintenance	$1,351	$198	7	9.5
9	506	**El Camino Real BRT (Palo Alto to San Jose)**	Santa Clara	BRT	$85	$13	7	6.5
10	301	**Geary BRT**	San Francisco	BRT	$124	$20	6	7.0
11	505	**Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)**	Santa Clara	Rail Expansion	$77	$12	6	5.5
12	518	**ACE Alviso Double-Tracking**	Santa Clara	Rail Efficiency	$36	$6	6	1.5
13	1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	Bus Maintenance	$623	$103	6	8.0
14	1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	Ferry	$29	$5	6	4.5
15	203	**Irvington BART Infill Station**	Alameda	Rail Efficiency	$30	$6	5	3.5
16	101	**Express Lane Network (US-101 San Mateo/San Francisco)**	Multi-County	Express Lanes	$48	$10	5	0.5
17	903	**Sonoma County Service Frequency Improvements**	Sonoma	Bus Frequency Improvements	$75	$15	5	5.0
18	523	**VTA Service Frequency Improvements (15-Minute Frequencies)**	Santa Clara	Bus Frequency Improvements	$103	$23	4	5.0
19	211	**SR-262 Connector (I-680 to I-880)**	Alameda	Intraregional Road Expansion	$22	$5	4	-0.5
20	1403	**Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)**	Multi-County	Local Streets Maintenance	$1,875	$428	4	3.5
21	207	**San Pablo BRT (San Pablo to Oakland)**	Multi-County	BRT	$67	$16	4	7.0
22	210	**I-580 ITS Improvements**	Alameda	ITS	$44	$11	4	1.0
23	504	**Stevens Creek LRT**	Santa Clara	Rail Expansion	$144	$38	4	5.5
24	1001	**BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)**	Multi-County	Rail Efficiency	$430	$123	3	9.0
25	1101	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)**	Multi-County	Rail Efficiency	$195	$56	3	6.5

all benefits and costs are in millions of 2017 dollars

May 2016

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
26	605	**Jepson Parkway (Fairfield to Vacaville)**	Solano	Intraregional Road Expansion	$17	$5	3	1.0
27	1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	Ferry	$16	$5	3	2.5
28	1102	**Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capacity Expansion)**	Multi-County	Rail Efficiency	$236	$77	3	6.5
29	411	**SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)**	Contra Costa	Intraregional Road Expansion	$44	$15	3	2.0
30	507	**Vasona LRT – Phase 2 (Winchester to Vasona Junction)**	Santa Clara	Rail Expansion	$30	$11	3	5.0
31	515	**Tasman West LRT Realignment (Fair Oaks to Mountain View)**	Santa Clara	Rail Expansion	$48	$18	3	5.0
32	517	**Stevens Creek BRT**	Santa Clara	BRT	$29	$11	3	5.5
33	102	**US-101 HOV Lanes (San Francisco + San Mateo Counties)**	Multi-County	Express Lanes	$63	$25	3	2.0
34	503	**SR-152 Tollway (Gilroy to Los Banos)**	Multi-County	Interregional Road Expansion	$95	$37	3	-1.5
35	307	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Transit Center**	Multi-County	Rail Expansion	$290	$113	3	7.0
36	331	**Better Market Street**	San Francisco	BRT	$32	$13	3	4.5
37	1206	**Alameda Point-San Francisco Ferry**	Multi-County	Ferry	$12	$5	2	3.0
38	1204	**Berkeley-San Francisco Ferry**	Multi-County	Ferry	$10	$4	2	5.0
39	1302	**Express Lane Network (East and North Bay)**	Multi-County	Express Lanes	$214	$91	2	3.0
40	206	**AC Transit Service Frequency Improvements**	Multi-County	Bus Frequency Improvements	$248	$120	2	6.5
41	513	**North Bayshore LRT (NASA/Bayshore to Google)**	Santa Clara	Rail Expansion	$42	$22	2	4.0
42	502	**Express Lane Network (Silicon Valley)**	Santa Clara	Express Lanes	$69	$38	2	3.0
43	604	**Solano County Express Bus Network**	Multi-County	Express Bus Network	$21	$12	2	2.5
44	522	**VTA Service Frequency Improvements (10-Minute Frequencies)**	Santa Clara	Bus Frequency Improvements	$177	$99	2	7.0
45	402	**eBART – Phase 2 (Antioch to Brentwood)**	Contra Costa	Rail Expansion	$21	$12	2	4.0
46	311	**Muni Forward Program**	San Francisco	Bus Frequency Improvements	$60	$36	2	6.5
47	901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Multi-County	Intraregional Road Expansion	$31	$19	2	3.0
48	409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	Intraregional Road Expansion	$42	$27	2	3.0
49	103	**El Camino Real Rapid Bus (Daly City to Palo Alto)**	San Mateo	Bus Frequency Improvements	$54	$36	2	2.0
50	401	**TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)**	Multi-County	Interregional Road Expansion	$75	$51	1	-0.5

all benefits and costs are in millions of 2017 dollars

Plan Bay Area 2040

PROJECT PERFORMANCE ASSESSMENT

FINAL RESULTS

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
51	312	**19th Avenue Subway (West Portal to Parkmerced)**	San Francisco	Rail Efficiency	$39	$27	**1**	**7.5**
52	801	**Golden Gate Transit Frequency Improvements**	Multi-County	Express Bus Network	$11	$8	**1**	**4.5**
53	313	**Muni Service Frequency Improvements**	San Francisco	Bus Frequency Improvements	$89	$79	**1**	**6.0**
54	1413	**Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)**	Multi-County	Local Streets Maintenance	$194	$198	**1**	**3.5**
55	516	**VTA Express Bus Frequency Improvements**	Santa Clara	Express Bus Network	$18	$19	**0.9**	**4.5**
56	202	**East-West Connector (Fremont to Union City)**	Alameda	Intraregional Road Expansion	$10	$12	**0.9**	**1.5**
57	304	**Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Services)**	San Francisco	Express Bus Network	$16	$27	**0.6**	**6.0**
58	410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Multi-County	Ferry	$9	$16	**0.6**	**1.5**
59	403	**I-680 Express Bus Frequency Improvements**	Multi-County	Express Bus Network	$12	$21	**0.6**	**2.5**
60	404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	Interregional Road Expansion	$9	$17	**0.5**	**-0.5**
61	510	**Downtown San Jose Subway (Japantown to Convention Center)**	Santa Clara	Rail Efficiency	$10	$18	**0.5**	**6.5**
62	104	**Geneva-Harney BRT + Corridor Improvements**	Multi-County	BRT	$15	$46	**0.3**	**5.0**
63	508	**SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)**	Multi-County	Interregional Road Expansion	$57	$200	**0.3**	**1.0**
64	519	**Lawrence Freeway**	Santa Clara	Intraregional Road Expansion	$7	$34	**0.2**	**2.0**
65	601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	Intraregional Road Expansion	$5	$32	**0.2**	**2.5**
66	1304	**Bay Bridge West Span Bike Path**	San Francisco	Bike/Ped	$4	$30	**0.1**	**2.0**
67	905	**SMART – Phase 3 (Santa Rosa Airport to Cloverdale)**	Sonoma	Rail Expansion	$0	$12	**0**	**4.0**
68	1201	**San Francisco-Redwood City + Oakland-Redwood City Ferry**	Multi-County	Ferry	$0	$8	**0**	**2.0**
69	205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	Express Bus Network	$0	$10	**0**	**5.0**

all benefits and costs are in millions of 2017 dollars

May 2016

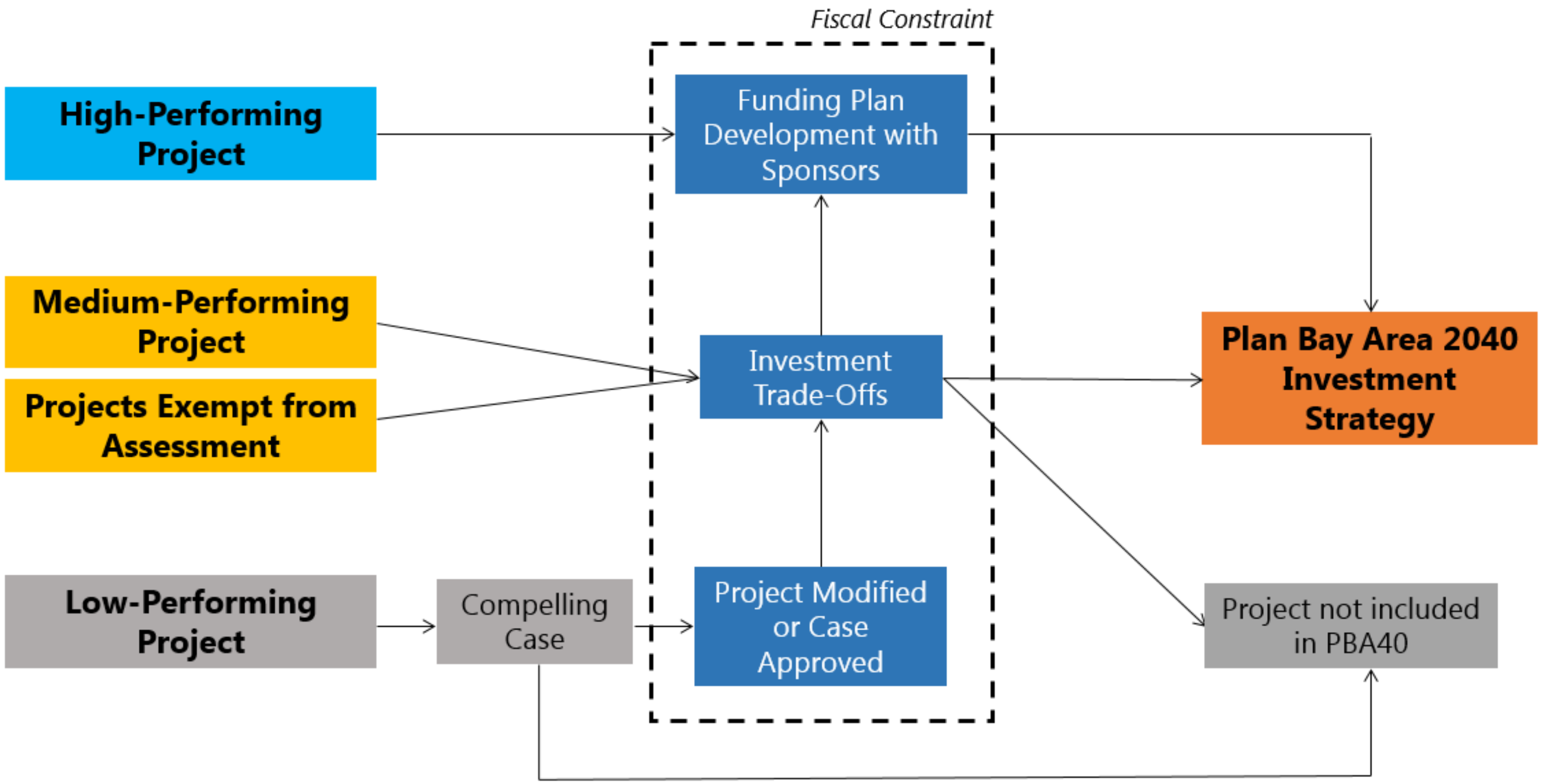
Attachment B: Summary of Revisions between April and May

Row #	Project ID	Project Name	Location (County)	Annual Benefit*	Annual Cost*	B/C Ratio
Updated annual cost information						
1	1001	BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)	Multi-County	$430	$123	**3**
Project modeling refinements						
2	207	San Pablo BRT (San Pablo to Oakland)	Multi-County	$67	$16	**4**
3	312	19th Avenue Subway (West Portal to Parkmerced)	San Francisco	$39	$27	**1**
4	502	Express Lane Network (Silicon Valley)	Santa Clara	$69	$38	**2**
Project dropped from the assessment						
5	1407	Local Streets and Roads Maintenance (Ideal Conditions vs. Preserve Conditions)	Multi-County	**--**	**--**	**--**

*all benefits and costs are in millions of 2017 dollars

Attachment C

Connection between performance results and the investment strategy



Attachment D

Proposed Performance Thresholds

Performance Definition	Plan Bay Area			Plan Bay Area 2040		
High-Performer	Benefit-Cost Ratio		Targets Score	Benefit-Cost Ratio		Targets Score
High benefit-cost ratio **and** medium targets score	≥ 10	And	≥ 2	≥ 7	And	≥ 3
High targets score **and** medium benefit-cost ratio	≥ 5	And	≥ 6	≥ 3	And	≥ 7
Low-Performer						
Low benefit-cost ratio **or** low targets score	< 1	Or	≤ -1	< 1	Or	< 0

Attachment E: Project Performance Assessment Draft High-Performers and Low-Performers**

DRAFT High-Performing Projects: High B/C (≥10) and Moderate Targets Score (≥3)
OR High Targets Score (≥7) and Moderate B/C (between 3 and 10)

Row #	Project ID	Project Name	Location (County)	B/C Ratio	Targets Score	Project Description
1	302	Treasure Island Congestion Pricing	San Francisco	**14**	**4.5**	Charges a toll for residents to exit Treasure Island with net revenues used to increase ferry and bus service to/from Treasure Island.
2	1301	Columbus Day Initiative	Multi-County	**11**	**4.0**	Increases capacity of freeways and arterials through adaptive ramp metering, signal coordination, and hard-shoulder running lanes for carpools and buses.
3	501	BART to Silicon Valley – Phase 2	Santa Clara	**8**	**8.0**	Extends BART from Berryessa through a new BART subway to Alum Rock, Downtown San Jose, Diridon Station, and Santa Clara.
4	306	Downtown San Francisco Congestion Pricing	San Francisco	**7**	**7.0**	Charges a toll to enter/exit the northeast quadrant of San Francisco with net revenues used to increase bus service, implement transit priority infrastructure, and pedestrian and bicycle improvements.
5	1651	Public Transit Maintenance – Rail Operators	Multi-County	**7**	**9.5**	Funds the maintenance of all assets related to providing existing rail service throughout the Bay Area.
6	301	Geary BRT	San Francisco	**6**	**7.0**	Constructs a bus rapid transit line with dedicated lanes along Geary Boulevard in San Francisco.
7	207	San Pablo BRT	Multi-County	**4**	**7.0**	Constructs a bus rapid transit line with dedicated lanes along San Pablo Avenue from San Pablo to downtown Oakland.
8	1650	Public Transit Maintenance – Bus Operators	Multi-County	**6**	**8.0**	Funds the maintenance of all assets related to providing existing bus service throughout the Bay Area.
9	1001	BART Metro Program	Multi-County	**3**	**9.0**	Increases frequency on all BART lines through infrastructure upgrades, new turnbacks and providing new express train service to SFO.
10	307	Caltrain Modernization + Caltrain to Transbay Transit Center	Multi-County	**3**	**7.0**	Electrifies the Caltrain line to support faster and more frequent high-capacity transit from San Jose to San Francisco and constructs a tunnel from the existing 4th and King terminus to the Transbay Terminal.

**thresholds for high- and low-performing projects reflect staff proposals for May 2016 Planning Committee; results on this table are revised draft results and subject to change before final results are released in mid-May.

DRAFT Low-Performing Projects: Low B/C (<1) OR Low Targets Score (<0)**

Row #	Project ID	Project Name	Location (County)	B/C Ratio	Targets Score	Project Description
1	211	SR-262 Connector	Alameda	**4**	**-0.5**	Upgrades existing facility to freeway standard from I-880 to I-680 and grade separates the facility.
2	401	TriLink Tollway + Expressways	Multi-County	**1**	**-0.5**	Constructs a new tollway from Brentwood to Tracy that would replace the existing Vasco Road, upgrades Byron Highway and constructs a new east-west facility at Byron Airport.
3	503	SR-152 Tollway	Multi-County	**3**	**-1.5**	Realigns SR-152 on a new facility east of Gilroy.
4	516	VTA Express Bus Frequency Improvements	Santa Clara	**0.9**	**4.5**	Increases frequency on VTA express bus routes from south to north Santa Clara County.
5	202	East-West Connector	Alameda	**0.9**	**1.5**	Constructs a new facility between I-880 and SR-238 in Fremont near the Union City BART station.
6	304	Southeast Waterfront Transportation Improvements	San Francisco	**0.6**	**6.0**	Increases transit service to a new Hunters Point Transit Center including new express bus service to downtown San Francisco.
7	410	Antioch-Martinez-Hercules-San Francisco Ferry	Multi-County	**0.6**	**1.5**	Implements ferry service between Antioch, Martinez, Hercules and downtown San Francisco.
8	403	I-680 Express Bus Frequency Improvements	Multi-County	**0.6**	**2.5**	Increases express bus frequencies along I-680 between the Tri-Valley and Central Contra Costa County.
9	404	SR-4 Widening	Contra Costa	**0.5**	**-0.5**	Widens SR-4 to six lanes from Laurel Road to Balfour Road and to four lanes from Balfour Road to the San Joaquin County Line.
10	510	Downtown San Jose Subway	Santa Clara	**0.5**	**6.5**	Constructs a subway in downtown San Jose that would replace four surface stations with two underground stations.
11	104	Geneva Harney BRT + Corridor Improvements	Multi-County	**0.3**	**5.0**	Constructs a full interchange at Candlestick/US-101, extends Geneva Avenue to US-101, constructs a bus bridge in Hunters Point and implements a bus rapid transit line from Hunters Point Transit Center to the Balboa Park BART Station.
12	508	SR-17 Tollway + Santa Cruz LRT	Multi-County	**0.3**	**1.0**	Replaces Highway 17 with a tolled tunnel from Los Gatos to Santa Cruz and extends light rail from Vasona Junction to downtown Santa Cruz on the new facility.
13	519	Lawrence Freeway	Santa Clara	**0.2**	**2.0**	Upgrades Lawrence Expressway to a freeway facility with grade separations and minor widening at interchanges.

Row #	Project ID	Project Name	Location (County)	B/C Ratio	Targets Score	Project Description
14	601	I-80/I-680/SR-12 Interchange Improvements	Solano	**0.2**	**2.5**	Widens I-80 and I-680 in the vicinity of the interchange and constructs direct-connectors, as well as HOV connector ramps, between I-80, I-680, and SR-12.
15	1304	Bay Bridge West Span Bike Path	San Francisco	**0.1**	**2.0**	Constructs a bike facility on the western span of the Bay Bridge between Treasure Island and San Francisco.
16	905	SMART – Phase 3	Sonoma	**0**	**4.0**	Extends SMART service from north of Santa Rosa to Windsor, Healdsburg, and Cloverdale.
17	1201	San Francisco-Redwood City Ferry + Oakland-Redwood City Ferry	Multi-County	**0**	**2.0**	Implements ferry service from San Francisco and Oakland to the Port of Redwood City.
18	205_15	Express Bus Bay Bridge Contraflow Lane	Multi-County	**0**	**5.0**	Implements a westbound bus-only lane on the eastbound deck of the Bay Bridge during the AM peak period.

**thresholds for high- and low-performing projects reflect staff proposals for May 2016 Planning Committee; results on this table are revised draft results and subject to change before final results are released in mid-May.

Attachment F: Project Performance Assessment Draft Compelling Case Criteria

A case can be made to include a low-performing project in the preferred Plan Bay Area 2040 transportation investment plan if the project is financially feasible and falls under one of the categories listed below. The first category, which applies to projects with a low benefit-cost ratio only, acknowledges that some benefits are not fully captured in the regional travel forecast model. The second category, which applies to all projects, acknowledges that federal requirements give special preference to certain kinds of investments, such as those that improve air quality or benefit low-income or minority communities.

Category 1: Benefits Not Captured by the Travel Model	Category 2: Federal Requirements
a) interregional or recreational corridor b) provides significant goods movement benefits** c) project benefits accrue from reductions in weaving, transit vehicle crowding, or other travel behaviors not well represented in the travel model d) enhances system performance based on complementary new funded investments	a) cost-effective means of reducing CO_2, PM, or ozone precursor emissions b) improves transportation mobility/reduces air toxics and PM emissions in communities of concern

**updated criteria from Plan Bay Area which replaces the criteria for accessing international airports with providing significant goods movement benefits

Plan Bay Area 2040

Project Performance Assessment:

Final Results + Guidelines for Applying Results

Image Source: https://www.flickr.com/photos/thomashawk/92733663

Dave Vautin and Kristen Carnarius

May 13, 2016 – ***Planning Committee***

Project Performance Objectives

Plan BayArea 2040

To inform a robust dialogue about regional priorities and trade-offs in a fiscally-constrained environment

---

To evaluate proposed transportation investments on **a level playing field** using the same methodologies

---

To identify outliers (high-performers and low-performers) with respect to targets support and cost-effectiveness

Image Source: https://www.flickr.com/photos/thomashawk/2442392997

Revisions & Final Performance Results

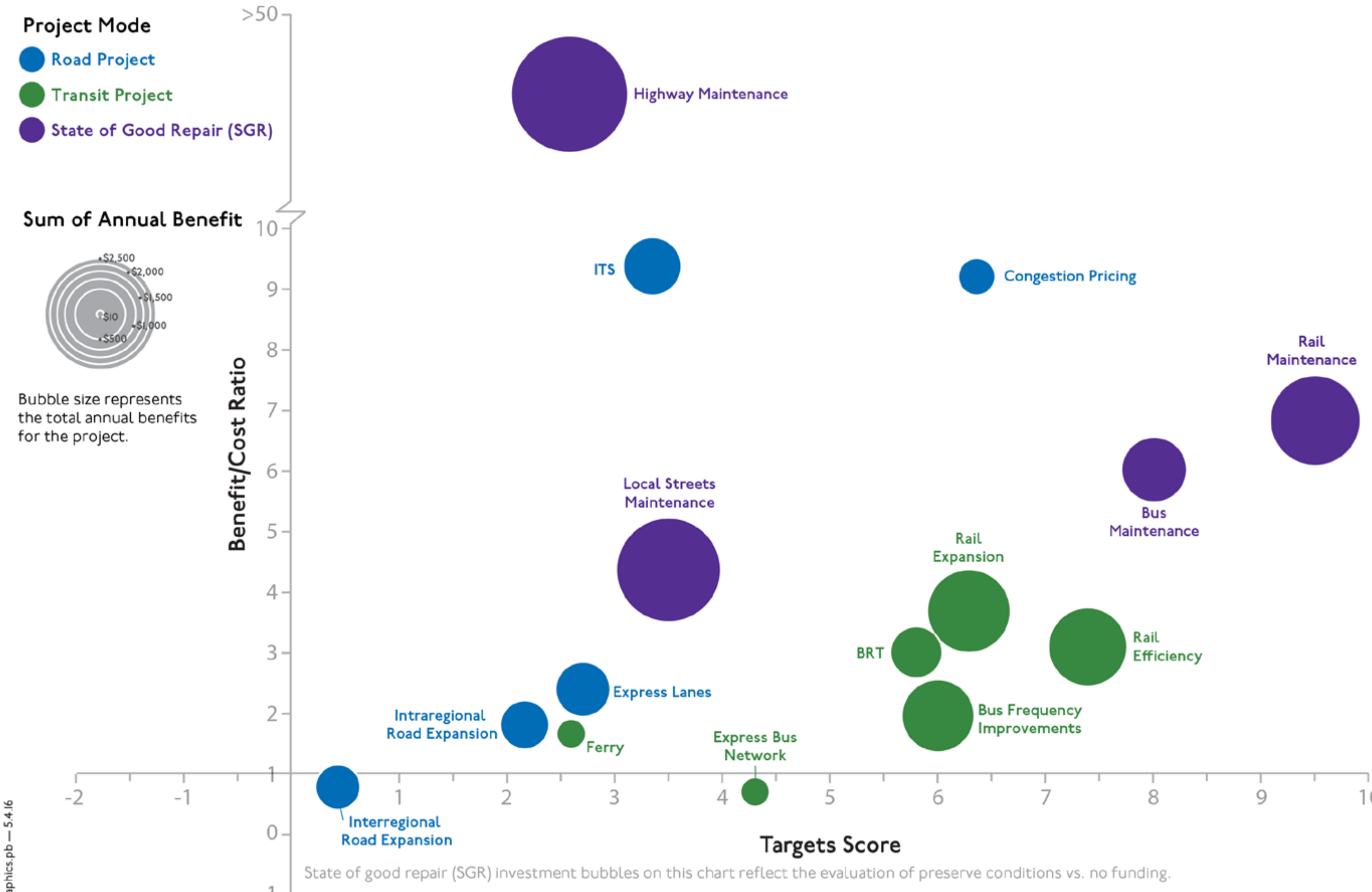
Plan
BayArea
2040

Staff has made select revisions to project performance results based on feedback received from sponsors.

- **Modest effect overall on outlier projects** (high- and low-performers)
- **Most changes have been related to targets scores** to reflect refined project definition and to maximize consistency
- Several project sponsors have **scaled back their proposed projects to pilot programs or environmental studies**, exempting them from further evaluation

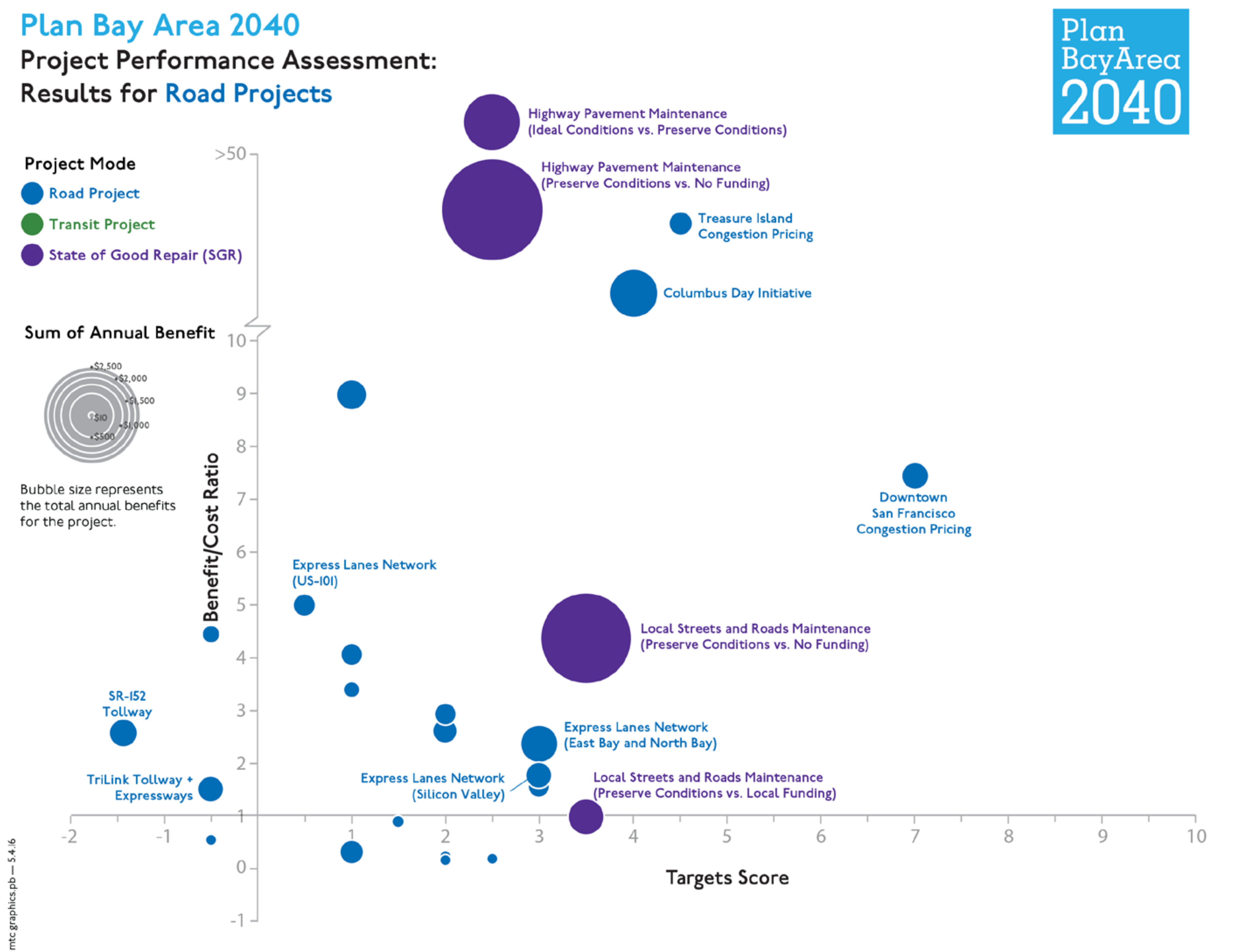
Plan Bay Area 2040

Project Performance Assessment: Overall Results by Project Type



State of good repair (SGR) investment bubbles on this chart reflect the evaluation of preserve conditions vs. no funding.

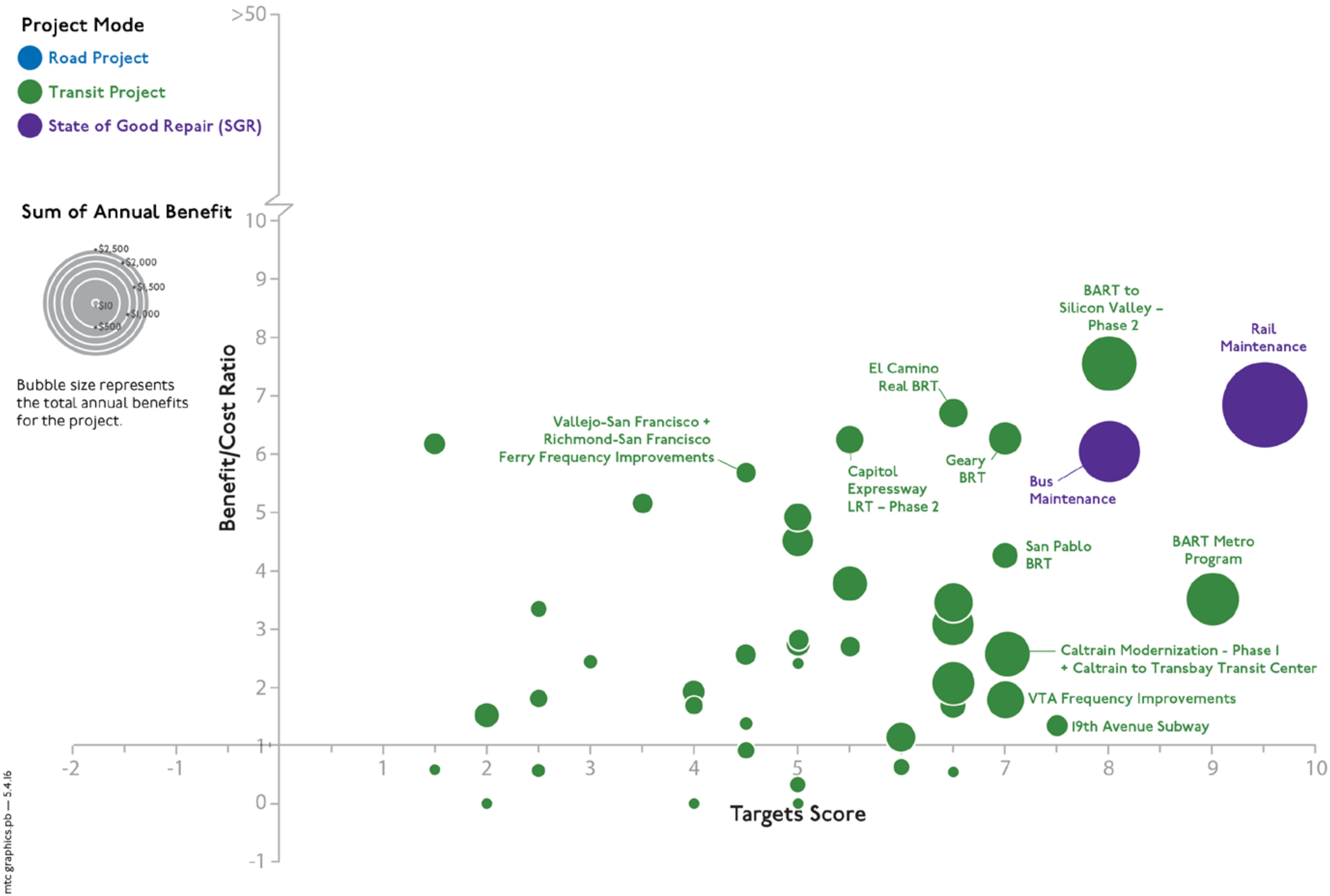
mtc graphics.pb — 5.4.16



Plan Bay Area 2040
Project Performance Assessment:
Results for Road Projects
Plan BayArea 2040
Project Mode
Road Project
Transit Project
State of Good Repair (SGR)
Sum of Annual Benefit
$2,500
$2,000
$1,500
$10
$1,000
$500
Bubble size represents the total annual benefits for the project.
Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)
Highway Pavement Maintenance (Preserve Conditions vs. No Funding)
Treasure Island Congestion Pricing
Columbus Day Initiative
Downtown San Francisco Congestion Pricing
Express Lanes Network (US-101)
Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)
SR-152 Tollway
Express Lanes Network (East Bay and North Bay)
TriLink Tollway + Expressways
Express Lanes Network (Silicon Valley)
Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)
Benefit/Cost Ratio
Targets Score
mtc graphics.pb — 5.4.16

Plan Bay Area 2040

Project Performance Assessment: Results for Transit Projects



mtc graphics.pb — 5.4.16

Proposed Thresholds

Plan Bay Area 2040

High benefit-cost ratio and **medium** targets score
- Plan Bay Area: B/C ≥ 10 and TS ≥ 2
- **Plan Bay Area 2040: B/C ≥ 7 and TS ≥ 3**

Medium benefit-cost ratio and **high** targets score
- Plan Bay Area: B/C ≥ 5 and TS ≥ 6
- **Plan Bay Area 2040: B/C ≥ 3 and TS ≥ 7**

→ **High-Performing Project**

All other projects → **Medium-Performing Project**

Low benefit-cost ratio or **low** targets score
- Plan Bay Area: B/C < 1 or TS ≤ -1
- **Plan Bay Area 2040: B/C < 1 or TS < 0**

→ **Low-Performing Project**

Plan Bay Area 2040 **Projects Breakdown**	**10** high-performers	**41** medium-performers	**18** low-performers

Proposed High-Performing Projects

Plan BayArea 2040

1 Rail Maintenance

2 Bus Maintenance

3 Columbus Day Initiative

4 Downtown San Francisco Congestion Pricing

5 Treasure Island Congestion Pricing

Proposed High-Performing Projects

Plan
BayArea
2040

6 BART to Silicon Valley: Phase 2

7 Caltrain Modernization + Extension to Transbay

Image Source: https://www.instagram.com/p/qexmPMLVrt/?taken-by=gocaltrain

8 BART Metro Program

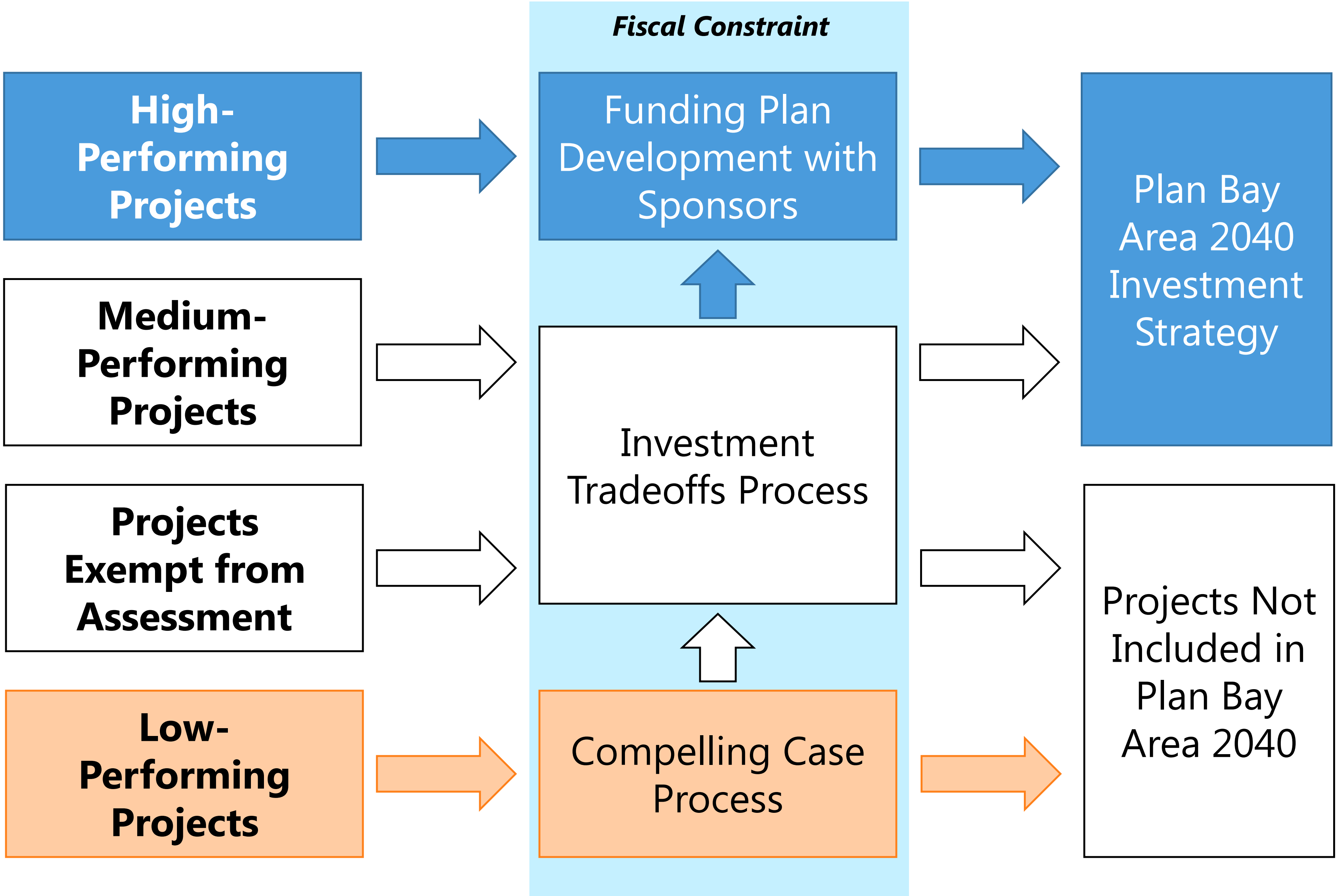
9 San Pablo BRT

10 Geary BRT

Image Source: https://www.flickr.com/photos/pfsullivan_1056/6276359727

Proposed Process *(same as Plan Bay Area)*

Plan BayArea 2040



Proposed Compelling Case Framework

Plan BayArea 2040

Staff Recommendation: Rely upon the framework established in Plan Bay Area, with two minor revisions:

- Remove international airport compelling case due to model upgrades that address this limitation.
- Add goods movement compelling case to recognize freight model limitations.

CATEGORY 1	CATEGORY 2
Benefits Not Captured by the Travel Model	**Federal Requirements**
a) interregional or recreational corridor ~~b) provides access to international airports~~ **provides significant goods movement benefits** c) project benefits accrue from reductions in weaving, transit vehicle crowding, or other travel behaviors not well represented in the travel model d) enhances system performance based on complementary new funded investments	a) cost-effective means of reducing CO_2, PM, or ozone precursor emissions b) improves transportation mobility/reduces air toxics and PM emissions in communities of concern

What's Next?

Plan BayArea 2040

JUNE	Deadline for low-performing project sponsors to submit compelling cases to MTC staff
JULY	Staff recommendation for final actions on project performance assessment to the MTC Planning Committee *(including compelling cases)*
SEPTEMBER	Preferred scenario for Plan Bay Area 2040 slated for adoption by MTC and ABAG, incorporating outcomes of the performance assessment

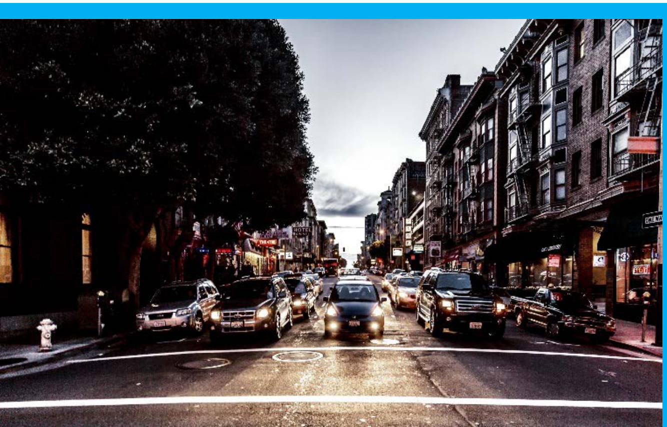


Image Sources: https://www.flickr.com/photos/davidedamico/16712437942/ https://www.facebook.com/sanfranciscobayferry/photos/pb.355219391208985.-2207520000.1460387922./557053587692230/ https://www.facebook.com/VTARapid/photos/pb.851498654963776.-2207520000.1460399887./889950214451953

Agenda Item 6

TO:	Joint MTC Planning Committee with the ABAG Administrative Committee	DATE:	July 2, 2015
FR:	MTC Executive Director and ABAG Executive Director		
RE:	Plan Bay Area 2040 Goals & Targets and Project Performance Update		

This memorandum presents the draft staff recommendation for goals and performance targets for Plan Bay Area 2040. Over the past three months, staff has been working closely with the Plan Bay Area 2040 Performance Working Group to update the adopted performance targets from Plan Bay Area. In line with the limited and focused nature of this update to Plan Bay Area, the goals and performance targets build upon the foundation of the prior Plan. Staff will seek approval of the Plan goals and targets at the September meeting of the Joint MTC Planning Committee with the ABAG Administrative Committee.

Background

Performance-based planning is a central element of the long-range planning process for MTC and ABAG. Plan Bay Area, the region's first integrated Regional Transportation Plan/Sustainable Communities Strategy, included a set of ten performance targets that were used to evaluate over a dozen different scenarios and hundreds of transportation projects. Plan Bay Area 2040 will preserve and build upon the performance-based planning process used as part of Plan Bay Area. Performance targets will again be used to compare Plan scenarios, highlight tradeoffs between policy goals, analyze proposed investments, and flag issue areas where the Plan may fall short. Regional performance targets will guide Plan development and will be supplemented in the future by required federal performance measures.

Goals and Performance Targets: Outreach & Engagement

The draft staff recommendation for goals and performance targets was extensively informed by meetings with key stakeholders, as well as outreach with the general public earlier this spring. Staff worked with the Performance Working Group, whose members include representatives of local governments, transportation agencies, non-profit organizations, and MTC's Policy Advisory Council, to identify suitable measures and targets to address key issue areas. A complete list of Performance Working Group members is included in **Attachment A**. In addition, staff sought feedback directly from the public at each of the county workshops in April and May, which generated valuable information about policy priorities for each Bay Area county.

Staff reviewed recommended changes to the performance targets through the lens of the technical criteria established in Plan Bay Area. These criteria, listed in **Attachment B** and **Attachment C**, emphasize that targets must be quantifiable and need to be able to be influenced by the Plan, among other factors. Most importantly, staff was cognizant of the importance of identifying a limited set of targets. While numerous statistics are produced over the course of the planning process via technical summaries, the Plan performance targets need to focus on the highest-priority metrics that reflect the region's most important long-term priorities.

Goals and Performance Targets: Draft Recommendation

Given the focused nature of this update to Plan Bay Area, staff recommends preserving the existing goals from Plan Bay Area and making strategic revisions to the performance targets. **Attachment D** summarizes the draft staff recommendation for Plan Bay Area 2040 goals and performance targets. Note that four targets have been carried over directly from Plan Bay Area, with modest changes recommended to another target (Adequate Housing). New targets proposed for inclusion in this Plan relate to public health, affordable housing, access to jobs, and state of good repair.

The proposed targets have a greater emphasis on transportation and housing in response to feedback received from the public at our initial round of workshops. Furthermore, the targets incorporate key improvements recommended by members of the Performance Working Group, such as an integrated public health target and an additional equity target serving as a proxy for displacement risk. Note that, at this time, MTC staff and ABAG staff are offering different proposals for target #2 (Adequate Housing) for your consideration. MTC's proposed language incorporates the in-commute language agreed to in the Building Industry Association settlement agreement. **Attachment E** outlines ABAG staff's objections to this approach. See **Attachment F** for MTC's response.

Project Performance Assessment

Before evaluating scenarios using the performance targets, MTC staff proposes conducting a performance assessment for uncommitted transportation projects, consistent with the approach taken in Plan Bay Area. This project-level evaluation will incorporate qualitative and quantitative analyses to identify both the project's level of support for adopted targets and its relative cost-effectiveness. The project performance assessment will identify high- and low-performing transportation investments and help inform scenario development by identifying regional priorities. Staff intends to work closely with the Performance Working Group this summer to identify methodological enhancements to the project performance assessment.

In addition to evaluating uncommitted expansion and operational improvement projects, staff proposes to incorporate state of good repair investments into the project performance assessment for the first time. Given the funding levels required to operate and maintain the existing system (87 percent of total revenue in Plan Bay Area), MTC believes it is appropriate to evaluate these projects in a manner consistent to other projects, thus allowing for an "apples-to-apples" performance comparison across all investment types. New state of good repair performance targets have been identified to align with this new element of the project performance assessment, in addition to better communicating the impacts of deferred maintenance on transportation system users.

Next Steps

- **Summer 2015:** Develop and document performance target methodologies
- **September 2015:** Seek approval of Plan Bay Area 2040 goals & targets
- **Fall 2015:** Define scenarios for evaluation in Plan Bay Area 2040
- **December 2015:** Release project performance assessment results for public review
- **Winter 2016:** Release scenario performance assessment results for public review

Ezra Rapport

Steve Heminger

ER/SH:dv

J:\COMMITTE\Planning Committee\2015\07_July_2015\6_PBA40_GoalsTargets_ProjectPerformance.docx

ATTACHMENT A: PERFORMANCE WORKING GROUP MEMBERSHIP

Category	Organization	Representative
Congestion Management Agencies	Alameda County Transportation Commission	Saravana Suthanthira
	San Francisco County Transportation Authority	Dan Tischler
	Sonoma County Transportation Authority	Chris Barney
Cities and Counties	City of Livermore	Bob Vinn
	City of San Jose	Jessica Zenk
	County of Contra Costa	Abigail Kroch
Transit Agencies	Bay Area Rapid Transit	Andrew Tang
	San Francisco Municipal Railway	Teresa Tapia
	Sonoma-Marin Area Rail Transit	Linda Meckel
	Valley Transportation Authority	George Naylor
Regional and State Agencies	Bay Area Air Quality Management District	Jaclyn Winkel
	California Department of Transportation	Cameron Oakes
	California Department of Public Health	Neil Maizlish
NGOs (Economy)	Building Industry Association	Paul Campos
	Working Partnerships USA	Louise Auerhahn
NGOs (Environment)	Greenbelt Alliance	Matt Vander Sluis
	Sierra Club	Matt Williams
NGOs (Equity)	TransForm	Clarrissa Cabansagan
	Center for Sustainable Neighborhoods	Tim Frank
MTC Policy Advisory Council	MTC Policy Advisory Council (Santa Clara County)	Randi Kinman
	MTC Policy Advisory Council (Solano County)	Richard Burnett
	MTC Policy Advisory Council (San Mateo County)	Richard Hedges

ATTACHMENT B: PRIMARY TECHNICAL CRITERIA FOR SELECTING PERFORMANCE TARGETS

#	Criterion
1	**Targets should be able to be forecasted well.** A target must be able to be forecasted reasonably well using MTC's and ABAG's models for transportation and land use, respectively. This means that the target must be something that can be predicted with reasonable accuracy into future conditions, as opposed to an indicator that can only be observed.
2	**Targets should be able to be influenced by regional agencies in cooperation with local agencies.** A target must be able to be affected or influenced by policies or practices of ABAG, MTC, BAAQMD and BCDC, in conjunction with local agencies. For example, MTC and ABAG policies can have a significant effect on accessibility of residents to jobs by virtue of their adopted policies on transportation investment and housing requirements.
3	**Targets should be easy to understand.** A target should be a concept to which the general public can readily relate and should be represented in terms that are easy for the general public to understand.
4	**Targets should address multiple areas of interest.** Ideally, a target should address more than one of the three "E's" – economy, environment, and equity. By influencing more than one of these factors, the target will better recognize the interactions between these goals. Additionally, by selecting targets that address multiple areas of interest, we can keep the total number of targets smaller.
5	**Targets should have some existing basis for the long-term numeric goal.** The numeric goal associated with the target should have some basis in research literature or technical analysis performed by MTC or another organization, rather than being an arbitrarily determined value.

ATTACHMENT C: PRIMARY TECHNICAL CRITERIA FOR IDENTIFYING A SET OF TARGETS

#	Criterion
A	**The total number of targets selected should be relatively small.** Targets should be selected carefully to make technical analysis feasible within the project timeline and to ensure that scenario comparison can be performed without overwhelming decision-makers with redundant quantitative data.
B	**Each of the targets should measure distinct criteria.** Once a set of targets is created, it is necessary to verify that each of the targets in the set is measuring something unique, as having multiple targets with the same goal unnecessarily complicates scenario assessment and comparison.
C	**The set of targets should provide some quantifiable metric for each of the identified goals.** For each of the seven goals identified, the set of performance measures should provide some level of quantification for each to ensure that that particular goal is being met. Multiple goals may be measured with a single target, resulting in a smaller set of targets while still providing a metric for each of the goals.

ATTACHMENT D: RECOMMENDED GOALS AND PERFORMANCE TARGETS

	Proposed Goal	#	Proposed Target	Same Target as PBA?
STATUTORY TARGETS	Climate Protection	1	Reduce per-capita CO_2 emissions from cars and light-duty trucks by **15%**	✓
STATUTORY TARGETS	Adequate Housing	2	*ABAG Proposal / Current Target*: House **100%** of the region's projected growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents **-- OR --** *MTC Proposal*: House **100%** of the region's projected growth by income level with no increase in in-commuters over the Plan baseline year	✓
VOLUNTARY TARGETS	Healthy and Safe Communities	3	Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by **10%**	
VOLUNTARY TARGETS	Open Space and Agricultural Preservation	4	Direct **all** non-agricultural development within the urban footprint (existing urban development and UGBs)	✓
VOLUNTARY TARGETS	Equitable Access	5	Decrease the share of lower-income residents' household income consumed by transportation and housing by **10%**	✓
VOLUNTARY TARGETS	Equitable Access	6	Increase the share of affordable housing in PDAs by **[TBD]%**	
VOLUNTARY TARGETS	Economic Vitality	7	Increase the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit by **[TBD]%** in congested conditions	
VOLUNTARY TARGETS	Transportation System Effectiveness	8	Increase non-auto mode share by **10%**	✓
VOLUNTARY TARGETS	Transportation System Effectiveness	9	Reduce vehicle operating and maintenance costs due to pavement conditions by **100%**	
VOLUNTARY TARGETS	Transportation System Effectiveness	10	Reduce per-rider transit delay due to aged infrastructure by **100%**	

ATTACHMENT E:

ASSOCIATION OF BAY AREA GOVERNMENTS

Representing City and County Governments of the San Francisco Bay Area

ABAG

TO: Joint MTC Planning Committee with the ABAG Administrative Committee
FR: Ezra Rapport, Executive Director ABAG
RE: ABAG's Approach to Adequate Housing Target in Plan Bay Area 2040
Date: July 10, 2015

ABAG, in collaboration with MTC, has made substantial progress in the strategies to reduce GHG emissions. Transit, biking and walking are strongly supported in Priority Development Areas (PDAs) and corridors. ABAG is working very closely with local jurisdictions to build necessary housing in PDAs. For the first time in many decades, the Bay Area has seen a substantial increase in in-fill housing development in PDAs. These accomplishments are effective responses to the two required targets for Plan Bay Area:

1. Reduce per-capita CO2 emissions from cars and light-duty trucks by 15 percent
2. House 100 percent of the region's projected growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents

ABAG proposes to retain the original targets as approved in Plan Bay Area 2013. MTC proposes to change target 2 to: "House 100 percent of the region's projected growth by income level with no increase in in-commuters over the Plan baseline year."

ABAG does not agree that it is realistic to create a Performance Target of "no increase in in-commuters over the Plan baseline year." Performance targets are written to help guide the policies, regulations and legislation ("policies") to impact the Plan. All of the other performance measures in the Plan can be affected by such policies, and these actions will be considered and assessed throughout the development of the Plan. In the case of inter-regional commuting, however, there is no known policy that holds the in-commute of residents from neighboring counties to the Plan baseline year. With an increase in employment in the Bay Area, particularly in the Tri Valley and Silicon Valley, the historical trend shows that there will be an actual increase in in-commuters over the baseline year. Since there are no policies to help the region achieve the proposed target of zero increase in the in-commute over the baseline year, the adoption of such a target will be misleading to the public and other stakeholders who are concerned with the impact of the forecasted increase in in-commuting, particularly in the 580 corridor. As ABAG is responsible for providing a reasonable and realistic forecast of housing and jobs, based on best practices, sound economic analysis and strong policies, we view this performance target as misleading to other agencies that rely on ABAG's forecast for infrastructure planning.

Attachment F

TO:	Joint MTC Planning Committee with the ABAG Administrative Committee	DATE:	July 2, 2015
FR:	Steve Heminger, MTC Executive Director		
RE:	Performance Target #2[Subject]		

This brief memo describes MTC staff's rationale for proposing changes to the language of performance target #2 – House 100% of the region's projected population growth. We have customarily referred to the first two performance targets (the other relates to greenhouse gas reductions) as the "statutory" or "required" targets because they are contained in – or derive from – Senate Bill 375. As currently stated, however, performance target #2 does not quite measure up to that mark in two respects.

First, the current language includes the phrase "without displacing current low-income residents" which is not included in state law. The ABAG and MTC boards decided to add this language because of the importance of the issue in the region. Since the phrase is not statutory, we propose to address the displacement issue under the terms of performance target #6 – Increase the share of affordable housing in PDAs by [TBD] %.

Second, following adoption of Plan Bay Area, the two agencies were sued by the Building Industry Association of the Bay Area (BIA Bay Area) about, among other things, whether we were correctly interpreting the statutory phrase "house 100% of the region's projected population growth." ABAG and MTC settled the lawsuit with BIA Bay Area by agreeing to interpret the statutory phrase to mean that we would plan for "no increase in in-commuters over the Plan baseline year." MTC staff simply proposes to include that agreed-upon interpretation in performance target #2.

ABAG staff objects. They assert that "there are no policies to help the region achieve the proposed target of zero increase in the in-commute" when building more affordable housing in the Bay Area is certainly one such policy. If ABAG staff mean to say there are no policies that can *guarantee* the in-commute result, that is obviously the case. Neither agency can force prospective homeowners to live in the Bay Area instead of the Central Valley. But neither can we force the region's residents to ride in the bicycle lanes we will construct in an attempt to meet performance target #8. Nor can we require commuters to patronize the new rail lines and bus service we will provide in an attempt to meet performance targets #7 & 10.

ABAG staff also express concern that forecasting no increase in in-commuting will somehow be "misleading to other agencies that rely on ABAG's forecast for infrastructure planning." Well, the most notable such infrastructure agency is MTC itself – and we don't feel at all misled. To the contrary, we believe it would be deeply misleading to adopt a performance target that ignores a legally-enforceable settlement agreement on the very same subject.

Indeed, it would appear that ABAG staff's real objection is to the way state law is phrased and the manner in which the BIA Bay Area's settlement agreement requires us to interpret that law. But the law says what it says, and the settlement agreement was freely entered into by both MTC and ABAG and is binding on both parties for Plan Bay Area 2040 and all subsequent updates. For a fuller exposition of the legal issues involved, please see the attached opinion by our outside counsel.

TLG Thomas Law Group

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NICHOLAS S. AVDIS
TODD W. SMITH
Of Counsel

MEMORANDUM

TO: Steve Heminger, MTC Executive Director
Adrienne Weil, MTC General Counsel

FROM: Tina Thomas and Amy Higuera

DATE: June 24, 2015

RE: Terms of Settlement Agreement with Building Industry Association Bay Area re Housing All the Growth of the Region within the Region

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ISSUES

You asked us for our legal opinion on the following questions:

1) Does the Settlement Agreement entered into with the Building Industry Association Bay Area (BIA) require the agencies to define the SB 375 requirement to "house 100% of the region's projected growth" in Plan Bay Area with no increase in in-commuters over the baseline year for the Sustainable Communities Strategy (SCS)?

2) Is the Settlement Agreement legally binding on both the Association of Bay Area Governments (ABAG) and the Metropolitan Transportation Commission (MTC)?

SHORT ANSWERS

Yes. The requirement to house 100% of the region's projected growth must exclude the rate of in-commuting over the SCS baseline year under the Settlement Agreement, and under Government Code section 65080, subdivision (b)(2)(B).

Yes. Both MTC and ABAG are bound by the terms of the Settlement Agreement and failure by either agency to comply with those terms could result in litigation and significant monetary consequences.

DISCUSSION

1. **The requirement to house 100% of the population with no increase in in-commuters over the Plan baseline year.**

We understand MTC staff has recommended that the draft Plan Bay Area include a performance target that would "house 100% of the region's projected growth by income level with no increase in in-commuters over the Plan baseline year." We also understand that ABAG staff objects to including such language in the performance target.

The terms of the Settlement Agreement explicitly require that the forecasted development pattern for the Sustainable Communities Strategy (SCS) include no increase in the rate of in-commuting over the baseline year of the SCS. The Plan Bay Area 2040 performance targets for adequate housing should therefore explicitly incorporate this requirement, consistent with the terms of the Settlement Agreement, and the requirement of the SCS statute (Government Code section 65080.)

Terms of the Settlement Agreement

Paragraph 6.a. of the Settlement Agreement states that the "SCS shall set forth a forecasted development pattern for the region that includes the Regional Housing Control Total, **which shall have no increase in in-commuters over the baseline year for the SCS**, and shall not be based on historical housing production." The "Regional Housing Control Total" is defined in paragraph 20 of the Definitions section of the Agreement as "the regional housing demand over the course of the planning period of the Regional Transportation Plan pursuant to Government Code section 65080, subdivision (b)(2)(B)(ii)."

The terms of the Settlement Agreement are clear; there must be no increase in the number of in-commuters over the baseline year for Plan Bay Area 2040 in the forecasted development pattern that accommodates regional growth. This requirement was negotiated with BIA to address arguments raised in their Verified Petition for Writ of Mandate and Complaint for Declaratory and Injunctive Relief (Petition) filed in Alameda County Superior Court challenging Plan Bay Area. In their Petition, BIA alleged that Plan Bay Area failed to comply with the requirements of SB 375 by failing to accommodate all projected population growth in the region and assuming a certain percentage of in-commuting based on historic levels. To address these arguments, Paragraph 6.a. of the Settlement Agreement prohibits the SCS from using "a 'ratio' theory, which assumes the same percentage of in-commuters as historic levels of in-commuting." Rather, the "**SCS must demonstrate how all of the Regional Housing Control Total can be accommodated within the boundaries of the nine counties of the Bay Area.**"

Statutory Requirements

The plain language of Government Code section 65080, subdivision (b)(2)(B)(ii) requires that the SCS identify areas "within the region sufficient to house **all the population of the region**" with no adjustment for residential growth that may instead take place outside the region (emphasis added). Subdivision (b)(2)(b)(vii) states that the SCS shall "set forth a **forecasted development pattern** for the region, which, when integrated with the transportation network, and other transportation measures and policies, will reduce the greenhouse gas emissions from automobiles and light trucks to achieve, **if there is a feasible way to do so**, the greenhouse gas emissions reduction targets approved by the state board" (emphasis added).

According to Government Code section 65080(b)(2)(C), ABAG is explicitly made responsible for identifying sufficient areas to house all the population of the region within the region under subsection (ii), and ABAG and MTC are jointly responsible for setting forth a forecasted development pattern for the region under subsection (vii).

Section 65080(b)(2)(C), subsection (ii) does not, on its face, allow for factoring in the costs of housing in adjacent regions. While subsection (ii) does state that the areas identified must include all economic segments "over the course of the planning period," the clause "all the population of the region" (as opposed to all the future growth) requires starting with an analysis that assumes no in-commuting. We believe a court would apply the literal interpretation to require that no in-commuting over the number currently in-commuting (the baseline number) be assumed in the model. Subsection (ii) sets forth the goal to be aspired to in the SCS.

Section 65080(b)(2)(C), subsection (vii) requires that the SCS consider what is feasible in preparing a forecasted development pattern. This subsection could be interpreted to allow consideration of in-commuting in the analysis of feasibility. However, other COGs in the state have interpreted subsection (vii) to apply the feasibility consideration to the reduction of GHG emissions through the interplay of the development forecast and design of the transportation network. In other words, subsection (vii) does not allow for a liberalization of the analysis in subsection (ii), and therefore does not allow consideration of in-commuting due to housing costs in neighboring regions. As stated above, we believe a court would also apply this interpretation.

2) Consequences of non-compliance with the terms of the Settlement Agreement.

Remedies for Non-Compliance with Agreement

The Settlement Agreement was "made and entered into" with BIA by both ABAG and MTC defined in the Agreement as "Respondents" and was signed by representatives of all three entities (BIA, ABAG, and MTC). The obligations of Respondents are set forth in Paragraph 6 of the Agreement, which includes the requirement that the forecasted development pattern reflect no increase in in-commuters over the baseline year for the SCS. Thus, this obligation applies to both MTC and ABAG.

Paragraph 9.i. of the Settlement Agreement sets forth remedies for noncompliance with its terms. That paragraph states that specific performance is an appropriate remedy for enforcement, and further provides that in any action to enforce the Agreement, the prevailing party shall recover not only its costs, but also its "reasonable attorneys' fees."

If the agencies proceed in a manner that BIA interprets as non-compliant with the terms of the Agreement, BIA may file an action with the superior court seeking specific performance, and if the court finds in BIA's favor, the agencies will be required to revise any work done on the Plan to make it conform to the terms of the Settlement Agreement, and pay BIA's attorneys' fees incurred in seeking specific performance, in addition to bearing their own fees and costs.

Future Litigation Challenging Plan Approval

Further, if the agencies ultimately adopt a version of Plan Bay Area 2040 that does not comply with the terms of the Settlement Agreement, BIA may also file a lawsuit challenging Plan approval, claiming violations of SB 375 and CEQA.

In addition to the significant amount of time that such an action takes to resolve, such litigation is costly. Over the past two years, the agencies have incurred substantial legal fees associated with defending against the four legal challenges filed against the agencies' 2013 approval of Play Bay Area.

We also note that the attorneys representing BIA are sophisticated CEQA practitioners and often use extensive Public Records Act requests as part of their litigation strategy.

which would make defending a lawsuit filed by them more expensive than the matters currently being litigated. Thus, defending a lawsuit brought by BIA could cost the agencies a substantial sum to defend in trial court and on appeal.

Plan Bay Area 2040

Goals & Targets

and Project Performance Update

Image Source: https://www.flickr.com/photos/thefatrobot/16159764057

Joint MTC Planning Committee with the ABAG Administrative Committee

July 10, 2015

Plan Bay Area 2040

Goals and performance targets form the foundation of the planning process.

2015
Goals & Targets
Project Evaluation

2016
Scenario Evaluation
Tradeoff Discussions

2017
EIR Process
Plan Approval

Image Source: https://www.flickr.com/photos/smadness/4999368225

What have we heard from the public about their top priorities for goals & targets?

Plan Bay Area 2040

1. Transportation System Effectiveness
2. Adequate Housing
3. Equitable Access
4. Open Space and Agricultural Preservation
5. Climate Protection
6. Healthy and Safe Communities
7. Economic Vitality

Image Source: https://www.flickr.com/photos/parksjd/5788858929

What have we heard from the public about their top priorities for goals & targets?

Plan Bay Area 2040

PRESERVATION
DEVELOPMENT
GOOD
JOBS-HOUSING BALANCE
OPEN SPACE
REALISTIC
NEIGHBORHOOD
COMMUTE
ACCESS
FOOD
PEDESTRIAN
SEA-LEVEL RISE
WATER
WAGE
RESIDENTIAL
WILDLIFE
WALKING
HOUSING
TRAILS
SEGREGATION
ACCOUNTABILITY
AFFORDABLE
LOCAL
LOW-INCOME
EQUITY
SAFETY
BAY
JOBS
EXPANSION
MORE NOTICE
PRIVATE-PROPERTY RIGHTS
INTERCONNECTEDNESS
AGRICULTURAL
ADEQUATE
GROWTH
REGIONAL
CORPORATE
ECONOMIC
BIKING
FREE
CARS
PLAN
SMART
COMMUNICATION
DROUGHT
TECH
TRANSIT
SLOWER
EDUCATION
CLIMATE CHANGE
PARKING
BALANCE
SYSTEM
SEISMIC
POPULATION
TRANSPORTATION
HOMELESSNESS
PUBLIC

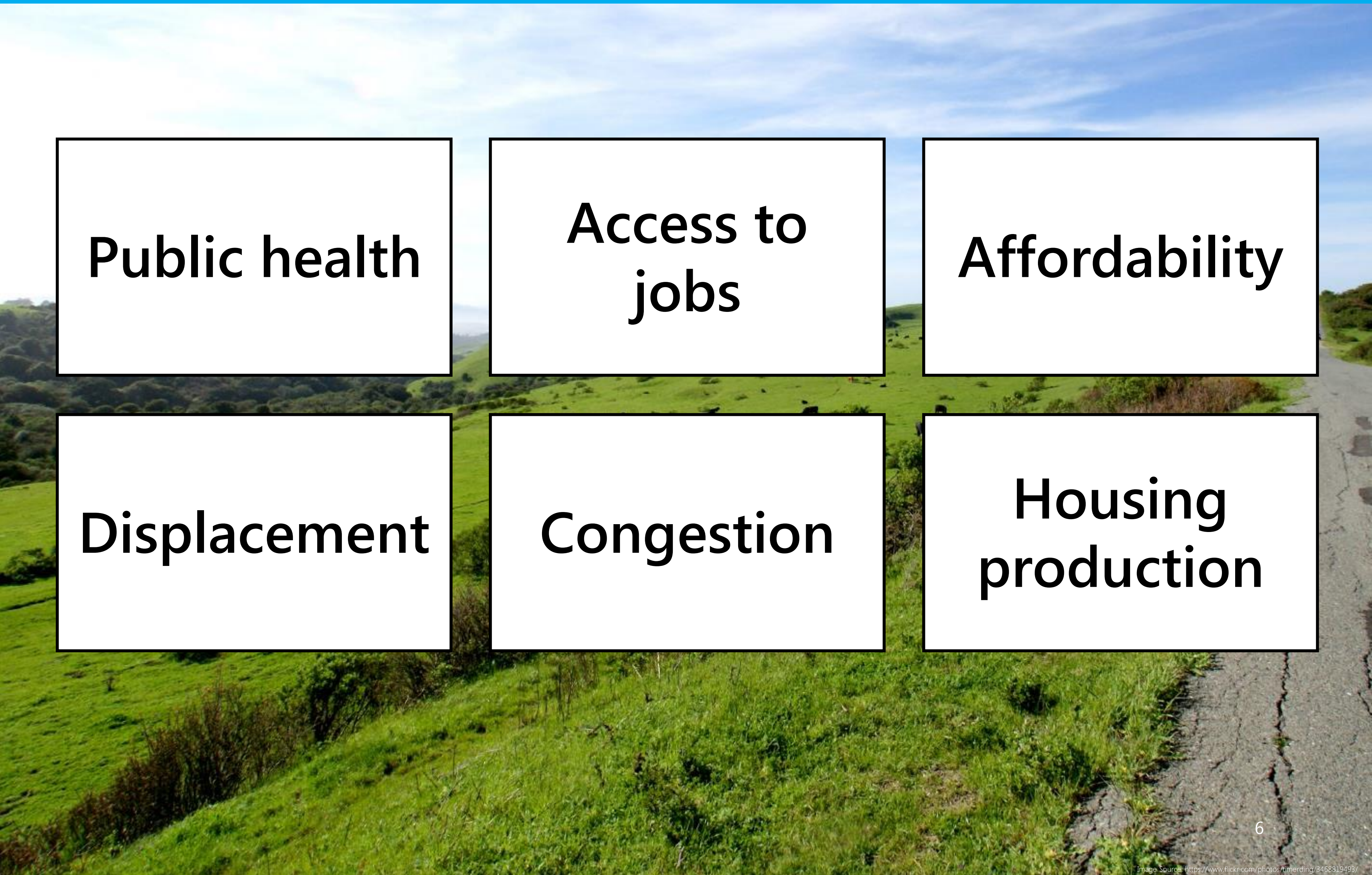
What have we heard from stakeholders about their top priorities for goals & targets?

Plan Bay Area 2040

Performance Working Group Membership	
Congestion Management Agencies (CMAs)	Alameda County Transportation Commission, San Francisco County Transportation Authority, Sonoma County Transportation Authority
Cities & Counties	City of Livermore, City of San Jose, County of Contra Costa
Transit Agencies	Bay Area Rapid Transit, San Francisco Municipal Railway, Sonoma-Marin Area Rail Transit, Valley Transportation Authority
Regional & State Agencies	Bay Area Air Quality Management District, California Department of Transportation, California Department of Public Health
Non-Government Organizations (Economy)	Building Industry Association, Working Partnerships USA
Non-Government Organizations (Environment)	Greenbelt Alliance, Sierra Club
Non-Government Organizations (Equity)	TransForm, Center for Sustainable Neighborhoods
Policy Advisory Council / Equity Working Group	Randi Kinman (Santa Clara County), Richard Burnett (Solano County), Richard Hedges (San Mateo County)

What have we heard from stakeholders about their top priorities for goals & targets?

Plan Bay Area 2040



Public health	Access to jobs	Affordability
Displacement	Congestion	Housing production

Image Source: https://www.flickr.com/photos/timerding/3468819493/

Staff evaluated revisions to the Plan Bay Area performance targets using technical criteria.

- Most importantly: targets should be **able to be forecasted and influenced** by the regional agencies.
- Targets should also be **easy to understand** and should be **limited in number** to maximize their effectiveness.

Image Source: https://www.flickr.com/photos/clintsharp/11061059935

Draft Staff Recommendation: Performance Targets

CLIMATE PROTECTION	**1**	Reduce per-capita CO_2 emissions from cars and light-duty trucks by **15%**
ADEQUATE HOUSING	**2**	*ABAG Proposal/Current Target:* House **100%** of the region's projected growth by income level (very-low, low, moderate, above-moderate) without displacing current low-income residents **– or –** *MTC Proposal*:* House **100%** of the region's projected growth by income level with no increase in in-commuters over the Plan baseline year
HEALTHY & SAFE COMMUNITIES	**3**	Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by **10%**

* = Risk of displacement is proposed to be addressed through a dedicated affordable housing production target for PDAs (target #6).

Text marked in blue indicates that the target was rolled over from Plan Bay Area.

Draft Staff Recommendation: Performance Targets

Plan Bay Area 2040

Open Space and Agricultural Preservation	4	Direct **all** non-agricultural development within the urban footprint (existing urban development and UGBs)
Equitable Access	5	Decrease the share of lower-income residents' household income consumed by transportation and housing by **10%**
	6	Increase the share of affordable housing in PDAs by **[TBD]%**
Economic Vitality	7	Increase the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit by **[TBD]%** in congested conditions

Text marked in blue indicates that the target was rolled over from Plan Bay Area.

Draft Staff Recommendation: Performance Targets

Plan Bay Area 2040

TRANSPORTATION SYSTEM EFFECTIVENESS

8 Increase non-auto mode share by **10%**

9 Reduce vehicle operating and maintenance costs due to pavement conditions by **100%**

10 Reduce per-rider transit delay due to aged infrastructure by **100%**

Text marked in blue indicates that the target was rolled over from Plan Bay Area.

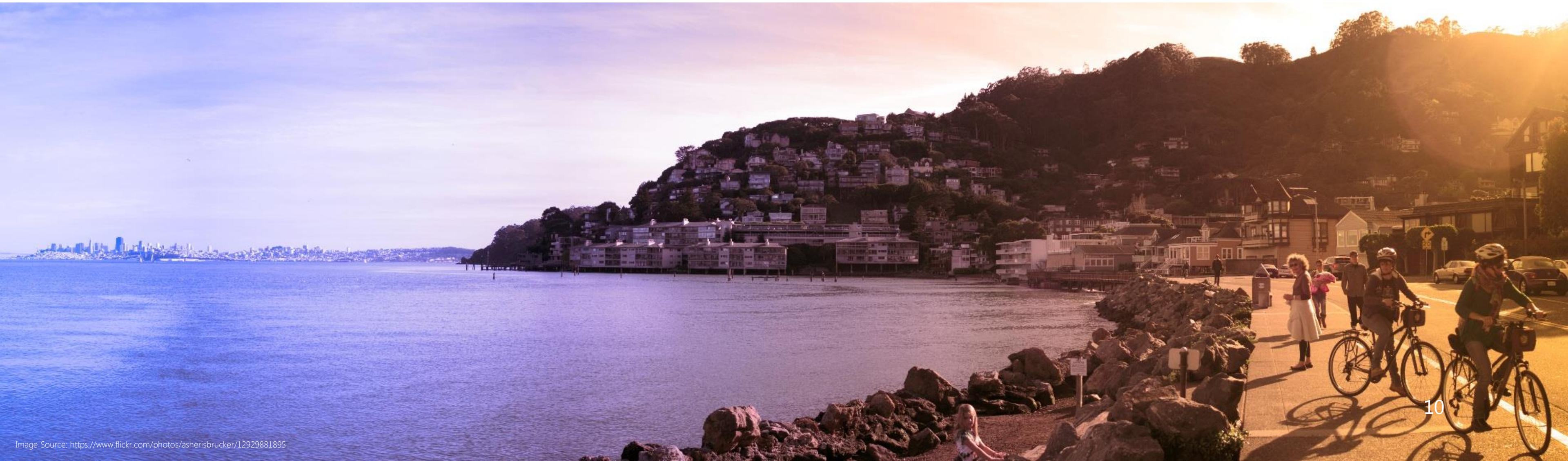


Image Source: https://www.flickr.com/photos/asherisbrucker/12929881895

Plan Bay Area 2040

Transportation projects will be analyzed to determine their impact on performance targets as well as their cost-effectiveness.

TARGETS ASSESSMENT

Assessed qualitatively using target scores

Determine impact on adopted targets

BENEFIT-COST ASSESSMENT

Assessed quantitatively using MTC Travel Model

Evaluate relative cost-effectiveness

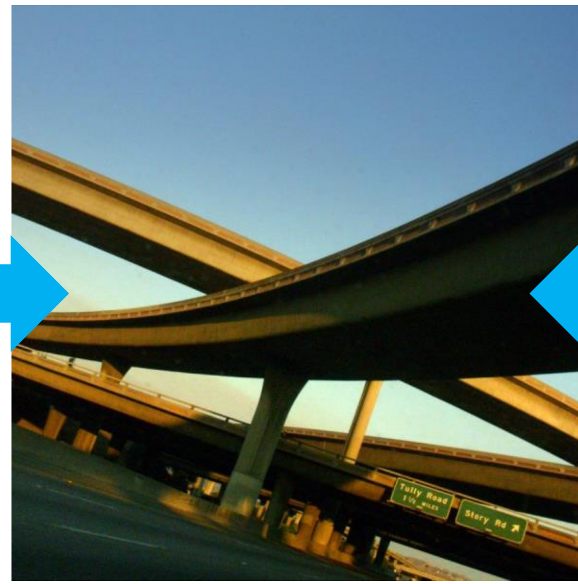
HIGH-PERFORMING and **LOW-PERFORMING PROJECTS**

Identified based on the combination of target scores & benefit-cost ratios

Image Source: https://www.flickr.com/photos/thomashawk/368102715/in/photostream/

Plan Bay Area 2040

Transportation investments will be evaluated consistently to allow for tradeoff discussion when crafting a preferred scenario.



Major uncommitted transit projects

Expansion
Operational improvements
State of good repair*

Major uncommitted roadway projects

Expansion
Operational improvements
State of good repair*

Major investments from regional initiatives

Goods Movement Study*
Managed Lanes Program*
Transit Core Capacity Study*

* = new elements of Project Performance Assessment when compared to Plan Bay Area

Image Sources: https://www.flickr.com/photos/michaelpatrick/2690957769; https://www.flickr.com/photos/pfsullivan_1056/856975371; https://www.flickr.com/photos/thomashawk/15260950789

Next Steps for Targets & Performance Assessment

Plan BayArea 2040

Targets

Summer: Refine methodology
September: MTC/ABAG approval

Project Performance

Fall: Conduct evaluation
December: Release draft results
January: Release final results

Scenario Development

Fall: Define scenarios
Winter: Release performance results
Spring: Develop preferred scenario

Identify Preferred Scenario

June 2016

PERFORMANCE ASSESSMENT REPORT

Plan Bay Area 2040

DRAFT SUPPLEMENTAL REPORT

METROPOLITAN TRANSPORTATION COMMISSION

Association of Bay Area Governments

MARCH 2017

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Plan Bay Area 2040:
Draft Performance Assessment Report

March 2017

METROPOLITAN TRANSPORTATION COMMISSION

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Table of Contents

List of Tables

List of Figures

Executive Summary

Performance-based planning is at the core of Plan Bay Area 2040, incorporating performance targets, project-level evaluation, and scenario assessment to better inform policy decisions and the public at large. As part of the performance-based planning process for Plan Bay Area 2040, MTC and ABAG developed a set of regional performance targets to evaluate both planning scenarios and individual transportation projects. Building on the framework established as part of Plan Bay Area, the work for Plan Bay Area 2040 featured an expanded emphasis on equity and sustainability, while at the same time conducting new performance analyses on state of good investments.

Methodology

Thirteen performance targets, based on seven regional goals, were developed collaboratively with state, regional, and local public agencies, as well as stakeholder groups. The adopted targets addressed a broad spectrum of issues including climate change, housing, health and safety, open space, equity, economic vitality, and transportation efficiency. While all of the goals and a handful of targets were carried over from Plan Bay Area, new targets were added on topics such as displacement risk and access to jobs that gained greater emphasis than in prior plans.

Performance assessment was a critical component throughout the development of Plan Bay Area 2040. After establishing the performance targets in late 2015, scenarios combining various land use patterns and transportation investments were quantitatively evaluated to determine how strongly they supported the adopted targets. In order to refine these scenarios and develop the Preferred Scenario, MTC also evaluated individual transportation projects to prioritize high-performers and to reconsider the efficacy of low-performers. This project-level assessment examined major projects' qualitative support for the Plan targets, in addition to quantitatively evaluating major projects' cost-effectiveness via a benefit-cost analysis. Finally, most scenarios were carried over into the EIR analysis as alternatives, alongside a new alternative added as a response to scoping comments. The ultimate scenario target results highlight where the Plan has succeeded in meeting the targets and where it falls short, as well as what alternative approaches or strategies might strengthen the Preferred Scenario or future long-range planning efforts.

Key Findings

Identification of Performance Targets: New issues emerged as priorities in this cycle of performance-based planning. As noted above, new targets were created on emerging issues like displacement risk and middle-wage jobs that had not previously been included in Plan Bay Area. In the end, five targets were carried over from the last Plan, and eight new targets were added to the mix, for a total of thirteen performance targets. Equitable Access and Economic Vitality, which each had one target in Plan Bay Area, were expanded to feature three targets each – an indication of a broader array of interests related to those two goals this cycle.

Scenario Targets Assessment: As with Plan Bay Area, scenarios often fell short of the adopted targets due to the ambitious nature of the targets selected by the Commission and by ABAG. This being said, many, if not all, scenarios made notable progress on issues like open space preservation, greenhouse gas reduction, middle-wage job growth, and congestion reduction on freight corridors. Serious challenges remained across all scenarios, though. Despite which land use pattern or transportation investment strategy was pursued, target results related to affordability and displacement risk consistently pointed in the wrong direction.

Project Performance Assessment: Results of the project-level assessment revealed the high cost-effectiveness and strong support of Plan Bay Area 2040 targets for maintaining public transit and state highways. Fully investing in state of good repair for these modes, when compared with medium-performing local streets & roads maintenance, would generate approximately $7 billion in annual benefit compared to $5 billion in annual benefit for the sum of the remaining 63 non-maintenance investments. Additionally, the assessment reinforced the positive effect of a focused growth land use pattern on performance, particularly for transit projects that would serve densifying PDAs in the South bay. Generally, modernization projects (which focus on improving existing transportation assets) typically performed better on both components of the project assessment than expansion projects (which emphasize widening highways or extending fixed transit guideways to new service areas)

The assessment identified 11 high-performing projects, for which staff subsequently prioritized future regional discretionary revenues. The assessment also identified 18 low-performing projects that were further screened before inclusion in Plan Bay Area 2040. Of the low-performing projects, 7 were approved with minor changes, 7 were re-scoped to a lower-cost phase or environmental/planning phases, and 4 were dropped via a compelling case process.

Conclusions

While the Preferred Scenario moves in the right direction on many of the region's important performance targets, the targets analysis revealed that the region's mature development pattern and extensive transportation system lead to challenges in changing the status quo and achieving aggressive adopted goals. Limited policy levers related to key equity and affordability challenges further constrain the ability of MTC and ABAG, in concert with local jurisdictions, to "move the needle" and reverse historical trends. In order to achieve the aspirational goals established in the Plan targets, much more aggressive action from multiple levels of government will be required after the adoption of this Plan.

Purpose of Performance Assessment

Plan Bay Area 2040 relied upon a performance-based planning approach, utilizing quantifiable metrics to evaluate the outcomes of integrated transportation investments and land use policies. By leveraging analytical tools to identify measureable outcomes of policy decisions, we can make more informed decisions and better understand the impacts of Plan Bay Area 2040.

Performance-based transportation planning is not a new approach for the Bay Area – over a period spanning nearly two decades, MTC's long-range transportation plans have been developed using performance measures to evaluate their support for regional goals. Starting with the 2001 Regional Transportation Plan (RTP), transportation investment packages were compared using a set of performance measures. Since then, qualitative and quantitative evaluations have been added to assess the impacts of individual transportation projects proposed for inclusion in RTPs.

This report provides documentation of the three-year-long effort to evaluate and improve the performance of Plan Bay Area 2040. These efforts have helped craft and guide the Plan from a series of vision scenarios to the Final Preferred Scenario, while examining how integrated transportation and land use planning efforts can help the region address long-term environmental, equity, and economic challenges. The remainder of this report is organized into the following chapters, which reflect the various phases of performance assessment during the planning process:

- **Identification of Performance Targets and Methodologies**
- **Scenario & EIR Alternative Performance Targets Analysis**
- **Project Performance Assessment** *(including State of Good Repair Performance)*

Identification of Performance Targets & Methodologies

Performance targets form the foundation of a performance-based planning approach – that is, one must start by defining the region's objectives before assessing the performance of various alternatives. Given that Plan Bay Area 2040 was a limited and focused update to the initial Plan adopted in 2013, the sustainability-focused goals – built on the 3 "E's" framework (equity, environment, economy) – were preserved. These goals – climate protection, adequate housing, healthy and safe communities, open space and agricultural protection, equitable access, economic vitality, and transportation system effectiveness – reflect the wide spectrum of sustainability objectives for this long-range planning effort. While the goals were carried over from Plan Bay Area, the performance measures and associated targets were updated to better reflect the priorities of the region today. These targets then provided a framework that allowed us to better understand how different projects and policies might affect the region's future.

Each target was designed to compare conditions over the life of the Plan – that is, measuring the change between the baseline year (2005 or 2010) and the planning horizon year (2035 or 2040). Importantly, the targets were crafted to focus on desirable regional outcomes that did not prescribe a specific mode or investment type to reach the target. For example, a potential target might focus on health outcome improvements, which can be addressed through a wide variety of investments such as new or improved transit services, changes in land use patterns to encourage walking and biking, increased incentives for adoption of electric vehicles, or reduced speed limits to address fatalities from collisions.

Criteria and Process for Performance Targets

In order to evaluate potential performance targets and to help advise staff on which targets should be recommended to MTC and ABAG for approval, staff assembled a Performance Working Group. Open to the public, Performance Working Group meetings were attended by local and regional government staff (including county congestion management agencies), Policy Advisory Council members, and non-governmental organization representatives (from groups focused on social equity, the environment, and the economy).

To guide the process, MTC staff developed a set of criteria (as shown in Table 1) to make the targets as meaningful as possible in measuring the Plan's success. The criteria utilized in this process primarily focused on ensuring the targets could be forecasted using available analytical tools and could be influenced by the Plan's investments and policies.

#	Criterion
1	**Targets should be able to be forecasted well.** A target must be able to be forecasted reasonably well using MTC's and ABAG's models for transportation and land use, respectively. This means that the target must be something that can be predicted with reasonable accuracy into future conditions, as opposed to an indicator that can only be observed.
2	**Targets should be able to be influenced by regional agencies in cooperation with local agencies.** A target must be able to be affected or influenced by policies or practices of ABAG, MTC, BAAQMD and BCDC, in conjunction with local agencies. For example, MTC and ABAG

	policies can have a significant effect on accessibility of residents to jobs by virtue of their adopted policies on transportation investment and housing requirements.
3	**Targets should be easy to understand.** A target should be a concept to which the general public can readily relate and should be represented in terms that are easy for the general public to understand.
4	**Targets should address multiple areas of interest.** Ideally, a target should address more than one of the three "E's" – economy, environment, and equity. By influencing more than one of these factors, the target will better recognize the interactions between these goals. Additionally, by selecting targets that address multiple areas of interest, we can keep the total number of targets smaller.
5	**Targets should have some existing basis for the long-term numeric goal.** The numeric goal associated with the target should have some basis in research literature or technical analysis performed by MTC or another organization, rather than being an arbitrarily determined value.

Table 1. Technical criteria for selecting performance targets.

Furthermore, staff established criteria for identifying the set of targets, seeking to ensure a reasonable number of distinct and quantifiable metrics. This focused the process on the most important issues for Plan Bay Area 2040 stakeholders. The criteria established for the overall set of targets is shown below in Table 2.

#	Criterion
A	**The total number of targets selected should be relatively small.** Targets should be selected carefully to make technical analysis feasible within the project timeline and to ensure that scenario comparison can be performed without overwhelming decision-makers with redundant quantitative data.
B	**Each of the targets should measure distinct criteria.** Once a set of targets is created, it is necessary to verify that each of the targets in the set is measuring something unique, as having multiple targets with the same goal unnecessarily complicates scenario assessment and comparison.
C	**The set of targets should provide some quantifiable metric for each of the identified goals.** For each of the seven goals identified, the set of performance measures should provide some level of quantification for each to ensure that that particular goal is being met. Multiple goals may be measured with a single target, resulting in a smaller set of targets while still providing a metric for each of the goals.

Table 2. Technical criteria identifying a set of targets.

Over a period of five months, the Performance Working Group discussed potential performance measures affecting a broad range of regional issues, debating which metrics reflected the most important objectives for this planning process. Incorporating this feedback, staff developed a proposal for the Commission and ABAG to review in September 2015. Both agencies approved nine performance targets at that time and asked for further review and refinement of four additional performance targets. The remaining four targets were approved in November 2015 by the Commission and by ABAG.

Adopted Goals and Targets

As discussed above, MTC Resolution 4204, Revised was adopted in fall 2015 and identified seven goals and thirteen performance targets for Plan Bay Area 2040. Accompanying the resolution were approved methodologies to be used in evaluating the performance measures as part of the scenario planning process (discussed later in this section). Like Plan Bay Area, the Plan Bay Area 2040 performance targets went well beyond the traditional mobility targets from past RTPs. The targets focused on broad outcomes – such as public health, displacement risk, and access to opportunity – that could be achieved by a variety of transportation and land use policies. This outcome-oriented approach to performance targets expanded the focus of the planning effort, emphasizing the societal benefits derived from implementing transportation projects or changing land use patterns.

One significant shift in the performance targets for Plan Bay Area 2040 was an increased emphasis on social equity and affordability, reflecting growing regional challenges associated with adverse impacts from the current economic boom. Ultimately, six of the targets had an equity nexus (public health, affordability, affordable housing, displacement risk, middle-wage job creation, and access to jobs) and were used as metrics in the equity analysis process; more information on that effort is available in the Equity Assessment Report.

Goal	#	Target
Climate Protection	**1**	Reduce per-capita CO_2 emissions from cars and light duty trucks by **15%**
Adequate Housing	**2**	House **100%** of the region's projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year
Healthy & Safe Communities	**3**	Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by **10%**
Open Space & Agricultural Preservation	**4**	Direct **all** non-agricultural development within the urban footprint (existing urban development and UGBs)
Equitable Access	**5**	Decrease the share of lower-income residents' household income consumed by transportation and housing by **10%**
	6	Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas by **15%**
	7	**Do not increase** the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at risk of displacement
Economic Vitality	**8**	Increase by **20%** the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit in congested conditions
	9	Increase by **38%** the number of jobs in predominantly middle-wage industries
	10	Reduce per-capita delay on the Regional Freight Network by **20%**

Transportation System Effectiveness	**11**	Increase non-auto mode share by **10%**
	12	Reduce vehicle operating and maintenance costs due to pavement conditions by **100%**
	13	Reduce per-rider transit delay due to aged infrastructure by **100%**

Table 3. Final adopted goals and performance targets for Plan Bay Area 2040.

Baseline and Horizon Years for Target Assessment

Baseline and horizon years for each target were identified in the methodology documentation associated with MTC Resolution 4204. In general, the Plan relies on a baseline year of 2005 and a horizon year of 2040; however, in some cases, specific rationale justified slight alterations to these assumptions due to data availability, consistency with land use forecasts, or state requirements under Senate Bill 375. A summary of the baseline and horizon years by target is shown below.

- Target 1: baseline year of 2005, horizon year of **2035** *[due to SB 375/CARB target]*
- Target 2: baseline year of **2010**, horizon year of 2040 *[due to control total timeframe]*
- Target 3: baseline year of 2005, horizon year of 2040
- Target 4: baseline year of **2010**, horizon year of 2040 *[per MTC Resolution No. 3987]*
- Target 5: baseline year of 2005, horizon year of 2040
- Target 6: baseline year of **2010**, horizon year of 2040 *[due to land use forecast constraint]*
- Target 7: baseline year of **2010**, horizon year of 2040 *[for consistency with land use targets]*
- Target 8: baseline year of 2005, horizon year of 2040
- Target 9: baseline year of **2010**, horizon year of 2040 *[due to control total timeframe]*
- Target 10: baseline year of 2005, horizon year of 2040
- Target 11: baseline year of 2005, horizon year of 2040
- Target 12: baseline year of 2005, horizon year of 2040
- Target 13: baseline year of 2005, horizon year of 2040

Target Descriptions and Methodologies

Performance Target #1: Climate Protection

Reduce per-capita CO_2 emissions from cars and light duty trucks by 15%

Background Information

Under California Senate Bill 375, major metropolitan areas in the state are required to develop a Sustainable Communities Strategy as part of their Regional Transportation Plan. This means that the adopted Plan must achieve per-capita greenhouse gas reduction targets as established by the California Air Resources Board (CARB). CARB established two climate protection targets for the San Francisco Bay Area in 2010, which have been incorporated into both Plan Bay Area and Plan Bay Area 2040:

- Per-capita reduction of greenhouse gas emissions by 7 percent by year 2020
- Per-capita reduction of greenhouse gas emissions by 15 percent by year 2035

This is a statutory target and therefore must be reflected in the set of Plan performance targets. Under Senate Bill 375, the Plan must meet state-identified greenhouse gas reduction targets to comply without the adoption of a separate Alternative Planning Strategy (APS).

Past Experience

This target is fully consistent with Plan Bay Area; no changes have been made to the target as originally adopted in 2011. Before the passage of Senate Bill 375, previous MTC long-range plans, including Transportation 2035, included non-statutory targets to reduce greenhouse gas emissions.

Plan Bay Area exceeded the greenhouse gas emissions target, achieving a 16 percent reduction for year 2035 and an 18 percent reduction in emissions between 2005 and 2040, while at the same time also exceeding its 2020 interim target. The target performance results incorporate both the emissions reduction from transportation, land use and demographics (from Travel Model One and EMFAC), in addition to the emissions reductions associated with the Regional Climate Program (based on off-model assessments).

Evaluation Methodology

The statutory Climate Protection target reflects greenhouse gas emissions reductions, focusing specifically on carbon dioxide emissions per statewide modeling guidance. Travel Model One – the region's activity-based travel demand model – was used to forecast emissions reductions as a result of various scenarios. Travel Model One analyzes daily travel patterns as a result of scenarios' transportation investments and land use patterns, making possible the calculation of vehicle miles traveled (VMT) and speed of travel. The California Air Resources Board's EMFAC air quality model was then used to calculate the pounds of carbon dioxide emissions associated with the forecasted levels of regional travel.

For off-model Climate Initiatives, which may include efforts like regional electric vehicle incentives, greenhouse gas emissions reductions were calculated by estimating the direct greenhouse gas emissions reduction of specific funded programs, rather than forecasting travel impacts in the model. This is appropriate, as many of the programs are not designed to necessarily reduce VMT, but instead reduce emissions through cleaner vehicles and improved driving habits. These greenhouse gas emission reductions were added to the model calculations, resulting in combined greenhouse gas emission reductions from the Plan as a whole. Reductions were normalized based on relevant population forecasts developed by ABAG. Refer to additional information on the forecasting methodology in the Plan Bay Area 2040 Travel Model One Data Summary.

Note that the target relies upon a horizon year of 2035 instead of the standard 2040 horizon year used for other performance targets to ensure consistency with the CARB target.

Performance Target #2: Adequate Housing

House 100% of the region's projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year

Background Information

Similar to the greenhouse gas reduction target, California Senate Bill 375 requires Plan Bay Area to house all of the region's growth. This is an important regional issue given that long interregional trips – which typically have above-average emission impacts – can be reduced by planning for sufficient housing in the region.

The Adequate Housing target relates to a Regional Housing Control Total per the 2014 settlement agreement signed with the Building Industry Association (BIA), which increases the housing forecast by the housing equivalent to in-commute growth. The forecast of households, jobs, population, and in-commute will remain as established by the approved forecast methodology and best practices.

Past Experience

A similar version of this target was included in Plan Bay Area adopted in 2013, although Plan Bay Area 2040 incorporates language clarifying how the regional housing control total was calculated, as agreed to by MTC, ABAG, and the Building Industry Association as part of a 2014 legal settlement. In 2013, Plan Bay Area housed 100% of the region's projected growth as defined under the adopted language from 2011.

Evaluation Methodology

Evaluation of this performance target utilized the methodology relating to the Regional Forecast agreed to by both agencies. The regional housing control total estimated the total number of units needed to accommodate all of the residents in the region plus the number of housing units that correspond to the in-commute increase. The number of units included a reasonable vacancy level for circulation of units among movers. The figure below diagrams the overall regional forecast process that led to a regional housing control total.

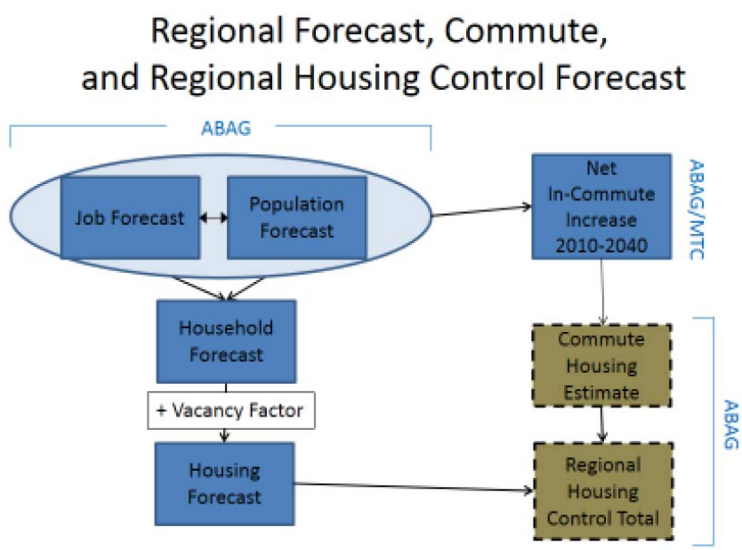

Figure 1. Diagram of regional housing forecast methodology.

Performance Target #3: Healthy and Safe Communities

Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by 10%

Background Information

This target focuses on the issue of public health by evaluating the net impacts of air quality, road safety and physical activity improvements. By creating a unified target that directly measures the net health impact of scenarios, Plan Bay Area 2040 elevated this issue when compared to prior planning cycles. Rather than adopting separate targets for air quality, road safety and physical activity, this proposed target focuses on the combined impact of the transportation and land use policies that move the region towards a common goal of improved health outcomes. Adverse health impacts are measured in disability-adjusted life-years of impact (DALYs) on a per-capita basis.

The numeric target was selected based on an analysis by Neil Maizlish, et al. entitled "Health Cobenefits and Transportation-Related Reductions in Greenhouse Gas Emissions in the San Francisco Bay Area", published in the American Journal of Public Health. In this paper, Maizlish et al. conducted an analysis of the Bay Area to see how an aggressive scenario focused on increased bicycle and pedestrian mode shares might move the needle for public health. When the net impact of such a policy (versus a business-as-usual scenario) is compared to the total disability-adjusted life-year impacts to the region from MTC model runs, the region yielded a reduction of just over five percent. While active transportation is the largest component of health benefits, road safety and air quality focused investments in the Plan can also move the needle. Given that analysis, a slightly more aggressive target of 10 percent reduction was recommended for this performance target.

Past Experience

This is a new target for Plan Bay Area 2040 that incorporates components of multiple Plan Bay Area targets into a single integrated target. It reflects one of the top priorities of the Performance Working Group in terms of advancing public health as a key element of the long-range planning process.

Evaluation Methodology

To calculate the health impacts of a given scenario, staff ran the Integrated Transportation and Health Impact Model (ITHIM), which was calibrated for the Bay Area by the California Department of Public Health. The run requires inputs from Travel Model One, which include travel activity patterns for walking and biking as well as rates related to collisions and air quality. ITHIM then translates those inputs into a detailed suite of health impact measures, including disability-adjusted life-year impacts. The impacts were normalized based upon population to take into account the overall growth expected in the region between 2005 and 2040.

Performance Target #4: Open Space and Agricultural Preservation

Direct all non-agricultural development within the urban footprint (existing urban development and UGBs)

Background Information

This performance target is focused very specifically on the protection of open space and agricultural lands. In order to move towards this goal, the target seeks to limit development to publicly-defined urban areas. SB 375 legislation asks regions to consider the best available data on resource lands. Special resource lands and farmland are specifically defined in SB 375 and include:

- Publicly owned parks and open space;
- Open space and habitat areas protected by natural resource protection plans;
- Species habitat protected by federal or state Endangered Species Acts;
- Lands subject to conservation or agricultural easements by local governments, districts, or non-profits
- Areas designated for open space/agricultural uses adopted in elements of general plans;
- Areas containing biological resources described in CEQA that may be significantly affected by a Sustainable Communities Strategy (SCS) or Alternative Planning Strategy (APS);
- Areas subject to flooding as defined by the National Flood Insurance Program; and
- Lands classified as prime/unique/state-significant farmland or lands classified by a local agency meeting or exceeding statewide standards that are outside of existing city spheres of influence/city limits.

One key difference between this target and the Adequate Housing target is that this measure is not statutory and therefore some scenarios may fall short in achieving the target.

Past Experience

This target is fully consistent with Plan Bay Area, which was the first regional plan in the Bay Area to include such a target related to greenfield protection. Plan Bay Area met the target with 100% of non-agricultural development focused in the urban footprint.

Evaluation Methodology

Using the localized development pattern forecasted by the UrbanSim land use model for each scenario, staff calculated the number of acres of new development, as well as significant redevelopment, across the entire region. Once identified, staff identified each development as occurring within the urban footprint or outside the 2010 urban footprint. The number of acres of development within the urban footprint was divided by the total acres of development across the region to calculate this target.

Note that the target relies upon the 2010 urban footprint instead of the standard year 2005 baseline used for other performance targets, per policy action taken during the adoption of Plan Bay Area targets in 2011.

Performance Target #5: Equitable Access (Affordability)

Decrease the share of lower-income residents' household income consumed by transportation and housing by 10%

Background Information

As an affordability target, decreasing the combined costs of housing and transportation for lower-income residents as a share of their income addresses a key challenge for these residents when they consider where to live and how far to travel to get to work, services and amenities. Often low-income households are not able to afford housing close to where they currently work, or where they may have access to a range of job opportunities and amenities. Being priced out of these high-opportunity areas may result in lower household income (as opportunity costs rise) and higher travel costs.

In the end, a household that can afford to live close to work and use transit or other affordable transportation options, may spend a similar or even lower share of its household income on the combined cost of housing and transportation. Reducing these costs across the region will increase affordability and boost economic opportunities for lower-income residents.

The numeric target was adapted from a 2006 report by the Center for Housing Policy ("A Heavy Load: The Combined Housing and Transportation Burdens of Working Families"). According to that report, Bay Area families with annual incomes under $70,000 spend a combined average of 61% of earnings on housing (39%) and transportation (22%). This share of 61% of earnings is approximately 10% above the national average share spent by lower-income households. Therefore, this target is set to improve transportation and housing affordability to approximately match the national average by 2040.

Past Experience

This target was included in Plan Bay Area, but the methodology for estimating housing costs has been improved as described below. Under Plan Bay Area, the region was forecasted to move in the opposite direction of this target, with housing and transportation costs as a share of income rising by 3% between 2005 and 2040. This reflects the difficulty of increasing affordability in an economically vibrant region, particularly given the forecasted future costs of housing.

Evaluation Methodology

The share of household income consumed by both transportation and housing will be forecasted by combining results from the transportation model (for future transportation costs) and land use model (for future housing costs). Both models are adjusted to identify costs for low-income households. Note that lower-income households are defined as households earning less than $60,000 in year 2000 dollars, roughly reflecting the lower two quartiles of the income spectrum.

For the transportation model, user costs account for the cost of maintaining and owning an automobile, purchasing transit fares and passes, and paying bridge and roadway tolls, etc. These costs are forecasted using Travel Model One using observed travel behavior for low-income and lower-middle-income residents; and assumptions about gas prices, toll fees, and transit fares, etc. For more information on the travel model and details on assumptions, refer to the Plan Bay Area 2040 Travel Model One Data Summary.

Housing costs for lower-income households were estimated using a combination of UrbanSim model output and a national cross-sectional model. Overall size and growth in regional population, regional income and wealth, and housing market leakage beyond the nine counties are all expected to influence housing prices in the long run. Therefore, median market-rate housing costs were estimated using a national cross-sectional model that relates housing prices to changes in population, income, and other region-specific factors. For lower-income households exposed to market-rate housing costs (i.e., the majority of lower-income households), their future costs are estimated by taking current housing costs and increasing those costs linearly at the same percent growth rate as the median home price.

Two other types of lower-income households exist as well; these households are not directly exposed to market-rate housing cost growth. First, deed-restricted housing residents are assumed to continue paying 27 percent of their income on housing, with the number of households falling into this category identified by UrbanSim model output (based on policy inputs to a given scenario). Second, lower-income households living in rent-controlled units are assumed to continue to pay roughly 85 percent of the market-rate housing costs, but households protected by rent control are forecast to continue to decline based on recent rates. Because rent control cannot be explicitly modeled at this time, these assumptions regarding rent control are the same across all scenarios analyzed. For more information on the land use model and details on assumptions, refer to the Plan Bay Area 2040 Land Use Model Data Summary.

Performance Target #6: Equitable Access (Affordable Housing)

Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas by 15%

Background Information

The provision of affordable housing is one of the Bay Area's most pressing issues. This target addresses the region's need to increase its overall share of housing that is affordable to lower-income households, focusing particularly on communities with strong transit access and communities with high levels of opportunity. The target has a nexus with anti-displacement efforts, as preservation and expansion of affordable housing in these communities helps to mitigate the risk of displacement for lower-income households.

As of 2010, approximately 15 percent of housing units in these communities have been identified as affordable; the proposed performance target would double this share to approximately 30 percent of housing units, an increase of 15 percentage points. Relying upon ballpark calculations using Plan Bay

Area growth forecasts, this would be the equivalent of locating all affordable housing in PDAs, TPAs or high opportunity areas while still allowing for 80 percent of all market-rate housing to be constructed in these zones as well.

Several definitions are critical for the evaluation of this target:

- Affordable Housing: refers to housing that is affordable to lower income households (moderate income making 80-120% AMI, low income making 50%-80% AMI, very low income making 0-50% AMI) that is either deed-restricted or produced by the market (non-deed-restricted).
- Priority Development Areas (PDAs): refers to locally-designated areas that are planned to accommodate the vast majority of regional housing and job growth.
- Transit Priority Areas (TPAs): refers to an area within a ½-mile of high quality transit (i.e., rail stop or a bus corridor that provides or will provide at least 15-minute frequency service during peak hours by the year 2040).
- High-Opportunity Areas: refers to areas that score highly in a composite score of 18 indicators, developed by the Kirwan Institute of Race and Ethnicity, pertaining to education, economic mobility, and neighborhood and housing quality.

Past Experience

This target was not included in Plan Bay Area and represents an expansion of Equitable Access targets to focus specifically on affordable housing development.

Evaluation Methodology

Baseline and future performance for this target were calculated using UrbanSim, the regional land use model, which will evaluate housing costs to identify affordable units available. UrbanSim incorporates deed restrictions into its analysis and thus reflects both deed-restricted and non-deed-restricted units in its calculations. GIS layers pertaining to PDAs, TPAs, and high-opportunity areas were then merged and overlaid on top of that baseline to determine the existing share of housing affordable to moderate to very low-income households in the Bay Area residing in those respective geographies.

Performance Target #7: Equitable Access (Displacement Risk)

Do not increase the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at risk of displacement

Background Information

Displacement has consistently been identified as a major concern for low-and-moderate-income households, who are most vulnerable to rising costs in the Bay Area's housing market. As households relocate to more affordable areas within and outside the region, they may lose not only their homes but also their social networks and support systems. The scale of displacement across the Bay Area has triggered major concerns among the region's elected officials who requested that displacement be directly addressed in Plan Bay Area.

The region's strong economy has brought many benefits such as employment growth, innovative technologies, and tax revenues for infrastructure improvements and public services. However, since housing production usually lags job creation, especially in a booming economy, there has been upward pressure on housing costs which is most keenly felt by households with the least resources. The working definition of displacement in this document is: Displacement occurs when a household is forced to move from its place of residence due to conditions beyond its ability to control. These conditions may include unjust-cause eviction, rapid rent increase, or relocation due to repairs or demolition, among others.

While there is currently no precise tool available to predict which and what number of households would be displaced from a given neighborhood, current research allows planners to measure existing and future displacement risk. According to the Regional Early Warning System for Displacement (REWS) study by the Center for Community Innovation at UC Berkeley (www.urbandisplacement.org), areas that are experiencing losses of low-income residents and affordable units are home to about 750,000 people. In general, areas of displacement and displacement risk are concentrated around high capacity transit corridors such as Caltrain on the Peninsula, BART in the East Bay, and in the region's three largest cities.

It is important to note that this approach highlights areas where lower-income households are potentially vulnerable to displacement; however, this study does not "predict" which specific neighborhoods will experience displacement, or how many households will be displaced in the future.

With a numeric target for ensuring displacement risk does not increase between the baseline and horizon years, ABAG and MTC are signaling the importance of this issue at the regional level. At the same time, regional agencies and stakeholders recognize that more specific local strategies will be needed beyond the scope of the Plan. The broader trend of risk is a function of job growth and wage disparities without an equal or greater expansion of adequate affordable housing at all income levels.

The performance target relies upon a consistent geography as target #6 (affordable housing), emphasizing minimization of displacement risk for low- and moderate-income renters who live in PDAs, TPAs (transit priority areas, per Senate Bill 375), or high-opportunity areas (as defined under target #6). This ensures consistency between the region's goals for affordable housing and minimization of displacement risk.

Past Experience

This target is not new to Plan Bay Area 2040, although it represents a more refined version of a displacement risk measure that was based on overburdened renters in the initial Plan Bay Area Equity Analysis. Overburdened renters served as a proxy for vulnerable populations. Using this methodology, the Equity Analysis conducted in 2013 estimated that the Plan increased the risk of displacement by 36% in Communities of Concern and by 8% everywhere else.

Evaluation Methodology

Displacement risk was calculated by measuring the decline of low and moderate-income households in PDAs, TPAs, or high-opportunity areas between the target baseline year and 2040. In order to forecast the risk of displacement in 2040 relative to conditions in the baseline year, the analysis compared the following data points [note that "lower-income" is defined as including both low- and moderate-income households; i.e., quartiles 1 and 2 for household income]:

- Number of lower-income households in the target baseline year in each TAZ; and
- Number of lower-income households in each TAZ in 2040 based on UrbanSim output (land use model)

Due to model limitations which make it impossible to identify household tenure by income level, all lower-income households are included in the target calculation. Only zones designated as PDAs, TPAs, or high-opportunity areas that lost lower-income households are included in the target calculation per the adopted language.

The analysis estimated which zones (i.e., TAZs) gained or lost lower-income households; those zones that lost lower-income households over the time period would be flagged as being “at risk of displacement.” The share of lower-income households at risk of displacement would be calculated by dividing the number of lower-income households living in TAZs flagged as PDAs, TPAs, or high-opportunity areas with an increased risk of displacement by the total number of lower-income households living in TAZs flagged as PDAs, TPAs, or high-opportunity areas in 2040.

The relative risk of displacement for each Plan scenario was estimated using this methodology, comparing to trends between year 2000 and year 2010 to establish baseline risk levels. Relative risk is varied between scenarios, since each scenario allocated households across the region based on different growth patterns.

Performance Target #8: Economic Vitality (Access to Jobs)

Increase by 20% the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit in congested conditions

Background Information

Given that economic forecasts for the Plan are consistent across scenarios, the Plan’s greatest potential to affect the region’s economic vitality can be measured via access to jobs. The general consensus amongst economists is that a higher number of jobs a worker can access within a reasonable commute shed leads to greater prospects for employment and greater potential for economic advancement. This performance measure is designed to capture the ability of workers to get to jobs in congested conditions, reflecting the economic impact of traffic congestion on the region’s economy. Rather than a “pure” measure of congestion (such as minutes of delay), which primarily captures the benefit of highway projects and fails to recognizes the underlying economic justification for projects that tackle this regional issue, this performance measure reflects the full suite of policy tools that can be used to improve access to jobs during congested times of day. These include highway expansion, highway operational improvements, transit expansion, transit operational improvements, and land use strategies to bring workers and jobs closer together (i.e., jobs-housing balance).

Congested conditions are defined as the AM peak period, the most common time of day for commuting to work. The 30-minute and 45-minute thresholds for each mode of transport approximately reflect the average regional door-to-door commute time for each mode per Vital Signs data originally tabulated by the U.S. Census Bureau in 2013. The performance target focuses on all residents connecting to all jobs, given that this is a measure of the region’s overall economy (rather than a specific industry or economic class). It is not possible to measure jobs-housing fit as ABAG does not forecast jobs by income level, making it impossible to link residents and jobs based on income classification for future years (e.g. year 2040).

The numeric target was developed relative to the baseline conditions in 2005, at which point roughly one in five regional jobs was accessible to the average Bay Area resident within the time and congestion criteria identified above. The numeric target represents an approximate doubling of this level of jobs access by year 2040; this is reflected in the target as an increase in jobs access by 20 percentage points. The target was inspired by research incorporated in the “Access to Destinations” report produced by the University of Minnesota Center for Transportation Studies, which cites a 2012 Transportation Research Board paper on productivity effects from accessibility (Melo et al., 2012). The report identified that doubling jobs access correlates to real average wage growth of 6.5 percent for the average U.S. metro area. This linkage between the target and wage growth highlights how improved access to jobs can result in real-world economic benefits for workers.

Past Experience

This target is new to Plan Bay Area 2040. However, long-range plans developed by MTC in the past have used access to jobs as an economic performance target. The proposed target expands upon this past work by specifically incorporating congestion into the target to highlight the importance of congestion reduction as a regional economic concern. The prior Plan's economic target of gross regional product was removed as a performance target as it will not differ between scenarios, making it a poor yardstick by which to compare scenarios focused on differing transportation investments and land use patterns.

Evaluation Methodology

This performance target relies upon the Travel Model One "skims" for zone-to-zone congested travel times both for single-occupant vehicles and public transit. Using a Python script developed to evaluate accessibility, the "skim" matrices are loaded into the script, which then calculates for each zone which other zones it can reach either within 30 minutes by auto or within 45 minutes by transit. It is assumed that auto users are single-occupant vehicle drivers who decline the use of Express Lanes; the job access target looks specifically at the AM peak period, when the greatest share of the region's residents are commuting to work. By focusing on the AM peak, both auto and transit travel times reflect the impact of congestion on job access. Once the script has calculated which zones are accessible, the number of jobs accessible for the zone is summed and divided by the total jobs in the region. Using the share of jobs accessible for each zone, a regional share is calculated using a weighted average of all 1454 zones based on the number of residents in each zone. The result is a reflection of the average share of jobs accessible to the average number in the Bay Area.

Performance Target #9: Economic Vitality (Jobs/Wages)

Increase by 38% the number of jobs in predominantly middle-wage industries

Background Information

As home to some of the world's most innovative and successful businesses, the Bay Area boasted a gross regional product of $631 billion in 2013, making it one of the world's largest economies. However, the region's economic prosperity is unevenly felt, as 36% of the region's 1.1 million workers earn less than $18 per hour – with the majority of these workers earning even less than $12 per hour. As the Bay Area's cost of living (particularly housing costs) continues to skyrocket, a decent quality of life is becoming increasingly out of reach for hundreds of thousands of workers, particularly those without higher education.

This performance target acknowledges the importance of middle-wage jobs in the Bay Area's economy. The numeric target is based on a goal to preserve the target baseline year share of middle-wage jobs - by growing middle-wage jobs at the same rate as the region's overall growth in total jobs. The exact numeric target was updated in early 2016 to make it fully consistent with the overall job growth rate forecast from the finalized control totals, consistent with adopted direction from the Commission and ABAG Board.

Past Experience

This target is new to Plan Bay Area 2040, as the issue of middle-wage jobs was not specifically addressed in Plan Bay Area.

Evaluation Methodology

The number of jobs in predominantly middle-wage industries was forecast using ABAG's Forecast of Housing, Population and Jobs. This target seeks to achieve proportional growth of jobs in predominantly middle-wage industries to the region's overall growth in jobs; forecasts show overall job growth of 38% between the target baseline year and 2040.

Given that some industries have a higher proportion of middle-wage jobs than others, ABAG used the number of jobs in predominantly middle-wage industries as a proxy for the number of middle-wage jobs. Presently, forecasting limitations do not allow us to project the number of jobs in individual occupations (i.e., how many nurses there will be in 2040); however, ABAG could project the sectoral makeup of jobs within different industries. The share of middle-wage jobs within each industry was identified using baseline data for wage breakdowns by industry; the share of middle-wage jobs in a given industry today was assumed to be the same in 2040 for the purpose of target forecasting.

Notably, this target does not differ between scenarios, typically a requirement for performance targets. All regional forecast totals are held constant throughout the Plan process in order to focus on the Plan's different transportation investments and land use patterns and to assure consistency within the EIR analysis. In this sense, this performance target is more of an aspirational target, rather than a measure that can be compared across scenarios.

Performance Target #10: Economic Vitality (Goods Movement)

Reduce per-capita delay on the Regional Freight Network by 20%

Background Information

This target reflects the importance of goods movement as a component of the region's overall economy. In addition to ensuring access to and from the Port of Oakland – a major economic engine for the Bay Area – goods movement is critical in supporting agricultural and industrial sectors in the region. This proposed target focuses specifically on how trucks – the primary mode for goods movement – are affected by traffic congestion. While truck traffic cannot be forecasted with a high level of precision, this performance target captures the delay on high-volume truck corridors already identified by the Regional Goods Movement Plan.

The numeric target, reflecting a goal of reducing per-capita delay on these corridors by 20 percent, was based on Transportation 2035 (adopted in 2009). That plan was the most recent long-range regional plan to incorporate a delay target, as Plan Bay Area did not have a specific target related to goods movement. While Transportation 2035 focused on delay across the entire network, this performance target is slightly refined to focus in on goods movement corridors under the overarching goal of Economic Vitality.

Past Experience

This target is similar to a performance target used in Transportation 2035; however, no targets related to congestion reduction or goods movement were included in Plan Bay Area. In Transportation 2035, per-capita congestion increased as a result of capacity-constrained infrastructure (combined with robust pre-recession employment forecasts). Plan Bay Area congestion forecasts, included in the Environmental Impact Report (EIR), also showed a significant increase in congestion between baseline year and horizon year conditions.

Evaluation Methodology

In addition to calculating total delay, Travel Model One outputs vehicle hours of delay for specific corridors. To calculate this target, the appropriate corridors were flagged for analysis based on the Regional Freight Network from the Regional Goods Movement Plan; these include segments of the following highway corridors: I-880, I-80, I-580, US-101, I-680, SR-12/SR-37, SR-152 and SR-4. Vehicle hours of delay on this network were calculated for a typical weekday and were based on the differential between forecasted and free-flow speeds. The total vehicle hours of delay accrued on the network identified above were then divided by the regional population to calculate the per-capita delay along these freeway segments. Note that rail freight delay – which is a relatively small component of both overall goods movement and goods movement delay in the Bay Area – was not reflected in the target due to travel model limitations.

Performance Target #11: Transportation System Effectiveness (Mode Share)

Increase non-auto mode share by 10%

Background Information

This target reflects the overall efficiency of the transportation system by capturing the share of trips taken by non-auto modes – public transit, walking and bicycling. By aiming to increase the share of trips taken without a car by 10 percentage points, the target reflects a given scenario's ability to make non-auto modes more convenient and accessible for all. While this target is in many ways a proxy for the benefits associated with sustainable modes of transport, it reflects key policy goals related to modal shift in support of sustainable communities and transport efficiency.

Unlike other performance targets, there was not a strong foundation for this specific target at the time of its identification in Plan Bay Area, as it was a result of target modifications after initial adoption by MTC/ABAG in 2011. The initial target was related to non-auto travel time reduction, which proved problematic given that modal shift tended to increase rather than decrease travel times. However, the performance target does align to a certain extent with the aggressive targets established by the California Department of Transportation (Caltrans) in 2015, which seek to double mode shares for walking and public transit and triple mode share for target. The Plan Bay Area 2040 target would nearly double non-auto mode share, albeit over a more achievable time period (between 2005 and 2040) when compared to Caltrans' goal to increase mode shares within the next five years (between 2015 and 2020).

Past Experience

This target is fully consistent with Plan Bay Area; no changes have been made to the target as originally adopted in 2011. Plan Bay Area fell short on this performance target, achieving only a 4 percentage point increase in non-auto mode share (an increase from 16% non-auto mode share in 2005 to 20% non-auto mode share in 2040). This reflects the difficulty of achieving significant modal shifts in a mature region without more aggressive transportation and land use interventions. While non-auto mode share is particularly strong in the center of the region, a significant share of Bay Area residents live in lower-density communities without time-competitive alternatives to the automobile.

Evaluation Methodology

Non-auto mode share is a direct output of Travel Model One. The region's mode share is based on all trips made by Bay Area residents, rather than a narrow focus on commute trips. To calculate non-auto mode share, all non-auto trips (transit, bicycle and pedestrian) trips were first summed. They were then divided by the total number of regional trips (which includes the aforementioned modes but also adds in single-occupant and multi-occupant vehicle trips), which resulted in the percentage of trips utilizing non-auto modes.

Performance Target #12: Transportation System Effectiveness (State of Good Repair for Roads)

Reduce vehicle operating and maintenance costs due to pavement conditions by 100%

Background Information

This target focuses on the user impacts as a result of road maintenance for the region's freeways, arterials, and local streets. In a reflection of the region's "Fix It First" policy, the performance target seeks to bring all roads to a state of good repair and thus reduce the extra vehicle operating and maintenance costs associated with rough roads to zero. This would result in a 100% decrease in such costs between 2005 and 2040.

The target combines two separate targets from Plan Bay Area into a single target, while still respecting the importance of preserving all streets and continuing MTC's long-standing commitment to infrastructure preservation as a top priority. The target incorporates the monetary impacts to drivers, regardless of the facility type in question. Furthermore, it reflects the miles traveled on each type of road – the greater the traffic volumes, the greater the impact on vehicle operating and maintenance costs.

Past Experience

This target is new to Plan Bay Area 2040, as it was not included as a performance target in Plan Bay Area. However, every long-range transportation plan adopted by MTC over the past decade has included some measure of road and/or freeway state of good repair as a performance target, reflecting the high-priority nature of this transportation issue area. The target works to quantify the impacts of road maintenance funding levels in terms an average citizen can understand – additional vehicle maintenance costs as a result of system condition – regardless of the facility type the driver chooses to use to get from point A to point B.

Evaluation Methodology

This performance target was calculated using MTC's StreetSaver tool, Caltrans pavement forecasts, and Travel Model One. The specific methodology is detailed both in the 2015 Transportation Research Board Annual Meeting Compendium of Papers (Paterson and Vautin, 2015) and in the road state of good repair methodology (found later in this document). The methodology relies upon pavement condition index and international roughness index to calculate increased vehicle operating and maintenance costs as a result of rough roads. In general, roads with a PCI greater than 60 and freeways with IRI less than 95 are considered to be in fair, good, or excellent condition, moving us towards the regional goal of bringing our road infrastructure to a state of good repair. The target was calculated by calculating extra vehicle operating and maintenance costs in Travel Model One for both baseline and horizon year conditions to determine whether cost burdens on drivers increase or decrease over this period. The methodology incorporates all motor vehicles, including trucks; while it does not capture bike or pedestrian impacts, it serves as a useful proxy for potential safety disbenefits on these users due to potholes or other impacts of disrepair.

Performance Target #13: Transportation System Effectiveness (State of Good Repair for Public Transit)

Reduce per-rider transit delay due to aged infrastructure by 100%

Background Information

MTC has consistently prioritized a "Fix It First" policy in regional transportation plans, in which preservation of the existing system takes priority over expansion projects. In the past, transit asset condition has been measured with an index known as PAOUL (percent of transit assets over their useful life) – with a goal of replacing all transit assets on time. For Plan Bay Area 2040, the performance target focuses on the impacts of replacing (or not replacing) transit assets on time, with a goal of replacing delay impacts on riders due to aged assets by 100 percent (e.g., achieve zero delays due to aged buses, trains, tracks, etc. failing and thus affecting transit riders).

The numeric target was selected to align the target with the Plan Bay Area PAOUL target (same goal of replacing assets on time) and to reflect the "Fix It First" policy. Given that objective, it seems appropriate to set this aggressive target to bring the entire transit system to a state of good repair. Note that per-rider transit delay was measured in minutes for Bay Area transit riders.

Past Experience

This target is new to Plan Bay Area 2040, as it was not included as a performance target in Plan Bay Area. However, every long-range transportation plan adopted by MTC over the past decade has included some measure of transit state of good repair as a performance target, reflecting the high-priority nature of this transportation issue area. The target works to quantify the impacts of transit maintenance funding levels in terms an average citizen can understand – minutes of delay impacting their commute (or non-commute) onboard public transit as a result of system condition.

Evaluation Methodology

This performance target was calculated using the Regional Transit Capital Inventory, the Federal Transit Administration's TERM-Lite transit asset prioritization tool, and Travel Model One. This methodology is detailed both in the 2015 Transportation Research Board Annual Meeting Compendium of Papers (Paterson and Vautin, 2015) and in the transit state of good repair methodology (found later in this document). These failure rates are translated into per-boarding and per-mile delay rates that affect passengers. To calculate a regional impact, the delays for each system will be weighted by the number of passengers experiencing such delay to identify the average delay for the typical transit rider in the Bay Area as a whole. Delays from assets still within their useful life were not reflected in the performance target, as the target focuses specifically on "aged infrastructure" – that is, infrastructure past its useful life.

Scenario & EIR Alternative Performance Targets Analysis

The primary purpose of the performance targets is to evaluate scenarios – combinations of different land use growth patterns aligned with complementary transportation investment packages. The performance targets help planners, policymakers, and the public at large to understand the benefits and drawbacks of each, in addition to identifying areas where more effort may be needed in future planning cycles to achieve ambitious targets. The section discusses the scenarios and EIR alternatives that were evaluated the process, the overall key findings of the performance targets analysis, and specific outcomes on a target-by-target basis.

Defining the Scenarios and EIR Alternatives

As part of the scenarios analysis process, four scenarios were developed in early 2016, designed to look at a range of alternative visions for transportation and land use. Ultimately, three of these scenarios were carried over to the Environmental Impact Report (EIR), alongside a Preferred Scenario that pulled the strongest elements from each of the previously evaluated scenarios. In addition, a fifth scenario known as Equity, Environment, and Jobs 2.0 was added to the mix in response to EIR scoping comments. The following sub-sections briefly describe each scenario's key concepts; refer to the Environmental Impact Report and Investment Strategy Report for more detailed descriptions of the scenarios.

Scenarios Evaluated in the Planning Process and as EIR Alternatives

Four scenarios were evaluated during the planning process, including the Preferred which was adopted in November 2016 by MTC and ABAG. The scenarios were evaluated using final year 2040 model runs during the EIR process; these final results are discussed below.

- **No Project:** No new growth strategies would be implemented (upzoning, office caps, CEQA streamlining, etc.), meaning that future growth would likely follow historic trends. Urban growth boundaries would be allowed to expand at historical rates, while only committed transportation projects (e.g., those under construction) would be allowed to proceed.
- **Main Streets:** Select suburban Priority Development Areas would be upzoned to increase residential and commercial development capacity, while urban growth boundaries would be allowed to expand at faster rate. In addition to limited affordable housing requirements on new development, transportation investments would be focused on service frequency increases and highway capacity expansion, as well as increased funding for state of good repair.
- **Big Cities:** To encourage growth the three largest cities, upzoning would be focused in areas with significant transit access. Development caps would be eliminated in urban areas, and urban growth boundaries would not be allowed to expand. Additional inclusionary zoning policies and development fees on high-VMT areas would be applied. Transportation investments would focus on public transit and other alternatives to the car, including core capacity investments, expansion projects linking to the three largest cities, and cordon pricing.
- **Preferred:** The Preferred Scenario, also referred to as the Draft Plan, would upzone Priority Development Areas across the region and keep existing urban growth boundaries in place to focus regional growth. Additionally, it assumes 10 percent of new housing units would be deed-restricts and that a development fee on high-VMT areas would be implemented. Transportation investments would be balanced between modes, emphasizing "Fix It First", modernization of roads and transit systems, and high-performing expansion projects.

Scenarios Only Evaluated in the Planning Process

One scenario was studied in the planning process but did not move forward to the EIR, primarily due to the fact that it was most similar to the Preferred Scenario. As such, performance results for this scenario are not shown below as preliminary (year 2035) target results for this scenario cannot be accurately and consistently compared to the final (year 2040) target results for all other scenarios.

- **Connected Neighborhoods:** Similar to the Preferred Scenario, upzoning, fees, and related policies would be applied to encourage growth in PDAs, especially those well served by transit. Transportation investments would be balanced across roads and public transit, with an emphasis on maintenance, operations, and modernization.

Scenarios Only Evaluated as EIR Alternatives

One scenario was added to the mix based on comments received during the EIR Notice of Preparation (NOP) process – an updated version of the Equity, Environment, and Jobs (EEJ) scenario from the Plan Bay Area EIR. This scenario has the same control total and transportation revenue total as the other scenarios, but focuses more growth in high-opportunity suburban communities and prioritizes transit and non-motorized projects over road expansion.

- **Equity, Environment, and Jobs 2.0:** Upzoning would be implemented in select PDAs but also high-opportunity TPAs as well; job caps and urban growth boundaries today would be preserved through 2040. A significantly higher 20 percent inclusionary requirement for affordable housing would be applied in all cities with PDAs, and development fees on high-VMT areas would be applied to encourage growth in transit-served locations. Transportation investments would focus on improved service frequencies for transit (especially buses) as well as similar transit expansion projects to the Preferred Scenario. A VMT tax of 2 cents per mile would be applied and uncommitted highway expansion projects would not be constructed.

Overall Results for Final Scenarios/EIR Alternatives

- **The Preferred Scenario achieves five performance targets, moves in the right direction on four performance targets, and moves in the wrong direction on the remaining four performance targets.** While notable successes exist relating to climate protection, open space preservation, and goods movement exist, the Preferred fails to slow rising unaffordability, mitigate growing displacement risk, increase access to opportunity, or provide sufficient funding to maintain aging freeways and local streets. The Equity, Environment, and Jobs 2.0 alternative performs slightly better on several targets, such as greenhouse gas emissions reduction and housing + transportation affordability, but results in significantly greater traffic congestion on freight corridors.
- **While all scenarios except the No Project alternative achieve the greenhouse gas target, lower levels of driving in Big Cities and Equity, Environment, and Jobs 2.0 result in stronger performance.** Compared to the more dispersed land use pattern in Main Streets, these two scenarios have higher non-auto mode shares that yield additional greenhouse gas benefits and build upon the foundation of the Climate Initiatives Program (which is included in all scenarios except the No Project scenario). The Preferred Scenario also achieves the targets but performs slightly worse due to its greater investment in capacity-increasing highway projects.
- **The region's ambitious public health target remains stubbornly out of reach across all scenarios.** Much higher levels of walking and bicycling, combined with significant reductions in

traffic collisions, would be needed to improve residents' health outcomes. Transformative shifts, ranging from highly-focused development patterns and generational shifts in public perceptions of biking and walking modes to widespread deployment of automated electric vehicles, would be necessary to reach this goal.

- **Strict urban growth boundaries are effective in focusing growth within the existing urban footprint.** The Preferred Scenario, Big Cities, and Equity, Environment, and Jobs alternatives achieve the Open Space and Agricultural Preservation target due to their inclusion of strict urban growth boundaries, while No Project and Main Streets fare worse on this target.
- **Significant housing affordability challenges exist in all scenarios.** Challenges related to affordability and displacement risk increase in all scenarios, with the No Project alternative resulting in the greatest adverse impacts. Despite various housing and land use strategies included across all the scenarios to make the region more affordable, housing costs continue to rise, reflecting an increasingly expensive Bay Area housing market. Of the scenarios analyzed, the Equity, Environment, and Jobs 2.0 alternative performs slightly better than its peers in this regard, thanks to expanded inclusionary zoning and associated housing subsidies.
- **Freight flows benefit from regional transportation investments and smart land use decisions.** Main Streets, Big Cities, and the Preferred Scenario exceeded the congestion reduction target for freight corridors using different strategies. Main Streets and the Preferred Scenario both relied on an expanded express lane network to reduce congestion on truck corridors, while Big Cities succeeded in improving goods movement by focusing growth in the urban core and encouraging use of non-auto modes through new transportation options. Conversely, the lack of capacity-increasing highway projects, combined with a more suburban land use pattern, results in higher levels of traffic congestion in Equity, Environment, and Jobs 2.0 and No Project.
- **Increasing funding to "Fix It First" leads to much smoother streets and more reliable transit.** Main Streets' funding brings state highway pavement to ideal conditions while improving local streets as well, saving residents a significant amount of money each year. Other scenarios prioritize local streets – where funding has a lower bang-per-buck – but lack sufficient funding to even keep local pavement from declining from today's conditions. Turning to transit, boosted funding levels compared to Plan Bay Area mean that all scenarios make substantial progress, reducing delays from aged infrastructure by roughly 75 percent by 2040.

Target-by-Target Discussion of Results

Similar to color scheme used in the table below, **green** dots indicate that the scenario achieved the target, **yellow** dots indicate that the scenario is moving in the right direction (but falling short) on the target, and **red** dots indicate that the scenario is moving in the wrong direction on the target. The Preferred Scenario is consistently marked in **bold** for reference purposes.

Performance Target #1: Climate Protection

● No Project: -2%
● Main Streets: -14%
● Big Cities: -17%
● **Preferred: -16%**
● Equity, Environment, and Jobs 2.0: -17%

Scenarios with a greater investment in public transit and non-motorized alternatives performed marginally better than Main Streets and ultimately met or exceeded this performance target. No Project lacked the Climate Initiatives Program investment and performed markedly worse than all other scenarios evaluated. Big Cities and Equity, Environment, and Jobs 2.0 performed the best – with a 17 percent per-capita reduction in GHG emissions – thanks to transportation investments that were more effective in reducing vehicle miles traveled.

Performance Target #2: Adequate Housing

- No Project: 100%
- Main Streets: 100%
- Big Cities: 100%
- **Preferred: 100%**
- Equity, Environment, and Jobs 2.0: 100%

All scenarios met this performance target as they all rely on consistent control totals for population and housing growth. Plan Bay Area 2040 control totals incorporate additional growth to plan for no growth in in-commuting from outside the Bay Area.

Performance Target #3: Healthy and Safe Communities

- No Project: -0%
- Main Streets: -1%
- Big Cities: -1%
- **Preferred: -1%**
- Equity, Environment, and Jobs 2.0: -1%

Ultimately, the Healthy and Safe Communities target proved too ambitious to achieve in the absence of more aggressive policies and strategies. As shown above, all of the scenarios except for No Project achieved roughly similar performance results when rounded (1% reduction in adverse health impacts for the typical resident). Looking at results using a single decimal point precision, Equity, Environment, and Jobs 2.0 and Big Cities had a very slight edge (-0.7%) over and Preferred (-0.6%) thanks to their greater investment in healthier transportation modes and reduced vehicle miles traveled (which reduces safety impacts from crashes). Much more aggressive policies would be needed to achieve this visionary target, ranging from slower speed limits and additional fees to discourage driving to extremely robust bicycle/pedestrian infrastructure investments and an even more highly focused land use pattern.

Performance Target #4: Open Space and Agricultural Preservation

- No Project: 84%
- Main Streets: 98%
- Big Cities: 100%
- **Preferred: 100%**
- Equity, Environment, and Jobs 2.0: 100%

Three scenarios achieved the open space preservation target – Big Cities, Preferred, and Equity, Environment, and Jobs 2.0 – thanks to their inclusion of strict urban growth boundaries through year 2040. While the other two scenarios – No Project and Main Streets – still put the vast majority of growth in non-greenfield locations, both convert rural lands outside of existing growth boundaries (including farmlands and open space) to urbanized uses. Main Streets would do so for roughly 1,300 acres and No Project would allow nearly 16,000 acres of greenfield development. Note that all scenarios do include some greenfield development within urban growth boundaries, which is not reflected in this target as it allows for growth within year 2010 boundaries (many of which have been approved by voters).

Performance Target #5: Equitable Access (Affordability)

- No Project: +15%
- Main Streets: +13%

- Big Cities: +13%
- **Preferred: +13%**
- Equity, Environment, and Jobs 2.0: +12%

No scenario evaluated was able to reduce the already-high cost of living in the Bay Area and all move in the wrong direction on this important target. That being said, strategies boosting housing production in transportation-efficient locations generates more naturally-affordable and deed-restricted housing in all scenarios except for No Project. Furthermore, Big Cities, Preferred, and Equity, Environment, and Jobs 2.0 all reduce dependence on automobiles, the most expensive mode for system users – encouraging transit, walking, and bicycling instead through multimodal investments. Combined, these policies reduce the rise of combined housing & transportation costs by several percentage points. Equity, Environment, and Jobs 2.0 does the best in this regard, primarily due to housing strategies like a greater inclusionary requirement for new developments.

Performance Target #6: Equitable Access (Affordable Housing)

- No Project: -0%
- Main Streets: +2%
- Big Cities: +1%
- **Preferred: +3%**
- Equity, Environment, and Jobs 2.0: +3%

Similar to some targets discussed above, the goal of doubling the share of affordable housing in identified locations was remarkably ambitious given limited resources on the housing front. That being said, all scenarios except for No Project made progress towards the target – which means the number of affordable units grew faster than housing growth overall. Main Streets, Big Cities, and Preferred all boosted the number of deed-restricted units in PDAs, TPAs, and HOAs – but Equity, Environment, and Jobs 2.0 resulted in 40,000 additional units more than the runner-up (Main Streets with 119,000 units). However, in terms of naturally-affordable units, Preferred performs the strongest of the scenarios evaluated, with Equity, Environment, and Jobs 2.0 only outperforming No Project. Ultimately, Preferred and Equity, Environment, and Jobs 2.0 tied for strongest performance on this target. Additional affordable housing production policies and subsidies would be required to achieve stronger performance on this target.

Performance Target #7: Equitable Access (Displacement Risk)

- No Project: +18%
- Main Streets: +6%
- Big Cities: +9%
- **Preferred: +5%**
- Equity, Environment, and Jobs 2.0: +5%

Displacement risk was highest in the No Project scenario as it lacked any substantive policies – such as inclusionary zoning – to help mitigate the displacement crisis. Furthermore, it produces more housing at the periphery and less in the region's core, where housing is most needed to alleviate the imbalance between supply and demand. Preferred and Equity, Environment, and Jobs 2.0 performed the best on this target. While neither achieved the goal of mitigating all growth in displacement risk, they performed better than the Big Cities scenario which funneled a greater level of growth into the urban core with a more limited inclusionary zoning policy.

Performance Target #8: Economic Vitality (Access to Jobs)

- No Project: -3%

- Main Streets: -1%
- Big Cities: -1%
- **Preferred: -0%**
- Equity, Environment, and Jobs 2.0: -1%

All scenarios saw some slippage in the share of regional jobs accessible to the typical Bay Area resident between 2005 and 2040, although the Preferred did the best job in this regard. The Preferred Scenario did the best due to its investment in all modes, which mitigated some of the rising congestion expected in a growth scenario while also providing a robust suite of transit options. In addition, it focused growth in existing job centers well-served by transit, rather than distributing jobs across the region. The No Project scenario performed the worst – it was hobbled by its lack of transportation investments, both in terms of highways and transit.

Performance Target #9: Economic Vitality (Jobs/Wages)

- No Project: +43%
- Main Streets: +43%
- Big Cities: +43%
- **Preferred: +43%**
- Equity, Environment, and Jobs 2.0: +43%

As noted in the target methodology section, all of the scenarios saw the same performance for this target, which relies on the regional control totals and associated forecasts. The target results highlight relatively good news on this front – indicating that jobs in middle-wage industries are expected to grow at a rate faster than overall job growth. This bodes well for reversing the trend of declining middle-wage jobs in the Bay Area in recent decades. However, as there is no guarantee that middle-wage industries will continue paying decent wages in the future, ongoing monitoring will be a more important avenue forward.

Performance Target #10: Economic Vitality (Goods Movement)

- No Project: +38%
- Main Streets: -25%
- Big Cities: -33%
- **Preferred: -29%**
- Equity, Environment, and Jobs 2.0: -15%

Of all the performance targets, the results for this one showed the greatest variance across scenarios – perhaps speaking to the greater policy levers at our disposal to tackle traffic congestion and goods movement. While No Project performs the worst due to only committed projects advancing in that scenario, Big Cities outperformed all other scenarios, thanks to its urban-focused land use pattern and investment in alternative modes. These policies reduced auto demand for long-distance freight corridors, smoothing flow for trucks and remaining motorists. Equity, Environment, and Jobs 2.0 struggled on this target, falling short due to increased congestion due to greater suburb-to-suburb commuting and elimination of all highway expansion projects. Preferred Scenario was in the middle of the pack, with slightly better results than Main Streets and slightly worse results than Big Cities, but all of these scenarios met the 20 percent per-capita reduction target.

Performance Target #11: Transportation System Effectiveness (Mode Share)

- No Project: +2%
- Main Streets: +2%
- Big Cities: +4%
- **Preferred: +3%**

🟡 Equity, Environment, and Jobs 2.0: +4%

All scenarios made limited but notable progress in terms of increasing the regional mode share by 10 percentage points by 2040. Big Cities and Equity, Environment, and Jobs 2.0 performed the best with a 4% increase due to their denser land use patterns (which result in greater competitiveness for non-auto modes) and greater investments in bus and rail networks across the Bay Area. Bike and walk mode shares are relatively consistent across all scenarios; increased transit ridership forecasts accounted for the bulk of the non-auto mode share growth.

Performance Target #12: Transportation System Effectiveness (State of Good Repair for Roads)

🔴 No Project: +53%
🟡 Main Streets: -59%
🔴 Big Cities: +8%
🔴 **Preferred: +6%**
🔴 Equity, Environment, and Jobs 2.0: +10%

While the No Project scenario performs the worst due to the lack of regional discretionary dollars being put towards highway and road maintenance, the notable result for this target is the significant improvement in the Main Streets scenario. This was one area where Main Streets far outperformed its peers, and it was primarily driven by a focus on highway maintenance; regional discretionary funds were only allocated towards state highway maintenance in this scenario. While local street maintenance was also funded, it was the heavily-used highway network where funding allowed the region to achieve ideal conditions and make very significant progress towards the target. The other scenarios were relatively similar in terms of impacts on drivers from highway and road maintenance, with the Preferred seeing a slight uptick not evident in draft model runs (due to failure of select ballot measures and updates to reflect year 2040 pavement conditions).

Performance Target #13: Transportation System Effectiveness (State of Good Repair for Public Transit)

🟡 No Project: -57%
🟡 Main Streets: -77%
🟡 Big Cities: -78%
🟡 **Preferred: -75%**
🟡 Equity, Environment, and Jobs 2.0: -76%

Thanks to the strategic priorities set in the MTC's Transit Capital Prioritization (TCP) policy – which prioritize vehicles and other critical infrastructure first – all of the scenarios make significant strides in reducing delay due to vehicle and non-vehicle system breakdowns from aged assets. Marginal differences exist across scenarios due to slight variation in funding levels, as well as the ridership levels of each system. For example, the transportation and land use pattern in Equity, Environment, and Jobs 2.0 results in higher levels of BART ridership (a system where not all SGR funding needs for assets with operational impacts are met), resulting in slightly weaker performance than in Big Cities.

Goal	#	Target	%	No Project	Main Streets	Big Cities	Preferred	EEJ2*
Climate Protection	1	Reduce per-capita CO_2 emissions from cars and light duty trucks	-15%	-2%	-14%	<u>-17%</u>	-16%	<u>-17%</u>
Adequate Housing	2	House region's projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year	100%	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>	<u>100%</u>
Healthy & Safe Communities	3	Reduce adverse health impacts associated with air quality, road safety, and physical inactivity	-10%	-0%	<u>-1%</u>	<u>-1%</u>	<u>-1%</u>	<u>-1%</u>
Open Space & Agricultural Preservation	4	Direct non-agricultural development within the urban footprint (existing urban development and UGBs)	100%	84%	98%	<u>100%</u>	<u>100%</u>	<u>100%</u>
Equitable Access	5	Decrease the share of lower-income residents' household income consumed by transportation and housing	-10%	+15%	+13%	+13%	+13%	<u>+12%</u>
	6	Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas	+15%	-0%	+2%	+1%	<u>+3%</u>	<u>+3%</u>
	7	Do not increase the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at risk of displacement	+0%	+18%	+6%	+9%	<u>+5%</u>	<u>+5%</u>
Economic Vitality	8	Increase the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit in congested conditions	+20%	-3%	-1%	-1%	<u>-0%</u>	-1%
	9	Increase the number of jobs in predominantly middle-wage industries	+38%	<u>+43%</u>	<u>+43%</u>	<u>+43%</u>	<u>+43%</u>	<u>+43%</u>
	10	Reduce per-capita delay on the Regional Freight Network	-20%	+38%	-25%	<u>-33%</u>	-29%	-15%
Transportation System Effectiveness	11	Increase non-auto mode share	+10%	+2%	+2%	<u>+4%</u>	+3%	<u>+4%</u>
	12	Reduce vehicle operating and maintenance costs due to pavement conditions	-100%	+53%	<u>-59%</u>	+8%	+6%	+10%
	13	Reduce per-rider transit delay due to aged infrastructure	-100%	-57%	-77%	<u>-78%</u>	-75%	-76%

Table 4. Final scenario/EIR alternative analysis for Plan Bay Area 2040 performance targets.

** = Targets shown in **green** were achieved. Targets shown in **orange** fell short but moved in the right direction. Targets shown in **red** are moving in the wrong direction. Underlined text indicates which alternative performed the best for a given target. Note that EEJ2 is the acronym for the Equity, Environment, and Jobs 2.0 alternative.*

Project Performance Assessment

One of the primary methods for prioritizing long-term regional investments when crafting the Preferred Scenario was an evaluation of the largest, capacity-increasing projects that transportation agencies submitted during the Call for Projects in 2015. These projects were assessed individually to determine their support of the Plan's performance targets and to determine their cost-effectiveness. This assessment goes beyond the scenario-level analysis, which evaluated packages of projects tied to different land use strategies. The project performance assessment evaluated individual major investments in more detail than in the scenario analysis and informed creation of the Preferred Scenario. Because the transportation plan is fiscally constrained, not all projects evaluated could ultimately be included. Conducting project performance assessment was critical to help MTC and county staff determine which projects to prioritize.

Approach to Project Performance Assessment

The performance assessment was designed to identify high-performing investments among the variety of potential investments to prioritize for regional funding and to flag low-performing investments that might merit further review through a follow-on process. For medium-project projects, congestion Management Agencies (CMAs) ultimately prioritized those investments on a county-by-county basis, subject to fiscal constraint.

Projects were evaluated using two primary distinct assessments – one quantitative and one qualitative – that were used to define performance. Methodologies for both assessments were similar to the methodologies developed in Plan Bay Area, with several notable improvements and changes.

The targets assessment illustrated which projects would help the region reach the Plan's ambitious targets. Projects received a score for each target and the combined targets score provided a basis for determine which projects were most supportive (or least supportive) of the Plan's targets. The second assessment was a benefit-cost assessment that provided a basis for determining which projects yielded the highest regional benefit and, when divided by annual cost, which would generate benefits beyond the annual costs.

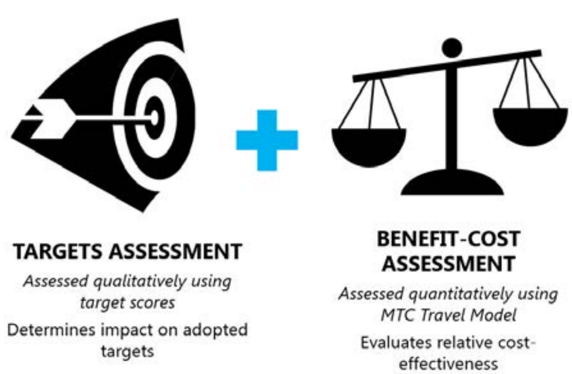

Figure 2. Project Performance Components.

Of the projects submitted for consideration in the long-range Plan, Projects that were fully committed, meaning having either a full funding plan or designated as committed by the MTC Commission, were not evaluated individually. Committed projects and programs, as defined by MTC Resolution No. 4182, were either fully funded by local/committed sources or had a certified environmental document by September 2015. Resolution 4182 also stated that committed programs such as Clipper and 511 were not subject to evaluation. These projects automatically were included in Plan Bay Area 2040.

Of the remaining, non-committed projects, MTC staff evaluated projects that met the following criteria:

1. The project impacts could be captured in the regional travel demand model (i.e., able to be modeled and either capacity-increasing or improving state of good repair). The following are examples of projects in this category:

    - Transit expansion projects (e.g., BART to Silicon Valley Phase 2)
    - Transit modernization projects (e.g., AC Transit Frequency Improvements)
    - Transit state of good repair investments (e.g., Muni Metro Maintenance)
    - Road expansion projects (e.g., SR-152 Widening)
    - Road modernization projects (e.g., Columbus Day Initiative)
    - Road state of good repair investments (e.g., Local Streets & Roads Maintenance)

2. The total project costs were at least $100 million (as measured in 2017 dollars), taking into account both capital and O&M costs through year 2040.

Using these criteria, staff evaluated 63 projects and 6 state of good repair investments. Unlike the projects, state of good repair, or maintenance, investments were not submitted by transportation agencies through the Call for Projects process. Instead, MTC developed different state of good repair scenarios based on funding levels from the various modal Needs Assessments to evaluate against the traditional expansion projects under consideration for the Plan. One of the key questions in developing the Plan was how much future funding to direct toward operations and maintenance compared to modernizing and expanding the existing transportation system. Understanding the cost-effectiveness of different investment levels and across modes helped inform this decision.

State of good repair investments were grouped into four modes – highways, local streets, rail transit, and bus transit. Costs and resulting asset conditions were forecast for three different scenarios – ideal conditions, preservation of existing asset condition, and a no funding scenario. For maintenance of local streets and roads, costs and pavement condition were also determined if only local funding was available. Benefits were then evaluated in the context of moving from one condition to the next. Table 5 presents the six state of good repair packages evaluated in this assessment. The assessment determined the cost-effectiveness of different investment levels in maintenance and across different modes.

Table 5. State of Good Repair Investments in Project-Level Performance Assessment

State of Good Repair Investment	Description	
Highway Pavement Maintenance	1	Preserve **existing** highway pavement conditions vs. **no future funding** for highway pavement
	2	**Ideal** highway pavement condition vs. preserve **existing** highway pavement conditions

State of Good Repair Investment		Description
Local Streets and Roads Maintenance	1	Preserve **existing** local streets and roads pavement conditions vs. **no future funding** for local streets and roads maintenance
	2	Preserve **existing** local streets and roads pavement conditions vs. **only local future funding** for local streets and roads maintenance
Public Transit Maintenance	1	Preserve **existing** rail asset condition (vehicles, fixed-guideway, etc) vs. **no future funding** for rail maintenance
	2	Preserve **existing** bus asset condition (primarily vehicles) vs. **no future funding** for bus maintenance

Targets Assessment

The first half of the project assessment was the qualitative targets assessment. As with the original Plan Bay Area, staff qualitatively evaluated the project's support for each of the targets on a 5-point scale, ranging from 1 to -1, in increments of 0.5. A project received a "+1" for a particular target if it strongly supported the target and a "-1" if it had a strong adverse impact on the target. The final target score is a sum across targets with the maximum possible score of a +13 and the lowest possible score of a -13. Ultimately though, target scores ranged from -1.5 to 9.5, with no project having adverse impacts across the board and no project advancing every target to the maximum extent.

Table 6 summarizes the criteria used to assess projects in this qualitative assessment; more detailed information, along with example projects evaluated as part of the targets assessment, can be found in Appendix A.

Table 6. Targets Assessment Methodology

#	Target	General Methodology
1	Reduce per-capita CO_2 emissions from cars and light duty trucks by 15%	**Positive Score:** Likely to reduce VMT **Negative Score:** Likely to increase VMT
2	House 100% of the region's projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year	**Positive Score:** Serves jurisdictions that approved high shares of RHNA for majority of income levels and planned to grow in Plan Bay Area **Negative Score:** Serves jurisdictions that approved low shares of RHNA across income categories and did not plan to grow in Plan Bay Area

#	Target	General Methodology
3	Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by 10%	**Positive Score:** Likely to cause moderate to large shift to non-auto modes **Negative Score:** Likely to moderately to significantly increase auto mode share or auto trips *Bonus 0.5 point if the project improves safety*
4	Direct all non-agricultural development within the urban footprint (existing urban development and urban growth boundaries)	**Positive Score:** Promotes infill development within urban growth boundaries or increases access to agricultural land **Negative Score:** Requires construction through open space or agricultural land or worsens access to agricultural land
5	Decrease by 10% the share of lower-income residents' household income consumed by transportation and housing	**Positive Score:** Transit project that improves service for an operator with significant low-income ridership or that serves a large share of the region's low-income riders **Negative Score:** Reduces transportation choices for low- and middle-income residents or increases transportation costs
6	Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas by 15%	**Positive Score:** Serves jurisdictions that permitted high share of affordable housing in the last two cycles of RHNA **Negative Score:** Serves jurisdictions that permitted low share of affordable housing in the last two cycles of RHNA
7	Reduce the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at an increased risk of displacement to 0%	**Positive Score**: No project is anticipated to reduce the risk of displacement **Negative Score:** Serves jurisdictions that plan to growth significantly in the most recently adopted long-range plan (Plan Bay Area) and are currently undergoing displacement
8	Increase the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit by 20% in congested conditions	**Positive Score**: Decreases travel time during commute hours and serves a regional or sub-regional job center **Negative Score:** Increases travel time
9	Increase by 38% the number of jobs in predominantly middle-wage industries)	**Positive Score**: Directly adds short-term and long-term jobs to the region (construction and operations) **Negative Score:** Reduces the number of transportation-related jobs required
10	Reduce per-capita delay on the Regional Freight Network by 20%	**Positive Score**: Reduces congestion or improves reliability on freight corridors **Negative Score:** Increases travel time or decreases reliability on freight corridors
11	Increase non-auto mode share by 10%	**Positive Score:** Likely to cause moderate to large shift to non-auto modes **Negative Score:** Likely to moderately to significantly increase auto mode share or auto trips
12	Reduce vehicle operating and maintenance costs due to pavement conditions by 100%	**Positive Score:** Improves roadway surface condition **Negative Score:** No project would be anticipated to generate an adverse impact by worsening pavement quality.
13	Reduce per-rider transit delay due to aged infrastructure by 100%	**Positive Score:** Improves transit asset condition **Negative Score:** No project would be anticipated to generate an adverse impact by worsening transit asset condition.

Several of the targets for Plan Bay Area 2040 have a housing focus. To evaluate individual transportation projects against housing targets, staff first determined a service area for each transportation project. Service areas varied by the scale of the transportation project. For example, the service area for the express lane network was the full nine-county Bay Area, whereas the service area for a BRT project is only the jurisdictions through which the project passes. Housing performance was then calculated for each jurisdiction, relying either on the last two RHNA cycles for a sense of past performance or the most recently adopted land use plan at the time of the assessment for a sense of future performance.

Benefit-Cost Assessment

The second half of the project assessment was a benefit-cost assessment. The assessment quantified as many benefits as technically feasible, relying heavily on the methodology developed in the benefit-cost assessment from the original Plan Bay Area. Benefits included changes in accessibility (travel time and cost), reliability, emissions, physical activity, and noise[1]. All benefits were monetized with the benefit valuations found in Table 2.

To complete the assessment, a project's monetized annual benefits in year 2040 were divided by a project's annualized total cost using 2017 dollars throughout. Annualized total cost was calculated by taking capital costs and dividing by the expected life of the capital investment (as shown in Table 3) and then adding one year of net operating and maintenance costs in 2040. For roadway projects, MTC staff estimated annual operations and maintenance costs using average per-mile road maintenance costs. For transit projects, the operating costs reflect potential revenues from fares, approximated with each operator's farebox recovery ratio[2]. For tolling projects, staff assumed the tolls would cover the operations and maintenance costs.

Evaluation of State of Good Repair Investments

As described in the Approach section, staff evaluated six state of good repair investment scenarios. This evaluation was one of the significant differences between the assessments in Plan Bay Area and Plan Bay Area 2040. Plan Bay Area evaluated different types of maintenance investments using a sketch-level methodology that monetized different benefits than what were included in the benefit-cost evaluation for the other projects. Since adoption of the last Plan, staff developed methodologies for evaluating the benefits of local streets and roads and transit state-of-good repair using the same metrics as for expansion projects. A brief description of the new methodology is as follows:

> <u>Local Streets and Roads</u> – The methodology involves the connection between pavement condition and vehicle operating costs. Staff forecasts pavement conditions for cities and

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[1] For all projects and state of good repair investments, a project's benefit was estimated using the regional travel demand model, Travel Model One. Each project was coded as its own "Build" scenario and compared to a "No Build" scenario. Both the Build and No Build used the same land use assumptions in the most recently adopted land use projection at the time of the assessment, Plan Bay Area, for the horizon year, 2040. MTC ran the full travel model through three iterations to estimate project benefits. MTC developed a tool to difference the build and no build metrics and monetize the metrics appropriately. The tool is called COBRA. The script is open source and available here: https://github.com/MetropolitanTransportationCommission/travel-model-one/tree/master/utilities/PBA40/metrics

[2] Based on the operators' FY13 farebox recovery ratio (most recent fully-audited data point at the time of this assessment) – from the Statistical Summary of Transit Operators.

counties based on funding levels and facility prioritizations using MTC's asset-management software, StreetSaver. A separate model translates pavement condition into vehicle maintenance and fuel consumption costs by type of vehicle, based on the findings in NCHRP Report 720.[3] These costs are incorporated into the vehicle operating cost in the travel demand model, which effectively makes trips more expensive if drivers are traveling on roadways in poor condition. This affects auto mode choice and travel costs.

Transit – The methodology involves the connection between asset age and travel times associated with aging infrastructure. Staff forecasts transit asset conditions for transit operators using FTA's TERM-Lite software. A separate model estimates in-vehicle and out-of-vehicle transit delay as a function of failure frequencies based on TCRP Report 157.[4] Delay varies by transit operator and mode. For example, the impact of a Caltrain failure often leaves a rider with fewer options than if the breakdown occurred on a Muni bus with available parallel routes, but a Muni breakdown might affect a larger number of customers in the travel model. Delay is then input into travel demand model, which effectively increases the travel time on transit modes in poor condition. This affects transit mode choice and travel times.

Appendix B includes more detailed methodology for the state of good repair assessments.

[3] National Cooperative Highway Research Program (NCHRP) Report 720: Estimating the Effects of Pavement Condition on Vehicle Operating Costs

[4] Transit Cooperative Research Program (TCRP) Report 157: State of Good Repair – Prioritizing the Rehabilitation and Replacement of Existing Capital Assets and Evaluating the Implications for Transit

Table 7. Benefit Valuations

	Benefit	Valuation ($2017)	What does this valuation represent?
Travel Time and Reliability	In-Vehicle Travel Time per Person Hour of Travel	$12.66	In-vehicle travel time for auto and transit users is set at 50% of the median regional wage rate ($25.32). [5] The valuation represents the discomfort to travelers of enduring transportation-related delay and the loss in regional productivity for on-the-clock travelers and commuters.
	Transit Out-of-Vehicle Travel Time per Person Hour of Travel	$27.85	This value is equal to 2.2 times the valuation of in-vehicle travel time.[6] The valuation represents the additional discomfort to travelers of experiencing uncertainty of transit arrival time, exposure to inclement weather conditions, and exposure to safety risks.
	Freight/Truck In-Vehicle Travel Time per Vehicle Hour of Travel	$33.69	The valuation is the total hourly compensation paid to truck drivers. This valuation represents the labor cost of transporting goods on the roadway network,[7] multiplied by a total compensation factor to estimate the total compensation cost.[8]
	Auto Travel Time Reliability per Person Hour of Non-recurring Delay	$12.66	The value is set equal to the value of in-vehicle travel time for autos. The valuation represents the additional traveler frustration of experiencing non-expected incident related travel delays.
	Freight/Truck Travel Time Reliability per Vehicle Hour of Non-recurring Delay	$33.69	The value is set equal to the value of in-vehicle travel time for trucks. The valuation represents the additional loss of regional productivity due to experiencing non-expected incident related travel delays.
Safety	Fatality Collisions (per fatality)	$10.8 million	The valuation includes the internal costs to a fatality collision victim (and their family) resulting from the loss of life, as well as the external societal costs. [9]
	Injury Collisions (per injury)	$124,000	The valuation includes the internal costs to an individual (and their family) resulting from the injury, as well as the external societal costs. [10]
	Property Damage Only Collision (per incident)	$4,590	The valuation includes the internal costs to a property damage collision victim (and their family) resulting from the time required to deal with the

[5] Valuation source: Plan Bay Area 2013, guidance from USDOT and Caltrans. Median wage is for the San Francisco-Oakland-Fremont MSA ($23.72), from the Bureau of Labor Statistics 2014 Metropolitan Area Occupational Employment and Wage and uprated to 2017 using a 2.2% expansion rate.

[6] Valuation source: FHWA Surface Transportation Economic Analysis Model (STEAM).

[7] Source: FHWA Highway Economic Requirements System. The wage value used is the weighted average of the mean wage rates for light and heavy truck drivers in the San Francisco-Oakland-Fremont MSA ($20.61), adjusted with a 2.2% escalation rate between 2014 and 2017.

[8] The total compensation factor is the national average total compensation divided by the national average wages, from the Bureau of Labor Statistics 2014 Employer Costs of Employee Compensation survey.

[9] Source: NHTSA May 2015 revision to The Economic and Societal Impact of Motor Vehicle Crashes

[10] See note 9.

	Benefit	Valuation ($2017)	What does this valuation represent?
			collision, as well as the external societal costs from this loss of time. [11]
GHG Emissions	CO_2 per Metric Ton	$100	This valuation represents the full global social cost of an incremental unit (metric ton) of CO_2 emission from the time of production to the damage it imposes over the whole of its time in the atmosphere. [12]
Air Quality	Diesel $PM_{2.5}$ per Ton	$665,400	These valuations represent the negative health effects of increased emissions including[13] loss of productivity, direct medical costs, pain and anxiety that result from adverse effects, loss of enjoyment time, and adverse effects on others due to health impacts.
	Direct $PM_{2.5}$ per Ton	$658,800	
	NO_x per Ton	$6,000	
	Acetaldehyde per Ton	$5,100	
	Benzene per Ton	$15,200	
	1,3-Butadiene per Ton	$42,600	
	Formaldehyde per Ton	$5,900	
	All Other ROG per Ton	$4,300	
	SO_2 per Ton	$22,200	
Operating, Parking and Ownership Costs	Auto Operating Costs per Auto Mile Traveled	$0.3072	This valuation represents the variable costs (per mile) of operating a vehicle, including fuel, maintenance, depreciation (mileage), and tires. Fuel costs and efficiencies reflect 2040 forecasts. [14]
	Truck Operating Costs per Truck Mile Traveled	$0.8795	
	Parking Costs per Auto Trip	Model Output	This valuation is consistent with parking cost estimation in Travel Model One.
	Auto Ownership Costs per Vehicle (change in the number of autos)	$3,920	This valuation represents the annual ownership costs of vehicles, beyond the per mile operating costs. This valuation includes purchase/lease costs, maintenance, and finance charges. [15]
Health	Costs of Physical Inactivity: Morbidity and Productivity, per Active Adult	$1,341	This valuation represents the savings achieved by influencing an insufficiently active adult to engage in moderate physical activity five or more days per week for at least 30 minutes. It reflects annual Bay Area health care cost savings of $326 (2006 dollars), as well as productivity savings of $717 (2006 dollars). [16]

[11] See note 9

[12] Source: Interagency Working Group on Social Cost of Carbon and using the 2040 cost at a 2.5% discount rate, adjusted to 2017 dollars.

[13] Source: BAAQGM Multi-Pollution Evaluation Method (MPEM

[14] Source: 2014 California High Speed Rail Benefit-Cost Analysis.

[15] Source: 2011-2012 Consumer Expenditure Survey (Bureau of Labor Statistics, 2014).

[16] Source: "The Economic Costs of Overweight, Obesity, and Physical Inactivity Among California Adults", California Center for Public Health Advocacy/Chenweth and Associates, 2006,

	Benefit	Valuation ($2017)	What does this valuation represent?
	Costs of Physical Inactivity: Mortality, per Life Saved	$10.8 million	The value of life estimation from the fatality benefit is used again to determine the value of reducing life-threatening disease by becoming more active.[17]
Noise	Noise per Auto Mile Traveled	$0.0013	This valuation represents the property value decreases and societal cost of noise abatement.[18]
	Noise per Truck Mile Traveled	$0.0170	

Table 8. Life-Cycle Cost Assumptions

Capital Component	Expected Useful Life (in years)
Local bus	14
Express bus	18
Bus rapid transit (BRT) system	20
Rail infrastructure (majority of ROW in tunnel)	80
Rail infrastructure (all other)	30
Ferry	25
Technology/operations	20
Roadway	20
Roadway (majority tunnel)	80

Key Findings of Project Performance

This section highlights several of the key findings from the project performance assessment. Tables with the final results (simplified and expanded) are in Appendix C.

1. **Maintaining regional transit infrastructure ranks as the top priority, given its high level of cost-effectiveness and strong support of adopted targets.**

When considering the projects with the largest total benefits, maintaining the region's highways, local streets and roads and rail assets generated significantly higher benefits than the benefits from all uncommitted expansion and modernization projects combined. Fully investing in state of good repair of all modes would generate approximately $7 billion in annual benefit compared to $5 billion in annual benefit for the non-maintenance investments. The largest maintenance benefit – at roughly $3 billion in annual benefit – would come from improving highway pavement condition. The primary benefit from these investments are reductions in vehicle operating costs that would arise from driving on smoother pavement. Maintaining rail assets would generate $1.4 billion in annual benefit, primarily from reducing

[17] Source: World Health Organization's Health Economic Assessment Tool, available online: http://www.heatwalkingcycling.org/

[18] Source: May 2000 addendum to the FHWA federal Cost Allocation report.

maintenance-related delays across the system. Conversely, if the region did not invest in maintaining rail assets, travelers would take between 270,000 and 320,000 fewer transit trips, leading to increasing congestion or just less travel overall. Benefit-cost ratios for these three maintenance investments vary from 11 for highways to 4 for local streets and roads. The annual benefits for rail maintenance are seven times the annual cost.

2. **The two largest benefits for transportation projects were either increases in access or increases in health benefits.**

The most commonly understood benefits for transportation projects are decreases in travel time and travel cost. This evaluation combined these two metrics into a single measure of access[19], which evaluated the ease of reaching destinations after a project is constructed. When monetized by half of the regional wage, access benefits typically comprised at least 40% of a project's benefits. Projects that connected a large number of people to dense activity centers had the largest access benefits. Examples include Highway Pavement Maintenance, which would decrease travel costs for the majority of Bay Area residents who continue to drive in the future, and increases in regional transit access, which would connect many people to dense jobs throughout the region (e.g. increasing service on BART and extending Caltrain to downtown San Francisco).

For smaller scale projects that would yield predominantly neighborhood-level benefits, the primary benefit came from health and lower vehicle ownership rates. This assessment evaluated health benefits of both the morbidity and mortality effects of an active lifestyle, with the research supporting the claim that walking and biking leads to longer lifespans (and thus fewer deaths overall). The World Health Organization developed a methodology for this association that staff applied for the first time in this assessment[20]. By valuing a life at $10.8 million and estimating how many lives would be saved from people becoming more active, projects like light rail extensions and bus rapid transit projects in Priority Development Areas would generate significant health benefits. Interestingly, these projects were also more likely to lead to lower vehicle ownership rates than the large-scale transit projects, which would still require driving to stations and for the rest of trips on a given work day.

3. **Land use matters – projects that support Plan Bay Area growth patterns showed strong performance.**

Because the performance assessment informs the ultimate Plan's transportation investments, it uses the most recently adopted land use pattern available at the time of analysis, which is typically from the previous Plan. The project assessment for this Plan used the adopted, focused growth pattern from Plan Bay Area and is thus the first performance assessment of a Sustainable Communities Strategy. Table 9 presents benefit-cost ratios and ranks of several transit projects that were only moderately cost-effective in Plan Bay Area that were among the most cost-effective projects in Plan Bay Area 2040. Several of these transit projects in the South Bay would increase transit service within San Jose and Sunnyvale's planned focused growth corridors, leading to significant benefits from active transportation and reductions in vehicle ownership.

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[19] The estimate of access is primarily a function of destination-choice logsums of the travel model, an estimate of freeway reliability, and an estimate of truck travel time and cost.

[20] Source: World Health Organization's Health Economic Assessment Tool, available online: http://www.heatwalkingcycling.org/

Table 9. Benefit-Cost Ratios and Ranks across Two Plans for Select Projects

Project	Plan Bay Area		Plan Bay Area 2040	
	B/C[1]	B/C – Rank[2]	B/C[1]	B/C – Rank[2]
BART to Silicon Valley	**5**	23	**8**	6
VTA El Camino BRT	**2**	36	**7**	9
Geary BRT	**2**	44	**6**	10
Capitol Light Rail Extension	**0.5**	68	**6**	11
Vasona Light Rail Extension	**0.0**	77	**3**	30

1. In both Plans, the highest B/C was "infinite." In Plan Bay Area, the second highest B/C was 59 and in Plan Bay Area 2040, the second highest B/C was 17.
2. In Plan Bay Area, benefit-cost assessment included 78 projects. In Plan Bay Area 2040, benefit-cost assessment included 69 projects.

Modal and Geographical Performance Differences

Modernization projects (which focus on improving existing transportation assets) typically performed better on both components of the project assessment than expansion projects (which emphasize widening highways or extending fixed transit guideways to new service areas). Implementation of ITS technologies – such as ramp metering and signal coordination – through programs like MTC's Columbus Day Initiative[21] performed better than freeway widening projects; this is due to the cost-effectiveness of efficiency projects in comparison to capital-intensive construction and the location of investments. Modernization projects in the core of the region, where most congestion is projected to occur in the future, were among the most cost-effective. Additionally, value pricing projects, including a proposal to implement congestion pricing in San Francisco's central business district and on Treasure Island, were shown to be highly cost-effective and particularly supportive of the Plan's targets, given their ability to reduce congestion and fund transit service and bicycle and pedestrian improvements with net revenues.

Transit modernization projects also performed very well, demonstrating a high level of cost-effectiveness and strong support for the targets, particularly when servicing high-growth Priority Development Areas of the East and South bays. Projects such as bus rapid transit systems in San Francisco, Oakland, and San Jose (Geary BRT, Stevens Creek BRT, and San Pablo BRT) emphasized high-demand corridors where dedicated lanes and bus signal priority achieve substantial benefits at a relatively low cost. Additionally, modernization of the BART system would increase service along several of the most congested corridors in the region – leading to significant access benefit with the additional service.

Combining Cost-Effectiveness and Targets Results

For both Plan Bay Area and this update, a project's performance is a function of both cost-effectiveness and support for targets. The best performing projects would score high across both metrics. Figures 3 through 5 present a series of bubble charts that illustrate a project's performance on cost-effectiveness (vertical axis) and target score (horizontal axis). The size of the bubble represents the magnitude of benefits. Among the highest performing projects, regional transit maintenance scored the highest on

[21] The Draft Plan now refers to Columbus Day Initiative as Bay Area Forward.

targets and medium-high on cost effectiveness. Extending BART to San Jose and constructing BRT along Geary Boulevard were also projects with high targets score and medium-high benefit-cost ratios.

Performance Application

To apply the results of the performance assessment, staff defined performance thresholds that placed projects in three buckets – high, medium, and low. Staff subsequently prioritized regional funding like New Starts/Small Starts/Core Capacity funding and STP/CMAQ on the highest performing projects. For projects in the low-performing category, sponsors were required to submit a compelling case, detailing reasons these projects should still be considered as candidates for Plan Bay Area 2040.

Performance Thresholds

At their May 2016 meeting, the MTC Planning Committee approved thresholds that created 11 high-performing projects, 40 medium-performing projects, and 18 low-performing projects. As shown in the thresholds below, high-performing projects could have either a high benefit-cost ratio and a medium targets score or a high targets score and a medium benefit-cost ratio. Low-performing projects could have either a negative targets score or a benefit-cost ratio less than 1.

- High-performer Thresholds:
    - Benefit-Cost Ratio ≥ 7 and Targets Score ≥ 3 **OR**
    - Targets Score ≥ 7 and Benefit-Cost Ratio ≥ 3
- Low-performer Thresholds:
    - Benefit-Cost Ratio < 1 **OR**
    - Targets Score < 0
- Medium-performer Thresholds: *all other projects*

Staff used the results of the performance thresholds to give priority to high-performing projects in the investment strategy of Plan Bay Area 2040 and work with sponsors to determine if medium and low performing projects should be included within the fiscal constraint of the Plan.

Figure 3. Overall Results by Project Type

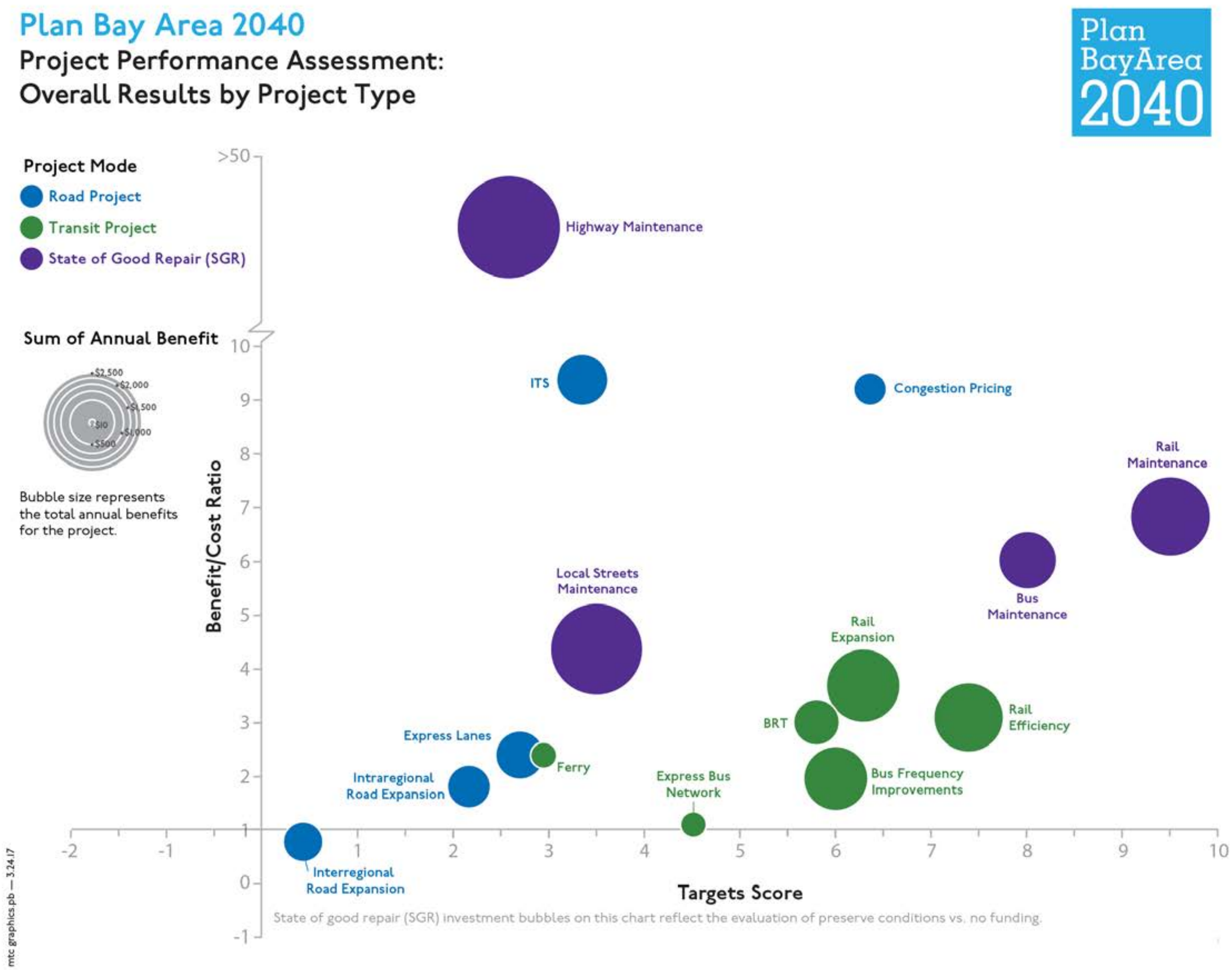


Figure 4. Results for Road Projects

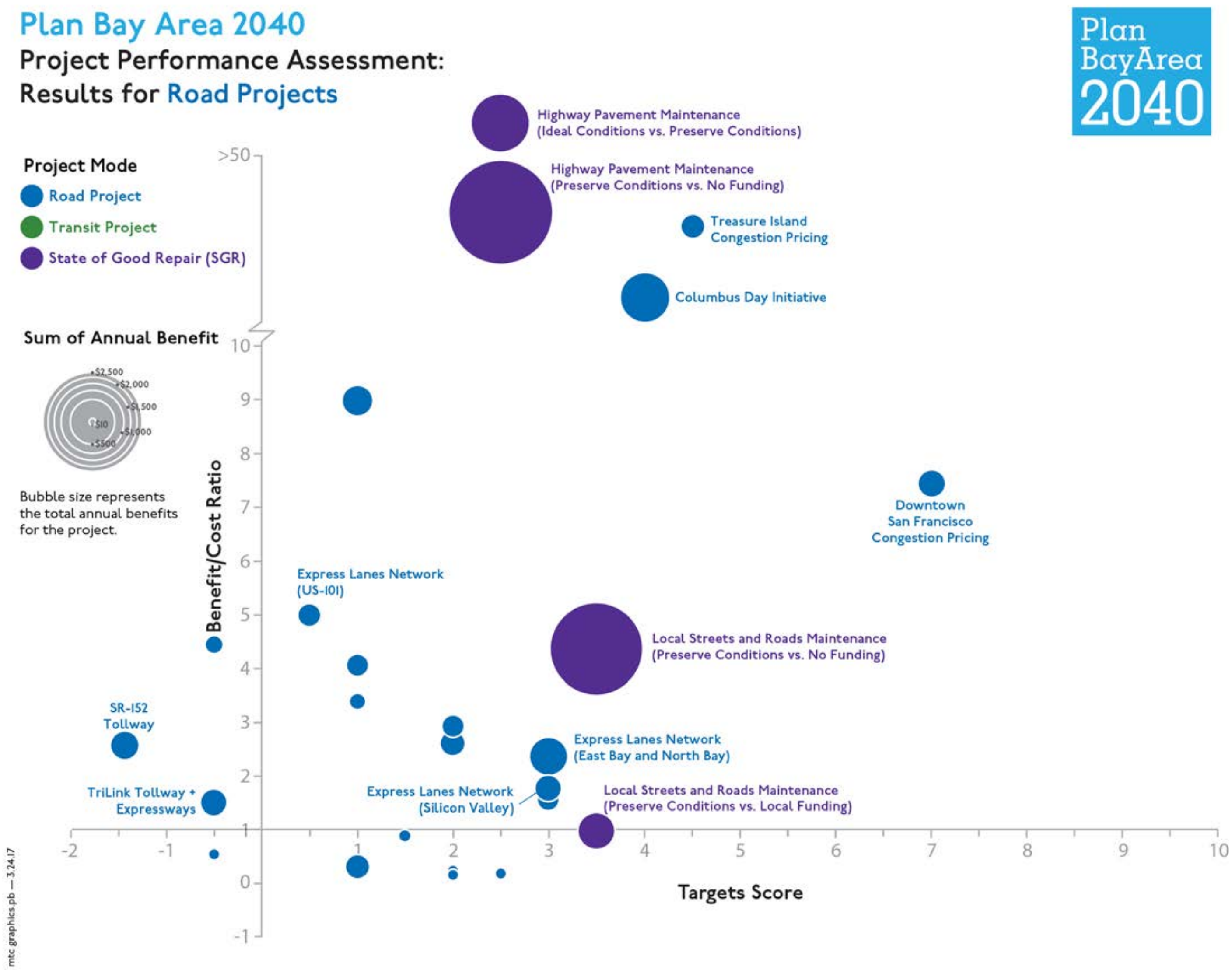
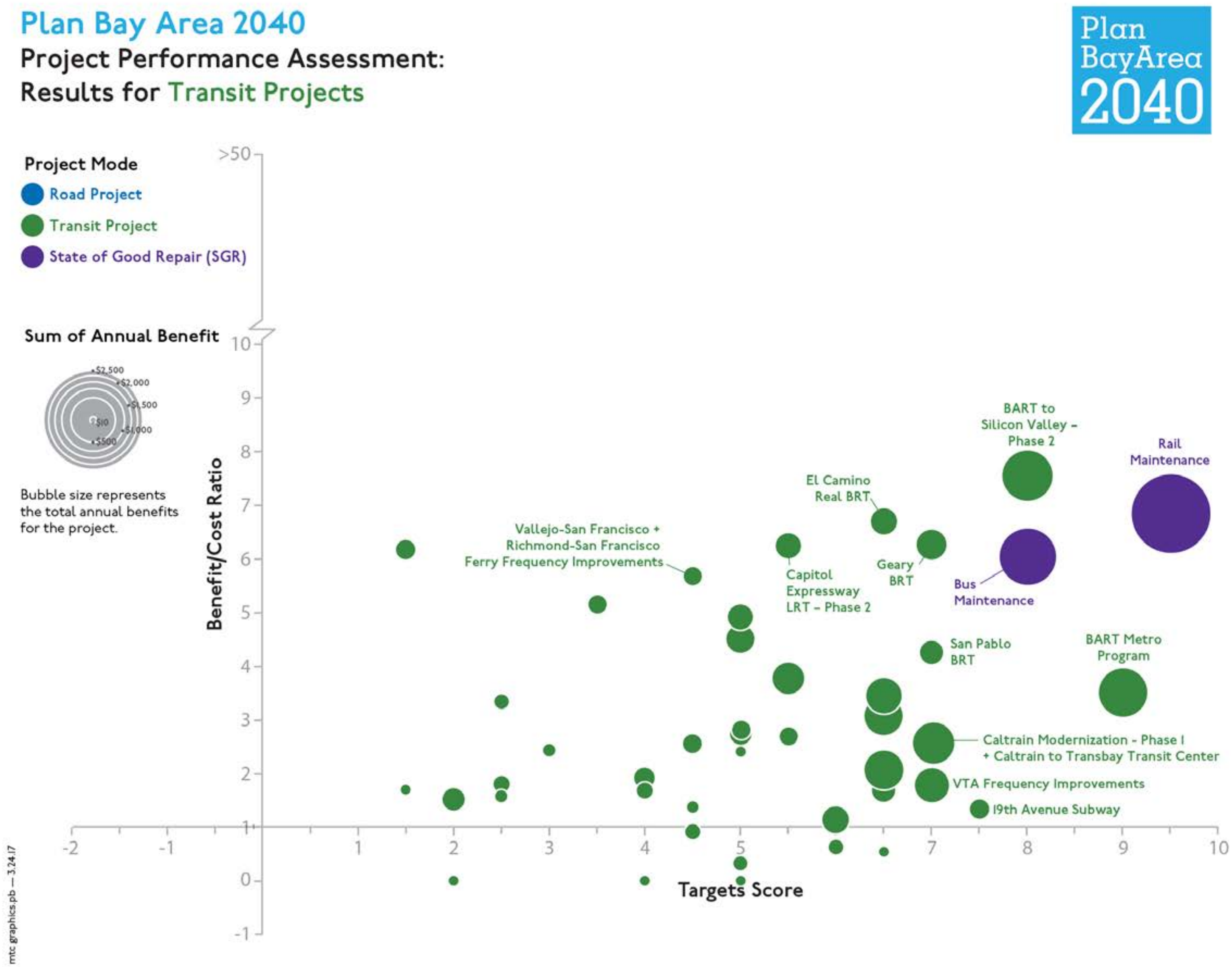


Figure 5. Results for Transit Projects



High-Performers

The performance threshold created two categories of high-performing projects – those with strong cost effectiveness and those with strong support for the Plan's targets. Projects with the highest cost-effectiveness and medium support for the targets included the Treasure Island Congestion Pricing Project, Columbus Day Initiative, BART to Silicon Valley (Phase 2), Downtown San Francisco Congestion pricing, Public Transit Maintenance – Rail Operators, and El Camino BRT.

Projects with the highest targets score and medium cost-effectiveness included Geary BRT, San Pablo BRT, Public Transit Maintenance – Bus Operators, BART Metro Program, and Caltrain Modernization + Downtown Extension.

Staff used these results to prioritize future regional discretionary revenues for the 11 high-performing projects. All of the high-performing transit projects reflect the region's latest FTA Section 5309 New Starts/Small Starts/Core Capacity priorities. Columbus Day Initiative and San Francisco's two congestion pricing projects have been prioritized for future regional discretionary funding. Staff have also prioritized almost 30% of regional discretionary funding (approximately $22 billion) to make significant progress on funding transit maintenance needs. For more information on transportation funding priorities in the Plan, see the Investment Strategy Supplemental Report.

Low-Performers

The performance thresholds also created two categories of low-performing projects – those that were not cost-effective and those that affected the region's ability to meet the Plan's targets. Of the latter case, only three projects received negative targets score. These included two major extensions of roadway into open space and one road facility upgrade in an area with poor land use performance. The fifteen remaining projects had benefit cost ratios less than 1.0. These included two express bus projects, tunneling Highway 17 through Santa Cruz Mountain, constructing a bike path on the west span of the Bay Bridge, extending SMART rail to Cloverdale, running ferry service to Redwood City, and constructing a contraflow bus lane on the Bay Bridge.

Because cost-effectiveness and targets score are not the only two considerations for inclusion in the regional transportation plan, staff set up a process for upgrading low-performing to medium-performing status based on more nuanced information. Similar to the original Plan Bay Area process, MTC approved a set of criteria under which a compelling case could be made. These criteria reflect either a short-coming in the benefit-cost methodology or an over-riding consideration related to federal policy initiatives. Table 10 displays the specific criteria and Table 11 presents the list of low-performing projects and outcomes for each project.

Table 10. Compelling Case Criteria

CATEGORY 1: Benefits Not Captured by the Travel Model	CATEGORY 2: Federal Requirements
A. Serves an interregional or recreational corridor B. Provides significant goods movement benefits C. Project benefits accrue from reductions in weaving, transit vehicle crowding or other travel behaviors not well represented in the travel model D. Enhances system performance based on complementary new funded investments	A. Cost-effective means of reducing CO2, PM, or ozone precursor emission (on cost per ton basis) B. Improves transportation mobility/reduces air toxics and PM emissions in communities of concern

Rather than go through the compelling case process, sponsors for ten of the eighteen low-performing projects decided to drop the project or convert them to a project type that was exempt from the evaluation. Two projects were converted to environmental studies, two projects were reduced in scope and funded completely with a local sales tax, and six projects were ultimately dropped.

Two additional projects provided updated cost or scope data that sufficiently demonstrated they could achieve a benefit-cost ratio greater than one, thus allowing staff to designate them as medium-performing projects.

For the remaining seven projects that did submit a compelling case, staff recommended approving four projects, most of which fell under criterion 2A (improving air quality in a cost-effective manner) or criterion 2B (improving mobility or air quality in Communities of Concern). The 80/680/12 interchange project provided several model-based reasons for justifying the project and staff approved their arguments under 1A, 1B, and 1C. The remaining three projects – totaling $1.2 billion – did not successfully receive approval of their cases based on evaluation against the six adopted criteria. These three projects were either down-scoped to environmental funding or scaled back.

All in all, the compelling case process removed billions of dollars of low-performing projects from Plan Bay Area 2040 and boosted the cost-effectiveness of the overall Plan. A summary of all low-performing projects and their outcomes is shown below.

Table 11. Low-Performing Projects

Project Title	Low-Performing Reason	Outcome
Downtown San Jose Subway (Japantown to Convention Center)	Low B/C	Dropped
SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)	Low B/C	Dropped
Bay Bridge West Span Bike Path	Low B/C	Rescoped to environmental
VTA Express Bus Frequency Improvements	Low B/C	Dropped
Express Bus Bay Bridge Contraflow Lane	Low B/C	Rescoped to environmental
TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)	Low Targets Score	Rescoped to only include Airport Connector arterial segment near Byron for a cost less than $100 million
Lawrence Freeway	Low B/C	Rescoped to Tier 1 elements only and funded with local sales tax
Antioch-Martinez-Hercules-San Francisco Ferry	Low B/C	Costs updated to reflect smaller-scale privately-operated ferries, bringing B/C above 1
I-680 Express Bus Frequency Improvements	Low B/C	Costs updated to reflect standard hourly rate for express bus service, bringing B/C above 1
SR-4 Widening (Antioch to Discovery Bay)	Low B/C	Dropped
I-80/I-680/SR-12 Interchange Improvements	Low B/C	Compelling case 1A, 1B, and 1C approved
SR-262 Connector (I-680 to I-880)	Low Targets Score	Compelling case 2A approved
East-West Connector (Fremont to Union City)	Low B/C	Compelling case 2B approved

Project Title	Low-Performing Reason	Outcome
Southeast Waterfront Transportation Improvements	Low B/C	Compelling case 2B approved
Geneva-Harney BRT (Phase 1)	Low B/C	Compelling case 2B approved
San Francisco-Redwood City + Oakland-Redwood City Ferry	Low B/C	Compelling case considered but ultimately included as environmental
SR-152 Tollway (Gilroy to Los Banos)	Low Targets Score	Compelling case considered but ultimately included as environmental
SMART – Phase 3 (Santa Rosa Airport to Cloverdale)	Low B/C	Compelling case considered but ultimately included as an extension to Cloverdale and environmental funding for the remaining segment

Supplemental Assessments

In addition to the targets assessment and benefit-cost assessment for all major projects, three supplemental assessments were conducted. The three supplemental assessments included:

Confidence assessment – this analysis identified the primary shortcomings of the quantitative assessment approach, including limitations in travel model specificity or calibration, completeness of benefit estimation, and the horizon-year approach.

Sensitivity testing – this analysis documented the impact of benefit valuations on the estimate of cost-effectiveness by varying key components of the B/C calculation and evaluating the effects on project ranking.

Equity considerations – this analysis calculated an equity targets score and overlaid projects on the region's Communities of Concern.

Confidence Assessment

The confidence assessment described potential limitations of the benefit-cost assessment. Disclosure of these limitations informed the project prioritization process for Plan Bay Area 2040 and is included in Appendix D. Staff qualitatively assessed confidence in the benefit-cost ratios based on the following criteria:

Travel Model Output

- Does the travel model have limitations in understanding a particular type of travel behavior (e.g. merging and weaving at interchanges)?
- Does the travel model lack an understanding of smaller-scale project travel changes relative to the region (e.g. single infill station, expressway improvements)?

Framework Completeness

- Does the travel model output capture all of the primary benefits of the project (e.g. the value of relieving transit crowding or primarily recreational or tourism benefits)?

Timeframe Inclusiveness

- Is the project an "early winner" (i.e. can be implemented quickly and provides key benefits in the short term)?

- Is the project a “late bloomer” (i.e. benefits will not be realized until the final years of the planning horizon)

Sensitivity Testing

Sensitivity testing was used to understand how benefit valuations and project cost assumptions affected the cost-effectiveness estimates across projects. The sensitivity test included three types of tests: one on a project’s costs, one on the valuation of travel time, and one on the valuation of life. The test on cost increased a project’s annual cost depending on project type, acknowledging that capital-intensive rail projects have historically experienced significant cost increases over several years of planning. The second test on the valuation of travel time reduced this valuation by 50% to assess which projects would have higher “social benefits” (e.g. safety and health) relative to user benefits. The third test on the valuation of life reduced this valuation by 50%. After these three tests, staff evaluated the new benefit/cost ratios and rankings for the projects.

Changing the valuation on travel time had a significant effect on the project rankings. Many of the projects with a high share of travel time benefits and that already were at the border of cost-effectiveness fell below the benefit-cost ratio threshold of 1. Examples include the Express Lane Network, US-101 Marin Sonoma Narrows Phase 2, TriLink Tollway, Golden Gate Transit Frequency Improvements and Muni Service Frequency Improvements. Additionally, benefit-cost ratios for Rail Maintenance and the Columbus Day Initiative decreased enough to drop their rankings by at least 4 projects. With this lower valuation, the resulting benefit-cost distribution would be more uniform, implying that the final performance outcomes (e.g. high, medium, low) might have relied more heavily on the targets score.

Increasing annual costs based on project type had the largest effect on rail projects. This is the type of project that has historically experienced the highest amount of cost increase of the period of project development. This sensitivity test mostly moved rail projects out of the top 10 and moved maintenance projects higher on the list. Changing the valuation of life did not generate significant changes in project ranking nor did any project’s B/C ratio fall from above 1 to below 1.

Appendix E includes detailed results for the sensitivity test.

Project-Level Equity Considerations

The third supplemental assessment evaluated a project’s ability to support the equity issue areas of Plan Bay Area 2040 and the degree to which they would serve a Community of Concern (CoC). This equity assessment first isolated each project’s scores on the six equity related targets for Plan Bay Area 2040 – healthy and safe communities, housing and transportation costs, affordable housing, displacement risk, access to jobs, and middle-wage jobs creation. Next, the assessment considered how each project would increase access for the region’s Communities of Concern. Projects that would not increase access for these populations did not receive a score in the equity assessment. Projects that would increase access were ranked according to their score on the subset of targets that have an equity nexus.

Every project with a high benefit-cost ratio and a strong support rating for regional targets would improve access to at least one Community of Concern in the Bay Area. The notable result reflects the strong equity nexus in the adopted performance targets, with six of the thirteen targets having a clear nexus with social equity. While the highest possible equity targets score possible was six, the three highest-performers only received a score of four. This is in part due to the many “Moderate Adverse” scores on the displacement target. The same inner urban areas that have the potential to increase access for a number of Communities of Concern, are also the areas with some of the highest risks for displacement.

Additionally, 19 projects would not increase access for a Community of Concern. These include ferry projects without an access point in a Community of Concern and light rail projects in the South Bay with stations outside Community of Concerns.

Appendix F includes more detailed methodology and results.

Appendices

Appendix A: Targets

Appendix B: Highway + Local Streets State of Good Repair Methodology
(Local Streets and Roads Working Group - February 2016)

Appendix B: Public Transit State of Good Repair Methodology
(Transit Asset Management Subcommittee - February 2015)

Appendix C: Project Performance Assessments

Appendix D: Confidence Assessment of Benefit-Cost Results

Appendix E: Benefit Valuation Sensitivity Test Methodology and Results

Appendix F: Equity Assessment

Appendix A: Targets Criteria Application and Data Tables

This section describes the methodology used to assign targets scores during the project-level assessment. The methodology includes example projects that received a range of target ratings, as well as common reasons for rating projects in a given way. This qualitative assessment is designed to complement the purely quantitative evaluation of cost-effectiveness.

As a reminder, the score for a particular target ranges from -1 to +1 and can be one of five categories: strong support, moderate support, minimal support (0), moderate adverse impact, and strong adverse impact. The final targets score is the straight sum of the 13 individual scores.

Target 1: Reduce per-capita CO2 emissions from cars and light-duty trucks by 15%.

Projects supported the target if they were likely to reduce VMT; provide an alternative to driving alone; or advance clean fuel vehicles. Projects that were likely to lead to an increase VMT are assumed to have an adverse impact on the target.

Guidelines for Applying Criteria

Transit, bicycle and pedestrian projects were expected to reduce VMT and were rated as supportive of the target. Larger projects, those likely to serve a large number of trips or serve longer trips, were rated as strongly supportive. Smaller projects, those likely to serve fewer trips or shorter trips, were rated as moderately supportive.

Projects that increased roadway capacity or were expected to increase VMT were generally rated as having a strong adverse impact on the target. Operational roadway projects, such as highway interchange projects, were not expected to increase VMT significantly since they did not add capacity and were generally rated as having minimal impact. Roadway projects that include transit, bicycle and pedestrian elements were given minimal or moderate support to recognize the impacts of these multi-modal elements.

Examples

Projects with the potential to reduce long car trips by attracting long-distance riders received strong support for this target. Example projects include BART Metro Program and Caltrain Electrification.

Projects that would expand a roadway, reducing congestion and making driving attractive received moderate to strong adverse impact scores. Example projects include SR-4 Auxiliary Lanes, TriLink, and SR-152 Alignment.

Target 2: House 100% of the region’s projected growth by income level without displacing current low-income residents and with no increase in in-commuters over the Plan baseline year.

The assessment of a project’s impact on housing was dependent upon two criteria: potential for housing growth in the jurisdictions affected and those jurisdictions’ past track record on producing housing at multiple income levels. The strongest support was for projects that were located in jurisdictions that had above average production for at least three income categories and a high amount of housing planned in the future (at least 20%). Staff designed the performance thresholds such that regional performance would receive a “moderate support” rating.

Guidelines for Applying Criteria

To determine a project's potential support for adequate housing, a project's service area was first determined. Service areas varied by project type, location, and travel demand. An expansive, regional project would cover more jurisdictions whereas a project on smaller facilities would likely only serve one jurisdiction. As an example, the service area for BART to San Jose spans multiple jurisdictions in Santa Clara and Alameda counties whereas the service area for Geary BRT is San Francisco.

For each service area, staff evaluated RHNA performance across the previous two RHNA cycles – 1999-2006 and 2007-2014. RHNA performance is based on the share of housing units permitted for the four income categories (very low income, low income, moderate income, and above moderate income). A project in a service area where most of the jurisdictions permitted above average shares of RHNA category would receive stronger ratings for this target. For each service area, staff also evaluated anticipated growth in Plan Bay Area 2013. A project in a service area where jurisdictions planned to increase housing stock by at least 10% received moderate to strong support for this target.

The data tables used to score this target are included later in this appendix.

Examples

Projects in eastern Contra Costa County and eastern San Clara County received strong support, because jurisdictions like Antioch, Brentwood, San Jose, Milpitas, and Sunnyvale have historically permitted housing across the income spectrum and accepted significant housing in Plan Bay Area 2013. Example projects include the SR-4 Operational Improvements, Capitol Expressway Light Rail Extension, and VTA Bus Service Increases.

Projects in San Mateo County and western Santa Clara County received minimal or moderate adverse results despite serving areas that plan to grow significantly in Plan Bay Area 2013. If a jurisdiction historically has only permitted housing for above-moderate incomes, the project serving that jurisdiction received a minimal score. Example projects include US-101 Express Lanes, Caltrain Electrification, and Stevens Creek BRT.

Target 3: Reduce adverse health impacts associated with air quality, road safety, and physical inactivity by 10%

Projects supported the target if it was likely to cause large shifts to non-auto modes. A shift to non-auto modes leads to more active lifestyles, reduces the amount of emissions associated with driving, and could reduce the number of auto collisions by virtue of few people in vehicles. If a project is primarily a road safety project, staff increased the target score by half a point.

Guidelines for Applying Criteria

Projects generally received the same rating for this target as they did for CO_2 reduction (target 1)

Examples

BRT projects that received moderate support in Target 1 received strong support in this target due to their ability to not only improve air quality but significantly increase non-auto mode share. The benefit-cost results support this claim as the BRT projects were more likely to create mortality benefits and reduce vehicle ownership than regional rail extensions. Example BRT projects include Geary BRT, San Pablo BRT, and Stevens Creek BRT.

Significant road expansion projects like TriLink and SR-152 received a moderate adverse score for this target due to their substantial safety components. These two projects received strong adverse scores for Target 1.

Target 4: Direct all non-agricultural development within the urban footprint (existing urban development and urban growth boundaries)

Projects that do not consume open space or agricultural lands support the target. Projects that improve access to agricultural lands support the target because they maintain economic viability of those lands; this is consistent with requirements in SB 375. Plan Bay Area must show how farmland is preserved from urban development and issues like access for farm to market are considered. Projects that directly consume open space or agricultural land have an adverse impact.

Guidelines for Applying Criteria

Projects that helped to promote infill development are given a supportive rating for this target, as developing or redeveloping existing urban areas reduced the demand for sprawling developments at the fringe of the region.

Support for the target was also given for improved access to agricultural lands. Highway projects that connected agricultural lands to urban areas were supportive of the target since these projects could foster improved goods movement by trucks to their destination. A project would receive an adverse score if it would require new right-of-way in previously undeveloped open space or agricultural land.

Examples

Staff evaluated transit projects that significantly increase access within Priority Development Areas while also not consuming open space as being strongly supportive of this target. Example projects include the BART Metro Program, BART to San Jose, Caltrain Electrification and Regional Transit State of Good Repair.

Staff evaluated road extension projects as having strong adverse impacts on achieving this target. Example projects include TriLink and SR-152 Alignment.

Target #5: Decrease by 10% the share of lower-income residents' household income consumed by transportation and housing

Projects supported the target if they included transit enhancements that provided a lower-cost transportation alternative to driving. The degree of support varied based on the operator's current low-income ridership. Road project with a significant low cost option such as HOV lanes, transit, bicycle, or pedestrian component AND that serves a Community of Concern could also receive a moderate support for this target.

Guidelines for Applying Criteria

Staff considered transit projects to be provide a lower-cost alternative to auto ownership and thus supported this target. The degree of support was based on the percentage of the region's total low-income riders and the proportion of low income riders served by the operator. The percentages of low-income riders were based on the Transit Demographics Survey and the Statistical Summary of Bay Area Transit Operators; refer to Table 3.

Transit operators' projects received a strong support rating if low-income riders constitute over 40% of system ridership or if the operator serves more than 10% of the region's low-income transit riders. Transit operators' projects received a moderate support rating if the projects serves more than 0.5% of the region's low-income transit riders; transit projects for operators with less than this threshold received a minimal impact rating.

Examples

The projects that most strongly supported this target were VTA and AC Transit projects, two operators whose share of low-income riders is over 40%. Example projects include San Pablo BRT and El Camino BRT. Muni and BART projects also strongly support this target for serving more than 10% of the region's low-income riders. Example projects include Geneva BRT and BART Metro Program.

Although Treasure Island Value Pricing and Downtown San Francisco Cordon Pricing includes significant increases to transit service, these two projects remove a free drive alone option and thus were rated as having a minimal impact on this target. No projects received a moderate or adverse impact.

Target 6: Increase the share of affordable housing in PDAs, TPAs, or high-opportunity areas by 15%

Staff considered projects to be supportive of this target if they serve jurisdictions that permitted high shares of affordable units in the last two RHNA cycles (1999-2014), irrespective of transportation mode.

Guidelines for Applying Criteria

To determine a project's potential support for affordable housing, a project's service area was first determined. The service area is the same as the service area for Target 2. Staff then evaluated the share of affordable units each jurisdiction permitted relative to their RHNA target. Affordable units are based on very low, low, and moderate income levels. Project's that serve areas with jurisdictions that approved more than 50% of their affordable housing target received strong support for this target. Staff created the RHNA thresholds such that region-wide performance was moderately supportive of the target.

Examples

Most of the cities in Contra Costa County and many cities in Sonoma County permitted high shares of affordable housing over the last decade. Projects serving these areas that received strong support for this target include San Pablo BRT, Sonoma County Bus Service Increases, and the SMART extension to Cloverdale.

Projects that received moderate adverse scores for this target served low growth communities of San Mateo County and communities that have permitted significant housing but at higher income levels like Dublin and Fremont. Example projects in this category include Caltrain Electrification, US 101 Express Lanes, Irvington BART Station, and I-580 Integrated Corridor Management.

Target 7: Reduce the share of low- and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at an increased risk of displacement to 0%

Admittedly, the criteria for this target was the most difficult to develop and implement. Staff determined that no transportation project would reduce the risk of displacement. These criteria assume that any increase in access would increase the attractiveness of a neighborhood, potentially leading to displacement of existing residents. The target score is a function of project location – whether a project serves a high growth area and the level of existing displacement risk for low-income and moderate-income households. If a project is completely outside of Priority Development Areas, the project would have a minimal impact on this target.

Guidelines for Applying Criteria

To determine a project's potential support for displacement risk, a project's service area was first determined. The service area is the same as the service area for Target 2 and Target 6. Staff then evaluated whether the service area had high growth jurisdictions, planned to grow more than 20%, or was in an area with high displacement risk. An area is currently undergoing displacement if it exhibits displacement typologies 2-4 for both lower income and moderate to high income tracts per the Regional Early Warning System definitions (REWS). For a map of displacement trends, see: http://www.urbandisplacement.org/map# Because the REWS typologies are for census tracts, staff assumed that if more than 75% of a jurisdiction's tracts are undergoing displacement then the jurisdiction is underdoing displacement.

Examples

Based on planned growth in Plan Bay Area 2013 and existing displacement trends, all San Francisco projects received a strong adverse impact score for this target. The two central bay ferry projects also received strong adverse impact for the displacement conditions in Oakland and Alameda.

Projects that received a minimal impact include projects in Contra Costa County like the 680/SR-4 Interchange and ferry expansion to Hercules, Martinez and Antioch. Additionally, projects in Solano and Marin counties, which are either low growth areas or are not experiencing displacement issues, would only minimally impact this target.

Target 8: Increase the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit by 20% in congested conditions

Supportive projects were those that significantly decrease travel times and connected many workers to the region's job centers. Rating was dependent on project location and degree of travel time improvement.

Guidelines for Applying Criteria

Projects serving the regional job centers of San Francisco, Silicon Valley, and Oakland and that significantly increased access to these job centers by virtue of major transit extensions or frequency increases strongly supported this target. Projects with moderate travel time savings like an interchange that are also relatively far from a sub-regional job center received minimal scores. If a project increased travel time, it would adversely impact the target.

Examples

Major transit extensions to existing and future job centers strongly supported this target. Example projects include BART to San Jose and the extension of Caltrain to downtown San Francisco. Service increases throughout San Francisco also strongly support this target.

Interchange and highway projects far from subregional job centers minimally supported this target. Example projects include the SR-152 alignment and SR-4 widening in Brentwood. Maintenance investments in highways and local streets and roads would have a minimal effect on travel times and received minimal scores for this target.

Target 9: Increase by 38% the number of jobs in predominantly middle-wage industries)

Supportive projects were those that through construction and an increase in service would add both short term and long term jobs to the regional economy. If a project reduces the number of transportation-related jobs, like automating an existing bus route, would adversely impact this target. Transportation-related jobs are typically middle-wage and supportive of the target.

Guidelines for Applying Criteria

All projects received moderate or strong support for this target as all projects either require constructing new infrastructure or operating new service. For example, increased maintenance funding would require additional long-term workers and a highway operational project would require short term construction workers. Transit and ITS projects that require both short term construction workers and long term operators strongly support this target.

Examples

Constructing and operating express lanes and integrated corridors received strong support for this target. Additionally, constructing and operating rail extensions also received strong support.

Examples of moderate support include service frequency increases and auxiliary lane projects.

Target 10: Reduce per-capita delay on the Regional Freight Network by 20%

Supportive projects were those that reduce congestion on the highest delay highway segments for truck activity. Projects would receive negative scores if they actually increased travel time on the regional freight network.

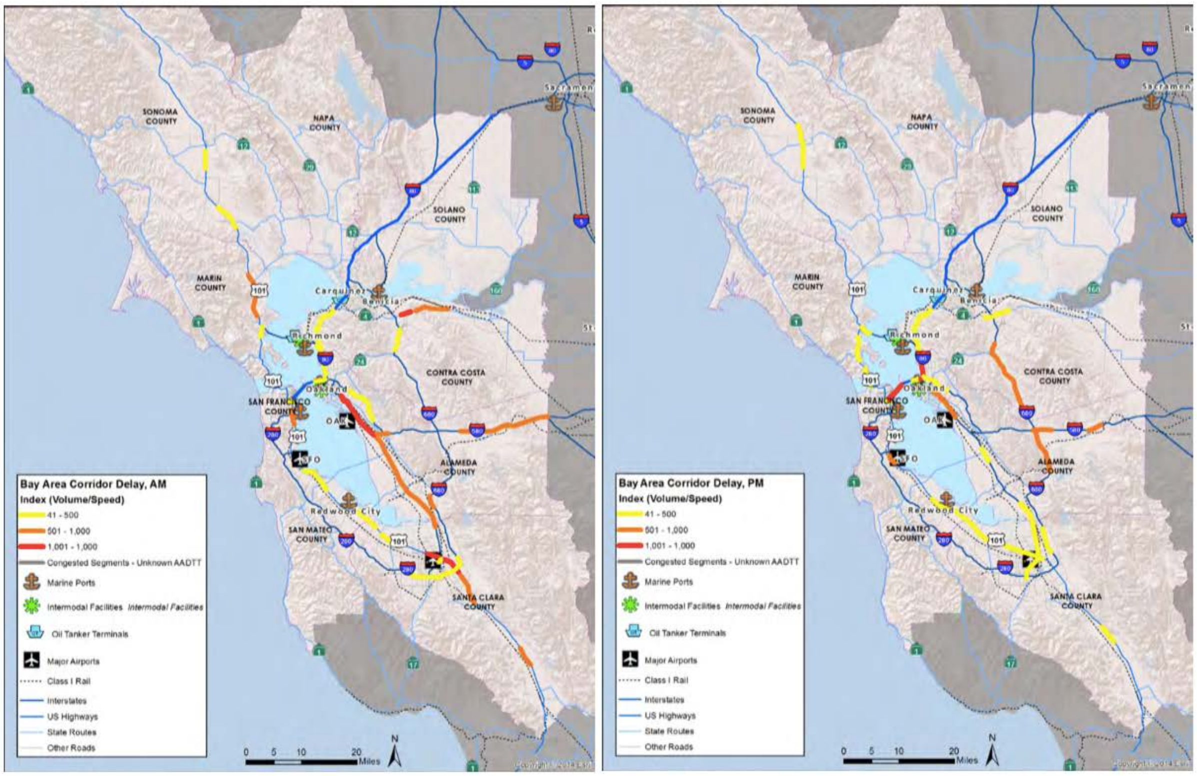
Guidelines for Applying Criteria

The MTC Regional Goods Movement Plan evaluated corridor delay and truck volumes. Projects that reduce congestion on segments with a medium or high corridor delay index would receive the highest score for this target. The corridor delay index is truck volume divided by speed so segments with high truck volumes and medium speed would receive the same index value as corridors with low truck volumes but significant congestion. The map is on the following page. Projects on the rest of the freight network or that would increase freight reliability would receive moderate scores and projects that do not affect the freight network would receive a minimal score.

Examples

The projects that received the strongest support were highway improvement projects on I-880 in Alameda County, US-101 in San Mateo, Marin, and Santa Clara counties, I-580 in Alameda County I-680 in Contra Costa and Alameda counties, and along the Bay Bridge. Example projects include US-101 Express Lanes, VTA Express Lane network, and the Columbus Day Initiative. Major transit projects that could remove driving trips from high-delay segments also received strong support. These projects include Regional Transit State of Good Repair and BART Metro Program.

No projects received negative scores for this target. Projects that minimally affected the goods movement network received a minimal score. These projects were mostly transit projects and included the Irvington BART Station, Geary BRT, and El Camino BRT.



Source: Congested Segments from INRIX 2013; Truck Volumes data from Caltrans Truck Counts, 2012; Analysis by Cambridge Systematics, Inc.

Target 11: Increase non-auto mode share by 10%

Criteria for this target are similar to those for the CO_2 and PM targets. Projects that provide alternatives to the single occupant vehicle such as public transit or bicycling/walking are generally supportive of the target. Projects that would potentially increase the use of single occupancy vehicles received the lowest score.

Guidelines for Applying Criteria

Scoring for this target was very similar to the guidelines under Target 1. Transit projects were supportive of this target if they provided frequency or operational improvements that would make transit service more convenient and attractive. Highway projects could receive a moderate score if they were a managed lane project that would significantly benefit transit service along the corridor.

Examples

Projects with the strongest support were similar to the projects that received strong support in Target 1 but also included neighborhood bus projects that would increase walking and biking to transit. Example projects include AC Transit's San Pablo Avenue BRT and VTA's El Camino BRT.

Projects with the lowest score for this target were highway extension projects like TriLink and SR-152 Alignment due to their increase in auto accessibility without significant provisions for non-auto improvements.

Target 12: Reduce vehicle operating and maintenance costs due to pavement conditions by 100%

Projects that funded street resurfacing, either exclusively or part of an operational project, received moderate to strong support. Staff determined that no project would have an adverse impact to pavement condition by worsening pavement quality.

Guidelines for Applying Criteria

State of good repair investments in state highways and local streets and roads received the highest score for this target. Highway projects that either repaved existing pavement or replaced and existing facility received a moderate support.

Examples

Only two projects - Local Streets and Roads State of Good Repair and State Highways State of Good Repair - received strong support.

Projects like the 680/SR4 Interchange and TriLink received moderate support because they would replace and upgrade existing highway facilities.

Target 13: Reduce per-rider transit delay due to aged infrastructure by 100%

Projects that funded transit vehicle or asset replacement, either exclusively or part of an expansion project, received moderate to strong support. Staff determined that no project would have an adverse impact on transit asset condition by worsening asset quality.

Guidelines for Applying Criteria

State of good repair investments in transit systems received the highest score for this target. Transit service expansion projects that replaced existing vehicles received a moderate support score.

Examples

Regional Bus Maintenance and Regional Rail Maintenance were the only two projects that received a strong support for this target.

Caltrain Electrification and BART Metro Program received moderate support because these projects would replace and upgrade existing fleet and power systems. Caltrain Electrification would replace most of Caltrain's diesel vehicles with electric vehicles. BART Metro Program would replace and upgrade BART traction power system to support higher frequencies.

Target 2 Performance: Share of RHNA Allocation by Income Level for Bay Area Cities and Anticipated Growth in Plan Bay Area
Source: 1999-2014 RHNA and Plan Bay Area, 2013

Jurisdiction	County	1999-2014 RHNA Performance - Share of RHNA Allocation Permitted					Plan Bay Area Growth 2015-2040	Target 2 Performance
		Very Low	Low	Moderate	Above Moderate	# of Income Categories Above 40%		
Alameda	Alameda	41%	6%	12%	34%	1	16%	Moderate Adverse
Albany	Alameda	4%	21%	178%	47%	2	15%	Moderate Support
Berkeley	Alameda	47%	60%	14%	115%	3	17%	Moderate Support
Dublin	Alameda	24%	28%	21%	177%	1	45%	Minimal
Emeryville	Alameda	64%	25%	47%	244%	3	71%	Strong Support
Fremont	Alameda	23%	13%	22%	94%	1	21%	Minimal
Hayward	Alameda	26%	3%	63%	138%	2	23%	Moderate Support
Livermore	Alameda	14%	27%	41%	97%	2	27%	Moderate Support
Newark	Alameda	0%	0%	0%	37%	0	23%	Minimal
Oakland	Alameda	46%	35%	3%	91%	2	28%	Moderate Support
Piedmont	Alameda	84%	14%	71%	63%	3	2%	Minimal
Pleasanton	Alameda	10%	37%	18%	70%	1	22%	Minimal
San Leandro	Alameda	54%	227%	34%	124%	3	20%	Strong Support
Union City	Alameda	39%	18%	10%	153%	1	13%	Moderate Adverse
Unincorporated Alameda	Alameda	19%	40%	11%	78%	1	9%	Strong Adverse
Antioch	Contra Costa	31%	50%	179%	123%	3	14%	Moderate Support
Brentwood	Contra Costa	35%	32%	163%	331%	2	11%	Moderate Support
Clayton	Contra Costa	64%	26%	15%	54%	2	4%	Minimal
Concord	Contra Costa	16%	16%	8%	106%	1	38%	Minimal
Danville	Contra Costa	26%	64%	51%	101%	3	8%	Minimal
El Cerrito	Contra Costa	109%	52%	25%	135%	3	11%	Moderate Support
Hercules	Contra Costa	39%	50%	35%	330%	2	43%	Moderate Support
Lafayette	Contra Costa	43%	11%	7%	182%	2	13%	Moderate Support
Martinez	Contra Costa	9%	0%	1%	54%	1	8%	Strong Adverse

Target 2 Performance: Share of RHNA Allocation by Income Level for Bay Area Cities and Anticipated Growth in Plan Bay Area
Source: 1999-2014 RHNA and Plan Bay Area, 2013

Jurisdiction	County	1999-2014 RHNA Performance - Share of RHNA Allocation Permitted					Plan Bay Area Growth 2015-2040	Target 2 Performance
		Very Low	Low	Moderate	Above Moderate	# of Income Categories Above 40%		
Moraga	Contra Costa	20%	0%	0%	41%	1	12%	Moderate Adverse
Oakley	Contra Costa	96%	198%	226%	246%	4	41%	Strong Support
Orinda	Contra Costa	71%	30%	22%	169%	2	10%	Minimal
Pinole	Contra Costa	27%	8%	74%	41%	2	14%	Moderate Support
Pittsburg	Contra Costa	38%	98%	148%	173%	3	31%	Strong Support
Pleasant Hill	Contra Costa	36%	38%	83%	95%	2	8%	Minimal
Richmond	Contra Costa	32%	204%	32%	61%	2	24%	Moderate Support
San Pablo	Contra Costa	127%	66%	28%	110%	3	19%	Moderate Support
San Ramon	Contra Costa	20%	61%	84%	234%	3	17%	Moderate Support
Walnut Creek	Contra Costa	33%	21%	24%	148%	1	21%	Minimal
Unincorporated Contra Costa	Contra Costa	24%	19%	19%	184%	1	8%	Strong Adverse
Belvedere	Marin	33%	100%	67%	180%	3	2%	Minimal
Corte Madera	Marin	66%	55%	4%	147%	3	6%	Minimal
Fairfax	Marin	0%	0%	13%	33%	0	6%	Strong Adverse
Larkspur	Marin	22%	19%	8%	44%	1	6%	Strong Adverse
Mill Valley	Marin	81%	104%	52%	49%	4	6%	Minimal
Novato	Marin	49%	131%	64%	104%	4	5%	Minimal
Ross	Marin	9%	38%	30%	121%	1	6%	Strong Adverse
San Anselmo	Marin	21%	47%	2%	70%	2	5%	Minimal
San Rafael	Marin	8%	27%	46%	52%	2	13%	Moderate Support
Sausalito	Marin	37%	36%	4%	44%	1	6%	Strong Adverse
Tiburon	Marin	6%	17%	0%	122%	1	6%	Strong Adverse
Unincorporated Marin	Marin	43%	99%	61%	148%	4	4%	Minimal
American Canyon	Napa	29%	20%	11%	256%	1	28%	Minimal

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Source: 1999-2014 RHNA and Plan Bay Area, 2013

Jurisdiction	County	1999-2014 RHNA Performance - Share of RHNA Allocation Permitted					Plan Bay Area Growth 2015-2040	Target 2 Performance
		Very Low	Low	Moderate	Above Moderate	# of Income Categories Above 40%		
Calistoga	Napa	28%	57%	3%	65%	2	2%	Minimal
Napa	Napa	23%	47%	60%	81%	3	11%	Moderate Support
St. Helena	Napa	20%	44%	62%	107%	3	2%	Minimal
Yountville	Napa	54%	80%	86%	93%	4	2%	Minimal
Unincorporated Napa	Napa	7%	13%	23%	41%	1	7%	Strong Adverse
Atherton	San Mateo	44%	0%	0%	-2%	1	9%	Strong Adverse
Belmont	San Mateo	16%	21%	9%	105%	1	9%	Strong Adverse
Brisbane	San Mateo	4%	1%	7%	69%	1	12%	Moderate Adverse
Foster City	San Mateo	50%	30%	19%	113%	2	7%	Minimal
Half Moon Bay	San Mateo	0%	122%	0%	79%	2	6%	Minimal
Hillsborough	San Mateo	245%	132%	87%	147%	4	7%	Minimal
Colma	San Mateo	0%	384%	0%	30%	1	46%	Minimal
Daly City	San Mateo	16%	22%	7%	71%	1	12%	Moderate Adverse
Burlingame	San Mateo	0%	0%	29%	24%	0	25%	Minimal
Portola Valley	San Mateo	40%	18%	7%	54%	2	7%	Minimal
East Palo Alto	San Mateo	12%	62%	19%	89%	2	9%	Minimal
Menlo Park	San Mateo	16%	4%	8%	45%	1	14%	Moderate Adverse
Woodside	San Mateo	47%	50%	31%	410%	3	5%	Minimal
Millbrae	San Mateo	1%	3%	10%	211%	1	30%	Minimal
Mountain View	Santa Clara	28%	5%	9%	142%	1	24%	Minimal
Palo Alto	Santa Clara	39%	21%	27%	165%	1	22%	Minimal
Unincorporated San Mateo	San Mateo	16%	18%	0%	167%	1	19%	Moderate Adverse
Redwood City	San Mateo	12%	28%	11%	149%	1	25%	Minimal
San Bruno	San Mateo	52%	244%	94%	127%	4	24%	Strong Support

Target 2 Performance: Share of RHNA Allocation by Income Level for Bay Area Cities and Anticipated Growth in Plan Bay Area
Source: 1999-2014 RHNA and Plan Bay Area, 2013

Jurisdiction	County	1999-2014 RHNA Performance - Share of RHNA Allocation Permitted					Plan Bay Area Growth 2015-2040	Target 2 Performance
		Very Low	Low	Moderate	Above Moderate	# of Income Categories Above 40%		
San Carlos	San Mateo	1%	4%	7%	76%	1	13%	Moderate Adverse
San Francisco	San Francisco	69%	34%	15%	127%	2	23%	Moderate Support
Pacifica	San Mateo	3%	10%	19%	78%	1	4%	Strong Adverse
San Jose	Santa Clara	47%	64%	7%	117%	3	34%	Strong Support
San Mateo	San Mateo	25%	19%	12%	103%	1	22%	Minimal
Santa Clara	Santa Clara	27%	39%	31%	174%	1	26%	Minimal
Campbell	Santa Clara	15%	158%	44%	95%	3	15%	Moderate Support
Cupertino	Santa Clara	10%	10%	15%	103%	1	16%	Moderate Adverse
Gilroy	Santa Clara	18%	72%	38%	127%	2	16%	Moderate Support
Los Altos	Santa Clara	35%	44%	10%	674%	2	9%	Minimal
Los Altos Hills	Santa Clara	138%	67%	27%	411%	3	5%	Minimal
Los Gatos	Santa Clara	7%	84%	10%	178%	2	6%	Minimal
Milpitas	Santa Clara	62%	37%	46%	278%	3	49%	Strong Support
Monte Sereno	Santa Clara	78%	136%	75%	130%	4	6%	Minimal
Morgan Hill	Santa Clara	46%	83%	41%	163%	4	25%	Strong Support
So. San Francisco	San Mateo	35%	20%	17%	92%	1	26%	Minimal
Sunnyvale	Santa Clara	38%	117%	102%	106%	3	29%	Strong Support
Saratoga	Santa Clara	36%	13%	61%	126%	2	5%	Minimal
Unincorporated Santa Clara	Santa Clara	66%	158%	36%	167%	3	9%	Minimal
Benicia	Solano	25%	89%	83%	125%	3	11%	Moderate Support
Dixon	Solano	25%	1%	3%	115%	1	8%	Strong Adverse
Fairfield	Solano	3%	17%	40%	218%	2	26%	Moderate Support
Rio Vista	Solano	6%	66%	78%	187%	3	10%	Moderate Support
Suisun City	Solano	35%	63%	16%	164%	2	13%	Moderate Support

Target 2 Performance: Share of RHNA Allocation by Income Level for Bay Area Cities and Anticipated Growth in Plan Bay Area
Source: 1999-2014 RHNA and Plan Bay Area, 2013

Jurisdiction	County	1999-2014 RHNA Performance - Share of RHNA Allocation Permitted					Plan Bay Area Growth 2015-2040	Target 2 Performance
		Very Low	Low	Moderate	Above Moderate	# of Income Categories Above 40%		
Vacaville	Solano	6%	77%	121%	89%	3	12%	Moderate Support
Vallejo	Solano	25%	26%	0%	97%	1	6%	Strong Adverse
Unincorporated Solano	Solano	0%	23%	0%	33%	0	18%	Strong Adverse
Cloverdale	Sonoma	64%	54%	85%	204%	4	21%	Strong Support
Cotati	Sonoma	41%	42%	30%	107%	3	15%	Moderate Support
Healdsburg	Sonoma	74%	107%	17%	105%	3	4%	Minimal
Petaluma	Sonoma	53%	53%	57%	132%	4	11%	Moderate Support
Rohnert Park	Sonoma	41%	93%	63%	101%	4	19%	Moderate Support
Santa Rosa	Sonoma	30%	93%	86%	90%	3	21%	Strong Support
Sebastopol	Sonoma	41%	106%	36%	64%	3	11%	Moderate Support
Sonoma	Sonoma	69%	69%	37%	161%	3	6%	Minimal
Windsor	Sonoma	34%	57%	9%	142%	2	17%	Moderate Support
Unincorporated Sonoma	Sonoma	42%	36%	30%	85%	2	8%	Minimal

Target 5 Performance: Low Income Transit Ridership for Bay Area Operators
Source: MTC or Operator Survey, 2013-2016
Results are for weekday and weekend, except where noted

Transit Operator	Share of Low Income Riders	Share of Regional Low Income Riders	Target 5 Performance
AC Transit	46%	15%	Strong Support
ACE	2%	0.0%	Minimal
BART**	21%	15%	Strong Support
Caltrain	9%	0.8%	Moderate Support
County Connection	31%	0.6%	Moderate Support
FAST**	33%	0.2%	Minimal
Golden Gate Transit (total)	15%	0.8%	Moderate Support
LAVTA	37%	0.3%	Minimal
Muni**	34%	46%	Strong Support
Napa Vine	38%	0.2%	Minimal
Petaluma	45%	0.1%	Strong Support
SamTrans	35%	3%	Minimal
Santa Rosa CityBus	52%	0.9%	Strong Support
SF Bay Ferry	4%	0.0%	Minimal
SolTrans	23%	0.4%	Minimal
Sonoma County	50%	0.4%	Strong Support
Tri-Delta	33%	0.6%	Moderate Support
Union City	36%	0.1%	Minimal
VTA**	55%	15%	Strong Support
WestCat**	32%	0.3%	Minimal
WETA	4%	0%	Minimal

**based on weekday ridership

Target 6 Performance: Share of RHNA Allocation Permitted for Very Low, Low, and Moderate Income Levels for Bay Area Cities

Source: 1999-2014 RHNA

Jurisdiction	County	1999-2014 Very Low + Low + Moderate RHNA Performance			Target 6 Performance
		RHNA Allocation	Permits Issued	Share Permitted	
Alameda	Alameda	2522	541	21%	Moderate Adverse
Albany	Alameda	333	251	75%	Strong Support
Berkeley	Alameda	2115	783	37%	Moderate Support
Dublin	Alameda	5174	1227	24%	Moderate Adverse
Emeryville	Alameda	1078	511	47%	Moderate Support
Fremont	Alameda	6640	1335	20%	Moderate Adverse
Hayward	Alameda	3623	1270	35%	Moderate Support
Livermore	Alameda	5141	1436	28%	Minimal
Newark	Alameda	1235	0	0%	Strong Adverse
Oakland	Alameda	12306	3144	26%	Minimal
Piedmont	Alameda	54	33	61%	Strong Support
Pleasanton	Alameda	4947	969	20%	Strong Adverse
San Leandro	Alameda	1426	1242	87%	Strong Support
Unincorporated Alameda	Alameda	5223	1070	20%	Moderate Adverse
Union City	Alameda	2418	550	23%	Moderate Adverse
Antioch	Contra Costa	3822	3623	95%	Strong Support
Brentwood	Contra Costa	3972	3205	81%	Strong Support
Clayton	Contra Costa	289	103	36%	Moderate Support
Concord	Contra Costa	2895	372	13%	Strong Adverse
Danville	Contra Costa	916	412	45%	Moderate Support
El Cerrito	Contra Costa	340	217	64%	Strong Support
Hercules	Contra Costa	648	257	40%	Moderate Support
Lafayette	Contra Costa	359	80	22%	Moderate Adverse
Martinez	Contra Costa	1334	52	4%	Strong Adverse
Moraga	Contra Costa	266	21	8%	Strong Adverse
Oakley	Contra Costa	1082	1819	168%	Strong Support

Target 6 Performance: Share of RHNA Allocation Permitted for Very Low, Low, and Moderate Income Levels for Bay Area Cities

Source: 1999-2014 RHNA

Jurisdiction	County	1999-2014 Very Low + Low + Moderate RHNA Performance			Target 6 Performance
		RHNA Allocation	Permits Issued	Share Permitted	
Orinda	Contra Costa	265	114	43%	Moderate Support
Pinole	Contra Costa	337	133	39%	Moderate Support
Pittsburg	Contra Costa	2367	2299	97%	Strong Support
Pleasant Hill	Contra Costa	754	408	54%	Strong Support
Richmond	Contra Costa	2639	1894	72%	Strong Support
San Pablo	Contra Costa	459	336	73%	Strong Support
San Ramon	Contra Costa	4584	2460	54%	Strong Support
Unincorporated Contra Costa	Contra Costa	5244	1097	21%	Moderate Adverse
Walnut Creek	Contra Costa	2034	548	27%	Minimal
Belvedere	Marin	17	11	65%	Strong Support
Corte Madera	Marin	244	98	40%	Moderate Support
Fairfax	Marin	92	5	5%	Strong Adverse
Larkspur	Marin	390	60	15%	Strong Adverse
Mill Valley	Marin	313	234	75%	Strong Support
Novato	Marin	2119	1523	72%	Strong Support
Ross	Marin	29	7	24%	Moderate Adverse
San Anselmo	Marin	150	28	19%	Strong Adverse
San Rafael	Marin	1971	558	28%	Minimal
Sausalito	Marin	212	50	24%	Moderate Adverse
Tiburon	Marin	156	10	6%	Strong Adverse
Unincorporated Marin	Marin	718	460	64%	Strong Support
American Canyon	Napa	1192	227	19%	Strong Adverse
Calistoga	Napa	162	43	27%	Minimal
Napa	Napa	3204	1386	43%	Moderate Support
St. Helena	Napa	163	68	42%	Moderate Support
Unincorporated Napa	Napa	1570	229	15%	Strong Adverse

Target 6 Performance: Share of RHNA Allocation Permitted for Very Low, Low, and Moderate Income Levels for Bay Area Cities

Source: 1999-2014 RHNA

Jurisdiction	County	1999-2014 Very Low + Low + Moderate RHNA Performance			Target 6 Performance
		RHNA Allocation	Permits Issued	Share Permitted	
Yountville	Napa	103	75	73%	Strong Support
San Francisco	San Francisco	31887	12600	40%	Moderate Support
Atherton	San Mateo	108	18	17%	Strong Adverse
Belmont	San Mateo	400	58	15%	Strong Adverse
Brisbane	San Mateo	496	22	4%	Strong Adverse
Burlingame	San Mateo	703	81	12%	Strong Adverse
Colma	San Mateo	85	73	86%	Strong Support
Daly City	San Mateo	1519	203	13%	Strong Adverse
East Palo Alto	San Mateo	1224	305	25%	Moderate Adverse
Foster City	San Mateo	600	192	32%	Moderate Support
Half Moon Bay	San Mateo	393	106	27%	Minimal
Hillsborough	San Mateo	81	128	158%	Strong Support
Menlo Park	San Mateo	1100	112	10%	Strong Adverse
Millbrae	San Mateo	453	23	5%	Strong Adverse
Pacifica	San Mateo	522	60	11%	Strong Adverse
Portola Valley	San Mateo	74	17	23%	Moderate Adverse
Redwood City	San Mateo	2534	384	15%	Strong Adverse
San Bruno	San Mateo	791	921	116%	Strong Support
San Carlos	San Mateo	537	22	4%	Strong Adverse
San Mateo	San Mateo	3175	584	18%	Strong Adverse
So. San Francisco	San Mateo	1724	421	24%	Moderate Adverse
Unincorporated San Mateo	San Mateo	1733	163	9%	Strong Adverse
Woodside	San Mateo	41	17	41%	Moderate Support
Campbell	Santa Clara	935	534	57%	Strong Support
Cupertino	Santa Clara	2067	254	12%	Strong Adverse
Gilroy	Santa Clara	3077	1105	36%	Moderate Support

Target 6 Performance: Share of RHNA Allocation Permitted for Very Low, Low, and Moderate Income Levels for Bay Area Cities

Source: 1999-2014 RHNA

Jurisdiction	County	1999-2014 Very Low + Low + Moderate RHNA Performance			Target 6 Performance
		RHNA Allocation	Permits Issued	Share Permitted	
Los Altos	Santa Clara	357	99	28%	Minimal
Los Altos Hills	Santa Clara	98	77	79%	Strong Support
Los Gatos	Santa Clara	580	150	26%	Minimal
Milpitas	Santa Clara	3746	1874	50%	Strong Support
Monte Sereno	Santa Clara	61	55	90%	Strong Support
Morgan Hill	Santa Clara	2110	1110	53%	Strong Support
Mountain View	Santa Clara	3467	520	15%	Strong Adverse
Palo Alto	Santa Clara	2598	771	30%	Minimal
San Jose	Santa Clara	34058	12033	35%	Moderate Support
Santa Clara	Santa Clara	6879	2144	31%	Moderate Support
Saratoga	Santa Clara	454	187	41%	Moderate Support
Sunnyvale	Santa Clara	4729	3824	81%	Strong Support
Unincorporated Santa Clara	Santa Clara	1811	1255	69%	Strong Support
Benicia	Solano	563	350	62%	Strong Support
Dixon	Solano	1302	138	11%	Strong Adverse
Fairfield	Solano	4416	913	21%	Moderate Adverse
Rio Vista	Solano	1485	701	47%	Moderate Support
Suisun City	Solano	946	330	35%	Moderate Support
Unincorporated Solano	Solano	1694	92	5%	Strong Adverse
Vacaville	Solano	4398	2987	68%	Strong Support
Vallejo	Solano	3634	586	16%	Strong Adverse
Cloverdale	Sonoma	487	343	70%	Strong Support
Cotati	Sonoma	490	180	37%	Moderate Support
Healdsburg	Sonoma	535	310	58%	Strong Support
Petaluma	Sonoma	1886	1029	55%	Strong Support
Rohnert Park	Sonoma	2143	1331	62%	Strong Support

Target 6 Performance: Share of RHNA Allocation Permitted for Very Low, Low, and Moderate Income Levels for Bay Area Cities

Source: 1999-2014 RHNA

Jurisdiction	County	1999-2014 Very Low + Low + Moderate RHNA Performance			Target 6 Performance
		RHNA Allocation	Permits Issued	Share Permitted	
Santa Rosa	Sonoma	8267	5533	67%	Strong Support
Sebastopol	Sonoma	257	141	55%	Strong Support
Sonoma	Sonoma	621	346	56%	Strong Support
Unincorporated Sonoma	Sonoma	4790	1723	36%	Moderate Support
Windsor	Sonoma	1686	481	29%	Minimal

Target 7 Performance: Share of Census Tracts With Displacment Risk for Bay Area Cities and Anticipated Growth in Plan Bay Area

Source: Urban Displacement Project, 2015 and Plan Bay Area, 2013

Jurisdiction	County	Share of Tracts with Displacement Risk**	Plan Bay Area Growth	Target 7 Performance
Alameda	Alameda	81%	16%	Moderate Adverse
Albany	Alameda	100%	15%	Moderate Adverse
Berkeley	Alameda	73%	17%	Minimal
Dublin	Alameda	50%	45%	Moderate Adverse
Emeryville	Alameda	75%	71%	Moderate Adverse
Fremont	Alameda	23%	21%	Moderate Adverse
Hayward	Alameda	28%	23%	Moderate Adverse
Livermore	Alameda	28%	27%	Moderate Adverse
Newark	Alameda	0%	23%	Moderate Adverse
Oakland	Alameda	84%	28%	Strong Adverse
Piedmont	Alameda	50%	2%	Minimal
Pleasanton	Alameda	14%	22%	Moderate Adverse
San Leandro	Alameda	56%	20%	Moderate Adverse
Unincorporated Alameda	Alameda	50%	9%	Minimal
Union City	Alameda	20%	13%	Minimal
Antioch	Contra Costa	16%	14%	Minimal
Brentwood	Contra Costa	14%	11%	Minimal
Clayton	Contra Costa	0%	4%	Minimal
Concord	Contra Costa	30%	38%	Moderate Adverse
Danville	Contra Costa	0%	8%	Minimal
El Cerrito	Contra Costa	80%	11%	Moderate Adverse
Hercules	Contra Costa	17%	43%	Moderate Adverse
Lafayette	Contra Costa	40%	13%	Minimal
Martinez	Contra Costa	67%	8%	Minimal
Moraga	Contra Costa	50%	12%	Minimal
Oakley	Contra Costa	0%	41%	Moderate Adverse
Orinda	Contra Costa	0%	10%	Minimal

Target 7 Performance: Share of Census Tracts With Displacment Risk for Bay Area Cities and Anticipated Growth in Plan Bay Area

Source: Urban Displacement Project, 2015 and Plan Bay Area, 2013

Jurisdiction	County	Share of Tracts with Displacement Risk**	Plan Bay Area Growth	Target 7 Performance
Pinole	Contra Costa	33%	14%	Minimal
Pittsburg	Contra Costa	38%	31%	Moderate Adverse
Pleasant Hill	Contra Costa	33%	8%	Minimal
Richmond	Contra Costa	65%	24%	Moderate Adverse
San Pablo	Contra Costa	17%	19%	Minimal
San Ramon	Contra Costa	0%	17%	Minimal
Unincorporated Contra Costa	Contra Costa	37%	8%	Minimal
Walnut Creek	Contra Costa	60%	21%	Moderate Adverse
Belvedere	Marin	0%	2%	Minimal
Corte Madera	Marin	50%	6%	Minimal
Fairfax	Marin	100%	6%	Moderate Adverse
Larkspur	Marin	50%	6%	Minimal
Mill Valley	Marin	33%	6%	Minimal
Novato	Marin	30%	5%	Minimal
Ross	Marin	0%	6%	Minimal
San Anselmo	Marin	67%	5%	Minimal
San Rafael	Marin	27%	13%	Minimal
Sausalito	Marin	0%	6%	Minimal
Tiburon	Marin	0%	6%	Minimal
Unincorporated Marin	Marin	19%	4%	Minimal
American Canyon	Napa	0%	28%	Moderate Adverse
Calistoga	Napa	100%	2%	Moderate Adverse
Napa	Napa	45%	11%	Minimal
St. Helena	Napa	50%	2%	Minimal
Unincorporated Napa	Napa	33%	7%	Minimal
Yountville	Napa	100%	2%	Moderate Adverse
San Francisco	San Francisco	88%	23%	Strong Adverse

Target 7 Performance: Share of Census Tracts With Displacment Risk for Bay Area Cities and Anticipated Growth in Plan Bay Area

Source: Urban Displacement Project, 2015 and Plan Bay Area, 2013

Jurisdiction	County	Share of Tracts with Displacement Risk**	Plan Bay Area Growth	Target 7 Performance
Atherton	San Mateo	0%	9%	Minimal
Belmont	San Mateo	60%	9%	Minimal
Brisbane	San Mateo	100%	12%	Moderate Adverse
Burlingame	San Mateo	100%	25%	Strong Adverse
Colma	San Mateo	100%	46%	Strong Adverse
Daly City	San Mateo	61%	12%	Minimal
East Palo Alto	San Mateo	50%	9%	Minimal
Foster City	San Mateo	0%	7%	Minimal
Half Moon Bay	San Mateo	0%	6%	Minimal
Hillsborough	San Mateo	100%	7%	Moderate Adverse
Menlo Park	San Mateo	75%	14%	Minimal
Millbrae	San Mateo	67%	30%	Moderate Adverse
Pacifica	San Mateo	38%	4%	Minimal
Portola Valley	San Mateo	0%	7%	Minimal
Redwood City	San Mateo	53%	25%	Moderate Adverse
San Bruno	San Mateo	44%	24%	Moderate Adverse
San Carlos	San Mateo	44%	13%	Minimal
San Mateo	San Mateo	58%	22%	Moderate Adverse
So. San Francisco	San Mateo	100%	26%	Strong Adverse
Unincorporated San Mateo	San Mateo	50%	19%	Minimal
Woodside	San Mateo	0%	5%	Minimal
Campbell	Santa Clara	29%	15%	Minimal
Cupertino	Santa Clara	17%	16%	Minimal
Gilroy	Santa Clara	25%	16%	Minimal
Los Altos	Santa Clara	43%	9%	Minimal
Los Altos Hills	Santa Clara	50%	5%	Minimal
Los Gatos	Santa Clara	56%	6%	Minimal

Target 7 Performance: Share of Census Tracts With Displacment Risk for Bay Area Cities and Anticipated Growth in Plan Bay Area

Source: Urban Displacement Project, 2015 and Plan Bay Area, 2013

Jurisdiction	County	Share of Tracts with Displacement Risk**	Plan Bay Area Growth	Target 7 Performance
Milpitas	Santa Clara	13%	49%	Moderate Adverse
Monte Sereno	Santa Clara	0%	6%	Minimal
Morgan Hill	Santa Clara	44%	25%	Moderate Adverse
Mountain View	Santa Clara	58%	24%	Moderate Adverse
Palo Alto	Santa Clara	67%	22%	Moderate Adverse
San Jose	Santa Clara	32%	34%	Moderate Adverse
Santa Clara	Santa Clara	39%	26%	Moderate Adverse
Saratoga	Santa Clara	17%	5%	Minimal
Sunnyvale	Santa Clara	63%	29%	Moderate Adverse
Unincorporated Santa Clara	Santa Clara	29%	9%	Minimal
Benicia	Solano	14%	11%	Minimal
Dixon	Solano	67%	8%	Minimal
Fairfield	Solano	19%	26%	Moderate Adverse
Rio Vista	Solano	100%	10%	Moderate Adverse
Suisun City	Solano	0%	13%	Minimal
Unincorporated Solano	Solano	0%	18%	Minimal
Vacaville	Solano	45%	12%	Minimal
Vallejo	Solano	29%	6%	Minimal
Cloverdale	Sonoma	0%	21%	Moderate Adverse
Cotati	Sonoma	50%	15%	Minimal
Healdsburg	Sonoma	100%	4%	Moderate Adverse
Petaluma	Sonoma	38%	11%	Minimal
Rohnert Park	Sonoma	11%	19%	Minimal
Santa Rosa	Sonoma	44%	21%	Moderate Adverse
Sebastopol	Sonoma	100%	11%	Moderate Adverse
Sonoma	Sonoma	67%	6%	Minimal
Unincorporated Sonoma	Sonoma	24%	8%	Minimal

Target 7 Performance: Share of Census Tracts With Displacment Risk for Bay Area Cities and Anticipated Growth in Plan Bay Area

Source: Urban Displacement Project, 2015 and Plan Bay Area, 2013

Jurisdiction	County	Share of Tracts with Displacement Risk**	Plan Bay Area Growth	Target 7 Performance
Windsor	Sonoma	33%	17%	Minimal

**based on the following typologies: At risk of gentrification or displacement, undergoing displacement, and advanced gentrification for lower income and moderate to high income tracts

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Memorandum

TO: Local Streets and Roads Working Group

DATE: February 11, 2016

FR: David Vautin

RE: Plan Bay Area 2040 State of Good Repair Performance Assessment – Objectives and Methodology

In order to inform policy decisions related to project and program selection for Plan Bay Area 2040, MTC is conducting a performance assessment of major uncommitted transportation investments. In addition to analyzing expansion and efficiency investments – similar to the assessment performed as part of Plan Bay Area – MTC is also evaluating how state of good repair investments perform using a unified, consistent performance framework. This effort is designed to provide additional context for policymakers as they craft a preferred scenario for Plan Bay Area 2040.

Staff is returning to the Local Streets and Roads Working Group to provide a refresher on the objectives and approach (which were discussed in prior meetings in 2015) and also to engage in a more technical discussion of analysis methodology specific to local streets & roads as well as state highways. A more robust discussion of results and findings will take place in March 2016, following the completion of the analysis.

Assessment Objectives

Over the past decade, MTC has adopted plans that allocate an increasing share of funding to preserve and maintain existing transportation infrastructure, in alignment with the region's "Fix It First" strategy. However, state of good repair investments were handled outside the project evaluation framework – meaning that consistent and comparable data on their benefits were not available for policymakers.

In order to integrate state of good repair and to allow it to be assessed on a level playing field with other investments, MTC staff has worked to develop and implement new methodologies for evaluating roads and public transit maintenance. By quantifying the effects of asset condition on system users, these investments can be analyzed for their cost-effectiveness and their support of regional performance targets, just like a traditional expansion project, using the regional travel demand model. The ultimate objective is to have "apples to apples" performance results, meaning that the scores can be easily compared between project performance and state of good repair performance to inform key policy decisions.

By evaluating state of good repair investments in the same manner as expansion and efficiency projects, staff seeks to provide additional information for policymakers to address the following questions:

- How does system maintenance perform relative to expansion and efficiency investments – both in terms of cost-effectiveness and targets support?
- Within the realm of state of good repair, what differences exist between modes and operators when it comes to cost-effectiveness and targets support?
- Are certain state of good repair investments high-performing, and if so, should they be eligible for regional discretionary dollars?

- Are certain state of good repair investments low-performing, and if so, is there a compelling case for funding these investments regardless of this status?

Approach

As the state of good repair performance assessment is designed to complement both the existing project performance and needs assessments, it builds off of the existing frameworks used in prior Plans. Like the project performance assessment, state of good repair performance will be evaluated based on two primary scores:

- **Benefit-cost ratio.** By exploring how asset conditions (forecasted by StreetSaver and TERM-Lite) affect system operations, Travel Model One simulates how system users respond to improved or degraded infrastructure. These benefits are monetized and compared to the costs of SGR investments as part of a benefit-cost assessment.
  In other words, if a system deteriorates to the point that it costs a user either time or money, how will the user react – will they shift modes? travel less? pay more? This behavior can then be modeled on a regional scale to see what the major impacts would be.
- **Targets score.** State of good repair investments can also be evaluated qualitatively against performance targets in the same manner as expansion projects. This is consistent with the approach taken in Plan Bay Area, albeit with the new Plan Bay Area 2040 targets.
- **Other supplemental data.** Several supplemental assessments being conducted for the project performance assessment will also be made available for state of good repair, including an examination of equity impacts, a confidence assessment of benefit-cost results, and sensitivity testing of the final results.

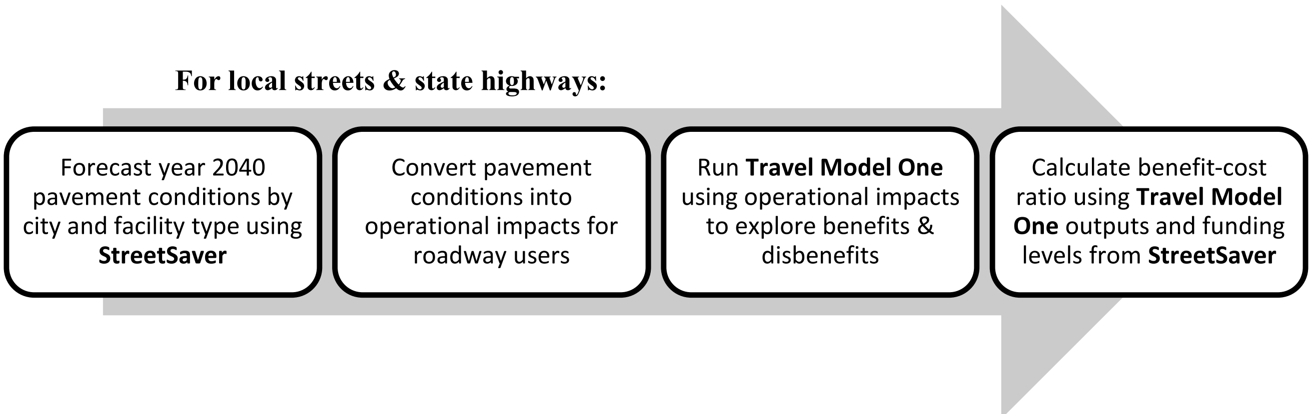
Given the thousands of assets that need to be replaced over the course of the Plan cycle, it is not possible to conduct a performance assessment of each asset individually. Instead, MTC is assessing performance at a modal and system level, looking at the impacts of different funding levels on operations and ultimately system users. For pavement maintenance on local streets and state highways, benefit-cost ratios and targets scores will be produced for the following scenarios at a minimum:

- For local streets and roads: **Preservation of existing conditions vs. system degradation**
- For local streets and roads: **Achievement of ideal conditions vs. preservation of existing conditions**
- For state highways: **Preservation of existing conditions vs. system degradation**
- For state highways: **Achievement of ideal conditions vs. preservation of existing conditions**

Technical Methodology for Benefit-Cost Assessment of Local Streets & Roads and State Highways

State of good repair investments are being evaluated through the same benefit-cost framework as expansion investments, leveraging Travel Model One and the MTC COBRA benefit-cost tool. However, in order to link asset conditions (the output of asset management models) and operational impacts (the input to travel demand models), staff developed new methodologies for roads and transit state of good repair, which were published in peer-reviewed journals in 2015. While the methodologies are merely the first iteration of such work – and as such have known limitations that will be fully documented in the confidence assessment – staff believes they can provide an order-of-magnitude evaluation of cost-effectiveness which is sufficient to identify high-, medium- or low-performer status.

Attachment A documents the methodology being used for local streets & roads and state highways in greater detail, but the graphic below serves a succinct summary of the process.



Analysis Findings

Preliminary results and findings for road state of good repair performance will be released at or before the March 21st meeting of the joint LSRPDWG. In addition to data tables breaking down the benefit-cost ratio and target score results, staff will prepare a detailed discussion of key findings based on the analysis. As the results will be released in concert with transit state of good repair performance and project performance, stakeholders will have an opportunity to see how performance differs across modes and funding programs.

While analytical work is still underway, staff has identified three high-level findings that have begun to emerge from the analysis so far:

- **Preserving and improving the pavement condition of the region's highway system would yield significant benefits for Bay Area residents.** Bringing the state highway system to a state of good repair is likely one of the most cost-effective investments under consideration for Plan Bay Area 2040.
- **Investment in local streets and road pavement preservation is also beneficial and cost-effective for roadway users, outperforming many of the region's expansion and efficiency investments.** However, the lower traffic volumes on many of these facilities – in particular, lightly-used residential streets – means that state highway maintenance yields more bang per buck on a relative scale.
- **While maintenance of our region's transit infrastructure strongly supports the performance targets for Plan Bay Area 2040, cost-effectiveness will likely vary widely across operators and modes and generally is lower than investments in local roads and state highways.** While many factors affect the benefit-cost ratio for transit state of good repair, systems with high utilization and infrequent service appear to benefit the most from state of good repair investments (i.e., a full bus with 30-minute headways generates more significant adverse impacts from a vehicle breakdown than an underutilized bus with 10-minute headways).

Next Steps

Staff will return to the Local Streets and Roads Working Group in the coming months to discuss results and key findings as we move towards a preferred scenario for Plan Bay Area 2040. In addition, interested parties can attend meetings of the Performance Working Group, the Partnership Board, PTAC, RAWG, Policy Advisory Council, and the Planning Committee in March and April, as state of good repair and project performance will be on the agenda at these meetings as well. If you have any questions or concerns in the meantime, feel free to contact David Vautin (dvautin@mtc.ca.gov).

ATTACHMENT A

State of Good Repair Benefit-Cost Assessment Methodology for: Local Streets & Roads and State Highways

This document is designed to provide additional detail on the Plan Bay Area 2040 methodology used for the state of good repair benefit-cost assessments of local streets & roads and state highways. In short, the methodology is designed to link the StreetSaver asset management model used for the needs assessment purposes to Travel Model One (the regional travel demand model used for performance assessment purposes). The end result is an "apples to apples" benefit-cost ratio that allows for the comparison of expansion and maintenance across modes based on impacts to system users and society at large.

In the case of local streets & roads and state highways, it is important to note that the methodology focuses specifically on the benefits and costs for pavement preservation and does not address non-pavement assets. This is due to the fact that sufficient literature exists on the user benefits associated with pavement preservation, while benefits of non-pavement assets may be more difficult to quantify. That said, preserving pavements in the San Francisco Bay Area costs billions of dollars over the Plan lifecycle, playing a primary role in local streets and state highway needs over the coming decades. For the sake of simplicity, the term "road maintenance" in this document refers specifically to the pavement on the roads in question.

While the methodology has been finalized for this iteration of the Plan, future efforts could enhance and expand on this work to provide even more refined results. Further discussion of research opportunities in this area will be included in a document slated for release later this year.

Step 1: Forecast year 2040 pavement conditions by city and facility type using StreetSaver.

1. Before analyzing a given scenario for road state of good repair, it is necessary to identify the following characteristics:
    a. Geographic scope[1]
    b. Facility type(s)[2]
    c. Funding prioritization strategy[3]
    d. Horizon year for analysis[4]

2. A state of good repair scenario compares conditions and impacts to users and society for two different funding levels. Before running StreetSaver, it is necessary to identify:
    a. Baseline funding level for pavement preservation[5] or baseline PCI target
    b. "With-project"[6] funding level for pavement preservation or "with-project" PCI target

3. StreetSaver also requires an inventory or dataset of street conditions in the baseline year as a foundation for forecasting pavement conditions in a future year:

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[1] For the purposes of this work, analysis was performed on the regional level. However, it would be possible to use this methodology to analyze benefits on a county or city level as well.
[2] For the purposes of this work, analysis was performed for the entire local streets and roads system and for the entire state highway system. However, it would be possible to use this methodology to study arterials in isolation, for example.
[3] Weighting factors for arterials, collectors, and residential streets in StreetSaver
[4] For the purposes of this work, the Plan has a horizon year of 2040.
[5] Regional funding for pavement preservation directed towards the geography and facilities in question
[6] Higher level of funding being analyzed in comparison to baseline

  a. For local streets and roads: this data is readily available for all jurisdictions in the San Francisco Bay Area via StreetSaver itself.[7]
  b. For state highways: Caltrans develops an inventory of pavement conditions every few years that can be converted into StreetSaver using the IRI[8]-to-PCI conversion formula discussed later this in document[9].

4. Run MTC's StreetSaver asset management model[10] to forecast pavement conditions in the horizon year for both the baseline and "with project" funding levels using the parameters identified above. If a PCI target seek forms the basis of this scenario instead of funding levels, run StreetSaver in that mode instead. (Note that this approach is consistent with the needs assessment process for Plan Bay Area 2040.)
  a. For each local streets and roads scenario, request that StreetSaver output pavement conditions by jurisdiction, facility type, and PCI bin in terms of lane-mileage.[11]
    i. Jurisdictions: 101 cities, 8 counties
    ii. Facility types: arterials, collectors, residential/local streets, other
    iii. PCI bins[12]: 25 or less, 26 to 30, 31 to 35, 36 to 40, 41 to 45, 46 to 50, 51 to 60, 61 or greater
  b. For each state highway scenario, request that StreetSaver output pavement conditions for three bins commonly used by Caltrans: good (IRI of 1 to 94), fair (IRI of 95 to 170), and poor (IRI greater than 170).[13] Unlike local streets, the state highway system was analyzed on the regional, rather than jurisdictional, level due to the coarseness of the Caltrans data.

Step 2: Convert pavement conditions into operational impacts for roadway users.

Note to readers: *In benefit-cost analysis, it is important to clearly delineate benefits to users and to society and costs to the system operator without double-counting any metrics in the process. For a more detailed explanation of the inclusion or exclusion of certain benefits, and an overarching literature review, please refer to Paterson and Vautin (2015) in the TRB 94th Annual Meeting Compendium of Papers.*[14]

1. Summarize cost outputs from the StreetSaver files for use in Step 4 below. Note that road maintenance costs to system operators – the basis for the cost side of the benefit-cost ratio – are

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[7] This analysis relied on the inventories as of late 2015, the most recent available at the time the analysis began.
[8] IRI stands for the International Roughness Index, an alternative measure of pavement conditions.
[9] This analysis relied on the latest iteration of that Caltrans dataset produced in late 2013.
[10] StreetSaver leverages inventories of local streets and state highways with pavement condition index (PCI) data for each segment. Note that PCI ranges from 0 to 100; higher index scores mean that roads are in better condition. StreetSaver operates using the principles of life-cycle cost assessment described above to maximize the cost effectiveness of pavement investments, factoring in the higher costs of repair as a result of deferred maintenance and mimicking the decision choices of pavement management professionals across the region. Funding level and prioritization inputs to StreetSaver affect its decisions about which pavements should get specific treatments, as it seeks to maximize pavement condition over time given resource constraints. In addition to being able to run StreetSaver with a given funding level, it can be run to seek to achieve a PCI and report back the funding level required.
[11] As there is not a one-for-one relationship between street segments in StreetSaver and Travel Model One, it is necessary to do some level of aggregation for local streets and state highways. Future upgrades to both tools will make it possible to link them directly on every street segment.
[12] As defined by MTC's StreetSaver team to provide more refined information between PCI of 25 and PCI of 60.
[13] These bins were designed to maximize consistency with Caltrans' historical reporting of pavement condition by district. As such, conditions and impacts for the state highway network are not geographically specific in the way local streets and roads are.
[14] See URL: http://trid.trb.org/view.aspx?id=1336990

relatively straightforward thanks to StreetSaver; they represent the difference between the two funding levels for the scenario in question, as the region's transportation agencies will be expending these dollars.[15]

2. In order to calculate benefits, it is necessary to focus on the impacts to system users and to society. Timely maintenance is known to reduce treatment costs over time, yielding greater marginal benefits by reducing deferred maintenance.[16] Travel Model One is used to forecast these benefits based on the operational impacts expected on roads across the network[17]. In the case of road maintenance, there are two primary direct[18]operational impacts demonstrated and quantified in literature[19]: **vehicle maintenance and repair costs** (for automobiles, trucks and buses) and **vehicle fuel costs** (for automobiles, trucks and buses).[20] Benefits derived from these operational impacts are calculated in Step 3 below and include time, cost, emissions, health, and safety impacts (among others)[21].
    a. Load the local streets and/or state highway StreetSaver output tables into the Operational Impact Calculator (OIC)[22]. OIC automatically calculates the share of lane-mileage in each jurisdiction and facility type combination that falls into each PCI bin.
    b. Given that StreetSaver outputs lane-mileage by jurisdiction, by facility type, and by PCI bin, and that Travel Model One requires vehicle operator costs by jurisdiction and by facility type, OIC makes the conversion to connect the two models, starting with a PCI to IRI conversion using a formula developed by Park, Thomas, and Lee.[23] While StreetSaver does not include data on segment IRI due to the unreliability of IRI data collection on lower-speed facilities, it is possible to estimate IRI based on observed PCI as shown below.[24] This calculation is not necessary for highway data, as it was converted to IRI under Step 1.
    $$PCI = 100(IRI)^{-0.436}$$
    c. Next, maintenance cost adjustment factors and fuel cost adjustment factors are calculated by OIC using NHCRP Report 720 formulas. For each PCI bin, the IRI upper bound is used to calculate the maximum percent increase in maintenance and fuel costs for each

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[15] Funding levels can be either inputs or outputs of StreetSaver in Step 1B.
[16] While a lower level of pavement preservation funding may reduce the cost side of the B/C ratio, it will also worsen pavement conditions and thus reduce the benefit side of the ratio as well – capturing the adverse impacts of deferred maintenance (as the remaining dollars will stretched even thinner).
[17] Travel Model One, and the overall assessment framework, is focused on long-term benefits and disbenefits and does not incorporate the positive and negative impacts associated with construction activities.
[18] Expansion project example: faster travel time from a bus frequency boost; state of good repair project example: educed fuel costs from pavement preservation funding
[19] Refer to the TRB paper cited above for additional discussion on this particular topic.
[20] Several other smaller-scale benefits may exist but lack a quantifiable link between pavement condition and operational impacts. Both are related to non-motorized users – bicycle maintenance costs may increase as pavement condition worsens, and non-motorized users may be particularly susceptible to safety hazards as pavement conditions worsens. Additional research efforts could address these limitations and quantify these expected links. Other often-cited operational impacts are weak at best – air quality and travel time impacts from pavement condition are likely small or negligible, especially when compared to indirect effects from induced demand.
[21] More information on this can be found in the upcoming Plan Bay Area 2040 Performance Assessment Report, as well as the materials provided to the Performance Working Group.
[22] Spreadsheet tool developed by MTC to link StreetSaver and Travel Model One using national research as described below.
[23] Park, K., N. Thomas, and K. Lee. *Applicability of the International Roughness Index as a Predictor of Asphalt Pavement Condition*, 2007. Published in the *Journal of Transportation Engineering*.
[24] Note that IRI in the formula above is output in meters per kilometer; IRI data from StreetSaver is output in inches per mile and then converted accordingly.

vehicle type (auto, small truck, heavy truck, and bus[25]) compared to ideal conditions. Given that speed limit data is unavailable for every road in the region, and many roads have congested speeds lower than their posted limits, local roads were assumed to have an average speed of 35 mph while state highways were assumed to have an average speed of 55 mph.[26]

d. Finally, for each jurisdiction, facility type, and vehicle type, OIC calculates weighted average adjustment factors were calculated based on the share of roads in each PCI bin. OIC's final output is a series of maintenance cost adjustment factors and fuel cost adjustment factors which can be applied across all roads of a given facility type in a given jurisdiction, specific to each vehicle type discussed above.

Step 3: Run Travel Model One using operational impacts to explore benefits & disbenefits.

1. Convert the output matrices from the two operational impact spreadsheets into a Cube-readable format.[27]
   a. For local streets and roads: update Matrix A, which reflects each jurisdiction's adjustment factors in a machine-readable line with its Travel Model One "cityname" field. Unincorporated areas are flagged with a -1 variable, triggering the model to apply the unincorporated county adjustment factors instead. The matrix can then be handed off to the modeling team.
   b. For state highways: update scalar B, which reflects the adjustment factors applied across the entire state highway network. These inputs are then translated into script text that can be handed off to the modeling team.

2. Run Travel Model One twice: once with baseline conditions and once with "with project" conditions to evaluate how travelers respond to changing asset conditions. While additional information on the model can be found in Travel Model One documentation[28], a rough and high-level summary of how the model applies the adjustment factors and associated costs for maintenance & fuel can be found below:
   a. The adjustment factor matrices are multiplied by the ideal maintenance costs and ideal fuel costs per mile; these values are then summed to create a vehicle operating cost for each jurisdiction, facility type, and vehicle type combination.
   b. Every link on the network is assigned specific attributes; one set of these attributes is the operating cost per mile for each vehicle type traversing the network. The operating cost attributes in the matrix above are assigned to the geography or jurisdiction in question. For example, all of the arterials in city X would be assigned four attributes, one for each vehicle type on the network.
   c. The model then begins to simulate how travelers respond to the various vehicle operating costs on the links they decide to traverse, generating impacts to those travelers but also influencing their decisions. This approach is similar to what is done for expansion projects, insofar that new conditions are loaded on the network and benefits/disbenefits are a result of the input conditions.
   d. Metrics calculated by Travel Model One are produced for the two runs, including the inputs to the COBRA benefit-cost script.

[25] Vehicle types from NHCRP 720 were correlated with MTC vehicle types as follows: auto = medium car, small truck = light truck, heavy truck = articulated truck, bus = heavy bus.
[26] To better reflect operating impacts on highly degraded streets, maintenance cost adjustment factors were capped between 2.0 and 3.0 (depending on vehicle class) and fuel cost adjustment factors were capped between 1.05 and 1.13 (depending on vehicle class).
[27] Cube is the travel model software used by Travel Model One for network coding.
[28] For more information: http://mtcgis.mtc.ca.gov/foswiki/Main/UsersGuide

Step 4: Calculate benefit-cost ratio using Travel Model One outputs and funding levels from StreetSaver.

1. First, calculate the costs by subtracting the 24-year baseline StreetSaver treatment costs[29] from the "with-project" treatment costs. In order to compare to the annualized benefit, divide by 24 to calculate the expenditures in a single year.

2. Second, calculate the benefits by running the COBRA benefit-cost script using the Travel Model One output CSV files. The benefits associated with the scenario are calculated by COBRA using standard benefit monetizations[30] applied to all projects evaluated for Plan Bay Area 2040, which compares the "with-project" and baseline conditions.

3. Finally, COBRA outputs the benefit-cost ratio by dividing the annualized benefits by the annualized costs. The result is a B/C ratio that reflects the benefits to users and society from increasing maintenance funding as defined in the scenario.

[29] Adjusted to year 2017 dollars using a 2.2% inflation rate.
[30] Benefit categories include: travel time, non-transfer user cost, public health, air pollutants, greenhouse gas emissions, noise, etc.

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Memorandum

TO: Transit Asset Management Subcommittee

DATE: February 18, 2016

FR: David Vautin

RE: Plan Bay Area 2040 State of Good Repair Performance Assessment – Objectives and Methodology

In order to inform policy decisions related to project and program selection for Plan Bay Area 2040, MTC is conducting a performance assessment of major uncommitted transportation investments. In addition to analyzing expansion and efficiency investments – similar to the assessment performed as part of Plan Bay Area – MTC is also evaluating how state of good repair investments perform using a unified, consistent performance framework. This effort is designed to provide additional context for policymakers as they craft a preferred scenario for Plan Bay Area 2040.

Staff is returning to the Transit Asset Management Subcommittee to provide a refresher on the objectives and approach (which were discussed in prior meetings in 2015) and also to engage in a more technical discussion of analysis methodology specific to public transit. A more robust discussion of results and findings will take place in March 2016, following the completion of the analysis.

Assessment Objectives

Over the past decade, MTC has adopted plans that allocate an increasing share of funding to preserve and maintain existing transportation infrastructure, in alignment with the region's "Fix It First" strategy. However, state of good repair investments were handled outside the project evaluation framework – meaning that consistent and comparable data on their benefits were not available for policymakers.

In order to integrate state of good repair and to allow it to be assessed on a level playing field with other investments, MTC staff has worked to develop and implement new methodologies for evaluating roads and public transit maintenance. By quantifying the effects of asset condition on system users, these investments can be analyzed for their cost-effectiveness and their support of regional performance targets, just like a traditional expansion project, using the regional travel demand model. The ultimate objective is to have "apples to apples" performance results, meaning that the scores can be easily compared between project performance and state of good repair performance to inform key policy decisions.

By evaluating state of good repair investments in the same manner as expansion and efficiency projects, staff seeks to provide additional information for policymakers to address the following questions:

- How does system maintenance perform relative to expansion and efficiency investments – both in terms of cost-effectiveness and targets support?
- Within the realm of state of good repair, what differences exist between modes and operators when it comes to cost-effectiveness and targets support?
- Are certain state of good repair investments high-performing, and if so, should they be eligible for regional discretionary dollars?
- Are certain state of good repair investments low-performing, and if so, is there a compelling case for funding these investments regardless of this status?

Approach

As the state of good repair performance assessment is designed to complement both the existing project performance and needs assessments, it builds off of the existing frameworks used in prior Plans. Like the project performance assessment, state of good repair performance will be evaluated based on two primary scores:

- **Benefit-cost ratio.** By exploring how asset conditions (forecasted by StreetSaver and TERM-Lite) affect system operations, Travel Model One simulates how system users respond to improved or degraded infrastructure. These benefits are monetized and compared to the costs of SGR investments as part of a benefit-cost assessment.
  In other words, if a system deteriorates to the point that it costs a user either time or money, how will the user react – will they shift modes? travel less? pay more? This behavior can then be modeled on a regional scale to see what the major impacts would be.
- **Targets score.** State of good repair investments can also be evaluated qualitatively against performance targets in the same manner as expansion projects. This is consistent with the approach taken in Plan Bay Area, albeit with the new Plan Bay Area 2040 targets.

In addition to the benefit-cost analysis and targets assessment, several supplemental assessments are being conducted as part of the project performance assessment. Similar to expansion and efficiency projects, state of good repair will be evaluated through an equity assessment to explore impacts and benefits to communities of concern. Additionally, staff will conduct a confidence assessment of benefit-cost results and run a series of performance sensitivity tests.

Given the thousands of assets that need to be replaced over the course of the Plan cycle, it is not possible to conduct a performance assessment of each asset individually. Instead, MTC is assessing performance at a modal and system level, looking at the impacts of different funding levels on operations and ultimately system users. The following bus and rail systems will be analyzed:

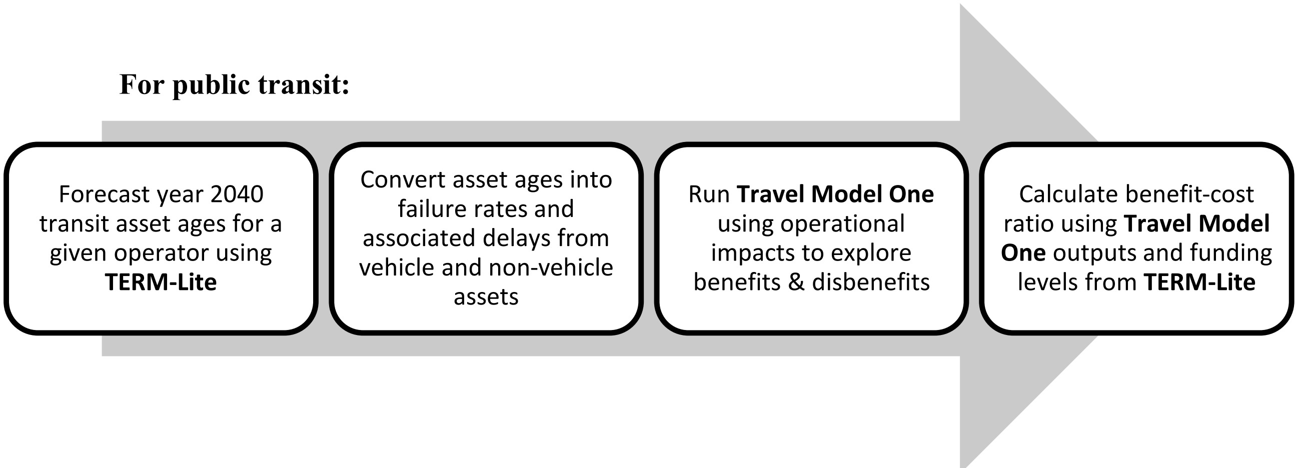
- Muni Bus
- Muni Rail
- AC Transit
- VTA Bus
- VTA Rail
- BART
- Caltrain
- SamTrans
- Golden Gate Bus
- Small Operators *(as a group)*

Benefit-cost ratios and target scores will be produced for each system (as well as the region as a whole). The analysis will evaluate the benefits and costs associated with preserving existing conditions as well as achieving ideal conditions.

Technical Methodology for Benefit-Cost Assessment of Public Transit

State of good repair investments are being evaluated through the same benefit-cost framework as expansion investments, leveraging Travel Model One and the MTC COBRA benefit-cost tool. However, in order to link asset conditions (the output of asset management models) and operational impacts (the input to travel demand models), staff developed new methodologies for roads and transit state of good repair, which were published in peer-reviewed journals in 2015. While the methodologies are merely the first iteration of such work – and as such have known limitations that will be fully documented in the confidence assessment – staff believes they can provide an order-of-magnitude evaluation of cost-effectiveness which is sufficient to identify high-, medium- or low-performer status.

Attachment A documents the methodology being used for public transit in greater detail, but the graphic below serves a succinct summary of the process.



Analysis Findings

Preliminary results and findings for public transit state of good repair performance will be released at or before the March 23rd meeting of the Transit Asset Management Subcommittee. In addition to data tables breaking down the benefit-cost ratio and target score results, staff will prepare a detailed discussion of key findings based on the analysis. As the results will be released in concert with road state of good repair performance and project performance, stakeholders will have an opportunity to see how performance differs across modes and funding programs.

While analytical work is still underway, staff has identified three high-level findings that have begun to emerge from the analysis so far:

- **Preserving and improving the pavement condition of the region's highway system would yield significant benefits for Bay Area residents.** Bringing the state highway system to a state of good repair is likely one of the most cost-effective investments under consideration for Plan Bay Area 2040.
- **Investment in local streets and road pavement preservation is also beneficial and cost-effective for roadway users, outperforming many of the region's expansion and efficiency investments.** However, the lower traffic volumes on many of these facilities – in particular, lightly-used residential streets – means that state highway maintenance yields more bang per buck on a relative scale.
- **While maintenance of our region's transit infrastructure strongly supports the performance targets for Plan Bay Area 2040, cost-effectiveness will likely vary widely across operators and modes and generally is lower than investments in local roads and state highways.** While many factors affect the benefit-cost ratio for transit state of good repair, systems with high utilization and infrequent service appear to benefit the most from state of good repair investments (i.e., a full bus with 30-minute headways generates more significant adverse impacts from a vehicle breakdown than an underutilized bus with 10-minute headways).

Next Steps

Staff will return to this group in the coming months to discuss results and key findings as we move towards a preferred scenario for Plan Bay Area 2040. In addition, interested parties can attend meetings of the Performance Working Group, the Partnership Board, the Local Streets and Roads Working Group, PTAC, RAWG, Policy Advisory Council, and the Planning Committee in March and April, as state of good repair and project performance will be on the agenda at these meetings as well. If you have any questions or concerns in the meantime, feel free to contact David Vautin (dvautin@mtc.ca.gov).

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ATTACHMENT A

State of Good Repair Benefit-Cost Assessment Methodology for: Public Transit

This document is designed to provide additional detail on the Plan Bay Area 2040 methodology used for the state of good repair benefit-cost assessments of public transit. In short, the methodology is designed to link the TERM-Lite asset management model[1] used for the needs assessment purposes to Travel Model One (the regional travel demand model used for performance assessment purposes). The end result is an "apples to apples" benefit-cost ratio that allows for the comparison of expansion and maintenance across modes based on impacts to system users and society at large.

In the case of public transit, it is important to note that the methodology focuses on operational impacts of asset condition – i.e., slow zones, stoppages, etc. – and how those impacts benefit or disbenefit existing and potential riders. Because safety is priority #1, it is assumed that operators would stop or delay service rather than risking harm to passengers. These sorts of time impacts – either from asset failures or from shutdowns or slowdowns associated with safety – have been quantified via significant research on the national and regional levels. However, improved asset condition may also affect the perception of a given mode – i.e., cleaner seats on new buses or brighter platforms at new/refreshed rail stations. Due to a lack of data on these types of aesthetic or non-operational impacts, the transit state of good repair analysis focuses primarily on assets with direct operational impacts, while recognizing that there may be smaller secondary benefits that cannot be easily quantified or monetized.

While the methodology has been mostly finalized for this iteration of the Plan, future efforts could enhance and expand on this work to provide even more refined results. Further discussion of research opportunities in this area will be included in a document slated for release later this year.

Step 1: Forecast year 2040 transit asset ages for a given operator(s) using TERM-Lite.

1. Before analyzing a given scenario for transit state of good repair, it is necessary to identify the following characteristics:
    a. Agency + mode combination(s) subject to analysis[2]
    b. Asset categories subject to analysis[3]
    c. Funding prioritization strategy[4]
    d. Horizon year for analysis[5]

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[1] For more information on TERM-Lite, refer to the Federal Transit Administration's website: http://www.fta.dot.gov/13248_13251.html.

[2] For the purposes of this work, analysis was performed for each of the region's seven major operators by bus and rail (when applicable) as well as the remaining small operators as a group. No national or regional methodology is currently available for ferries, meaning that ferries were not analyzed in this analysis; future work could involve regression analysis to identify coefficients for a ferry mode.

[3] For the purposes of this work, analysis was performed for the system as a whole, rather than calculating a benefit-cost ratio specifically for vehicle replacement (for example). However, the methodology could be used for that type of task in the future.

[4] For the purposes of this work, funding was prioritized using the same approach as the needs assessment – 90% based on the TCP score and 10% based on condition.

[5] For the purposes of this work, the Plan has a horizon year of 2040.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

2. A state of good repair scenario compares conditions and impacts to users and society for two different funding levels. Before running TERM-Lite, it is necessary to identify:
    a. Baseline funding level for transit asset preservation[6] or baseline PAOUL[7] target[8]
    b. "With-project"[9] funding level for transit asset preservation or "with-project" PAOUL target

3. TERM-Lite also requires an inventory or dataset of transit assets in the baseline year as a foundation for forecasting pavement conditions in a future year, generally collected every four years by MTC[10].

4. Run the TERM-Lite asset management model to forecast asset ages in the horizon year[11] for both the baseline and "with project" funding levels using the parameters identified above. If a PAOUL target seek (such as preserve current PAOUL or zero PAOUL) forms the basis of this scenario instead of funding levels, run TERM-Lite in that mode instead. (Note that this approach is generally consistent with the needs assessment process for Plan Bay Area 2040.)

5. For each public transit scenario, request the following TERM-Lite output values for every asset in the relevant inventory:
    - Basic Information
        - TRS ID – transit operator ID code
        - Transit System – name of system
        - Asset Type Code – five-digit code identifying category & element across operator
        - Category, Sub-Category, Element, Sub-Element – associated text data for validation purposes
        - Operational Flag – binary variable identifying the asset has operational impacts[12]
    - Age Data
        - Useful Life
        - Date Built
        - Age – five-year average age in horizon year[13]
    - Quantity and Valuation Data
        - Quantity[14]
        - Units[15]
        - Valuation – value of the asset(s) in question

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[6] Regional funding for transit asset preservation directed towards the operator and system in question
[7] PAOUL stands for the percent of transit assets past their useful lives – i.e., share of aged assets.
[8] When run in target mode that seeks to reduce the backlog, TERM-Lite needs to know the year by which the target needs to be achieved (and preserved thereafter). For this analysis, a year 10 assumption for target achievement is provided as an input in line with the Needs Assessment work.
[9] Higher level of funding being analyzed in comparison to baseline
[10] Refer to the Plan Bay Area 2040 Needs Assessment work for more information on this process.
[11] To minimize noise from asset replacement in the horizon year dataset, a five-year average age (with the horizon year as its midpoint) for each asset is output by TERM-Lite.
[12] As defined by later formulas and data tables developed from TCRP Report 157.
[13] Five-year average age is used to minimize "lumpiness" from asset replacement cycles, especially in small operators; those operators are more likely to replace all of their vehicles at once, rather than on a rolling basis. This improves the accuracy of the future year forecast, especially given the horizon year approach. The five-year average is calculated using 2040 as the midpoint.
[14] Technically relies on AdjustedQNTY variable from TERM-Lite.
[15] For example, feet or miles of track – this variable is essential for later conversions to standardize across systems.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

- Investment Costs by Year – stream of rehabilitation and replacement costs by year for a given asset(s)

Step 2: Convert asset ages into failure rates and associated delays from vehicle and non-vehicle assets.

Note to readers: *In benefit-cost analysis, it is important to clearly delineate benefits to users and to society and costs to the system operator without double-counting any metrics in the process. For a more detailed explanation of the inclusion or exclusion of certain benefits, and an overarching literature review, please refer to Paterson and Vautin (2015) in the TRB 94th Annual Meeting Compendium of Papers[16] and the Journal of Public Transportation.[17]*

1. Begin this part of the process as a new iteration of the Operational Impact Calculator (OIC) for public transit state of good repair.[18] OIC takes the TERM-Lite customized outputs as input and calculates the delays for each transit system, which can be then input into Travel Model One for simulation.

2. Gather key data inputs from the FTA National Transit Database[19] required for use of Transit Cooperative Research Program (TCRP) Report 157[20] by operator and by mode to establish baseline year conditions:
    a. Annual revenue vehicle miles
    b. Number of revenue vehicles[21]
    c. Major and minor vehicle failures per year
    d. Fuel consumption and fuel type[22]

3. Gather key data inputs from past Travel Model One (TMO) forecasts[23] by operator and by mode to establish baseline year and forecast year system-level conditions:
    a. Typical weekday passenger-miles
    b. Typical weekday revenue vehicle miles
    c. Typical weekday boardings
    d. Weighted-average[24] weekday headway[25]
    e. Weighted-average route length

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[16] See URL: http://docs.trb.org/prp/15-1207.pdf.
[17] See URL: http://scholarcommons.usf.edu/cgi/viewcontent.cgi?article=1445&context=jpt.
[18] Spreadsheet tool developed by MTC to link TERM-Lite and Travel Model One using the formulas and methodologies highlighted below.
[19] NTD data is available online at: http://www.ntdprogram.gov/ntdprogram/.
[20] See URL: http://onlinepubs.trb.org/onlinepubs/tcrp/tcrp_rpt_157.pdf.
[21] Used primarily to calculate consistent NTD rates below; RTCI asset inventory is primary source for this data when calculating impacts.
[22] Fuel consumption, type, and price data is used later in the analysis; however, for the sake of brevity, the data collection process is shown here instead.
[23] For the purposes of this analysis, model runs from the adopted Plan Bay Area (2013) were used to establish consistent historical and forecast data by operator.
[24] Weighted average is used to account for the fact that some lines on a given system are used more heavily than others; the weighted average headway reflects the user experience (passenger-mileage as weighting factor) while the weighted average route length reflects the bus or rail operator experience (vehicle-mileage as weighting factor).
[25] For rail operators with complex stopping patterns (such as Caltrain), slight adjustments were made to headways to better correspond to the user experience.

f. Fuel prices[26]

4. Calculate a series of key calibration values based on the NTD and TMO data above:
   a. Boardings per mile[27]
   b. Average vehicle loading[28]
   c. Average mileage on an individual vehicle[29]
   d. Average number of lines using a given segment of track or guideway[30]

5. Gather data from regional transit operators how they would respond to failures of different types of non-vehicle assets (due to the lack of failure formulas in national literature and the system-specific differences that exist across the United States). Key variables include whether the typical failure of a given asset[31]:
   a. Affects one or both directions of service?[32]
   b. Causes a slow zone or a stoppage?[33]
   c. Generates how many minutes of delay for the average rider?[34]
   d. Requires how many hours for repair under regular conditions? [35]

   Also, gather information about the availability of work crews to fix non-vehicle failures (i.e., the number of non-vehicle failures that can be fixed per day given current staffing) and the average amount of time required to clear tracks of a stalled train (for rail systems only)[36].

6. Start by calculating failure rates in order to forecast the frequency for which SGR-related events take place on an average weekday in the forecast year:

   a. TCRP Report 157 developed an exponential curve that calculates future vehicle failure rates of a given vehicle based on the vehicle's lifetime mileage, its "year zero" failure rate[37], and a mode-specific constant:

$$\mathrm{RM(LM)} = \mathrm{k_{r2}} e^{\mathrm{k_{r1}} * \mathrm{LM}}$$

   where:
   RM = road calls or failures per vehicle mile
   LM = lifetime mileage[38]

[26] In addition to Travel Model One data for gasoline prices, CNG and diesel prices were calculated using data from the Department of Energy.
[27] Calculated as typical weekday boardings divided by typical weekday revenue vehicle-miles.
[28] Calculated as typical weekday passenger-miles divided by typical weekday.
[29] Calculated as annual revenue vehicle miles divided by the number of revenue vehicles.
[30] Only for fixed-guideway systems.
[31] A data table of the merged and standardized failure operational impacts across operators is available by request and will be incorporated into the final report.
[32] Based upon information submitted by transit operators.
[33] Based upon information submitted by transit operators; majority opinion used to standardize across region.
[34] Informed by ranges submitted by transit operators but generally scaled upwards by MTC.
[35] Informed by ranges submitted by transit operators but generally scaled upwards by MTC. This information is used later to scale up delay impacts in catastrophic scenarios when work crews would be overwhelmed by system failures.
[36] Based on operator input, geographic system scope (i.e., distance to rail yard), etc., we assumed 15 minutes for Muni, 20 minutes for VTA, 30 minutes for BART and Caltrain, and 60 minutes for ACE and SMART for the purposes of this analysis.
[37] "Year zero" failure rate would be the failure rate of the asset when first purchased (i.e., brand-new).
[38] Estimated based on FTA NTD year 2013 data multiplied by asset age.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

k_{r1} = a constant reflecting the sensitivity of road calls or failures to lifetime mileage[39]
k_{r2} = a system-specific constant set to match year zero road calls or failures

b. For each system, calibrate the "year zero" failure rate constant using current failure rate data (both major and minor vehicle failures) per vehicle revenue mile in the formula above. Once the k_{r2} values are calibrated, it is then possible to forecast failures (i.e., road calls) per mile for the forecast year for each operational vehicle in the inventory.

c. TCRP Report 157 developed a Weibull distribution curve that calculates future non-vehicle failure probability in a given year based on the asset age and asset type-specific shape and scale parameters:

$$\mathrm{PF} = 1 - \frac{e^{-\left(\frac{t+1}{\lambda}\right)^k}}{e^{-\left(\frac{t}{\lambda}\right)^k}}$$

where:
PF = probability of asset failure in the forecast year[40]
t = asset age in the forecast year
k = asset-specific shape parameter[41]
λ = asset-specific scale parameter[42]

d. Using the formula above, for each non-vehicle asset in the inventory, calculate its probability of failure in the forecast year. Adjust all linear unit assets to track-mile or mile to align with TCRP Report 157 units, as well as operational impact assumptions discussed later on.

7. Now that the failure rates of each asset have been calculated, it is necessary to estimate the impacts of each failure in terms of minutes of delay for input to Travel Model One[43]. For both vehicles and non-vehicles, there are two primary direct operational impacts for a customer: **per-mile delays** (when on board a transit vehicle) and **per-boarding delays** (when waiting for a transit vehicle to arrive). For more information on formula derivations, refer to Paterson and Vautin (2015).

   a. Starting with vehicle per-mile delays, calculate the passenger delays both on-board the vehicle and for other vehicles trapped behind the stalled vehicle[44]:

$$\mathrm{DWBT} = \mathrm{AWT} * \left(\frac{\mathrm{PM}}{\mathrm{VM}}\right)$$

[39] Constant k_{r1} was estimated in TCRP Report 157 to be 7.0 x 10^{-7} for heavy rail, 1.0 x 10^{-6} for light rail, and 1.98 x 10^{-6} for buses.
[40] Assumes the asset is functioning in the year prior to the forecast year.
[41] Identified for each asset type in TCRP Report 157 – Table E-1, pages 118 to 121.
[42] Identified for each asset type in TCRP Report 157 – Table E-1, pages 118 to 121.
[43] Travel Model One, and the overall assessment framework, is focused on long-term benefits and disbenefits and does not incorporate the positive and negative impacts associated with construction activities.
[44] Wait times are capped at 60 minutes. It is assumed that after that point, a passenger will give up on that operator and switch to another transit mode, use their personal automobile, join a carpool, use a bus bridge, or otherwise defer their trip.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

$$AWT = \frac{\sum_{i-NT}\left(\frac{TC}{H}\right) - i}{NT} * H$$

$$NT = RoundDown\left(\frac{TC}{H}\right)$$

where:
DWBT = delay from waiting behind stalled trains
AWT = average wait time in headways for trains stuck behind stalled train
PM = passenger miles
VM = revenue vehicle miles
i = each additional train
TC = average time it takes to clear tracks
H = headway
NT = the number of trains that are delayed due to a stalled train ahead

$$IVED(V) = RM * \left(DWBT + \left(EH * \left(\frac{PM}{VM}\right)\right)\right)$$

where:
IVED(V) = in-vehicle expected delay from vehicle failures (onboard + upstream)
RM = road calls per mile from equation 3
EH = effective headway (incorporating crowding factor)[45]
PM = passenger miles
VM = revenue vehicle miles

b. Next, calculate the vehicle per-boarding delays, which are based on passengers waiting for the failed vehicle(s).

$$PWV = \left(\frac{PT}{VM}\right) * MR$$

where:
PWV = passengers waiting for the failed vehicle
PT = passenger trips
VM = revenue vehicle miles
MR = recovery miles (miles before another bus takes over the route)[46]

$$OVED(V) = \frac{(EH * PWV) * (MR * VM)}{PT}$$

where:
OVED(V) = out-of-vehicle expected delay from vehicle failures
EH = effective headway (incorporating crowding factor)
MR = recovery miles
VM = revenue vehicle miles
PWV = passengers waiting for the failed vehicle

[45] The crowding factor incorporates the reality that, when a vehicle breaks down, not all passengers will fit on board the next vehicle. Instead, the effective headway represents the average or typical number of headways a passenger would have to be wait (1.0 in normal conditions, 1.5 in crowded conditions, 2.0 in crush load conditions). Crowding factors are identified on a system level based on current and future daily ridership.
[46] Assumed to be half the length of the average route (i.e., on average case, bus breaks down halfway between its origin and destination). However, in catastrophic scenarios, recovery time – as well as recovery miles – increases due to the lack of availability of additional buses.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

PT = passenger trips

c. Calculate the average non-vehicle per-mile delays using the following formulas to incorporate both slow zone delays from non-vehicle assets and stoppage delays from non-vehicle assets, making sure to convert from annual to daily failures in the process:

$$\mathrm{SZD} = \mathrm{PF} * \left(\frac{\mathrm{NT} * \mathrm{MD}}{\mathrm{VM} * 300}\right)$$

$$\mathrm{NT} = \mathrm{RoundDown}\left(\frac{(\mathrm{TR}) - \left(\frac{1}{2}\mathrm{H}\right)}{\mathrm{H}}\right) * \mathrm{LA}$$

where:
SZD = expected delay arising from slow zones
PF = probability of failure in 2040
NT = number of trains affected by failure
MD = minutes of delay to the train caused by slow zone
VM = revenue vehicle miles
TR = time until repair or replacement of the failed asset in minutes[47]
H = headways
LA = average number of lines affected by failure

$$\mathrm{STD} = \mathrm{PF} * \left(\frac{\mathrm{NT} * \left(\frac{\mathrm{TR}}{2}\right)}{\mathrm{VM} * 300}\right)$$

where:
STD = expected delay from being on a stopped train due to a non-vehicle failure ahead
PF = probability of failure in 2040
NT = number of trains affected by failure
TR = time until repair or replacement of the failed asset in minutes[48]
VM = revenue vehicle miles

$$\mathrm{IVED(NV)} = \mathrm{SZD} + \mathrm{STD}$$

where:
IVED(NV) = in-vehicle expected delay from non-vehicle asset failures
SZD = expected delay arising from slow zones
STD = expected delay from being on a stopped train due to a non-vehicle failure ahead

d. Finally, calculate the non-vehicle per-boarding delays, which are primarily the result of system stoppages[49], making sure to convert from annual to daily failures in the process.

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[47] Minutes needed to repair the asset are adjusted upwards in catastrophic scenarios to reflect that the maintenance crews would be overwhelmed, assuming that additional staff would be called in or that workers would be exhausted due to overtime.
[48] We cap the expected wait until for the stoppage to be resolved at TR/2 = 60 minutes, assuming that the operator would not leave passengers captive on-board for more than that amount of time. Instead, they would likely transition to a bus bridge or other alternative operating pattern.
[49] Impacts to headways from slow zones can generally be overcome by adding a small number of new train runs to preserve frequencies at a slightly slower origin-to-terminus speed.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

$$OVED(NV) = PF\frac{WT * WN}{WB * 300}$$

$$WT = TR - (\frac{1}{2}H)$$

$$WN = BM * \left(\frac{1}{2}ARL\right) * \min(NT, DT)$$

$$DT = LA\left(\frac{MOD}{H}\right)$$

where:
OVED(NV) = out-of-vehicle expected delay from non-vehicle asset failures
WT = additional out-of-vehicle wait time when a vehicle is stopped by a non-vehicle asset failure[50]
WN = number of passengers waiting to board a vehicle stopped by a non-vehicle asset failure
TR = minutes until asset repair or replacement[51]
WB = average weekday boardings
BM = average boardings per mile
ARL = average route length
DT = number of trains passing through affected area in one day
NT = number of trains affected by failure
MOD = minutes of operation daily[52]
H = headways
LA = average number of lines affected by failure

e. Calculate the average per-mile delay by aggregating and averaging the vehicle and non-vehicle failure impacts across all rows of the inventory. Repeat for the average per-boarding impacts. Note that these values reflect the experience of average rider on the given system in the horizon year on a per-mile and per-boarding basis (i.e., they are time-based "friction factors" due to breakdowns which riders build into their daily schedule).

8. Summarize cost outputs from the TERM-Lite export files for use in Step 4 below; sum the replacement conditions for all assets flagged as having operational impacts between year 1 and the horizon year (24-year costs). Note that transit asset replacement costs for operators – the primary input on the cost side of the benefit-cost ratio – are relatively straightforward thanks to TERM-Lite; they represent the difference between the two funding levels for the scenario in question, as the region's transportation agencies will be expending these dollars.[53]

Step 3: Run Travel Model One using operational impacts to explore benefits & disbenefits.

1. Convert the Results tab of the OIC spreadsheet into a Cube-readable format by extracting the data in the combined per-mile delay and combined per-boarding delay columns.[54] When an individual operator is run, values will be null or zero for all other operators.

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[50] Wait times are capped at 60 minutes. It is assumed that after that point, a passenger will give up on that operator and switch to another transit mode, use their personal automobile, join a carpool, use a bus bridge, or otherwise defer their trip.
[51] Refer to the earlier comment about catastrophic failure scenarios.
[52] For example, 1080 minutes for a 6 AM to 12 AM service schedule.
[53] Funding levels can be either inputs or outputs of TERM-Lite in Step 1.
[54] Cube is the travel model software used by Travel Model One for network coding.

NOTE: PRELIMINARY DRAFT – SUBJECT TO FUTURE REVISIONS

2. Paste the operational impact values into two BLOCK files, using the relevant Travel Model One mode codes to identify the rows to modify.
    a. When evaluating all operators in the region, start with blank BLOCK files for both per-mile and per-boarding delays.
    b. When evaluating one or more operators in isolation, use the year 2040 baseline delay BLOCK files[55] and swap out the per-mile and per-boarding for the operator(s) in question, leaving all other systems with status quo delays.

3. Run Travel Model One twice: once with baseline conditions and once with "with project" conditions to evaluate how travelers respond to changing asset conditions. While additional information on the model can be found in Travel Model One documentation[56], a rough and high-level summary of how the model applies the delay factors can be found below:
    a. For each line on each system, the per-mile travel time impacts are applied to the point-to-point travel times between stops (to simulate greater in-vehicle time), while the per-boarding travel time impacts are applied to the headways (to simulate greater out-of-vehicle time).
    b. The model then begins to simulate how travelers respond to the various levels of typical delay on the systems they decide to use in a given day, generating impacts to those travelers but also influencing their decisions. This will affect their access to destinations, as well as their travel behavior, generating secondary effects like emissions, collisions, etc. This approach is similar to what is done for expansion projects, insofar that new conditions are loaded on the network and benefits/disbenefits are a result of the input conditions.
    c. Metrics calculated by Travel Model One are produced for the two runs, including the inputs to the COBRA benefit-cost script. These metrics are leveraged in Step 4.4 below to calculate benefits, reflecting the forecasted behavioral impacts (both direct and indirect effects on riders and the region as a whole).

Step 4: Calculate benefit-cost ratio using Travel Model One outputs and funding levels from TERM-Lite.

1. First, calculate the costs by subtracting the 24-year baseline TERM-Lite asset replacement costs[57] from the "with-project" asset replacement costs. In order to compare to the annualized benefit, divide by 24 to calculate the expenditures in a single year.

2. Second, adjust the gross cost differential by incorporating vehicle energy cost impacts using the energy cost modeled identified in TCRP Report 157. The formula below relies upon an exponential curve that calculates future vehicle energy consumption of a given vehicle based on the vehicle's lifetime mileage, its "year zero" failure rate[58], and a mode-specific constant:

$$\mathrm{CME(LM)} = \mathrm{k_{e2}} e^{\mathrm{k_{e1}} * \mathrm{LM}}$$

    where:
    CME = energy costs per mile
    LM = lifetime mileage[59]

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[55] Based on the 2015 inventory and 2040 operating conditions (i.e., assuming that asset conditions for all other operators are about the same as today).
[56] For more information: http://mtcgis.mtc.ca.gov/foswiki/Main/UsersGuide
[57] Adjusted to year 2017 dollars using a 2.2% inflation rate.
[58] "Year zero" failure rate would be the failure rate of the asset when first purchased (i.e., brand-new).
[59] Estimated based on FTA NTD year 2013 data multiplied by asset age.

k_{e1} = a constant reflecting the sensitivity of energy consumption to lifetime mileage[60]
k_{e2} = a system-specific constant set to match year zero energy costs[61]

Additional cost adjustments related to emergency replacements may be added if time allows; note that this element of the methodology is still under development.

3. Third, calculate the benefits by running the COBRA benefit-cost script using the Travel Model One output CSV files. The benefits associated with the scenario are calculated by COBRA using standard benefit monetizations[62] applied to all projects evaluated for Plan Bay Area 2040, which compares the "with-project" and baseline conditions.

4. Finally, COBRA outputs the benefit-cost ratio by dividing the annualized benefits by the annualized costs, incorporating a system-wide farebox recovery ratio to roughly account for fare revenue impacts associated with higher or lower ridership in a given run[63]. The result is a B/C ratio that reflects the benefits to users and society from increasing system preservation funding as defined in the scenario.

[60] Constant k_{e1} was estimated in TCRP Report 157 to be 6.27 x 10^{-7} for buses and 4.0 x 10^{-7} for rail vehicles.
[61] k_{e2} values by operator are calibrated using a similar process as described in Step 2 under vehicle failure rates – NTD data on the primary fuel type of an operator, and its total consumption of said fuel per mile, allows us to back calculate the rough year zero energy costs by system.
[62] Benefit categories include: person time + cost (i.e., access to destinations), truck time + cost, collisions (i.e., fatalities, injuries, property damage), air quality (i.e., greenhouse gas emissions, fine particulate emissions, criteria pollutant emissions), physical activity (i.e., mortality and morbidity), auto ownership costs, and noise.
[63] This approach is consistent with expansion and operational improvement projects. For details on the valuation of each benefit ($ per unit of benefit), refer to the Plan Bay Area 2040 Performance Working Group packet on this topic (http://mtcmedia.s3.amazonaws.com/files/performanceworkinggroup/Performance_Working_Group_-_August_2015.pdf). Final benefit valuations will also be included in the Plan Bay Area 2040 Performance Assessment Report.

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
FINAL RESULTS

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
1	1503	**Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)**	Multi-County	Highway Maintenance	$638	($1)	>50	2.5
2	1502	**Highway Pavement Maintenance (Preserve Conditions vs. No Funding)**	Multi-County	Highway Maintenance	$2,433	$144	17	2.5
3	302	**Treasure Island Congestion Pricing (Toll + Transit Improvements)**	San Francisco	Congestion Pricing	$56	$4	14	4.5
4	1301	**Columbus Day Initiative**	Multi-County	ITS	$421	$38	11	4.0
5	209	**SR-84 Widening + I-680/SR-84 Interchange Improvements (Livermore to I-680)**	Alameda	Intraregional Road Expansion	$116	$13	9	1.0
6	501	**BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)**	Santa Clara	Rail Expansion	$472	$62	8	8.0
7	306	**Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)**	San Francisco	Congestion Pricing	$84	$11	7	7.0
8	1651	**Public Transit Maintenance - Rail Operators (Preserve Conditions vs. No Funding)**	Multi-County	Rail Maintenance	$1,351	$198	7	9.5
9	506	**El Camino Real BRT (Palo Alto to San Jose)**	Santa Clara	BRT	$85	$13	7	6.5
10	301	**Geary BRT**	San Francisco	BRT	$124	$20	6	7.0
11	505	**Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)**	Santa Clara	Rail Expansion	$77	$12	6	5.5
12	518	**ACE Alviso Double-Tracking**	Santa Clara	Rail Efficiency	$36	$6	6	1.5
13	1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	Bus Maintenance	$623	$103	6	8.0
14	1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	Ferry	$29	$5	6	4.5
15	203	**Irvington BART Infill Station**	Alameda	Rail Efficiency	$30	$6	5	3.5
16	101	**Express Lane Network (US-101 San Mateo/San Francisco)**	Multi-County	Express Lanes	$48	$10	5	0.5
17	903	**Sonoma County Service Frequency Improvements**	Sonoma	Bus Frequency Improvements	$75	$15	5	5.0
18	523	**VTA Service Frequency Improvements (15-Minute Frequencies)**	Santa Clara	Bus Frequency Improvements	$103	$23	4	5.0
19	211	**SR-262 Connector (I-680 to I-880)**	Alameda	Intraregional Road Expansion	$22	$5	4	-0.5

all benefits and costs are in millions of 2017 dollars

July 2016

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
20	1403	**Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)**	Multi-County	Local Streets Maintenance	$1,875	$428	4	3.5
21	207	**San Pablo BRT (San Pablo to Oakland)**	Multi-County	BRT	$67	$16	4	7.0
22	210	**I-580 ITS Improvements**	Alameda	ITS	$44	$11	4	1.0
23	504	**Stevens Creek LRT**	Santa Clara	Rail Expansion	$144	$38	4	5.5
24	1001	**BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)**	Multi-County	Rail Efficiency	$430	$123	3	9.0
25	1101	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)**	Multi-County	Rail Efficiency	$195	$56	3	6.5
26	605	**Jepson Parkway (Fairfield to Vacaville)**	Solano	Intraregional Road Expansion	$17	$5	3	1.0
27	1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	Ferry	$16	$5	3	2.5
28	1102	**Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capacity Expansion)**	Multi-County	Rail Efficiency	$236	$77	3	6.5
29	411	**SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)**	Contra Costa	Intraregional Road Expansion	$44	$15	3	2.0
30	507	**Vasona LRT – Phase 2 (Winchester to Vasona Junction)**	Santa Clara	Rail Expansion	$30	$11	3	5.0
31	515	**Tasman West LRT Realignment (Fair Oaks to Mountain View)**	Santa Clara	Rail Expansion	$48	$18	3	5.0
32	517	**Stevens Creek BRT**	Santa Clara	BRT	$29	$11	3	5.5
33	102	**US-101 HOV Lanes (San Francisco + San Mateo Counties)**	Multi-County	Express Lanes	$63	$25	3	2.0
34	503	**SR-152 Tollway (Gilroy to Los Banos)**	Multi-County	Interregional Road Expansion	$95	$37	3	-1.5
35	307	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Transit Center**	Multi-County	Rail Expansion	$290	$113	3	7.0
36	331	**Better Market Street**	San Francisco	BRT	$32	$13	3	4.5
37	1206	**Alameda Point-San Francisco Ferry**	Multi-County	Ferry	$12	$5	2	3.0
38	1204	**Berkeley-San Francisco Ferry**	Multi-County	Ferry	$10	$4	2	5.0

all benefits and costs are in millions of 2017 dollars

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
39	1302	**Express Lane Network (East and North Bay)**	Multi-County	Express Lanes	$214	$91	2	3.0
40	206	**AC Transit Service Frequency Improvements**	Multi-County	Bus Frequency Improvements	$248	$120	2	6.5
41	513	**North Bayshore LRT (NASA/Bayshore to Google)**	Santa Clara	Rail Expansion	$42	$22	2	4.0
42	502	**Express Lane Network (Silicon Valley)**	Santa Clara	Express Lanes	$69	$38	2	3.0
43	604	**Solano County Express Bus Network**	Multi-County	Express Bus Network	$21	$12	2	2.5
44	522	**VTA Service Frequency Improvements (10-Minute Frequencies)**	Santa Clara	Bus Frequency Improvements	$177	$99	2	7.0
45	412	**Antioch-Martinez-Hercules-San Francisco Privately-Operated Ferry**	Multi-County	Ferry	$9	$5	2	1.5
46	403	**I-680 Express Bus Frequency Improvements**	Multi-County	Express Bus Network	$12	$7	2	2.5
47	402	**eBART – Phase 2 (Antioch to Brentwood)**	Contra Costa	Rail Expansion	$21	$12	2	4.0
48	311	**Muni Forward Program**	San Francisco	Bus Frequency Improvements	$60	$36	2	6.5
49	901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Multi-County	Intraregional Road Expansion	$31	$19	2	3.0
50	409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	Intraregional Road Expansion	$42	$27	2	3.0
51	103	**El Camino Real Rapid Bus (Daly City to Palo Alto)**	San Mateo	Bus Frequency Improvements	$54	$36	2	2.0
52	401	**TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)**	Multi-County	Interregional Road Expansion	$75	$51	1	-0.5
53	312	**19th Avenue Subway (West Portal to Parkmerced)**	San Francisco	Rail Efficiency	$39	$27	1	7.5
54	801	**Golden Gate Transit Frequency Improvements**	Multi-County	Express Bus Network	$11	$8	1	4.5
55	313	**Muni Service Frequency Improvements**	San Francisco	Bus Frequency Improvements	$89	$79	1	6.0
56	1413	**Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)**	Multi-County	Local Streets Maintenance	$194	$198	1	3.5
57	516	**VTA Express Bus Frequency Improvements**	Santa Clara	Express Bus Network	$18	$19	0.9	4.5

all benefits and costs are in millions of 2017 dollars

ROW	ID	PROJECT NAME	LOCATION (COUNTY)	PROJECT TYPE	ANNUAL BENEFIT	ANNUAL COST	B/C RATIO	TARGETS SCORE
58	202	**East-West Connector (Fremont to Union City)**	Alameda	Intraregional Road Expansion	$10	$12	0.9	1.5
59	304	**Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Services)**	San Francisco	Express Bus Network	$16	$27	0.6	6.0
60	404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	Interregional Road Expansion	$9	$17	0.5	-0.5
61	510	**Downtown San Jose Subway (Japantown to Convention Center)**	Santa Clara	Rail Efficiency	$10	$18	0.5	6.5
62	104	**Geneva-Harney BRT + Corridor Improvements**	Multi-County	BRT	$15	$46	0.3	5.0
63	508	**SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)**	Multi-County	Interregional Road Expansion	$57	$200	0.3	1.0
64	601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	Intraregional Road Expansion	$5	$18	0.3	2.5
65	519	**Lawrence Freeway**	Santa Clara	Intraregional Road Expansion	$7	$34	0.2	2.0
66	1304	**Bay Bridge West Span Bike Path**	San Francisco	Bike/Ped	$4	$30	0.1	2.0
67	905	**SMART – Phase 3 (Santa Rosa Airport to Cloverdale)**	Sonoma	Rail Expansion	$0	$12	0	4.0
68	1201	**San Francisco-Redwood City + Oakland-Redwood City Ferry**	Multi-County	Ferry	$0	$8	0	2.0
69	205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	Express Bus Network	$0	$10	0	5.0

all benefits and costs are in millions of 2017 dollars

July 2016

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
BENEFITS ASSESSMENT (sorted by B/C ratio)

						TRAVEL TIME + COST SAVINGS		AIR POLLUTION			HEALTH + SAFETY		
Row	**ID**	**PROJECT NAME**	**B/C RATIO**	**ANNUAL COST**	**ANNUAL BENEFIT**	Travel Time + Cost	Vehicle Ownership	GHG	PM	Other	Collisions	Physical Activity	Noise
1	**1503**	**Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)**	**>50**	**($1M)**	**$637.7M**	$726.7M	($0.9M)	($5.7M)	($5.4M)	($0.1M)	($47.3M)	($28.8M)	($0.9M)
2	**1502**	**Highway Pavement Maintenance (Preserve Conditions vs. No Funding)**	**17**	**$144M**	**$2,432.9M**	$2,735.4M	$0.8M	($22.7M)	($18.8M)	($0.5M)	($170.4M)	($87.6M)	($3.1M)
3	**302**	**Treasure Island Congestion Pricing (Toll + Transit Improvements)**	**14**	**$4M**	**$56.2M**	$28.5M	$0.3M	$0.5M	$0.3M	$0.0M	$3.6M	$23.0M	$0.1M
4	**1301**	**Columbus Day Initiative**	**11**	**$38M**	**$420.7M**	$495.5M	$0.0M	($3.8M)	($3.2M)	$0.2M	($61.4M)	($6.0M)	($0.5M)
5	**209**	**SR-84 Widening + I-680/SR-84 Interchange Improvements..**	**9**	**$13M**	**$116.3M**	$107.0M	($0.1M)	($0.4M)	$0.1M	$0.0M	$5.5M	$4.2M	$0.0M
6	**501**	**BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)**	**8**	**$62M**	**$472.0M**	$390.7M	$2.9M	$2.0M	$1.9M	$0.0M	$18.2M	$55.9M	$0.3M
7	**306**	**Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)**	**7**	**$11M**	**$83.9M**	$16.7M	$14.9M	$0.6M	$0.9M	$0.0M	$9.2M	$41.5M	$0.1M
8	**1651**	**Public Transit Maintenance - Rail Operators (Preserve Conditions vs. No Funding)**	**7**	**$198M**	**$1,351.4M**	$1,160.8M	$37.8M	$4.9M	$4.5M	$0.1M	$42.4M	$100.2M	$0.7M
9	**506**	**El Camino Real BRT (Palo Alto to San Jose)**	**7**	**$13M**	**$85.5M**	$50.0M	$9.3M	$0.6M	$0.6M	$0.0M	$7.3M	$17.6M	$0.1M
10	**301**	**Geary BRT**	**6**	**$20M**	**$124.1M**	$73.8M	$13.3M	$0.5M	$0.5M	$0.0M	$5.6M	$30.3M	$0.1M
11	**505**	**Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)**	**6**	**$12M**	**$77.1M**	$31.3M	$2.7M	$0.9M	$0.9M	$0.0M	$8.3M	$32.9M	$0.1M
12	**518**	**ACE Alviso Double-Tracking**	**6**	**$6M**	**$35.7M**	$33.3M	$0.2M	$0.0M	$0.1M	$0.0M	$0.7M	$1.4M	$0.0M
13	**1650**	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	**6**	**$103M**	**$623.0M**	$369.0M	$82.2M	$3.5M	$2.9M	$0.1M	$30.5M	$134.4M	$0.5M
14	**1203**	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	**6**	**$5M**	**$29.2M**	$16.3M	$0.3M	$0.0M	$0.1M	$0.0M	$0.9M	$11.6M	$0.0M
15	**203**	**Irvington BART Infill Station**	**5**	**$6M**	**$29.9M**	$17.6M	$0.7M	$0.0M	$0.0M	$0.0M	$0.6M	$11.1M	$0.0M
16	**101**	**Express Lane Network (US-101 San Mateo/San Francisco)**	**5**	**$10M**	**$48.5M**	$51.2M	($0.7M)	($1.8M)	($0.2M)	$0.0M	$5.9M	($5.9M)	$0.0M

all benefits and costs are in millions of 2017 dollars

July 2016

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
BENEFITS ASSESSMENT (sorted by B/C ratio)

						TRAVEL TIME + COST SAVINGS		AIR POLLUTION			HEALTH + SAFETY		
Row	ID	PROJECT NAME	B/C RATIO	ANNUAL COST	ANNUAL BENEFIT	Travel Time + Cost	Vehicle Ownership	GHG	PM	Other	Collisions	Physical Activity	Noise
17	903	Sonoma County Service Frequency Improvements	5	$15M	$75.1M	$26.8M	$22.5M	$0.7M	$0.5M	$0.0M	$6.0M	$18.6M	$0.1M
18	523	VTA Service Frequency Improvements (15-Minute Frequencies)	4	$23M	$103.2M	$52.9M	$19.3M	$0.5M	$0.4M	$0.0M	$4.7M	$25.2M	$0.1M
19	211	SR-262 Connector (I-680 to I-880)	4	$5M	$22.4M	$10.1M	$0.0M	$0.4M	$0.1M	$0.0M	$6.4M	$5.5M	$0.0M
20	1403	Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)	4	$428M	$1,875.2M	$2,302.2M	($1.1M)	($19.7M)	($16.6M)	($0.1M)	($150.8M)	($235.8M)	($2.8M)
21	207	San Pablo BRT (San Pablo to Oakland)	4	$16M	$67.2M	$59.0M	$12.3M	$0.3M	$0.4M	$0.0M	$5.7M	$27.9M	$0.1M
22	210	I-580 ITS Improvements	4	$11M	$44.2M	$45.3M	$0.0M	$0.0M	($0.1M)	$0.0M	($2.3M)	$1.3M	$0.0M
23	504	Stevens Creek LRT	4	$38M	$144.2M	$67.1M	($2.9M)	$1.0M	$0.9M	$0.0M	$9.7M	$68.2M	$0.2M
24	1001	BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Ex..	3	$123M	$430.3M	$344.9M	$14.6M	$2.1M	$1.8M	$0.0M	$18.0M	$48.5M	$0.3M
25	1101	Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)	3	$56M	$194.7M	$158.2M	$2.8M	$0.8M	$0.8M	$0.0M	$7.9M	$24.1M	$0.1M
26	605	Jepson Parkway (Fairfield to Vacaville)	3	$5M	$17.1M	$4.4M	$0.9M	($0.1M)	$0.0M	$0.0M	$4.8M	$7.0M	$0.0M
27	1202	Oakland-Alameda-San Francisco Ferry Frequency Improvements	3	$5M	$16.1M	$8.1M	$0.6M	$0.0M	$0.0M	$0.0M	$0.1M	$7.4M	$0.0M
28	1102	Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capaci..	3	$77M	$236.3M	$191.4M	$3.6M	$1.2M	$1.1M	$0.0M	$10.8M	$27.9M	$0.2M
29	411	SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)	3	$15M	$44.3M	$39.4M	$0.3M	($0.2M)	($0.3M)	$0.0M	($1.8M)	$7.0M	($0.1M)
30	507	Vasona LRT – Phase 2 (Winchester to Vasona Junction)	3	$11M	$30.3M	$19.1M	$1.2M	$0.3M	$0.1M	$0.0M	$1.6M	$7.9M	$0.0M
31	515	Tasman West LRT Realignment (Fair Oaks to Mountain View)	3	$18M	$47.9M	$16.4M	$5.7M	$0.3M	$0.3M	$0.0M	$2.4M	$22.7M	$0.0M
32	517	Stevens Creek BRT	3	$11M	$29.1M	$11.8M	$1.5M	$0.3M	$0.3M	$0.0M	$3.7M	$11.4M	$0.1M

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July 2016

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
BENEFITS ASSESSMENT (sorted by B/C ratio)

Row	ID	PROJECT NAME	B/C RATIO	ANNUAL COST	ANNUAL BENEFIT	TRAVEL TIME + COST SAVINGS		AIR POLLUTION			HEALTH + SAFETY		
						Travel Time + Cost	Vehicle Ownership	GHG	PM	Other	Collisions	Physical Activity	Noise
33	102	US-101 HOV Lanes (San Francisco + San Mateo Counties)	3	$25M	$63.4M	$55.8M	$0.2M	($1.1M)	$0.1M	$0.0M	$4.6M	$3.7M	$0.0M
34	503	SR-152 Tollway (Gilroy to Los Banos)	3	$37M	$94.8M	$70.8M	$0.3M	$1.4M	$0.1M	$0.0M	$21.1M	$1.2M	$0.0M
35	307	Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Tr..	3	$113M	$289.8M	$243.1M	$3.2M	$1.1M	$1.1M	$0.0M	$10.9M	$30.2M	$0.2M
36	331	Better Market Street	3	$13M	$32.4M	$21.7M	$5.8M	$0.4M	$0.2M	$0.0M	$1.6M	$2.7M	$0.0M
37	1206	Alameda Point-San Francisco Ferry	2	$5M	$11.7M	$5.6M	$0.3M	($0.1M)	$0.0M	$0.0M	($0.3M)	$6.3M	$0.0M
38	1204	Berkeley-San Francisco Ferry	2	$4M	$10.0M	$2.9M	$0.5M	($0.1M)	$0.0M	$0.0M	$0.3M	$6.5M	$0.0M
39	1302	Express Lane Network (East and North Bay)	2	$91M	$213.9M	$276.8M	($2.1M)	($10.5M)	($5.5M)	($0.1M)	($32.1M)	($11.7M)	($0.9M)
40	206	AC Transit Service Frequency Improvements	2	$120M	$247.6M	$149.0M	$40.2M	$1.4M	$1.2M	$0.0M	$12.6M	$43.0M	$0.2M
41	513	North Bayshore LRT (NASA/Bayshore to Google)	2	$22M	$41.9M	$24.5M	$3.8M	$0.2M	$0.3M	$0.0M	$2.0M	$11.0M	$0.0M
42	502	Express Lane Network (Silicon Valley)	2	$38M	$69.1M	$104.4M	($1.0M)	($7.1M)	($5.7M)	$0.0M	($25.2M)	($21.9M)	($1.0M)
43	604	Solano County Express Bus Network	2	$12M	$21.2M	$11.9M	$1.5M	$0.3M	$0.2M	$0.0M	$1.8M	$5.4M	$0.0M
44	522	VTA Service Frequency Improvements (10-Minute Frequencies)	2	$99M	$176.7M	$85.6M	$37.2M	$0.9M	$0.9M	$0.0M	$9.6M	$42.2M	$0.2M
45	412	Antioch-Martinez-Hercules-San Francisco Privately-Operated Ferry	2	$5M	$9.0M	$7.4M	$0.3M	$0.1M	$0.1M	$0.0M	$1.0M	$0.1M	$0.0M
46	403	I-680 Express Bus Frequency Improvements	2	$7M	$11.5M	$7.7M	$1.0M	$0.2M	$0.1M	$0.0M	$1.2M	$1.2M	$0.0M
47	402	eBART – Phase 2 (Antioch to Brentwood)	2	$12M	$20.6M	$18.4M	$0.0M	$0.2M	$0.1M	$0.0M	$1.2M	$0.7M	$0.0M
48	311	Muni Forward Program	2	$36M	$60.4M	$44.9M	$15.1M	$0.7M	$0.5M	$0.0M	$5.6M	($6.6M)	$0.1M

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Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
BENEFITS ASSESSMENT (sorted by B/C ratio)

Row	ID	PROJECT NAME	B/C RATIO	ANNUAL COST	ANNUAL BENEFIT	TRAVEL TIME + COST SAVINGS: Travel Time + Cost	TRAVEL TIME + COST SAVINGS: Vehicle Ownership	AIR POLLUTION: GHG	AIR POLLUTION: PM	AIR POLLUTION: Other	HEALTH + SAFETY: Collisions	HEALTH + SAFETY: Physical Activity	HEALTH + SAFETY: Noise
49	901	US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2	2	$19M	$30.6M	$24.7M	$0.0M	($0.1M)	$0.1M	$0.0M	$2.1M	$3.7M	$0.0M
50	409	I-680/SR-4 Interchange Improvements + HOV Direct Connector	2	$27M	$41.8M	$40.8M	$0.2M	($0.4M)	($0.1M)	$0.0M	($0.6M)	$1.9M	$0.0M
51	103	El Camino Real Rapid Bus (Daly City to Palo Alto)	2	$36M	$53.7M	$26.9M	$4.3M	$0.2M	$0.2M	$0.0M	$2.7M	$19.3M	$0.0M
52	401	TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)	1	$51M	$75.1M	$66.6M	$0.4M	$0.4M	$0.3M	$0.0M	$4.9M	$2.4M	$0.0M
53	312	19th Avenue Subway (West Portal to Parkmerced)	1	$27M	$38.7M	$21.2M	$2.1M	$0.2M	$0.1M	$0.0M	$1.4M	$5.5M	$0.0M
54	801	Golden Gate Transit Frequency Improvements	1	$8M	$10.9M	$9.4M	($0.2M)	($0.1M)	$0.0M	$0.0M	($0.3M)	$2.0M	$0.0M
55	313	Muni Service Frequency Improvements	1	$79M	$89.4M	$68.0M	$25.5M	$0.6M	$0.5M	$0.0M	$5.5M	($10.8M)	$0.1M
56	1413	Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)	1	$198M	$193.6M	$311.8M	$0.3M	($3.8M)	($4.1M)	($0.1M)	($43.4M)	($66.5M)	($0.7M)
57	516	VTA Express Bus Frequency Improvements	0.9	$19M	$17.6M	$7.5M	$1.4M	$0.0M	$0.0M	$0.0M	$0.4M	$8.3M	$0.0M
58	202	East-West Connector (Fremont to Union City)	0.9	$12M	$10.3M	$4.1M	$0.9M	$0.2M	$0.1M	$0.0M	$1.6M	$3.3M	$0.0M
59	304	Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Ser..	0.6	$27M	$16.4M	$17.3M	$4.6M	$0.2M	$0.1M	$0.0M	$1.1M	($7.0M)	$0.0M
60	404	SR-4 Widening (Antioch to Discovery Bay)	0.5	$17M	$9.1M	$8.7M	$0.6M	$0.2M	$0.1M	$0.0M	$1.9M	($2.3M)	$0.0M
61	510	Downtown San Jose Subway (Japantown to Convention Center)	0.5	$18M	$9.7M	$8.1M	$0.5M	$0.1M	$0.2M	$0.0M	$1.4M	($0.6M)	$0.0M
62	104	Geneva-Harney BRT + Corridor Improvements	0.3	$46M	$14.8M	$6.5M	$2.0M	$0.2M	$0.1M	$0.0M	$2.8M	$3.2M	$0.0M
63	508	SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)	0.3	$200M	$57.3M	$68.1M	$0.8M	$0.3M	$0.6M	$0.0M	($20.8M)	$8.2M	$0.1M
64	601	I-80/I-680/SR-12 Interchange Improvements	0.3	$18M	$5.1M	$13.0M	($0.5M)	($0.5M)	($0.1M)	$0.0M	($1.3M)	($5.5M)	$0.0M

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July 2016

						TRAVEL TIME + COST SAVINGS		AIR POLLUTION			HEALTH + SAFETY		
Row	**ID**	**PROJECT NAME**	**B/C RATIO**	**ANNUAL COST**	**ANNUAL BENEFIT**	Travel Time + Cost	Vehicle Ownership	GHG	PM	Other	Collisions	Physical Activity	Noise
65	**519**	**Lawrence Freeway**	**0.2**	**$34M**	**$7.3M**	$8.9M	$0.2M	($0.6M)	($0.3M)	$0.0M	($6.6M)	$5.8M	($0.1M)
66	**1304**	**Bay Bridge West Span Bike Path**	**0.1**	**$30M**	**$4.3M**	($1.3M)	$0.3M	($0.1M)	($0.1M)	$0.0M	($1.2M)	$6.6M	$0.0M
67	**905**	**SMART – Phase 3 (Santa Rosa Airport to Cloverdale)**	**0**	**$12M**	**$0.0M**	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M
68	**1201**	**San Francisco-Redwood City + Oakland-Redwood City Ferry**	**0**	**$8M**	**$0.0M**	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M
69	**205_15**	**Express Bus Bay Bridge Contraflow Lane**	**0**	**$10M**	**$0.0M**	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M	$0.0M

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July 2016

Plan BayArea 2040

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
TARGETS ASSESSMENT (sorted by target score)

Row	ID	PROJECT NAME	Total Targets Score	Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Equitable Access			Economic Vitality			Transportation System Effectiveness		
				1 Climate Protection	2 Adequate Housing	3 Healthy + Safe Communities	4 Open Space + Agricultural Preservation	5 Housing + Transportation Costs	6 Affordable Housing	7 Displacement Risk	8 Access to Jobs	9 Jobs Creation	10 Goods Movement	11 Non-Auto Mode Share	12 Road Maintenance	13 Transit Maintenance
1	1651	**Public Transit Maintenance - Rail Operators (Preserve Conditions vs. No Funding)**	9.5	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT
2	1001	**BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)**	9	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT
3	501	**BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)**	8	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
4	1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	8	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT
5	312	**19th Avenue Subway (West Portal to Parkmerced)**	7.5	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT
6	306	**Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)**	7	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
7	301	**Geary BRT**	7	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
8	207	**San Pablo BRT (San Pablo to Oakland)**	7	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
9	307	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Transit Center**	7	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT
10	522	**VTA Service Frequency Improvements (10-Minute Frequencies)**	7	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
11	506	**El Camino Real BRT (Palo Alto to San Jose)**	6.5	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
12	1101	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)**	6.5	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT
13	1102	**Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capacity Expansion)**	6.5	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT
14	206	**AC Transit Service Frequency Improvements**	6.5	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
15	311	**Muni Forward Program**	6.5	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
16	510	**Downtown San Jose Subway (Japantown to Convention Center)**	6.5	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT

July 2016

Plan Bay Area 2040

PROJECT PERFORMANCE ASSESSMENT

TARGETS ASSESSMENT (sorted by target score)

Row	ID	PROJECT NAME	Total Targets Score	Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Equitable Access			Economic Vitality			Transportation System Effectiveness		
				1	2	3	4	5	6	7	8	9	10	11	12	13
				Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Housing + Transportation Costs	Affordable Housing	Displacement Risk	Access to Jobs	Jobs Creation	Goods Movement	Non-Auto Mode Share	Road Maintenance	Transit Maintenance
17	313	Muni Service Frequency Improvements	6	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
18	304	Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Services)	6	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
19	505	Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)	5.5	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
20	504	Stevens Creek LRT	5.5	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
21	517	Stevens Creek BRT	5.5	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
22	903	Sonoma County Service Frequency Improvements	5	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
23	523	VTA Service Frequency Improvements (15-Minute Frequencies)	5	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
24	507	Vasona LRT – Phase 2 (Winchester to Vasona Junction)	5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
25	515	Tasman West LRT Realignment (Fair Oaks to Mountain View)	5	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
26	1204	Berkeley-San Francisco Ferry	5	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
27	104	Geneva-Harney BRT + Corridor Improvements	5	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
28	205_15	Express Bus Bay Bridge Contraflow Lane	5	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
29	302	Treasure Island Congestion Pricing (Toll + Transit Improvements)	4.5	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
30	1203	Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements	4.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
31	331	Better Market Street	4.5	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT
32	801	Golden Gate Transit Frequency Improvements	4.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT

July 2016

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
TARGETS ASSESSMENT (sorted by target score)

Row	ID	PROJECT NAME	Total Targets Score	Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Equitable Access			Economic Vitality			Transportation System Effectiveness		
				1 Climate Protection	2 Adequate Housing	3 Healthy + Safe Communities	4 Open Space + Agricultural Preservation	5 Housing + Transportation Costs	6 Affordable Housing	7 Displacement Risk	8 Access to Jobs	9 Jobs Creation	10 Goods Movement	11 Non-Auto Mode Share	12 Road Maintenance	13 Transit Maintenance
33	516	**VTA Express Bus Frequency Improvements**	4.5	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
34	1301	**Columbus Day Initiative**	4	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
35	513	**North Bayshore LRT (NASA/Bayshore to Google)**	4	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
36	402	**eBART – Phase 2 (Antioch to Brentwood)**	4	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT
37	905	**SMART – Phase 3 (Santa Rosa Airport to Cloverdale)**	4	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT
38	203	**Irvington BART Infill Station**	3.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
39	1403	**Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)**	3.5	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT
40	1413	**Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)**	3.5	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT
41	1206	**Alameda Point-San Francisco Ferry**	3	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
42	1302	**Express Lane Network (East and North Bay)**	3	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
43	502	**Express Lane Network (Silicon Valley)**	3	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
44	901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	3	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT
45	409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	3	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT
46	1503	**Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)**	2.5	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT
47	1502	**Highway Pavement Maintenance (Preserve Conditions vs. No Funding)**	2.5	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT
48	1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	2.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT

July 2016

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
TARGETS ASSESSMENT (sorted by target score)

Row	ID	PROJECT NAME	Total Targets Score	Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Equitable Access			Economic Vitality			Transportation System Effectiveness		
				1 Climate Protection	2 Adequate Housing	3 Healthy + Safe Communities	4 Open Space + Agricultural Preservation	5 Housing + Transportation Costs	6 Affordable Housing	7 Displacement Risk	8 Access to Jobs	9 Jobs Creation	10 Goods Movement	11 Non-Auto Mode Share	12 Road Maintenance	13 Transit Maintenance
49	604	**Solano County Express Bus Network**	2.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
50	403	**I-680 Express Bus Frequency Improvements**	2.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
51	601	**I-80/I-680/SR-12 Interchange Improvements**	2.5	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
52	411	**SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)**	2	MODERATE ADVERSE	STRONG SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
53	102	**US-101 HOV Lanes (San Francisco + San Mateo Counties)**	2	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT
54	103	**El Camino Real Rapid Bus (Daly City to Palo Alto)**	2	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
55	519	**Lawrence Freeway**	2	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT
56	1304	**Bay Bridge West Span Bike Path**	2	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
57	1201	**San Francisco-Redwood City + Oakland-Redwood City Ferry**	2	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT
58	518	**ACE Alviso Double-Tracking**	1.5	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT
59	412	**Antioch-Martinez-Hercules-San Francisco Privately-Operated Ferry**	1.5	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT
60	202	**East-West Connector (Fremont to Union City)**	1.5	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT
61	209	**SR-84 Widening + I-680/SR-84 Interchange Improvements (Livermore to I-680)**	1	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
62	210	**I-580 ITS Improvements**	1	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT
63	605	**Jepson Parkway (Fairfield to Vacaville)**	1	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT
64	508	**SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)**	1	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG ADVERSE	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT

July 2016

Plan Bay Area 2040
PROJECT PERFORMANCE ASSESSMENT
TARGETS ASSESSMENT (sorted by target score)

				Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Equitable Access			Economic Vitality			Transportation System Effectiveness		
				1	2	3	4	5	6	7	8	9	10	11	12	13
Row	ID	PROJECT NAME	Total Targets Score	Climate Protection	Adequate Housing	Healthy + Safe Communities	Open Space + Agricultural Preservation	Housing + Transportation Costs	Affordable Housing	Displacement Risk	Access to Jobs	Jobs Creation	Goods Movement	Non-Auto Mode Share	Road Maintenance	Transit Maintenance
65	**101**	**Express Lane Network (US-101 San Mateo/San Francisco)**	**0.5**	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
66	**211**	**SR-262 Connector (I-680 to I-880)**	**-0.5**	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
67	**401**	**TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)**	**-0.5**	STRONG ADVERSE	MODERATE SUPPORT	MODERATE ADVERSE	STRONG ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
68	**404**	**SR-4 Widening (Antioch to Discovery Bay)**	**-0.5**	MODERATE ADVERSE	MODERATE SUPPORT	STRONG ADVERSE	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT
69	**503**	**SR-152 Tollway (Gilroy to Los Banos)**	**-1.5**	STRONG ADVERSE	MODERATE SUPPORT	MODERATE ADVERSE	STRONG ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	MINIMAL IMPACT

July 2016

Confidence Assessment of Benefit-Cost Results (listed by ID)

ID	Project Name	CONFIDENCE ASSESSMENT CRITERIA *if marked in yellow, see comments to the right* Travel Model Accuracy	Framework Completeness	Timeframe Inclusiveness	Comments
101	**Express Lane Network (US-101 San Mateo/San Francisco)**				The travel model has difficulty representing the benefits of an operational strategy that relies on real-time price changes throughout the morning and evening commute periods.
102	**US-101 HOV Lanes (San Francisco + San Mateo Counties)**				-
103	**El Camino Real Rapid Bus (Daly City to Palo Alto)**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
104	**Geneva-Harney BRT + Corridor Improvements**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
202	**East-West Connector (Fremont to Union City)**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
203	**Irvington BART Infill Station**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model. Infill stations can be implemented quickly for near-term benefits.
206	**AC Transit Service Frequency Improvements**				Bus frequency projects can be implemented quickly for near-term benefits.
207	**San Pablo BRT (San Pablo to Oakland)**				-
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements (Livermore to I-680)**				-
210	**I-580 ITS Improvements**				-
211	**SR-262 Connector (I-680 to I-880)**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
301	**Geary BRT**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. This project can be implemented quickly to achieve benefits in the near-term.
302	**Treasure Island Congestion Pricing (Toll + Transit Improvements)**				-
304	**Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Services)**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
306	**Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)**				-
307	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Transit Center**				Framework does not capture the benefits to residents outside of the Bay Area who would now have improved access to San Francisco. B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. The air quality benefits of converting diesel vehicles to electric vehicles is not included in this assessment.

Confidence Assessment of Benefit-Cost Results (listed by ID)

ID	Project Name	CONFIDENCE ASSESSMENT CRITERIA *if marked in yellow, see comments to the right*			Comments
		Travel Model Accuracy	**Framework Completeness**	**Timeframe Inclusiveness**	
311	**Muni Forward Program**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. This project can be implemented quickly to achieve benefits in the near-term.
312	**19th Avenue Subway (West Portal to Parkmerced)**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. The modeling assumes that the land use is the same with and without the project, potentially under-estimating the change in transit benefits between the baseline and the build scenarios.
313	**Muni Service Frequency Improvements**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. This project can be implemented quickly to achieve benefits in the near-term.
331	**Better Market Street**				B/C framework does not estimate benefits of streetscape elements of the project (including safety and economic development). This project can be implemented quickly to achieve benefits in the near-term.
401	**TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)**				Because the land uses outside of the 9-county Bay Area are not explicitly represented, the model does not fully understand the likely impact of projects located near the boundaries of the planning region. The modeling assumes that land use is the same with and without the project, potentially over-estimating the travel time savings of this project.
402	**eBART – Phase 2 (Antioch to Brentwood)**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
403	**I-680 Express Bus Frequency Improvements**				Bus frequency projects can be implemented quickly for near-term benefits.
404	**SR-4 Widening (Antioch to Discovery Bay)**				-
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**				The model does not explicitly represent weaving (thus ignoring the benefits of longer weaving sections), acceleration or deceleration behavior, or queue spillback. The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
410	**Antioch-Martinez-Hercules-San Francisco Ferry**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
411	**SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)**				The model does not explicitly represent weaving (thus ignoring the benefits of longer weaving sections), acceleration or deceleration behavior, or queue spillback.
501	**BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
502	**Express Lane Network (Silicon Valley)**				The travel model has difficulty representing the benefits of an operational strategy that relies on real-time price changes throughout the morning and evening commute periods. Some portions of the project may be implemented early and accrue benefits over a long period in the Plan, the Network likely will not be complete until near the end of the Plan period.

Confidence Assessment of Benefit-Cost Results (listed by ID)

ID	Project Name	CONFIDENCE ASSESSMENT CRITERIA *if marked in yellow, see comments to the right*			Comments
		Travel Model Accuracy	Framework Completeness	Timeframe Inclusiveness	
503	**SR-152 Tollway (Gilroy to Los Banos)**				The model poorly estimates freight travel behavior so may be underestimating the freight benefits of this project, both in terms of the number of truck trips and the impacts of steep grades on trucks. The modeling assumes that land use is the same with and without the project, potentially over-estimating the travel time savings of this project.
504	**Stevens Creek LRT**				-
505	**Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)**				-
506	**El Camino Real BRT (Palo Alto to San Jose)**				-
507	**Vasona LRT – Phase 2 (Winchester to Vasona Junction)**				-
508	**SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)**				The model does not estimate inter-regional transit trips so may be underestimating the transit benefits for this project. B/C methodology includes a broad treatment of safety benefits so may underestimate projects with the primary purpose of safety improvement. The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
510	**Downtown San Jose Subway (Japantown to Convention Center)**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
513	**North Bayshore LRT (NASA/Bayshore to Google)**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
515	**Tasman West LRT Realignment (Fair Oaks to Mountain View)**				The project is likely to be complete toward the end of the Plan, reducing the total benefits potentially accrued during the Plan period.
516	**VTA Express Bus Frequency Improvements**				Bus frequency projects can be implemented quickly for near-term benefits.
517	**Stevens Creek BRT**				-
518	**ACE Alviso Double-Tracking**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
519	**Lawrence Freeway**				-
522	**VTA Service Frequency Improvements (10-Minute Frequencies)**				Bus frequency projects can be implemented quickly for near-term benefits.
523	**VTA Service Frequency Improvements (15-Minute Frequencies)**				Bus frequency projects can be implemented quickly for near-term benefits.
601	**I-80/I-680/SR-12 Interchange Improvements**				The model does not explicitly represent weaving (thus ignoring the benefits of longer weaving sections), acceleration or deceleration behavior, or queue spillback. Freight benefits are also not explicitly included.
604	**Solano County Express Bus Network**				Bus frequency projects can be implemented quickly for near-term benefits.
605	**Jepson Parkway (Fairfield to Vacaville)**				-

Confidence Assessment of Benefit-Cost Results (listed by ID)

ID	Project Name	CONFIDENCE ASSESSMENT CRITERIA *if marked in yellow, see comments to the right*			Comments
		Travel Model Accuracy	Framework Completeness	Timeframe Inclusiveness	
801	**Golden Gate Transit Frequency Improvements**				Bus frequency projects can be implemented quickly for near-term benefits.
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**				-
903	**Sonoma County Service Frequency Improvements**				Bus frequency projects can be implemented quickly for near-term benefits.
905	**SMART – Phase 3 (Santa Rosa Airport to Cloverdale)**				Analysis is performed for a typical weekday, but many of the project's benefits will be accrued on weekends due to recreational use and tourism.
1001	**BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions.
1101	**Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. The air quality benefits of converting diesel vehicles to electric vehicles is not included in this assessment.
1102	**Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capacity Expansion)**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. The air quality benefits of converting diesel vehicles to electric vehicles is not included in this assessment.
1201	**San Francisco-Redwood City + Oakland-Redwood City Ferry**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model. Ferry frequency improvements can be implemented quickly for near-term benefits.
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model. Ferry frequency improvements can be implemented quickly for near-term benefits.
1204	**Berkeley-San Francisco Ferry**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
1206	**Alameda Point-San Francisco Ferry**				Due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model.
1301	**Columbus Day Initiative**				The model is likely overestimating the benefits of arterial signal coordination in dense, urban environments. The model is likely underestimating the safety benefits of advanced queue-warning and connected vehicles.
1302	**Express Lane Network (East and North Bay)**				The travel model has difficulty representing the benefits of an operational strategy that relies on real-time price changes throughout the morning and evening commute periods. Some portions of the project may be implemented early and accrue benefits over a long period in the Plan, the Network likely will not be complete until near the end of the Plan period.
1304	**Bay Bridge West Span Bike Path**				Analysis is performed for a typical weekday, but many of the project's benefits will be accrued on weekends due to recreational use and tourism.

Confidence Assessment of Benefit-Cost Results (listed by ID)

ID	Project Name	CONFIDENCE ASSESSMENT CRITERIA *if marked in yellow, see comments to the right* Travel Model Accuracy	Framework Completeness	Timeframe Inclusiveness	Comments
1403	**Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)**				While time and cost benefits are captured in the B-C framework, potential safety benefits (particularly for non-motorized users) are not included. Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
1407	**#N/A**				While time and cost benefits are captured in the B-C framework, potential safety benefits (particularly for non-motorized users) are not included. Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
1413	**Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)**				While time and cost benefits are captured in the B-C framework, potential safety benefits (particularly for non-motorized users) are not included. Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
1502	**Highway Pavement Maintenance (Preserve Conditions vs. No Funding)**				Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
1503	**Highway Pavement Maintenance (Ideal Conditions vs. Preserve Conditions)**				Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. Similar to crowding, the model does not reflect the increased comfort or perceived modernity of a new transit vehicle, for example. Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
1651	**Public Transit Maintenance - Rail Operators (Preserve Conditions vs. No Funding)**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions. Similar to crowding, the model does not reflect the increased comfort or perceived modernity of a new transit vehicle, for example. Because the analysis was conducted for year 2040, benefits are overestimated compared to interim years; however, benefits may continue to accrue past the Plan horizon year as well.
205_15	**Express Bus Bay Bridge Contraflow Lane**				B/C framework doesn't consider the value of relieving crowded transit vehicles and may be underestimating benefits of projects in areas with crowded conditions.

Transportation leadership you can trust.

Memorandum

TO: Kristen Carnarius and Dave Vautin, MTC

FROM: Tim Grose, Krista Jeannotte, and Casey Osborn

RE: Plan Bay Area 2040 Project Performance Support – Task 4.1 Benefit Valuation Sensitivity Test Methodology and Results

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Introduction

This memorandum and accompanying spreadsheet represent the Plan Bay Area 2040 Project Performance Support final deliverable for Task 4.1. It contains three types of sensitivity tests on the benefit-cost assessment: one on a project's cost, one on the valuation of travel time used to estimate a project's benefits, and one on reduced valuation of life. The first two components are key drivers for a project's ultimate performance in the context of the Project Performance Assessment and the third assesses the estimated impact of the adjustments made to life valuation for Plan Bay Area 2040. The values used for this assessment reflect project performance results as presented to the MTC Planning Committee on May 13, 2016.

Sensitivity Test #1 – Cost Uncertainty

Financially constrained long-term planning requires that large transportation project sponsors submit costs estimates, but these estimates are subject to uncertainty. The proposed sensitivity test approach is based on extensive research done by Bent Flyvbjerg regarding "optimism bias" in project cost. Flyvbjerg found that the projects with the highest degree of optimism bias are capital-intensive rail projects and that these are the projects most likely to experience cost overrun. Flyvbjerg's recommended cost increases were applied by project type and evaluated the extent to which cost uncertainty would affect project rankings.

Sensitivity Test #2 – Reduced Valuation of Travel Time

In benefit-cost assessments for transportation projects, the largest benefit is typically travel time and cost savings. For this test, the valuation of travel time and cost savings were reduced by 50% to assess which projects have higher "societal benefits" (e.g. safety and health) relative to user benefits.

Sensitivity Test #3 – Reduced Valuation of Life

One of the changes for Plan Bay Area is the value of statistical life has doubled from $4.8 million (in $2013) to $10 million (in $2017). The value is also applied to a new mortality benefit corresponding to changes in walking and biking. This change has increased the relative weight of health and safety impacts of transportation projects. This sensitivity test reduces the valuation

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of life by half to return the weighting of health and safety to the same approximate weight as in the Plan Bay Area assessment.

Sensitivity Test Methodology

For the cost sensitivity tests, cost increases factors from Flyvbjerg's research were applied to the Plan Bay Area project cost estimates. Table 1 presents Flyvbjerg's recommended cost increases factors for different project types. Cost increase factors are provided for both the 50^{th} percentile (i.e., projects that experience the median percentage increase from estimated cost to actual cost) and 80^{th} percentile projects. Both values were used in the tests, with 50^{th} percentile corresponding with typical cost increases and 80^{th} percentile corresponding with particularly high cost increases. For cost increase factors in Table 1 with ranges (Building projects, IT projects, Standard civil engineering, and Non-standard civil engineering), 50^{th} and 80^{th} percentile values were calculated based on their ranges. For example, the Standard civil engineering cost increase factors were 20% in the 50^{th} percentile and 32% in the 80^{th} percentile.

There are not specific cost increase factors for express lanes projects, buses or ferries. Instead, the Roads cost increase factors were applied to express lanes and buses, and the Standard civil engineering cost increase factors were applied to ferry projects. Fixed links increase factors were applied to road bridges and road tunnels. Cost increase factors were not applied to state of good repair projects. Appendix A includes a brief literature review of cost uncertainty, noting different sources of overrun, and more information on Flyvbjerg's research.

Table 1. Flyvbjerg's Recommended Cost Increase Factors for Capital Expenditures[1]

Category	Types of Projects	Applicable Cost Increase Factor	
		50% Percentile	80% Percentile
Roads	Motorway Trunk roads Local roads Bicycle facilities Pedestrian facilities Park and ride Bus lane schemes Guided bus on wheels	15%	32%
Rail	Metro Light rail Guided buses on tracks Conventional rail High speed rail	40%	57%
Fixed links	Bridges Tunnels	23%	55%
Building projects	Stations Terminal buildings	4-51%	
IT projects	IT system development	10-200%	
Standard civil engineering	Included for reference purposes only	3-44%	
Non-standard civil engineering	Included for reference purposes only	6-66%	

Given the challenges of gathering comprehensive information on individual project risk factors, *general* risk factors were applied to the projects. Using a blend of general risk factors to calculate cost can mitigate the shortcomings of any single risk factor.

Four risk factors correspond with Flyvbjerg's optimism bias sensitivity adjustments. The specific operations for each risk factor are:

1. Flyvbjerg's 50th Percentile Cost Increase Factors to Capital Costs: Projects were categorized using the Flyvbjerg classes listed in Table 1. Most projects were tagged as road or rail projects, though some fell into the fixed link (i.e., roads and bridges), building, or standard civil engineering project categories. Then, the applicable 50th percentile optimism bias uplift (the percentages shown in Table 1) were added the original project capital cost estimates. For categories with ranges in Table 1, the median value of the range was used.

[1] "Procedures for Dealing with Optimism Bias" The British Department of Transport. 10 June 2004. Report no. 58924, Issue 1, Flyvbjerg – 10 Jun 2004.

2. Flyvbjerg's 80th Percentile Cost Increase Factors to Capital Costs: This operation was similar to the 50th percentile calculation but escalated project capital costs using the 80th percentile increase factors in Table 1. For categories with increase ranges, the 80th percentile value of the range was used. The 80th percentile test produces a higher and thus more conservative cost estimate.

3. Flyvbjerg's 50th Percentile Cost Increase Factors to All Costs: This test used the same method as test #1 but applied the 50th percentile cost increase factors to all costs rather than only capital costs to account for underestimated operations and maintenance costs.

4. Flyvbjerg's 80th Percentile Cost Increase Factors to All Costs: This test used the same method as test #2 but applied the 80th percentile cost increase factors to all costs rather than only capital costs to account for underestimated operations and maintenance costs.

In addition, the sensitivity test spreadsheet includes additional tests involving project benefits.

- Travel Time Sensitivity Test: This test reduces select travel time and cost benefit categories for all projects by 50%. These categories include travel and cost savings for residents, travelers passing through the region, truck drivers, and non-recurring freeway delay. The test examines how projects perform when travel time savings has a lower value compared to other benefits.

- Life Valuation Sensitivity Test: This test reduces the benefit categories that use the valuation of life by 50%. These categories include fatalities due to collisions and mortality rates due to physical activity. The test examines how projects perform when the value of statistical life is adjusted to align with the previous Plan Bay Area assumptions.

- General Benefit Sensitivity Test: This test allows MTC to adjust the relative weights of each benefit category using the sensitivity test spreadsheet.

Unit cost sensitivity tests were also considered. These tests compare each project's unit costs to average costs across similar project types. A unit cost sensitivity analysis relies heavily on the nature and number of projects included within each category and the available information on the proposed projects. Ideally, unit cost categories are both narrowly defined (i.e., contain very similar projects) and have a large number of projects. Furthermore, having rich attribute information about each historic and proposed project would make it easier to categorize projects more narrowly and isolate variables contributing to cost factors other than the overall project category.

Given the limited amount of attribute information for the proposed projects, the broad project categories with high cost ranges, and relatively small sample sizes that restricted the categorization process, applying these unit cost sensitivity tests did not yield useful results at the individual project level.

Results

This section presents key results of the sensitivity tests. It reviews trends for the different groups of sensitivity tests and shows the projects most affected by each test, measured by percent change in benefit/cost ratio (see Tables 2 through 5). Appendix B shows full results for each test.

Flyvbjerg Cost Increase Factors

Tables 3 and 4 show the shift in results from the sensitivity tests applying Flyvbjerg cost increase factors to the major Plan Bay Area 2040 projects for the 50th and 80th percentile capital cost increases. The rows shows projects by original rank. The columns with blue headings indicate original annualized benefits and costs. The columns with purple headings relate to the tests; they show adjusted annualized cost with the test, original and adjusted benefit/cost ratios (B/C ratios), percent change in B/C ratios, and original and adjusted rank. These and subsequent key results tables are filtered to include the projects experiencing the highest percent changes in B/C ratios. The Flyvbjerg increase factors are substantially higher for rail than for other projects. The next highest multipliers used were, in descending order, building projects, fixed links (i.e., bridges and tunnels), standard civil engineering projects, and roads. The Flyvberg cost increase factors were not applied to state of good repair projects.

The 50th and 80th percentile results affect the same projects proportionally and differ only in magnitude, with the latter increasing costs more. Since the Flyvbjerg cost increase factors are higher for rail than for roadway, rail projects are most affected by these tests. Because these two tests are applied only to capital costs, capital cost intensive projects experience greater cost increases. The Tasman West LRT Realignment and 19th Avenue Subway projects undergo the largest B/C ratio declines, with several rail capital projects close behind. For the 80th percentile capital cost tests, the B/C ratios for the 19th Avenue Subway dropped below 1. In the 50th percentile test, BART to Silicon Valley fell from 6th to 10th, and the Public Transit Maintenance – Bus Operators project rose into the top 10 (from 13th to 8th). In the 80th percentile capital cost test, El Camino Real BRT and Geary BRT fell out of the top 10 projects (from 9th and 10th to 11th and 12th, respectively), and Public Transit Maintenance – Bus Operators and Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements rose into the top 10 (from 13th and 14th to 7th and 10th, respectively).

The Flyvberg 50th and 80th percentile cost increase factors were also applied to all costs rather than only capital costs. Rail projects are again affected most heavily. Since these tests do not distinguish between capital and operating and maintenance costs, cost escalations are uniform across each Flyvbjerg category (hence the same B/C ratio percent changes in tables B-3 and B-4). For the 80th percentile all cost tests, the B/C ratio for the 19th Avenue Subway dropped below 1. For both tests, BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara) fell out of the top 10 projects (6th to 11th and 6th to 10th, respectively), and Public Transit Maintenance – Bus Operators rose into the top 10 (13th to 8th and 13th to 7th, respectively).

Overall, the literature and subsequent Flyvbjerg test results indicate that substantial cost escalation can be anticipated for many capital projects, particularly rail projects. However, limited quantitative information about the evaluated projects and historic projects in the literature, plus limited resources for this particular effort, make it difficult to informatively estimate more specific risk factors. These and future sensitivity tests could be improved with a wider and deeper research scope. Topics for investigation include (1) specific risk factors and associated quantities; (2) past projects, including cost escalation over project lifecycle, more refined unit costs, and richer attribute information to be investigated and analyzed for cost implications; and (3) more information on proposed projects, such as project phase, cost broken out into more detailed components, and project cost histories.

Table 2. Key Results: Flyvbjerg 50th Percentile Cost Increase Factors to Capital Costs

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$82	**8**	**6**	**-24%**	**6**	**10**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$16	**6**	**5**	**-24%**	**11**	**13**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$8	**6**	**5**	**-26%**	**12**	**15**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$166	**3**	**3**	**-25%**	**24**	**27**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$77	**3**	**3**	**-27%**	**25**	**29**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$14	**3**	**2**	**-24%**	**30**	**36**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$24	**3**	**2**	**-28%**	**31**	**38**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$152	**3**	**2**	**-25%**	**35**	**40**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$28	**2**	**1**	**-21%**	**41**	**44**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$16	**2**	**1**	**-26%**	**45**	**51**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$38	**1**	**1**	**-29%**	**51**	**53**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$23	**0.5**	**0.4**	**-21%**	**61**	**61**

Table 3. Key Results: Flyvbjerg 80th Percentile Cost Increase Factors to Capital Costs

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$90	**8**	**5**	**-31%**	**6**	**9**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$18	**6**	**4**	**-31%**	**11**	**15**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$9	**6**	**4**	**-34%**	**12**	**17**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$183	**3**	**2**	**-33%**	**24**	**28**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$85	**3**	**2**	**-34%**	**25**	**30**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$16	**3**	**2**	**-31%**	**30**	**36**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$27	**3**	**2**	**-35%**	**31**	**39**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$168	**3**	**2**	**-33%**	**35**	**40**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$30	**2**	**1**	**-28%**	**41**	**45**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$18	**2**	**1**	**-33%**	**45**	**50**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$43	**1**	**1**	**-36%**	**51**	**54**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$25	**0.5**	**0.4**	**-28%**	**61**	**61**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$308	**0.3**	**0.2**	**-35%**	**63**	**63**

Travel Time Sensitivity

The travel time sensitivity test examined how a reduction in travel time and cost savings benefits would affect a project's B/C ratio. This valuation is applied to a unified metric of travel time and cost, which means that projects that primarily affect vehicle operating costs are also influenced by the new valuation. Table 4 presents key results for the travel time valuation sensitivity test. One project, the Bay Bridge West Span Bike Path, shows positive B/C ratio change given its emphasis on benefits other than travel time. Conversely, projects that derive most or all of their benefits from travel time and cost savings experience large B/C ratio reductions. These projects include the local streets preservation and maintenance projects, the express lane projects, and I-80/I-680/SR-12 Interchange Improvements.

In the travel time sensitivity test, B/C ratios fell below 1 for the following projects:

- Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)[2]
- Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)[2]
- Express Lane Network (East and North Bay)
- eBART – Phase 2 (Antioch to Brentwood)
- US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2
- I-680/SR-4 Interchange Improvements + HOV Direct Connector
- TriLink Tollway and Expressways (Brentwood to Tracy/Altamont Pass)
- Golden Gate Transit Frequency Improvements
- Muni Service Frequency Improvements
- 19th Avenue Subway
- Express Lane Network (Silicon Valley)

The Public Transit Maintenance – Rail Operators fell out of the top 10 projects (from 8th to 14th), and Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge) rose into the top 10 (from 11th to 5th).

[2] This project derives most of its benefits from operating cost savings, which is converted to travel time savings for the B/C ratio and monetized with the valuation of time.

Table 4. Key Results: Travel Time Sensitivity Test

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	$1,065	**17**	**7**	**-56%**	**2**	**3**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$173	**11**	**4**	**-59%**	**4**	**8**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$23	**5**	**2**	**-53%**	**16**	**23**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	$724	**4**	**2**	**-61%**	**20**	**34**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$22	**4**	**2**	**-51%**	**22**	**29**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$75	**2**	**1**	**-65%**	**39**	**48**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$4	**2**	**0.1**	**-95%**	**42**	**64**
1413	**Local Streets and Roads Maintenance** (Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	$38	**1**	**0.2**	**-81%**	**54**	**61**
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$8	**0.6**	**0.3**	**-53%**	**57**	**58**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$23	**0.3**	**0.1**	**-59%**	**63**	**63**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$3	**0.2**	**0.1**	**-61%**	**64**	**65**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	-$1	**0.2**	**0**	**-128%**	**65**	**69**

Reduced Valuation of Life Sensitivity

The life valuation sensitivity test assessed how a reduction in the value of life for fatalities would affect the project's B/C ratio. As noted previously, the value of statistical life has doubled from $4.8 million (in $2013) to $10 million (in $2017), and a new mortality benefit corresponding to changes in walking and biking was added to Plan Bay Area 2040. These changes have increased the relative weight of health and safety impacts of transportation projects by approximately double so this sensitivity test reduces the valuation of life by half to return the weighting of health and safety to the same approximate weight as in the Plan Bay Area assessment.

Table 5 presents the key results for the life valuation sensitivity test. None of the projects' B/C ratios fell from above 1 to below 1. One project – Geary BRT – fell out of the top 10 projects (from 10th to 11th). ACE Alviso Double-Tracking rose into the top 10 (from 12th to 8th).

Table 5. Key Results: Life Valuation Sensitivity Test

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$64	**7**	**6**	**-24%**	**7**	**10**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$62	**6**	**5**	**-20%**	**11**	**13**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$114	**4**	**3**	**-21%**	**23**	**25**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$13	**3**	**3**	**-24%**	**26**	**29**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$13	**3**	**3**	**-20%**	**27**	**28**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$38	**3**	**2**	**-21%**	**31**	**37**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$23	**3**	**2**	**-20%**	**32**	**38**
1206	**Alameda Point-San Francisco Ferry**	Multi-County	$12	$5	$9	**2**	**2**	**-20%**	**37**	**39**
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$7	**2**	**2**	**-26%**	**38**	**41**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$84	**2**	**2**	**21%**	**42**	**36**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	$8	**0.2**	**0.2**	**56%**	**65**	**64**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$2	**0.1**	**0.1**	**-56%**	**66**	**66**

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Appendix A. Literature Review on Cost Sensitivity

To identify risk factors that would affect cost sensitivity thresholds, and to provide some explanation of the theory behind cost sensitivity analysis, we first conducted a brief literature review.

Bent Flyvbjerg is a leading author on cost sensitivity analysis. His work relies on reference class forecasting, first developed by economists Daniel Kahneman and Amos Tversky[3], which uses data on past project cost overruns to determine the likelihood that a certain type or class of project will be at risk of cost overruns[4]. These forecasts do not predict the *future causes* of cost overruns, but instead rely on the *explanations for past* overruns by project class and uses these explanations or factors to estimate the potential for future cost overrun. (In other words, past projects provide a reference point for estimating future cost forecasts). Reference forecasting can be summarized in three steps: (1) identify the reference class, (2) establish a probability distribution for the selected class, and (3) assign the project to a particular position within this distribution[5].

In a 2002 paper[6] Flyvbjerg et al used a large sample of 258 transportation infrastructure projects throughout the world to demonstrate that the pattern of cost underestimation is statistically significant and holds for the majority of transportation projects. In their study they found that:

- A randomly selected project is 86% likely to experience a cost overrun;
- On average actual costs were 28% higher than estimated costs; and
- Rail projects underestimate cost by 44.7%, fixed links (i.e., bridges and tunnels) by 33.8%, and roads by 20.4%.

Flyvbjerg grouped explanations for cost underestimation into four categories[7]: technical, economic, psychological, and political. His study concludes that “cost estimation cannot be explained by error and seems to be best explained by strategic misrepresentation...”[8] On this

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[3] Salling, Kim Bang; Leleur, Steen; Skougaard, Britt Zoëga. “Reference Scenario Forecasting: A New Approach to Transport Project Assessment.” 12th WCTR, July 11-15, 2010 – Lisbon, Portugal

[4] “Procedures for Dealing with Optimism Bias” The British Department of Transport. 10 June 2004. Report no. 58924, Issue 1, Flyvbjerg – 10 Jun 2004.

[5] Flyvbjerg, 2004.

[6] Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl, "Underestimating Costs in Public Works Projects: Error or Lie?" Journal of the American Planning Association, vol. 68, no. 3, Summer 2002, pp. 279-295.

[7] The first are technological explanations, whereby the underestimation is due to “forecasting errors,” such as unreliable data, flawed methods, or lack of experience. Economic explanations for cost overruns include economic self-interest - where the parties standing to benefit from the project (construction firms, etc.) have influence over the project’s cost estimation - and public interest, where costs are intentionally low in order to curry the public’s favor. Psychological explanations include those like a politicians’ “monument complex,” and more commonly “appraisal optimism.” “An optimistic cost estimate is clearly a low one” (pg. 17). Lastly, there are political explanations for cost overruns, where projects are subject to political boosterism and made to look financially more favorable.

[8] Flyvbjerg et al. 2002, pg. 22.

basis, we can assume that most project costs – whether knowingly or not - are underestimated by sponsors.

Many researchers have applied and built on Flyvberg's work, and have sought to identify additional risk factors or to apply the principals of cost sensitivity analysis to different locales or project types. Cost overruns have been examined for the World Cup in South Africa,[9] in Sweden[10], and Denmark[11].

Lind et al[12] developed a questionnaire for project managers in Sweden in order to isolate some of the causes for cost overruns. The questionnaire asked project managers to provide responses to statements such as "Cost overruns would be considerably less if Design Build were used instead of Design Bid Build," and "Cost overruns would be considerably less if the client let external reviewers evaluate the project and calculation in advance." The researchers then used these responses in tandem with a literature review to propose changes to organizational structure, quality, and processes that might enable more accurate project estimates and minimize cost overruns.

Salling, et al developed an enhanced reference forecasting technique. To better capture the risk of uncertainty, the authors combined reference forecasting with more rigorous quantitative risk analysis and Monte Carlo simulations to develop a methodology they called "reference scenario forecasting." While compelling, these techniques require extensive statistical analysis.

Many researchers, Wachs[13] in particular, have investigated the political motivations behind cost underestimation and accompanying ethical concerns. While political motivations appear to be a widespread explanation for cost underestimation, they are poorly understood and difficult to capture quantitatively.

The Federal Transit Administration developed the "Capital Cost Database,"[14] using data on rail projects from across the county. This database creates "order of magnitude" project cost estimates based on user-adjusted parameters, including rail type, number of stations and type of construction. The FTA stresses that the database should not be used to prepare detailed cost estimates, but for ballpark estimates of conceptual transit projects.

The literature mentions a number of risk factors for cost overruns. Most of these risk factors do not have quantified sensitivity thresholds. Furthermore, applying a specific risk factor is unfeasible if the projects being assessed do not have sufficient information on that specific factor. A project is at risk of experiencing cost overruns if it:

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9 Baloyi, Lucis, Michiel Bekker. "Cause of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa."

10 Lind, Hand, Fresrik Brunes. "Polices to Avoid Cost Overruns in Infrastructure Projects: Critical Evaluation and Recommendations." JCEB.

11 Salling, Kim Bang 2010.

12 Lind, Hand, et al.

13 Wachs, M., 1990, Ethics and advocacy in forecasting for public policy." Business and Professional Ethics Journal, 9 (1-2), pp 141-157.

14 "Capital Cost Database – Purpose and Suggested Use." 1-10. Federal Transit Administration, 2010. Web.

- Is in very early stages of development[15], has very long implementation timeline, or is expected to have a long contract.[16]
- Is not well defined and has the potential to have major changes to scope.[17]
- Is a rail project or bridge project, which have been shown to have higher potential for cost overruns.[18]
- Is adjacent to major natural, manmade, and protected environmental assets, which could contribute to litigation and/or construction delay.[19]
- Requires land to be acquired because construction is outside of existing curblines and right-of-way.[20]
- Has a high degree of interest from politicians[21] or interest groups and costs estimates may be influenced by politics.
- Has known utility conflicts.
- Is similar in scale and scope to previous Bay Area projects that have experienced significant cost overruns.
- Does not include explicit cost contingency accommodation in the project cost estimate.

On behalf of the British Department of Transport, Flyvbjerg developed a number of sensitivity thresholds based on his past research and condensed these thresholds into what he calls the "optimism bias uplift" scale. Table 1 in the Sensitivity Test Methodology section illustrates this scale. In it, projects are sorted by category – e.g., road, rail, and fixed link (i.e., bridges and tunnels) – and are assigned a sensitivity threshold based on the accepted degree of uncertainty.

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[15] See: Baloyi and Bekker. In the South Africa World Cup unfinished designs were a cause for delay.
[16] Ahsan, K., I. Gunawan. "Analysis of Cost and Schedule Performance of International Development Projects." International Journal of Project Management 28.1 (2010): 68-78. Web.
[17] Le-Hoai, Long, Young Dai Lee , Jun Yong Lee, KSCE Journal of Civil Engineering. November 2008, Volume 12, Issue 6, pp 367-377.
[18] Bent Flyvbjerg, Mette Skamris Holm, and Søren Buhl found that rail projects had a higher cost escalation than (average cost escalation 45%, SD = 38), fixed link project (average cost escalation at 34%, SD = 62), or a road project (average cost escalation is 20%, SD=30.
[19] Le-Hoai, Long, 2008.
[20] K. Ahsan, 2010.
[21] Flyvbjerg, et al, 2002.

Appendix B. Full Sensitivity Test Results

Table B-1. Results: Flyvbjerg 50th Percentile Cost Increase Factors to Capital Costs

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1503	**Highway Pavement Maintenance** (Ideal Conditions vs. Preserve Conditions)	Multi-County	$638	-$1	n/a	**Infinite**	**Infinite**	**--**	**1**	**1**
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	n/a	**17**	**17**	**--**	**2**	**2**
302	**Treasure Island Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$56	$4	$5	**14**	**12**	**-13%**	**3**	**3**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$42	**11**	**10**	**-9%**	**4**	**4**
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements** (Livermore to I-680)	Alameda	$116	$13	$15	**9**	**8**	**-12%**	**5**	**5**
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$82	**8**	**6**	**-24%**	**6**	**10**
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$13	**7**	**6**	**-13%**	**7**	**7**
1651	**Public Transit Maintenance - Rail Operators (Preserve vs. No Funding)**	Multi-County	$1,351	$198	n/a	**7**	**7**	**--**	**8**	**6**
506	**El Camino Real BRT** (Palo Alto to San Jose)	Santa Clara	$85	$13	$15	**7**	**6**	**-13%**	**9**	**9**
301	**Geary BRT**	San Francisco	$124	$20	$22	**6**	**6**	**-10%**	**10**	**11**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$16	**6**	**5**	**-24%**	**11**	**13**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$8	**6**	**5**	**-26%**	**12**	**15**
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	$623	$103	n/a	**6**	**6**	**--**	**13**	**8**
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	$29	$5	$5	**6**	**5**	**-6%**	**14**	**12**
203	**Irvington BART Infill Station**	Alameda	$30	$6	$7	**5**	**4**	**-16%**	**15**	**19**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$11	**5**	**4**	**-13%**	**16**	**18**
903	**Sonoma County Service Frequency Improvements**	Sonoma	$75	$15	$16	**5**	**5**	**-6%**	**17**	**14**
523	**VTA Service Frequency Improvements** (15 minutes)	Santa Clara	$103	$23	$23	**4**	**4**	**-2%**	**18**	**16**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
211	**SR-262 Connector** (I-680 to I-880)	Alameda	$22	$5	$6	**4**	**4**	**-13%**	**19**	**20**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	n/a	**4**	**4**	**--**	**20**	**17**
207	**San Pablo BRT** (San Pablo to Oakland)	Multi-County	$67	$16	$19	**4**	**4**	**-13%**	**21**	**22**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$12	**4**	**4**	**-12%**	**22**	**21**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$47	**4**	**3**	**-19%**	**23**	**24**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$166	**3**	**3**	**-25%**	**24**	**27**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$77	**3**	**3**	**-27%**	**25**	**29**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$6	**3**	**3**	**-11%**	**26**	**25**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$5	**3**	**3**	**-5%**	**27**	**23**
1102	**Caltrain Modernization - Phase 1 + Phase 2** (Capacity Expansion)	Multi-County	$236	$77	$87	**3**	**3**	**-11%**	**28**	**26**
411	**SR-4 Auxiliary Lanes - Phase 1 + Phase 2** (Concord to Pittsburg)	Contra Costa	$44	$15	$17	**3**	**3**	**-12%**	**29**	**28**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$14	**3**	**2**	**-24%**	**30**	**36**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$24	**3**	**2**	**-28%**	**31**	**38**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$12	**3**	**2**	**-11%**	**32**	**30**
102	**US-101 and I-280 HOV Lanes** (GP Lane Conversions in San Francisco, widening in San Mateo	San Mateo - San Francisco	$63	$25	$27	**3**	**2**	**-11%**	**33**	**32**
503	**SR-152 Tollway**	Santa Clara	$95	$37	$42	**3**	**2**	**-13%**	**34**	**33**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$152	**3**	**2**	**-25%**	**35**	**40**
331	**Better Market Street**	San Francisco	$32	$13	$15	**3**	**2**	**-13%**	**36**	**34**
1206	**Alameda Point-San Francisco Ferry**	Multi-County	$12	$5	$5	**2**	**2**	**-2%**	**37**	**31**
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$5	**2**	**2**	**-10%**	**38**	**35**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$104	**2**	**2**	**-13%**	**39**	**37**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
206	**AC Transit Service Frequency Improvements**	Alameda	$248	$120	$129	**2**	**2**	**-7%**	**40**	**39**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$28	**2**	**1**	**-21%**	**41**	**44**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$44	**2**	**2**	**-13%**	**42**	**43**
604	**Solano County Express Bus Network**	Solano	$21	$12	$13	**2**	**2**	**-8%**	**43**	**42**
522	**VTA Service Frequency Improvements** (10 minutes)	Santa Clara	$177	$99	$101	**2**	**2**	**-2%**	**44**	**41**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$16	**2**	**1**	**-26%**	**45**	**51**
311	**Muni Forward Program**	San Francisco	$60	$36	$41	**2**	**1**	**-12%**	**46**	**45**
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Marin - Sonoma	$31	$19	$22	**2**	**1**	**-11%**	**47**	**47**
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	$42	$27	$31	**2**	**1**	**-12%**	**48**	**48**
103	**El Camino Real Rapid Bus** (Daly City to Palo Alto)	San Mateo	$54	$36	$37	**2**	**1**	**-3%**	**49**	**46**
401	**TriLink Tollway + Expressways** (Brentwood to Tracy/Altamont Pass)	Contra Costa	$75	$51	$58	**1**	**1**	**-13%**	**50**	**50**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$38	**1**	**1**	**-29%**	**51**	**53**
801	**Golden Gate Transit Frequency Improvements**	Marin - Sonoma	$11	$8	$8	**1**	**1**	**-3%**	**52**	**49**
313	**Muni Service Frequency Improvements**	San Francisco	$89	$79	$83	**1**	**1**	**-5%**	**53**	**52**
1413	**Local Streets and Roads Maintenance** Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	n/a	**1**	**1**	**--**	**54**	**54**
516	**VTA Express Bus Network**	Santa Clara	$18	$19	$20	**0.9**	**0.9**	**-2%**	**55**	**55**
202	**East-West Connector** (Fremont to Union City)	Alameda	$10	$12	$14	**0.9**	**0.8**	**-13%**	**56**	**56**
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$27	**0.6**	**0.6**	**-2%**	**57**	**57**
410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Contra Costa	$9	$16	$17	**0.6**	**0.5**	**-8%**	**58**	**59**
403	**I-680 Express Bus Frequency Improvements**	Contra Costa	$12	$21	$21	**0.6**	**0.5**	**-3%**	**59**	**58**
404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	$9	$17	$19	**0.5**	**0.5**	**-11%**	**60**	**60**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$23	**0.5**	**0.4**	**-21%**	**61**	**61**
104	**Geneva-Harney BRT + Corridor Improvements**	San Mateo - San Francisco	$15	$46	$52	**0.3**	**0.3**	**-12%**	**62**	**62**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$247	**0.3**	**0.2**	**-19%**	**63**	**63**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$39	**0.2**	**0.2**	**-13%**	**64**	**64**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	$36	**0.2**	**0.1**	**-12%**	**65**	**65**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$34	**0.1**	**0.1**	**-13%**	**66**	**66**
205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	$0	$10	n/a	**0.0**	**0.0**	**--**	**67**	**67**
1201	**Redwood City-San Francisco Ferry**	Multi-County	$0	$8	$8	**0.0**	**0.0**	**--**	**67**	**67**
905	**SMART – Phase 3** (Windsor to Cloverdale)	Sonoma	$0	$12	$15	**0.0**	**0.0**	**--**	**67**	**67**

Table B-2. Results: Flyvbjerg 80th Percentile Cost Increase Factors to Capital Costs

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1503	**Highway Pavement Maintenance** (Ideal Conditions vs. Preserve Conditions)	Multi-County	$638	-$1	n/a	**Infinite**	**Infinite**	**--**	**1**	**1**
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	n/a	**17**	**17**	**--**	**2**	**2**
302	**Treasure Island Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$56	$4	$5	**14**	**11**	**-24%**	**3**	**3**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$47	**11**	**9**	**-18%**	**4**	**4**
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements** (Livermore to I-680)	Alameda	$116	$13	$17	**9**	**7**	**-23%**	**5**	**5**
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$90	**8**	**5**	**-31%**	**6**	**9**
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$15	**7**	**6**	**-24%**	**7**	**8**
1651	**Public Transit Maintenance - Rail Operators (Preserve vs. No Funding)**	Multi-County	$1,351	$198	n/a	**7**	**7**	**--**	**8**	**6**
506	**El Camino Real BRT** (Palo Alto to San Jose)	Santa Clara	$85	$13	$17	**7**	**5**	**-24%**	**9**	**11**
301	**Geary BRT**	San Francisco	$124	$20	$25	**6**	**5**	**-20%**	**10**	**12**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$18	**6**	**4**	**-31%**	**11**	**15**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$9	**6**	**4**	**-34%**	**12**	**17**
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	$623	$103	n/a	**6**	**6**	**--**	**13**	**7**
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	$29	$5	$6	**6**	**5**	**-9%**	**14**	**10**
203	**Irvington BART Infill Station**	Alameda	$30	$6	$8	**5**	**4**	**-23%**	**15**	**18**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$13	**5**	**4**	**-24%**	**16**	**19**
903	**Sonoma County Service Frequency Improvements**	Sonoma	$75	$15	$17	**5**	**4**	**-12%**	**17**	**16**
523	**VTA Service Frequency Improvements** (15 minutes)	Santa Clara	$103	$23	$24	**4**	**4**	**-3%**	**18**	**14**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
211	**SR-262 Connector** (I-680 to I-880)	Alameda	$22	$5	$7	**4**	**3**	**-24%**	**19**	**20**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	n/a	**4**	**4**	**--**	**20**	**13**
207	**San Pablo BRT** (San Pablo to Oakland)	Multi-County	$67	$16	$22	**4**	**3**	**-24%**	**21**	**22**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$14	**4**	**3**	**-22%**	**22**	**21**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$51	**4**	**3**	**-25%**	**23**	**24**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$183	**3**	**2**	**-33%**	**24**	**28**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$85	**3**	**2**	**-34%**	**25**	**30**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$6	**3**	**3**	**-21%**	**26**	**25**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$5	**3**	**3**	**-8%**	**27**	**23**
1102	**Caltrain Modernization - Phase 1 + Phase 2** (Capacity Expansion)	Multi-County	$236	$77	$97	**3**	**2**	**-20%**	**28**	**27**
411	**SR-4 Auxiliary Lanes - Phase 1 + Phase 2** (Concord to Pittsburg)	Contra Costa	$44	$15	$20	**3**	**2**	**-23%**	**29**	**31**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$16	**3**	**2**	**-31%**	**30**	**36**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$27	**3**	**2**	**-35%**	**31**	**39**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$13	**3**	**2**	**-20%**	**32**	**32**
102	**US-101 and I-280 HOV Lanes** (GP Lane Conversions in San Francisco, widening in San Mateo County)	San Mateo - San Francisco	$63	$25	$31	**3**	**2**	**-20%**	**33**	**33**
503	**SR-152 Tollway**	Santa Clara	$95	$37	$49	**3**	**2**	**-24%**	**34**	**35**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$168	**3**	**2**	**-33%**	**35**	**40**
331	**Better Market Street**	San Francisco	$32	$13	n/a	**3**	**3**	**--**	**36**	**26**
1206	**Alameda Point-San Francisco Ferry**	Multi-County	$12	$5	$5	**2**	**2**	**-4%**	**37**	**29**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$5	**2**	**2**	**-15%**	**38**	**34**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$120	**2**	**2**	**-24%**	**39**	**37**
206	**AC Transit Service Frequency Improvements**	Alameda	$248	$120	$139	**2**	**2**	**-13%**	**40**	**38**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$30	**2**	**1**	**-28%**	**41**	**45**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$50	**2**	**1**	**-24%**	**42**	**44**
604	**Solano County Express Bus Network**	Solano	$21	$12	$14	**2**	**2**	**-16%**	**43**	**42**
522	**VTA Service Frequency Improvements** (10 minutes)	Santa Clara	$177	$99	$103	**2**	**2**	**-4%**	**44**	**41**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$18	**2**	**1**	**-33%**	**45**	**50**
311	**Muni Forward Program**	San Francisco	$60	$36	$46	**2**	**1**	**-22%**	**46**	**46**
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Marin - Sonoma	$31	$19	$25	**2**	**1**	**-22%**	**47**	**48**
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	$42	$27	$35	**2**	**1**	**-23%**	**48**	**49**
103	**El Camino Real Rapid Bus** (Daly City to Palo Alto)	San Mateo	$54	$36	$38	**2**	**1**	**-7%**	**49**	**43**
401	**TriLink Tollway + Expressways** (Brentwood to Tracy/Altamont Pass)	Contra Costa	$75	$51	$67	**1**	**1**	**-24%**	**50**	**51**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$43	**1**	**0.9**	**-36%**	**51**	**54**
801	**Golden Gate Transit Frequency Improvements**	Marin - Sonoma	$11	$8	$8	**1**	**1**	**-5%**	**52**	**47**
313	**Muni Service Frequency Improvements**	San Francisco	$89	$79	$88	**1**	**1**	**-10%**	**53**	**52**
1413	**Local Streets and Roads Maintenance** (Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	n/a	**1**	**1**	**--**	**54**	**53**
516	**VTA Express Bus Network**	Santa Clara	$18	$19	$20	**0.9**	**0.9**	**-4%**	**55**	**55**
202	**East-West Connector** (Fremont to Union City)	Alameda	$10	$12	$16	**0.9**	**0.7**	**-24%**	**56**	**56**

CAMBRIDGE SYSTEMATICS

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$27	**0.6**	**0.6**	**-3%**	**57**	**57**
410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Contra Costa	$9	$16	$18	**0.6**	**0.5**	**-12%**	**58**	**59**
403	**I-680 Express Bus Frequency Improvements**	Contra Costa	$12	$21	$22	**0.6**	**0.5**	**-6%**	**59**	**58**
404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	$9	$17	$21	**0.5**	**0.4**	**-21%**	**60**	**60**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$25	**0.5**	**0.4**	**-28%**	**61**	**61**
104	**Geneva-Harney BRT + Corridor Improvements**	San Mateo - San Francisco	$15	$46	$58	**0.3**	**0.3**	**-22%**	**62**	**62**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$308	**0.3**	**0.2**	**-35%**	**63**	**63**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$45	**0.2**	**0.2**	**-24%**	**64**	**64**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	$41	**0.2**	**0.1**	**-22%**	**65**	**65**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$39	**0.1**	**0.1**	**-24%**	**66**	**66**
205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	$0	$10	n/a	**0.0**	**0.0**	**--**	**67**	**67**
1201	**Redwood City-San Francisco Ferry**	Multi-County	$0	$8	$9	**0.0**	**0.0**	**--**	**67**	**67**
905	**SMART – Phase 3** (Windsor to Cloverdale)	Sonoma	$0	$12	$16	**0.0**	**0.0**	**--**	**67**	**67**

Table B-3. Results: Flyvbjerg 50th Percentile Cost Increase Factors to All Costs

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1503	**Highway Pavement Maintenance** (Ideal Conditions vs. Preserve Conditions)	Multi-County	$638	-$1	n/a	**Infinite**	**Infinite**	**--**	**1**	**1**
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	n/a	**17**	**17**	**--**	**2**	**2**
302	**Treasure Island Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$56	$4	$5	**14**	**12**	**-13%**	**3**	**3**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$42	**11**	**10**	**-9%**	**4**	**4**
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements** (Livermore to I-680)	Alameda	$116	$13	$15	**9**	**8**	**-12%**	**5**	**5**
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$87	**8**	**5**	**-29%**	**6**	**11**
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$13	**7**	**6**	**-13%**	**7**	**7**
1651	**Public Transit Maintenance - Rail Operators (Preserve vs. No Funding)**	Multi-County	$1,351	$198	n/a	**7**	**7**	**--**	**8**	**6**
506	**El Camino Real BRT** (Palo Alto to San Jose)	Santa Clara	$85	$13	$15	**7**	**6**	**-13%**	**9**	**9**
301	**Geary BRT**	San Francisco	$124	$20	$23	**6**	**5**	**-13%**	**10**	**10**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$17	**6**	**4**	**-29%**	**11**	**13**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$8	**6**	**4**	**-29%**	**12**	**14**
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	$623	$103	n/a	**6**	**6**	**--**	**13**	**8**
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	$29	$5	$6	**6**	**5**	**-17%**	**14**	**12**
203	**Irvington BART Infill Station**	Alameda	$30	$6	$7	**5**	**4**	**-19%**	**15**	**18**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$11	**5**	**4**	**-13%**	**16**	**16**
903	**Sonoma County Service Frequency Improvements**	Sonoma	$75	$15	$18	**5**	**4**	**-13%**	**17**	**17**
523	**VTA Service Frequency Improvements** (15 minutes)	Santa Clara	$103	$23	$26	**4**	**4**	**-13%**	**18**	**19**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
211	**SR-262 Connector** (I-680 to I-880)	Alameda	$22	$5	$6	**4**	**4**	**-13%**	**19**	**20**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	n/a	**4**	**4**	**--**	**20**	**15**
207	**San Pablo BRT** (San Pablo to Oakland)	Multi-County	$67	$16	$19	**4**	**4**	**-13%**	**21**	**21**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$12	**4**	**4**	**-13%**	**22**	**22**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$54	**4**	**3**	**-29%**	**23**	**25**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$173	**3**	**2**	**-29%**	**24**	**29**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$79	**3**	**2**	**-29%**	**25**	**30**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$6	**3**	**3**	**-11%**	**26**	**23**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$6	**3**	**3**	**-17%**	**27**	**24**
1102	**Caltrain Modernization - Phase 1 + Phase 2** (Capacity Expansion)	Multi-County	$236	$77	$89	**3**	**3**	**-13%**	**28**	**26**
411	**SR-4 Auxiliary Lanes - Phase 1 + Phase 2** (Concord to Pittsburg)	Contra Costa	$44	$15	$17	**3**	**3**	**-12%**	**29**	**27**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$15	**3**	**2**	**-29%**	**30**	**37**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$25	**3**	**2**	**-29%**	**31**	**38**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$12	**3**	**2**	**-13%**	**32**	**31**
102	**US-101 and I-280 HOV Lanes** (GP Lane Conversions in San Francisco, widening in San Mateo County)	San Mateo - San Francisco	$63	$25	$27	**3**	**2**	**-11%**	**33**	**32**
503	**SR-152 Tollway**	Santa Clara	$95	$37	$42	**3**	**2**	**-13%**	**34**	**33**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$158	**3**	**2**	**-29%**	**35**	**39**
331	**Better Market Street**	San Francisco	$32	$13	n/a	**3**	**3**	**--**	**36**	**28**
1206	**Alameda Point-San Francisco Ferry**	Multi-County	$12	$5	$6	**2**	**2**	**-17%**	**37**	**35**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$5	**2**	**2**	**-17%**	**38**	**36**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$104	**2**	**2**	**-13%**	**39**	**34**
206	**AC Transit Service Frequency Improvements**	Alameda	$248	$120	$138	**2**	**2**	**-13%**	**40**	**40**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$31	**2**	**1**	**-29%**	**41**	**46**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$44	**2**	**2**	**-13%**	**42**	**41**
604	**Solano County Express Bus Network**	Solano	$21	$12	$14	**2**	**2**	**-13%**	**43**	**42**
522	**VTA Service Frequency Improvements** (10 minutes)	Santa Clara	$177	$99	$114	**2**	**2**	**-13%**	**44**	**43**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$17	**2**	**1**	**-29%**	**45**	**50**
311	**Muni Forward Program**	San Francisco	$60	$36	$41	**2**	**1**	**-13%**	**46**	**44**
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Marin - Sonoma	$31	$19	$22	**2**	**1**	**-11%**	**47**	**45**
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	$42	$27	$31	**2**	**1**	**-12%**	**48**	**47**
103	**El Camino Real Rapid Bus** (Daly City to Palo Alto)	San Mateo	$54	$36	$41	**2**	**1**	**-13%**	**49**	**48**
401	**TriLink Tollway + Expressways** (Brentwood to Tracy/Altamont Pass)	Contra Costa	$75	$51	$58	**1**	**1**	**-13%**	**50**	**49**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$38	**1**	**1**	**-29%**	**51**	**53**
801	**Golden Gate Transit Frequency Improvements**	Marin - Sonoma	$11	$8	$9	**1**	**1**	**-13%**	**52**	**51**
313	**Muni Service Frequency Improvements**	San Francisco	$89	$79	$83	**1**	**1**	**-5%**	**53**	**52**
1413	**Local Streets and Roads Maintenance** (Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	n/a	**1**	**1**	**--**	**54**	**54**
516	**VTA Express Bus Network**	Santa Clara	$18	$19	$22	**0.9**	**0.8**	**-13%**	**55**	**55**
202	**East-West Connector** (Fremont to Union City)	Alameda	$10	$12	$14	**0.9**	**0.8**	**-13%**	**56**	**56**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$31	**0.6**	**0.5**	**-13%**	**57**	**57**
410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Contra Costa	$9	$16	$19	**0.6**	**0.5**	**-17%**	**58**	**60**
403	**I-680 Express Bus Frequency Improvements**	Contra Costa	$12	$21	$24	**0.6**	**0.5**	**-13%**	**59**	**58**
404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	$9	$17	$19	**0.5**	**0.5**	**-11%**	**60**	**59**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$26	**0.5**	**0.4**	**-29%**	**61**	**61**
104	**Geneva-Harney BRT + Corridor Improvements**	San Mateo - San Francisco	$15	$46	$52	**0.3**	**0.3**	**-13%**	**62**	**62**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$248	**0.3**	**0.2**	**-19%**	**63**	**63**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$39	**0.2**	**0.2**	**-13%**	**64**	**64**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	$36	**0.2**	**0.1**	**-12%**	**65**	**65**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$34	**0.1**	**0.1**	**-13%**	**66**	**66**
205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	$0	$10	n/a	**0.0**	**0.0**	**--**	**67**	**67**
1201	**Redwood City-San Francisco Ferry**	Multi-County	$0	$8	$9	**0.0**	**0.0**	**--**	**67**	**67**
905	**SMART – Phase 3** (Windsor to Cloverdale)	Sonoma	$0	$12	$17	**0.0**	**0.0**	**--**	**67**	**67**

Table B-4. Results: Flyvbjerg 80th Percentile Cost Increase Factors to All Costs

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1503	**Highway Pavement Maintenance** (Ideal Conditions vs. Preserve Conditions)	Multi-County	$638	-$1	n/a	**Infinite**	**Infinite**	--	**1**	**1**
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	n/a	**17**	**17**	--	**2**	**2**
302	**Treasure Island Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$56	$4	$5	**14**	**11**	**-24%**	**3**	**3**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$47	**11**	**9**	**-18%**	**4**	**4**
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements** (Livermore to I-680)	Alameda	$116	$13	$17	**9**	**7**	**-23%**	**5**	**5**
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$98	**8**	**5**	**-36%**	**6**	**10**
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$15	**7**	**6**	**-24%**	**7**	**8**
1651	**Public Transit Maintenance - Rail Operators (Preserve vs. No Funding)**	Multi-County	$1,351	$198	n/a	**7**	**7**	--	**8**	**6**
506	**El Camino Real BRT** (Palo Alto to San Jose)	Santa Clara	$85	$13	$17	**7**	**5**	**-24%**	**9**	**9**
301	**Geary BRT**	San Francisco	$124	$20	$26	**6**	**5**	**-24%**	**10**	**11**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$19	**6**	**4**	**-36%**	**11**	**14**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$9	**6**	**4**	**-36%**	**12**	**15**
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	$623	$103	n/a	**6**	**6**	--	**13**	**7**
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	$29	$5	$7	**6**	**4**	**-24%**	**14**	**13**
203	**Irvington BART Infill Station**	Alameda	$30	$6	$8	**5**	**4**	**-27%**	**15**	**17**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$13	**5**	**4**	**-24%**	**16**	**16**
903	**Sonoma County Service Frequency Improvements**	Sonoma	$75	$15	$20	**5**	**4**	**-24%**	**17**	**18**
523	**VTA Service Frequency Improvements** (15 minutes)	Santa Clara	$103	$23	$30	**4**	**3**	**-24%**	**18**	**19**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
211	**SR-262 Connector** (I-680 to I-880)	Alameda	$22	$5	$7	**4**	**3**	**-24%**	**19**	**20**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	n/a	**4**	**4**	**--**	**20**	**12**
207	**San Pablo BRT** (San Pablo to Oakland)	Multi-County	$67	$16	$22	**4**	**3**	**-24%**	**21**	**22**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$14	**4**	**3**	**-23%**	**22**	**21**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$60	**4**	**2**	**-36%**	**23**	**26**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$194	**3**	**2**	**-36%**	**24**	**29**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$89	**3**	**2**	**-36%**	**25**	**30**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$6	**3**	**3**	**-21%**	**26**	**23**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$6	**3**	**3**	**-24%**	**27**	**25**
1102	**Caltrain Modernization - Phase 1 + Phase 2** (Capacity Expansion)	Multi-County	$236	$77	$100	**3**	**2**	**-23%**	**28**	**27**
411	**SR-4 Auxiliary Lanes - Phase 1 + Phase 2** (Concord to Pittsburg)	Contra Costa	$44	$15	$20	**3**	**2**	**-23%**	**29**	**28**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$17	**3**	**2**	**-36%**	**30**	**37**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$28	**3**	**2**	**-36%**	**31**	**38**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$14	**3**	**2**	**-24%**	**32**	**32**
102	**US-101 and I-280 HOV Lanes** (GP Lane Conversions in San Francisco, widening in San Mateo County)	San Mateo - San Francisco	$63	$25	$29	**3**	**2**	**-17%**	**33**	**31**
503	**SR-152 Tollway**	Santa Clara	$95	$37	$49	**3**	**2**	**-24%**	**34**	**33**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$178	**3**	**2**	**-36%**	**35**	**39**
331	**Better Market Street**	San Francisco	$32	$13	n/a	**3**	**3**	**--**	**36**	**24**
1206	**Alameda Point-San Francisco Ferry**	Multi-County	$12	$5	$6	**2**	**2**	**-24%**	**37**	**34**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$6	**2**	**2**	**-24%**	**38**	**35**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$120	**2**	**2**	**-24%**	**39**	**36**
206	**AC Transit Service Frequency Improvements**	Alameda	$248	$120	$159	**2**	**2**	**-24%**	**40**	**40**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$34	**2**	**1**	**-36%**	**41**	**46**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$50	**2**	**1**	**-24%**	**42**	**41**
604	**Solano County Express Bus Network**	Solano	$21	$12	$16	**2**	**1**	**-24%**	**43**	**42**
522	**VTA Service Frequency Improvements** (10 minutes)	Santa Clara	$177	$99	$131	**2**	**1**	**-24%**	**44**	**43**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$19	**2**	**1**	**-36%**	**45**	**50**
311	**Muni Forward Program**	San Francisco	$60	$36	$48	**2**	**1**	**-24%**	**46**	**44**
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Marin - Sonoma	$31	$19	$25	**2**	**1**	**-22%**	**47**	**45**
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	$42	$27	$35	**2**	**1**	**-23%**	**48**	**47**
103	**El Camino Real Rapid Bus** (Daly City to Palo Alto)	San Mateo	$54	$36	$47	**2**	**1**	**-24%**	**49**	**48**
401	**TriLink Tollway + Expressways** (Brentwood to Tracy/Altamont Pass)	Contra Costa	$75	$51	$67	**1**	**1**	**-24%**	**50**	**49**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$43	**1**	**0.9**	**-36%**	**51**	**54**
801	**Golden Gate Transit Frequency Improvements**	Marin - Sonoma	$11	$8	$10	**1**	**1**	**-24%**	**52**	**51**
313	**Muni Service Frequency Improvements**	San Francisco	$89	$79	$88	**1**	**1**	**-10%**	**53**	**52**
1413	**Local Streets and Roads Maintenance** (Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	n/a	**1**	**1**	**--**	**54**	**53**
516	**VTA Express Bus Network**	Santa Clara	$18	$19	$26	**0.9**	**0.7**	**-24%**	**55**	**55**
202	**East-West Connector** (Fremont to Union City)	Alameda	$10	$12	$16	**0.9**	**0.7**	**-24%**	**56**	**56**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Cost ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$35	**0.6**	**0.5**	**-24%**	**57**	**57**
410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Contra Costa	$9	$16	$21	**0.6**	**0.4**	**-24%**	**58**	**58**
403	**I-680 Express Bus Frequency Improvements**	Contra Costa	$12	$21	$27	**0.6**	**0.4**	**-24%**	**59**	**60**
404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	$9	$17	$21	**0.5**	**0.4**	**-21%**	**60**	**59**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$29	**0.5**	**0.3**	**-36%**	**61**	**61**
104	**Geneva-Harney BRT + Corridor Improvements**	San Mateo - San Francisco	$15	$46	$60	**0.3**	**0.2**	**-24%**	**62**	**62**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$311	**0.3**	**0.2**	**-36%**	**63**	**63**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$45	**0.2**	**0.2**	**-24%**	**64**	**64**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	$41	**0.2**	**0.1**	**-22%**	**65**	**65**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$39	**0.1**	**0.1**	**-24%**	**66**	**66**
205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	$0	$10	n/a	**0.0**	**0.0**	**--**	**67**	**67**
1201	**Redwood City-San Francisco Ferry**	Multi-County	$0	$8	$10	**0.0**	**0.0**	**--**	**67**	**67**
905	**SMART – Phase 3** (Windsor to Cloverdale)	Sonoma	$0	$12	$19	**0.0**	**0.0**	**--**	**67**	**67**

Table B-5. Results: Travel Time Sensitivity Test

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1503	**Highway Pavement Maintenance** (Ideal Conditions vs. Preserve Conditions)	Multi-County	$638	-$1	$274	**Infinite**	**Infinite**	**--**	**1**	**1**
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	$1,065	**17**	**7**	**-56%**	**2**	**3**
302	**Treasure Island Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$56	$4	$42	**14**	**11**	**-25%**	**3**	**2**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$173	**11**	**4**	**-59%**	**4**	**8**
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements** (Livermore to I-680)	Alameda	$116	$13	$63	**9**	**5**	**-46%**	**5**	**6**
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$277	**8**	**4**	**-41%**	**6**	**9**
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$76	**7**	**7**	**-10%**	**7**	**4**
1651	**Public Transit Maintenance - Rail Operators (Preserve vs. No Funding)**	Multi-County	$1,351	$198	$771	**7**	**4**	**-43%**	**8**	**14**
506	**El Camino Real BRT** (Palo Alto to San Jose)	Santa Clara	$85	$13	$60	**7**	**5**	**-29%**	**9**	**7**
301	**Geary BRT**	San Francisco	$124	$20	$87	**6**	**4**	**-30%**	**10**	**10**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$61	**6**	**5**	**-20%**	**11**	**5**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$19	**6**	**3**	**-47%**	**12**	**18**
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	$623	$103	$439	**6**	**4**	**-30%**	**13**	**11**
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	$29	$5	$21	**6**	**4**	**-28%**	**14**	**12**
203	**Irvington BART Infill Station**	Alameda	$30	$6	$21	**5**	**4**	**-29%**	**15**	**15**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$23	**5**	**2**	**-53%**	**16**	**23**
903	**Sonoma County Service Frequency Improvements**	Sonoma	$75	$15	$62	**5**	**4**	**-18%**	**17**	**13**
523	**VTA Service Frequency Improvements** (15 minutes)	Santa Clara	$103	$23	$77	**4**	**3**	**-26%**	**18**	**17**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
211	**SR-262 Connector** (I-680 to I-880)	Alameda	$22	$5	$17	**4**	**3**	**-22%**	**19**	**16**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	$724	**4**	**2**	**-61%**	**20**	**34**
207	**San Pablo BRT** (San Pablo to Oakland)	Multi-County	$67	$16	$51	**4**	**3**	**-24%**	**21**	**19**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$22	**4**	**2**	**-51%**	**22**	**29**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$111	**4**	**3**	**-23%**	**23**	**21**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$258	**3**	**2**	**-40%**	**24**	**26**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$116	**3**	**2**	**-41%**	**25**	**28**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$15	**3**	**3**	**-13%**	**26**	**20**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$12	**3**	**2**	**-25%**	**27**	**22**
1102	**Caltrain Modernization - Phase 1 + Phase 2** (Capacity Expansion)	Multi-County	$236	$77	$141	**3**	**2**	**-41%**	**28**	**32**
411	**SR-4 Auxiliary Lanes - Phase 1 + Phase 2** (Concord to Pittsburg)	Contra Costa	$44	$15	$25	**3**	**2**	**-45%**	**29**	**35**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$21	**3**	**2**	**-32%**	**30**	**30**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$40	**3**	**2**	**-17%**	**31**	**24**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$23	**3**	**2**	**-20%**	**32**	**25**
102	**US-101 and I-280 HOV Lanes** (GP Lane Conversions in San Francisco, widening in San Mateo County)	San Mateo - San Francisco	$63	$25	$35	**3**	**1**	**-44%**	**33**	**38**
503	**SR-152 Tollway**	Santa Clara	$95	$37	$59	**3**	**2**	**-37%**	**34**	**36**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$168	**3**	**1**	**-42%**	**35**	**37**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$9	**2**	**2**	**-14%**	**38**	**27**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$75	**2**	**0.8**	**-65%**	**39**	**48**
206	**AC Transit Service Frequency Improvements**	Alameda	$248	$120	$173	**2**	**1**	**-30%**	**40**	**39**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$30	**2**	**1**	**-29%**	**41**	**41**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$4	**2**	**0.1**	**-95%**	**42**	**64**
604	**Solano County Express Bus Network**	Solano	$21	$12	$15	**2**	**1**	**-28%**	**43**	**42**
522	**VTA Service Frequency Improvements** (10 minutes)	Santa Clara	$177	$99	$134	**2**	**1**	**-24%**	**44**	**40**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$11	**2**	**0.9**	**-45%**	**45**	**46**
311	**Muni Forward Program**	San Francisco	$60	$36	$38	**2**	**1**	**-37%**	**46**	**44**
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Marin - Sonoma	$31	$19	$18	**2**	**0.9**	**-40%**	**47**	**45**
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	$42	$27	$21	**2**	**0.8**	**-49%**	**48**	**50**
103	**El Camino Real Rapid Bus** (Daly City to Palo Alto)	San Mateo	$54	$36	$40	**2**	**1**	**-25%**	**49**	**43**
401	**TriLink Tollway + Expressways** (Brentwood to Tracy/Altamont Pass)	Contra Costa	$75	$51	$42	**1**	**0.8**	**-44%**	**50**	**49**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$25	**1**	**0.9**	**-36%**	**51**	**47**
801	**Golden Gate Transit Frequency Improvements**	Marin - Sonoma	$11	$8	$6	**1**	**0.8**	**-43%**	**52**	**51**
313	**Muni Service Frequency Improvements**	San Francisco	$89	$79	$55	**1**	**0.7**	**-38%**	**53**	**53**
1413	**Local Streets and Roads Maintenance** (Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	$38	**1**	**0.2**	**-81%**	**54**	**61**
516	**VTA Express Bus Network**	Santa Clara	$18	$19	$14	**0.9**	**0.7**	**-21%**	**55**	**52**
202	**East-West Connector** (Fremont to Union City)	Alameda	$10	$12	$8	**0.9**	**0.7**	**-20%**	**56**	**54**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$8	**0.6**	**0.3**	**-53%**	**57**	**58**
410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Contra Costa	$9	$16	$5	**0.6**	**0.3**	**-41%**	**58**	**56**
403	**I-680 Express Bus Frequency Improvements**	Contra Costa	$12	$21	$8	**0.6**	**0.4**	**-34%**	**59**	**55**
404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	$9	$17	$5	**0.5**	**0.3**	**-48%**	**60**	**59**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$6	**0.5**	**0.3**	**-42%**	**61**	**57**
104	**Geneva-Harney BRT + Corridor Improvements**	San Mateo - San Francisco	$15	$46	$12	**0.3**	**0.3**	**-22%**	**62**	**60**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$23	**0.3**	**0.1**	**-59%**	**63**	**63**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$3	**0.2**	**0.1**	**-61%**	**64**	**65**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	-$1	**0.2**	**0.0**	**-128%**	**65**	**69**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$5	**0.1**	**0.2**	**15%**	**66**	**62**
205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	$0	$10	$0	**0.0**	**0.0**	**--**	**67**	**66**
1201	**Redwood City-San Francisco Ferry**	Multi-County	$0	$8	$0	**0.0**	**0.0**	**--**	**67**	**66**
905	**SMART – Phase 3** (Windsor to Cloverdale)	Sonoma	$0	$12	$0	**0.0**	**0.0**	**--**	**67**	**66**

Table B-6. Results: Life Valuation Sensitivity Test

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1503	**Highway Pavement Maintenance** (Ideal Conditions vs. Preserve Conditions)	Multi-County	$638	-$1	$660	**Infinite**	**Infinite**	**--**	**1**	**1**
1502	**Highway Pavement Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$2,433	$144	$2,507	**17**	**17**	**3%**	**2**	**2**
302	**Treasure Island Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$56	$4	$46	**14**	**12**	**-17%**	**3**	**3**
1301	**Columbus Day Initiative**	Multi-County	$421	$38	$436	**11**	**11**	**4%**	**4**	**4**
209	**SR-84 Widening + I-680/SR-84 Interchange Improvements** (Livermore to I-680)	Alameda	$116	$13	$113	**9**	**9**	**-3%**	**5**	**5**
501	**BART to Silicon Valley – Phase 2** (Berryessa to Santa Clara)	Santa Clara	$472	$62	$445	**8**	**7**	**-6%**	**6**	**6**
306	**Downtown San Francisco Congestion Pricing** (Toll + Transit Improvements)	San Francisco	$84	$11	$64	**7**	**6**	**-24%**	**7**	**10**
1651	**Public Transit Maintenance - Rail Operators (Preserve vs. No Funding)**	Multi-County	$1,351	$198	$1,299	**7**	**7**	**-4%**	**8**	**7**
506	**El Camino Real BRT** (Palo Alto to San Jose)	Santa Clara	$85	$13	$77	**7**	**6**	**-10%**	**9**	**9**
301	**Geary BRT**	San Francisco	$124	$20	$110	**6**	**6**	**-11%**	**10**	**11**
505	**Capitol Expressway LRT – Phase 2** (Alum Rock to Eastridge)	Santa Clara	$77	$12	$62	**6**	**5**	**-20%**	**11**	**13**
518	**ACE Alviso Double-Tracking**	Santa Clara	$36	$6	$35	**6**	**6**	**-2%**	**12**	**8**
1650	**Public Transit Maintenance - Bus Operators (Preserve Conditions vs. No Funding)**	Multi-County	$623	$103	$560	**6**	**5**	**-10%**	**13**	**12**
1203	**Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements**	Multi-County	$29	$5	$24	**6**	**5**	**-17%**	**14**	**15**
203	**Irvington BART Infill Station**	Alameda	$30	$6	$25	**5**	**4**	**-16%**	**15**	**18**
101	**Express Lane Network (US-101 San Mateo/San Francisco)**	San Mateo - San Francisco	$48	$10	$48	**5**	**5**	**-1%**	**16**	**14**
903	**Sonoma County Service Frequency Improvements**	Sonoma	$75	$15	$66	**5**	**4**	**-12%**	**17**	**17**
523	**VTA Service Frequency Improvements** (15 minutes)	Santa Clara	$103	$23	$92	**4**	**4**	**-11%**	**18**	**20**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
211	**SR-262 Connector** (I-680 to I-880)	Alameda	$22	$5	$19	**4**	**4**	**-16%**	**19**	**21**
1403	**Local Streets and Roads Maintenance** (Preserve Conditions vs. No Funding)	Multi-County	$1,875	$428	$2,006	**4**	**5**	**7%**	**20**	**16**
207	**San Pablo BRT** (San Pablo to Oakland)	Multi-County	$67	$16	$57	**4**	**3**	**-15%**	**21**	**22**
210	**I-580 ITS Improvements**	Alameda	$44	$11	$44	**4**	**4**	**0%**	**22**	**19**
504	**Stevens Creek LRT**	Santa Clara	$144	$38	$114	**4**	**3**	**-21%**	**23**	**25**
1001	**BART Metro Program** (Service Frequency Increase)	Multi-County	$430	$123	$406	**3**	**3**	**-6%**	**24**	**23**
1101	**Caltrain Modernization - Phase 1** (Electrification + Service Frequency Increase)	Multi-County	$195	$56	$183	**3**	**3**	**-6%**	**25**	**24**
605	**Jepson Parkway** (Fairfield to Vacaville)	Solano	$17	$5	$13	**3**	**3**	**-24%**	**26**	**29**
1202	**Oakland-Alameda-San Francisco Ferry Frequency Improvements**	Multi-County	$16	$5	$13	**3**	**3**	**-20%**	**27**	**28**
1102	**Caltrain Modernization - Phase 1 + Phase 2** (Capacity Expansion)	Multi-County	$236	$77	$222	**3**	**3**	**-6%**	**28**	**26**
411	**SR-4 Auxiliary Lanes - Phase 1 + Phase 2** (Concord to Pittsburg)	Contra Costa	$44	$15	$42	**3**	**3**	**-5%**	**29**	**27**
507	**Vasona LRT – Phase 2** (Winchester to Vasona Junction)	Santa Clara	$30	$11	$27	**3**	**2**	**-12%**	**30**	**34**
515	**Tasman West LRT Realignment** (Fair Oaks to Mountain View)	Santa Clara	$48	$18	$38	**3**	**2**	**-21%**	**31**	**37**
517	**Stevens Creek BRT**	Santa Clara	$29	$11	$23	**3**	**2**	**-20%**	**32**	**38**
102	**US-101 and I-280 HOV Lanes** (GP Lane Conversions in San Francisco, widening in San Mateo County)	San Mateo - San Francisco	$63	$25	$60	**3**	**2**	**-5%**	**33**	**31**
503	**SR-152 Tollway**	Santa Clara	$95	$37	$90	**3**	**2**	**-5%**	**34**	**33**
307	**Caltrain to Transbay Transit Center + Electrification**	Multi-County	$290	$113	$274	**3**	**2**	**-5%**	**35**	**35**
331	**Better Market Street**	San Francisco	$32	$13	$31	**3**	**2**	**-4%**	**36**	**32**
1206	**Alameda Point-San Francisco Ferry**	Multi-County	$12	$5	$9	**2**	**2**	**-20%**	**37**	**39**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
1204	**Berkeley-San Francisco Ferry**	Multi-County	$10	$4	$7	**2**	**2**	**-26%**	**38**	**41**
1302	**Express Lane Network (East and North Bay)**	Multi-County	$214	$91	$226	**2**	**2**	**6%**	**39**	**30**
206	**AC Transit Service Frequency Improvements**	Alameda	$248	$120	$226	**2**	**2**	**-9%**	**40**	**40**
513	**North Bayshore LRT** (NASA/Bayshore to Google)	Santa Clara	$42	$22	$37	**2**	**2**	**-12%**	**41**	**43**
502	**Express Lane Network (Silicon Valley)**	Santa Clara	$69	$38	$84	**2**	**2**	**21%**	**42**	**36**
604	**Solano County Express Bus Network**	Solano	$21	$12	$18	**2**	**2**	**-13%**	**43**	**46**
522	**VTA Service Frequency Improvements** (10 minutes)	Santa Clara	$177	$99	$157	**2**	**2**	**-11%**	**44**	**45**
402	**eBART – Phase 2** (Antioch to Brentwood)	Contra Costa	$21	$12	$20	**2**	**2**	**-4%**	**45**	**44**
311	**Muni Forward Program**	San Francisco	$60	$36	$62	**2**	**2**	**2%**	**46**	**42**
901	**US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2**	Marin - Sonoma	$31	$19	$29	**2**	**1**	**-6%**	**47**	**48**
409	**I-680/SR-4 Interchange Improvements + HOV Direct Connector**	Contra Costa	$42	$27	$41	**2**	**2**	**-1%**	**48**	**47**
103	**El Camino Real Rapid Bus** (Daly City to Palo Alto)	San Mateo	$54	$36	$45	**2**	**1**	**-16%**	**49**	**52**
401	**TriLink Tollway + Expressways** (Brentwood to Tracy/Altamont Pass)	Contra Costa	$75	$51	$72	**1**	**1**	**-4%**	**50**	**49**
312	**19th Avenue Subway** (West Portal to Parkmerced)	San Francisco	$39	$27	$36	**1**	**1**	**-7%**	**51**	**50**
801	**Golden Gate Transit Frequency Improvements**	Marin - Sonoma	$11	$8	$10	**1**	**1**	**-5%**	**52**	**51**
313	**Muni Service Frequency Improvements**	San Francisco	$89	$79	$92	**1**	**1**	**3%**	**53**	**54**
1413	**Local Streets and Roads Maintenance** (Preserve Conditions vs. Local Funding)	Multi-County	$194	$198	$230	**1**	**1**	**19%**	**54**	**53**
516	**VTA Express Bus Network**	Santa Clara	$18	$19	$14	**0.9**	**0.7**	**-18%**	**55**	**55**
202	**East-West Connector** (Fremont to Union City)	Alameda	$10	$12	$9	**0.9**	**0.7**	**-18%**	**56**	**56**

ID	Project Name	County	Annual Benefit ($2017M)	Annual Cost ($2017M)	Adjusted Annual Benefit ($2017M)	Original B/C	Adjusted B/C	Percent Change B/C	Original Rank	Adjusted Rank
304	**Southeast Waterfront Transportation Improvements** (Hunters Point Transit Center + New Express Bus Services)	San Francisco	$16	$27	$19	**0.6**	**0.7**	**14%**	**57**	**57**
410	**Antioch-Martinez-Hercules-San Francisco Ferry**	Contra Costa	$9	$16	$9	**0.6**	**0.6**	**-3%**	**58**	**59**
403	**I-680 Express Bus Frequency Improvements**	Contra Costa	$12	$21	$11	**0.6**	**0.5**	**-6%**	**59**	**60**
404	**SR-4 Widening (Antioch to Discovery Bay)**	Contra Costa	$9	$17	$10	**0.5**	**0.6**	**8%**	**60**	**58**
510	**Downtown San Jose Subway** (Japantown to Convention Center)	Santa Clara	$10	$18	$10	**0.5**	**0.5**	**-2%**	**61**	**61**
104	**Geneva-Harney BRT + Corridor Improvements**	San Mateo - San Francisco	$15	$46	$13	**0.3**	**0.3**	**-14%**	**62**	**63**
508	**SR-17 Tollway + Santa Cruz LRT** (Los Gatos to Santa Cruz)	Santa Clara	$57	$200	$61	**0.3**	**0.3**	**6%**	**63**	**62**
519	**Lawrence Freeway** (US-101 to I-280)	Santa Clara	$7	$34	$7	**0.2**	**0.2**	**-2%**	**64**	**65**
601	**I-80/I-680/SR-12 Interchange Improvements**	Solano	$5	$32	$8	**0.2**	**0.2**	**56%**	**65**	**64**
1304	**Bay Bridge West Span Bike Path**	Multi-County	$4	$30	$2	**0.1**	**0.1**	**-56%**	**66**	**66**
205_15	**Express Bus Bay Bridge Contraflow Lane**	Multi-County	$0	$10	$0	**0.0**	**0.0**	**--**	**67**	**67**
1201	**Redwood City-San Francisco Ferry**	Multi-County	$0	$8	$0	**0.0**	**0.0**	**--**	**67**	**67**
905	**SMART – Phase 3** (Windsor to Cloverdale)	Sonoma	$0	$12	$0	**0.0**	**0.0**	**--**	**67**	**67**

Memorandum

TO: Kristen Carnarius and Dave Vautin, MTC

FROM: Casey Osborn and Krista Jeannotte, Cambridge Systematics, Inc

DATE: May 11, 2016

RE: Plan Bay Area 2040 Project Performance Support – Task 5.1 Equity Assessment

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This memorandum and accompanying spreadsheet represent the Plan Bay Area 2040 Project Performance Support deliverable for Task 5.1. It contains a summary of the equity assessment methodology and results.

Equity Assessment Methodology

As part of the performance assessment for the Plan Bay Area 2040 update, a separate equity assessment was conducted focused exclusively on a project's ability to support the equity issue areas of Plan Bay Area 2040 and to serve vulnerable populations. This equity assessment first isolated each project's scores on the equity related targets in the performance assessment. Next, the assessment considered how each project would increase access for vulnerable populations, also known as "Communities of Concern." Projects that did not increase access for these populations did not receive a score in the equity assessment. Projects that did increase access were ranked according to their score on the equity targets.

The equity-related targets taken from the overall performance assessment were:

- Reduce adverse health impacts associated with air quality, road safety, and physical activity by 10% (Target 3);
- Decrease by 10% the share of lower-income residents' household income consumed by transportation and housing (Target 5);
- Increase the share of affordable housing in PDAs, TPAs, or other high-opportunity areas by 15% (Target 6);
- Reduce the share of low-and moderate-income renter households in PDAs, TPAs, or high-opportunity areas that are at an increased risk of displacement to 0% (Target 7);
- Increase the share of jobs accessible within 30 minutes by auto or within 45 minutes by transit by 20% in congested conditions (Target 8); and
- Increase by 35% the number of jobs in predominantly middle-wage industries (Target 9).

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The same scoring methods from the targets assessment were used for the equity analysis: strong support (1); moderate support (0.5); minimal impact (0); moderate adverse (-0.5); and strong adverse (-1). The six equity related target scores were summed to calculate an overall equity targets score ranging from +6 to -6, strong support to strong adverse impact.

To identify whether a project served a vulnerable population, each project was mapped against census tracts identified by MTC as "Communities of Concern," an index that takes into account multiple disadvantage factors[1] including percent of residents that are low-income, members of a minority group, zero-household vehicles, to name a few. At first, service areas were defined broadly, consistent with the service areas used in the overall performance assessment. A service area includes not only the cities within and adjacent to a project and its access points (bus stop, freeway on ramps, etc.), but also any cities that connect or meet up with the project area (e.g., one stop away on a BART train or along a commute path).

By this definition service areas cast a wide net, and under the service area geography nearly all projects served a Community of Concern.[2] Such a high performance rate made it clear that the Communities of Concern "service area" methodology was not subtle enough to capture variations in project locations and types.

As such, the process was refined, and projects were evaluated on whether or not they *increased access* for a Community of Concern. Using GIS, the projects that actually ran within Communities of Concern, and/or contained access points within those Communities of Concern, were identified.

This more detailed increased access consideration resulted in 16 projects that *do not* increase access for a Community of Concern. Examples to illustrate how the criteria of access points affected projects that formerly contained service areas with Communities of Concern include:

- While several ferry projects had service areas that included communities of concern such as Berkeley and San Francisco, access points along the Bay and the project scope itself were not within Communities of Concern.

- Many of the light rail transit projects in the South Bay appeared to primarily increase access for wealthier outlying areas, not necessarily for Communities of Concern. Under the service area methodology, Communities of Concern within the City of San Jose resulted in these projects initially "serving" a Communities of Concern, when in actuality no part of the project area fell within a Community of Concern.

[1] For Plan Bay Area 2040, the definition of communities of concern include all census tracts that have a concentration of BOTH minority AND low-income households at specified thresholds of significance, or that have a concentration of low-income households AND a concentration of three or more of six additional factors. These additional factors include: limited English proficiency population, zero-vehicle households, seniors 75 and older, and people with a disability, single-parent families, and severely cost-burdened renters.

[2] The exceptions were two projects, an ITS and freeway project in the Tri-Valley.

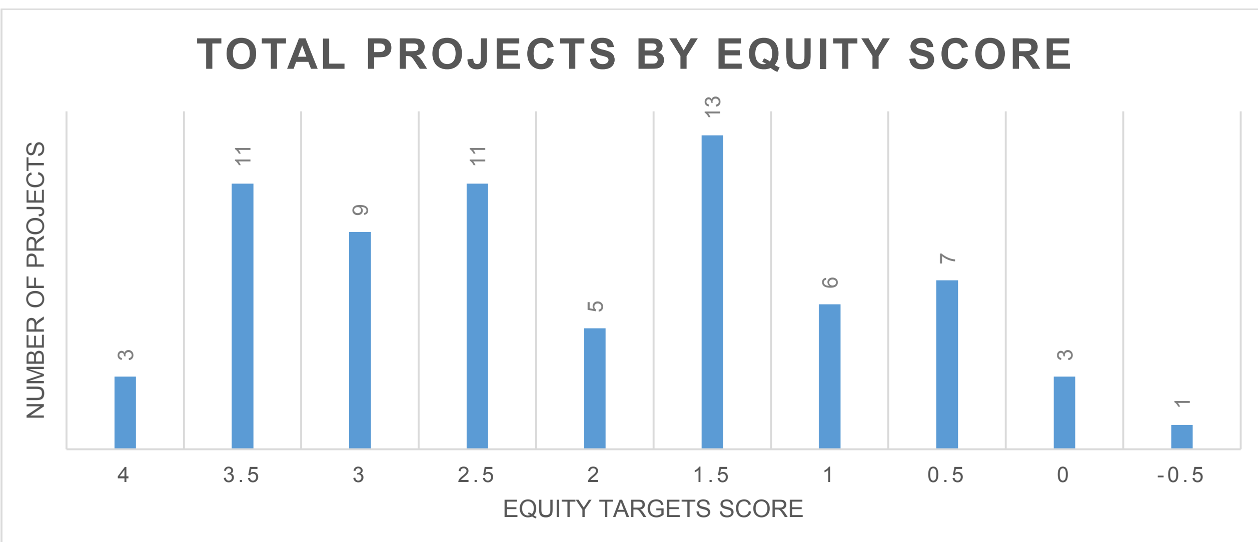
Results

Of the projects, 53 provided access to a Community of Concern, while 16 did not. The projects that increased access for a Community of Concern were then ranked according to their total equity targets score. Table 1 presents the equity analysis results.

The projects that performed highest on the equity assessment were large scale transit projects serving primarily inner urban areas, including San Pablo and Geary BRT, BART Metro, Muni Forward and AC Transit Frequency Improvements, and BART to Silicon Valley. Rounding out the top ten were VTA's Steven Creek LRT, El Camino Real BRT, and Downtown San Jose Subway. The highest scoring non-transit project was the Columbus Day Initiative. While the highest possible equity score possible was six, the three highest-performers only received a score of four. This is in part due to the many "Moderate Adverse" scores on the displacement target. The same inner urban areas that have the potential to increase access for a number of Communities of Concern, are also the areas with some of the highest risks for displacement.

In general, roadway projects did not score as high on equity targets as transit projects. This is partially attributable to roadway project's overall lower performance on targets promoting healthy and safe communities, and decreasing household and transportation costs. Figure 1 below provides a break down of number of projects by equity score.

Figure 1: Number of Projects by Equity Score



CAMBRIDGE SYSTEMATICS

Table 1: Equity Analysis Scoring

PROJECT ID	PROJECT NAME	3 - HEALTHY + SAFE COMMUNITIES	5 - HOUSING + TRANSPORTATION COSTS	6 - AFFORDABLE HOUSING	7 - DISPLACEMENT RISK	8 - ACCESS TO JOBS	9 - JOBS CREATION	EQUITY TARGET SCORE	SERVES COMMUNITY OF CONCERN
207	San Pablo BRT (San Pablo to Oakland)	STRONG SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	4	Yes
501	BART to Silicon Valley – Phase 2 (Berryessa to Santa Clara)	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	4	Yes
1001	BART Metro Program (Service Frequency Increase + Bay Fair Operational Improvements + SFO Airport Express Train)	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	4	Yes
206	AC Transit Service Frequency Improvements	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	3.5	Yes
301	Geary BRT	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	STRONG SUPPORT	3.5	Yes
311	Muni Forward Program	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	STRONG SUPPORT	3.5	Yes
402	eBART – Phase 2 (Antioch to Brentwood)	MINIMAL IMPACT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	3.5	No
504	Stevens Creek LRT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	3.5	Yes
506	El Camino Real BRT (Palo Alto to San Jose)	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	3.5	Yes
507	Vasona LRT – Phase 2 (Winchester to Vasona Junction)	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	3.5	No
510	Downtown San Jose Subway (Japantown to Convention Center)	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	3.5	Yes
522	VTA Service Frequency Improvements (10-Minute Frequencies)	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	3.5	Yes
1650	Public Transit Maintenance - Bus	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	3.5	Yes
1651	Public Transit Maintenance - Rail	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	3.5	Yes
304	Southeast Waterfront Transportation Improvements (Hunters Point Transit Center + New Express Bus Services)	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	3	Yes
307	Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase) + Caltrain to Transbay Transit Center	STRONG SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	3	Yes
312	19th Avenue Subway (West Portal to Parkmerced)	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	3	Yes
313	Muni Service Frequency Improvements	STRONG SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	3	Yes
505	Capitol Expressway LRT – Phase 2 (Alum Rock to Eastridge)	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	3	Yes
515	Tasman West LRT Realignment (Fair Oaks to Mountain View)	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	3	No
517	Stevens Creek BRT	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	3	Yes
801	Golden Gate Transit Frequency Improvements	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	3	Yes
903	Sonoma County Service Frequency Improvements	MODERATE SUPPORT	STRONG SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	3	Yes
104	Geneva-Harney BRT + Corridor Improvements	STRONG SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	2.5	Yes
306	Downtown San Francisco Congestion Pricing (Toll + Transit Improvements)	STRONG SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG ADVERSE	STRONG SUPPORT	STRONG SUPPORT	2.5	Yes
513	North Bayshore LRT (NASA/Bayshore to Google)	MODERATE SUPPORT	STRONG SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	2.5	No
516	VTA Express Bus Frequency Improvements	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	2.5	Yes
523	VTA Service Frequency Improvements (15-Minute Frequencies)	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	2.5	Yes
1101	Caltrain Modernization - Phase 1 (Electrification + Service Frequency Increase)	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	2.5	Yes
1102	Caltrain Modernization - Phase 1 + Phase 2 (Electrification + Service Frequency Increase + Capacity Expansion)	STRONG SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	2.5	Yes
1203	Vallejo-San Francisco + Richmond-San Francisco Ferry Frequency Improvements	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE SUPPORT	2.5	Yes
1204	Berkeley-San Francisco Ferry	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG SUPPORT	2.5	No
1301	Columbus Day Initiative	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	2.5	Yes
205_15	Express Bus Bay Bridge Contraflow Lane	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	2.5	Yes
203	Irvington BART Infill Station	MODERATE SUPPORT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	2	No
331	Better Market Street	MODERATE SUPPORT	STRONG SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	2	Yes

PROJECT ID	PROJECT NAME	3 - HEALTHY + SAFE COMMUNITIES	5 - HOUSING + TRANSPORTATION COSTS	6 - AFFORDABLE HOUSING	7 - DISPLACEMENT RISK	8 - ACCESS TO JOBS	9 - JOBS CREATION	EQUITY TARGET SCORE	SERVES COMMUNITY OF CONCERN
905	SMART – Phase 3 (Santa Rosa Airport to Cloverdale)	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	2	No
1403	Local Streets and Roads Maintenance (Preserve Conditions vs. No Funding)	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	2	Yes
1413	Local Streets and Roads Maintenance (Preserve Conditions vs. Local Funding)	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	2	Yes
302	Treasure Island Congestion Pricing (Toll + Transit Improvements)	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	1.5	Yes
403	I-680 Express Bus Frequency Improvements	MODERATE SUPPORT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	1.5	Yes
409	I-680/SR-4 Interchange Improvements + HOV Direct Connector	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	1.5	No
410	Antioch-Martinez-Hercules-San Francisco Ferry	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	1.5	Yes
502	Express Lane Network (Silicon Valley)	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	1.5	Yes
508	SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG SUPPORT	1.5	No
519	Lawrence Freeway	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	1.5	Yes
601	I-80/I-680/SR-12 Interchange Improvements	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	1.5	Yes
604	Solano County Express Bus Network	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	1.5	Yes
901	US-101 Marin-Sonoma Narrows HOV Lanes – Phase 2	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	1.5	No
1302	Express Lane Network (East and North Bay)	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	STRONG SUPPORT	STRONG SUPPORT	1.5	Yes
1502	Highway Maintenance (Preserve Conditions vs. No Funding)	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	1.5	Yes
1502	Highway Maintenance (Ideal Conditions vs. Preserve Conditions)	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	1.5	Yes
103	El Camino Real Rapid Bus (Daly City to Palo Alto)	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	1	Yes
401	TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass)	MODERATE ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	1	No
605	Jepson Parkway (Fairfield to Vacaville)	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE SUPPORT	1	Yes
1201	San Francisco-Redwood City + Oakland-Redwood City Ferry	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	1	No
1206	Alameda Point-San Francisco Ferry	MODERATE SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	STRONG ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	1	Yes
1304	Bay Bridge West Span Bike Path	MODERATE SUPPORT	MODERATE SUPPORT	MODERATE SUPPORT	STRONG ADVERSE	MINIMAL IMPACT	MODERATE SUPPORT	1	Yes
102	US-101 HOV Lanes (San Francisco + San Mateo Counties)	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	0.5	Yes
202	East-West Connector (Fremont to Union City)	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	0.5	Yes
210	I-580 ITS Improvements	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	0.5	No
404	SR-4 Widening (Antioch to Discovery Bay)	STRONG ADVERSE	MINIMAL IMPACT	STRONG SUPPORT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	0.5	Yes
411	SR-4 Auxiliary Lanes - Phases 1 + 2 (Concord to Pittsburg)	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE SUPPORT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	0.5	Yes
518	ACE Alviso Double-Tracking	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	0.5	No
1202	Oakland-Alameda-San Francisco Ferry Frequency Improvements	MODERATE SUPPORT	MINIMAL IMPACT	MODERATE ADVERSE	STRONG ADVERSE	STRONG SUPPORT	MODERATE SUPPORT	0.5	Yes
101	Express Lane Network (US-101 San Mateo/San Francisco)	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	STRONG SUPPORT	0	Yes
209	SR-84 Widening + I-680/SR-84 Interchange Improvements (Livermore to I-680)	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	0	No
503	SR-152 Tollway (Gilroy to Los Banos)	MODERATE ADVERSE	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MINIMAL IMPACT	MODERATE SUPPORT	0	Yes
211	SR-262 Connector (I-680 to I-880)	MODERATE ADVERSE	MINIMAL IMPACT	MODERATE ADVERSE	MODERATE ADVERSE	MODERATE SUPPORT	MODERATE SUPPORT	-0.5	No

Projects that scored high on the equity targets (with scores of 3 or greater), but failed to increase access for a Community of Concern included eBART, and two VTA LRT projects: Vasona and Tasman West LRT. There were more transit projects (9) than roadway projects (6) that did not serve Communities of Concern. The only other project that failed to serve a Community of Concern was the Santa Cruz tollway and LRT project, which is both a transit and roadway project.

Lastly, only four projects received a zero or negative score on equity targets. Of these four, two – US-101 Express Lane Network in San Mateo and San Francisco, and SR-152 Tollway – increased access for Communities of Concern. However, given their equity score of 0, the project's increase in access does not advance the six equity-related targets for Plan Bay Area 2040.

METROPOLITAN
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Memorandum

TO: Planning Committee DATE: July 1, 2016

FR: Executive Director

RE: Plan Bay Area 2040: Compelling Case Review for Low-Performing Projects

At the May Commission meeting, the Commission approved the final project performance assessment results for Plan Bay Area (PBA) 2040, as well as thresholds for identifying high- and low-performing projects and eligible cases for the compelling case process. Since that time, staff has met with low-performing project sponsors to determine the best path forward for each of the eighteen projects identified. Eight sponsors decided to file a case for review by staff and by the Planning Committee. This memorandum summarizes the staff recommendations for low-performing projects. Staff is asking the committee to take action on low-performing projects this month to ensure that these actions are reflected in the transportation investment strategy for the preferred scenario, slated for adoption this fall.

Staff continues to work with high-performing project sponsors to catalog committed funding sources and to prioritize funding. An update on this equally important implementation action from the project performance assessment will be provided at your September meeting.

Background

The project performance assessment for PBA 2040 was designed to help inform policymakers and the public regarding the cost-effectiveness and targets support for all of the region's major uncommitted transportation investments. The Commission adopted guidelines for implementing the performance results in the investment strategy, setting thresholds that identified 11 high-performing projects, 40 medium-performing projects, and 18 low-performing projects. High-performing projects were identified as the top priorities for regional discretionary funding in PBA 2040, with county and regional budgets anticipated to fund some – but not all – of the medium-performing projects.

Similar to the PBA process, the Commission also approved in May a set of criteria shown in **Attachment A** under which a compelling case can be made for a project to be upgraded from low-performing to medium-performing status. A low-performing project may only be included in the PBA 2040 transportation investment strategy if the project is financially feasible (i.e. having a full funding plan) and if it makes a compelling case under at least one of the identified criteria.

Committee approval of a compelling case does not guarantee that the project will ultimately be included in the fiscally-constrained transportation investment strategy. Instead, approving a compelling case only allows for the project to compete with other projects.

Low-Performing Projects: Exemptions

Rather than go through the compelling case process, seven of the 18 low-preforming projects decided to rescope their projects or fund them with 100% local dollars, thus exempting them from performance requirements. Additional details are as follows:

- Five projects were converted to environmental studies, which are exempt from a performance assessment.
- Two projects were reduced in scope, with sponsors committing to fully fund the downscoped project with local sales tax dollars (thus making them committed investments).

Three additional projects were also updated prior to the beginning of the compelling case process. Additional details are as follows:

- Two projects provided updated cost or scope data that sufficiently demonstrated they could achieve a benefit-cost ratio greater than one, thus allowing staff to redesignate them as medium-performing projects.
- One project was dropped due to its status as a “vision” (not fiscally-constrained) project in that county’s transportation plan, per direction from the project sponsor.

A summary of these projects is provided in **Attachment B**.

Low-Performing Projects: Compelling Case Review

For the remaining seven projects that did submit a compelling case for review by the committee, MTC staff recommends approving four projects, all of which fall under criterion 2A (improving air quality in a cost-effective manner) or criterion 2B (improving mobility or air quality in Communities of Concern). The remaining three projects – totaling $1.2 billion – did not, in the opinion of MTC staff, submit a sufficient compelling case based on an evaluation against the six adopted criteria. As shown in **Attachment C**, staff recommends shifting two of those projects to environmental studies for further analysis, while downscoping the third project below the $100 million threshold for performance analysis.

Next Steps

For projects whose compelling cases are ultimately approved by the committee, MTC staff will work with the relevant congestion management agencies (CMAs) to determine if the project can fit within the fiscal constraint of PBA 2040. For projects whose compelling cases are rejected by the committee, the project sponsor can take one of the following approaches:

1. **The project can be dropped and the CMA can re-allocate funds to other local or regional priorities.** Given that many projects are not able to be funded within the funding constraint of PBA 2040, CMAs could choose to fund higher-performing projects instead.
2. **The project sponsor can concur with MTC’s recommendation to update the project scope.** Environmental studies, or projects with a cost less than $100 million, are exempt from performance requirements.

3. **The CMA or project sponsor may elect to fully fund the project with local sources (such as local sales tax revenues), subject to project sponsor board approval.** This would meet the committed policy for PBA 2040. The relevant board would be required to approve this funding policy decision, as it would indicate that local funding would be the planned sole funding source for that project moving forward.

Steve Heminger

Attachments:

- Attachment A: Low-Performing Projects – Adopted Compelling Case Criteria
- Attachment B: Low-Performing Projects – Rescoped to Exempt Status or Dropped
- Attachment C: Summary of Compelling Cases and Justification for Staff Recommendation
- Attachment D: Compelling Cases Letters Received
- PowerPoint

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Low-Performing Projects – Adopted Compelling Case Criteria

CATEGORY 1: Benefits Not Captured by the Travel Model	CATEGORY 2: Federal Requirements
1. Serves an interregional or recreational corridor 2. Provides significant goods movement benefits 3. Project benefits accrue from reductions in weaving, transit vehicle crowding or other travel behaviors not well represented in the travel model 4. Enhances system performance based on complementary new funded investments	1. Cost-effective means of reducing CO_2, PM, or ozone precursor emission (on cost per ton basis) 2. Improves transportation mobility/reduces air toxics and PM emissions in communities of concern

Low-Performing Projects – Rescoped to Exempt Status or Dropped

NOT SUBJECT TO COMPELLING CASE DUE TO REVISION BY PROJECT SPONSOR **Now Only Seeking Funding for Environmental Phase***
Downtown San Jose Subway (Japantown to Convention Center)
SR-17 Tollway + Santa Cruz LRT (Los Gatos to Santa Cruz)
Bay Bridge West Span Bike Path
VTA Express Bus Frequency Improvements
Express Bus Bay Bridge Contraflow Lane**

NOT SUBJECT TO COMPELLING CASE DUE TO REVISION BY PROJECT SPONSOR **Rescoped to Initial Phase + Fully Funded with Local Sales Tax or Tolls**
TriLink Tollway + Expressways (Brentwood to Tracy/Altamont Pass) • Rescoped to only include Airport Connector arterial segment near Byron. • Project will be funded 100% with future local sales tax revenues.
Lawrence Freeway • Rescoped to Tier 1 elements of corridor upgrades. • Project will be funded 100% with future local sales tax revenues.

UPDATED PROJECT COSTS – NOW MEDIUM-PERFORMING PROJECTS **Reduced Project Costs to Achieve B/C Ratio Greater than 1**
Antioch-Martinez-Hercules-San Francisco Ferry • Smaller-scale privately-operated ferries would cost less than traditional WETA service. • Updated audited costs would result in a B/C ratio greater than 1.
I-680 Express Bus Frequency Improvements • Initial cost estimate was well above standard hourly rate for express bus service. • Updated audited costs would result in a B/C ratio of 2, shifting it to medium-performer status.

NOT PURSUED BY PROJECT SPONSORS
SR-4 Widening (Antioch to Discovery Bay)

* = An environmental phase is defined as work on environmental studies or preliminary design engineering.
** = Project sponsor initially submitted a compelling case but ultimately concurred with staff recommendation to shift the project to an environmental-only phase.

Summary of Compelling Cases and Justification for Staff Recommendation

All costs shown are in year 2017 dollars and reflect total capital + net O&M costs.

COMPELLING CASE APPROVED AT JUNE PLANNING COMMITTEE
I-80/I-680/SR-12 Interchange Improvements

<table>
<tr><td colspan="2">Plan Bay Area 2040 Compelling Case Review Sheet</td></tr>
<tr><td>1. SR-262 CONNECTOR (I-680 TO I-880)
Staff Recommendation: Upgrade to Medium-Performer</td><td>$101 million
in total costs</td></tr>
<tr><td colspan="2">BENEFIT-COST RATIO = 4; <u>TARGETS SCORE = -0.5</u></td></tr>
<tr><td colspan="2">Project Purpose: Upgrades existing facility to freeway standard from I-880 to I-680 and grade separates the facility.</td></tr>
<tr><td>COMPELLING CASE ARGUMENTS APPROVED</td><td>COMPELLING CASE ARGUMENTS NOT APPROVED</td></tr>
<tr><td><u>2A – COST-EFFECTIVE FOR AIR QUALITY</u>
ACTC notes that the benefit-cost analysis conducted for Plan Bay Area 2040 indicates that the proposed project would improve air quality by reducing greenhouse gas and particulate emissions. Of the 70 projects evaluated in the project performance assessment, the SR-262 Connector was the third-most cost-effective project in the region for reducing greenhouse gas emissions and the 15th-most cost-effective project in the region for reducing particulate emissions. This places the project in the top quartile for both types of emissions and buttresses their case under this criterion.</td><td>none</td></tr>
<tr><td colspan="2">Other considerations noted by project sponsor: partially funded by sales tax measure; connects heavily-congested corridors; includes Complete Streets improvements</td></tr>
</table>

Plan Bay Area 2040 Compelling Case Review Sheet

2. EAST-WEST CONNECTOR (FREMONT TO UNION CITY)
Staff Recommendation: Upgrade to Medium-Performer

$239 million in total costs

BENEFIT-COST RATIO = 0.9; TARGETS SCORE = +1.5

Project Purpose: *Constructs a new facility between I-880 and SR-238 in Fremont near the Union City BART station.*

COMPELLING CASE ARGUMENTS APPROVED	COMPELLING CASE ARGUMENTS NOT APPROVED
2B – COMMUNITIES OF CONCERN ACTC indicates that the East-West Connector project improves mobility for drivers, transit riders, pedestrians, and bicyclists for residents of a Community of Concern located in southern Union City. This roadway project provides a new facility on the eastern side of the Community of Concern, better connecting it to SR-238 and I-880. As assessed by MTC, the project features new capacity for vehicles as well as non-motorized amenities to improve connectivity.	**1C – BENEFITS NOT CAPTURED BY MODEL (NOT SPECIFIED BY ACTC)** ACTC states that the project's benefit-cost ratio is not accurate due to its small size. While MTC agrees that the regional model's precision is lesser for smaller-scale projects, ACTC does not provide any data to support its case, nor does it indicate which benefits were underestimated.

Other considerations noted by project sponsor: partially funded by sales tax measure.

Plan Bay Area 2040 Compelling Case Review Sheet

3. SOUTHEAST WATERFRONT TRANSPORTATION IMPROVEMENTS (HUNTERS POINT TRANSIT CENTER + NEW EXPRESS BUS SERVICES)
Staff Recommendation: Upgrade to Medium-Performer

$193 million in total costs

BENEFIT-COST RATIO = 0.6; TARGETS SCORE = +6.0

Project Purpose: *Increases transit service to a new Hunters Point Transit Center, including new express bus service to downtown San Francisco.*

COMPELLING CASE ARGUMENTS APPROVED	COMPELLING CASE ARGUMENTS NOT APPROVED
2B – COMMUNITIES OF CONCERN SFCTA and other project co-sponsors demonstrate that the project is located in – and provide mobility benefits to – residents of the Bayview and Hunters Point Communities of Concern. The proposed local bus improvements, as well as new express bus lines, are expected to provide access to existing and new employment sites, grocery stores, educational opportunities, and parks in the community. The sponsors also note that the project serves a large number of geographically-isolated subsidized public housing developments in these Communities of Concern, and that the communities served have some of the highest poverty levels in the city of San Francisco.	none

Other considerations noted by project sponsor: serves Hunters Point/Candlestick Point redevelopment area.

Plan Bay Area 2040 Compelling Case Review Sheet

4. GENEVA-HARNEY BRT (PHASE 1)
Staff Recommendation: Upgrade Phase 1 to Medium-Performer

TBD
in total costs

BENEFIT-COST RATIO = 0.3; TARGETS SCORE = +5.0

Project Purpose: *Implements a bus rapid transit line from Hunters Point Transit Center to the Balboa Park BART station, following an interim Phase 1 alignment through Little Hollywood as proposed by SFMTA and SFCTA.*

COMPELLING CASE ARGUMENTS APPROVED	COMPELLING CASE ARGUMENTS NOT APPROVED
2B – COMMUNITIES OF CONCERN SFMTA and SFCTA indicate that the project is primarily located within Communities of Concern, including the neighborhoods of Crocker-Amazon and Hunters Point. More importantly, the project is expected to be heavily utilized by residents of the Communities of Concern, as demonstrated by over 32,000 passenger-boardings along the corridor by today's Muni services. In addition to the new BRT service, new dedicated guideways will be used by several other Muni lines that provide service within the Community of Concern and to job centers across San Francisco. Streetscape elements included in the project scope will also yield mobility benefits for pedestrian and bicycle trips within the Communities of Concern.	none

Other considerations noted by project sponsor: strong performance of project on target score despite poor performance on benefit-cost analysis; serves Hunters Point/Candlestick Point redevelopment area.

Plan Bay Area 2040 Compelling Case Review Sheet	
5. SAN FRANCISCO-REDWOOD CITY + OAKLAND-REDWOOD CITY FERRY **Staff Recommendation: Reject Scope Change and Shift to Environmental Only**	**$147 million** in total costs
BENEFIT-COST RATIO = 0.0; TARGETS SCORE = +2.0	
Project Purpose: *Implements ferry service from San Francisco and Oakland to the Port of Redwood City.*	
COMPELLING CASE ARGUMENTS APPROVED	**COMPELLING CASE ARGUMENTS NOT APPROVED**
none	**REDUCE SCOPE TO TERMINAL ONLY ($30 MILLION)** Redwood City and WETA have requested to include just the terminal component of this project, with the assumption that private operators provide the service at their cost (and that WETA service could begin outside of the Plan horizon). However, given that the project achieved a benefit-cost ratio of zero – indicating negligible ridership potential – shifting costs to private operators would be unlikely to yield an investment with benefit-cost ratio greater than one. Importantly, Redwood City did not submit any documentation demonstrating private-sector interest in operating such a ferry. Past pilots by companies such as Google have been discontinued. Furthermore, it would be unprecedented to include a public transit project in the Plan without the corresponding service. A terminal-only project serving only private charter ferry service would not provide benefits to the public at large. Staff recommend shifting the project scope to include environmental studies of the terminal and of future WETA service to Redwood City, rather than including a terminal-only construction project.
Other considerations noted by project sponsor: project has potential to address capacity constraints on US-101 corridor.	

Plan Bay Area 2040 Compelling Case Review Sheet

6. SR-152 TOLLWAY (GILROY TO LOS BANOS)
Staff Recommendation: Reject Compelling Case and Shift to Environmental Only

$737 million in total costs

BENEFIT-COST RATIO = 3; TARGETS SCORE = -1.5

Project Purpose: *Realigns SR-152 on a new facility east of Gilroy.*

COMPELLING CASE ARGUMENTS APPROVED	COMPELLING CASE ARGUMENTS NOT APPROVED
none	**1A – INTERREGIONAL AND RECREATIONAL TRAFFIC** **1B – GOODS MOVEMENT** **1C – SAFETY BENEFITS NOT CAPTURED BY MODEL** VTA correctly notes a number of characteristics of the project corridor, including its key role in serving interregional freight, its above-average level of recreational travel, as well as the likely safety benefits associated with key features of the new alignment. However, these arguments are not germane to the project in question. SR-152 Tollway is not eligible for criteria under Category 1, as it already received a medium benefit-cost ratio of 3 (meaning that the travel model accurately captured its benefits). Instead, it must make a case that overriding considerations (under Category 2) merit discounting its poor performance on the targets score. **100% LOCALLY FUNDED** VTA made this argument during Plan Bay Area when the project was also identified as a low-performer, committing to fully fund it with tolls. However, they subsequently continued to pursue additional discretionary funds in conflict with their letter to MTC. Documents submitted by VTA indicate that the project continues to require substantial RTIP/ITIP funds (totaling $20 million). Further commitments from VTA to guarantee that startup costs and any toll revenue shortfalls would be covered by local revenues are necessary to qualify for this exemption.

Other considerations noted by project sponsor: none

Plan Bay Area 2040 Compelling Case Review Sheet

7. SMART – PHASE 3 (SANTA ROSA AIRPORT TO CLOVERDALE)
Staff Recommendation: Reject Compelling Case and Downscope

$307 million
in total costs

BENEFIT-COST RATIO = 0.0; TARGETS SCORE = +4.0

Project Purpose: *Extends SMART service from north of Santa Rosa to Windsor, Healdsburg, and Cloverdale.*

COMPELLING CASE ARGUMENTS APPROVED	COMPELLING CASE ARGUMENTS NOT APPROVED
none	**2B – COMMUNITIES OF CONCERN** SMART indicates that the project would benefit residents of Santa Rosa Communities of Concern commuting to jobs in Healdsburg. However, none of the areas served by new stations in this extension (Windsor, Healdsburg, or Cloverdale) would serve a Community of Concern. SMART's ridership forecasts indicate that the "reverse commute" pattern cited above would be quite rare, and that ridership forecasts for Healdsburg and Cloverdale are amongst the lowest in the system. As such, staff does not believe that there is a compelling case that residents of the Santa Rosa Communities of Concern would experience significant increased mobility as a result of a SMART extension miles to the north. SMART does correctly point out that the extension serves tribal lands and lower-income populations in northern Sonoma County (and its neighbors to the north). However, none of the communities identified was approved based on the definition of Community of Concern in Plan Bay Area 2040. **ALTERNATIVE PHASING PROPOSAL** In case the compelling case was not approved, SMART submitted a proposed phasing strategy that breaks the project into multiple pieces, each of which is less than $100 million (passenger service from Santa Rosa Airport to a provisional South Healdsburg station + freight components through Healdsburg + environmental analysis for a future Cloverdale segment). In addition, SMART proposes to reduce the annual O&M costs from greater than $10 million per year to just $1 million per year, a shift that requires further analysis given that most service would still be maintained (excluding service to Cloverdale). MTC staff believes that breaking low-performing projects into pieces to avoid cost-effectiveness requirements is not consistent with the overall spirit and intent of the process. Instead, staff recommends preserving the mutually-acceptable approach from Plan Bay Area – inclusion of the segment to Windsor (~$40 million) as well as environmental studies for the remaining segments to the north.

Other considerations noted by project sponsor: serves agricultural area to the north of Santa Rosa; provides access for veterans to the Veterans Affairs Clinic

Alameda-Contra Costa Transit District

Mike Hursh, General Manager

June 10, 2016

Mr. Steve Heminger
Executive Director
Metropolitan Transportation Commission (MTC)
Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

RE: Bay Bridge Contra-Flow Bus Lane Compelling Case Argument

Dear Mr. Heminger,

In 2015, AC Transit submitted the Contraflow Lane Project for inclusion into the Plan Bay Area Regional Transportation Plan (RTP). The Metropolitan Transportation Commission (MTC) reviewed all projects as part of the Plan Bay Area Project Performance Assessment. In this assessment, the Contraflow Lane performed poorly. AC Transit disagrees with how the project was evaluated and is committed to keeping the contraflow lane in the RTP for it to remain a viable project.

While measuring project performance is crucial for MTC to evaluate projects for the RTP, evaluation of the contraflow lane in isolation misses key elements that interact with other parts of the Transbay travel system that may otherwise affect the rating. The chief specific deficits of the evaluation are outlined below as well as important project benefits not captured in the analysis.

The Evaluation Did Not Consider Future Bus Service Levels

The Contraflow Bus Lane Project was evaluated using existing bus service levels. Presently, seventy buses operated by AC Transit and WestCat cross the Bay Bridge during the peak hour. Both agencies have committed to expand to meet growing demand. The new Transbay Transit Center can accommodate up to a maximum of 300 buses per hour. Thus, the number of passengers using Transbay bus service and the overall project benefit is underestimated. MTC's Core Capacity Transit Study (CCTS) predicts Transbay bus service will more than double by 2040. The Contraflow Bus Lane Project should be evaluated, at the very least, with a conceptual bus operating plan created with input from the transit operators and a method to estimate bus service provided by private operators.

Modeling Accuracy

MTC used its regional model to evaluate the project. The underlying land use assumptions forecast significant job growth in Oakland, generating more work trips to the East Bay across the bridge. The model has a simplifying assumption that the contraflow lane would reduce a five-lane bridge to four lanes. There are three full freeway lanes feeding into the eastbound bridge. The on-ramps at 1st Street and Essex add two more lanes. MTC's model assumption would only hold accurate if the capacity of the on-ramps is equal to a freeway (bridge) lane. A contraflow lane with lower capacity would have less of an impact to actual vehicle capacity. This topic should be evaluated further to determine if travel delays actually would occur, reducing the project's benefits.

In addition, the CCTS has a lower projection of growth in Oakland than Plan Bay Area. Therefore, the evaluation of the Contraflow Lane may have overstated the level of eastbound AM peak travel across the bridge.

Westbound AM Bay Bridge Capacity Assumptions

Removing buses and possibly heavy trucks from the westbound lanes of the Bay Bridge opens up additional vehicle capacity and person-throughput.

Buses: Buses, according to the Federal Highway Administration (FHWA), equal 2 passenger car equivalents. The maximum hourly capacity of the new Transbay Transit Terminal is 300 buses per hour. In addition, it is feasible that another 100 buses could use the lane but not stop in the terminal. This includes private shuttle buses, school buses, tour buses and intercity companies such as Megabus.

Each bus = 2.0 cars. 400 x 2 = 800 cars.
TOTAL ≈ 800 additional peak hour cars on the westbound lanes.

Permit Heavy Duty Commercial Trucks in the Contra-Flow Lane: The lane could also be a High-occupancy Toll Lane. If the Contraflow Bus Lane Project admits heavy trucks into the lane, the effects would be both increased westbound bridge capacity and increased toll revenue. According to the FHWA, in urban areas a heavy truck equals 2.5 passenger car equivalents. In the 5am to 10am period, there are about 976 trucks traveling on the westbound Bay Bridge (162/hour).

Peak Hour Westbound Capacity Calculation
Each truck = 2.5 cars. 162 x 2.5 = 406 cars.

Currently, about 9,500 vehicles pass across the bridge in the peak hour. The Contraflow Bus Lane Project could increase this capacity by about 1,200 vehicles or 12.6 percent of the total volume. Traffic queues at the eastern approaches would also be shortened commensurably.

Tolling trucks using the contraflow lane can generate significant revenue and support the efforts of MTC's Managed Lanes Implementation Plan and potential dynamic pricing on the bridge. In addition, the contraflow lane could greatly speed travel time for commercial trucks, reducing private sector emissions and expenses by lowering fuel and labor costs. The small number of trucks per hour would not degrade the performance of the buses in the lane.

Potential Truck Toll Revenue Calculations

Trucks per 5-hour AM peak period = 976
Weekdays per year = 255 Low toll scenario = $1.00 and High toll scenario = $15.00
Annual Revenue - Low toll scenario ≈ $249,000
Annual Revenue – High toll scenario ≈ $3,733,000

Social Equity

The eastern approach to the Bay Bridge, centered on West Grand Avenue, is a community of concern (see Attachment 1). By reducing the impact of truck traffic on local streets and freeways, the pollution burden on these neighborhoods can be reduced. In addition, by expanding Transbay bus service throughout the West Oakland area, residents would realize better access to higher paying jobs available in the core of San Francisco. The City of Oakland is working closely with AC Transit on an Active Transportation Program to design transit, pedestrian and bicycle improvement along West Grand Avenue. All of these efforts could affect the operation of the Contraflow Bus Lane Project.

Air Quality

The ability of buses and trucks to move smoothly across the bridge without stop-and-go traffic and excessive idling contributes to improved air quality near both approaches to the bridge. A secondary benefit is reduced idling by cars traveling on freeways approaching the bridge.

Costs

The cost estimate supplied for the project was based on a 2011 study, which looked at a range of options for the Contraflow Lane Project. To be conservative, we supplied the highest cost package at the highest range; however, there are other configurations of the project which could cut those costs in half. See Attachment 2 – The Bay Bridge Corridor Congestion Study, page 30. In addition, these costs include the approaches to the contraflow lane improving the travel times more than in the evaluation.

Regional Planning Focus

There is a multi-agency planning process focusing on how to best improve the capacity of the Transbay corridor. MTC's Core Capacity Transit Study is the more appropriate venue for the evaluation of the Contraflow Bus Lane Project as it focuses on the overall person capacity of the bridge and the Bay Area Rapid Transit (BART) system. In less than a year, the CCTS is poised to give a more thorough evaluation of the project combined with other supportive projects organized into coherent packages. Taken together, these supportive projects can create a higher level of benefits than the Contraflow Bus Lane Project in isolation. The restoration of transit service to a former Key System tunnel is being evaluated as part of the CCTS. This potential project could create a new access facility that may further reduce delays accessing the Contraflow Bus Lane Project and increasing the project's benefit. We recommend that a final decision on the performance of the project be completed after the conclusion this study.

Other agencies and stakeholders are also grappling with the eastern approach to the Bay Bridge. The topic is being evaluated in AC Transit's Major Corridors Study and the Alameda County Transportation Commission's Countywide Transit Plan. The findings of both studies will be released in late 2016.

We therefore kindly request that MTC reevaluates the Contraflow Lane Project based on the points outlined in this letter, and request that the project be reconsidered for inclusion into the Regional Transportation Plan.

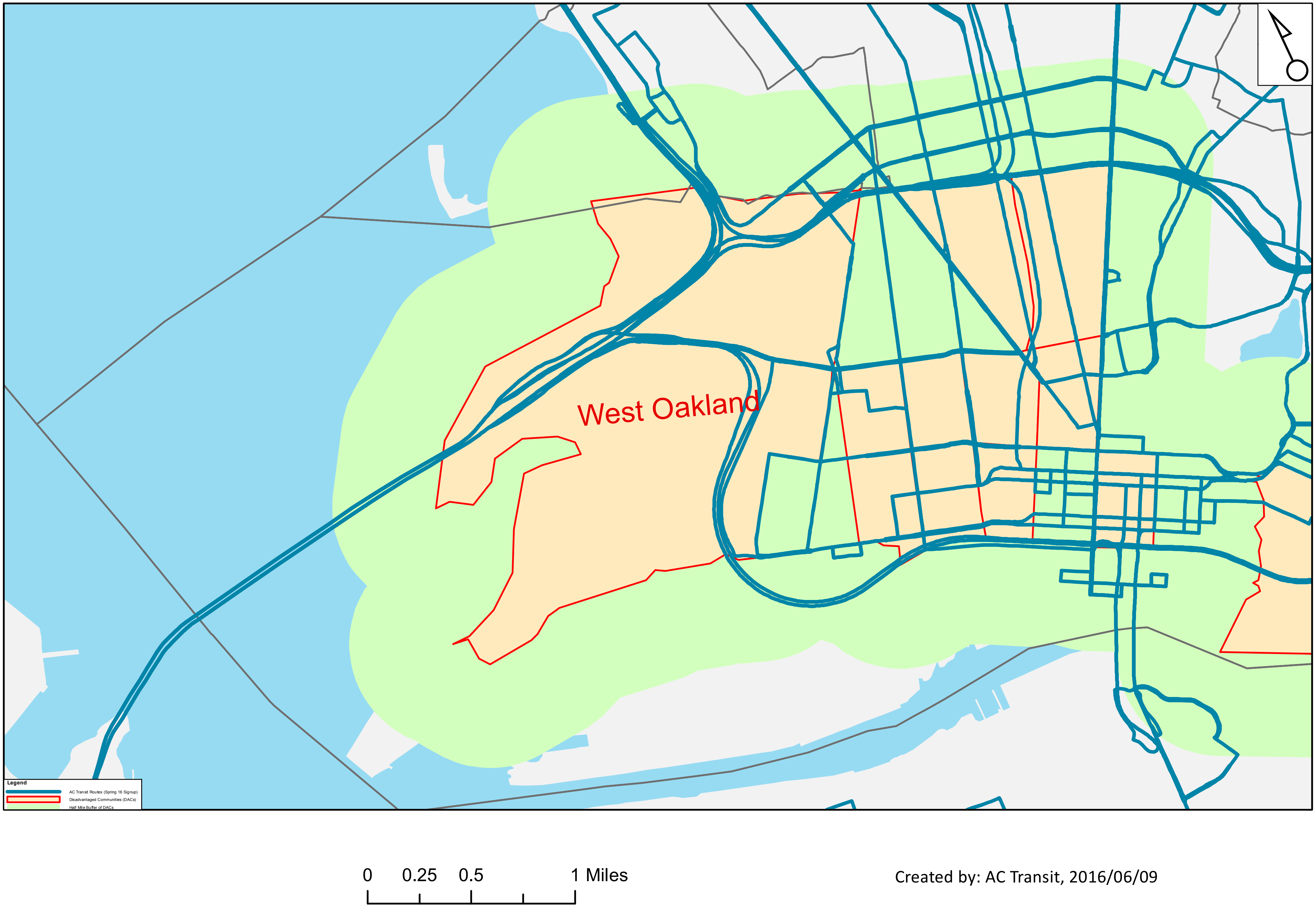
If you have and questions regarding this request, please contact Robert del Rosario, Director of Service Development and Planning at 510-891-4734.

Thank you in advance for your consideration of this request.

Sincerely,

Michael Hursh
General Manager

Disadvantaged Communities and AC Transit Routes



Created by: AC Transit, 2016/06/09

Bay Bridge Corridor Congestion Study

February 2011

Sponsored by:

TJPA

AC Transit

LCW Consulting

Cambridge Systematics

ARUP

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Contents

Summary

The Bay Bridge Corridor Congestion Study estimates the future operating conditions for vehicles traveling across the Bay Bridge from Oakland into San Francisco during the peak morning commute hours. The study utilizes a microsimulation model to analyze a 24-mile freeway network that includes the Bay Bridge, the toll plaza and metering lights in Oakland, the distribution structure ("MacArthur Maze"), and segments of Interstates 80 (I-80), 580, and 880. The study predicts the severity of future vehicle queuing at the toll plaza and assesses how this congestion could affect bus service between the East Bay and the new Transbay Transit Center (TTC).

The analysis indicates that future traffic growth along the corridor will result in a substantial worsening of congestion at the Bay Bridge toll plaza. The projected queues would block the High Occupancy Vehicle (HOV) lanes that currently serve as a bypass around the toll plaza for Transbay buses. These future conditions would result in a significant degradation to transit operations.

To improve operating conditions along the corridor, a series of potential operational and physical improvements are evaluated. These improvements include the implementation of a westbound contraflow lane along the Bay Bridge during the morning commute and various options for accessing the contraflow lane on the Oakland and San Francisco sides. A contraflow lane incorporates a reversible travel lane. In this study, a westbound contraflow lane across the Bay Bridge in the morning would utilize the leftmost travel lane that typically serves eastbound traffic. The analysis indicates that a contraflow lane, in conjunction with a series of other roadway improvements, could help maintain future transit reliability. Conceptual cost estimates and the feasibility of these improvements are also discussed.

The study also considers conditions for the eastbound return trip that originates in the "South-of-Market" (SoMa) district of San Francisco during the afternoon commute. While traffic heading into San Francisco in the morning can queue on freeway lanes approaching the toll plaza in Oakland, traffic exiting San Francisco using the Bay Bridge must queue on local SoMa streets during the afternoon. This queuing can have a negative effect on local transit and traffic operations in San Francisco. For this evaluation, a microsimulation model of 75 intersections within the local SoMa street network was developed. The SoMa model incorporates dynamic assignment, which allows traffic to reroute as congestion builds within the simulation model. A base year calibrated network was developed and several potential improvements to the Bay Bridge on-ramps were investigated. This analysis suggests that the on-ramp changes have local and regional benefits, but further work is required. The effort is intended as a "first-step" towards a more detailed study of these potential improvements.

Enhancing transportation operations and capacity along the Bay Bridge corridor is critical for the following reasons:

- The performance of the new TTC is dependent on maintaining reliable and convenient bus links with the East Bay
- The existing travel demand between the East Bay and San Francisco is approaching the capacity of the available transportation modes (auto, bus, rail, ferry)
- The economic viability of downtown San Francisco, including additional development planned for the SoMa area, is dependent on increasing transportation capacity with the East Bay

The results of the study are intended to provide a point of discussion for policymakers as improvement options are considered in the corridor.

Figure 1: Bay Bridge Corridor Study Area

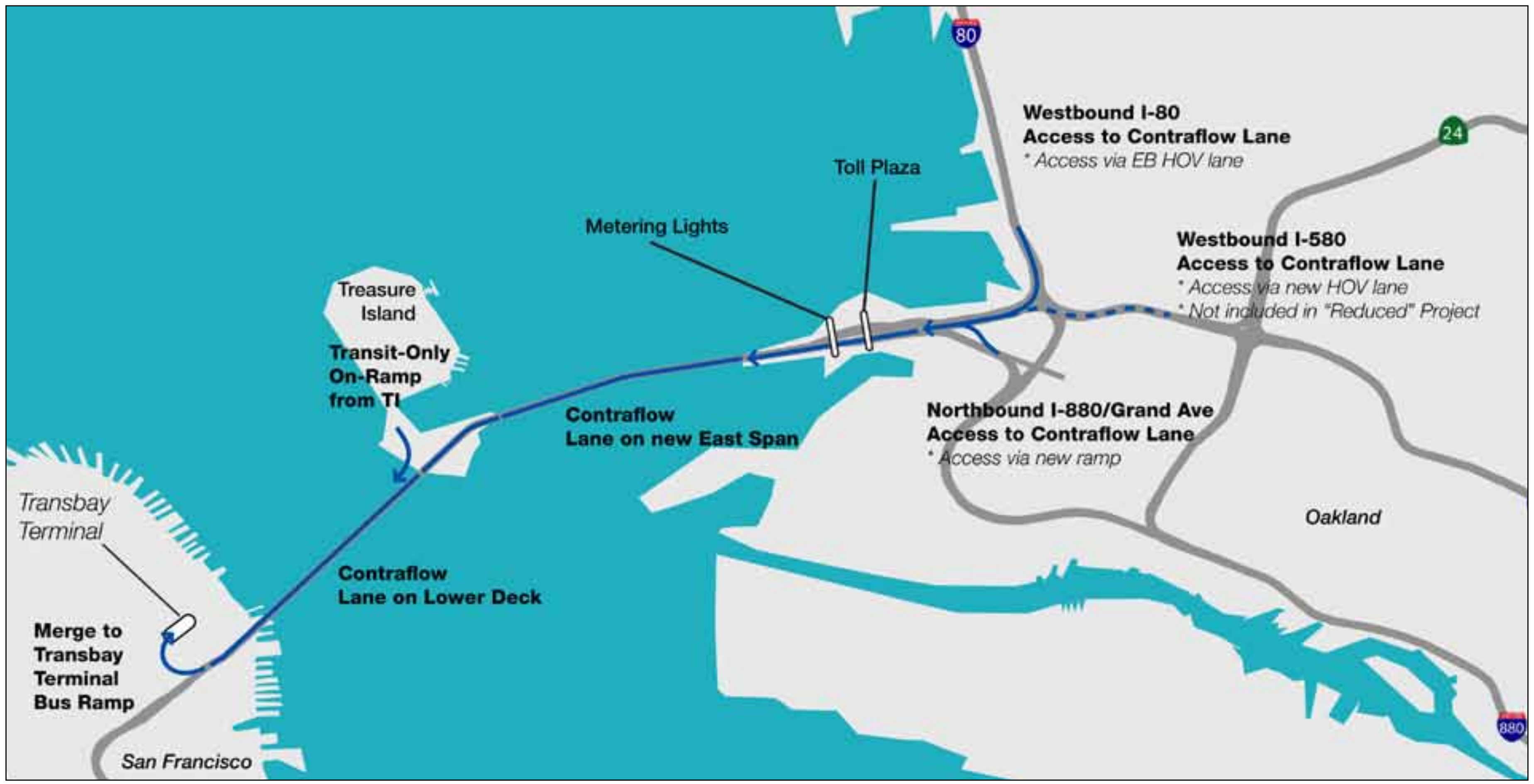


Figure 2: Improvement Options

Model Development

A transportation microsimulation model was developed for a 24-mile study area using the software program VISSIM. Figure 1 presents the study area included in the westbound AM VISSIM model.

The model study network includes fifteen freeway interchanges serving the westbound direction into San Francisco. The VISSIM model was calibrated to October 2009 conditions at the Bay Bridge toll plaza and the metering lights. The calibrated VISSIM model was used as a basis for the future operations analysis.

Improvement Options

The analysis considers two different approaches to improving operations along the westbound Bay Bridge corridor during the morning commute:

1. **Alternative Metering:** Increase the metering rate at the Bay Bridge metering lights to shift the queue on to the bridge and reduce the likelihood of vehicles blocking the HOV bypass lanes.

2. **Physical Improvements:** A package of physical improvements that include a westbound contraflow lane on the Bay Bridge, access points necessary to enter the contraflow lane on the East Bay side and exit the contraflow lane on the San Francisco side of the bridge, and extension of the HOV network in the vicinity of the toll plaza.

Figure 2 shows the package of proposed physical improvements. The contraflow lane could be operated as a bus/high occupancy toll (HOT) facility or as a bus/truck facility.

Summary

Analysis Scenarios

A series of analysis scenarios was developed to assess future operating conditions along the corridor. These scenarios were developed using the calibrated VISSIM model, the improvements listed above, and future 2035 baseline traffic forecasts obtained from the San Francisco County Transportation Authority's (SFCTA) travel demand model (SF-Champ). Existing bus service within the corridor was obtained from current schedules, while future bus service assumptions were developed from TTC planning studies and are based on total TTC capacity. Table 1 summarizes the analysis scenarios:

Scenario	Assumptions
Base Year	• October 2009 traffic volumes and existing bus frequencies • October 2009 roadway network
Future 2020 No Improvements	• 2020 traffic volumes interpolated from 2035 SFCTA travel demand model and 2035 bus frequencies • No changes or improvements to the roadway network
Future 2035 No Improvements	• 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	• 2035 traffic volumes and bus frequencies • No I-580 HOV lane, no metering change • Assumes contraflow lane operates as a HOT lane with 1,000 vehicles per hour

Table 1: Analysis Scenarios

Performance Measures

Performance measures and targets were established by the consultant team in consultation with the stakeholders in the study. The performance measures are grouped into three categories: congestion, transit travel time, and transit reliability. A set of targets is defined for each measure. The performance measures and targets for the westbound Bay Bridge corridor analysis are:

- **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.

The performance measures and targets were evaluated for each scenario based on the results of the microsimulation modeling. Table 2 provides a summary of these results for the 8-9 AM hour. Table 2 indicates whether the target is satisfied – "Pass" – or exceeds the target – "Fail".

The results in Table 2 indicate that the westbound AM corridor would experience acceptable operating conditions through 2020. However, the analysis predicts that conditions for both transit and autos would degrade to unacceptable levels by 2035. The two Physical Improvement scenarios could substantially improve mobility through the corridor, particularly for transit. The results indicate that the physical improvements examined in this study have clear operating benefits.

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

Table 2: Performance Measures

Review and Conclusions

San Francisco employment is projected to increase by about 50 percent over the next 25 years. Already 40,000 workers commute into the city from the East Bay in the peak hour; simply projecting a 50 percent increase beyond the current use will create demand beyond the peak hour capacity of the Bay Bridge and BART.

The study used several analysis tools including:

- A detailed microsimulation model of the AM peak period commute testing a range of improvements, including alternative toll plaza metering and physical projects. The physical improvements included a westbound bus contraflow lane on the Bay Bridge that could operate as bus/HOT lane or a bus/truck lane; other improvements included new ramps to enter and exit the contraflow lane, as well an extension of the HOV network in the East Bay.
- A detailed microsimulation model of the SoMa area in downtown San Francisco studied PM peak period conditions on local streets that serve afternoon commute traffic accessing the eastbound Bay Bridge.

The major conclusions of the Bay Bridge Corridor Congestion Study are:

AM Westbound

- The Bay Bridge and the toll plaza are currently are congested on most days; however, vehicle queues do not typically extend back from the toll plaza to the distribution structure.
- The HOV bypass lanes are not typically blocked, which allows for acceptable bus operations.
- With projected increases in traffic along the corridor, queuing will worsen and routinely block the HOV bypass lanes in the future.
- Transbay buses will not meet transit performance targets by 2035, which will limit the performance of the Transbay Transit Center.
- The physical improvements show considerable promise for maintaining bus travel times and schedule reliability along the corridor, while also providing potential increases in person-trip capacity

PM Eastbound/SoMa

- Based on a preliminary analysis of the SoMa area, a reconfiguration of the Bay Bridge on-ramps and streets feeding these ramps could result in both improvements in regional access to the Bay Bridge and a betterment of local circulation for transit.
- SoMa traffic is impacted by the land configuration of the eastbound West Approach and Bay Bridge.
- The SoMa model development has produced a valuable tool for future study of the area

Overall, the study has identified existing and future constraints along the corridor, developed tools to effectively analyze improvement options, and generated ideas that warrant further study

Introduction

The Challenge

The Association of Bay Area Governments (ABAG) forecasts that San Francisco employment will increase by approximately 240,000 (about 50%) by 2035. The traditional downtown job centers, the Financial District and the "South-of-Market" (SoMa) area, will add more than 100,000 of these jobs. Another 50,000 jobs could be added along the US-101/Bayshore corridor in Priority Development Areas designated by San Francisco and ABAG. To the immediate south of the San Francisco-San Mateo County Line, Brisbane, South San Francisco and the San Francisco International Airport area are projected to add almost 40,000 jobs. Many of these job centers are not located in transit-rich corridors.

Traditionally, East Bay residents have filled about 40 percent of the jobs in downtown San Francisco, 15 percent of the jobs in the 101/Bayshore Corridor, and 5 percent of the jobs in the South San Francisco and Brisbane area. This pattern that will likely continue as population growth in the City is projected to be less than the increase in jobs (160,000 new residents versus 240,000 new jobs).

Already 40,000 workers commute into the city from the East Bay in the peak hour; simply projecting a 50% increase beyond teh current use will create demand beyond the peak hour capacity of the Bay Bridge and BART. However, the Bay Bridge is already at capacity and commuter rail service offered by the San Francisco Bay Area Rapid Transit District (BART) has capacity for only 8,000 to 12,000 additional trips per hour. The new Transbay Transit Center (TTC) will provide additional Transbay capacity on a new and expanded bus deck. However, bus operators are concerned that future traffic growth may compromise the operations of the HOV lanes that allow buses to bypass queues at the Bay Bridge toll plaza. It is likely that demand for job access to transit-deficient locations on U.S. 101 will also compete with existing automobile access to San Francisco. These forecasts suggest that the transportation capacity into San Francisco from the East Bay will not support the level of expected development and could have negative quality-of-life impacts.

In the SoMa area, the local street system often gridlocks with afternoon commute traffic bound for the Bay Bridge. While traffic heading into San Francisco in the morning can queue on freeway lanes approaching the toll plaza in Oakland, traffic exiting San Francisco must queue on the local SoMa streets. Currently, traffic demand from the Financial District and SoMa job centers greatly exceeds the capacity of the Bay Bridge on-ramps in the afternoon. The forecast increase in jobs and residents in downtown San Francisco, coupled with the corridor capacity constraints identified in the westbound AM analysis, will contribute to worsening queuing conditions on locals SoMa streets.

Study Approach

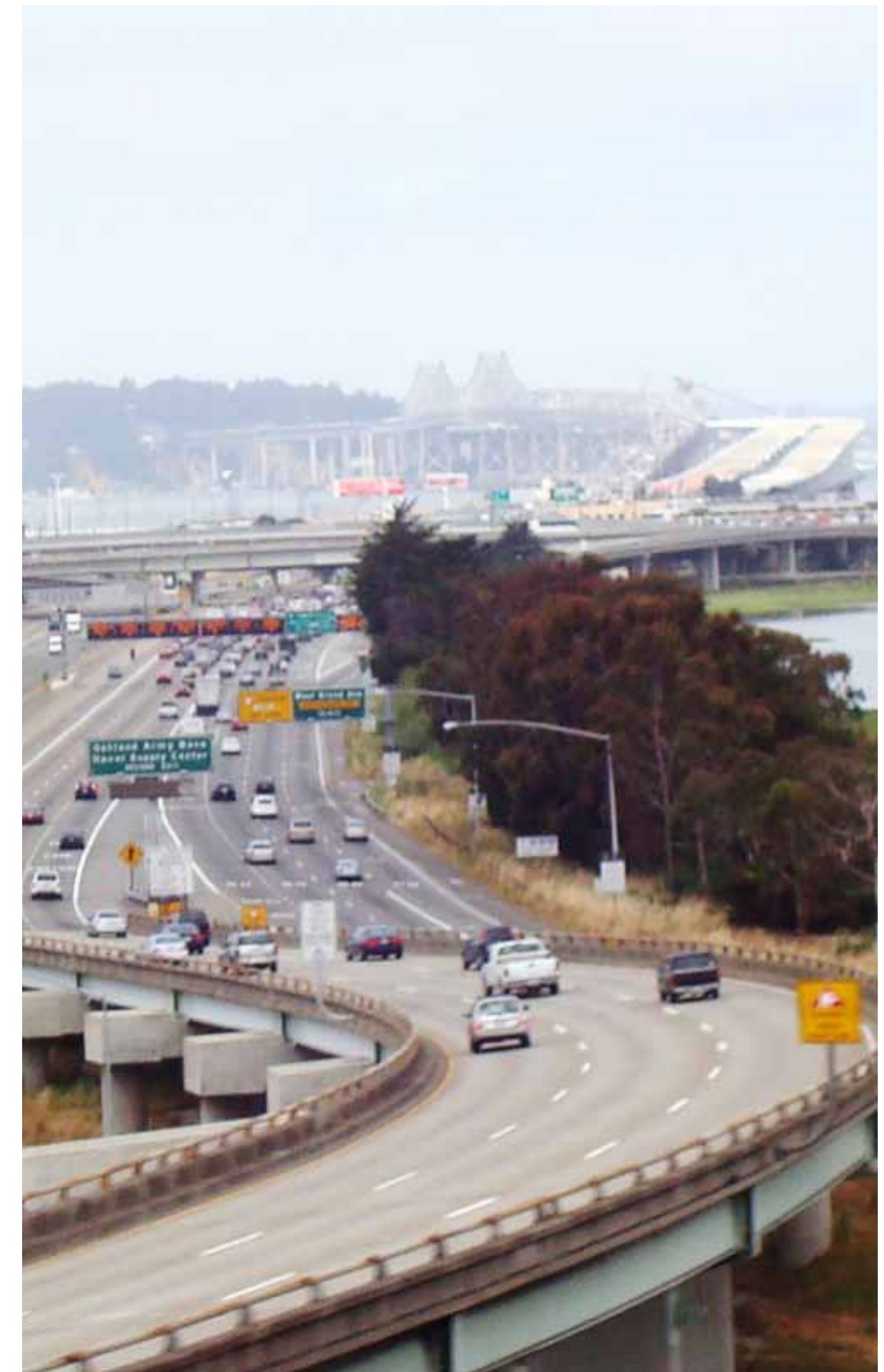
Arup was commissioned by the **Transbay Joint Powers Authority** and **AC Transit** to develop an initial study of the impacts of future demand on the Bay Bridge Corridor. **Cambridge Systematics** provided traffic forecasts and reviewed the microsimulation models. **LCW Consulting** provided analysis and oversight. The objective of the study is to:

> Develop a high-quality analysis that produces an estimate of future operating conditions for cars, trucks and buses along the Bay Bridge corridor under congested conditions. This analysis will identify potential improvement options and serve as a useful case study of corridor planning in the San Francisco Bay Area. The intent is to produce a report that the Federal Transit Administration and other project sponsors can share with planning and transportation agencies to help motivate the discussion of improving mobility along the Bay Bridge corridor.

The SoMa PM analysis considers a different study area with a different set of constraints than the westbound AM analysis. The SoMa PM component of the analysis considers a very large and complex urban grid network, which poses a series of modeling challenges. These challenges have limited the scope of the SoMa analysis presented in this study. However, a set of potential improvements are introduced and investigated.

To complete these expectations, the study's work tasks include:

1. Study of the Bay Bridge Corridor Background and Context
2. Microsimulation Model Development
3. Improvement Options
4. Future Scenario Analysis
5. SoMa Model Development and Analysis
6. Further Study



Previous Studies

The Bay Bridge corridor has been the subject of several studies dating back more than twenty years, usually under the sponsorship and direction of the Metropolitan Transportation Commission (MTC), . These studies include:

The I-80 Corridor Study, issued by MTC in 1988 and prepared with consultant assistance:

The report noted that between 1980 and 2005 workers would increase faster than jobs in the corridor (from Richmond to Solano County) and that even with more than $600 million in highway improvements, “I-80 is projected to experience severe peak hour congestion in the year 2000 from Vallejo to the Bay Bridge, due to increases in commuting.”   Among the projects recommended were the I-80 HOV lanes, which are now in operation. In addition, the study considered an I-80 “Bus Facility” to save time on the Alameda County portion of I-80 as well as the Bay Bridge (not implemented), and also additional express bus improvements and other widening, arterial and park and ride improvements. Many, but not all, of the improvements were completed, including the HOV lanes, the park and ride facilities, and the arterial (San Pablo Avenue) improvements.

San Francisco Bay Crossing Study, prepared for MTC by Korve Engineering, Inc. (1991):

In 1991, under a request from the state Senate, MTC examined 11 “build” alternatives to improve Transbay travel. These ranged from new bridges and tunnels for both cars and trains to additional ferries and airport to airport connections. The options were narrowed to five major concepts:

- High Speed Ferry Service
- I-380 to I-238 (S. San Francisco to Hayward) Bridge with BART
- BART SFO-OAK connection
- New BART Transbay Tube
- Intercity Rail Connection

The key findings were that:

- Planned and programmed improvements including widening the San Mateo-Hayward Bridge and more frequent BART service would provide enough capacity to accommodate Transbay travel to 2010, although congestion would increase.
- The new bridge plus BART would carry the greatest number of trips but would only reduce the duration of the Bay Bridge peak period and not the volume of the peak hour. In addition, there would be significant land use impacts and environmental impacts with new bridges or tunnel options.

San Francisco Bay Crossing Study, prepared for MTC by Korve Engineering, Inc. (2002):

About 10 years after the 1991 study, MTC (in response to a request from Senator Dianne Feinstein) studied six different alternatives for Transbay travel including a new Bridge (again between I-380 and I-238) as well as improvements to the San Mateo Bridge, west side Dumbarton Bridge access improvements, and Dumbarton rail service. A new BART/conventional rail tunnel was also considered, as well as a lower cost express bus and HOV system improvements. The express bus/HOV system included additional HOV lanes, more express bus service in Transbay corridors, and additional park-and-ride lots for Transbay buses.

The key recommendations from the study’s Policy Committee were that:

- Lower cost operational improvements could be implemented as a near-term response to traffic congestion in the bridge corridors. These included additional HOV lanes and Toll Plaza improvements, modest BART capacity increases, and additional express bus service.
- New crossings will be extremely costly, in some cases requiring funding equal to or exceeding the entire amotunt of new regional funds estimated by MTC’s RTP to be available over the next 25 years. The report noted that a “major new Bay crossing has intrigued the public for a long time, but has not yet received a critical mass of support.”
- Use existing funds to reestablish San Mateo Bridge bus service.
- Pursue new bridge toll funds (which were later approved by the Legislature and the voters in RM2) for reversible lanes on the San Mateo-Hayward Bridge, Dumbarton rail basic service, additional carpool lanes and BART core capacity improvements.

Further studies should include:

- Higher cost bridge HOV improvements (including an I-580 HOV lane and other improvements on the San Mateo and Dumbarton Bridges)
- Dumbarton approach improvements
- BART core capacity improvements
- Express bus physical improvements including HOV improvements that would benefit express buses

The detailed analysis noted that the express bus/carpool and operational improvement alternative was extremely cost effective, relative to other alternatives. This alternative included HOV lanes and spot operational traffic improvements on bridge approaches, toll plaza modifications including electronic toll collection, incremental expansion of Transbay BART service, and expanded express bus service in all three bridge corridors with park-and-ride lot expansion and additions.

The study noted that the five to six new HOV lanes or extensions near the Bay Bridge have merit, but recommended further study and analysis. The study stated that if systemwide and Transbay capacity plans that were under development by BART were implemented, projected demand for Transbay BART service could be handled by adding additional trains and pursuing strategies for faster boarding and alighting of passengers in the downtown San Francisco stations (through the use of three-door cars).   The study also noted that “adequate platform space in downtown San Francisco stations may become a capacity constraint by or before 2025” and also noted that “further study is needed to refine our understanding of BART Transbay capacity constraints and needs.” Some of those studies have been conducted, but few BART capacity increases have been implemented.

Bay Bridge Corridor Background

2002 HOV Lane Master Plan, prepared for MTC by DKS Associates (2002)

In 2002, MTC commissioned the HOV Master Plan, which identified the use and benefits of the HOV system and identified an overall vision for a regional HOV network. The general conclusions were that most Bay Area HOV lanes were performing within Caltrans criteria with volumes ranging from about 2,000 vehicles per hour (U.S. 101 in Santa Clara) to a midrange of about 1,300 vehicles per hour on I-80, I-880 and U.S. 101 (Marin). Some routes have fewer vehicles. In addition, the HOV Master Plan forecast additional increases in usage on most routes and forecast use of new HOV facilities.

The HOV Master Plan called for an additional 300 miles of HOV lanes, costing about $3.7 billion. In addition, the Plan called for a network of express buses to use the HOV lanes, and suggested that buses be provided with in-line freeway-stations with good intermodal connections to save time, decrease operating costs and encourage ridership. The Plan also noted that some, but not all, HOV lanes had excess capacity in the present, but perhaps not in the future and HOT could be considered on some corridors. The Plan did note that there was excess capacity in all corridors in the off-peak and reverse peak periods.

Bay Area High-Occupancy/Toll Network Study, Final Report (and Update), MTC with assistance from PBAmericas and ECONorthwest, 2007 and 2008

Moving from the 2002 Bay Crossing Study and the 2002 HOV Master Plan, MTC analyzed the impacts and benefits of converting the HOV network into a HOT network. The analysis indicated that by tolling HOV facilities the network could be built earlier and could free-up programmed RTP funds to other projects. The Study noted that HOT revenues could be made available to fund express bus service in the HOT corridors.

The Future of Downtown (San Francisco), San Francisco Planning and Urban Research Association (SPUR), March 2009

SPUR produced a policy paper that compared ABAG's future year employment and population projections against both the city's development (zoning) capacity and its transportation capacity. About 40 percent of downtown San Francisco jobs are held by East Bay residents and SPUR projected that within 25 years peak hour demand from new jobholders would exceed available transit capacity (including BART and expanded bus and ferry services). Within 10 years it is likely that BART will be near capacity, although the opening of the new Transbay Transit Center represents new near-term capacity in the corridor.

Figure 3: Westbound AM Study Area

Existing Transportation Context

Figure 3 shows the westbound Bay Bridge highway system that is included in the study area, with the ramps and the major gateways that make up the extents of the freeway network. The bridge, which connects Oakland with San Francisco, was opened in 1936 as a highway/rail facility. In the early 1960s the railroad on the lower deck was removed and the Caltrans converted the Bridge to five lanes of traffic in each direction, with each bridge deck carrying a one-way flow. The current "cantilever" section of the bridge, which connects the East Bay to Yerba Buena Island (YBI), is a double deck steel structure. This section is being replaced with a new concrete structure featuring a self-anchored suspension bridge near YBI – the new bridge will maintain five lanes in each direction but will feature wider lanes with full shoulders.

West of YBI, the suspension span (actually two suspension bridges connected at the anchorage structure) consists of five lanes on each deck, with lanes ranging from 11 feet-7 inches to 11 feet-11 inches wide. Access to and from Treasure Island/YBI occurs via a series of substandard ramps that pose significant challenges to drivers entering and existing the mainline traffic stream on the bridge.

Figure 4 illustrates a section of the suspension span.

Approaching the Bay Bridge on the East Bay side, I-80 and I-580 converge at a complex junction known as the "distribution structure". The distribution structure consists of a number of freeway connector ramps that funnel traffic from I-80 and I-580 into the toll plaza area at the base of the bridge. I-880 headed to the Bay Bridge bypasses the distribution structure and converges with the other freeway approaches at the toll plaza. A bank of metering lights is located 1,000 feet west of the toll plaza complex. The connector ramps from each freeway into the toll plaza area include dedicated high-occupancy vehicle (HOV)/transit lanes that bypass the toll plaza and the metering lights. The HOV lanes serve as a queue jump for HOVs and buses around the congestion that develops at the toll plaza during a typical weekday morning commute.

Figure 5 shows a schematic drawing of the toll plaza (as of September 2009), the three interstate freeways that approach the Bay Bridge from Oakland, and the number of lanes provided to each of the three payment types served at the toll plaza: Cash, Electronic Toll Collection (ETC) or "FasTrak", and HOV. During the AM peak period, which is defined in this study as 5:00 AM to 10:00 AM, lane assignments by payment type are:

- Lanes 1 – 2: HOV (serves I-880 and I-580)
- Lanes 3 – 6: Cash (serves I-580)
- Lanes 7 – 11: FasTrak (serves I-80 and I-580)
- Lanes 12 – 17: Cash (serves I-80 and I-880)
- Lane 18: FasTrak (serves I-880 and Grand Ave)
- Lane 19 – 20: HOV (serves I-880, Grand Ave, and I-80 HOV)

Traffic congestion on most weekdays occurs throughout the entire morning commute period. Day-to-day variations caused by lane blocking incidents or minor demand fluctuations can greatly exacerbate the normal congestion experience. As a result, congestion through the toll plaza area and the distribution structure can also vary. Queues typically extend from the toll plaza back several thousand feet. However, there is sufficient storage so that queues do not extend back to the distribution structure during "normal" operating days. A normal operating day is one without an incident (e.g., traffic accident or lane closure).

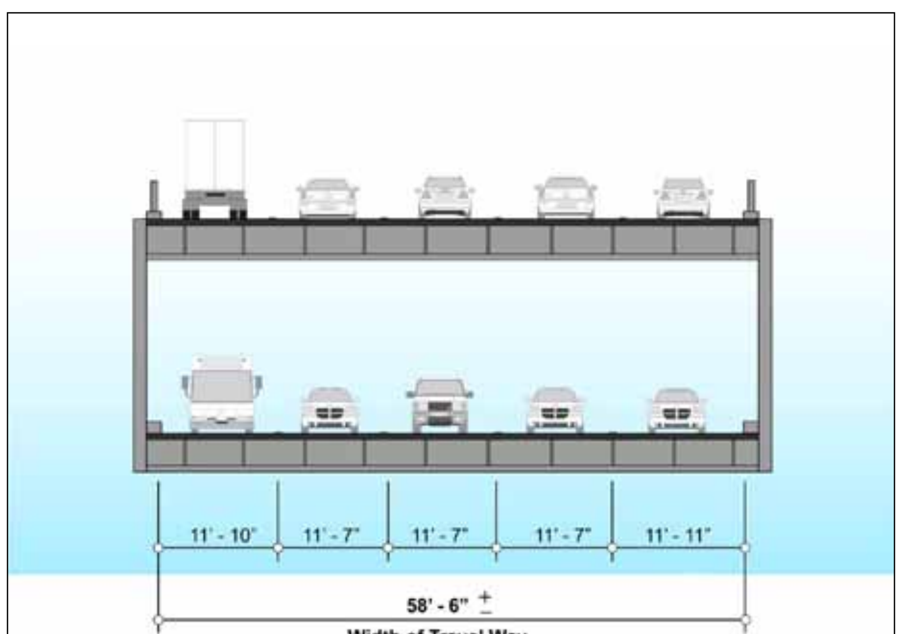


Figure 4: Bay Bridge Suspension Span Roadway Cross-Section

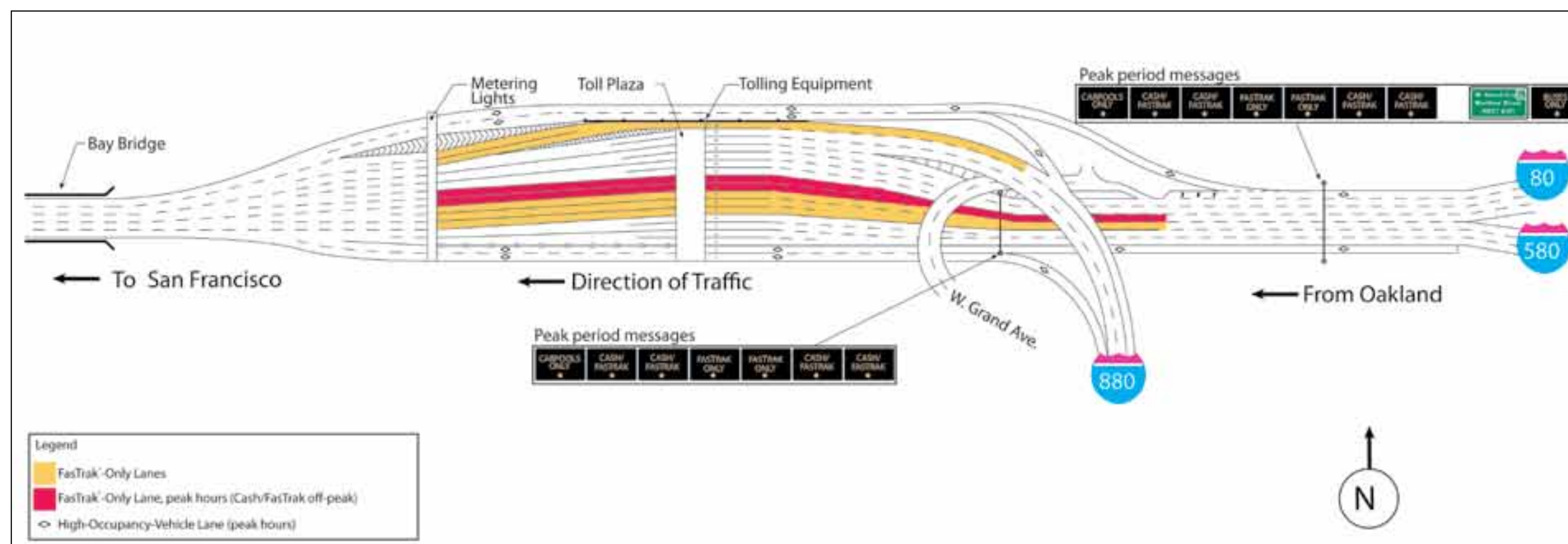


Figure 5: Toll Plaza Complex (source: MTC)

Bay Bridge Corridor Background

Caltrans policy is to accept queues at the toll plaza in lieu of excessive congestion on the bridge spans. To accomplish this goal, Caltrans monitors the flow of traffic at the western base of the Bay Bridge using loop detectors and activates the metering lights once the bridge's capacity is exceeded. This occurs at a flow rate of approximately 9,300 vehicles per hour. Once the metering lights are activated, Caltrans adjusts the rate to maintain this level of traffic flow onto the bridge. This effectively minimizes congestion and queuing on the structure. Once activated, the metering lights are the controlling factor for vehicle capacity in the corridor. The presence of queues upstream of the metering lights is a clear indication that traffic demand currently exceeds the capacity of the bridge.

Carpools and buses traveling in the HOV bypass lanes avoid most of the congestion associated with the toll plaza and the metering lights, while queues in the general purpose lanes extend upstream from the metering lights into the toll plaza complex and beyond. These queues can extend into the weaving portions of the distribution structure and impact traffic flow on the multiple freeways connecting into the Toll Plaza. For transit and HOVs, these queues already impact operations on the worst days. The West Grand connection for transit/HOVs is especially impacted.

In the AM peak hour, the Bridge Corridor serves more than 40,000 westbound person-trips by auto and transit modes. AC Transit carries about 3,000 westbound passengers on the Bridge in the morning peak hour, while BART carries about 14,000 westbound passengers in the AM peak hour. Table 3 provides a breakdown of existing AM travel demand from the East Bay to San Francisco:

Peak Hour Travel, AM/Westbound, Bay Bridge Corridor	
Vehicles:	9,300
Auto Passengers:	23,000
AC Transit Passengers:	3,000
BART Passengers:	14,000
TOTAL PASSENGERS	**40,000**

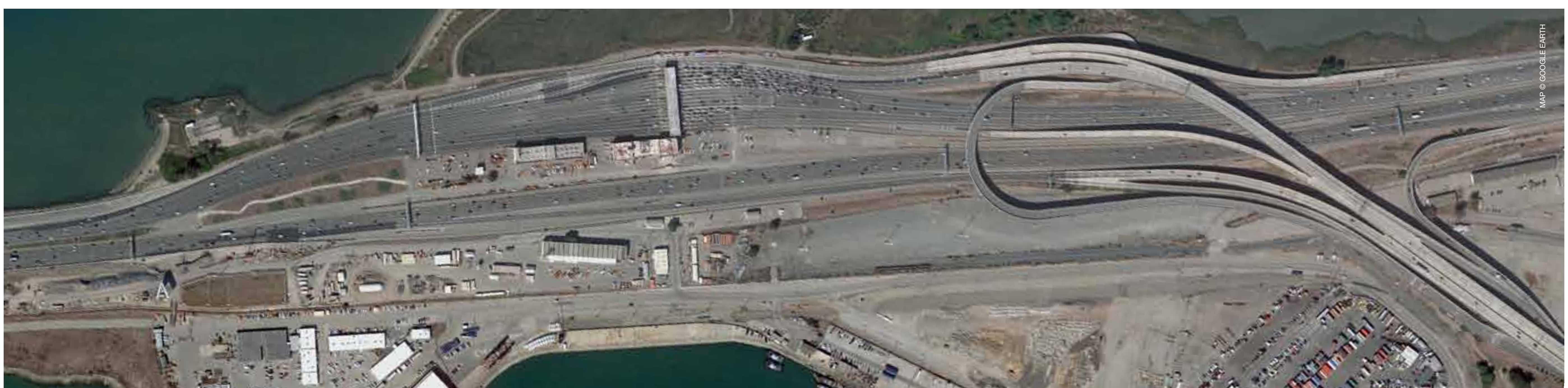
Source: Cambridge Systematics, 2007

Table 3: AM Peak Hour Travel - Westbound Bay Bridge

Every study conducted for MTC over the last 20 years has predicted that peak period demand in the Bay Bridge Transbay corridor would surpass the total transportation capacity of the corridor during some horizon year, which has generally been recognized as sometime between 2010 and 2020. While the current economic recession has likely moved that point out a few years, it is likely to occur within a generation. Every study gives buses a crucial role in bridging this capacity gap.

Recent toll bridge traffic changes – Figure 7 tracks trip volumes on the Bay, San Mateo and Dumbarton Bridges from 1992 – 2009. Over this 18 year period, while volumes have peaked and ebbed, total volumes in 2009 are about the same as in 1992 on the Dumbarton and San Mateo Bridges. Vehicular volumes on the Bay Bridge also show the same trend, however BART volumes have increased substantially leading to a large increase in overall Bay Bridge corridor volumes.

Figure 6: Toll Plaza



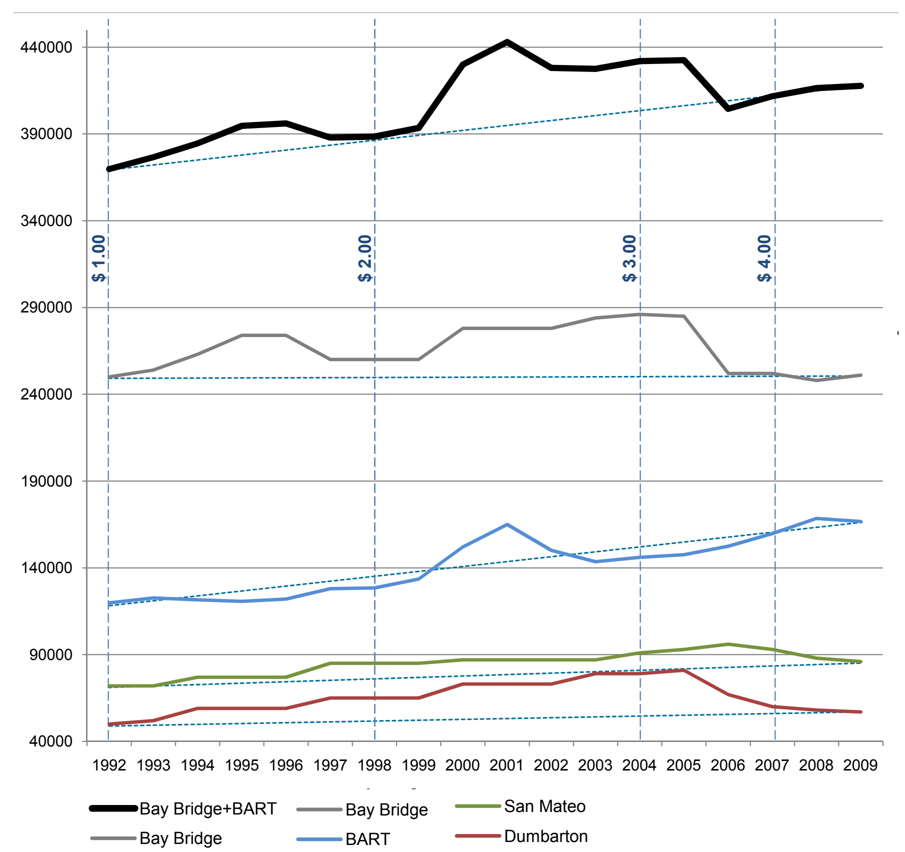


Figure 7: Bay, San Mateo & Dumbarton Corridor Traffic Graph

Methodology

To accurately model traffic conditions, Arup developed a microsimulation model of the westbound Bay Bridge corridor using the software program VISSIM[1]. VISSIM is a stochastic, multi-modal, microscopic simulation program that models the interaction of individual users (drivers, transit vehicles, pedestrians) in complex freeway and urban transportation systems. The modeling process includes developing a calibrated Base Year (2009) model that replicates current conditions. The calibrated model, along with future traffic projects, becomes the basis for developing a Future (2035) No Project model. The Future (2035) No Project scenario provides an estimate of how severe congestion along the corridor could become without any additional infrastructure improvements. This analysis serves as a basis for developing potential improvement options for the corridor. This section details the development of the Base Year (2009) calibrated model and the Future (2035) No Project model.

Model Scope

The study analyzes traffic and transit operating conditions during the AM peak period commute for the freeways carrying traffic across the Bay Bridge from the East Bay and Oakland into San Francisco.

The study area includes the following:

- Approximately 24 miles of mainline freeway and 15 freeway interchanges
- Three interstate freeway corridors in the East Bay with the following gateways:
  - Interstate 80 (I-80) westbound north of the I-80/I-580 merge in Albany
  - I-580 eastbound north of the I-80/I-580 merge in Albany
  - I-580 westbound east of the State Route 24 (SR 24)/I-980 junction in Oakland
  - I-880 northbound south of the Jackson Street on-ramp in Oakland
  - I-80 in San Francisco to a point south of the US-101/Central Freeway junction

Base Year (2009) VISSIM Model Development and Calibration

Figure 7 presents a flow chart that depicts the development and calibration of the Base Year (2009) VISSIM model. This section details this process.

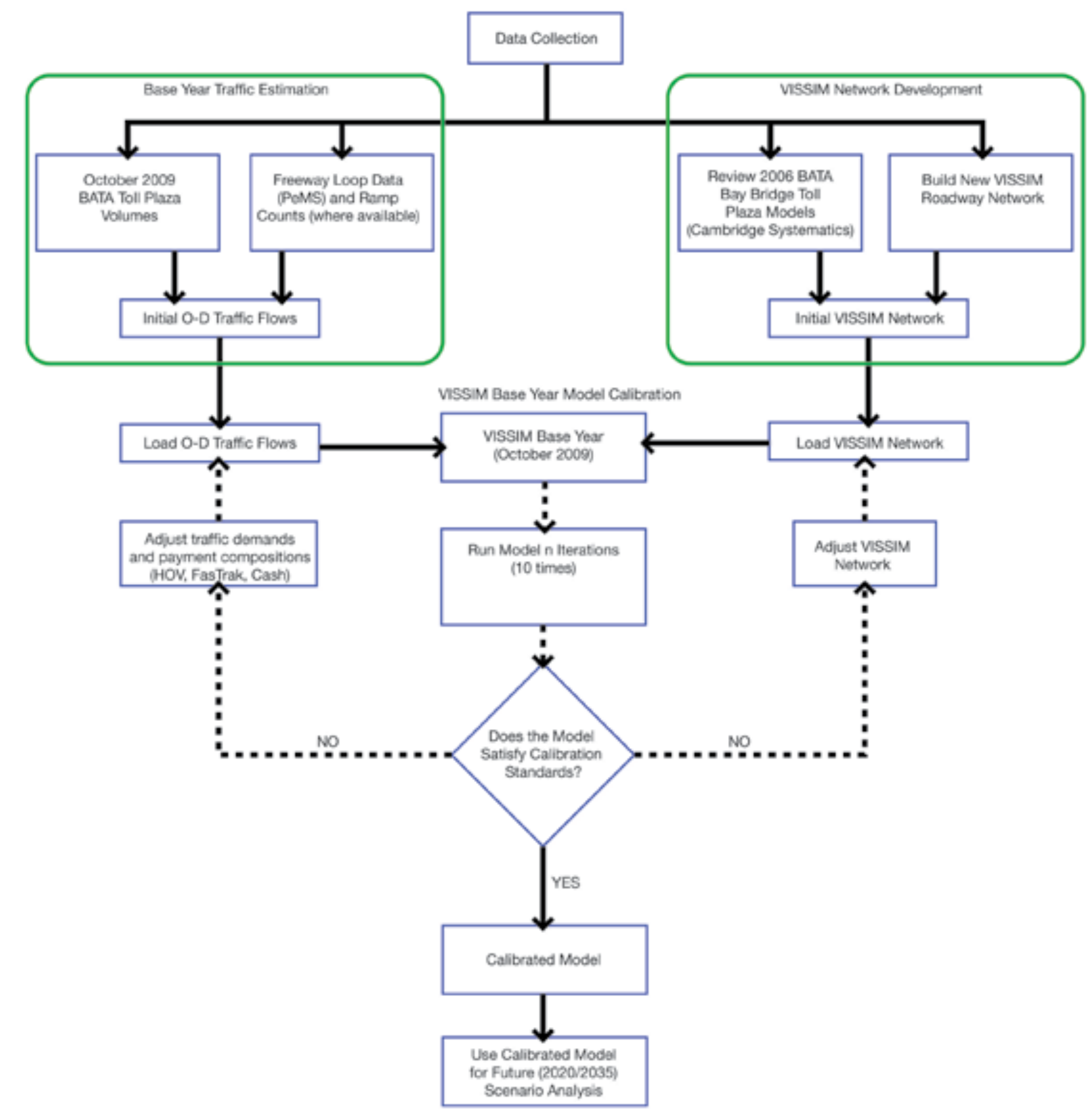


Figure 8: Bay Bridge AM Model VISSIM Development and Calibration

[1] PTV America

Microsimulation Model Development

Data Collection, Field Observations, and VISSIM Model Development

The Bay Bridge corridor model was based on an earlier VISSIM model of the toll plaza area developed by Cambridge Systematics in 2006 for the Bay Area Toll Authority (BATA). The operation of the toll plaza, the metering light algorithm, and core vehicle performance and driver behavior assumptions were incorporated from this earlier work. The Cambridge Systematics model focused primarily on the toll plaza and was calibrated to volume and travel time data collected specifically for the BATA study. Based on this earlier work and calibration, VISSIM is considered a valid tool to model toll plaza and freeway operations along this corridor.

For the Bay Bridge Corridor Congestion Study, the original Cambridge Systematics model was expanded to include a larger portion of I-80, I-580 and I-880 in the East Bay and a larger portion of the highway system through downtown San Francisco. The Bay Bridge AM peak period model contains the following features:

- The VISSIM model area includes about 24 miles of freeway mainline
- The model runs for a five-hour AM peak period (5:00 AM to 10:00 AM)
- The first hour (5:00 to 6:00 AM) is included as a "warm-up" period to congest the network; no simulation data or statistics are collected for this warm-up period
- The model analysis is conducted for the four-hour period from 6:00 to 10:00 AM
- Traffic volumes are loaded in 15-minute increments
- Only the inbound direction to San Francisco is modeled
- The most recent toll plaza configuration from September 2009 is included
- Three major toll payment types are included and summarized in the model calibration: Cash, Electronic Toll Collection (FasTrak), and High Occupancy Vehicle (HOV)
- The toll plaza metering light signal algorithm is included
- Existing Transbay bus routes were modeled using current schedule information

Field observations, a review of previous studies, and an initial data analysis indicate a number of factors that determine traffic flow and capacity through the toll plaza area. Key findings of existing practices include:

- The metering lights are activated between 6:15 and 6:30 AM when throughput measured at the five lanes at the base of the Bay Bridge exceeds a threshold of approximately 9,000 to 9,200 vehicles per hour.
- Once the metering lights are activated, a brief "all-red" phase is shown to allow a small queue to develop at the metering light stop bar.
- Once the metering lights are activated, the metering cycle length and green time for Cash and FasTrak vehicles is determined by a complex algorithm that considers and prioritizes the throughput of HOV vehicles measured at the toll plaza while keeping the total flow constant.
- The metering algorithm monitors HOV flows on a one-minute basis and allocates the green time to Cash and FasTrak lanes at the metering lights.
- When the metering lights are activated, queues quickly stack up and extend back through the toll plaza complex
- Upstream traffic demand at the approaches into the toll plaza increases steadily throughout the AM peak period until approximately 8:30 AM, when demand to the Bay Bridge begins to subside.

Base Year Traffic Demand

Traffic demand data for the base year model conditions was developed from a number of sources:

- Detailed toll plaza volumes (by lane and payment type, for one-hour and five-minute intervals) were obtained for a period from January 2006 to December 2009
- Freeway mainline traffic volumes (hourly and 5-minute intervals) were developed using loop detector data obtained from the Freeway Performance Measurement System (PeMS)
- Ramp volumes in the East Bay were developed from counts published in the I-80 Integrated Corridor Mobility Project (DKS, January 2010)
- Ramp volumes in San Francisco were developed from counts collected by Arup, Fehr & Peers, and AECOM for other projects
- Origin and destination data used to develop vehicle routings in VISSIM were obtained from base year model runs of regional travel demand models developed by MTC and the San Francisco County Transportation Authority (SFCTA)

These data were used to define the initial traffic volume inputs and distribution of vehicular demand throughout the model area. The traffic volume inputs at origins in the model were developed on a 15-minute basis to better control demands within the model. Development of the model required a complete set of internally consistent and balanced traffic flows throughout the entire corridor. The toll plaza data represented the most robust dataset and was the focus of the overall calibration effort. Where it was necessary, traffic volumes were interpolated and balanced using the best available traffic counts and travel demand model information.

Base Year (2009) Model Calibration

Calibration is an iterative process that involves adjusting model parameters to produce a result that closely replicates field measured traffic conditions. The calibration strategy includes:

- Identifying appropriate calibration data and targets
- Identifying the appropriate model parameters to adjust or calibrate
- Modifying the selected parameters until traffic flow and capacity satisfies the calibration targets

The calibration process involved collaboration between the consulting team and Caltrans, MTC, and AC Transit. In addition, Cambridge Systematics conducted an independent review of the base year model calibration and found no major issues with the model's structure or assumptions.

The Bay Bridge model calibration must:

- Replicate the distribution of vehicles by payment type (Cash, FasTrak, HOV) across the toll plaza lanes
- Replicate a typical hourly volume profile at the toll plaza
- Replicate the metering light algorithm, including when the metering lights are activated and the green time allotted to Cash and FasTrak vehicles at the metering light stop bar
- Replicate traffic flow and queuing at the major freeway approaches (I-80, I-580, I-880) from the distribution structure into the toll plaza area

It should be noted that congestion throughout the corridor is highly variable and results from a number of different factors, including: existing traffic demand exceeding the capacity of the toll plaza, a high number of lane blocking incidents (e.g., accidents, vehicle stalls, etc.), and roadway geometric issues (e.g., lane drops, short weaving sections, etc.). Because of this variability, the consultant team analyzed the toll plaza and PeMS datasets to identify a set of potential observation days during October 2009 that experienced normal operating conditions with no major incidents. October 2009 was selected because it was one month after the installation of the "S-curve" on the Bay Bridge. Eleven mid-week days (Tuesday, Wednesday, Thursday) were considered: these days occurred before the eyebar failure and subsequent closure of the Bay Bridge (afternoon of October 27 to the morning of November 2).

Figure 8 plots the hourly volumes (5:00 – 10:00 AM) at the toll plaza for the eleven analysis days in October 2009. The minimum and maximum volumes for each hour are noted. October 11 was eliminated because an incident upstream of the distribution structure constrained the vehicle demand reaching the toll plaza. Of the remaining ten days, eight experienced the highest observed toll plaza throughput between 6:00 and 7:00 AM, while two experienced the peak between 7:00 and 8:00 AM.

October 8 was selected as the basis for the VISSIM model calibration because the hourly traffic profile is within the observed ranges plotted on Figure 7. All of the upstream and downstream traffic inputs in the VISSIM model were based initially on these October 8 traffic volumes. Using this one day to validate the model rather than an average of several days is preferred because averaging would smooth or flatten out the hourly traffic profile, or "peaking" profile, that is typically observed over the five-hour AM peak. The hourly traffic profile is a critical determinant of traffic operations and queuing at the toll plaza and along the entire corridor. As Figure 7 illustrates, October 8 falls in the median of the "typical days" that were evaluated as the basis for calibration.

The breakdown of traffic by payment type at the toll plaza is also an important component of the calibration. Table 4 provides a summary of the traffic payment compositions for the calibration day.

% Total Volume	5:00-6:00	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00
Vehicles/Hr	6,020	9,284	9,000	8,893	8,530
CASH %	31%	27%	20%	22%	28%
FT %	50%	45%	35%	38%	48%
HOV %	18%	28%	45%	41%	24%

Table 4: Traffic Payment Compositions

The core driver behavior and vehicle performance parameters developed for the previous Cambridge Systematics toll plaza model were left unchanged. In particular, Cambridge Systematics developed a more aggressive lane changing driver behavior for use around the toll plaza complex to help with the quick lane merges and lane drops. These lane changing behaviors were used on various links around the toll plaza to help with the model calibration.

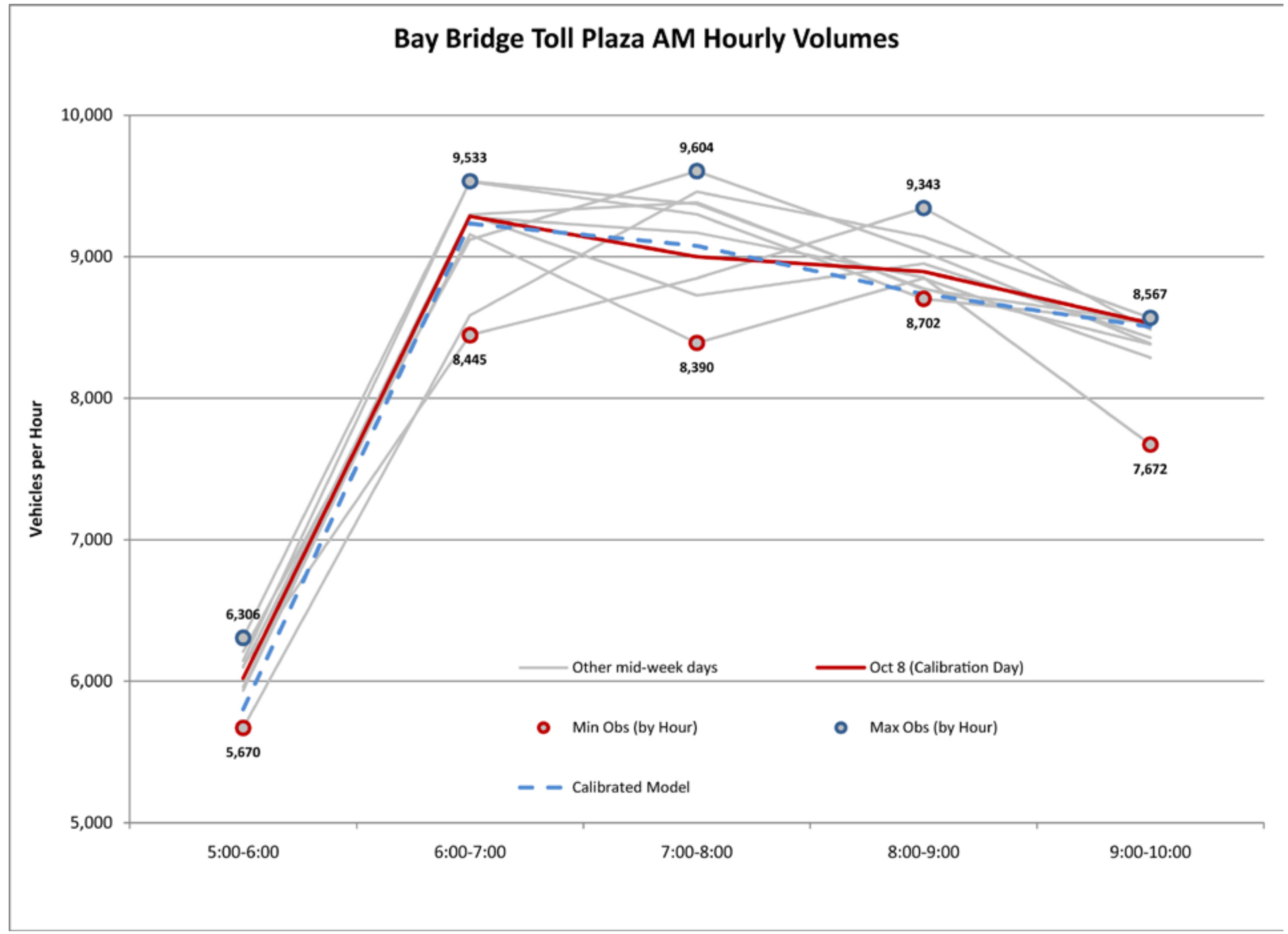


Figure 9: Bay Bridge Toll Plaza Calibration Volumes

Microsimulation Model Development

Calibration Criteria

Calibration typically involves comparing various measures of effectiveness (MOEs) between the model and observed values. Vehicle throughput, travel time and vehicle queues are commonly used MOEs. In addition, a visual audit of the simulation video provides a useful reality check.

The calibration presented in this study focuses on the traffic throughput at the toll plaza by hour and by payment type. Special attention was also paid to the shape of the hourly volume contour and the activation of the metering lights. Calibrated models should reflect these factors as it is primary influence on the accumulation of queuing and congestion upstream of the toll plaza. Upstream volumes at the approaches from the distribution structure to the toll plaza were monitored. The MOEs were compared between the base and future year models to assess the effectiveness of various improvements in the analysis.

The primary performance measure selected was the GEH statistic, which is a standard traffic modeling measure used to evaluate the accuracy of flows given wide ranges in observed volumes. The GEH formula is named for its inventor, Geoffrey E. Havers, a traffic engineer who developed the statistic in the 1970s. The GEH formula is:

$$GEH=\sqrt{\frac{2(M-C)^2}{M+C}}$$

Where
M = modeled volume
C = observed volume

Caltrans staff recommended using a target GEH statistic of less than 2.0 at the toll plaza (the lower the GEH the better the fit between modeled and observed volumes) because this is the primary bottleneck along the corridor. For an observed volume of 9,000 vehicles, a GEH of 2.0 represents a difference of only +/- 190 vehicles. In this example, a GEH of 2.0 translates into a 2 percent difference.

Arup calculated the GEH statistic for each hour across the four-hour analysis period. GEH was also calculated by payment type (Cash, FasTrak, HOV) to ensure vehicle processing is modeled accurately. This criterion exceeds guidelines established by the Federal Highway Administration (FHWA) and Caltrans, which typically call for a GEH below 5.0 for 85 percent of observed counts.

Calibration Actions

The toll plaza and upstream approaches were the focus of the calibration. The following issues were identified and addressed during the calibration:

- Vehicle speed and flow upon activation of the metering lights – Vehicles are metered at a lower rate upon activation of the metering lights in order to slow vehicles and expedite the creation of a queue.
- Vehicle lane choice at the toll plaza – Fixed vehicle routes were terminated upstream of the toll booths, allowing vehicles the freedom to make lane choices based on queue length.
- HOV merging behavior downstream of toll plaza – the large volume of HOVs caused long queues as they attempt to merge with mainline traffic. Lane merge priorities were set to minimize queuing and prevent it from spilling back to the toll booths.

In order to achieve modeling results in accordance with the calibration criteria, adjustments to the model inputs were made. The following inputs to the model were adjusted during calibration to achieve the validated model:

- Hourly origin destination data – Relative flows between origin and destination points
- 15-min demand profiles – Absolute traffic flows from an origin
- Hourly vehicle payment types – The percentage of vehicles using each payment type at the toll plaza
- Metering light algorithm – The start and end times of the metering lights as well as the metering rate in each hour

Calibration Results

The VISSIM model was run 10 times with different random seeds. Executing multiple runs with different seed numbers allows the model to capture random variations in driver behaviors and decision making.

Table 5 provides the calibration results. The modeled volumes and the GEH results are averaged across the ten runs and are summarized for each hour and payment type combination (e.g., 6:00 – 7:00 AM for HOV). The GEH results of each payment type at each hour are the primary focus as they provide a higher resolution of traffic flow – 75% of modeled flows have a GEH < 2.0 and 100% are under 5.0. A full summary of the toll plaza results for each of the ten simulation runs are included in Appendix A.

Volumes	Observed/ Model	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	4-HR Total
Total	Observed	9,284	9,000	8,893	8,530	35,707
	Modeled	9,234	9,075	8,735	8,504	35,548
HOV	Observed	2,585	4,012	3,609	2,085	12,291
	Modeled	2,593	4,015	3,558	2,185	12,350
Cash	Observed	2,533	1,824	1,917	2,358	8,632
	Modeled	2,645	1,808	1,996	2,374	8,823
FasTrak	Observed	4,166	3,164	3,367	4,087	14,784
	Modeled	3,996	3,253	3,182	3,945	14,375
GEH[1]	Payment Type	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	4-HR Total
	Total	0.52	0.79	1.68	0.28	0.84
	HOV	0.16	0.04	0.86	2.17	0.54
	Cash	2.20	0.37	1.79	0.32	2.04
	FasTrak	2.66	1.56	3.24	2.24	3.39

[1] GEH = Statistic used to compare modeled volumes to observed traffic counts. A target GEH < 2.0 is the goal, although a GEH < 5.0 is a typical modeling target

Table 5: Calibration Results

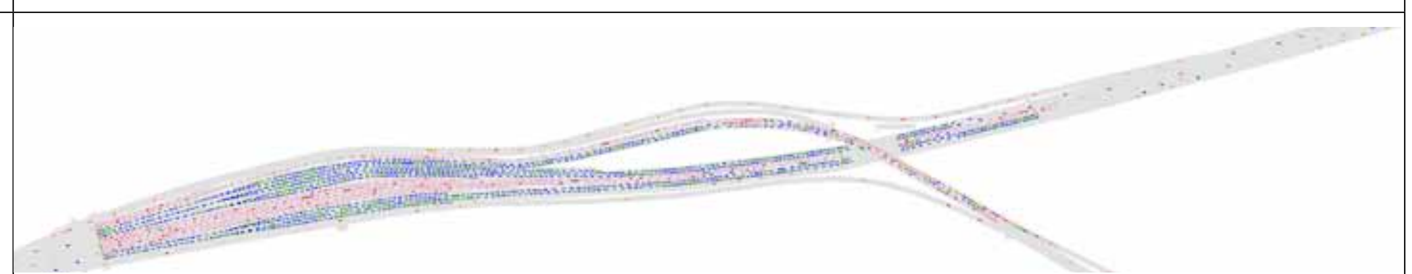
Hour	Base Year (2009) Vehicle Queuing at the Bay Bridge Toll Plaza by Hour(VISSIM Screenshots)
6:00AM	
7:00AM	
8:00AM:	
9:00AM:	
10:00AM	

Figure 10: Calibration Queuing by Hour

The results presented in Table 5 indicate the following:

- All of the GEH statistics (100 percent) are less than 5.0
- All of the Toll Plaza hourly **totals** have a GEH less than 2.0
- 70 percent of the hour/payment type combinations have a GEH less than 2.0
- 30 percent of the hour/payment type combinations have a GEH between 2.0 and 4.0

These low GEH statistics represent model volumes that are within 5 percent of the observed values. Small differences do exist, but these are caused by the activation and operation of the metering lights. As stated previously, the metering logic in the model differs slightly from the actual logic used in the field. The consistently low GEH statistics indicate that the model is reasonably replicating throughput at the toll plaza and the metering lights, which satisfies the basic calibration criteria.

A visual audit of the queuing upstream of the toll plaza further supports these calibration findings. Figure 8 provides a series of VISSIM screenshots that show the progression of queues at the toll plaza at 6:00, 7:00, 8:00, 9:00, and 10:00 AM.

Microsimulation Model Development

Future Year (2020/2035) No Project Model Development

Future (2020) and (2035) No Project scenarios were developed to predict future traffic and transit operations along the corridor without any additional infrastructure improvements. The Future No Project models analyze 2020 and 2035 future traffic projections with the same freeway network and toll plaza payment assumptions as the calibrated Base Year model described above. This section describes the traffic forecasting process used to develop the demands for the Future No Project VISSIM models.

Travel Demand Forecasts

This section describes the forecasting process used to develop the background traffic volumes for the microsimulation analysis of the future improvement scenarios. Future traffic forecasts were developed after a review of four Bay Area regional travel demand models:

- Metropolitan Transportation Commission (MTC)
- San Francisco County Transportation Authority (SFCTA)
- Alameda County Congestion Management Agency (ACCMA)
- Transbay Mode Choice/Caltrain Downtown Extension Studies

The purpose of considering the four models was to assess the range of future year traffic demand. While the four models are all based on the same ABAG demographic information, some differences inevitably arise. The project team focused on two of the model forecasts – the MTC and the SF-Champ. These models were identified as generating the "high" (MTC) and "low" (SFCTA) traffic estimates. (The MTC forecasts higher overall traffic volumes, although the SF-Champ model was slightly higher).

Table 6 shows demand model traffic volumes on the Bay Bridge for both the MTC and SF-Champ models. Year 2010 near-term forecasts are shown to represent existing conditions and Year 2035 volumes are the horizon year volumes. Both models show similar volumes on the Bay Bridge – both in the base and future years (the difference in AM peak period traffic volumes on the Bay Bridge between the two models is less than four percent).

Table 6 also illustrates where the East Bay generated traffic is headed to – either to Downtown San Francisco, to the Central Freeway/8th Street or further sound on US 101. The models show general agreement that a little more than half the traffic is headed downtown. However, the models do not agree where the rest of the traffic is going to – The SF-Champ model predict more traffic is headed to Northwest San Francisco (Central Freeway, 8th Street), while the MTC model shows more East Bay generated traffic is headed south on US-101. However, the question of where the East Bay generated traffic not headed to downtown goes to is not critical; the focus has been to examine East Bay to Downtown San Francisco travel patterns.

Both models show that traffic demand is forecast to increase by 16% on the Bay Bridge during the four hour AM peak period. Both models also agree on the percentage change in trips to downtown San Francisco (growth is about 20% for each model). In addition, trips generated by the new Treasure ISland development (as identified in the TIEIR) were also added to Westbound Bay Bridge traffic for future years.

Model Year	Bay Bridge	SF Downtown exits at Fremont, Harrison	To SF NW exits at 8th, Central Fwy	Through South of the Central Fwy
2010 MTC Model	36,400	19,600	5,800	11,000
2010 SF-Champ	37,700	19,000	9,600	9,100
2035 MTC Model	42,300	23,500	7,000	11,800
2035 SF-Champ	43,800	22,700	10,200	10,900
Percent of Traffic (Sums to 100%)				
2010 MTC Model		54%	16%	30%
2010 SF-Champ		50%	25%	24%
2035 MTC Model		56%	17%	28%
2035 SF-Champ		52%	23%	25%

Source: Cambridge Systematics

Table 6: Bay Bridge Corridor Traffic Forecasts

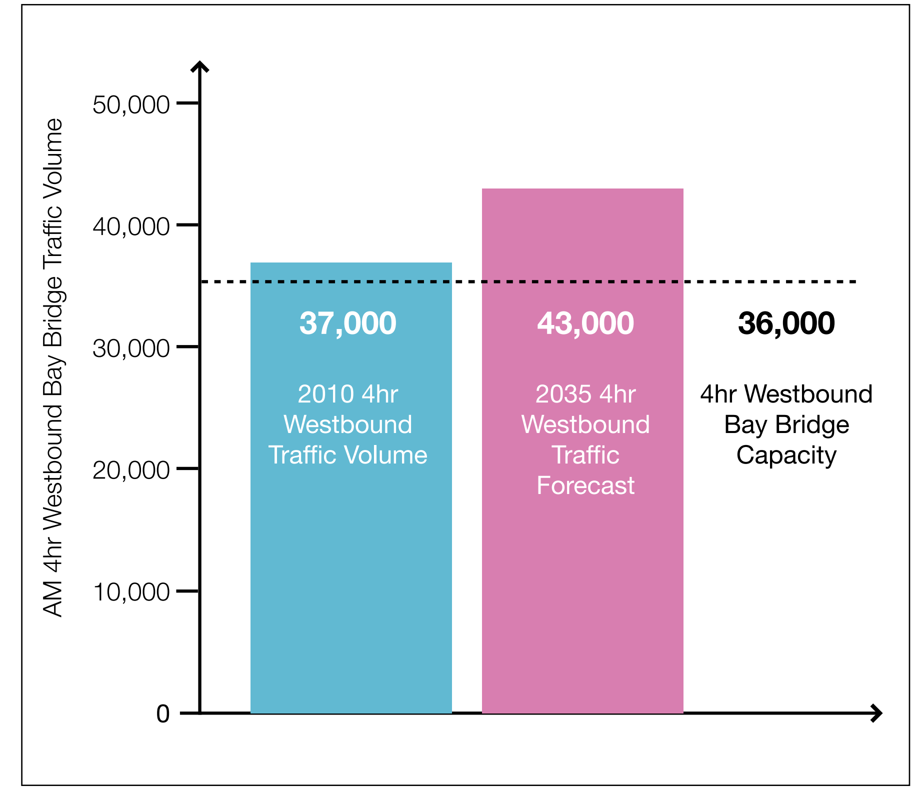


Figure 11: Existing and Future Bay Bridge AM Peak Period Demand

It is useful to note that the four hour volumes shown in the travel demand models are likely not achievable. Currently, the maximum one hour volumes on the Bay Bridge are limited to about 9,200 vehicles per hour. Thus, the Bay Bridge is currently at capacity for the entire four hour AM peak period today in 2010. Additional growth in traffic on the Bay Bridge can only be accommodated through a longer peak period than four hours, conversion of eastbound lanes to westbound and from additional mode shifts to BART, AC Transit and ferries. Figure 10 provides a comparison of the existing and future AM four-hour peak period demand at the Bay Bridge.

At the Toll Plaza, downtown-bound vehicles represent 50 to 55 percent of total Bay Bridge westbound traffic (this range holds for both the MTC and the SF-Champ model and in both current and future projections). In the future, while the percentage of trips beyond downtown stays about the same, the absolute numbers increase by about 2,000 trips in the peak period. These additional trips compare with additional downtown trips on a facility with no excess capacity. The key findings from the travel demand forecasts are:

- Demand increases by 10 to 16 percent by 2035
- The MTC and the SF-Champ models generated 2035 forecasts that varied by only 5 percent on the westbound Bay Bridge
- Future demand exceeds capacity, so the following is likely to occur: queuing and congestion will worsen, peak-hour spreading will occur, and commuters will shift to buses or BART (or all three occur)

The consultant team decided to use the SF-Champ model to generate the traffic forecasts used in the analysis of future scenarios. All of the forecast models were similar enough in their outputs, but the SF-Champ model produced forecast results that were appeared more reasonable and stable around critical freeway interchanges, particularly in San Francisco.

Table 7 compares the Base Year (2009) and Future (2035) traffic forecasts at the major origins on the VISSIM network. Future (2020) No Project traffic volumes were estimated using linear interpolation.

Gateway/On-Ram	Base Year (2009)	Future (2035)	% Growth
I-80 Start Point on 580	28,756	29,500	3%
I-580 Start Point on 80	11,458	12,500	9%
I-80 Buchanan St On	2,379	2,500	5%
I-80 Gilman St On	1,218	1,900	56%
I-80 University Ave	1,899	1,999	5%
I-80 Ashby On	1,634	2,140	31%
I-80 WB Powell On	3,016	4,100	36%
I-80 EB Powell On	640	900	41%
I-580 Start Point on 24	14,761	17,000	15%
WB SR 24 to 580 Connector	6,383	6,500	2%
EB SR 24 Connector to 580	5,176	5,600	8%
I-880 Start Point	18,596	22,400	20%
I-880 Jackson St On	2,436	2,900	19%
I-880 Union St On	3,222	3,270	1%
I-880 Maritime/Grand On	4,467	4,667	4%
East Bay Total	106,041	117,876	11%
I-80 TI On	1,300	3,200	146%
I-80 4th On	4,557	4,700	3%
I-80 7th On	829	1,400	69%

Source: Cambridge Systematics, Arup, 2009

Table 7: Base Year (2009) Volumes and Future (2035) Traffic Forecasts

Performance Measures

Performance measures and targets were established by the consultant team in consultation with the stakeholders in the study. The performance measures are grouped into three categories: congestion, transit travel, and transit reliability. A set of targets is defined for each measure. The performance measures and targets for the westbound Bay Bridge corridor analysis are:

- **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.

The Base Year and Future No Project model results are used to identify if the scenario satisfies the performance measure targets.

Microsimulation Model Development

Base Year (2009) and Future (2020/2035) No Project Results

This section compares travel speed, delay, and transit MOEs obtained from the VISSIM model for Base Year (2009) and Future (2020) and (2030) No Project scenarios. The evaluation of the performance measures is also provided.

Travel Speed Comparison

The Base Year (2009) and Future No Project VISSIM model results were compared. One interesting aspect of microsimulation modeling tools is the ability to collect various measures of congestion, such as average travel speed, on a link level. Travel speed serves as a good proxy for overall traffic operations and level of congestion. Figure 10 compares the estimated model travel speeds at the toll plaza (at 8:00 and 9:00 AM) for the Base Year (2009) and Future (2035) No Project scenarios. Figure 11 shows that in the future, travel speeds at the toll plaza will decline considerably by 8:00 AM.

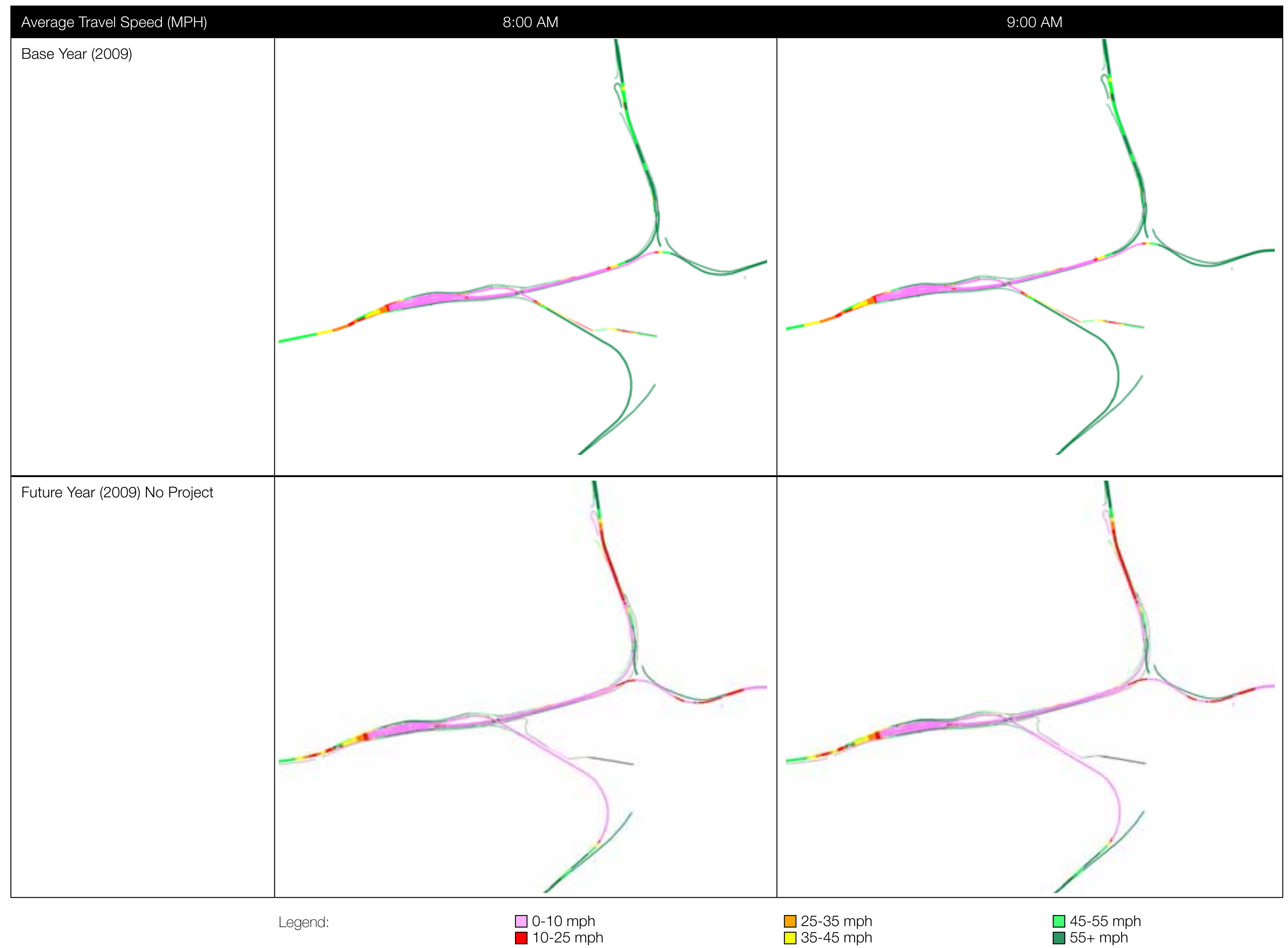


Figure 12: Average Travel Speeds at the Toll Plaza

Vehicle Delay, Person Delay, and Transit Analysis

Table 8 and Table 9 compare the vehicle-hours of delay and person-hours of delay results for Base Year and Future No Project conditions. These delay MOEs are collected systemwide and reflect the total delay experienced by each vehicle on the 24-mile network.

Vehicle-Hours of Delay	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	Total
Base Year (2009)	265	1,335	2,350	3,703	7,654
Future (2020) No Project	391	1,620	2,725	3,269	8,006
Future (2035) No Project	524	2,058	3,208	3,707	9,497

Table 8: Vehicle-Hours of Delay

Person-Hours of Delay	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	Total
Base Year (2009)	409	2,010	3,583	5,587	11,588
Future (2020) No Project	607	2,490	3,937	4,711	11,745
Future (2035) No Project	802	3,375	4,720	5,501	14,998

Table 9: Person-Hours of Delay

Table 10 and Table 11 compare the bus speed and travel time from each freeway approach at the distribution structure (I-80, I-580, or I-880) to the TTC bus ramp.

Bus Travel Speeds (MPH)	6:00-7:00	7:00-8:00	8:00-9:00
Base Year (2009)			
I-80 to the TTC	55.5	53.9	46.8
I-580 to the TTC	52.4	48.5	29.6
I-880 to the TTC	57.1	52.9	49.7
Future (2020) No Project			
I-80 to the TTC	54.3	51.0	45.9
I-580 to the TTC	51.5	37.9	19.2
I-880 to the TTC	54.6	52.4	50.2
Future (2035) No Project			
I-80 to the TTC	51.9	47.6	36.5
I-580 to the TTC	50.9	37.5	12.7
I-880 to the TTC	54.5	29.5	42.8

Table 10: Bus Travel Speed (MPH) from the Distribution Structure to the TTC Bus Ramp

Bus Travel Time (Min)	6:00-7:00	7:00-8:00	8:00-9:00
Base Year (2009)			
I-80 to the TTC	9.7	10.0	11.5
I-580 to the TTC	9.7	10.5	17.2
I-880 to the TTC	10.0	10.8	11.5
Future (2020) No Project			
I-80 to the TTC	9.9	10.6	45.9
I-580 to the TTC	9.9	13.4	26.5
I-880 to the TTC	10.4	10.9	11.4
Future (2035) No Project			
I-80 to the TTC	10.4	11.4	14.8
I-580 to the TTC	10.0	13.6	40.9
I-880 to the TTC	10.4	19.3	13.3

Table 11: Bus Travel Time (Min) from the Distribution Structure to the TTC Bus Ramp

Microsimulation Model Development

Performance Measures and Targets

The performance measures provide a way to quickly summarize and compare the scenario results to the operating targets identified by the stakeholder group. Table 12 compares the congestion, transit travel, and transit reliability performance measures for the Base Year, Future (2020) No Project, and Future (2030) No Project scenarios.

The results in Table 12 indicate the following:

- Operating performance along the westbound Bay Bridge corridor will remain within acceptable performance targets until at least 2020
- However, future traffic growth will cause operating performance along the corridor to exceed acceptable performance targets by 2035
- Congestion upstream of the toll plaza is expected to increase and persist for a much longer period by 2035
- The worsening of vehicle queuing in 2035 will block the HOV bypass lanes at the toll plaza, which will have a negative effect on transit speeds and reliability

These findings clearly show that measures are needed to improve transit mobility in the corridor.

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

Table 12: Performance Measures

Introduction

The analysis considers two different approaches to improving operations along the westbound Bay Bridge corridor during the morning commute:

1. **Alternative Metering:** Increase the metering rate at the Bay Bridge metering lights.
2. **Physical Improvements:** A package of physical improvements that include a westbound contraflow lane on the Bay Bridge, access points necessary to enter the contraflow lane on the East Bay side and exit the contraflow lane on the San Francisco side of the bridge, and extension of the HOV network in the vicinity of the toll plaza.

Alternative Metering Option

The alternative metering option assumes an increase in the rate that vehicles are metered at the Bay Bridge metering lights. This would increase the throughput on to the Bay Bridge, which could reduce the queuing upstream the toll plaza. Shifting the queue from upstream of the toll plaza and on to the bridge would reduce the likelihood of vehicles blocking the HOV bypass lanes. However, increasing the flow of traffic onto the bridge is likely to lead to a degradation of traffic conditions on the bridge. This increase in traffic on the bridge structure could impede bus travel.

Physical Improvement Options

Policy Context

A traditional option for mitigating traffic increases is to build more capacity. In the last 38 years (since a 1972 public referenda that rejected the Southern Crossing), regional and local Bay Bridge corridor policy has been to increase the efficiency of the current transportation network and prioritize investment in transit. As a result, there has been no significant increase in highway capacity in the corridor since the Bay Bridge was converted to 10 lane operation in the early 1960s. However, the efficiency of the existing system has increased substantially – the Bridge's vehicle occupancy is almost 2.5 people per vehicle in the peak period, and BART regularly carries about 15,000 passengers per hour between Oakland and San Francisco in the peak hour (or more than six lanes of traffic on a traditional freeway).

Over the last decade, managed lanes have become an accepted tool to increase capacity and manage congestion. The Federal Highway Administration defines a managed lane as having most of these elements:

- The managed lane concept is typically a"freeway-within-a-freeway" where a set of lanes within the freeway cross section is separated from the general-purpose lanes.
- The facility incorporates a high degree of operational flexibility so that over time operations can be actively managed to respond to growth and changing needs.
- The operation of and demand on the facility is managed using a combination of tools and techniques in order to continuously achieve an optimal condition, such as free-flow speeds.
- The principal management strategies can be categorized into three groups: pricing, vehicle eligibility, and access control.

Using this definition, the Bay Bridge has been effectively "managed" since 1970 when the metering light and HOV bypass elements were incorporated into the Bridge. These elements have allowed for the Bay Bridge to carry more people on its lanes than any highway in California (23,000 in carpools and 3,000 in buses in the peak hour), and makes the facility second only to the New Jersey-New York Lincoln Tunnel in "people-moving" highways.

The Bay Area has embarked on a conversion of its HOV lane system to a HOT (high occupancy – toll) system, also called the "express lane" system. This system allows single occupant vehicles to "buy" into the HOV lanes. The public benefit in this approach is primarily financial and timing. The HOT system can be built sooner since funding would be available sooner compared with the traditional HOV lane financing approach. In addition, the transportation (tax) funding that would normally be dedicated to the HOV system can be used for other projects, and excess HOT toll revenues can finance transit services in the impacted corridors.

Most proposed Bay Area HOT projects simply convert the existing HOV lanes to HOT lanes, although some construction is required for tolling equipment and enforcement activities. However, some HOT lanes will involve new construction. One of the criticisms of the HOT network is that it focuses investment on the fringes of the region and not in the core.

In developing potential physical improvements, policy continuity was a prime consideration. The major physical improvements evaluated in the study considered:

- Extensions of the HOV system to improve the ability of transit vehicles to bypass congestion both into the Toll Plaza and at the Toll Plaza.
- Contraflow transit lane on the lower deck of the Bay Bridge, operated as a HOT lane

The main policy nexus of the contraflow lane proposal would be to serve Transbay buses. Future year forecasts indicate that 200 to 300 bus trips per hour could use the Bay Bridge in the morning peak. Various reports provide guidance for a reasonable warrant to a dedicated bus lane. These reports provide a range from a 1976 Organization for Economic Co-operation and Development (OECD) report recommending a low end of 40 to 60 buses per hour (and passenger volumes of 1,600 to 2,400 passengers per hour) to the more recent American guidance contained in the National Cooperative Highway Research Program (NCHRP) Report 414 HOV Systems Manual recommending warrants of 200-400 buses per hour for an exclusive bus contraflow lane or 400-800 high occupancy vehicles (buses and carpools sharing the facility). In either definition, the literature suggests that an exclusive facility could be justified.

Caltrans' HOV guidelines note that contraflow lanes can be considered when "the peak period directional traffic split is 35% or less during the design life of the project, and (2) if the speed of the opposing mixed-flow traffic is not reduced by implementation of the contraflow lane." The current Bay Bridge west-east weekday peak period split is about 65/35 percent. While the Bay Bridge currently operates at capacity in the AM westbound direction, it operates at only about 70 percent capacity in the AM eastbound direction. The contraflow option considers using a reversible lane in the eastbound direction on the Bay Bridge. An example of a contraflow system is New York. The Port Authority of New York and New Jersey pioneered the concept with the Exclusive Bus Lane (XBL) in the Lincoln Tunnel (SR 495) which provides AM inbound access from New Jersey into Midtown Manhattan's Port Authority Bus Terminal.

While the primary purpose of providing a contraflow lane is to maintain bus travel times and reliability, the contraflow lane would have spare capacity based on the projected bus trips. Future year projections assume approximately 300 Transbay buses per hour. This indicates that the contraflow lane could accommodate another 1,000 vehicles without impacting transit operations.

Improvement Options

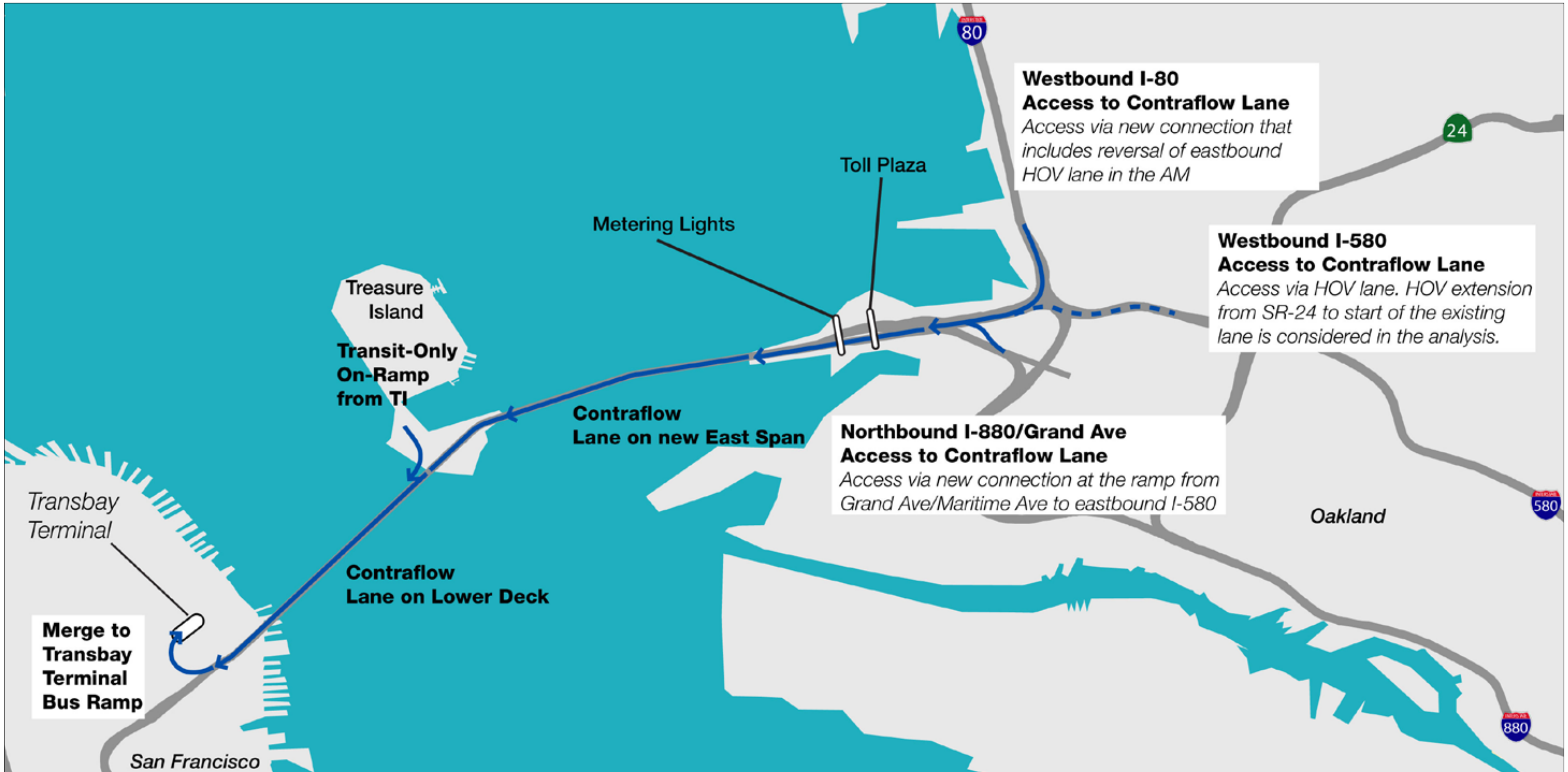


Figure 13: Bay Bridge Corridor AM Physical Improvements

If consistent with the policy direction of major stakeholders, the lane could be operated as a HOT lane to allow private vehicles to use the lane. The Bay Bridge contraflow lane would then serve as a continuation of the Bay Area HOT network. Operating the contraflow lane as bus/HOT lane would allow single occupant vehicles to “jump the queue” for a premium fare up to the capacity of the lane and ensuring average speed was at least 42mph. HOVs would continue to use the existing upper deck HOV bypass. This would help finance the cost of constructing and operating the lane. The contraflow lane could also operate as a combined bus/truck facility, with trucks paying the toll to operate in the lane. While trucks comprise only 2 percent of total vehicle volume in the morning commute (approximately 200 trucks per hour), the size and poor acceleration performance of trucks on the incline of the Bay Bridge’s eastern span can result in congestion.

Physical Improvement Options Considered

The physical improvement projects considered in the analysis focus on the construction of the contraflow lane on the Bay Bridge. The improvements also focus on providing access points to enter the contraflow lane from East Bay freeways and at YBI. Options for exiting the lane on the San Francisco side of the Bay Bridge are also discussed. Figure 12 summarizes the proposed physical improvements.

Contraflow Lane on the Bay Bridge

The Bay Bridge contraflow lane would comprise the number #1 lane in the eastbound direction across the entire length of the bridge. A movable “zipper” barrier would separate the contraflow lane from eastbound traffic. Figure 13 shows concept of the contraflow lane on the lower deck of the suspension span. The contraflow lane could be operated as a transit/HOT facility or as a bus/truck facility. Access into the contraflow lane from I-80, I-580, I-880, and Grand Avenue on the East Bay side would occur via new connector ramps. Access out of the contraflow lane on the San Francisco side of the bridge would occur with a new facility located at the First and Essex Street ramps. Details on these access points are described in the next section.

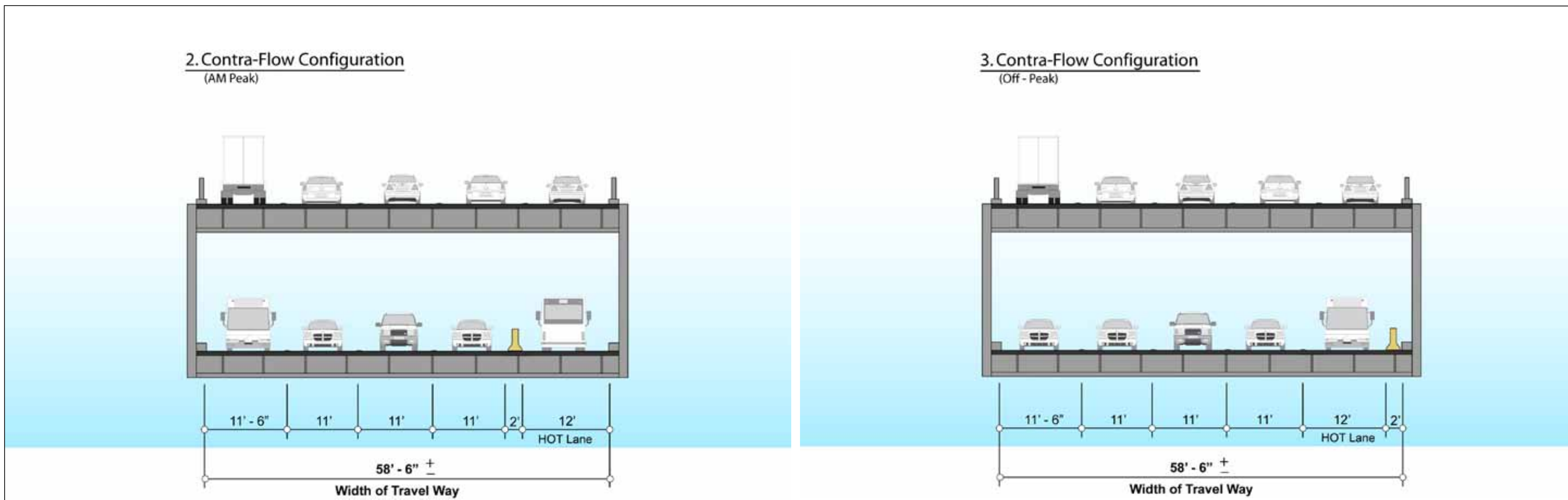


Figure 14: Contraflow Lane on Lower Deck

Figure 15: I-80 Contraflow Access

Figure 16: I-580 Contraflow Access

East Bay Options for Entering the Contraflow Lane

I-80 Access: The westbound HOV lane occupies the #1 lane along I-80 through the East Bay. As I-80 approaches the distribution structure, a flyover ramp connects the westbound HOV lane to the toll plaza. This flyover ramp begins its grade separation and divergence from I-80 approximately 1,500 feet south of Powell Street in Emeryville. In the opposite direction of travel, the eastbound I-80 HOV lane from the Bay Bridge merges with the northbound I-880 ramp at roughly the same location south of Powell Street.

It would be possible to begin the contraflow lane on I-80 between Powell Street and the beginning of the HOV flyover ramp. The contraflow lane would be created by reversing the eastbound I-80 HOV lane and providing a break in the median barrier to allow autos to crossover at this location. Westbound contraflow traffic (buses and HOT vehicles) would transition from the westbound HOV lane and into the reversible eastbound I-80 HOV lane. A moveable barrier would separate the contraflow lane from eastbound I-80 traffic in the mixed-flow travel lanes. The I-80 contraflow lane would the merge with the I-580 access point and connect to the contraflow lane on the bridge. Outside of the AM peak period the moveable barrier would be removed and traffic operations would revert to their present patterns.

Figure 14 shows the I-80 access point, the beginning of the contraflow section, and the crossover location south of Powell Street.

I-580 Access: The access from westbound I-580 into the contraflow lane could be provided at the base of the distribution structure. A break in the median barrier could be provided to allow vehicles to enter the contraflow lane. Figure 15 illustrates this concept.

The I-580 HOV lane would extend westbound from the I-580/SR-24 junction to the exisiting lanes west of the distribution structure. However, because this would be a particularly high-cost facility, the analysis analyzes scenarios both with and without this extension.

I-880 Access: I-880 traffic headed towards the bridge could access the contraflow lane using the existing HOV ramp. The HOV lane that leads to the south side of the toll plaza could diverge prior to the toll plaza and merge with the contraflow lane. The existing at grade roadway that crosses below the I-880 ramp and serves the Caltrans toll plaza from westbound I-80 would be closed to prevent conflicts.

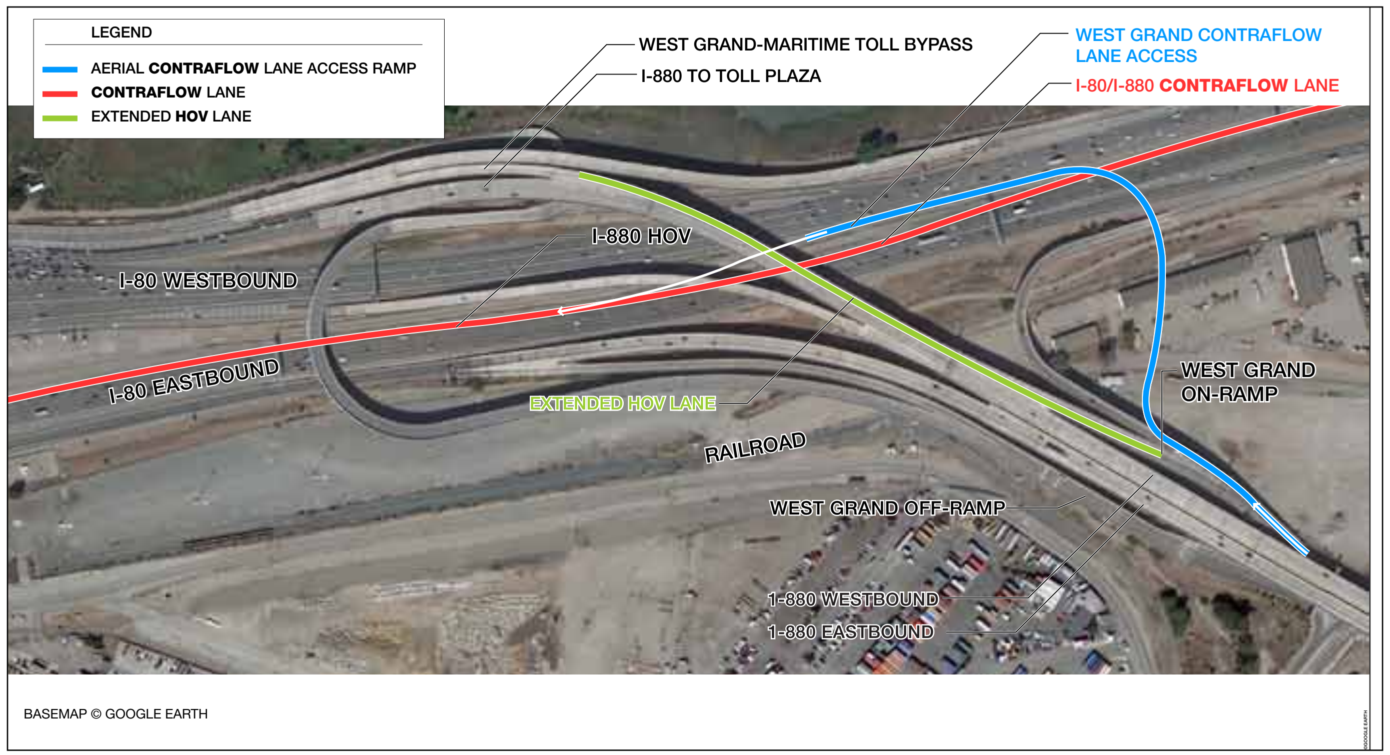


Figure 17: West Grand Access - Option A

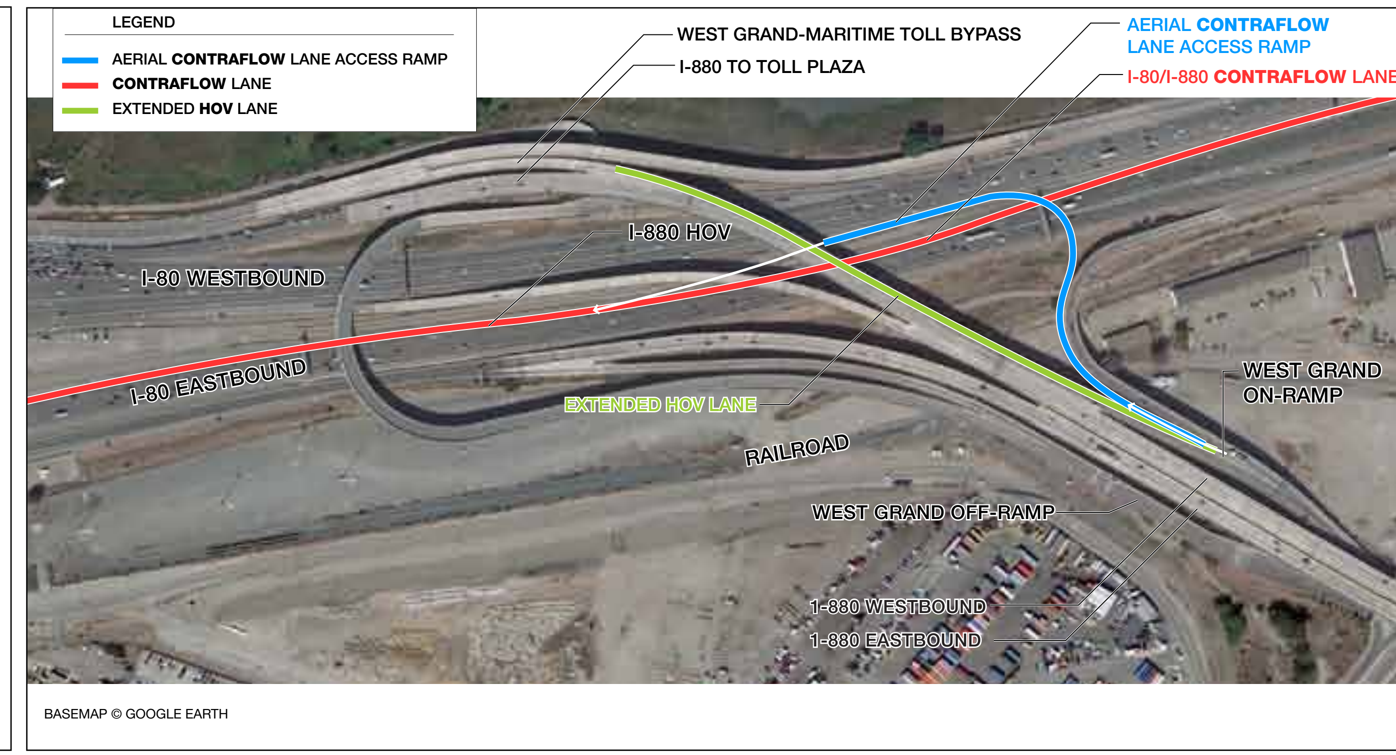


Figure 18: West Grand Access - Option B

West Grand On-ramp Access: Providing a point of access to the contraflow lane from the West Grand Avenue and Maritime Street is complex but critical for AC Transit bus operations. The need for a straightforward and effective entrance is enhanced by proposals for a bus rapid transit (BRT) corridor along West Grand through Oakland. Four potential options have been explored. For all options it is assumed that the westbound West Grand-Maritime ramp above the I-80 eastbound and westbound roadways will be widened. This will extend the toll plaza bypass HOV lane to Maritime and allows for continuation of a bus/HOV lane along the West Grand structure located under the I-880 freeway.

West Grand Option A includes an aerial ramp beginning at the West Grand/Maritime Street intersection. As shown in Figure 16 the West Grand On-ramp could be widened for a dedicated contraflow lane access ramp. The contraflow lane access ramp would diverge to pass over Engineer Road, the railroad, I-580 eastbound on-ramp, and the eastbound I-80. The ramp would descend at approximately 5 percent touching down in the I-80 median. The contraflow access lane would utilize the existing toll plaza access lane where a zipper barrier would provide a merge into the facility.

West Grand Option B would diverge from the extended HOV lane on the widened westbound ramp. As shown in Figure 17 it would parallel the West Grand Avenue to I-580 eastbound connector, passing over the port railroad and I-80 eastbound roadway. The ramp would descend at approximately 8 percent and return to grade in the I-80 median, utilizing the existing toll plaza access lane as per Option A, where a zipper barrier would allow for a merge into the contraflow lane.

Improvement Options

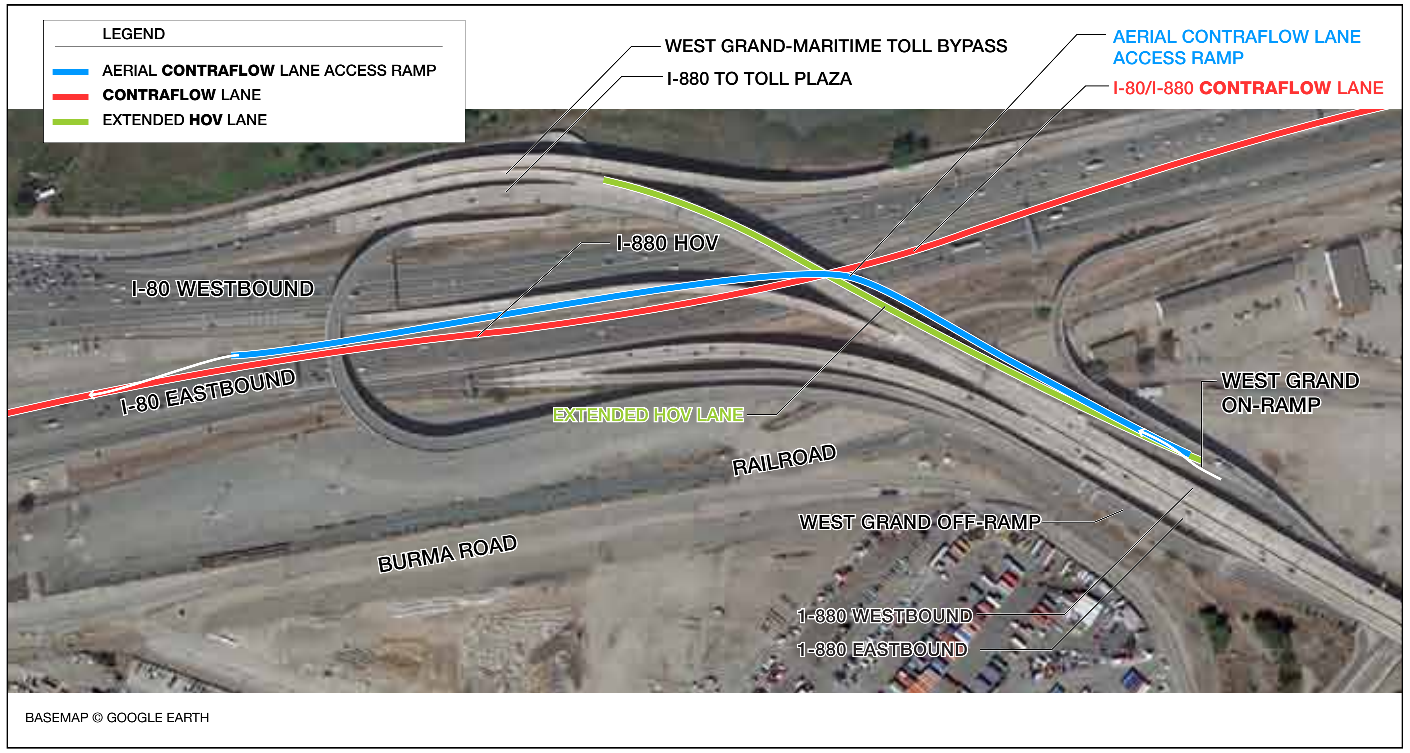


Figure 19: West Grand Access - Option C

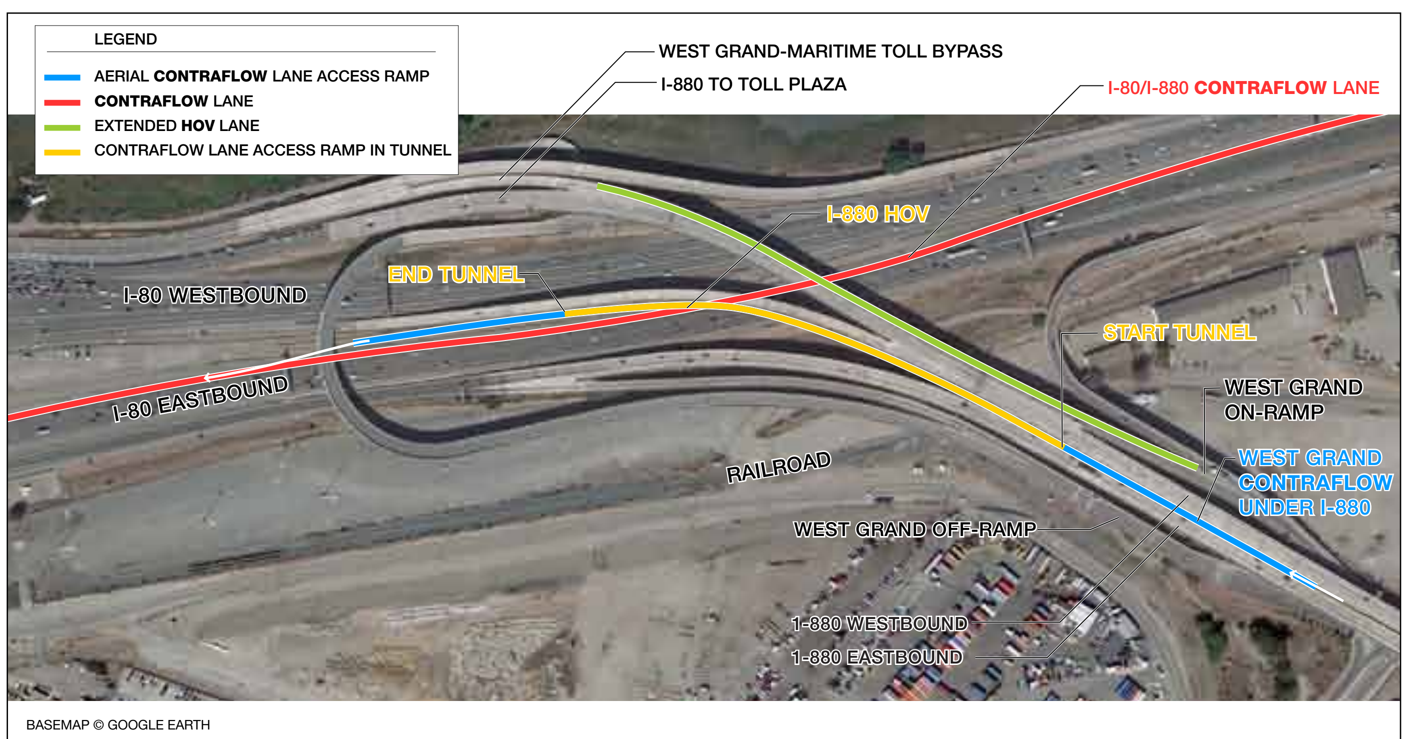


Figure 20: West Grand Access - Option D

West Grand Option C would diverge from the extended HOV lane on the widened I-880 westbound ramp. As shown in Figure 18 it would climb at approximately 8 percent to pass over I-880 westbound, I-880 HOV ramp, and I-80 to Maritime Avenue 'loop-back'. The ramp would descend at roughly 8 percent until touchdown within the current Caltrans plaza. A zipper barrier, as per Option A, would provide a merge into the contraflow lane.

West Grand Option D would tunnel beneath the eastbound traffic of I-80 and I-580 as shown as in Figure 19. From the Maritime St and West Grand Ave intersection the contraflow lane access ramp would be constructed at grade, beneath the I-880 elevated roadway. It would depress to pass under the railroad and eastbound I-80. The tunnel would return to grade at the east end of the Caltrans plaza and a zipper barrier would provide a merge into the HOT lane.

San Francisco Options for Exiting the Contraflow Lane

Approaching San Francisco the contraflow lane would be on the lower deck of the Bay Bridge. Westbound buses utilizing the lane are destined for the proposed Transbay Transit Center (TTC) and therefore must access it via the proposed TTC bus ramps, while private autos must be able to exit without entering the TTC facility. Two options were developed for exiting the contraflow lane. Alternatives were considered for routing buses via city streets but these were rejected due to congestion uncertainty and poor travel times reliability.

Exit Option A closes the Essex Street ramp and autos would exit on a reversible First Street ramp to Harrison Street. Buses would exit on a new lane ramp to the TTC bus ramps. The new contraflow lane ramp would use the closed Essex ramp at grade, pass beneath the exiting Fremont Street off-ramp, avoid existing columns, and tie into the TTC bus ramps in the vicinity of the Caltrans electrical substation. As a result, the Sterling Street ramp would be the sole downtown entrance for eastbound traffic in the AM peak period. Outside the AM peak period the First Street, Essex Street and Sterling Street ramps could remain for eastbound access to the Bay Bridge and the new bus connector lane to TTC would be closed. Moveable barriers could be used to close Essex Street in the AM peak and close the HOT lane bus ramp at other times. This option could be combined with SoMa Analysis Option A, the possible closure of Essex Street ramp.

Exit Option B maintains an eastbound on-ramp from Essex Street. Essex Street would be grade-separated with Harrison Street and lowered to pass beneath Harrison Street and a new bus ramp connection from the contraflow lane. Autos would exit on a reversible First Street ramp, with buses diverging from the contraflow lane onto the bus ramp connector. Essex Street and Sterling Street ramps could provide downtown entrances for eastbound traffic. The bus ramp would be grade separated above the lowered Essex Street, pass beneath the Fremont Street Off-ramp, and tie into the TTC bus ramps. The bus ramp connector horizontal geometry is dictated by column locations and vertical clearances above Essex Street and beneath Fremont Street Off-ramp. Essex Street would require an approximate gradient of 10 percent to rise from beneath the bus ramp connector to tie in with the existing First Street ramp nose. The horizontal curves and vertical clearances could be optimized with a more detailed study. Figure 20 illustrates this plan.

In Exit Option B, Essex Street ramps remain open and Essex Street would be widened to five lanes between Folsom and Harrison streets to increase eastbound queuing capacity. As suboptions, changes could be made to Sterling Street and First Street and these concepts can be coordinated with the SoMa PM improvement options that consider reconfiguring the downtown on-ramp.

Figure 21: San Francisco Contraflow Lane Exit Option B

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

Figure 22: Treasure Island and Yerba Buena Island Ramps (Source: Fehr & Peers, AECOM, 2009)

Yerba Buena Island and Treasure Island

As part of the Bay Bridge East Span replacement project and the Treasure Island and Yerba Buena Island Redevelopment Plan, new on/off-ramps will be constructed on the east side of Yerba Buena Island (see Figure 21). These ramps will comprise standard right hand merging and diverging and will not affect the operation of the proposed contraflow lane. The existing eastbound off-ramp (number 5 in Figure 19) could be utilized as a bus only on-ramp to the contraflow lane in the AM peak period, subject to further operational considerations. As a further option, HOT vehicles from Treasure Island could be allowed to use the Contraflow lane using the bus ramps.

Improvement Options

Caltrans Toll Plaza Access

Regardless of the option pursued for West Grand contraflow lane access ramp, access must be provided to the Caltrans administration building. Under current conditions an entrance to the plaza is provided from #1 lane of both eastbound and westbound I-80. An additional access is provided from I-80 westbound #1 lane approximately 2,500 ft east of the toll plaza, which passes beneath the I-880 connection ramp farther east of the toll plaza. This roadway would be permanently closed in all options.

The contraflow lane access ramp from West Grand Ave, for all options, would serve as an entrance to the toll plaza at all times. Access from westbound I-80, I-580, and I-880 would be via the entrance immediately east of the toll booths, with additional access from the contraflow lane available in the AM peak.

Access from eastbound I-80 would be severed during the AM peak by the contraflow lane, however vehicles would be able to exit at West Grand Ave and loop back on the contraflow lane access ramp. Outside the AM peak, the current eastbound I-80 access would remain. In the AM peak period maintaining an eastbound move for vehicles exiting the toll plaza is an issue and requires further study.

Cost of Improvements

Arup analyzed the cost of delivering the range of improvement identified in this report. All estimates are considered "high-level" and it is recommended that an additional 25 percent general contingency be added for any budgeting purposes. The low costs represent the most modest improvements at the lowest unit costs, which the higher costs represent the most complex improvements at higher unit costs. Table 13 presents the cost estimates. The total improvement costs presented at the bottom of the table represent two potential packages; these are shown for illustrative purposes.

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	$2,500,000	$4,100,000
Exit Option B	$24,100,000	$42,900,000

Total Improvemant Costs		
Improvement Package Options	Low Range Cost	High Range Cost
Package 1: Core Items + West Grand Option B + Exit Option A	$51,000,000	$97,200,000
Package 2: Core Items + West Grand Option D + Exit Option Bt	$96,100,000	$176,600,000

Source: Arup, 2010

Table 13: Conceptual Cost Estimates

Further analysis is necessary to provide a more accurate budget for these improvements to provide a more robust analysis of the value of the improvements and to further define their costs.

Figure 23: West Span

Analysis Scenarios

A series of analysis scenarios was developed to assess future operating conditions along the corridor. These scenarios were developed using the calibrated VISSIM model, the improvements listed above, and future 2035 traffic forecasts obtained from the San Francisco County Transportation Authority's (SF-Champ) travel demand model. Existing bus service within the corridor was obtained from current schedules, while future bus service assumptions were developed from TTC planning studies. Table 13 summarizes the analysis scenarios included in the analysis:

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	• 2035 traffic volumes and bus frequencies • No I-580 HOV lane, no metering change • Assumes contraflow lane operates as a HOT lane with 1,000 vehicles per hour

Table 14: Analysis Scenarios

In the Future scenarios with the contraflow lane, an assumption was made that 1,000 vehicles per hour would use the lane as a HOT lane. This also reduces the traffic demand at the toll plaza by 1,000 vehicles. In the VISSIM model, 1,000 vehicles per hour were shifted out of the projected traffic flow and into the contraflow lane. This produces delay results in the two Physical Improvements scenarios that are better than the Base Year condition.

In reality, any available capacity in the freeway system resulting from vehicles shifting to a bus/HOT contraflow lane would get absorbed quickly. Any capacity increases associated with a bus/HOT contraflow lane could induce travelers to shift from transit to driving, or induce drivers to shift their trip back into the peak period. This phenomenon of "induced demand" is likely to occur in this context. The Bay Bridge corridor and the entire Bay Area region have high levels of "latent" demand that cannot be satisfied by the region's transportation system during peak periods. Induced demand was not considered in this study, as it requires a more detailed analysis of travel behavior and demand.

Regardless of how induced demand is considered, the transit analysis results are unlikely to change. The VISSIM analysis indicates that the physical improvements provide real benefits to bus operations. Additional congestion as a result of induced demand is unlikely to interfere with the ability of Transbay buses to access and operate within the contraflow lane.

Future Scenario Analysis

Future Scenario Microsimulation Analysis

VISSIM microsimulation models were developed for each analysis scenario using the assumptions detailed earlier in this report. This section provides a summary of the performance measures and targets and detail on the delay and transit measures.

Summary of Performance Measures and Targets

The performance measures and targets were evaluated for each scenario based on the results of the microsimulation modeling. Table 15 provides a summary of these results for the 8-9 AM hour. Table 2 indicates whether the target is satisfied – "Pass" – or exceeds the target – "Fail".

The results in Table 2 indicate that the westbound AM corridor would experience acceptable operating conditions through 2020. However, the analysis predicts that conditions for both transit and autos would degrade to unacceptable levels by 2035. The two Physical Improvement scenarios could substantially improve mobility through the corridor, particularly for transit. The results indicate that the physical improvements examined in this study have clear operating benefits. The consultant team also evaluated an option to increase metering rates onto the Bay Bridge. This scenario provided the worst service of all options studied.

The microsimulation data supporting the results in Table 15 are provided in the following sections. These sections describe vehicle delay, person delay, and transit speed and travel times.

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

Table 15: Performance Measures

Vehicle Delay

Vehicle-hours of delay were analyzed for the four-hour modeling period for each of the five scenarios. Vehicle delay was measured for vehicles in the network crossing the Bay Bridge; this measurement excludes vehicle trips to other destinations within the network, as well the delay associated with continuing on through San Francisco. Table 15 presents the vehicle-hours of delay results by scenario. Values highlighted are delays that exceed the delay targets. The Future (2035) With Physical Improvements scenario is the only one that meets the performance criteria for each hour.

Vehicle-Hours	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	Total
Base Year (2009)	265	1,335	2,350	3,703	7,654
Future (2020) No Project	391	1,620	2,725	3,269	8,006
Future (2035) No Project	524	2,058	3,208	3,707	9,497
Future (2035) With Alternative Metering	585	2,899	3,680	3,352	10,516
Future (2035) With Physical Improvements	225	989	2,168	3,295	6,677
Future (2035) With Reduced Set of Physical Improvements	240	1,086	2,288	3,349	6,962
2035 No Project vs Base Year	98%	54%	37%	0%	24%
2035 With Physical Improvements vs Base Year	-15%	-26%	-8%	-11%	-13%
2035 With Physical Improvementst vs 2035 No Project	-57%	-52%	-32%	-11%	-30%

Table 16: Vehicle-Hours of Delay Results

Person Delay

Person-hours of delay were based on vehicle-hours of delay and assumptions of vehicle occupancy. Bus occupancy was collected from Transbay ridership counts estimated by hour. Table 16 reports the person-hours of delay results by scenario. The results are similar to vehicle-hours of delay, with the With Physical Improvements scenario satisfying the performance criteria.

Person-Hours	6:00-7:00	7:00-8:00	8:00-9:00	9:00-10:00	Total
Base Year (2009)	409	2,010	3,583	5,587	11,588
Future (2020) No Project	607	2,490	3,937	4,711	11,745
Future (2035) No Project	802	3,375	4,720	5,501	14,398
Future (2035) With Alternative Metering	858	4,608	6,256	5,173	16,894
Future (2035) With Physical Improvements	333	1,434	3,254	4,946	9,967
Future (2035) With Reduced Set of Physical Improvements	376	1,618	3,426	5,187	10,607
2035 No Project vs Base Year	96%	68%	32%	-2%	24%
2035 With Physical Improvements vs Base Year	-19%	-29%	-9%	-11%	-14%
2035 With Physical Improvementst vs 2035 No Project	-58%	-58%	-31%	-10%	-31%

Table 17: Person-Hours of Delay Results

Future Scenario Analysis

Transit Travel Speed and Travel Time

Average bus travel speeds were measured by each approach to the toll plaza for the four-hour analysis period. The results show that even in the Future (2035) No Project models, not all buses meet the 42 mph average speed. In the later hours congestion can reduce speeds on the approaches. The With Physical Improvements scenario maintains high speeds throughout the modeling period, outperforming even the Base Year model. Table 17 provides a summary of the transit travel speed results for the 6:00 to 9:00 AM period.

Travel times are measured between the distribution structure and the bus off-ramp to the Transbay Terminal. The highlighted values exceed the 10 minute travel time specified in the performance criteria. The With Physical Improvements model travel times remain under 10 minutes for I-580 and I-880; I-80 travel times exceed 10 minutes by around 12 seconds. Travel times are most consistent in the With Improvements scenario throughout the entire four-hour period compared to most other scenarios where travel times begin to vary during the later hours. Table 18 presents the travel time results by scenario.

Bus Travel Speeds (MPH)	6:00-7:00	7:00-8:00	8:00-9:00
Base Year (2009)			
I-80 to the TTC	55.5	53.9	46.8
I-580 to the TTC	52.4	48.5	29.6
I-880 to the TTC	57.1	52.9	49.7
Future (2020) No Project			
I-80 to the TTC	54.3	51.0	45.9
I-580 to the TTC	51.5	37.9	19.2
I-880 to the TTC	54.6	52.4	50.2
Future (2035) No Project			
I-80 to the TTC	51.9	47.6	36.5
I-580 to the TTC	50.9	37.5	12.7
I-880 to the TTC	54.5	29.5	42.8
Future (2035) With Alternative Metering			
I-80 to the TTC	53.7	51.1	27.1
I-580 to the TTC	51.0	35.5	21.6
I-880 to the TTC	54.5	29.4	32.9
Future (2035) With Physical Improvements			
I-80 to the TTC	53.0	52.4	52.8
I-580 to the TTC	54.8	53.6	52.9
I-880 to the TTC	59.0	58.4	58.0
Future (2035) With Reduced Set of Physical Improvements			
I-80 to the TTC	53.0	52.4	52.8
I-580 to the TTC	55.2	50.3	37.4
I-880 to the TTC	59.0	58.4	58.0
2035 No Project vs Base Year			
I-80 to the TTC	-6%	-12%	-22%
I-580 to the TTC	-3%	-23%	-57%
I-880 to the TTC	-4%	-44%	-14%
2035 With Physical Improvements vs Base			
I-80 to the TTC	-4%	-3%	13%
I-580 to the TTC	5%	10%	78%
I-880 to the TTC	3%	10%	16%
2035 With Reduced Set of Physical Improvements vs No Project			
I-80 to the TTC	2%	10%	45%
I-580 to the TTC	8%	43%	318%
I-880 to the TTC	8%	98%	35%

Table 18: Transit Travel Speed Results

Bus Travel Speeds (Time)	6:00-7:00	7:00-8:00	8:00-9:00
Base Year (2009)			
I-80 to the TTC	9.7	10.0	11.5
I-580 to the TTC	9.7	10.5	17.2
I-880 to the TTC	10.0	10.8	11.5
Future (2020) No Project			
I-80 to the TTC	9.9	10.6	11.8
I-580 to the TTC	9.9	13.4	26.5
I-880 to the TTC	10.4	10.9	11.4
Future (2035) No Project			
I-80 to the TTC	10.4	11.4	14.8
I-580 to the TTC	10.0	13.6	40.3
I-880 to the TTC	10.4	19.3	13.3
Future (2035) With Alternative Metering			
I-80 to the TTC	10.1	10.6	19.9
I-580 to the TTC	10.0	14.4	23.6
I-880 to the TTC	10.5	19.4	17.3
Future (2035) With Physical Improvements			
I-80 to the TTC	10.2	10.3	10.2
I-580 to the TTC	9.3	9.5	9.6
I-880 to the TTC	9.7	9.8	9.8
Future (2035) With Reduced Set of Physical Improvements			
I-80 to the TTC	10.2	10.3	10.2
I-580 to the TTC	9.2	10.1	13.6
I-880 to the TTC	9.7	9.8	9.8
2035 No Project vs Base Year			
I-80 to the TTC	7%	13%	28%
I-580 to the TTC	3%	29%	134%
I-880 to the TTC	5%	80%	16%
2035 With Physical Improvements vs Base			
I-80 to the TTC	5%	3%	-11%
I-580 to the TTC	-4%	-9%	-44%
I-880 to the TTC	-3%	-9%	-14%
2035 With Reduced Set of Physical Improvements vs No Project			
I-80 to the TTC	-2%	-9%	-31%
I-580 to the TTC	-7%	-30%	-76%
I-880 to the TTC	-7%	-49%	-26%

Table 19: Transit Travel Time Results

Figure 24: Morning Queue at Toll Plaza

Major Findings

San Francisco employment is projected to increase by about 50 percent over the next 25 years. Already 40,000 workers commute into the city from the East Bay in the peak hour; simply projecting a 50 percent increase beyond the current use will create demand beyond the peak hour capacity of the Bay Bridge and BART.

The major conclusions of the AM westbound analysis for the Bay Bridge Corridor Congestion Study are:

- The Bay Bridge and the toll plaza are currently congested on most days; however, vehicle queues do not typically extend back from the toll plaza to the distribution structure.
- The HOV bypass lanes are not typically blocked, which allows for acceptable bus operations.
- With projected increases in traffic along the corridor, queuing will worsen and routinely block the HOV bypass lanes in the future (traffic growth is projected at less than half-percent annually).
- Transbay buses will not meet transit performance targets by 2035, which will limit the performance of the Transbay Transit Center.
- The physical improvements show considerable promise for maintaining bus travel times and schedule reliability along the corridor, while also providing potential increases in person-trip capacity

SoMa Analysis

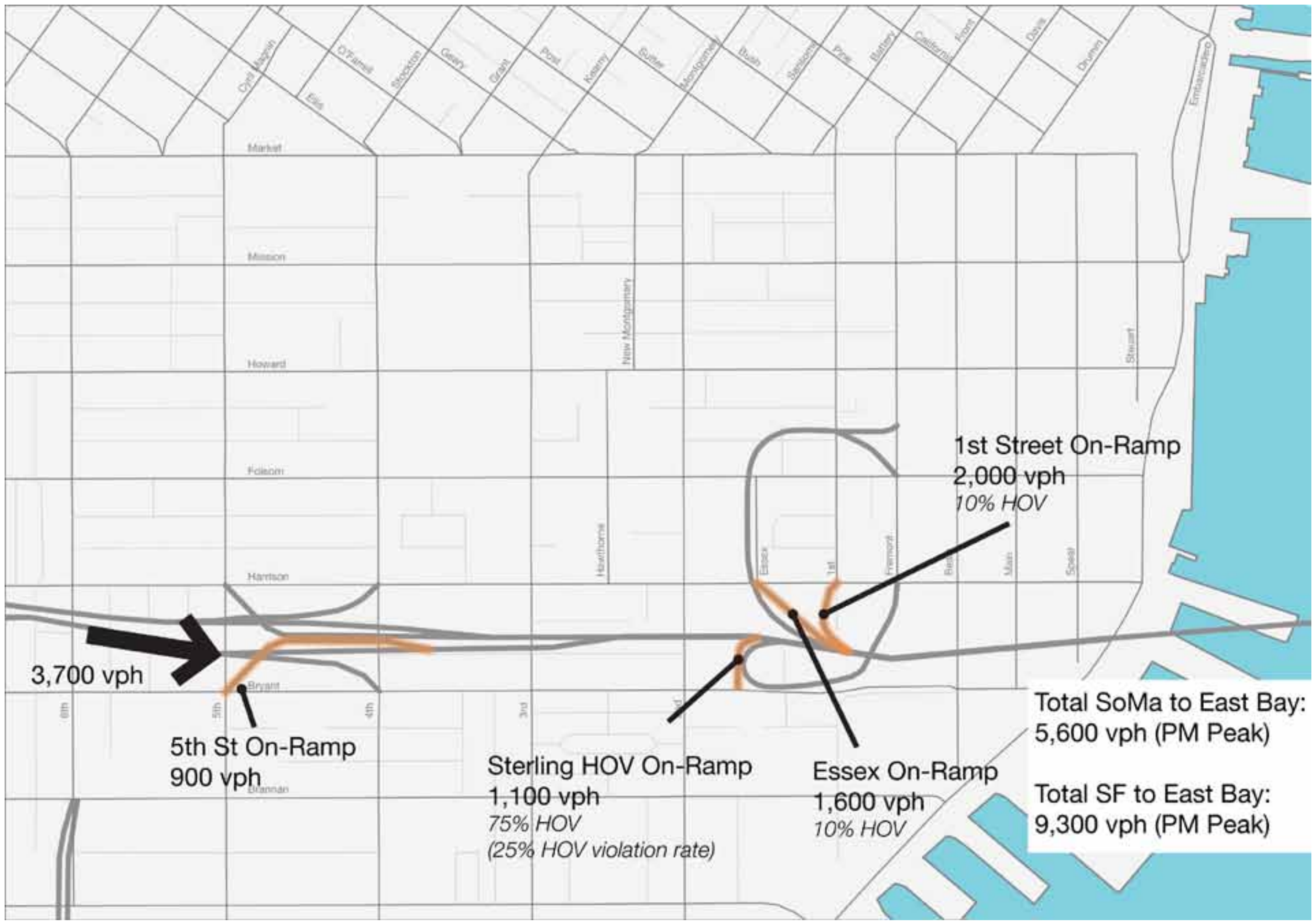


Figure 25: SoMa PM Peak Hour Ramp Volumes

Background

The "South-of-Market" (SoMa) area plays an important role in San Francisco and the Bay Area's transportation system. SoMa provides the critical roadway linkages between downtown San Francisco and the Bay Bridge. During the afternoon commute, automobile traffic leaving downtown San Francisco utilizes the SoMa roadway network to access the ramps serving I-80 and the Bay Bridge. This traffic queues on local streets as it is funneled towards the major Bay Bridge on-ramps at First Street, Essex Street, and the HOV on-ramp at Sterling Street (via Bryant Street). SoMa afternoon traffic, especially east of Fifth Street, is characterized by heavy congestion and frequently experiences gridlock on many streets.

Afternoon traffic conditions on SoMa streets vary considerably from day-to-day. While the causes of congestion within SoMa are very complex, operating conditions on the Bay Bridge and local fluctuations in demand exert considerable influence on local street operations. On a normal "functioning" day, the four SoMa on-ramps to the Bay Bridge at First, Essex, Sterling (HOV), and Fifth Streets serve approximately 5,600 vehicles during the PM peak hour. The PM peak hour volumes for each ramp are shown on Figure 24.

On days when the Bay Bridge is congested or there is an event in downtown (e.g., a San Francisco Giants baseball game), it is not unusual for vehicle queues to extend along First Street from the First Street on-ramp to Market Street, and along Harrison Street from the on-ramp to the Embarcadero. It is likely that even on a normal functioning day, the traffic demand is very close to the street system's capacity. It is conceivable that a relatively small increase in vehicle demand, perhaps in the range of 10 to 15 percent, could create conditions that result in a failing day. Figure 25 provides an example of queuing on a functioning "good" day compared to a failing "bad" day.

While system failure is difficult to measure precisely, field observations suggest that the local SoMa street network breaks down two to three days per week. System failure is typically defined as queues extending back from the Bay Bridge on-ramps on First Street to a point beyond Mission or Market Streets. When queues of this severity develop, intersections often get blocked, which can interfere with transit operations on Market, Mission, and Folsom Streets.

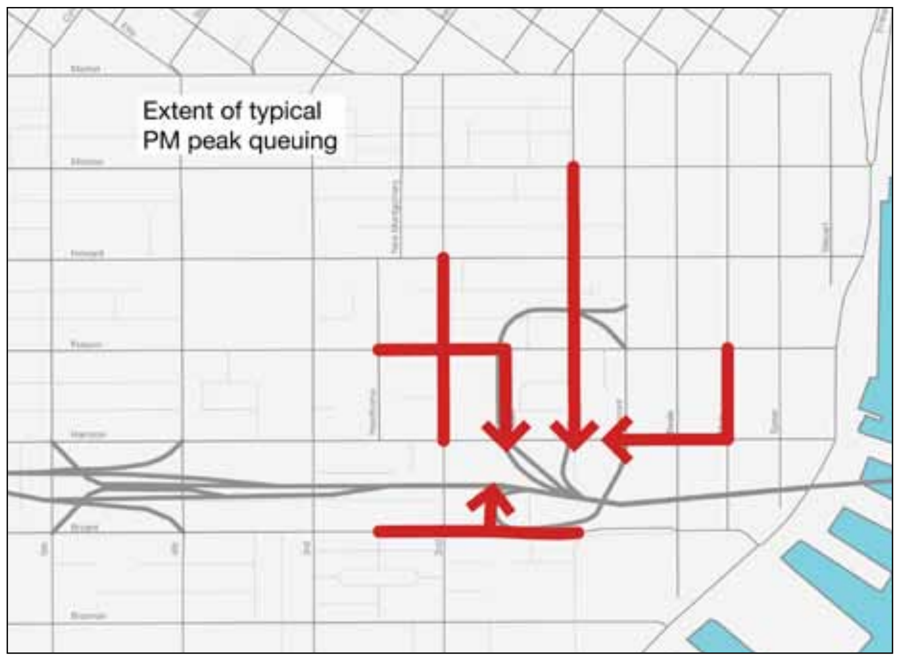


Figure 26: Typical versus Gridlocked Queuing

The character of SoMa has been changing over the years as it has transitioned from a light-industrial area to a mix of commercial and residential uses. The TTC and the San Francisco Planning Department's proposed Transit Center District Plan (TCDP) promise to increase the intensity of development within SoMa, while transforming the street grid into a more locally-focused pedestrian and transit-oriented area.

Balancing the regional and local transportation needs within SoMa is a challenge. The regional needs are related to managing the Bay Bridge-bound vehicle queues on SoMa streets. Local needs are related to accommodating increased transit and pedestrian activity on SoMa streets as redevelopment occurs.

Purpose and Limitations of this Study

The ultimate objective of the SoMa analysis is to identify transportation improvements that better manage Bay Bridge queues and improve local traffic circulation and transit reliability. This study represents a first step towards investigating and understanding the transportation issues in SoMa.

The initial work on a second VISSIM microsimulation model of the SoMa street network east of Fifth Street was advanced as part of this study. The SoMa model utilizes VISSIM's dynamic assignment routine to assign traffic to the network. Dynamic assignment, as applied in this study, is an iterative procedure that adjusts a driver's route choice based on the experienced travel time and cost on the network.

The analysis does have limitations. While the VISSIM model is considered calibrated, further model development work is required before a more comprehensive analysis of the study area is possible. The additional work required to further advance the model includes:

- Refining VISSIM's dynamic assignment routine
- Adjusting the origin-destination (O-D) tables and traffic compositions (SOV, HOV, Truck)
- Understanding the variability in eastbound Bay Bridge traffic operations during the PM peak period
- Understanding the variability in traffic demand across the SoMa study area
- Developing a better estimate of traffic produced and attracted to internal zones
- Adding pedestrian volumes at more intersections
- Developing a future year traffic forecast

A comprehensive analysis of potential improvements has not been conducted because the model requires these additional refinements. However, initial testing of potential improvements has been completed and promising strategies have been identified. The microsimulation model developed for this effort will serve as a valuable tool for further analysis.

SoMa Desired Outcomes

The following desired outcomes will become performance measures when the model is further developed. These tentative performance measures were developed as a result of discussions with the stakeholders:

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 and Folsom Street should decrease with any improvement option.

SoMa Analysis

VISSIM Microsimulation Analysis

Model Study Area and Scope

Figure 26 presents the study area for the SoMa PM peak period VISSIM model. The VISSIM model network includes the following:

- 0.75 square-miles of the SoMa street network bounded by Market, Embarcadero, Bryant and Fifth Street
- 80 signalized intersections, including the intersections north of Market Street that provide points of access for traffic entering and exiting the Financial District
- 9 freeway ramps serving I-80 and the Bay Bridge
- All of the major paths of travel between the Financial District and the Bay Bridge.
- All of the major on and off-ramps that serve downtown San Francisco and SoMa
- I-80 is included in the model as an external zone that produces and attracts traffic. However, freeway operations were not explicitly modeled nor included in the calibration
- The existing Transbay Terminal (as of 2009)
- A two-hour PM peak period (includes a one-hour “warm-up” period and a one-hour analysis period)
- VISSIM’s dynamic assignment routine is utilized
- Existing traffic volumes (2008-2010) and existing transit service (as of 2009)
- The PM peak period traffic demand tested in the model represents a typical “functioning” data
- Traffic demand is split into SOV, HOV, and Truck based on recent counts and observations
- 31 external zones on local streets
- 2 external freeway zones (Bay Bridge East and I-80 West)
- 26 internal zones within the study area

While the SoMa area is generally defined as covering a larger area of downtown San Francisco, the model study area was limited to what is shown in Figure 26. This study area is sufficient to capture most of the major commute paths for traffic exiting downtown San Francisco during the afternoon.

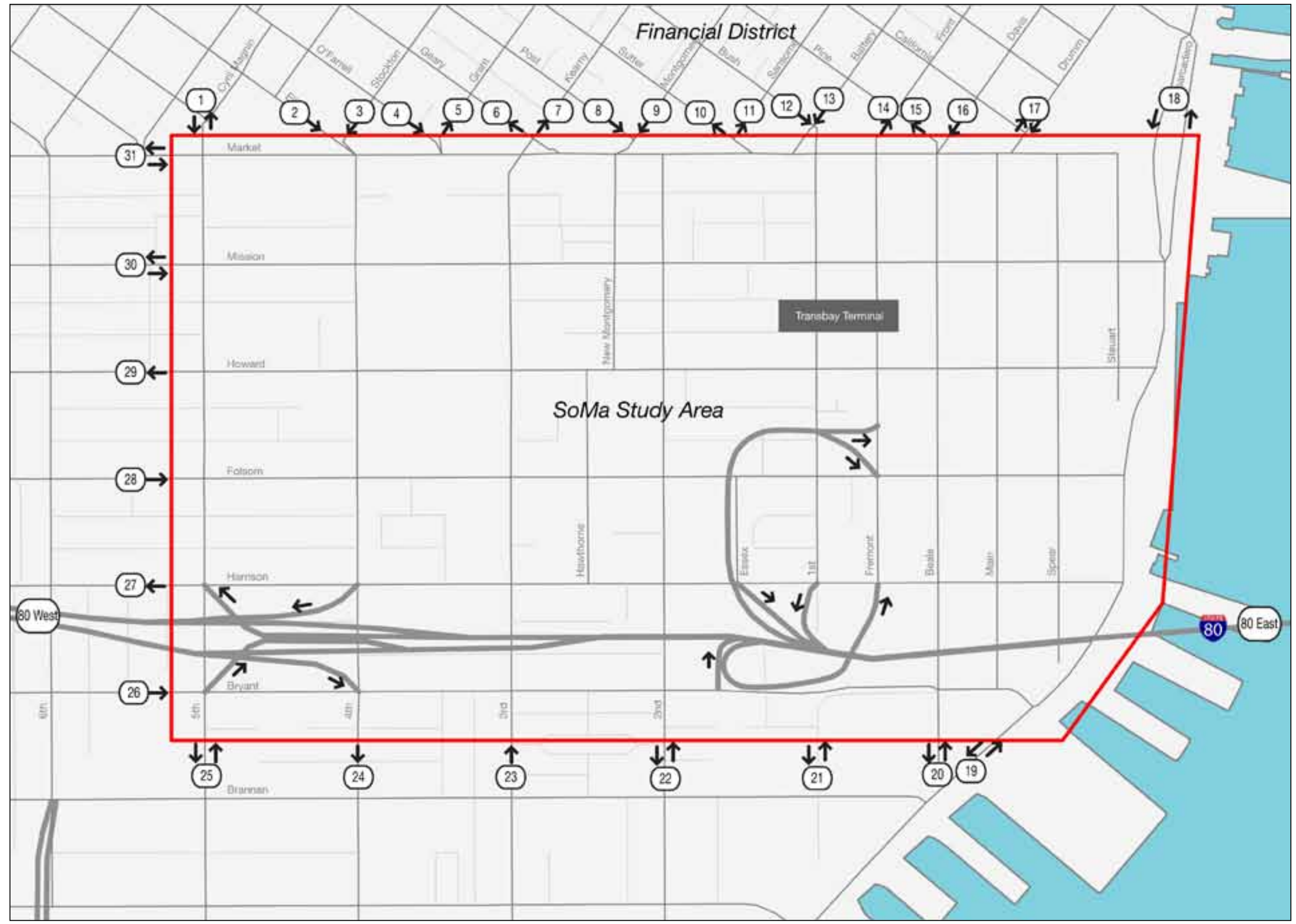


Figure 27: SoMa VISSIM Model Study Area

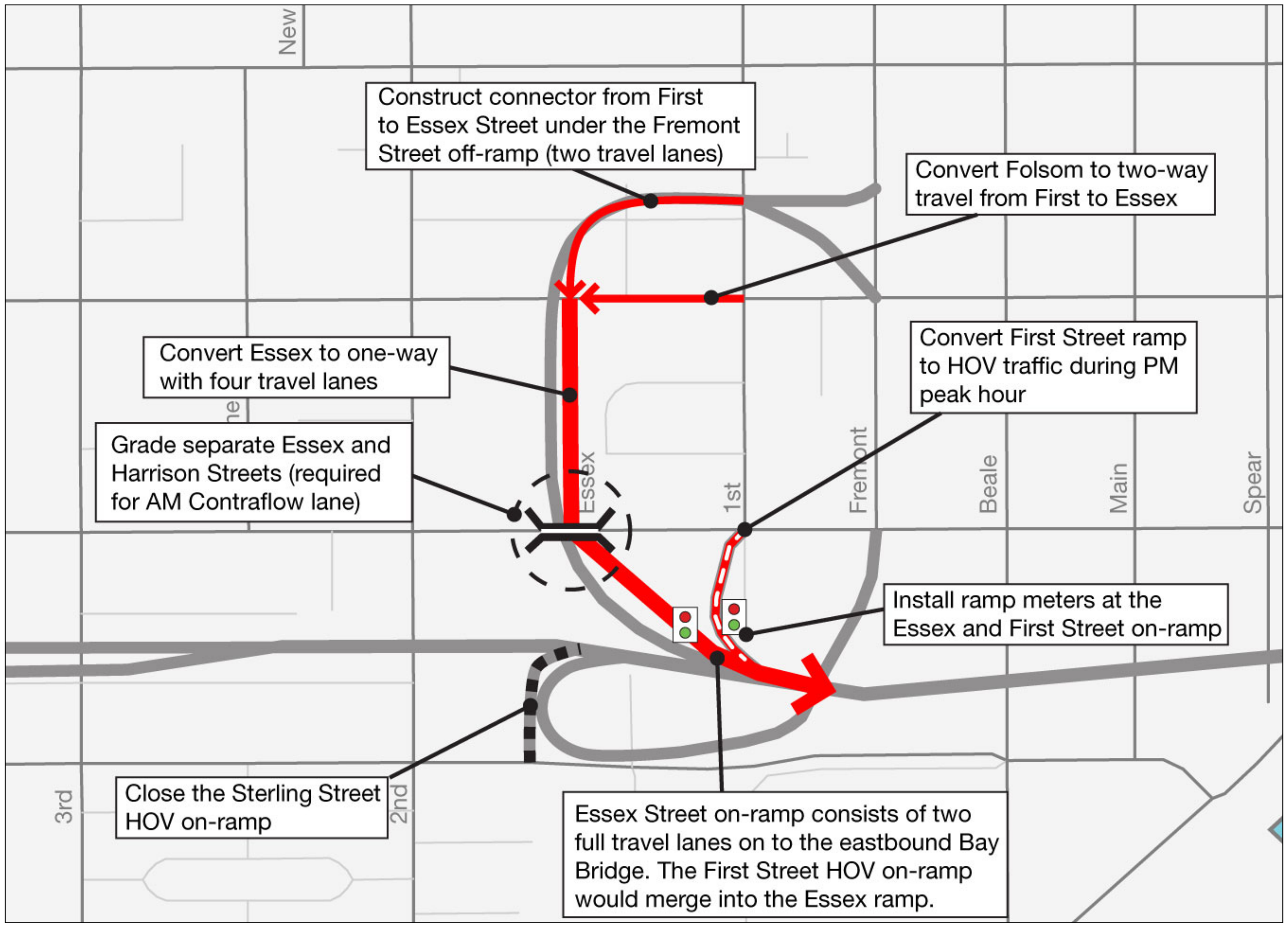


Figure 28: Potential SoMa Improvements

Previous Modeling Efforts

The SoMa VISSIM model developed for this study leverages two previous modeling efforts:

- A detailed Market-Embarcadero VISSIM model developed by Tony Young at the San Francisco Municipal Transportation Agency (SFMTA) for studying signal timing and coordination plans along Market Street and the Embarcadero.
- A VISSIM model of the TTC street level bus plaza developed by Arup for the TJPA that analyzed the operating capacity of the plaza and traffic operations/signal timings along Fremont Street. Traffic operations on streets immediately adjacent to the TTC (Mission, Howard, Second, and Beale Streets) were also included in the analysis.

Both of these VISSIM models analyzed existing traffic demand. Traffic signal timings, field observations, transit information, and pedestrian volumes were all carried over into the SoMa model.

Model Scenarios

The SoMa assessment considers two scenarios:

- **Base Year:** This scenario represents the final calibrated version of the VISSIM model and includes existing traffic volumes, transit service, the existing Transbay Terminal, and the existing roadway network. The existing traffic volumes and origin-destination (O-D) matrices were developed using a variety of traffic counts that were collected between 2006 and 2010. While this represents a long time frame, the most recent traffic volumes collected at the on-ramps in 2010 do not differ significantly from the ramp volumes collected in 2006.

- **Base Year With Improvements:** This scenario analyzes the same base year traffic volumes but includes a set of street improvements that have the potential to better manage afternoon Bay Bridge queues and improve local circulation and transit reliability. The set of improvements is extensive and assumes that the contraflow lane is constructed and in operation. It is also assumed that the grade separation of the Essex Street on-ramp and Harrison Street are constructed. All of these improvements are considered feasible for purposes of this study. Figure 27 presents the improvements.

The set of improvements are summarized below:

- Closure of the Sterling Street HOV on-ramp
- Relocation of HOV's to the First Street on-ramp
- Restrict the First Street on-ramp to HOV traffic only; Essex Street becomes the major on-ramp to the Bay Bridge for auto traffic
- Conversion of Essex Street to one-way southbound (towards the Bay Bridge) and widening of the ramp to four lanes. This increases the storage capacity of Essex Street.
- Grade separating Essex Street at Harrison. Grade separation at this intersection is necessary to construct the AM contraflow lane under Exit Option B.
- Installing metering signals to control traffic entering the Bay Bridge on-ramp at Essex Street.
- Converting Folsom to two-way traffic from First Street to Essex. This provides an additional path for vehicles east of First Street to access Essex Street, since Harrison must provide access.
- Constructing a one-way street with two travel lanes under the Fremont Street off-ramp that connects First Street to Essex Street. This provides an additional path for vehicles on First Street to access Essex Street.

Other changes to the street system proposed by the Planning Department in the Transit Center District Plan (TCDP) were not modeled and are not included in the improvement list.

The analysis presented in this study includes the calibration of the Base Year model with the existing traffic demand and the existing network. A screening of the Base Year and the Base Year with Improvements scenarios was done to compare queuing and the throughput of the Bay Bridge on-ramps.

This study does not consider the impacts of future traffic demand or other circulation changes on SoMa streets. Previous modeling work has indicated that forecasts of future traffic far exceed the capacity of the SoMa transportation system. A discussion of SoMa traffic forecasts is provided in a later section to highlight the significant increases forecast by the SF-Champ's travel demand model.

Dynamic Assignment: Explanation and Rationale

The SoMa model incorporates VISSIM's dynamic assignment routine to model driver's route choice between origin and destination zones in the network. Dynamic assignment, as defined within VISSIM and as applied in this study, is an iterative routine that redistributes traffic between an O-D pair based on the cost experienced by users as they travel within the simulation. VISSIM's dynamic assignment routine has the ability to produce a set of O-D traffic flows that are responsive to queuing and congestion as it develops over time.

VISSIM identifies routes between each O-D pair and assigns traffic to each path based on the travel time and cost experienced by users during a series of simulation runs. Successive iterations of the model employ a search for new routes and O-D traffic is redistributed to routes based on travel costs from previous iterations. The new traffic assignment is loaded on the network, the travel costs are collected during the run, which are then used in subsequent runs. These steps are executed until convergence criteria are met.

VISSIM's dynamic assignment routine differs from standard "static assignment" procedures for modeling traffic flows. Static assignment produces a set of O-D routings and traffic flows that do not change as congestion and queuing develops. As simulation study area's increase in size, it becomes increasingly difficult to specify routes between all O-D pairs and assign a traffic flow to each route. In the SoMa model study arae, static assignment would require identifying and assigning traffic flows to thousands of routes. VISSIM's dynamic assignment routine eliminates the need to do this by generating the routes and traffic flows as it iterates.

The usage of the term dynamic assignment in VISSIM differs from other definitions commonly used in transportation planning. While there is no unified definition, to most transportation researchers and practitioners the term "dynamic assignment" is most often associated with the process of "Dynamic Traffic Assignment" (DTA) in travel demand modeling. DTA in travel demand modeling is a technique for producing an equilibrium solution that is based on experienced travel costs[2]. DTA is a different concept from the microsimulation dynamic assignment routine applied in this analysis.

Model Development

This section details the development of the SoMa VISSIM model. The model development was an iterative process and includes the following steps:

- Step 1: Data collection
- Step 2: Matrix estimation
- Step 3: VISSIM network development
- Step 4: Assign initial O-D matrix on the VISSIM network using dynamic assignment
- Step 5: Run VISSIM multiple times to generate multiple routes and traffic assignments
- Step 6: Compare VISSIM output to calibration criteria
- Step 7: Adjust O-D table and refine VISSIM network
- Step 8: Repeat Steps 5 through 7 until the model is successfully calibrated
- Step 9: Use calibrated model in the scenario analysis

Details on the data collection, O-D matrix estimation, and the steps to calibrate the SoMa VISSIM model are presented in the following sections.

[2] A Primer for Dynamic Traffic Assignment, ADB30 Transportation Network Modeling Committee (Transportation Research Board, 2010).

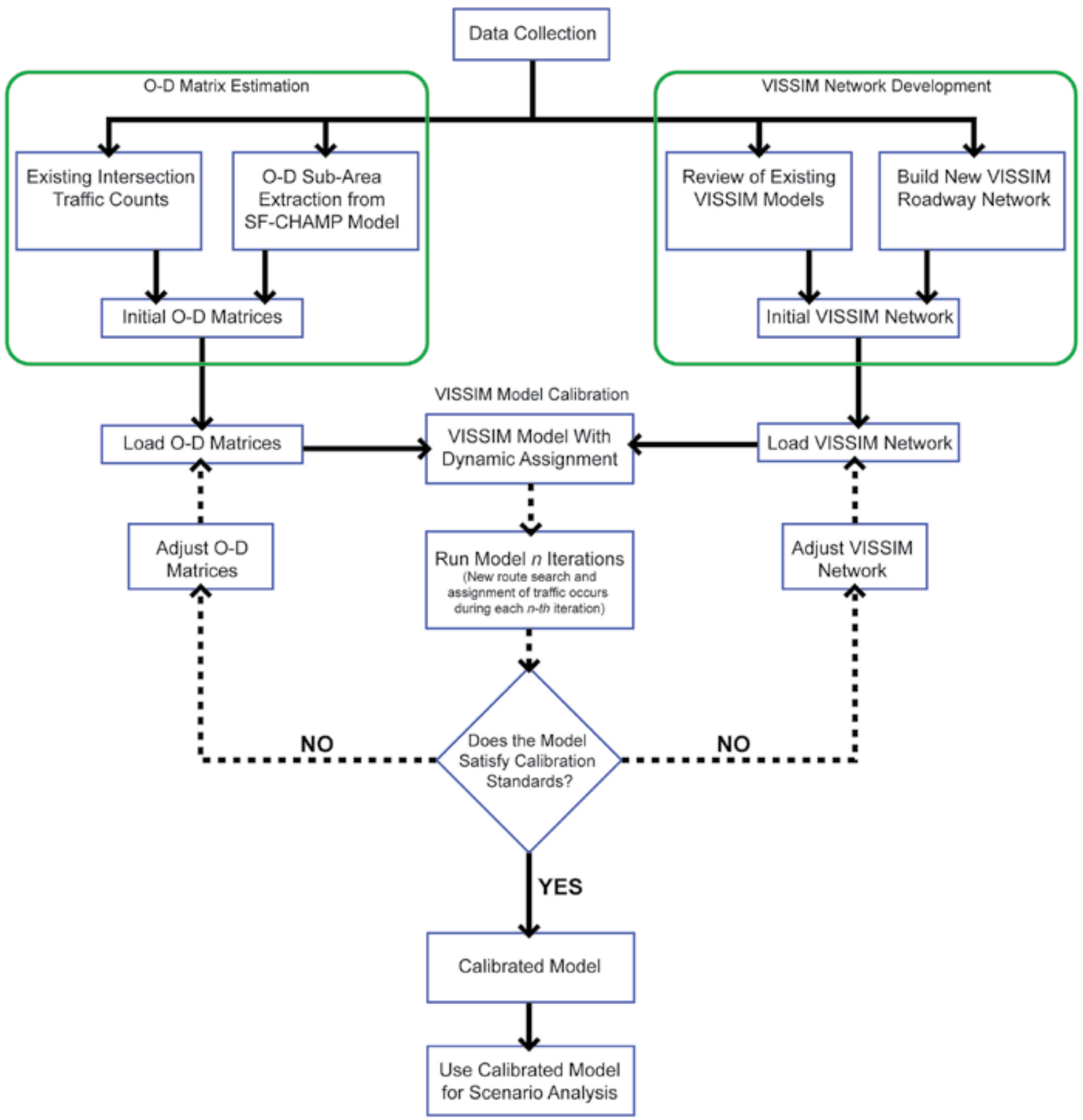


Figure 29: SoMa VISSIM Model Development Process

Data Collection

A considerable amount of traffic, transit, and pedestrian data was compiled from existing sources. Table 20 lists the traffic data sources used to develop the existing O-D matrices:

Study	Count Date	Count Locations Used in SoMa Model	Source
Market-Embarcadero VISSIM Model	2006	Market Street and Embarcadero	SFMTA
Transit Center District Plan	2008	Area bounded by Mission, Third, Bryant, Steuart Streets	AECOM
Eastern Neighborhoods	2010	Area bounded by Harrison, Fourth, Bryant, and Fifth Streets	Fehr & Peers
Other Studies (SF Mint Plaza traffic study, others)	2008–2009	Locations on Fourth and Fifth Streets (between Mission and Folsom)	LCW Consulting
Bay Bridge Corridor Congestion Study	2008–2009	First, Essex, Sterling Street on-ramps; additional vehicle occupancy counts to confirm HOV percentages	Arup

Table 20: Data Sources

The recent traffic counts at the First, Essex, and Sterling on-ramps confirm that traffic levels have not changed to a measurable degree over the last several years. Additional vehicle occupancy counts were also conducted at the on-ramps to confirm the split between SOV and HOV traffic on the ramps.

SoMa Analysis

Origin-Destination Matrix Estimation

The VISSIM dynamic assignment routine requires a set of O-D matrices that correspond to each traffic composition (SOV, HOV, Truck) and each hour of analysis. The O-D tables specify the number of vehicles that travel between a given origin and destination pair. The dynamic assignment procedure identifies a set of feasible routes between a given O-D pair and then assigns the O-D volumes to each route based on the generalized cost.

Estimating an accurate O-D matrix is critical to developing a calibrated model. The O-D matrix estimation process in the SoMa study area is complex for the following reasons:

- Size of the network and the number of zones: The SoMa model contains 64 total zones (external and internal), which makes the O-D table 4,096 cells (64*64).
- Uncertainty related to regional versus local travel: While regional trips to the Bay Bridge are the primary focus of the study, local trips still represent the majority of total traffic on the network at any given time. Estimating the split of Bay Bridge versus local traffic at each origin is extremely difficult. Presumably, a vehicle loading on the network at an origin has already chosen a route that provides the most direct route to its intended destination.
- The intersection traffic counts used for the model reflect the traffic produced and generated from zones external and internal to the SoMa study area network. Turning movement counts at intersections along the edge of the study area can be translated into external origin and destination flows rather easily. However, trips produced and attracted at internal zones require using a travel demand model.
- Balancing the external and internal flows to achieve a reasonable demand matrix

The estimation of the O-D tables was an iterative process:

1. An initial set of origin and destination volumes were developed for each external zone based on the traffic counts.

2. Cambridge Systematics extracted a sub-area O-D table from the SFCTA's SF-CHAMP model that roughly matched the SoMa model area zone structure. This O-D table provided:

    o Vehicle trips produced and attracted by internal zones
    o An initial estimate of the relative flows between O-D pairs

3. The O-D tables were split into SOV, HOV, and Truck matrices based on the following percentages (collected from traffic counts at the Bay Bridge on-ramps):
    o SOV = 75%
    o HOV = 23%
    o Truck = 2%

4. A set of additional rules and adjustments were applied to modify or restrict trips between certain O-D pairs.

5. The zonal origins and destination were factored iteratively to balance the overall O-D table.

6. The O-D tables used with VISSIM's dynamic assignment routine.

7. Based on the VISSIM model output and calibration criteria, the O-D matrices were adjusted to provide a better calibration result (steps 4 through 6). The matrix estimation is referenced in the calibration procedure section presented below.

VISSIM Network Development

The VISSIM network development included the following elements:

- Intersections along Market Street from Fifth Street to the Embarcadero and along the Embarcadero from south of Washington Street to Bryant Street were input from the SFMTA's Market-Embarcadero VISSIM model
- The remaining intersections, approximately 50 locations, were coded
- Traffic signal timings were carried over from previous models (where available) and coded at the remaining locations based on field observations and signal timing plans (where available)
- Bus routes operated by Muni, Golden Gate Transit, and SamTrans
- Pedestrian volumes (where available)
- Conflict areas and priority rules were included to provide right-of-way guidance and reduce the incidences of intersection blocking

Figure 30 illustrates the VISSIM SoMa model.

Figure 30: SoMa VISSIM Network

VISSIM Model Dynamic Assignment Development

VISSIM's dynamic assignment routine is an iterative process that requires various assumptions and actions. The SoMa model dynamic assignment routine includes the following:

- Number of iterations: Multiple runs of the model are required for the dynamic assignment routine to generate enough paths to distribute traffic to. For this analysis, the number of runs was set at 10 (n = 10). The first iteration (n=1), the shortest path between each O-D pair is searched. All traffic is assigned to this route. Each run executes a different random seed. The random seed initializes the random number generator, which provides stochastic variation of input flow into the model.
- Network loading: In early iterations, there are not enough paths to provide a reasonable distribution of traffic on the network. Until the model searches enough paths, applying 100 percent of the traffic will lead to gridlock. Therefore, traffic loading is set at 50 percent of the total for n=1, and is increased in 5 percent intervals until 100 percent of the traffic demand is assigned.
- Evaluation interval: This is a sub-interval where travel time and cost information is collected. In this model, O-D tables are provided on a one-hour basis and the evaluation interval is set at 10 minutes.
- In subsequent iterations, (e.g., n = 2 – 10), additional routes are searched and added. For a given evaluation interval, traffic is assigned to each route based on the experienced travel costs collected during that evaluation interval in previous iterations. A process weights the travel costs for a given evaluation interval across the previous iterations.

Model Calibration Criteria and Actions

The calibration of the SoMa VISSIM model focused on two criteria:

- Achieve a GEH statistic of 5.0 on three of the four SoMa study area Bay Bridge on-ramps: First, Essex, Sterling, and Fifth. These four on-ramps act as a screenline for traffic exiting downtown San Francisco and destined for the East Bay.
- Replicate queuing conditions on First Street, Essex Street, and Harrison Street that match field observations.

The following actions were taken to calibrate the SoMa VISSIM model:

- Adjusted relative traffic flows between O-D pairs
- Adjusted signal timings
- Add surcharges to discourage certain turning movements. This makes other slightly longer routes more attractive in VISSIM.

Calibration Results

Table 21 summarizes the calibration results for the Bay Bridge on-ramps.

SoMa Bay Bridge On-Ramp	Observed	Model	GEH
First Street	2,024	2,126	2.22
Essex Street	1,590	1,753	3.99
Sterling Street (HOV)	1,117	732	12.7
Fifth Street	876	766	3.86
Total to Eastbound Bay Bridge	5,607	5,377	3.11

Source: Arup, 2010

Table 21: SoMa Calibration Results

- The calibration at the two main Bay Bridge on-ramps, First and Essex Streets, have a GEH statistic less than 5.00
- The total volume the model sends to the eastbound Bay Bridge is slightly less than the observed counts. However, the model difference, as measured by the GEH statistic of 3.11, is less than the GEH standard of 5.00
- The overall distribution of traffic between the four on-ramps approximates the proportions indicated in the observed ramp counts

The model is less effective at estimating the HOV traffic to the Sterling Street on-ramp. Possible explanations for this include:

- The model appears to be over-assigning HOVs to First and Essex Streets
- The O-D table requires further refinement to assign more trips from the south edge of the model (Bryant, Second, and Third Street origins) to the Bay Bridge. This would send more HOV trips towards Sterling Street.

While the calibration of the model to vehicle throughput at the ramps is important, replicating the queuing upstream of the ramps is the primary focus of the study. Calibrating the model to queuing was done by reviewing the extent of vehicle queues observed in the simulation run and comparing that to field observations. Figure 31 shows snapshots of queuing during the simulation period at several critical locations. Additional data collection is advisable to better measure existing queue lengths.

The process described above indicates that the SoMa PM peak period model is calibrated for this level of analysis. As stated earlier, further refinements to the model are required.

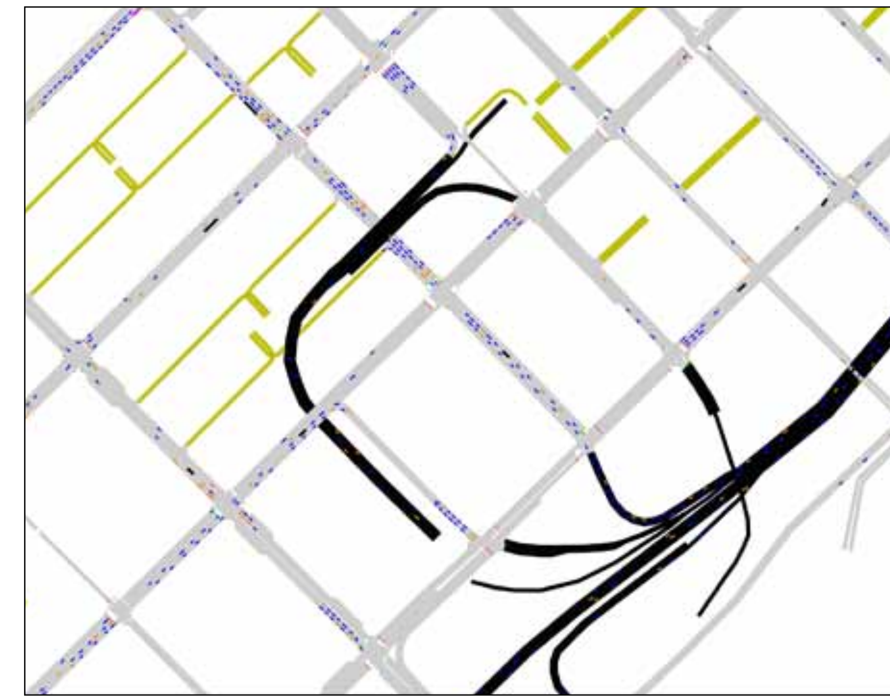


Figure 31: Vehicle Queuing at the end of the PM Peak Hour Simulation Model

SoMa Analysis

Scenario Evaluation

The two scenarios, Base Year and Base Year With Improvements, were analyzed in VISSIM for the two-hour PM peak period. No performance metrics were generated. A screening of the two scenarios was done to compare queuing and the throughput of the Bay Bridge on-ramps.

Observations from the VISSIM model runs of the Base Year and Base Year with Improvements scenarios are summarized below:

- The improvement options have the potential to enhance afternoon access to the Bay Bridge, while also maintaining or enhancing circulation on local streets for transit and local vehicular traffic
- The closure of the Sterling Street HOV on-ramp and the relocation of the HOV access to First Street warrants further study.
- The queue storage at Essex appears adequate with the recommended widening to four lanes and the addition of the two-lane connector under the TTC bus ramps between First and Essex. Traffic along Folsom gets slightly worse in this scheme and will require further improvements to help manage traffic entering Essex from Folsom.
- The grade separation of Essex will require some form of metering to control traffic flow onto the new two-lane on-ramp.
- The new First Street HOV on-ramp will likely require a ramp meter. The First and Essex Street on-ramp meters should then be coordinated to allow for a safe and orderly merge of traffic flows from the two ramps. Without any metering, the HOV traffic entering from First Street could have difficulty merging into the flow of traffic.

This screening was done to begin the investigation of possible solutions. Further work is required to test and optimize any potential improvements.

Major Findings

The SoMa afternoon analysis presented in this study accomplished the following:

- Completed a calibrated microsimulation model of the SoMa area in downtown San Francisco. The model utilizes dynamic assignment to study PM peak period traffic conditions on local streets and ramps serving the Bay Bridge
- A reconfiguration of the Bay Bridge on-ramps and streets feeding these ramps can improve regional access to the bridge and local transit circulation; 5th Street ramp, for example, is well below capacity
- SOMA traffic is impacted by the lane configuration of the eastbound west approach and Bay Bridge. Further studies should also consider changes to the Bridge flow in coordination with SOMA improvements
- The SoMa model will serve as a valuable tool for future study of land use and transportation alternatives within the study area

Introduction

This analysis illustrates the need to maintain bus transit travel times and reliability on the Bay Bridge corridor. A number of potential physical and operating strategies, including a contraflow transit lane, appear promising based on the preliminary analysis presented in this study.

Further study is suggested for the contraflow concept, but should carefully consider the conflicting impacts and issues:

- Bus transit enhancements
- Additional vehicle access into San Francisco
- Distribution of those vehicles in downtown versus beyond downtown
- HOT revenue potential
- Impact of those vehicles in the afternoon on freeway and downtown street operation
- Impact of the contraflow lane on morning eastbound traffic, both on the Bridge and on access to the Bridge
- Impact of freeway metering on westbound traffic
- Impact of Treasure Island development
- BART capacity
- Impact of proposed bicycle lane
- Impact on Bridge maintenance activities
- Morning goods movement needs
- Ability of the City to manage afternoon Bridge-bound traffic queues
- Design of the eastbound West Approach and its impact on traffic flow, both on Bridge on the City streets
- Urban design impacts on City streets of alternatives
- Additional congestion pricing to manage queues and increase LOS
- Cost of improvements and construction and operational feasibility

Further investigation could be an opportunity to actively manage the limited system capacity proactively and transparently. It could also lead to important improvements that benefit both regional travel and local conditions in San Francisco. However, for the benefits to be greater than the impacts requires careful thought and considerable discussion and collaboration with multiple stakeholders.

This study has added to our understanding of future year conditions at the Toll Plaza and also South-of-Market in their respective peak periods. As a result, it appears warranted to proceed with additional investigation of improvements to the Bay Bridge Corridor. Further studies should be comprehensive and investigate improvement options as a system.

As a starting point, further study should include the following work elements:

Policy and Priority Understanding

While San Francisco has accommodated substantial job growth over the last 30 years, that growth has absorbed most of the available capacity in the transportation system – including BART's ability to operate longer trains and more trains, or the Bay Bridge's ability to carry more people through carpools and buses. With another 250,000 jobs projected in San Francisco over the next 25 years, and with about 40 percent of those jobs held by East Bay residents, BART and the Bridge will like move an additional 100,000 workers into San Francisco daily. As BART reaches capacity, a revisiting of the Bridge's functions should be considered.

Survey of Best Practices

This study mentions several highway facilities that provide preferences for buses and HOVs including the Lincoln Tunnel in New York and New Jersey. There are other examples, and to provide decisionmakers with a robust understanding of the universe of operational options, further studies should provide additional detail and also arrange field trips to see these facilities and discuss their operations with staff. Among the freeways to consider investigating are the Lincoln Tunnel (and the Port Authority Bus Terminal), San Diego's I-15 Managed Lanes, the LA Silver Line (Harbor Transitway and El Monte Busway), the Champlain Bridge in Montreal, I-30 in Dallas, and the Shirley Highway in the Washington DC area.

Study of Alternatives – Transit and Overall Corridor Demand

The Bay Bridge is an important part of the infrastructure system that connects San Francisco to the East Bay. Our understanding of the relationship between transit demand and capacity and highway demand and capacity has increased in recent years, but any further study of the use and demand of additional peak period westbound capacity will need to be framed by BART's available capacity.

A robust demand forecasting exercise which analyzes the peak period capacity constraints relative to total demand is vital to both our understanding of the corridor and required for any outside financing.

Suite of Alternatives – Westbound Study

Additional Westbound HOV Facilities

Caltrans has designed the Bay Bridge access system to allow HOVs to bypass queues either on the mainline freeways or at the Toll Plaza by using dedicated HOV bypass lanes and ramps. Two significant gaps exist in this network:

- West Grand/Maritime on-ramp
- I-580 to SR 24

Prior to the Loma Prieta earthquake, the West Grand/Maritime on-ramp included a HOV lane that extended to the beginning of the ramp at Maritime. When the ramp was rebuilt after the earthquake, the HOV lane was designed to begin at its junction with I-880 (about 2,000 feet west of Maritime). During peak periods, the ramp is congested and buses using it are delayed by up to 10 minutes. Expanding the ramp to extend the HOV lane to Maritime has been identified as a critical improvement several times, and was even included in the RM2 legislation, but the project did not advance. AC Transit has considered operating a Transbay Bus Rapid Transit route via MacArthur and West Grand to the Bridge, but reliability suffers without a dedicated HOV lane on the Maritime ramp.

As with the Maritime ramp, westbound HOV and bus traffic on I-580 is the only freeway that lacks a HOV lane outside of the distribution structure. Extending a westbound-only HOV lane could save up to 20 minutes of travel time for HOVs and for buses in the corridor, which will become critical as traffic increases and freeway travel times slow. During the peak hour about 15 buses use I-580.

Further Study

Contraflow Lane on Bay Bridge westbound

As traffic increases in the system, absent additional capacity, Caltrans can either choose to allow traffic to queue further back on the East Bay freeway system or it can increase the metering rates and effectively move the queue from the Toll Plaza and the freeways onto the Bridge. In the first case, all traffic is impacted, including those vehicle not destined for the Bridge. In the later case, the HOV/bus time advantage degrades, since the Bridge will operate at a reduced speed.

A contraflow lane on the Bridge could operate in several configurations. It is recommended that two approaches be considered in further studies. In Option 1, the contraflow lane would be an extension of the HOT network. Buses (up to about 300 per hour) and tolled vehicles would use the lane for direct access into San Francisco. The toll would be adjusted to ensure the lane operated slightly below capacity to ensure good service and fast speeds. HOVs would continue to use the existing HOV bypass system. Under this option, VISSIM simulations indicate that the Bridge queue is about the same in 2035 as today. The downside is that additional private vehicles enter San Francisco in the morning peak, and likely leave in the afternoon peak.

In Option 2, private passenger vehicles would not be permitted, but trucks would be allowed to use the contraflow lane along with buses. Option 2 would result in less additional capacity into San Francisco, but would improve travel time and reliability for buses and trucks.

In this option, there would be a slight increase in Bridge capacity, since about 200 trucks per hour would be eliminated from the westbound direction, possibly creating additional capacity for another 500 peak hour autos. Since buses would be operating relatively free-flow in the contraflow lane, Caltrans has greater flexibility adjust the metering rates to keep the queue upstream of the toll plaza to reasonable lengths.

Any contraflow analysis should also consider the impacts on the morning eastbound traffic. Currently, about 6,500 vehicles use the Bay Bridge eastbound in the highest morning peak hour. Any future analysis should consider morning eastbound traffic conditions impacts resulting from the removal of one traffic lane.

In addition, the impact on Bridge maintenance (where Caltrans crews often close a lane to work on the Bridge) should also be considered.

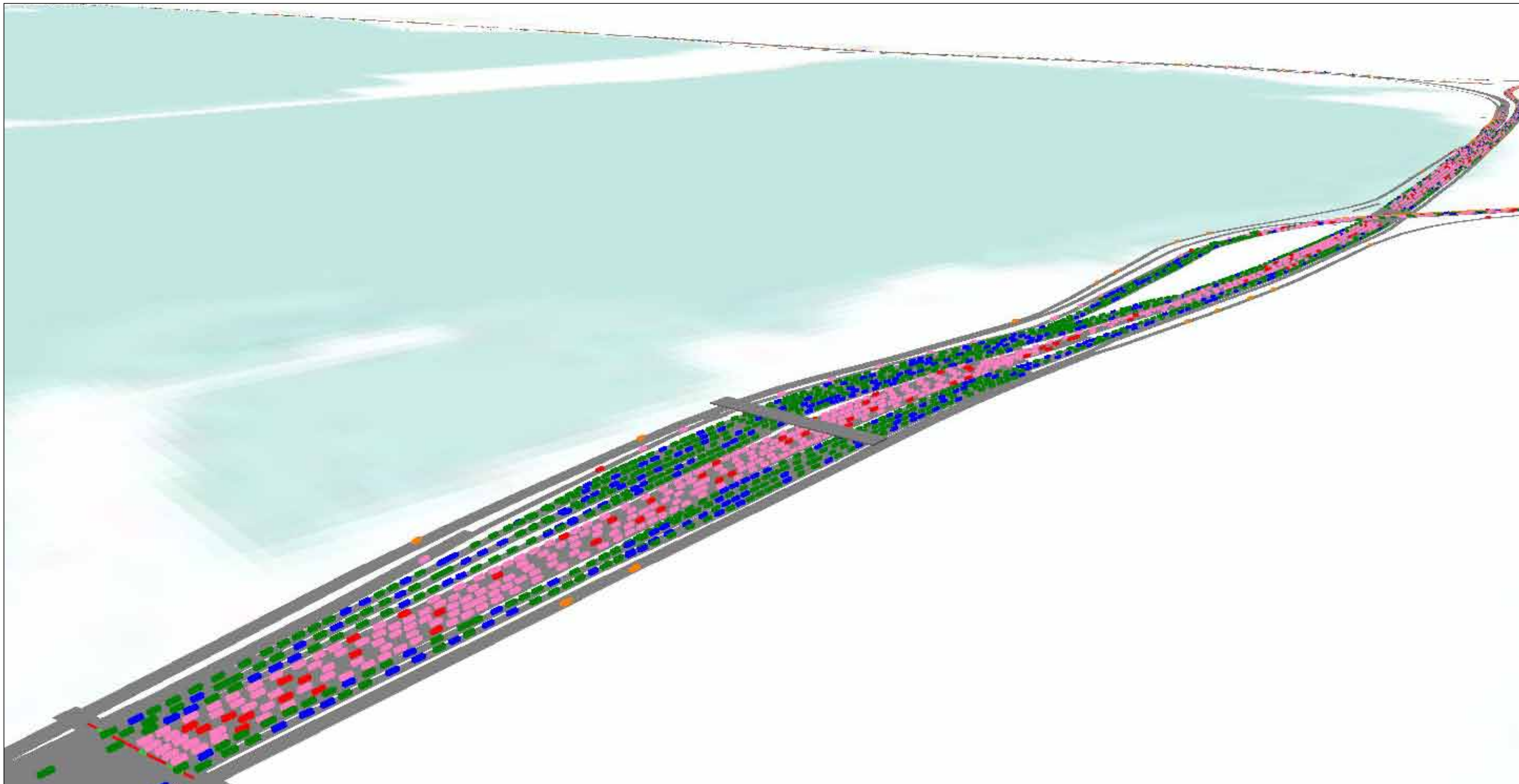
Suite of Alternatives – Eastbound Study

The addition of a contraflow lane on the Bay Bridge would create additional capacity into San Francisco. The use of the contraflow lane as a HOT facility could deliver an additional 1,000 vehicles per hour into downtown. This could increase demand in the PM peak for the return trip to the East Bay, which could increase the amount of traffic queuing on SoMa streets trying to access the Bay Bridge on-ramps. A series of additional questions warrant further investigation in SoMa:

- Future studies should consider whether reconfiguring the eastbound travel lanes at the West Approach to the Bay Bridge. These could include realigning lanes and reconfiguring ramps.
- Closing Sterling Street Ramp, improving Essex Street ramp, converting First to HOV only
- Closing Essex Street ramp and reconfiguring the Bridge so that Sterling ramp has its own lane, converting First to HOV only
- Closing upstream ramps and reconfiguring the 101-80 Freeway so that 8th Street eastbound enters from the right, allowing the Fifth Street ramp to enter its own lane
- Using congestion pricing in the eastbound direction to manage queues and keep streets clear
- Studying the urban design impact of the various SoMa alternatives

Study of Alternatives – Implementation Options

As a plan is developed and the benefits, primarily ridership and time savings, are better understood, the next study should investigate the best option to deliver whatever improvement is selected. Project risk and project financing could lead to a traditional design-bid-build process financed by tolls charged on the contraflow lane, or it could lead to an alternative approach using a public-private partnership. All options should be considered as the project scope and its risks become clearer.



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Executive Director
Arthur L. Dao

June 9, 2016

Mr. Ken Kirkey
Metropolitan Transportation Commission
375 Beale Street
San Francisco, CA 94105

Dear Mr. Kirkey:

The Alameda County Transportation Commission (Alameda CTC) appreciates the opportunity to make a "compelling case" to the Metropolitan Transportation Commission (MTC) regarding two of our projects that were ranked as "low performing" in MTC's recent project performance assessment for Plan Bay Area 2040: Project 202 East-West Connector and Project 211 SR-262 Connector.

Both of these projects have widespread public and countywide jurisdiction support as voter-approved projects under two local transportation sales tax measures: Measure B and Measure BB. This demonstrates the need for these projects as recognized by the local communities.

The East-West Connector project provides the missing east-west connection between I-880 and Mission Boulevard in Southern Alameda County. It improves access to transit, enhances non-motorized travel, and improves access to a community of concern at the east end of the project, located near Alvarado-Niles Road and Decoto Boulevard. The performance assessment for this project from MTC included a note on the travel model accuracy that "due to the project's smaller size, the travel model may not accurately estimate its benefits relative to the regional scale of the model." Therefore, the benefit-cost ratio assessed as less than one is likely not accurate, and using this as a basis to classify this project as a low-performing project is questionable. Since MTC has identified that both of the above points are valid compelling case criteria, we request that this project be included in the final PBA 2040.

The SR-262 Connector project improves the existing Mission Boulevard between I-880 and I-680, including grade separation of the facility from the Warm Springs Boulevard. The project will follow the Complete Streets design that implements Class II bike lanes and ADA compliant sidewalks and curb ramps. Additionally, by easing congestion on Mission Boulevard, access to Transit Hubs like the Warm Springs BART station will be made easier for commuters and local bus lines. In this regard, this project will improve the non-auto mode share, which is a target in the PBA 2040.

Further, the SR 262/Mission Boulevard connects the two top 10 most congested corridors in the region as published by MTC in 2015: I-880 (Top 2 with a daily vehicle hours of delay of 7,300 in the southbound direction) and I-680 (Top 6 with a daily vehicle hours of delay of 3,940 in the northbound direction). The proposed improvements under this project will improve the overall system performance and delay, when combined with the other proposed Express Lane projects on I-880 (Bay Area Express Lanes Network) and on NB I-680.

Additionally, the PBA 2040 Performance Assessment results for this project shows that this project does provide climate change benefit of $0.4 million for GHG reduction and $0.1 million for Particulate Matter. However, given that the accuracy of the regional model to estimate benefits for this project is low, as indicated by MTC, and the fact that modeling the proposed improvements on I-880 and I-680 corridors combined with this project would capture the synergy and increased climate change benefits more accurately, we request that this project be included in the final PBA 2040.

The East-West Connector project and the SR-262 Connector project both aim to provide critical connections that will improve traffic flow and provide improved multimodal access to major freeways that move people and goods in Alameda County and beyond. They are both much-needed additions to PBA 2040, as demonstrated by the voter approval.

Please let me know if you have any questions. Feel free to contact me at 510.208.7428 or contact Saravana Suthanthira at 510.208.7426 to address any questions regarding this matter.

Sincerely,

Tess Lengyel

Tess Lengyel, Deputy Director of Planning and Policy

cc: Arthur L. Dao, Alameda CTC
Dave Vautin, MTC

ALAMEDA
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Mayor Carol Dutra-Vernaci

Executive Director
Arthur L. Dao

June 21, 2016

Mr. Ken Kirkey
Metropolitan Transportation Commission
375 Beale Street
San Francisco, CA 94105

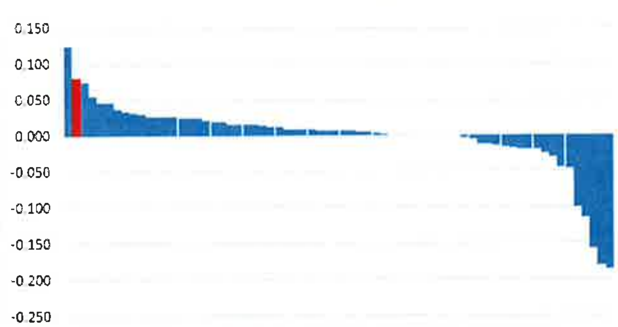
Dear Mr. Kirkey:

The Alameda County Transportation Commission (Alameda CTC) would like to follow up regarding our compelling case letter dated June 9, 2016 to the Metropolitan Transportation Commission (MTC), particularly for the Project 211 SR-262 Connector, which ranked as "low performing" in MTC's recent project performance assessment for Plan Bay Area 2040. The intent of this letter is to provide supplemental information on this project, particularly demonstrating the cost effectiveness of the project, to support the compelling case evaluation of MTC.

The SR-262 Connector project improves the existing Mission Boulevard between I-880 and I-680 including grade separation of the facility from the Warm Springs Boulevard. MTC's project performance assessment shows that the SR-262 connector project has one of the highest benefit per million dollar project cost among all 70 projects that were subjected to project performance assessment:

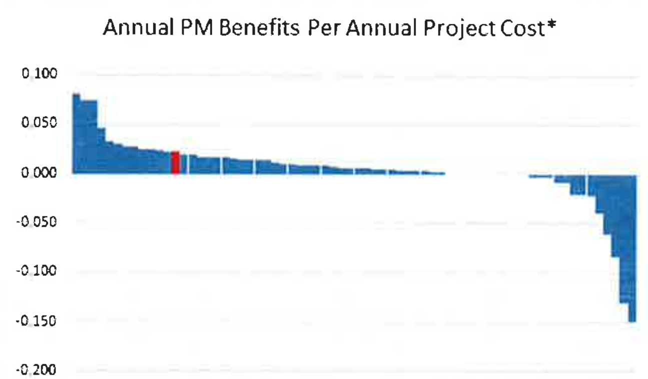
- Greenhouse Gas (GHG) Reduction Benefits:
  - MTC estimates that the project will yield $ 0.4 million in annual GHG reduction benefits. Given the annual project cost of $5 million, the project is estimated to have an annual GHG benefit to project cost ratio of 0.08, which makes it the third most cost effective project in reducing GHG as illustrated below (red bar indicates the SR-262 Connector and blue bars indicate all other projects):

Annual GHG Benefits Per Annual Project Cost*



*Graph does not include Regional Highway Pavement Maintenance (with a ratio of 5.7) for scale.

- Particulate Matter (PM) Benefits:
    - MTC estimates that the project will yield $0.1 million in annual PM reduction benefits. Given the annual project cost of $5 million, the project is estimated to have an annual PM benefit to project ratio of 0.020, which makes it the 15th most cost effective project in reducing PM out of 70 projects. See graph below (red bar indicates the SR-262 Connector and blue bars indicate all other projects):



*Graph does not include Regional Highway Pavement Maintenance (with a ratio of 5.4) for scale reasons

As mentioned in our earlier letter, the SR-262 Connector project aims to provide critical connections that will improve traffic flow between the most congested corridors of the region and provide cost effective reduction in greenhouse gas and particular matters in Alameda County and beyond. The project's contribution to regional goals in air pollutant reduction highlight its importance to PBA 2040.

Please let me know if you have any questions. Feel free to contact me at 510.208.7428 or contact Saravana Suthanthira at 510.208.7426 to address any questions regarding this matter.

Sincerely,

Tess Lengyel, Deputy Director of Planning and Policy

cc: Arthur L. Dao, Alameda CTC
Dave Vautin, MTC

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transportation authority

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June 9, 2016

Steve Heminger
Metropolitan Transportation Commission
Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105

Re: Change in Status of Projects Submitted as Part of Plan Bay Area (PBA) 2040

Dear Mr. Heminger:

In October 2015, the Authority adopted Resolution 15-49-G, which transmitted our proposed 2017 RTP project lists to MTC for consideration in PBA 2040. Several of the projects submitted exceeded $100 million in cost, and therefore were subject to a performance assessment by MTC. Through the assessment process, MTC identified several "low performing" projects and MTC staff indicated that these projects would need to be subject to the "Compelling Case" process in order to remain a part of the Plan Bay Area 2040 final project list.

The purpose of this letter is to provide an update on those projects, and to let you know about some changes in project scope and phasing that have transpired since our submittal to you last October. These changes bear on our decision regarding the Compelling Case process and result in changes in how to proceed with them as they relate to Plan Bay Area's financially constrained project listing.

- Tri-Link Tollway and Expressways (ID 401): This project was submitted as three separate projects (SR-239 Freeway, Airport Connector, and South Link/Byron Highway) which can be constructed as individual projects or as one complementary suite of projects. As part of the performance assessment, the three projects were analyzed together. As part of the Transportation Expenditure Plan (TEP) proposed for the November 2016 ballot, only the Airport Connector (Vasco Road to Byron Hwy) would be funded. Because this would be a 100% locally funded project, CCTA staff requests that the SR-239 Freeway and South Link/Byron Highway projects be removed from the list of projects, with the Airport Connector ($74.4m in 2017$) remaining as a standalone project, and not subject to the major project performance assessment. CCTA staff also requests revising the name of the Airport Connector to Vasco Road – Byron Highway Connector Road.

- I-680 Express Bus Frequency Improvements (ID 403): The project cost information was reviewed with County Connection and it was determined the cost information used needed to be updated to accurately reflect the components of the modeled project. The capital cost for 20 electric buses is approximately $20 million, with an annual O&M cost of $5 - $7 million per year (or $90 - $126 million over 18 years), for a total project cost ranging for $110 million to $146 million. With this revision, the benefit to cost ratio should be around 2.0. The Authority will not be submitting a compelling case for the project.

- SR-4 Widening (Antioch to Discovery Bay) (ID 404): This is a group of widening projects on SR-4 between Laurel Road and the San Joaquin County Line. This project is currently on the Authority's 'Vision' list, will not be seeking state or federal funding for right-of-way or construction in the near future, and we will not be submitting a compelling case for this project.

- Antioch-Martinez-Hercules-San Francisco Ferry (ID 410): This is a group of four projects that involve landside improvements and WETA Ferry Service from Antioch, Martinez to San Francisco. The four projects are currently listed in the database as: 1) Martinez Ferry Terminal; 2) Antioch Ferry Landside Improvements; 3) Antioch Ferry Service; and 4) Regional Ferry Service in Hercules – Landside Improvements. We are proposing to replace this group of four projects with a new project titled "Privately Run Ferry Service including Small-Scale (non-WETA complying) Landside Improvements from Antioch, Martinez, and Hercules to San Francisco." The project cost is estimated at $73 million over the RTP period which includes $1.5 million for landside improvement per stop, $1.33 million per vessel, and $720,000 operating cost per year per vessel. Three vessels and three stops are assumed. The benefits are projected to be similar to the original projects. With the project reduced cost, the B/C ratio for the project should exceed 1.0, exempting the project from the compelling case process.

We appreciate the time and effort that MTC staff has spent guiding us through the RTP project submittal and performance assessment processes. We hope that this letter provides your staff with the information they need to proceed and will help to position Contra Costa's better performing projects and high priority projects where they will have an improved chance of receiving funding from the RTP.

Please contact Hisham Noeimi at hnoeimi@ccta.net or 925-256-4731 should you have any questions.

Sincerely,

Randell H. Iwasaki
Executive Director

cc: David Vautin, MTC
Kristen Carnarius, MTC
William Bacon, MTC

Office of the City Manager
Melissa Stevenson Diaz

1017 Middlefield Road
Redwood City, CA 94063
(650) 780-7301
Fax (650) 780-7225

June 10, 2016

Metropolitan Transportation Commission
Bay Area Metro Center
Dave Vautin, AICP
375 Beale Street, Suite 800
San Francisco, CA 94105

Subject: Plan Bay Area 2040/MTC Regional Transportation Plan
Project: San Francisco – Redwood City Ferry Service + Oakland – Redwood City Ferry Service

Dear Mr. Vautin:

The purpose of this letter is to request a redefinition or change to the project RWC (Project ID 1201). The Project sponsor is the Water Emergency Transportation Authority and the Project is to implement multi-county ferry service from San Francisco/Oakland to the Port of Redwood City. The City of Redwood City, the Port of Redwood City and WETA are requesting a redefinition of the Project to phase terminal development and start of ferry service with private vessel passenger service.

The Project as submitted by WETA is to implement a passenger ferry service which would link San Francisco, Oakland, and Redwood City with three 400-passenger vessels and a fourth back-up vessel and operate a regular weekday commuter service with three peak period trips in the AM and PM per day. A new ferry terminal would be constructed at the Port of Redwood City consisting of docking facilities for two vessels, dredged turning basin, passenger terminal and gangways, a 4 – acre vehicle access and parking area, and waterfront public access. Project costs, not including operating costs, are estimated at $110 million.

The City and Port of Redwood City are partnering with WETA to redefine the Project in a phased manner to plan, construct, and implement the Project which would have the same goal of providing regional ferry service between the three mid-Bay and south Bay metropolitan areas. The initial phase of the Project would re-examine and reevaluate the ferry service and new ferry terminal to incorporate privately operated passenger vessel service. Ferry terminal public docking facilities would be designed to accommodate multiple vessel sizes and designs including WETA vessels.

The phased Project would implement private charter passenger service in the initial phase and WETA public ferry transit service would start at a later phase. Phased construction of the terminal facilities will be evaluated and, if feasible, a timetable developed to indicate stages of development. Planning, design, and environmental studies would be done to coincide with the phased timetable. Ridership studies will also be re-evaluated and updated to incorporate phased-in service.

The initial cost of the ferry terminal, estimated at $30 million, would be reduced in the initial stage if economically beneficial. The City of Redwood City would be the lead agency for the terminal facilities of a phased Project partnering with the Port of Redwood City, San Mateo County Transportation Authority, and WETA under a Project MOU/Partner Agreement.

The advantages of the redefined Project include the ability to capture current interest and operations already underway for private charter passenger service by major Peninsula employers. The initial stage of the Project could combine funding from San Mateo County Measure A sales tax with private funding possibilities related to Charter vessel service. When WETA public ferry service is incorporated into the Project, it will be able to take advantage of the initial terminal development and the experience, and possibly ridership, from operating private passenger service.

Redwood City is experiencing significant growth in both office and residential units, and has intentionally located this development along the Caltrain line to avoid contributing to existing congestion. The City is also actively working on City-wide transportation plan to help coordinate commute efforts. In spite of these efforts, exploding job growth in Silicon Valley as a whole has severely impacted the Highway 101 corridor and exceeded Caltrain rider capacity. Google and Stanford University are in the process of creating new employment centers in Redwood City, and these and other major employers in adjacent cities would benefit from creation of a meaningful new approach for bringing employees to and from work. Ferry service offers a relatively quick, low cost alternative for a comfortable and congestion free commute. The Project as re-defined would lead to a shorter time for startup of initial service from public terminal facilities while still embracing the long term goal of WETA public ferry service.

Thank you for your consideration to redefine the Redwood City Ferry Project in the Plan Bay Area 2040. Please do not hesitate to contact us for any additional information.

Sincerely,

Melissa Stevenson Diaz
City Manager
City of Redwood City

Kevin Connolly
Manager, Planning and Development
Water Emergency Transportation Authority

Mike Giari
Executive Director
Port of Redwood City

OCII office of COMMUNITY INVESTMENT and INFRASTRUCTURE

SAN FRANCISCO PUBLIC WORKS

SAN FRANCISCO COUNTY TRANSPORTATION AUTHORITY

SFMTA Municipal Transportation Agency

June 10, 2016

The Honorable Dave Cortese, Chair
Metropolitan Transportation Commission
Bay Area MetroCenter
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

RE: Southeast Waterfront Transportation Improvements: Plan Bay Area (PBA 2040) Compelling Case for Low Performing Project

---

Dear Chairman Cortese:

The Metropolitan Transportation Commission (MTC) has undertaken a Project Performance Assessment of many transportation projects under consideration for the Plan Bay Area 2040. We appreciate the efforts of MTC staff over the past several months to develop and refine the Southeast Waterfront Transportation Improvements (SWTI) project located in one of poorest neighborhoods in San Francisco to ensure its accurate evaluation. Unfortunately, the Project Performance Assessment identified it as a low-performing project, and we are writing to present a compelling case for Category 2b which recognizes projects that improve transportation mobility or reduces air pollution within communities of concern.

Executive Summary

The Southeast Waterfront Transportation Improvements (SWTI) is a package of capital investments in streetscape improvements to support increased transit service on new and existing transit routes, along with bicycle and pedestrian facilities in the southeast San Francisco neighborhood of Bayview Hunters Point associated with the Candlestick Hunters Point Shipyard Redevelopment Projects. These investments will primarily increase transit frequency, speed and reliability on six San Francisco Municipal Railway ("Muni") bus routes. They will also improve safety and usability for pedestrians and bicyclists. The Southeast Waterfront transit enhancement coupled with the Geneva Harney Bus Rapid Transit Project targets a near doubling of the current mode share of transit in the vicinity of Candlestick Point and Hunters Point Shipyard.

The transit, bicycle, and pedestrian investments in SWTI will dramatically improve mobility, safety, and access for the Bayview Hunters Point Community of Concern (COC) identified by the Metropolitan Transportation Commission (MTC) in Plan Bay Area 2040 –

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specifically, residents in census tracts 230.01, 231.02, 231.03, 232, 234, 612 and 9806. Benefits to COC residents will include:

- Increased access to local job concentrations (>10,000 jobs) planned at combined India Basin, Candlestick Point and Hunters Point Shipyard developments;
- Increased access to healthy food at grocery stores planned at Candlestick Point and Hunters Point Shipyard;
- Increased access to connect to regional transit systems via the T-Third Street light rail line, downtown San Francisco, Caltrain and BART;
- Increased access to citywide educational opportunities for students;
- Increased access to parks and recreational facilities being developed at India Basin, Candlestick Point and Hunters Point Shipyard;
- Increased economic activity and employment within the COC;
- Safer and more user-friendly bicycle and pedestrian facilities; and
- Reduced exposure to criteria pollutants from automobiles.

This memo discusses community needs in the affected COC, and how SWTI will benefit those communities. We believe these arguments meet the compelling case threshold for allowing a low performing project to be included in Plan Bay Area 2040.

Project description
SWTI transit investments are detailed in Table 1 and 2. The locations of the investments are shown in **Attachment 1 Plan Bay Area Map**, which shows the majority of investments are located in a COC.

These investments will improve the speed, reliability, new bus stops and frequency of existing transit services and new planned services. One effect of these improvements will be reduced transit headways, as shown in Table 1:

Table 1: Improvements to peak-hour headways

Service Routes	Current headway (minutes)	Planned headway (minutes)
23	20	15
24	9	7.5
29	8	5
44	8	6.5
48	15*	10
HPX	n/a**	12

* 19-Polk bus headway. The 48 bus will replace the existing 19 bus service in southeast San Francisco.
** Service does not currently exist.

The Bayview COC will benefit greatly from these improvements, certain extremely disadvantaged neighborhoods within BVHP will experience dramatic improvements. For example, census tract 231.03, which includes the Westbrook, Hunters View, Hunters Point East, and Hunters Point West San Francisco

Housing Authority subsidized housing developments (adjacent to Innes Avenue), will see transit vehicle trips serving the neighborhood at peak hour increase by 60%, as shown in 2.

Table 2: Transit vehicle stops in census tract 231.01 before and after SWTI

Before SWTI	**After SWTI**
19-Polk: every 15 minutes 44-O'Shaughnessy: every 8 minutes 54-Felton: every 20 minutes	48-Quintara (replacing 19-Polk): every 10 minutes 44-O'Shaughnessy: every 6.5 minutes 54-Felton: every 20 minutes HPX-Hunters Point Express: every 12 minutes
Average vehicles per hour: **14.5**	Average vehicles per hour: **23.2**

In addition to transit improvements, SWTI will deliver streetscape improvements and lighting that will improve usability and safety for pedestrians and bicyclists. This will address some conditions that reduce walking and bicycling in southeast San Francisco, including sidewalk hazards and fears of crime. Specific improvements along the corridors include new signals, corner bulbouts, and improved crosswalks to improve pedestrian safety; new pedestrian-scaled lighting to improve the overall sense of security in the area; new street trees and other amenities to make walking and bicycling more pleasant; and, improvements to pavement conditions to enhance comfort for all travel modes and the overall attractiveness of the neighborhood.

Bayview-Hunters Point Community of Concern

Bayview-Hunters Point (BVHP) was historically a working-class neighborhood with strong employment ties to the Hunters Point Naval shipyard and local industrial businesses. Local employment has fallen sharply with the closure of the Naval shipyard in 1994 and sustained declines in local manufacturing.

A 2016 assessment of community health needs by the San Francisco Department of Public Health found that Bayview-Hunters Point has a high percentage of households at or below 200% of the Census Poverty Threshold, and a high percentage of households spending 50% or more of household income on rent.[1] BVHP neighborhood residents also have a higher percentage car ownership than other San Francisco neighborhoods with 53% of population drive alone to work. See Attachment 2 with BVHP neighborhood profile data and maps. The elevated rate of auto ownership and use in the neighborhood is notable given BVHP's comparative lower median income, large youth and senior and disabled populations, and other frequent contributors to transit demand. However, BVHP is a neighborhood that has been geographically isolated, with currently minimal retail activity outside of the Third Street corridor. Bayview residents are more likely to need to travel beyond their neighborhood for basic needs and employment because fewer of those needs can be met locally. The San Francisco Health Improvement Partnership has identified BVHP as among the San Francisco neighborhoods with the fewest retail food options.[2] **See Attachment 2 with BVHP community profile statistics.**

---

[1] San Francisco Health Improvement Partnership. (2016). *San Francisco Community Health Needs Assessment 2016*. San Francisco, CA.

[2] San Francisco Health Improvement Partnership. (2016). *San Francisco Community Health Needs Assessment 2016*. San Francisco, CA. Pages 228-231.

The San Francisco Child Care Planning & Advisory Council has identified Bayview-Hunters Point as among the San Francisco neighborhoods with the greatest unmet need for child care facilities.[3] The high auto ownership rates may also, however, be a reflection of gaps in transit service, lacking bicycle and pedestrian infrastructure, and safety concerns for non -auto modes.

The 2010 SFCTA Bayview Hunters Point Neighborhood Transportation Plan identified the following mobility barriers in BVHP that will be addressed as part of the SWTI improvements:

- Safety concerns further limit the attractiveness of non -automobile modes.
- Beyond the Third Street corridor, Muni can be unreliable and is relatively infrequent.
- There are no regional transit stations within the community and local transit does not directly serve many trips.
- It is difficult to get around the BVHP neighborhood or go beyond the neighborhood without a car.
- Walking and bicycling are often not seen as pleasant or practical means of travel due to poor streetscape pedestrian oriented amenities.

New developments in Bayview-Hunters Point

Hunters Point Shipyard, a former Navy shipyard, and Candlestick Point, a former stadium site, are now being redeveloped as walkable, mixed-use neighborhoods. This new areas dramatically increase both the number of affordable transit options and promote pedestrian and bicycling options, providing critically needed connectivity to the 12,000 new housing units within the Hunters Point and adjacent Candlestick Point redevelopment projects (Project). Approximately 32 percent of these units will be below market rate units, adding much needed affordable options to the region's housing stock. The Project also includes 2.65 million square feet of office/R&D space; a hotel; 8 acres of community facilities serving local residents, and 336 acres of open space. The Project includes a requirement meet a 50% goal to hire local Bayview residents for the jobs within these new developments, so it is anticipated that there will be an increase of travel demand within the BVHP neighborhood to these new opportunities and recreational areas.

The development will also bring significant job opportunities for Bayview residents and beyond. In 2012, the Office of Community Investment and Infrastructure ("OCII") estimated that more than 10,000 permanent jobs will be created at Hunters Point Shipyard and Candlestick Point. OCII also estimated that construction of Hunters Point Shipyard and Candlestick Point – scheduled to last 18 years – will produce hundreds of construction jobs during that period.[4]

These developments are one to two miles away from most residents of the identified Communities of Concern in Bayview-Hunters Point, putting them beyond comfortable walking distance so the SWTI investments will allow

Benefits of SWTI for Communities of Concern

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[3] Bayview-Hunters Point defined as zip code 94124. San Francisco Child Care Planning & Advisory Council. (2013). *San Francisco Early Care and Education Needs Assessment*. San Francisco, CA.

[4] Successor Agency to the San Francisco Redevelopment Agency (now OCII). (2012). *Hunters Point Shipyard – Candlestick Point Project Summary*.

The improvements in SWTI will have the following benefits for the identified Communities of Concern:

- By increasing vehicle frequency, speed and reliability on the 23, 24, 29, 44, 48 and HPX bus lines, SWTI will provide residents with greater general mobility and access to amenities, including existing and future jobs, educational and recreational opportunities. Many of these routes will provide reliable one seat ride connections to BART.
- SWTI will improve access to education among public school students in COCs. In the San Francisco Unified School District ("SFUSD"), students are permitted to attend schools in any neighborhood. The COCs identified by MTC are all "CTIP 1" areas, meaning that student test scores are in the lowest quintile and SFUSD will grant preference to students residing there in selecting schools citywide. However, in San Francisco many students travel to school on public transit, and deficiencies in transit service in southeast San Francisco prevent some students from attending schools where their educational outcomes could be improved. SWTI will give these students better access to these schools.
- By improving service specifically on the 23, 24, 29, 44 and 48 lines – each of which connect Bayview-Hunters Point with new developments at Candlestick Point, Hunters Point Shipyard, and/or India Basin – SWTI will give COC residents greater access to the amenities at these new developments. These amenities will include grocery stores, child care facilities, parks and recreational facilities, and over 10,000 jobs.
- The service improvements on the 23, 24, 29, 44 and 48 lines will also facilitate trips to the Third Street commercial corridor by residents of the new developments at Candlestick Point, Hunters Point Shipyard, and India Basin. This will expand the potential customer base for Third Street businesses, increasing economic activity and employment within the COCs in Bayview-Hunters Point.
- By making transit services more effective, SWTI will increase transit mode share. This is especially critical among residents of the new developments at India Basin, Candlestick Point, and Hunters Point Shipyard, who will be more open to establishing habits of transit use, having recently relocated. Increasing transit use among these residents later will be more difficult. Transit mode share increases will decrease emissions of criteria pollutants from automobiles, improving health among COC residents.
- By improving streetscapes and installing street lighting and pedestrian lighting, SWTI will enhance pedestrian and bicycle safety, encouraging walking and biking for commuting and recreation. This will increase opportunities for exercise for COC residents with health outcome benefits.

Conclusion

The BVHP Community of Concern has faced longstanding deficiencies in reliable public transit service and access to amenities. These challenges alone would make the SWTI an investment well worth making. However, those investments will have a greater effect now than at any other time, because they will help residents to take advantage of amenities and opportunities created by the major new developments now underway and along the southeast shoreline. The SFCTA, OCII and SFMTA urge

MTC to consider the significant mobility improvements and reductions to historically disadvantaged community and to the new riders 32% of which will be low income.

We request that MTC approve this compelling case request based on the magnitude of mobility improvements it will provide in the Bayview Hunters Point COC. We thank you in advance for your favorable consideration.

Sincerely,

Amber Crabbe
Assistant Deputy Director for Policy and Programming
San Francisco County Transportation Authority

RACHEL ALONSO

Rachel Alonso
Transportation Finance Analyst
San Francisco Public Works

Lila Hussain
Project Manager of Hunters Point Shipyard Candlestick Point
Office of Community Investment and Infrastructure

Tom Maguire
Director, Sustainable Streets Division
San Francisco Municipal Transportation Agency

ATTACHMENT 1

Plan Bay Area 2040 | Southeast SF

Southeast Waterfront Transportation Improvements (OCII/SFPW)
Only new roadways and arterials with Transit. Also includes all local and downtown express Muni service (capital and operating)

Geneva Harney BRT
Includes 2 options between Geneva Ave and Harney Way. All CP-HPS BRT ROW and HPS Transit Center included. Separate BPA submission for Harney Widening from BTIP.

Geneva Harney BRT Option 1 (SFMTA)
Presumes no Geneva Extension and interchange

Geneva Harney BRT Option 2 (SFMTA, San Mateo County, City of Brisbane)
Presumes no Geneva Extension and interchange

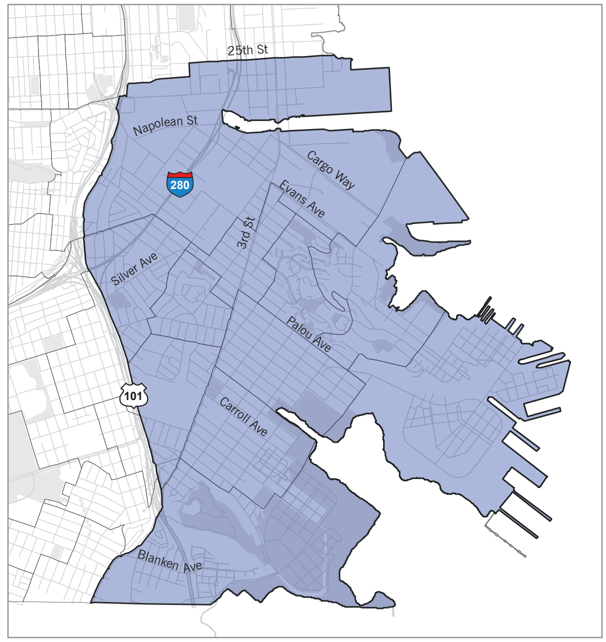
BTIP Segment A and G (SFPW)
Not in the Hunters Point Shipyard Project Area. HPX and Route 48 will use these segments.

BTIP Roadway Improvements in CP-HPS Project Area - Will not be submitted to PBA
Excluded from PBA because no transit or streetscape improvements

Plan Bay Area 2040 Communities of Concern

Bayview Hunters Point

Demographics



Total Population	**37,540**
Group Quarter Population	*220*
Percent Female	50%

Households	**10,960**
Family Households	73%
Non-Family Households	27%
Single Person Households, % of Total	21%
Households with Children, % of Total	40%
Households with 60 years and older	39%
Average Household Size	3.4
Average Family Household Size	4.2

Race/Ethnicity

Asian	34%
Black/African American	31%
White	17%
Native American Indian	1%
Native Hawaiian/Pacific Islander	2%
Other/Two or More Races	15%
% Latino (of Any Race)	22%

Age

0–4 years	8%
5–17 years	17%
18–34 years	25%
35–59 years	33%
60 and older	17%
Median Age	34.6

Educational Attainment

(Residents 25 years and older)

High School or Less	50%
Some College/Associate Degree	28%
College Degree	17%
Graduate/Professional Degree	6%

Nativity

Foreign Born	38%

Language Spoken at Home

(Residents 5 years and older)

English Only	46%
Spanish Only	18%
Asian/Pacific Islander	33%
Other European Languages	1%
Other Languages	1%

Linguistic Isolation

% of All Households	15%
% of Spanish-Speaking Households	27%
% of Asian Language Speaking Households	34%
% of Other European-Speaking Households	12%
% of Households Speaking Other Languages	15%

Housing Characteristics

Total Number of Units	11,920
Units Built During 2000	1,960
Median Year Structure Built*	1957

Occupied Units	
Owner occupied	49%
Renter occupied	51%

Vacant Units	**8%**
For rent	16%
For sale only	15%
Rented or sold, not occupied	7%
For seasonal, recreational, or occ. use	5%
Other vacant	56%

Median Year Moved In to Unit (Own)	1992
Median Year Moved In to Unit (Rent)	2001

Percent in Same House Last Year	90%
Percent Abroad Last Year	1%

Structure Type	
Single Family Housing	62%
2–4 Units	14%
5–9 Units	8%
10–19 Units	4%
20 Units or more	11%
Other	1%

Unit Size	
No Bedroom	3%
1 Bedroom	13%
2 Bedrooms	34%
3–4 Bedrooms	46%
5 or More Bedrooms	3%

Housing Prices	
Median Rent	$1,820
Median Contract Rent	$840
Median Rent as % of Household Income	29%
Median Home Value	$476,820

Vehicles Available	**16,180**
Homeowners	64%
Renters	36%
Vehicles Per Capita	0.43

Households with no vehicle	20%
Percent of Homeowning households	8%
Percent of Renting households	32%

Income, Employment and Journey to Work

Income	
Median Household Income	$51,450
Median Family Income	$53,750
Per Capita Income	$22,390
Percent in Poverty	22%

Employment	
Unemployment Rate	14%
Percent Unemployment Female	13%
Percent Unemployment Male	15%
Employed Residents	16,410
Managerial Professional	27%
Services	27%
Sales and Office	23%
Natural Resources	8%
Production Transport Materials	15%

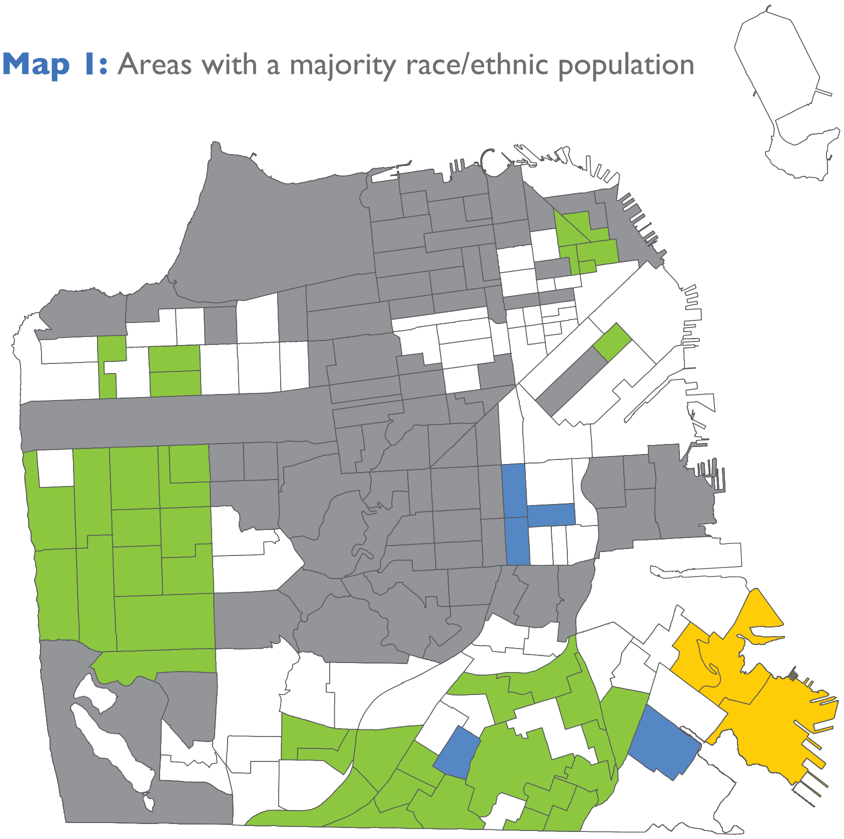
Journey to Work	
Workers 16 Years and Older	15,930
Car	65%
Drove Alone	53%
Carpooled	12%
Transit	27%
Bike	1%
Walk	2%
Other	2%
Worked at Home	3%

Notes:
* "1939" represents 1939 or earlier

Note: Numbers from the American Community Survey are estimates and are subject to sampling and non-sampling errors. For more information, see http://www.census.gov/acs/www/Downloads/handbooks/ACSGeneralHandbook.pdf

2010 Census Tracts for Neighborhood: 9806, 9809, 612, 231.03, 610, 230.03, 232, 234, 233, 231.02, 230.01

Map 1: Areas with a majority race/ethnic population



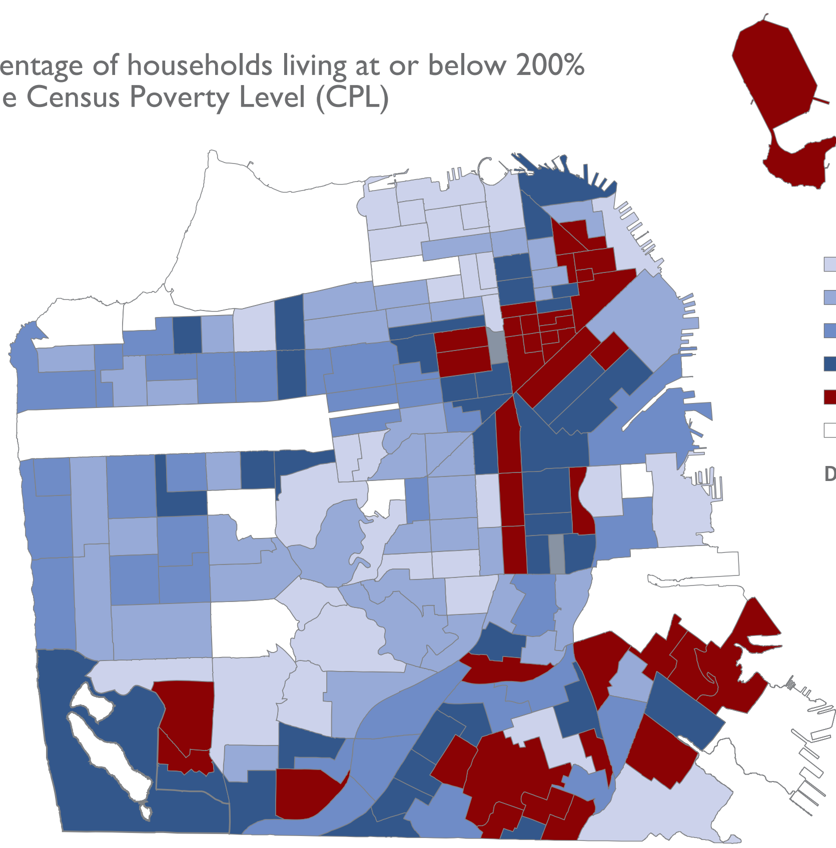
- API
- B/AA
- Latino
- White
- No majority ethnic group
- Area of minority concentration*

Data source: ACS 2009–13.

*San Francisco defines an area of *minority concentration* as any census tract with a non-White population that is 20 percent greater than that of the City's total Non-White percentage.

According to the 2009–13 ACS, 58.3 percent of the City's population identifies as being Non-White. Therefore any census tract in which 78.3% of the population is classified as minority would qualify as an area of minority concentration.

Map 2: Percentage of households living at or below 200% of the Census Poverty Level (CPL)



- 0.0–15.3%
- 15.4–21.6 %
- 21.7–28.8%
- 28.9–40.8%
- 40.9–79.1%
- Statistically unstable

Data source: ACS 2009–13.

SFMTA
Municipal
Transportation
Agency

San Francisco County Transportation Authority

Edwin M. Lee, *Mayor*

Tom Nolan, *Chairman*
Cheryl Brinkman, *Vice-Chairman*
Gwyneth Borden, *Director*

Malcolm Heinicke, *Director*
Joél Ramos, *Director*
Cristina Rubke, *Director*

Edward D. Reiskin, *Director of Transportation*

June 10, 2016

The Honorable Dave Cortese, Chair
Metropolitan Transportation Commission
Bay Area MetroCenter
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

Subject: Plan Bay Area 2040 Project Performance Assessment Compelling Case Geneva-Harney BRT

Dear Chairman Cortese:

The Metropolitan Transportation Commission (MTC) has undertaken a Project Performance Assessment of a diverse array of transportation projects proposed for consideration in Plan Bay Area 2040. We appreciate the efforts of MTC staff to develop and refine the Geneva-Harney Bus Rapid Transit (BRT) project to ensure its accurate evaluation. Unfortunately, the Project Performance Assessment identified it as a low-performing project, and we are writing to present a compelling case for its re-categorization as a medium-performing project and therefore eligible for inclusion in the financially constrained project list for Plan Bay Area 2040.

The Geneva-Harney BRT project closes a critical east-west gap in San Francisco's rapid transit network. The seven mile project will provide exclusive bus lanes, transit signal priority, high-quality stations, and pedestrian and bicycle amenities between Balboa Park and Hunters Point Shipyard. The larger Geneva BRT and Corridor Improvements project evaluated through the PBA 2040 performance assessment included both the Geneva-Harney BRT project and road infrastructure in the City of Brisbane. We have subsequently decided to divide the project into two phases:

- Phase 1: BRT implementation serving the community on an alternative route using existing right of way, and performing planning and environmental review work on the Brisbane interchange and Geneva extension projects.
- Phase 2: Implement the Brisbane interchange and Geneva extension projects and operate BRT service on the newly constructed infrastructure.

We anticipate seeking full inclusion of the first phase of the project in PBA 2040 and are working with MTC staff to ensure the phased project is correctly reflected in future modeling efforts.

MTC staff presented several possible criteria for making a compelling case for inclusion within Plan Bay Area. Category 2b recognizes projects that improve transportation mobility or reduces air pollution within communities of concern. As shown in Attachment 1, the overwhelming majority of the study area for Geneva-Harney BRT is located within a community of concern. The Project Performance Assessment recognizes positive benefits to air quality, health, and safety, and due to the location of this project within a Community of Concern, these and the project's related mobility benefits will especially reach low-income and minority populations.

Existing Muni stops on this corridor serve over 32,000 passengers daily, and SFMTA must provide more robust transit service in order to accommodate the area's future job and population growth. The SFMTA is committed to operating Geneva-Harney BRT at eight minute headways by 2023 for the Candlestick Point/Hunters Point Shipyard development. This development project—one of many in the pipeline along the corridor—includes over 12,000 units, approximately one-third of which will be affordable.

The Geneva-Harney BRT project will also enhance mobility for low income and minority residents with the addition of a dedicated transit-only right of way along Geneva Avenue. The transit-only lane will improve service reliability for a number Muni routes, including the 28R, 8, 8BX, 9, and 9R by allowing these lines to operate without delays from mixed-flow traffic. The BRT project will directly connect existing and future residents of Hunters Point Shipyard and Candlestick Point to regional transit at the Bayshore Intermodal Station and the Balboa Park BART station. In addition to the high-quality transit improvements that the Geneva-Harney BRT project will provide, enhancements will be made to the streetscape experience to increase safety and encourage use of active transportation modes.

We also note that the Geneva-Harney BRT project scored well in the targets assessment portion of the Project Performance Evaluation, with a score of 5. This score reflects the strong support this project provides to regional goals including Healthy and Safe Communities, management of Housing and Transportation Costs, Jobs Creation, and Non-Auto Mode Share, and other metrics.

SFMTA and SFCTA urge MTC to consider the significant mobility improvements the Geneva BRT project will bring for existing and future residents of the Hunters Point neighborhood, whose residents are disproportionately low-income, minority, and living in households without vehicles. We request that MTC approve this compelling case argument and allow the project to be considered for inclusion in the financially constrained project list. The San Mateo City/County Association of Governments has concurred with our proposed phased approach to the project and with our submission of this compelling case argument for the Geneva/Harney BRT project. Thank you for your consideration.

Sincerely,

Tilly Chang

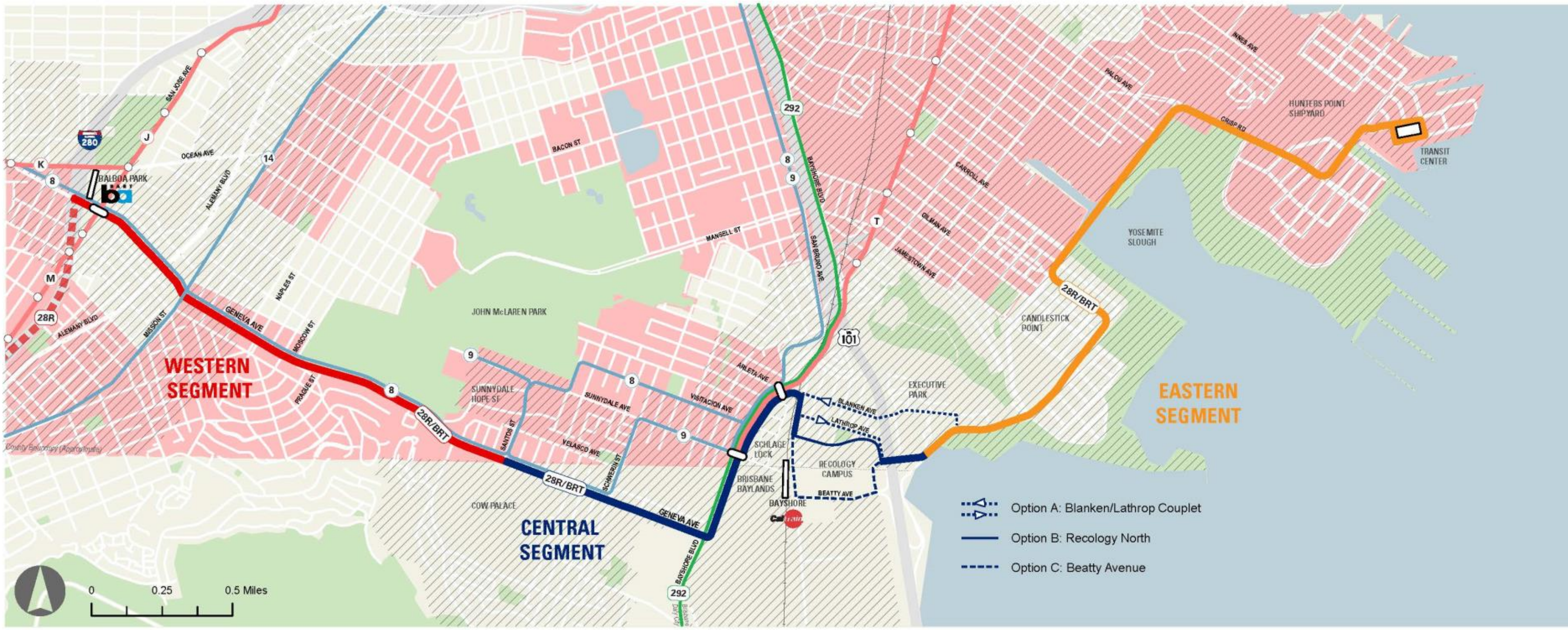
Edward D. Reiskin
Director of Transportation
San Francisco Municipal Transportation Agency

Tilly Chang
Executive Director
San Francisco County Transportation Authority

Attachment: Geneva-Harney BRT Project Map

cc: Supervisor Scott Wiener
Supervisor David Campos
K. Kirkey, D. Vautin, K. Carnerios, W. Bacon – MTC
M. Lombardo, A. Crabbe – SFCTA
D. Ito, L. Woodward – SFMTA
R. Alonso – SFPW
L. Hussain, OCII

GENEVA-HARNEY BUS RAPID TRANSIT | PLAN BAY AREA 2040



- 28R 19th Avenue
- 28R / Geneva-Harney (GH) BRT: Western Segment
- 28R / GH BRT: Central Segment
- 28R / GH BRT: Eastern Segment
- Existing Muni Metro Light Rail
- Existing Muni Bus Routes (Express Routes Not Shown)
- Existing SamTrans Bus Routes
- Caltrain / Future High-Speed Rail Alignment
- Priority Development Areas
- Communities of Concern
- Existing Muni Metro Light Rail Stops
- Potential BRT / Muni Metro Transfers*

*Geneva-Harney BRT stop locations are under review.

SONOMA~MARIN SMART AREA RAIL TRANSIT

Judy Arnold, Chair
Marin County Board of Supervisors

Barbara Pahre, Vice Chair
Golden Gate Bridge, Highway/Transportation District

Jim Eddie
Golden Gate Bridge, Highway/Transportation District

Debora Fudge
Sonoma County Mayors and Councilmembers Association

Eric Lucan
Transportation Authority of Marin

Jake Mackenzie
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Stephanie Moulton-Peters
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Gary Phillips
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David Rabbitt
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June 10, 2016

Steve Heminger
Executive Director
Metropolitan Transportation Commission
Bay Area Metro Center
375 Beale Street, Suite 800
San Francisco, CA 94105-2066

RE: Plan Bay Area – SMART Phase 3 Compelling Case

~~Dear Mr. Heminger,~~ Steve

We have been informed by your staff that the project performance assessment process undertaken to evaluate Plan Bay Area 2040 project submittals has resulted in SMART's Phase 3 rail extension project north from Sonoma County Airport to Cloverdale receiving a benefit/cost ratio of "less than one" through a travel model evaluation of benefits. The SMART Phase 3 project will include passenger and freight rail improvements from Sonoma County Airport, through Windsor, Healdsburg and to Cloverdale, a distance of over 24 miles. The project is proposed to be included as fully funded within the financially constrained Sonoma County Transportation Authority Comprehensive Transportation Plan.

SMART staff has discussed with MTC staff the need to detail a compelling case for inclusion of the SMART Phase 3 project in Plan Bay Area 2040. MTC staff has encouraged SMART to focus on Category 2 (Federal Requirements) Compelling Case Criteria, in particular that the project "improves transportation mobility in communities of concern". It is worth noting, however, that Category 1 (Benefits Not Captured by the Travel Model) Compelling Case criteria apply to the SMART Phase 3 project, such as the project supporting interregional and recreational corridor trips, including connections to the Sonoma County Airport with most ridership growth from north of the Airport, and the project providing significant goods movement benefits.

Regional Communities of Concern

The SMART Phase 3 project will benefit several communities of concern, some regionally defined and others locally defined. As the SMART project will provide transit connections at a regional scale in both the northbound and southbound directions, it will serve to connect workers to jobs along the entire corridor. The MTC community of concern that will directly benefit from the project is the Roseland Community in Southwest Santa Rosa, a community like Santa Rosa as a whole, which increasingly provides affordable housing stock for people who work in areas such as Healdsburg with less affordable housing availability. The practice is beginning of rural communities facing shortages of affordable housing bussing workers from Santa Rosa in to work. Calistoga is initiating such a vanpool service starting June 13th and their success may influence others. As an example of the mismatch between available housing stock and workforce needs, the City of Healdsburg has a median home sale price of $825,882 for May 2016, up 18% over last year. Of the 5,964 jobs in Healdsburg, only 18% are held by local residents with an equal number of workers coming from Santa Rosa (18%), 13% coming from Windsor area and 5% coming from Cloverdale. Within Healdsburg is a neighborhood that was the subject of an MTC-funded Community Based Transportation Plan in 2009, based on its designation at the time as a regional community of concern. The study area population was 35% persons in poverty and 35% Hispanic. Needs identified by the community included more express transit and more frequent transit service between Healdsburg and Santa Rosa. The SMART Phase 3 project would support such services.

Federally Recognized Tribes

The North Bay is the only part of the Bay Area that is home to a number of Federally-recognized Tribes. These Tribes (Cloverdale Rancheria, Dry Creek Rancheria, Federated Indians of Graton Rancheria, Lytton Rancheria, and Stewarts Point Rancheria) have a range of economic interests and transportation needs across the SMART corridor. The Tribes are actively engaged in creating jobs and economic opportunity as well as health care and support services for Tribal members. The Federated Indians of Graton Rancheria, for example, provides support services for 1,300 Tribal members including housing services, operating a Tribal Youth Mentoring Program, administering housing services and administering the Tribal Temporary Assistance for Needy Families (TANF) of Sonoma and Marin for 100 low income families. The Graton Casino and Resort opened in Rohnert Park in November 2013 and quickly became one of the largest employers in the North Bay with over 2,500 new workers. A resort hotel at that site is scheduled to open in late 2016, supporting even more jobs. Tribal offices and service programs as well as the casino are accessible from the Rohnert Park SMART Station. Local bus public transit serves the casino and Tribal leaders are examining future shuttle connectivity between SMART and the casino for employees as well as clientele. In addition, the Federally-recognized Tribes of the North Bay have designated the Sonoma County Indian Health Project (SCIHP), located in Santa Rosa, as a Tribal Organization. The multi-million dollar health care facility, in relationship with the California Rural Indian Health Board, is a subcontractor with the federal government and performs the functions of the Indian Health Service for 5,500 Tribal members throughout the assigned service area. The State reports this facility had the fourth highest service population in the state (2012). The SCIHP facility in Santa Rosa is 1.5 miles from the Santa Rosa Railroad Square SMART Station, with convenient local bus connectivity or the paved pedestrian pathway, the Santa Rosa Creek Trail, as multi-modal travel options. Within the immediate area of the SMART Phase 3 stations, several recent developments have taken place. The Cloverdale Rancheria of Pomo Indians has received federal approval to take 62 acres of land into trust within ¼ mile of the SMART Cloverdale Station site and has plans for the property including a potential casino and resort. Additionally, the Lytton Rancheria Band of Pomo Indians owns more than 500 acres of land within a mile of the SMART Windsor Station that it is seeking to take into federal trust to build residences, a hotel and winery.

Other Vulnerable Populations

Existing transit riders through Northern Sonoma County and Mendocino County, located 3-miles north of Cloverdale, are some of the more economically vulnerable transit riders in the Bay Area. It is worth noting that the Cloverdale School District, with 1,300 students is 54% Hispanic and 62% low income. The 2012 Sonoma County Transit Passenger Survey found that over two-thirds of Sonoma County Transit trips are made by riders that are transit dependent, as indicated by 70% not having a driver's license, and 35% indicating that they do not have any drivable vehicles available to their household. Of respondents, 57% had a household income under $25,000, with another 25% of respondents having a household income from $25,000-$50,000. With the Cloverdale to Downtown Santa Rosa trip taking over 97 minutes by bus and only 37 minutes by train, the SMART Phase 3 project will provide a more efficient and express service than the current condition for the region's transit dependent populations. For transit riders on other systems, including Mendocino Transit Authority and the Veterans Administration bus services, access to Santa Rosa's Airport Area jobs and the new Veterans Administration Clinic services located there, are vital. The US Department of Veterans Affairs moved the Santa Rosa VA Outpatient Clinic from another Santa Rosa location to the Sonoma County Airport Boulevard area in 2009. In 2012 the Santa Rosa VA Clinic found a need to begin a project to expand its 22,000 square feet of space by nearly 30% to accommodate rapidly growing demand. In 2012 the clinic saw more than 7,500 patients, up from 5,000 in 2009. The clinic serves Sonoma County's 34,000 veterans as well as some of Marin County's 16,000 veterans and clinic clientele frequently travel to the Santa Rosa VA Clinic because of the specialty services offered. The Veterans Administration also operates the North Bay Vet Center in Rohnert Park to assist with job and housing and other support services. Each of these veteran support facilities draws from a regional clientele and each are located within ½ mile of a SMART Station.

Phase Strategy

Should the Category 2 Compelling Case Criteria referenced above be found insufficient for your purposes, and to ensure that SMART has the ability to proceed with seeking resources to complete the SMART Phase 3 project within the four year life of this Plan Bay Area update, we propose the below SMART rail scenario that would allow for the most practical implementation path forward for this phase:

- SMART Passenger Rail = $74m in 2018 dollars (YOE), includes PTC
    1. Airport to Windsor (w/o freight components) = $31.2m
    2. Windsor to Healdsburg south of bridge with station = $42.8 m
    3. O&M dependent on service levels, estimated at $25.8m through 2040
- Freight projects = $30m in 2019 dollars
    1. Double track Airport to Aviation = $5 m
    2. Healdsburg Russian River Bridge = $25 m
    3. O&M by freight private parties
- Passenger and Freight rail Healdsburg to Cloverdale = $15 million
    1. Conduct Environmental Studies/Preliminary Design for rail from Healdsburg to Cloverdale.

We look forward to your continued partnership as we connect the rural agricultural communities located along the 24 miles of our tracks north of our Phase 1 project with the Bay Area.

Thank you for the opportunity to comment.

Sincerely,

Farhad Mansourian
General Manager

Cc: SMART Board of Directors
Commissioner Steve Kinsey
Commissioner Jake Mackenzie
Suzanne Smith, Executive Director, Sonoma County Transportation Authority

SANTA CLARA
Valley Transportation Authority

June 10, 2016

Mr. Steve Heminger, Executive Director
Metropolitan Transportation Commission
101 Eighth Street
Oakland, California 94607

Subject: Compelling Case Documents

Steve

Dear Mr. Heminger:

The Santa Clara Valley Transportation Authority (VTA) was notified by MTC staff that five projects included in the Project List submitted to MTC by VTA for inclusion in the Regional Transportation Plan (RTP) were identified as "low scoring" projects. These low scores require a Compelling Case statement for each project from the respective project sponsors to allow them to remain in the RTP.

Accordingly, VTA is submitting Compelling Cases for two projects: the Lawrence Freeway (Attachment A) and the SR 152 Tollway (Attachment B). We will resubmit the three remaining projects; the Santa Cruz Light Rail/Toll Road, the Downtown San Jose Subway, and VTA Express Bus Enhancements, for inclusion in the RTP as studies.

COMPELLING CASES

As a preamble, VTA would just like to note that the 10 targets and benefit/cost (B/C) methodology used in the assessment do not capture the full breadth of the benefits of these projects. In the case of the two highway projects, the targets and B/C methodology do not adequately recognize, among other things, that our roadway systems cannot and should not remain static over time, but should evolve – along with other modes – into safer, more efficient and more cost-effective components on an integrated multimodal transportation system.

Lawrence Freeway

MTC evaluated the Lawrence Freeway project by combining seven projects within the corridor. These seven projects included three projects in Santa Clara County's Countywide Expressway Study Tier 1 Category: Lawrence Expressway at Homestead Road Grade Separation; Lawrence Expressway at Homestead Road Interim Improvements; and Lawrence Expressway from Reed/Monroe to Arques Grade Separation. This compelling case is being made for these three Tier 1 projects only. The six remaining Tier 2 projects can be removed from the financially constrained section of the RTP.

Funding for the three Tier 1 projects will come through local sales tax and local contributions through impact fees. Accordingly, the first aspect of our compelling case is that these projects

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should be included in the RTP because local funds are expected to fully cover capital and operating costs.

In addition, these Tier 1 projects include bicycle and pedestrian improvements. MTC's model did not capture the benefits of these improvements in terms of CO_2, PM and ozone precursor emissions, and multimodal mobility enhancements that result from making biking and walking more attractive options. Furthermore, the Santa Clara County Expressway System are significant trade routes, and we believe the MTC model does not fully capture goods movement benefits of these projects. Attachment A contains supporting documentation.

SR 152 Tollway

The SR 152 Tollway project includes four major design components: 1) new alignment of SR 152; 2) reconstruction of the existing US 101/SR 25 interchange (within new alignment limits); 3) eastbound SR 152 Climbing Lane at Pacheco Pass; and 4) access control improvements. The total project cost is estimated at $1.120 billion; with $1.107 billion coming from future toll revenue, and $13 million from federal and local funds. The $13 million represents funds already received and not part of the new RTP submittal. Attachment B provides supporting documentation.

It is important to note that the project's footprint extends into counties not within MTC's jurisdiction or the framework of its travel demand model (as opposed to the project modeling by VTA using the VTA model that includes these other counties). In fact, components of the project, including design and environmental clearances, may be come from those partner counties. VTA is assuming the project is fully funded through toll revenues.

In addition, VTA believes the project offers the following significant benefits not fully captured by MTC's model and evaluation process, as outlined below.

1. Goods Mobility - SR 152 is a major trade corridor from the Central Valley to the San Francisco Bay area and the Salinas Valley in Monterey. Based on Caltrans observed truck volumes for 2007 taken at Pacheco Pass, trucks comprise about 24 percent of the total vehicle mix, with heavy duty five-axle trucks comprising between 56 and 81 percent of the truck volumes. In 2008, the highest recorded truck average daily traffic (ADT) on SR 152 east of SR 156 was 6,100 truck vehicles. In light of the heavy truck volumes, benefits accruing from the proposed truck climbing lanes may not be accounted for in the analysis based on data from the MTC Regional model. Also, infrastructure improvement benefits accruing to the longer distance commodity flow markets outside of the MTC Regional model networks might not be adequately considered.

   Traffic volumes have grown significantly along SR 152 over the past decade resulting in worsening congestion and travel delays. In 2009, average weekday daily traffic varied from 23,700 vehicles per day (VPD) near I-5 to 32,500 VPD near US 101. Congestion along the corridor is exacerbated by major "bottlenecks". These bottlenecks can be addressed by:

- A new alignment for SR 152 other than the existing ten-mile, two-lane segment between Gilroy and SR 156 winding through farmlands, fruit stands and rural home sites (this is the only stretch of the entire 80-mile distance of SR 152 that is two lanes); and
- Adding a truck climbing lane to the eastbound ascent to Pacheco Pass (that would match the truck climbing lane that already exists in the westbound direction).

Re-alignment of SR 152 would allow goods movement and other traffic to bypass the above described existing ten-mile, two-lane stretch of SR 152 that has over 140 at-grade intersections and private driveway access points, and reduce truck delays which in turn will reduce the cost of freight shipments, the cost of doing business in the region, and the cost of living in general. In addition, the US 101 Central Coast California Freight Strategy Final Report, prepared by the Association of Monterrey Bay Area Governments (AMBAG), highlights the critical nature of Route 152 in supporting employment opportunities related to goods movement, agriculture, transportation and warehousing – generally benefitting lower income and minority communities in southern Santa Clara and northern San Benito counties.

2. Interregional Corridor - This project significantly improves an interregional corridor. Based on the select link runs for the year 2035, using ABAG Projections for the existing regional plans land use scenario (P 2011) and the VTA countywide model, of the total ADT of 30,400, approximately 90.4 % of the vehicle trips using SR 152 at the selected location (west of the SR 156 interchange) travel to and from the Central Valley into and out from the nine-county MTC region. The remaining 9.6 % are through vehicle trips traveling between the Central Valley and the AMBAG region (Santa Cruz, Monterey and San Benito Counties). The travel benefits to these trips are not captured in the MTC Travel Demand model.

   SR 152 between US 101 and I-5 is part of the California Freeway and Expressway System, the Interregional Road System (IRRS), and also is a Terminal Access STAA Route. STAA refers to the Surface Transportation Assistance Act of 1982 allowing large trucks, referred to as STAA trucks, to operate on routes that are part of the National Network. SR 152 is also classified by Caltrans as a Focus Route in the Caltrans Interregional Transportation Strategic Plan which means that the roadway is particularly important for goods movement, has interregional and statewide significance, and has the highest priority for completion to minimum facility standard. Much of this and more is documented in the Caltrans Project Study Report – Project Development Support (PSR-PDS) document that was approved by Caltrans for the SR 152 Trade Corridor Project in April 2015.

3. Recreational Corridor - SR 152 is also a major recreational corridor, with the highest traffic volumes for this recreational corridor occurring outside of the typical weekday traffic patterns captured by the MTC regional model. Based on PEMS data profiling ADT by day of the week, Fridays exhibited the highest ADT volumes followed by the weekend days. In addition, SR 152 corridor traffic also shows marked variation depending on the month of the year. Locations west of SR 99 exhibit peak ADT volumes in the summer months. As with weekend traffic benefits, summertime benefits are not captured in the typical weekday traffic volumes estimated by the MTC Travel Demand model.

4. Safety benefits – The project provides significant safety benefits. Based on accident data documented in the project Traffic Operations Report, 1,563 traffic collisions were recorded on SR 152 within the study limits between 2003 and 2008, including 51 fatalities and 922 persons injured. During that period, actual collision rates exceeded the statewide average between Gilroy and SR 156; at the US 101, SR 156 and I-5 interchanges; and at Ferguson Road. Factors that exacerbate safety at various locations along the corridor include:

   - The more than 140 at-grade intersections and driveway access points;
   - Differential speed between fast and slow moving vehicles including slow moving trucks on inclined sections of Pacheco Pass and farm vehicles sharing the highway with commuter/commercial traffic;
   - Sharp curves in combination with extended tangent approaches, steep grades and limited sight distance on inclined sections of Pacheco Pass;
   - Undivided roadway with limited passing zones between Gilroy and SR 156 increasing the potential for cross centerline collisions;
   - Narrow shoulders with no space for breakdowns to shelter;
   - Lack of clear recovery zones for errant vehicles.

   The project improves safety benefits by providing access control and other roadway safety improvements in the stretch of road east of SR 156, and by providing an alternative route to the existing section of roadway between US 101 and SR 156 that includes the over 140 private driveway access points and at-grade intersections with SR 152. The project provides a needed eastbound climbing lane to match the existing westbound climbing lane separating slow and fast moving vehicles. Since the infrastructure improvements include a geometric redesign of the interchange at US 101/SR 25, it is likely that many of the safety benefits provided by this project are not be captured properly within the context of the MTC Travel Demand Model.

In conclusion, the improvements to the SR 152 corridor, and hence expected benefits – both economic and travel time, extend well outside of Santa Clara County. Proper calculation of benefit/costs would need to consider full accounting for these metrics. This project has interregional significance and is supported by Caltrans and the California Transportation Commission (CTC). The project is also included in MTC's Regional Goods Movement Plan, which highlights significant corridors that provide circulation for important economic benefits.

Funding to support the capital cost for the new SR 152 Alignment project is supported by a self-sustaining funding plan through the generation of toll revenues in this corridor. The revenues generated by this project are specific to the corridor and will not be generated if the project is not built. In addition, this project benefits from a formal partnership between two counties, two Caltrans Districts (covering multiple counties), two MPOs (covering multiple counties) and VTA.

PROJECTS SUBMITTED AS STUDIES

As noted previously, the three other low scoring projects - the SR 17 Tollway and Santa Cruz Light Rail, Downtown San Jose Subway, and Express Bus Enhancements - are being resubmitted for inclusion in the RTP as studies. Projects resulting from this work may be included in the next RTP.

OTHER SANTA CLARA COUNTY PRIORITY PROJECTS

VTA has recently taken action to reaffirm the priority status of several projects which were included in a program of projects and sales tax measure ("Measure A") approved by the voters in Santa Clara County in 2000. On June 2nd, the VTA Board of Directors established $79 million in additional funding commitments for the Capitol and Vasona Light Rail projects and the Airport People Mover Rail Connection to Mineta San Jose´ International Airport. In total, VTA has committed $113 million in local sales tax funding in FY 2016 for these projects.

The MTC Commission, especially Chair Cortese, expressed concern that equity issues and communities of Concern be taken into account when MTC evaluates projects in Plan Bay Area 2040. The Capitol Light Rail Extension serves an area entirely within a Community of Concern in east San Jose´. Further, the VTA Board has approved a series of policy decisions over the years to repeatedly reaffirm the status of this project as the second-highest priority in this program. Another priority project is the Vasona Light Rail extension, which would bring a light rail extension to a part of Silicon Valley that is experiencing, and planning for significant land use developments. VTA's analysis of projected residential development and jobs growth in this area differs from MTC's model, and projects a significantly higher number of jobs in this area in the future. Accordingly, VTA requests MTC to re-evaluate these two projects.

Finally, project submittal for the Airport People Mover lists the scope of work for this project in the next cycle as $70.2 million; however, the projected total cost of this project is between $350 to $800 million – depending on the technology and route selected. This project scope was under the $100 million threshold to be included in MTC's Project Performance Assessment. However, it is important to note that the area between the airport and Diridon Station is the site of significant developer interest that promises to transform this part of San Jose´. The Airport People Mover remains a priority project in Santa Clara County as demonstrated by the $3 million in local funds just committed by the VTA Board.

ADDITIONAL COMMENTS

VTA also has some general comments in relation to the projects being developed for Plan Bay Area and the importance of those to Santa Clara County. These projects represent a multimodal effort to provide useful transportation improvements and to provide effective options for mobility otherwise not addressed.

Model Considerations

For future RTP consideration, we request that MTC work closely with VTA when modeling and evaluating projects. Compared to MTC's model, the VTA Travel Demand Models includes four additional counties (Santa Cruz, San Benito, Monterey, and San Joaquin) which reflect travel markets that could significantly influence the evaluation of projects located in parts of Santa Clara County on the edges of the MTC region. In addition, the enhanced zonal structure compared with MTC's and the calibration to local conditions, allows VTA to more accurately capture the influence and benefit of our projects and programs. Lastly, we believe the evaluation methodology we have established for plans, as recently applied in the Envision Silicon Valley project evaluation process, better captures the effects of our projects and programs, and an enhanced collaborative partnership between VTA and MTC in this regard could greatly benefit both agencies.

In conclusion, we appreciate your consideration of these two VTA Board approved projects to the financially constrained RTP project list. Please contact me at (408) 321-5713 with any questions regarding these projects or the information presented here.

Sincerely,

John Ristow, VTA Chief CMA Officer

cc: VTA Board of Directors

Attachments: VTA Candidates for Compelling Case
Compelling Case Documents

Project ID# 519
Project Name: Lawrence Freeway

Preamble

VTA believes this project should not require a compelling case justification, and should be included in the financially constrained section of the RTP. The Lawrence Freeway was modeled combining seven projects along the corridor:

- Lawrence Expressway at Homestead Road Grade Separation (Tier 1 Exp. Plan 2040)
- Lawrence Expressway at Homestead Road Interim Improvements (Tier 1 Exp. Plan 2040)
- Lawrence Expressway from Reed/Monroe to Arques Grade Separation (Tier 1 Exp. Plan 2040)
- Lawrence Expressway right-in/out closures (Tier 2 Exp. Plan 2040)
- Lawrence/Stevens Creek/I-280 Interchange (Tier 2 Exp. Plan 2040)
- Realign Wildwood Avenue to connect with Lawrence Expressway (includes new traffic signal at Lawrence Expressway/Wildwood Avenue intersection)
- Widen Lawrence Expressway between Moorpark and I-280 (Tier 2 Exp. Plan 2040)

The County of Santa Clara is in the process of adopting the Countywide Expressway Plan 2040. The Countywide Expressway Plan 2040 takes a look at the needs of the expressways based on city land use plans, projected 2040 traffic growth, and Complete Streets planning. The Expressway Plan developed a program of projects based on tiers that was adopted by the Expressway Plan Policy Advisory Board made up of VTA Board Members, County Supervisors, Roads Commission Members and City Elected Officials in 2015. These projects were grouped in categories of Tier 1, Tier 2 and Tier 3. These tiers represent near, mid, and long-term improvements. Expressway improvements listed in Tier 1 represent a priority for Santa Clara County in improving mainline conditions and improving access for transit, pedestrians, and bikes. There are three projects on the Lawrence Freeway category that we would like to see included within Plan Bay Area 2040:

- Lawrence Expressway at Homestead Road Grade Separation (Tier 1 Exp. Plan 2040)
- Lawrence Expressway at Homestead Road Interim Improvements (Tier 1 Exp. Plan 2040)
- Lawrence Expressway from Reed/Monroe to Arques Grade Separation (Tier 1 Exp. Plan 2040)

These three projects represent a priority for Santa Clara County as adopted by the Expressway Plan Policy Advisory Board and will be funded 100% through local funding. The County of Santa Clara has developed a project concept study for Lawrence Expressway specifically on these three projects.

Project Description and Benefits:

The Tier 1 Lawrence Expressway projects includes three major components; 1) Interim improvements at the Homestead interchange, 2) New grade separation at Homestead, and 3) New grade separation from Reed/Monroe to Arques. The improvements are further described below.

1) Add eastbound through lane on Homestead Road through Lawrence Expressway intersection in Santa Clara.

2) Grade separation of Lawrence Expressway at Homestead Road, including HOV lanes and class I bike/pedestrian trail.

3) Grade separation of Lawrence Expressway from Reed/Monroe to Arques including HOV lanes and class I bike/pedestrian trails on both sides of expressway.

Project Cost and Funding: $542.7 Million

Amount ($Millions)	Funding Source
$542.7	Local Funding

Justification:

1. The Tier 1 Lawrence Expressway projects will be fully funded through local sales tax initiatives and local transportation impact fees. The local sales tax initiative will fund the improvements on Lawrence Expressway and have been identified as part of the approval of the Envision Silicon Valley program on June 2, 2016 by the VTA Board of Directors. The approval sets the Tier 1 as one of the priorities of the ballot initiative.

2. These Tier 1 projects serves as a priority for the Expressway Plan Policy Advisory Board which identified the Tier 1 projects as near term improvements. On August 31, 2015, the Policy Advisory Board adopted the Tier 1 list of projects, including those on Lawrence Expressway, for inclusion in the Plan. The Tier 1 list of projects are those that will be completed in a near term timeframe. They also represent those sets of projects that not only relieve congestion but are safety projects with complete streets elements.

3. Lawrence Expressway is a heavily traveled route with 253,000 average weekday vehicle trips during peak hours. Level of Service along the length of the expressway regularly is at Level of Service (LOS) F, with the intersections at Homestead Road, Arques Avenue, and Reed Avenue/Monroe Street at LOS F during AM and PM Peak periods. The improvements

outlined in Tier 1 will address circulation, relieve congestion, and improve connectivity for all users of the roadway, including bicyclists and pedestrians.

4. The Lawrence Expressway grade separation segments have some of the highest collision rates on the County Expressway System due to the very high volumes and severe levels of traffic congestion. Between 2009 and 2013, there were 429 collisions, of which 5 involved bicycles or pedestrians. The expressway currently has low use by bicyclists and pedestrians. At the community meetings for the Expressway Plan, safety concerns were frequently raised and community requested for improved facilities along Lawrence Expressway. The grade separation project will greatly improve safety for all users by reducing the number of conflicts with crossings and by providing Class I bicycle/pedestrian trail and short crossings of cross streets.

Recommendation

The recommendation to the MTC Planning Committee would be to:

1) Include the following projects in Plan Bay Area:
    a. Lawrence Expressway at Homestead Road Grade Separation (Tier 1 Exp. Plan 2040)
    b. Lawrence Expressway at Homestead Road Interim Improvements (Tier 1 Exp. Plan 2040)
    c. Lawrence Expressway from Reed/Monroe to Arques Grade Separation (Tier 1 Exp. Plan 2040)

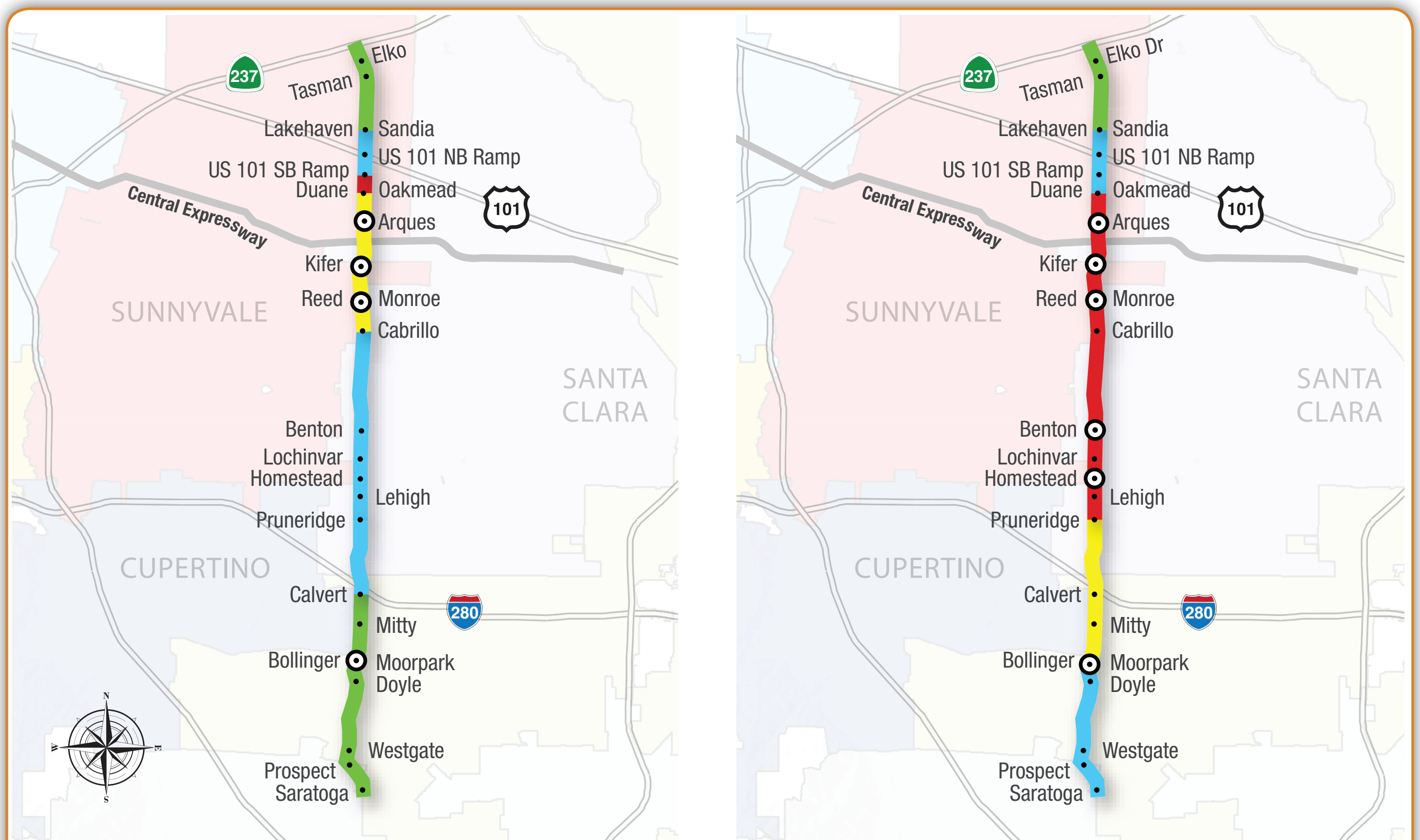
2) Remove from consideration:
    a. Lawrence Expressway right-in/out closures (Tier 2 Exp. Plan 2040)
    b. Lawrence/Stevens Creek/I-280 Interchange (Tier 2 Exp. Plan 2040)
    c. Widen Lawrence Expressway between Moorpark and I-280 (Tier 2 Exp. Plan 2040)

3) Will be captured as a local streets project:
    a. Realign Wildwood Avenue to connect with Lawrence Expressway

ATTACHMENT A

Lawrence Expressway | Fact Sheet

EXISTING CONDITIONS AND ACCOMPLISHMENTS



2003 Conditions | **2013 Conditions**

Peak Period "Levels Of Service" (LOS)

- LOS A-C: Minor Delays
- LOS D: Some Delays
- LOS E: Major Delays
- LOS F: Severe Delays
- Intersection LOS F

Expressway Characteristics

- 8.7 miles long
- 6-8 lanes wide, including
- HOV lanes
- 23 signalized intersections
- 3 freeway connections: I-280, US 101, SR 237
- 253,000 vehicle trips daily
- Adjacent jurisdictions: Saratoga, San Jose, Cupertino, Santa Clara, Sunnyvale

Improvements Completed Since 2008

- Bicycle signal detection at all signalized intersections
- Bicycle adaptive signal timing
- Interim channelization improvement to reduce crossing conflicts at Granada Ave
- Traffic responsive signal timing

In the Works

- Grade Separation Concept Study for Reed/ Monroe, Kifer, and Arques
- Add 2nd left turn lane EB Prospect to NB Lawrence
- Pavement rehabilitation from Homestead to SR 237

ATTACHMENT A

2008 STUDY RECOMMENDATIONS FOR LAWRENCE EXPRESSWAY

2008 Vision Statement

Southern end more arterial-like; mid-section more high-end expressway with freeway-like segments; and northern end more high-end express arterial

List of 2008 Expressway Study Projects Not Yet Funded

Tier 1A

Add 2nd left turn lane EB Saratoga to NB Lawrence (Partial funding from Apple)

Widen to 8 lanes from Moorpark/ Bollinger to south of Calvert

Initiate study to reconfigure Lawrence/ Calvert/ I-280 interchange area

Close median at Lochinvar and right-in-and-out access at various locations

Tier 1B

Construct interchanges at Reed/ Monroe, Kifer and Arques

Tier 1C

Provide additional left-turn lanes on Saratoga, Benton, and Oakmead/ Duane

Construct interim improvements at Lawrence/ Calvert/ I-280 (Partial implementation by Apple)

Provide additional EB through lane on Homestead

Tier 2

Realign and signalize Wildwood Avenue intersection

Tier 3

Reconstruct interchange for direct access between Lawrence, I-280, and Stevens Creek and HOV direct connector ramps

Construct Lawrence/ US 101 HOV Direct Connector Ramps

Tier Definitions

SHORTER TERM

Tier 1A - Highest priority developed concepts

Tier 1B - Next highest priority

LONGER TERM

Tier 1C - Possible future priority

Tier 2 - Second level priority
Limited conceptual development

Tier 3 - Third level priority
Undeveloped-concept only

IMPROVEMENTS FOR ALL EXPRESSWAYS

Bicycle

Bicycle signal detection and bicycle adaptive signal timing at all signalized intersections on cross-streets and expressway

Pedestrian

Pedestrian sensors and pedestrian adaptive signal timing at all signalized intersections on cross-streets and expressway

Sidewalks or parallel pedestrian facilities along the length of all expressways

Traffic Signal System Operations

Signal coordination/ interconnection between expressway signals and city/ Caltrans signals on cross streets

Real-time traffic information

Finishing Program

Sound wall, landscaping, and street lighting improvements

Operations and Maintenance

Provide for cleaner and greener expressways with smooth pavement and synchronized signals

2008 PLAN PROJECT COSTS (all expressways)

Capacity and Operational	$2.6 billion
Bicycle	$17 million
Pedestrian	$84 million
Sound Walls	$77 million
Landscaping	$29 million
Operations and Maintenance	$27 million annually

ATTACHMENT B

FACT SHEET: Highways

State Route (SR) 152 Trade Corridor Project

Project Description

Santa Clara and San Benito counties are working together to develop and deliver infrastructure improvements for SR 152 between U.S. 101 and the Santa Clara/Merced county line. This project includes a new alignment of SR 152 between U.S. 101 and SR 156, and an eastbound truck climbing lane over Pacheco Pass. The improvements would accommodate the long-term travel needs of commercial, commuter, and recreational traffic by enhancing travel safety and improving traffic operations. Additionally, these improvements would enhance the quality of life for the local communities and economic vitality of the region. Santa Clara Valley Transportation Authority (VTA) in coordination with California Department of Transportation (Caltrans) is leading the development of this project.

Objectives

- Improve mobility between the Bay Area and Central Valley
- Improve travel times
- Reduce traffic congestion
- Enhance travel safety

Outcomes

- Complete SR-152 as a continuous four-lane facility between US 101 and SR 156
- Reduce regional traffic on local roadways through Gilroy
- Provide a truck climbing lane over Pacheco Pass

Current Activities

- Advancing technical studies and environmental documentation
- Continued stakeholder outreach
- Securing additional funding

Benefits

- A new four-lane freeway between SR 156 and U.S. 101, curve corrections and access control improvements will enhance safety.
- The eastbound Pacheco Pass climbing lane will improve travel times and enhance safety by separating slower moving vehicles from traffic moving at freeway speeds.
- Eliminate 114 direct driveway access points to SR 152.

Project Funding

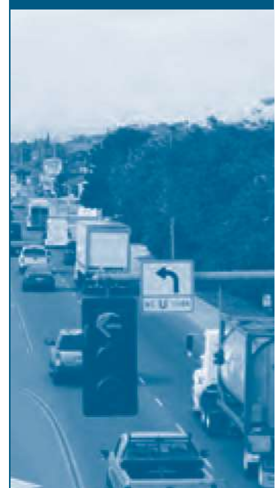
VTA received $5 million of State funding from the Interregional Improvement Program (IIP), matched with $5 million of VTA's highway funds and is seeking additional funding from the State.

Project Schedule

Completed Preliminary Traffic and Revenue Study	February 2010
Completed SR 152 Trade Corridor Summary Report	September 2010
Completed PSR	Spring 2015
Complete Environmental Documents	Pending funding
Complete Design and Construction	Pending funding

How to Reach Us

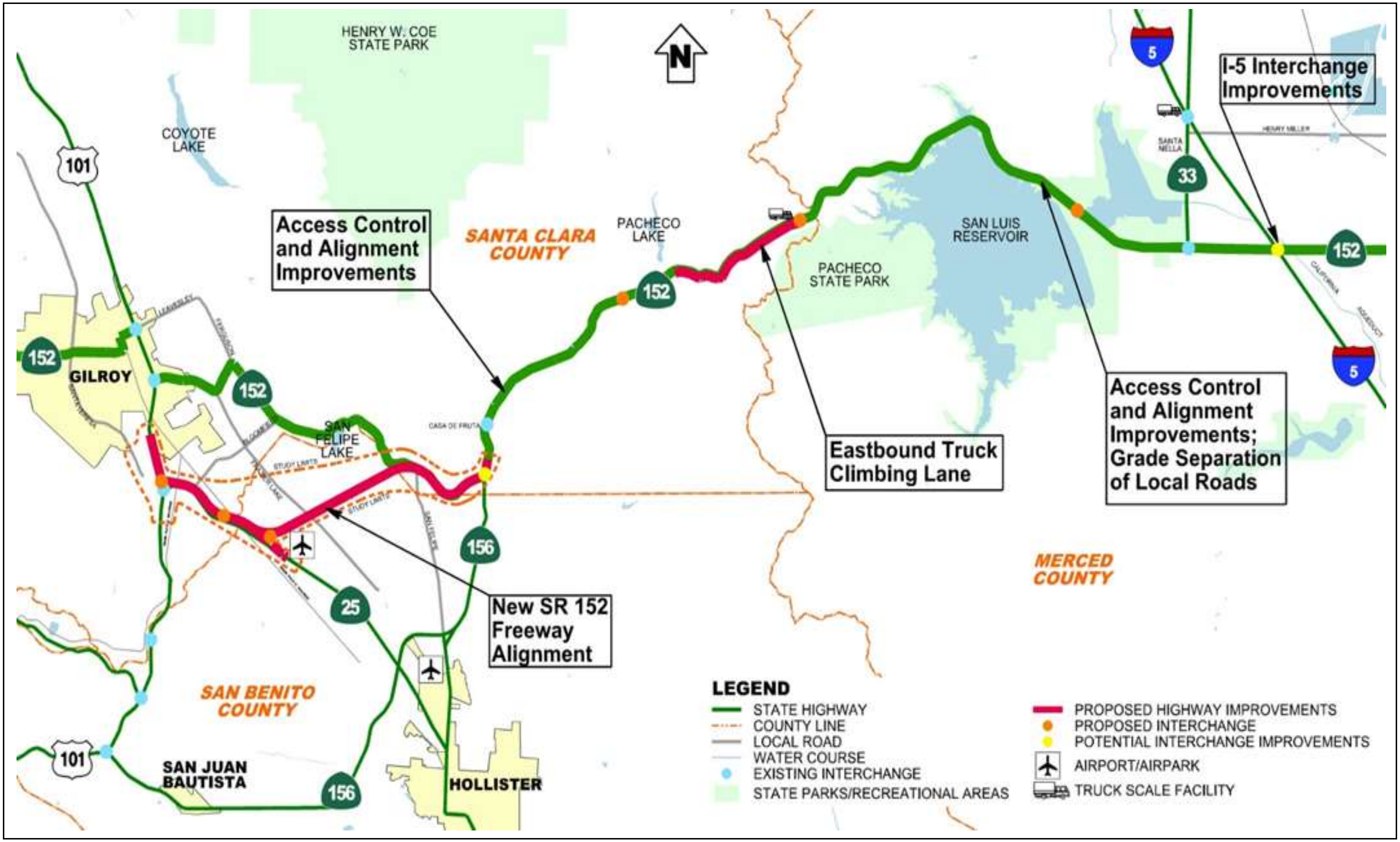
For more information on this project, please call VTA's Community Outreach at (408) 321-7575, (TTY) for the hearing impaired (408) 321-2330. You may also visit us on the web at *www.vta.org*, or e-mail us at *community.outreach@vta.org*.



Planning for Future Generations

ATTACHMENT B

Route 152 Trade Corridor Project



ATTACHMENT B

04 – SCL – 152 - PM 9.9/35.2
10 – MER – 152 - PM 0.0/15.0
Project ID 04000003190
EA 04-0G2300
February 2015

PROJECT STUDY REPORT-
PROJECT DEVELOPMENT SUPPORT
(PSR-PDS)

To

Request Programming for
Capital Support
(Project Approval and Environmental Document Phase in Multi-Funding Programs)

On Route 152

Between US Route 101

And Interstate 5

APPROVAL RECOMMENDED:

GENE GONZALO, VTA, CAPITAL PROGRAM MANAGER

PROJECT SPONSOR ACCEPTS RISK IDENTIFIED IN THIS PSR-PDS AND ATTACHED RISK REGISTER

NICK SALEH, CALTRANS PROJECT MANAGER

APPROVED:

BIJAN SARTIPI, DISTRICT 4 DIRECTOR

4/30/15
DATE

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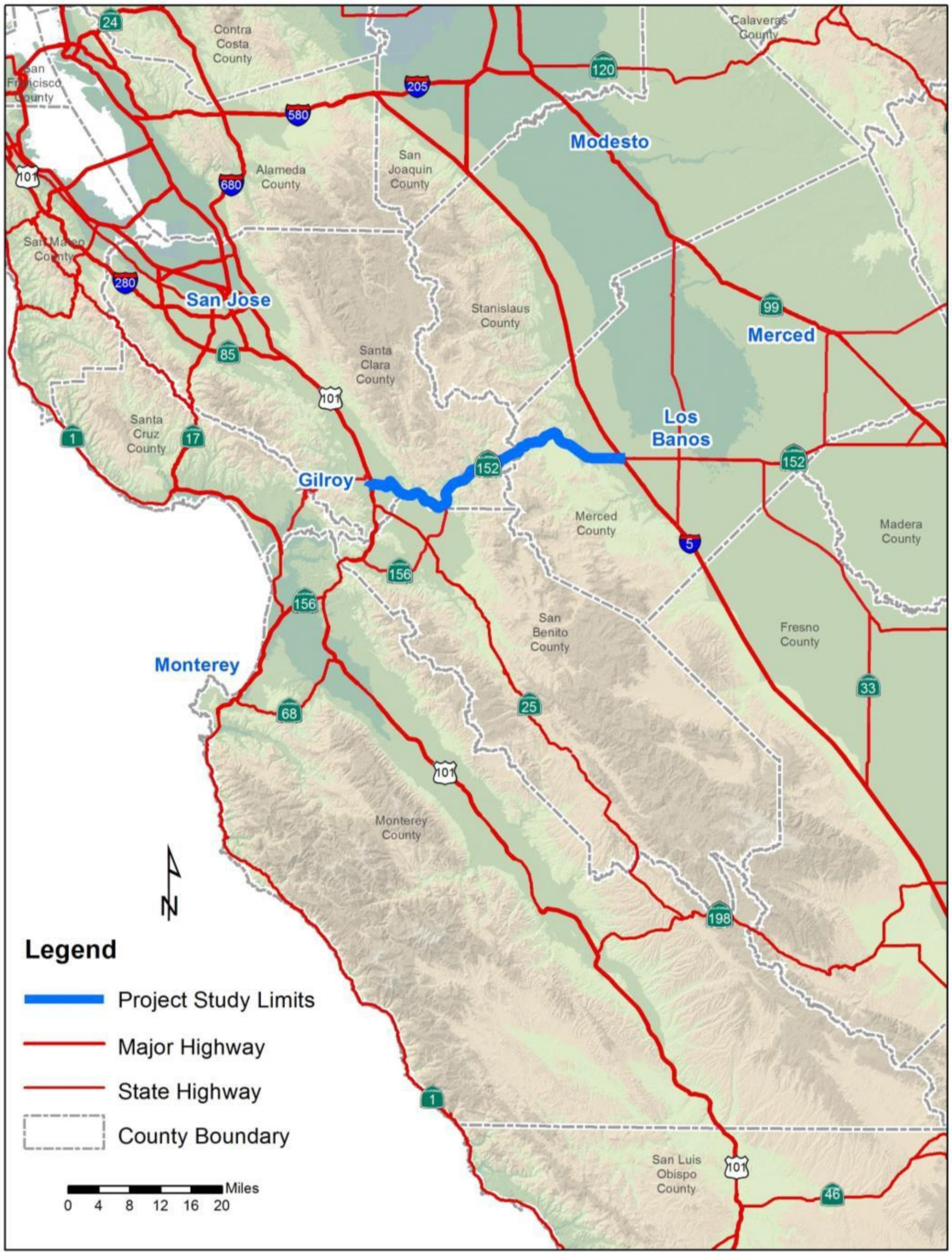

Vicinity Map

On Route 152

Between US Route 101

And Interstate 5

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10 – MER – 152 - PM 0.0/15.0

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

2-13-2015

REGISTERED CIVIL ENGINEER	*DATE*

REGISTERED PROFESSIONAL ENGINEER
Timothy Lee
No. C50605
Exp. 9/30/15
CIVIL
STATE OF CALIFORNIA

Reviewed by:

CELIA MC CUAIG , OFFICE CHIEF, ADVANCE PLANNING

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TABLE OF CONTENTS

REQUIRED ATTACHMENTS

A. **Location and Vicinity Map**

B. **Build Alternative – Key Map, Layouts and Typical Cross Sections**

C. **Preliminary Cost Estimate**

D. **Preliminary Environmental Analysis Report (PEAR)**

E. **Transportation Planning Scoping Information Sheet**

F. **Right of Way Conceptual Cost Estimate**

G. **Project Risk Register**

SUPPLEMENTAL ATTACHMENTS (FOR PROJECT FILE) UNDER SEPARATE COVER

- **Quality Management Plan**
- **Storm Water Data Report (SWDR)**
- **Survey Needs Questionnaire**
- **Traffic Engineering Performance Assessment (TEPA)**
- **DES Scoping Checklist**
- **Design Scoping Index**
- **Design Standards Summary Table**
- **Existing Utilities Summary Table**
- **References**

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ATTACHMENT B

04 – SCL – 152 - PM 9.9/35.2
10 – MER – 152 - PM 0.0/15.0

1. INTRODUCTION

The SR 152 Trade Corridor Project (Project) is a high profile project that proposes improvements to an east-west trade corridor on State Route (SR) 152 between US Route (US) 101 and Interstate 5 (I-5) – a distance of approximately 40 miles along the existing alignment.

In the current economic climate of limited federal funding and shortfalls in state and local taxes, new methods of funding infrastructure improvements are being sought to initiate and implement projects that keep traffic moving, commerce flowing and the economy growing. At the request of the California Transportation Commission (CTC), the Santa Clara Valley Transportation Authority (VTA), in coordination with the Council of Council of San Benito County Governments (SBCOG), and the California Department of Transportation (Caltrans), is exploring the role of both public and private capital together with user fees to move this project forward.

Project Limits (Dist., Co., Rte., PM)	04-SCL-152-9.91/35.16 10-MER-152-0.00/15.00
Number of Alternatives:	Two: No Build and Build Alternative *
Capital Outlay Support for PA&ED	$32 million
Estimated Capital Construction Cost	$766 Million (Roadway and Structures)
Right of Way Cost	$108 million
Funding Source:	ITIP, STIP, and Local
Type of Facility (conventional, expressway, freeway):	Freeway (for New SR 152 Alignment) Expressway (where full access control is not feasible)
Number of Structures:	57 structures. Retaining walls at various locations
Anticipated Environmental Determination or Document:	Combined CEQA EIR and NEPA EIS
Legal Description	In Santa Clara, San Benito and Merced Counties on State Route 152 from US 101 to 1.1 miles east of Interstate 5
Approximate Schedule	Complete PA&ED: December 2019
Project Category	1

* During the PA&ED phase, a reasonable range of alternatives will be developed and studied for each segment, including those which would attain most of the basic project objectives while avoiding or reducing the environmental effect of the project.

Attachment C contains a cost estimate for specific work items included in this project. The remaining support, right of way, and construction components of the project are preliminary estimates and are not suitable for programming purposes. See Attachment C, Preliminary Cost Estimate for specific work items included in this project. A Project Report will serve as approval of the “selected” alternative and the programming document for the remaining support and capital components of the project.
This PSR-PDS serves as the authorizing document to initiate the Project Approval and Environmental Document (PA&ED) phase. Conceptual approval of the build alternative will be requested early in the PA&ED phase.

2. BACKGROUND

General
SR 152 is a major east-west corridor for interregional commercial, commuter, and recreational traffic connecting the South San Francisco Bay Area, North Central Coast and Central Valley regions. The closest east-west routes traversable by trucks are 60 miles to the north on I-580, or 120 miles to the south on SR 46. SR 152 is a vital artery for the State's agricultural heartland of the San Joaquin Valley and Monterey Peninsula, a link to the Oakland Ports and a major international trade highway corridor. Nearly half of the State's agricultural production is produced and transported in counties along and adjacent to the SR 152 corridor. SR 152 is the most direct east-west route connecting I-5 and US 101, and also provides a viable alternative to the heavily congested I-580/I-238/I-880 east-west corridor. See Attachment A for the project location.

The SR 152 corridor is located within or at the fringes of four counties (Santa Clara, San Benito, Merced and Madera), four Metropolitan Planning Organizations (VTA, Association of Monterey Bay Area Governments (AMBAG), Merced County Association of Governments (MCAG), and Madera County Transportation Commission (MCTC), one Regional Transportation Planning Agency San Benito County of Governments (SBCOG), and three Caltrans Districts (Districts 4, 5, and 10). Because of the fragmentation of jurisdictions along the route and competing local priorities, a combined effort to improve the entire route has never been made before.

Despite numerous studies that have been undertaken to improve portions of the route, only three major projects have been completed in the last 40 years:

- Realignment of SR 152 to construct the San Luis Reservoir (1975)
- Widening the realignment of SR 152 to bypass Casa de Fruta (1992)
- Construction of the SR 152/SR 156 Interchange (2009)

VTA began the project to convert the SR 152 / SR 156 intersection into an interchange in 2000. The purpose of the improvement was to improve safety, congestion and route continuity. VTA assembled local, state and federal funds to design, acquire right of way, and construct the new interchange, which was successfully completed and opened to the public in 2009.

With that interchange project underway, VTA began to investigate improvements to the SR 152 corridor within Santa Clara County from US 101 to SR 156. The existing corridor is a winding 2-lane rural road through hilly terrain. The majority of the corridor is not access controlled, with numerous driveways for homes and farm buildings. To convert the corridor into a 4-lane limited access highway, a new alignment would be required to meet expressway standards. Over the years, several efforts to identify a new alignment have been undertaken by Caltrans without success as consensus could not be reached on the location of a new alignment.
In 2006, VTA in coordination with SBCOG began investigating several new alignment alternatives for SR 152 between US 101 and SR 156. In 2008, SBCOG adopted a resolution restricting any new SR 152 alignment to the northwest corner of their county.

In 2008, $10.2 million in funding was allocated to the Project. The CTC provided $5 million from the 2008 State Transportation Improvement Program (STIP), with VTA matching this with an additional $5.2 million. The CTC funding was provided with the request that the SR 152 corridor be examined between US 101 and SR 99 and that a study of the feasibility of a public-private partnership (P3) to implement improvements be conducted.

In a separate project, the VTA is currently developing a project to widen a 2-mile, corridor-wide section of US 101 at the western end of the SR 152 Corridor and it is estimated that with current funding allocations for Santa Clara County that the project would take up to 50 years to finance and construct.

It is clear that the conventional approach to funding and constructing improvements is not going to be viable for delivering SR 152 in a reasonable timeframe. With current level of public funding it can take several generations to accomplish the corridor wide benefits on SR 152. A more innovative financing approach is clearly needed to bring the Project to fruition. For example, the route passes through the city of Gilroy and despite extensive efforts since the late 1980s, plans to construct a bypass around this community have proven to be out of reach of available funding or have been given a lower priority to other projects in the region.

Existing Corridor Description
SR 152 route characteristics vary significantly within the study limits. From US 101 in the west, the route passes through 5 signalized intersections in the city of Gilroy's commercial district along a 4-lane signalized arterial then continues on a narrow, winding, 2-lane alignment to the SR 156 junction then crossing the 1,000 feet high Pacheco Pass on a winding 4-lane divided highway.

SR 152 key features for the project limits are summarized in the table below.

Length	40 miles (1.5 miles in Gilroy)
No. Lanes	2/4
Setting	•Narrow, curved, undivided highway •Passes through Gilroy commercial centers •Sustained grades across Pacheco Pass
Interchanges	US 101, SR 156, Casa de Fruta, SR 33 North, I-5
Local Road Intersections	24 (5 signalized)
Private Driveway Intersections	117

West (US 101 to SR 33 North)
After exiting the large commercial developments in Gilroy near US 101, SR 152 continues east to the SR 152/156 interchange as a winding 2-lane conventional highway, with narrow shoulders and a posted speed limit of 55 mph. As it is prone to cross centerline collisions, headlights are required at all times. This segment is a significant bottleneck for traffic traveling along SR 152 between the Bay Area and the Central Valley causing some traffic to divert to local roads (e.g., Bloomfield Road and Ferguson Road). There are numerous public and private at-grade access points to the highway. A soft median barrier was installed in the late 1990s. An eastbound climbing lane (just east of San Felipe Road) and the first stage of the new SR 152/156 interchange recently constructed.

East of the SR 152/156 interchange, the highway is divided with two lanes in each direction, passing the roadside attraction at Casa de Fruta and then ascending and crossing the Diablo Range before descending into the Central Valley. The highway follows a winding alignment to climb 1000 vertical feet on a sustained grade to the Pacheco Pass summit. A State truck inspection facility is located at the summit. SR 152 continues eastward as a 4-lane divided expressway, descending on a winding alignment along the northern and eastern shore of the San Luis Reservoir. There are two separate climbing lanes on the westbound ascent to the Pacheco Pass. The route then aligns around the northside of the San Luis Reservoir then passes between the San Luis Dam and the O'Neill Forebay to SR 33 North (leading to the community of Santa Nella). Major truck stops are located at the SR 33 North interchange for SR 152 traffic, and in nearby Santa Nella for I-5 traffic.

Just east of the SR 33 North interchange, the route connects with I-5. The interchange has a full cloverleaf configuration and was constructed in the early 1960s. Short weaving distances between on- and off-ramps and tight curves at loop ramps affect the mobility of traffic, particularly truck traffic. East of I-5, SR 152 continues as a 4-lane undivided urban arterial to the city of Los Banos.

Significance of SR 152 as a Goods Movement Corridor
California is the ninth largest economy in the world and its economic status is dependent upon the safe and efficient movement of goods both locally, statewide, nationally, and internationally. SR 152 between US 101 and I-5 is part of the California Freeway and Expressway System, the Interregional Road System (IRRS), and a Terminal Access STAA[1] Route. SR 152 is classified by Caltrans as a Focus Route in the Caltrans Interregional Transportation Strategic Plan, which means that the roadway is especially important for goods movement, has interregional and statewide significance, and has the highest priority for completion to minimum facility standards.

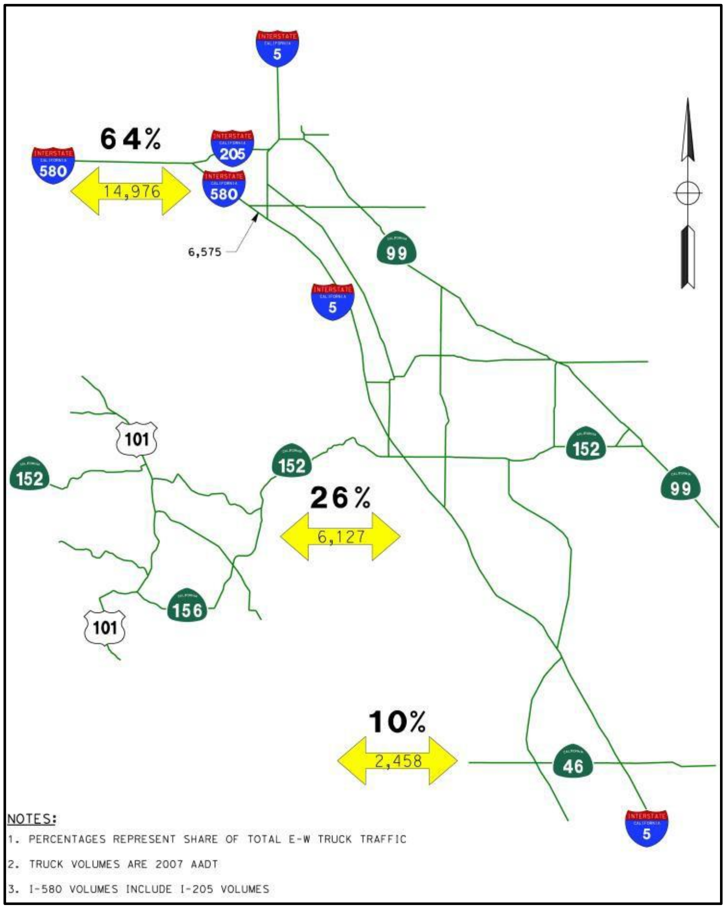
SR 152 serves commuter, recreational and commercial traffic. The route is a major international highway trade corridor linking the north-south trade corridor backbones of US 101, and I-5, as shown on Attachment A. Along with the I-80 and I-580(I-205)/I-238/I-880 corridors, SR 152 provides a critical east-west connection between the San Francisco Bay Area and the Central Valley. SR 152 from SR 165 to SR 33 is a designated Extra Legal Load Network (ELLN) and is preserved for 20-foot high loads. SR 152 is also a vital link for Monterey Peninsula traffic. SR 152 is the most direct major east-west route between I-580 to the north and SR 46 to the south, a distance of 180 miles. Furthermore, SR 152 is also the most direct, continuous, east-west route connecting I-5 and US 101, and provides a viable alternative to the heavily congested I-580 (I-205)/I-238/I-880 east-west corridor.

SR 152 is a vital artery for the movement of agricultural foods and other products, and serves California's agricultural heartland of the San Joaquin Valley and Monterey/Santa Cruz Counties.

Trade corridors are critical to the region's agribusiness. Trucking is the dominant mode for transporting perishable goods, and shippers rely on the interconnected system of local and state routes in order to make it from farm-to-market in a timely manner.

[1] The Surface Transportation Assistance Act of 1982 allows large trucks, referred to as STAA trucks, to operate on routes that are part of the National Network

East-West Truck Crossings



Limited Investment/Maintenance In Transportation Infrastructure
As noted earlier, SR 152 is part of the California Freeway and Expressway System and Interregional Road System (IRRS); however, only a small portion of the route currently meets freeway or expressway standards. Providing access control and upgrading the geometric design of the facility are key requirements to meet freeway or expressway geometric standards and improve deficiencies including safety and traffic operational issues.

Investment in past decades has not kept pace meeting operational and safety deficiencies in the corridor, nor have investments supported a goods movement corridor of noted interregional and statewide significance.

The transportation needs for the State continue to outpace funding available through traditional sources such as gas taxes. Bonds for Proposition 1B funds and local sales tax measures have helped finance additional infrastructure needs but are still insufficient to meet all needs, including such projects as the SR 152 Trade Corridor Project. The remaining choices are to either allow the corridor freight movement opportunities to diminish or exploring alternatives that leverage existing public funding. VTA in coordination with Caltrans and the CTC is leading the effort to explore those opportunities to improve the economics of the region through improved freight from source to market improvements to the SR152 infrastructure.

3. PURPOSE AND NEED STATEMENT

SR 152 is a major east-west corridor for interregional commercial, commuter, and recreational traffic connecting the South San Francisco Bay Area, North Central Coast and Central Valley regions. This section summarizes the primary transportation needs in the SR 152 corridor and identifies the purpose of the project. Note that during PA&ED, the Purpose & Need Statement will be expanded to provide additional details and analyses regarding the existing and future needs, as per the *Standard Environmental Reference* (SER) guidelines.

Need
There are a number of existing deficiencies in the existing SR 152 corridor that hinder the safe and efficient movement of goods and people. These deficiencies form the basis for the need for the project and are categorized as follows:

- Congestion and Delay: The existing roadway features and capacity of various segments of SR 152 are inadequate to accommodate existing and future demand. The result is congestion and delay during peak travel periods. The segments where "bottlenecks" and congestion are most notable are in the vicinity of 5 signalized intersections in Gilroy, as well as the eastbound ascent to Pacheco Pass where there is no truck climbing lane. There is a need, therefore, for additional roadway capacity and operational improvements, so as to reduce congestion and delay.
- Accident Rates: The existing roadway features along portions of SR 152 do not meet current design criteria. This fact, in combination with large volumes of both slow-moving trucks and fast-moving autos on SR 152, has resulted in accident rates in excess of the statewide average in certain locations. There is a need, therefore, for roadway upgrades and improvements to reduce accidents.

These needs are described in greater detail in Section 5, *Deficiencies*.

Purpose
The purpose of the project is to meet existing and projected vehicular transportation needs in California's vital east-west SR 152 corridor, the critical components of the transportation need being as follows:

- The importance of the SR 152 corridor for the movement of goods between the Central Valley and North Central Coast regions of California.
- The importance of the SR 152 corridor as a commuter route between residential areas of the Central Valley and employments centers of the San Francisco and Monterey Bay Areas.
- The importance of the SR 152 corridor for general and recreational travel between the North Central Coast area and other regions of California, including the Central Valley, Sierra Nevada, and Southern California.

Meeting the vehicular transportation needs in the SR 152 corridor will encompass elements of all of the following:

- Improvements that will reduce travel time
- Improvements that will reduce congestion
- Improvements that will reduce the potential for accidents

4. TRAFFIC ENGINEERING PERFORMANCE ASSESSMENT

The Traffic Engineering Performance Assessment (TEPA) was prepared to support this PSR-PDS using traffic data developed for a preliminary traffic and revenue analysis study completed in February 2010. This macro-level study included planning level analysis of mainline operations under current (2009) and forecasted (2015 and 2035) conditions to assess the financial feasibility of generating revenue to construct and maintain the corridor improvements through tolling.

Supplemental traffic data collection efforts and traffic studies will be performed to support the PA&ED phase of project development. That information is not included in this TEPA and will be documented in the PA&ED phase deliverables including the Traffic Operations Analysis Report (TOAR).

Current Operating Conditions

Annual Average Daily Traffic

SR 152 experienced steady traffic growth between 1998 and 2006 throughout the corridor. Subsequent traffic decline is generally attributed to the economic recession that began in 2007 and fluctuations in gas prices. Portions of SR 152 have experienced heavy congestion for many years; however, traffic volumes are expected to return to 2006 levels and continue to increase as the nation continues to recover from the economic recession. Traffic counts collected in 2009 showed slightly higher traffic volumes compared to 2008 suggesting system wide growth is occurring.

The highest traffic volumes on SR 152 are recorded on the segment between SR 156 and SR 33 North. Considering the split of traffic on SR 152 west of the junction with SR 156, SR 152 carries approximately two-thirds of interregional traffic and SR 156 carries the other third into San Benito County. The combined AADT for SR 152, SR 156 and SR 25 east of US 101 was 70,800 in 2008. Shifting this traffic on to a new freeway alignment would provide a more focused route for SR 152 that is more suited to interregional traffic.

SR 152 and I-580, just west of I-5 carry similar traffic volumes. Between 2004 and 2006, SR 152 volumes surged and were carrying approximately 30 percent more traffic than I-580 (just west of I-5).

Annual Average Daily Truck Traffic

The highest percent of trucks on SR 152 was on the easternmost segment, between SR 156 and I-5, where trucks represented 17 percent of total traffic, with the actual volume of trucks peaking at over 6,100 trucks per day just east of SR 156. AADT truck volumes in Gilroy were 2,514 per day. According to the local agencies, the majority of these trucks pass straight through and are a significant burden on the quality of life of these communities. There is an equal split of truck traffic on SR 152 and SR 156, west of the interchange.

Comparing the total number of trucks crossing the SR 152, SR 46, and I-580 east-west crossings in 2007, 26 percent used SR 152, 10 percent used SR 46, and 65 percent used I-580 (west of the I-205 merge). Although I-580 west of I-205 carries the highest truck volumes, the portion of I-580 south of I-205 and SR 132 carries similar truck volume to SR 152, suggesting that Central Valley truck movements are split evenly between these two east-west routes. The average AADT truck percentage on SR 152 in Merced County was approximately 14 percent in 2008, which is similar to the truck percentage on I-580 and I-205 in San Joaquin County.

Over 60 percent of trucks were 5-axle type west of I-5. The highest proportion of 2-axle trucks occurred in the urbanized area of Gilroy, likely driven by a greater number of local delivery trips. Prior to 2005, volumes on SR 152 in the vicinity of I-5 were comparable to volumes on I-580. More recently, however, SR 152 has carried considerably more truck traffic than I-580 in the vicinity of I-5.

At Pacheco Pass the highest volumes occurred during the spring, summer and fall months with volumes in the westbound direction being slightly higher than the eastbound direction.

The high volume of interregional traffic, particularly truck traffic, passing through San Benito County is a major concern to San Benito County communities. Trucks originating outside the county, either bring goods into the county for local consumption or pass through to connect with US 101 on the west and the Central Valley on the east. Although the county designated routes for trucks are SR 152 and SR 156, there is evidence that some truck traffic detours onto local roads not intended for that use.

<u>Weekday and Weekend Traffic</u>
SR 152 is a significant route for recreational destinations on weekends. Traffic counts conducted in September 2009 indicate that average weekend traffic is higher than average weekday traffic on SR 152 between US 101 and I-5 with the highest volumes occurring in Gilroy. It should be noted, however, that this data was collected in late summer and volumes will vary seasonally.

Ferguson Road is a known detour for traffic using SR 152, particularly during the average weekday. Approximately 30 percent of westbound SR 152 traffic was found diverting to Ferguson Road, and 14 percent from Ferguson Road to eastbound SR 152. Shore Road, Frazier Lake Road, Bloomfield Avenue, and Bolsa Road are also known detours for traffic during periods of congestion.

Just east of US 101, traffic grows throughout the day until reaching a maximum in the late afternoon into the early evening before receding again. Reflecting substantial retail activity in the Gilroy area, this pattern is similar on both weekdays and weekends and in both directions of travel, with weekends slightly exceeding weekdays. West of SR 156, a familiar commuting pattern is seen. This pattern entails directional peaks, with westbound weekday traffic peaking in the morning, and eastbound weekday traffic peaking in the evening. Weekend volumes increase gradually throughout the day, peaking in both directions in the late afternoon and early evening, at volumes similar to weekday peaks.

<u>Travel Times</u>
SR 152 between US 101 and SR 156 is characterized by slower free-flow speeds and somewhat greater volatility in speeds compared with other rural stretches, likely the result of lower overall capacity, platooning of vehicles, and limited passing opportunities. The slowest

speeds and greatest volatility were found in the vicinity of US 101, where retail development is widespread, traffic signals interrupt the flow of traffic, and the speed limit is lower.

For the remainder of the corridor nearly free-flow speeds occur at all times. The only location exhibiting a consistent drop in speeds is eastbound SR 152 on the sustained grade up to Pacheco Pass, which features sharp curves and heavy truck volumes. Some loaded trucks were observed dropping to speeds of 25 mph ascending the grade. A similar speed drop was not observed in the westbound direction which has climbing lanes on the ascent to Pacheco Pass. Average travel speeds between US 101 and SR 156, ascending eastbound to Pacheco Pass, and through the I-5 Interchange, are below free-flow conditions.

The aforementioned speed differentials along the corridor demonstrate that the bottlenecks through Gilroy, the 2-lane segment between Gilroy and SR 156, and the eastbound ascent to Pacheco Pass exacerbate the efficient movements of trucks and overall traffic.

Existing Conditions Analysis

The western end of the corridor, between US 101 and SR 156, is approaching capacity, and the greatest excess capacity exists at the eastern end. Outside of the urbanized area of Gilroy, near free-flow conditions exist for the most part. The exception is the eastbound ascent to Pacheco Pass. Due to steep grades, sharp curves, and a significant proportion of trucks, the effective capacity of this segment is considerably lower than surrounding stretches. In general, weekdays experience more concentrated peak hour traffic, resulting in higher peak hour congestion, with the exception of the western end of the corridor in Gilroy, which experiences significant weekend traffic and comparable peak hour congestion.

The majority of delay experienced on the SR 152 corridor currently occurs between US 101 and SR 156, reflecting both the highest overall volumes and among the lowest capacities, and ascending to Pacheco Pass in the eastbound direction. Delay ascending to the pass is the result of steep sustained grades and sharp curves, which cause extreme speed reductions among trucks and a resulting decline in the effective capacity of the roadway. This is further exacerbated by breakdowns or accidents due to narrow shoulders.

Accident Data
Accident Data from the Caltrans Traffic Accident Surveillance and Analysis System (TASAS) was obtained for SR 152 in the study area. A summary of the data for the years 2003 through 2008 is summarized in the table below, and discussed in the paragraphs that follow.

SR 152 Accident data (2003-2008)

								Accident Rate					
								Actual			Average		
Location				Fatal	Injury	Fatalities	Persons Injured	FAT	F+I	TOT	FAT	F+I	TOT
Santa Clara (east of US 101)	1133	1038	95	18	373	26	644	0.01	**0.3**	**0.81**	0.02	0.3	0.8
2-lane segment*	523	452	71	7	178	14	333	0.01	**0.37**	**1.04**	0.02	0.3	0.76
Merced County	430	422	8	17	162	25	278	0.02	0.3	0.75	0.02	0.3	0.87

FAT = number of fatal accidents per million vehicle miles
F+I = number of fatal plus injury accidents per million vehicle miles
TOT = total number of accidents per million vehicle miles
*East of Gilroy city limits to SR 156

SR 152: US 101 to Santa Clara/Merced County Line
For the 25.5-mile section of Route 152 between US 101 and the Santa Clara/Merced County line, the actual accident rate is calculated to be 0.81 accidents per million vehicle miles (MVM). Of the recorded 1,133 accidents, 95 occurred at intersections and 1,038 occurred between intersections. Eighteen of the accidents resulted in 26 fatalities and 373 of the accidents resulted in 644 persons injured. Forty-six percent of the accidents on SR 152 in Santa Clara County (east of US 101) occurred on the 10.6-mile section of 2-lane highway between Gilroy and SR 156. The actual accident rate is 1.04 accidents per MVM and largely occur at the intersections of US 101, Ferguson Road and SR 156.

Safety and operational improvements constructed or planned on this section of SR 152 include:
- Installation of soft median barrier (rumble strips)
- Daylight headlight and double-fine zones
- Eastbound climbing lane, east of San Felipe Road
- Upgrade median barrier on Pacheco Pass
- Extension of 4-lane section east of SR 156 and new Casa de Fruta interchange
- SR 152/SR 156 Interchange
- Curve correction at Lovers Lane (planning stage)
- Signalization of SR 152/Ferguson Road intersection (planning stage)

SR 152: Merced County
For the 15-mile section of the Project in Merced County, the actual accident rate is calculated to be 0.75 accidents per MVM. Seventeen of the accidents resulted in 25 fatalities and 162 of the accidents resulted in 278 persons injured, while a large amount of accidents occurred at the I-5 interchange.

Traffic and Revenue Analysis
A Traffic and Revenue (T&R) analysis was completed in February 2010 to develop planning level traffic and toll revenue forecasts for the major corridor improvements and a range of tolling scenarios. The purpose of the analysis was to establish tolling configurations that would lead to a scenario in which the corridor mobility improvements could be fully funded through a combination of fund sources.

Macro-level travel demand modeling for the study area was performed using a combined VTA, MCAG and San Joaquin Goods Movement model. Average weekday daily traffic forecasts were developed under toll free and tolled conditions. Preliminary toll rates for the T&R analysis were established from a toll sensitivity analysis for similar new toll facilities. Assumed toll rates were estimated at approximately $0.15 per mile in 2015 and $0.20 per mile in 2035 for this study. Commercial vehicles were assumed to be tolled per axle.

Annual toll transactions and accumulated toll revenues were estimated for the 20-year period from 2015 to 2035, and a conceptual-level financial feasibility analysis conducted for each toll scenario assuming a 50-year bonding period.

The financial analysis considered highway construction costs, as well as capital and annual operating costs for tolling facilities. The analysis was based on typical financial structures utilized on similar toll-based financings, including Transportation Infrastructure Finance and Innovation Act (TIFIA) financing and Private Activity Bonds (PABs).

The tolling scenarios studied for the project limits were:
- Toll Scenario T1 - Construct the new SR 152 Alignment between US 101 and SR 156 with a toll facility located just east of Casa de Fruta. Under this scenario only the portion of the corridor between SR 156 and I-5 would be tolled.
- Toll Scenario T2 – Construct the new SR 152 Alignment between US 101 and SR 156 with a toll facility located on the New SR 152 Alignment.
- Toll Scenario T3 – Construct the new SR 152 Alignment between US 101 and SR 156 with a toll facility located on US 101, North of Gilroy.
- Toll Scenario T4 – Construct the new SR 152 Alignment between US 101 and SR 156 with a toll facility located on SR 152 (east of Casa de Fruta) and I-580 (west of I-5).

The Preliminary T&R Study assumed tolling of all lanes in each direction at toll locations.

The results of the financial capacity assessment for the T&R Study showed the most promising toll scenario for the project limits to be Toll Scenario T1.

5. DEFICIENCIES

Improvements to SR 152 are critical to the overall improvement of goods mobility between the Central Valley and North Central Coast regions. Corridor improvements benefitting goods movement would also improve SR 152 as a viable alternative to the heavily congested I-580/I-238/I-880 corridor. Key deficiencies that affect trade and mobility along the SR 152 corridor are outlined below.

Goods Mobility
SR 152 is a heavily used truck route. In 2007, daily truck volumes exceeded 6,000 vpd and 17 percent of the traffic mix on some segments of the corridor. Comparing the total number of trucks crossing the three east-west crossings of SR 152, SR 46, and I-580, 26 percent used SR 152, 10 percent used SR 46, and 64 percent used I-580 (west of the I-205 merge). SR 152 is classified by Caltrans as a Focus Route in the Caltrans Interregional Transportation Strategic Plan, meaning that the roadway is especially important for goods movement, has interregional and statewide significance, and has the highest priority for completion to minimum facility standards.

Although I-580 carries the highest truck volumes, the portion of I-580 south of SR 132 carries similar truck volumes to SR 152, suggesting that Central Valley truck movements south of SR 132 are split evenly between these two routes.

As noted earlier, SR 152 is the only major east-west route between I-580 to the north and SR 46 to the south, a distance of 180 miles. SR 152 is the most direct east-west route connecting SR 99 and US 101, and also provides a viable alternative to the heavily congested I-580 (I-205)/I-238/I-880 east-west corridor.

The efficient flow of goods along the SR 152 corridor is impacted by signal delays in Gilroy, steep grades on the ascent to Pacheco Pass, and the 2-lane section east of Gilroy. As the region recovers from the recent economic recession, truck volumes are expected to increase. Delays to trucks are of particular concern because the economy is highly dependent on reliable and cost-effective truck-freight transportation. Truck delays add to the cost of freight shipments, increasing the cost of doing business in the region and the cost of living.

Safety
1,563 traffic collisions were recorded on SR 152 within the study limits between 2003 and 2008, including 51 fatalities and 922 persons injured. During that period, actual collision rates exceeded the statewide average between Gilroy and SR 156; at the US 101, SR 156 and I-5 interchanges; and at Ferguson Road.

Factors that exacerbate safety at various locations along the corridor include:

- More than 140 at-grade intersections and driveway access points
- Differential speed between fast and slow moving vehicles including slow moving trucks on inclined sections of Pacheco Pass and farm vehicles sharing the highway with commuter/ commercial traffic
- Sharp curves in combination with extended tangent approaches, steep grades and limited sight distance on inclined sections of Pacheco Pass

- Undivided roadway with limited passing zones between Gilroy and SR 156 increases potential for cross centerline collisions
- Narrow shoulders with no space for breakdowns to shelter
- Lack of clear recovery zones for errant vehicles

Traffic Volumes and Bottlenecks
Traffic volumes have grown significantly along SR 152 over the past decade resulting in worsened congestion and travel delays. In 2009, average weekday daily traffic varied from 32,500 vehicles per day (vpd) near US 101 to 23,700 vpd near I-5. Congestion along the corridor is exacerbated by major “bottlenecks”:

- The winding, 10-mile 2-lane segment between Gilroy and SR 156
- The eastbound ascent to Pacheco Pass where there is no truck climbing lane
- Delays and significant congestion at the 5 signalized intersections in the city of Gilroy during both weekday and weekend periods

System Connectivity
Portions of the route exhibit poor connectivity with the adjoining state highway system. West of the SR 152/SR 156 interchange, for example, the route splits from a 4-lane expressway type facility to the 2-lane conventional highways of SR 152 and SR 156 before reaching US 101. Rural, 2-lane undivided highways are not capable of effectively carrying the traffic volumes we see today. The resulting congestion causes some traffic to divert onto local roads and SR 152 volumes drop off by almost one-third west of Ferguson Road as a result of diverting traffic.

Route Concept and Access Control
Although SR 152 is part of the California Freeway and Expressway System and Interregional Road System (IRRS), only a small portion of the route currently meets freeway or expressway standards. Providing improved or full access control and upgrading the geometric design of the facility are key requirements to meet freeway or expressway standards and improve safety and traffic operations.

Community Impacts
Through the city of Gilroy, interregional traffic (including commuter, commercial and recreational traffic) mixes with local traffic resulting in heavy congestion during peak hours due to queuing at multiple signalized intersections.

Congestion and conflicting traffic movements (including pedestrians and bicyclists) have generated strong safety and general quality of life concerns within the community. Access to local businesses is also affected during periods of congestion.

SR 152 is particularly important to Los Banos commuters who have the second longest average commute time in the state (2006 to 2008 Census) and many of them travel to the Bay area for work. In the absence of other modes of transportation, they rely on SR 152 to provide a safe and reliable route to and from work.

6. CORRIDOR AND SYSTEM COORDINATION

System

Within the project area, SR 152 serves primarily interregional traffic as the backbone of the circulation system for many cities and communities in the region. It is part of the Freeway and Expressway System, Terminal STAA Access Truck Network (see Table 6-1), and Interregional Road System (IRRS). SR 152 is a focus route identified by Caltrans in the 1998 Interregional Transportation Strategic Plan.

Table 6-1 : STAA Terminal Access Routes	
District 4	SR 152 (US 101 to Santa Clara / Merced County Line)
	SR 25 (US 101 to San Benito County Line)
District 5	SR 152 (in San Benito County)
	SR 25 (Santa Clara County Line to San Felipe Road)
	SR 156
District 10	SR 152 (Santa Clara/Merced to Merced/Madera County Lines)
	SR 33 (North)

Deficiencies in system connectivity on the SR 152 corridor are discussed in Section 5. A continuous 4-lane freeway or expressway type facility would significantly improve system connectivity throughout the corridor.

State Planning

Caltrans District 4 approved the *SR 152 Corridor Plan* (CP) in April 2010 for the portion of the route in Santa Clara County. The 25-year concept for SR 152 between US 101 and SR 156: (Segment C) is a 4-lane expressway and between Santa Teresa Boulevard and US 101; (Segment D) is a two- to six-lane conventional highway. The map and data sheet, developed for inclusion in the CP acknowledges the need to resolve corridor concept issues on Segment C through evaluation of realignment alternatives within the study limits of this project.

Caltrans District 5 approved the *Route Concept Report for SR 156* (RCP) in 1986. The concept for SR 156 between US 101 and San Juan Road/4th Street is a 4-lane expressway (Segments 1 and 2). No significant change to the 2-lane rural minor arterial designation of SR 152 is planned between San Juan Road/4th Street and SR 152 (Segments 4 and 5). A Transportation Concept Report (TCR) is currently being prepared for the route and the concept will remain consistent with that approved in 1986.

Caltrans District 5 approved the TCR for SR 25 in 2003. The route concept LOS for SR 25 between San Felipe Road and US 101 (Segments 5 and 6) is LOS C or better and Caltrans recommends construction of a 4-lane facility in order to meet the targeted LOS.

Regional Planning
Metropolitan Transportation Commission oversees regional transportation planning efforts for nine Bay Area Counties. Transportation projects in the Bay Area are included in the *Regional Transportation Plan* (RTP). The most recent *Plan Bay Area, Strategy for A Sustainable Region* (adopted July 2013) lists the Project (US 101 to SR 156) under reference #230294 for $917 million (committed funds) to conduct environmental and design studies. The US 101 Widening Project (Monterey St. to SR 25) Project is listed under reference #21714 for $7 million (discretionary funds). SR 25 Widening in Santa Clara County is not included. The MTC prepares and adopts a new *Transportation Improvement Program* (TIP) every two years. The 2015 TIP is the most recent TIP and was adopted by the MTC on September 24, 2014. FHWA and FTA approved the 2015 TIP on December 15, 2014.

Local Planning
The MTC's Bay Area Implementation Plan for conversion of High Occupancy Vehicle (HOV) lanes to Express Lanes includes US 101 south to Cochrane Road. *Valley Transportation Plan 2040* (VTP) includes HOV lane widening of US 101 south to SR 25 with conversion to express lanes.

A summary of other relevant projects in the study area are listed in Table 6-2.

Table 6-2: Planned and Programmed Projects

Project Description	County	Comments
US 101 Widening (Monterey St. to SR 25)	SCL	EA 04-3A1600. Includes new US 101/SR 25 Interchange and Santa Teresa Extension. Included in MTC RTP 2035 Plan.
US 101 6-Lane Widening (SR 25 to SR 129)	SCL / SBT	EA 04-3A1600. Included in 2010 SBt RTP
SR 152/Ferguson Rd. Intersection	SCL	EA 04-2A260. SHOPP project
SR 152/Bloomfield Ave. Intersection	SCL	Included in VTP 2035
SR 152/Frazier Lake Rd. Intersection	SCL	Included in VTP 2035
SR 152/Lovers Lane Intersection	SCL	EA 2A4400. Safety improvements. SHOPP project.
US 101 Express Lanes (10th St. to SR 25)	SCL	Does not include cost of additional widening to accommodate express lanes. Not included in MTC RTP 2035 Plan
SR 25 Widening and Route Adoption	SCL / SBT	Two 3.8 mile long alternatives are proposed for construction near Hollister, and two route adoption alternatives between San Felipe Rd. and US 101 are also proposed (EA 05-485400). DED circulated May, 2010. Not included in VTP 2035.
Gilroy Orbital	SCL	Extend Santa Teresa Blvd. to US 101, and connect Buena Vista Ave., New Ave., and Leavesley Rd. to provide orbital route for local traffic.
US 101 Widening (SR 156 to SCl Cnty Line)	SBT	Part of RTP
SR 156 Improvements	SBT	EA 05-344900 San Juan Bautista to just east of Union Road. Supp. EIR approved September 2011
SR 152 near San Luis Reservoir	MER	Install concrete median barrier (EA 10-0S940)
SR 152, west of Romero Visitors Center	MER	Install shoulder rumble strips (EA 10-0Q360)

Transit

In 2008, the California High Speed Rail Authority completed program-level environmental studies to determine overall route and station locations for the proposed High Speed Train (HST) system from Los Angeles to San Francisco. Following voter approval of additional state bonds for the project later that year, project specific studies for a draft environmental document (DEIR/DEIS) began. Several HST alignments are under consideration for the San Jose to Merced segment of the project. An HST Alternatives Evaluation Report was completed in June 2010 and defines the alignments to be studied in the Environmental Document. Two alignments pass through the project limits. One alignment includes a station in Downtown Gilroy and the other in East Gilroy. A supplemental HST Alternatives Evaluation Report was completed in 2011 which included two new alignments (Morgan Hill-Gilroy At-Grade and the SR 152 Hybrid).

Prior and Current Corridor Studies

A number of major studies on or adjacent to the SR 152 Corridor are complete or underway. The Project continues to maintain coordination with the stakeholders involved on these studies and is consistent with their planning efforts. A summary of these studies is listed in Table 6-3.

Table 6-3: Prior and Current Corridor Studies

STUDY	COMMENTS
SR 152 DEIR/DEIS (US 101 to SR 156)	1994 draft Tier 1 document to relocate SR 152 to a new alignment between US 101 and SR 152
SR 25 Widening and Route Adoption	2010 draft environmental document to realign and widen SR 25 with Tier 1 Route adoption.
VTA Southern Gateway Study	2005 planning study to identify near and long-term transportation improvements between south Santa Clara County and adjacent counties.
Caltrans District 5 Regional Systems Analysis Study	2008 study to identify improvements for US 101, SR 152, SR 25 and SR 156
VTA SR 152 Realignment Study	2008 study to identify new SR 152 alignment alternatives between US 101 and SR 156.
VTA South County Circulation Study	2008 study to identify highway improvements for South Santa Clara County
US 101 Widening (Monterey St. to SR 129)	Environmental Document to widen US 101 to 6 lanes and upgrade to freeway facility was approved in June, 2013.
SR 156 Widening (Hollister to San Juan Bautista)	2008 FEIR/FONSI (and 2011 Supplemental EIR) to widen and realign SR 156.
MCAG Goods Movement Study	2009 study to identify significance of goods movement in Merced County
AMBAG Central Coast Commercial Flows Study	Ongoing study to identify capital improvements and legislative priorities to meet freight movement challenges for Central Coast
San Joaquin Valley Goods Movement Action Plan	2007 study to identify highway and transit improvements for Central Valley goods movement
SR 152 Trade Corridor (US 101 to SR 99) – Preliminary T&R Study	2010 report identifying feasibility to construct major highway improvements on SR 152 using toll revenues
SR 152 Trade Corridor Summary Report (US 101 to SR 99)	2010 report summarizing preliminary studies and stakeholder coordination to assess feasibility of the Project.
California High Speed Rail (Merced to San Jose segment)	Ongoing environmental studies to identify alternative alignments for HSR along SR 152 corridor.
Santa Nella Community Plan	2001 FEIR plans mixed use development in Merced County.

7. ALTERNATIVES

No Build Alternative
The No Build Alternative assumes minimal roadway improvements. Under this alternative, the existing route would remain unchanged except for planned and programmed improvements included in Section 6. This alternative does not meet the project purpose and need. Rather, it provides a basis for the analysis and evaluation of the Build Alternative.

Build Alternative
The Project proposes substantial improvements to the full length of SR 152 between US 101 in Santa Clara County on the west and I-5 in Merced County on the east, a total distance of approximately 40 miles. The footprint of the Build Alternative was developed during the Project Initiation Document (PID) phase using the design variations shown in Table 7-1, and defines the preliminary environmental study limits. During the PA&ED phase, a reasonable range of design variations will be developed and studied for each segment, including those which would attain most of the basic project objectives while addressing the results of detailed traffic studies and avoiding or reducing the environmental effect of the project.

Table 7-1: SR 152 Trade Corridor Design Variations Studied in PID Phase

Segment	Design Variation
A	• Range of alignment options and new interchanges (US 101 and SR 156) • Range of interchange options to complete the US 101/SR 25 interchange
B	• Full and partial access control
C	• Range of alignment options for the range of allowable design speeds in mountainous areas Full and partial access control
D	• Full and partial access control
E	• Full and partial access control • Range of interchange options to modify the SR 152/I-5 interchange

The extent of the proposed improvements will vary by segment and are described from west to east as follows:

US 101 to SR 156 (Segment A)

SR 152 will be reconstructed as a freeway on a new alignment south of its existing alignment. The new alignment will traverse portions of Santa Clara and San Benito Counties, connecting to US 101 at SR 25 on the west and connecting to SR 152 at the SR 152/SR 156 interchange on the east. Three potential alignments for the new freeway are under consideration. Specific components within this segment will include:

- Modification of the new US 101/SR 25 interchange configuration proposed as part of the separate US 101 Widening Project (EA 04-3A1600) to accommodate additional traffic generated by the new SR 152 alignment. Widening of US 101 to a 8-lane freeway between SR 25 and SR 152 (East) will be considered, and may be added pending results of detailed traffic studies.
- SR 25 will be widened and realigned to a 6-lane freeway from the proposed UPRR grade separation, just east of US 101, to just east of the Santa Clara/San Benito County Line, with new bridge crossings at Carnadero Creek, the UPRR, and Pajaro River, and a new interchange at SR 152/Bolsa Road.
- A new SR 25/SR 152 interchange will be constructed just east of the Pajaro River with connections to SR 25.
- SR 152 will be reconstructed as a new 4-lane freeway from the new SR 25/SR 152 interchange to just east of the SR 152/SR 156 interchange. New bridge crossings will be constructed at Frazier Lake Road, future High Speed Rail, Tequisquita Slough, Pacheco Creek, and the Santa Clara Conduit. A new interchange at San Felipe Road will be considered, and may be added pending results of detailed traffic studies.
- The existing SR 152/SR 156 interchange will be modified to accommodate a 4-lane freeway.
- Frontage roads will be constructed, as needed, to replace existing access to US 101, SR 25 and SR 152 from adjacent properties.
- Bicycle facilities will be constructed, as needed, to replace access lost when US 101 is upgraded to a freeway.

Upon completion of the new freeway, the existing alignment of SR 152 between the city of Gilroy and SR 156 will be relinquished by the State to the city and Santa Clara County and will function as a local roadway.

SR 156 to SR 33 North (Segments B, C and D)

SR 152 will be upgraded to provide an access-control facility, which will have the effect of eliminating the existing at-grade access points between SR 152 and local roadways and adjacent land uses to the extent feasible. Existing access to SR 152 will be replaced through the construction of new interchanges on SR 152 and a system of overcrossings and frontage roads.

Improvements within this segment will include the construction of a 4-mile long eastbound climbing lane on the ascent to Pacheco Pass. A new eastbound climbing lane will improve traffic operations and safety by separating fast and slow moving traffic on the 1,000 foot high sustained grade to the summit. The improvement will also complement the westbound climbing lane on the other side of Pacheco Pass. Currently trucks must climb the eastbound Pacheco Pass Grade mixed in with passenger automobiles.

There are no existing bicycle facilities within this segment.

SR 33 North to I-5 (Segment E)
SR 152 will be upgraded to provide an access-control facility, which will have the effect of eliminating the existing at-grade access points between SR 152 and local roadways and adjacent land uses to the extent feasible. Existing access to SR 152 will be replaced through the construction of new interchanges on SR 152 and a system of overcrossing and frontage roads. The project will also modify the existing SR 152/I-5 interchange.

Other Improvements
Other improvements that may be considered to further benefit SR 152 as a major east-west trade corridor and meet the needs of the users of the route include:
- Interchange modifications to enhance traffic operations and safety, and accommodate STAA truck turning movements, including construction of direct connector ramps at the SR 152 / I-5 interchange to eliminate weaving conflicts at loop ramp merge/diverge locations
- Alignment improvements on Pacheco Pass to improve or eliminate nonstandard design features and better accommodate STAA truck maneuvering
- Major maintenance improvements including pavement and bridge rehabilitation
- Upgrade or develop new truck stops or freight villages
- Relocate or modify truck inspection facilities
- Install and integrate Intelligent Transportation Systems (ITS) facilities such as traffic management, traveler information, incident management and commercial vehicle operations systems to enhance goods movement and corridor mobility

Tolling
Toll facilities on SR 152 will be considered to generate revenue to construct, maintain and operate the improved facility. Potential tolling locations of all lanes could be considered (a) just east of the SR 152 / Casa de Fruta interchange, or (b) on the New SR 152 Alignment (US 101 to SR 156). All Electronic Tolling (AET) is assumed. Three operational scenarios will be considered for this improvement:
- Operate the Western Segment of the SR 152 Corridor (US 101 to I-5) as a Tolled Facility
- Operate the New SR 152 Alignment (US 101 to SR 156) as a Tolled Facility
- No Tolls

Structures
A total of 57 new or modified bridge structures are required to accommodate the proposed improvements, including 21 highway bridges, 12 railroad bridges, and 24 creek bridges.

Highway Planting
Replacement, revegetation, restoration highway planting work, as a result of construction impacts, will be conducted as a separate follow-on highway planting contract.

Constructability Review
A preliminary constructability review was conducted by VTA during development of the PSR-PDS and the following issues were identified for further consideration during the PA&ED phase.
- Consideration of roadway on embankment versus roadway on elevated structure crossing the Soap Lake area (Pajaro River Flood Basin) of the New SR 152 Alignment (US 101 to SR 156)
- Consideration of special retaining walls and rock cuts to construct the eastbound SR 152 climbing lane at Pacheco Pass

Water Quality
A PID (PSR-PDS) level Storm Water Data Report was prepared for the project and is summarized below.

The Central Coast and Central Valley Regional Water Quality Control Boards are located within the project limits and Section 401 Water Quality Certification is anticipated and location specific requirements will be determined during the PA&ED phase.

The project is subject to the “NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities,” (NPDES Number CAS000002), or Construction General Permit (CGP). The estimated project Risk Level is 3 because the Pajaro River and Pacheco Creek have both a high sediment and high receiving water risk. The total disturbed soil area (DSA) for the project is estimated at 1,030 acres and Best Management Practices (BMPs) would be implemented to minimize or prevent the potential for both short-term and long-term degradation of water quality during and after construction.

Although the DSA for the project is substantial, the project is located entirely within a rural setting with availability of surplus right of way to accommodate the requirements for water quality and hydromodification using a combination of on-site and off-site locations. Adequate resources are included in the preliminary cost estimate for the project (see Attachment C) for construction and permanent water quality treatment and hydromodification mitigation.

The terrain along SR 152 within the project limits is described in Section 2: Existing Corridor Description.

Soils in Santa Clara County area are rich alluvial Pleistocene deposits. Erosion of the Diablo Range has been the source of the soils that now form the alluvial plain in the area. Meandering creeks that have their headwaters in the surrounding mountains cross the foothills and the flat alluvial portions of Santa Clara County. Alluvial and sedimentary deposits consist of alternating layers of loam, clay, gravel, sand and various mixtures of each. Soils in San Benito County vary greatly in each drainage basin. Well drained rich alluvial plain material is evident along the San Benito River. Soils in Merced County have a good to fair potential for developing habitat for both rangeland and openland wildlife. The development of water facilities such as small ponds and guzzlers enhances the value of the habitat. The Natural Resources Conservation Service (NRCS) Web Soil Survey (WSS) was utilized to determine the Hydrologic Soil Groups with the project limits. The WSS shows that the soils within the vicinity of the project are within Hydrologic Soil Groups A, B, C and D.

The project extends through two groundwater basins and four groundwater sub-basins, based on the Central Coast and Central Valley Basin Plans. The groundwater depth varies within the project area.

The estimated costs and right of way needs for both permanent and temporary BMPs are included in Attachment C.

Project Scoping Strategy
A range of project alternatives and design variations were considered by the project sponsor to establish the preliminary environmental study limits that will be evaluated during the PA&ED phase. These design variations were developed by applying standard design requirements to the design concept and modifying with nonstandard design features at specific locations where a full standard design was not considered feasible. Based on this preliminary information, a list of potential mandatory nonstandard features that will require focused attention during the PA&ED phase has been identified. The same approach will be maintained as the reasonable range of design variations is further developed for each segment of the project. An early focus of developing the Build Alternative geometric design will be to evaluate potential exceptions to advisory and mandatory design standards for all existing and proposed nonstandard features.

If the need for a design exception is identified, potential alternatives and background analysis for each location will be fully evaluated and discussed with the District, Design Coordinator and geometric reviewer based on specific circumstances while maintaining safety. Once these nonstandard design features are determined to have sufficient grounds for approval, a formal Design Exception Fact Sheet shall be prepared for approval per the *Project Development Procedures Manual* guidelines.

Since a Fatal-Flaw analysis has been deferred to the PA&ED phase, this PSR-PDS does not constitute conceptual approval of any of the build alternatives, and instead indicates that the Department agrees with the project's purpose and need statement, along with the general range of alternatives to be studied.

Context Sensitive Solutions
Context Sensitive Solutions (CSS) will be used to integrate and balance community, aesthetic, historic, and environmental values with transportation safety, maintenance, and performance goals. CSS will be reached through a collaborative, interdisciplinary approach involving all stakeholders, engaged through early coordination with agencies as well as early outreach to the community. In the preliminary design that has occurred to date, efforts have been be made to avoid resources or other areas that would be sensitive to the communities along the alignment. As the project becomes more defined, and well before publication of a draft environmental document, it is recommended that public outreach and early agency coordination occur.

During the PA&ED phase, context sensitive solutions will be considered to incorporate the proposed improvements into the surroundings consistent with Caltrans policy, available funding, and maintenance considerations.

Complete Streets
During the PA&ED phase, the proposed improvements will be developed to provide safe mobility for all users, including bicyclists, pedestrians, transit riders, and motorists appropriate to the function and context of the facility.

Project Benefits
The proposed corridor improvements would result in the following benefits to travelers and communities along the route.

Traffic Operations
Construction of the new SR 152 alignment (US 101 and SR 156) will provide a continuous 4-lane facility between US 101 and I-5 free of any signalized intersections. These improvements, together with the eastbound climbing lane at Pacheco Pass will eliminate the major bottlenecks along the corridor, shift interregional traffic off of local roads, and provide additional capacity to accommodate future traffic demand.

The major improvements will also improve system continuity between SR 152 and US 101 and I-5. Realignment of SR 152 to SR 25 will also promote the opportunity to shift SR 152 West out of downtown Gilroy on to Santa Teresa Boulevard which will also form part of Gilroy's orbital traffic circulation system.

Safety
Removal of bottlenecks is expected to reduce congestion related collisions. Access control improvements along the corridor would significantly reduce intersection–related collisions.

The proposed eastbound climbing lane across Pacheco Pass would offer the same separation of slower moving traffic from the regular traffic that exists today for commuters and truckers traveling westbound across Pacheco Pass.

The proposed grade separations for traffic across SR 152 would provide safer crossings for local traffic (including farm vehicles and school buses) that are today required to use gaps in the traffic stream to cross SR 152.

Providing standard shoulder and clear recovery zone widths will accommodate errant or broken down vehicles more safely and ensure that through lanes of traffic are not blocked.

Community
The new freeway bypass proposed around the city of Gilroy would provide an alternative path for regional traffic that separates it from the local automobile, pedestrian and bicycle traffic in commercial/retail areas of Gilroy thereby relieving the stop-and-go traffic conditions that are experienced today at the existing traffic signal intersections.

Trade
The major bottlenecks at the 2-lane undivided segment of roadway between Gilroy and SR 156, the 5 signal intersections in Gilroy and lack of climbing lanes on the eastbound ascent to Pacheco Pass that significantly impede the safe and efficient movement of goods along the existing corridor will be eliminated.

Removal of the major bottlenecks along the corridor will reduce truck delays which in turn will optimize the cost of freight shipments, the cost of doing business in the region, and the cost of living.

8. RIGHT OF WAY

Acquisition
The project is estimated to require acquisition from over 100 parcels to accommodate the proposed improvements. Relocation assistance would be required for existing structures impacted by the proposed improvements. The project will acquire access control rights. Permanent easements are anticipated for access control improvements. Temporary construction easements (TCE) are anticipated to construct the proposed improvements.

Portions of local agency right of way required for access control will be transferred to the State under the Streets and Highways Code Section 83 for freeway access rights. The portion of existing SR 152 between US 101 and SR 156 would be relinquished to the city of Gilroy and Santa Clara County.

Impacts to prime farmland and Williamson Act lands are anticipated. To mitigate impacts to natural floodplain (e.g., Soap Lake) and environmental sensitive areas, flood easements and biological mitigation sites would need to be acquired by the Project. Opportunities to convert surplus land from remainder parcels for mitigation or permanent BMPs will be considered.

A number of water wells located within the project limits would be impacted by the proposed improvements and would need to be relocated. Properties impacted by the project footprint that are supplied water from springs with deeded rights, or from wells that are partially fed by highway drainage, would also need to be addressed.

Railroad
Railroad grade separations (overheads) are required at three locations for the New SR 152 Alignment (US 101 to SR 156) – UPRR Overhead just east of US 101, UPRR overhead just west of the Pajaro River, and California High Speed Train (HST) Overhead near Lake Road. Railroad structures would be designed in accordance with current standards and procedures. A determination would be required on whether future electrification of the UPRR railroad is planned in order to establish the appropriate minimum vertical clearance.

A California Public Utilities Commission (CPUC) permit would be required to convert the existing UPRR at-grade railroad crossings to grade separations.

Railroad agreements would be required between the State and UPRR, and the State and HST, to construct and maintain the overhead structures and any other highway facilities constructed within railroad right of way. A permanent easement would be required for the highway footprint within railroad right of way.

Utilities
New utility easements will be required where private utilities are relocated outside State right of way.

Where required to meet freeway standards, the Project would eliminate longitudinal encroachments within the State right of way. High risk utilities identified within the project limits include.

Santa Clara Conduit

This 8-foot diameter water line is maintained and operated by Santa Clara Valley Water District. A 50-foot wide strip of land is owned in fee by the US Bureau of Reclamation. Water is pumped from San Luis Reservoir into the pipeline to provide water supply to Santa Clara residents. The pipeline splits (bifurcates) near Casa de Fruta to serve the Hollister area. That pipeline is maintained and operated by San Benito County Water District. Any crossing of the pipeline will need to be bridged due to loading restrictions. There are numerous manholes, air valves and corrosion monitoring stations along the conduit alignment.

Electrical Transmission Lines (PG&E/California Energy Commission)
Overhead electrical transmission lines (greater than 200kV) parallel the UPRR right of way, just east of US 101, and would require relocation to provide standard vertical clearance for the new overhead structure at that location. Relocation of these electrical transmission lines will be in accordance with the California Public Utilities Code and all California Public Utilities Commission rules and regulations.

9. STAKEHOLDER INVOLVEMENT

A collaborative planning process is being used through a series of Project Development Team (PDT) meetings, workshops, and briefings. A broad array of stakeholders is involved, including:

- Caltrans HQ, and Districts 4, 5 and 10
- US Fish and Wildlife Service
- Cities of Gilroy, Hollister, San Juan Bautista
- Transportation Agency for Monterey County (TAMC)
- Council of San Benito County Governments (SBCOG)
- California High Speed Rail Authority
- Santa Clara Valley Water District
- Pajaro River Watershed Flood Prevention Authority
- California Transportation Commission
- US Army Corps of Engineers
- Counties of Santa Clara, San Benito, Monterey and Santa Cruz
- Metropolitan Transportation Commission
- California Trucking Association
- US Bureau of Reclamation and other affected resource agencies
- California Highway Patrol
- County Farm Bureaus (Santa Clara, San Benito, Merced, Monterey and Santa Cruz)

The Project has maintained close coordination with adjacent projects including but not limited to the SR 25 Widening, US 101 Widening (Monterey Street to SR 129), and California High Speed Train (Merced to San Jose segment).

Stakeholder briefings have been conducted on a regular basis to update decision makers on the project background, objectives and study findings. These presentations were also made to staff from the majority of the agencies listed above. Presentations were also made to executive staff of the three Caltrans districts within the project limits.

Opportunities for the public and media to attend elected official briefings have been ongoing since September 2009. Public outreach for the Project is led by the VTA and a project website is available for public access at:

http://www.vta.org

Personal contact with property owners or key stakeholders such as the agriculture and trucking, tourism, education, economic development and other key industries is the preferred approach to assure awareness of the proposed project alternatives and to assess project support and/or concerns, especially in the very early phases.

10. ENVIRONMENTAL DETERMINATION AND DOCUMENTATION

The SR 152 Trade Corridor project area contains many environmental resources and constraints and the project (including all design options) has the potential to cause significant impacts. The areas of particular environmental concern include:

- the presence of and potential impacts to prime farmland
- the presence of and potential impacts to historic properties and historical resources within or immediately adjacent to the Project Study Limits
- the potential for the project to result in disproportionate impacts to low income and minority populations
- residential and commercial displacements or relocations
- potential air quality impacts
- potential subsurface unrecorded paleontological or Native American cultural resources
- potential impacts to riparian and wetland areas along water bodies that may provide habitat for endangered plant and animal species
- portions of the project area are within a high-risk flood zone, there is the potential for project features to be exposed to flood hazards and/or for project structures to redirect flood flows
- the presence of, and potential impacts to, contaminated soils, groundwater, and building materials

The following environmental technical studies are anticipated to be required:

- Natural Environment Study
- Noise Study Report
- Air Quality Study
- Initial Site Assessment
- Preliminary Geotechnical Report
- Visual Impact Assessment
- Energy Report
- Historic Resources Evaluation Report
- Storm Water Data Report
- Water Quality Report
- Finding of Effect Report
- Biological Assessment
- Noise Abatement Decision Report
- Mobile Source Air Toxics Report
- Traffic Operations Analysis Report
- Community Impact Assessment
- Paleontological Evaluation Report
- Archaeological Survey Report
- Historic Properties Survey Report
- Location Hydraulic Study
- Section 4(f) Evaluation

Given the magnitude of the proposed project, the presence of substantial environmental resources and the potential for federal funding, preparation of a combined Environmental Impact Report (EIR) under CEQA and Environmental Impact Statement (EIS) under NEPA is anticipated.

The option of preparing a Program-level or tiered EIS/EIR for this project was considered. That approach, however, is not compatible with the goals and objectives of a P3 project. Therefore, a Project-level EIS/EIR will be prepared.

California Executive Order (EO) S-13-08 (November 2008), and Caltrans *Guidance on Incorporating Sea Level Rise* (May 16, 2011) require that all projects be reviewed to determine whether to incorporate SLR adaptation measures into the design. Making this determination is a two-part analysis: the first step is to determine whether there is the potential for the project to be impacted by an increase in SLR; the second step is to balance the potential SLR impacts with the level of risk and the potential consequences to the transportation system to determine whether the potential impacts warrant programming resources to include adaptation measures into the project.

This project has been assessed utilizing the criteria set forth in the Caltrans *Guidance on Incorporating Sea Level Rise* (May 16, 2011) and it has been determined, based on the distance to coastal features and the project's elevation, that SLR adaptation measures are not required.

11. FUNDING

Capital Cost

The range of project alternatives and design variations considered by the project sponsor to establish the preliminary environmental study limits were evaluated and used to create the preliminary Cost Estimates shown in Attachment C. The methodology used to develop the range of preliminary capital costs in the table below use the segment costs as a baseline then assign an uncertainty to depict the specific assumptions within each segment. The range of total project capital cost is based upon a statistical analysis of the sum of the segment cost ranges and reflects that neither the low nor high value for all segments occur simultaneously.

Preliminary Cost Estimate Breakdown

Segment Description		Range of Total Cost
A	New SR 152 Alignment (US 101 to SR 156)	$320 to $530 Million
B	SR 152 Access Control Improvements (SR 156 to EB SR 152 Pacheco Pass Climbing Lane)	$32 to $53 Million
C	EB SR 152 Pacheco Pass Climbing Lane	$110 to $140 Million
D	SR 152 Access Control Improvements (EB SR 152 Pacheco Pass Climbing Lane to SR 33 North)	$53 to $75 Million
E	SR 152 Access Control Improvements (SR 33 North to Los Banos Bypass) and SR 152/I-5 Interchange Improvements	$32 to $106 Million
-	Tolling Improvements	$12 to $22 Million
	Total Project Cost	$740 to $950 Million

Notes:
1. Date of cost estimate is November 2012. Capital costs are escalated to 2015 dollars
2. Escalation to mid-construction year, support, and roadway operating and maintenance costs are not included.
3. Detailed cost estimates are provided in Attachment C

The level of detail available to develop these capital cost estimates is only accurate to within the above ranges and is useful for long-range planning purposes only. The capital costs should not be used to program or commit capital funds. The Project Report will serve as the appropriate document from which the remaining support and capital components of the project will be programmed.

Support Cost

- The CTC previously programmed $5 million in Interregional Transportation Improvement Program (ITIP) funds to this project and the VTA made available an additional $5.2 million in local funds to support the project. Using these funds, VTA retained a consultant and completed an initial Traffic and Revenue (T&R) Study and has strategic implementation planning work underway.
- Based on recent estimates, an additional $20 million will be needed over the next 3 years to complete the PA&ED phase of the project.
- VTA has developed a proposed funding scenario for the next phase of this project (completion of the PA&ED):
  - Approximately $2.8 million from VTA in the form of unexpended federal funds on the SR 152/SR 156 interchange project[2].
  - $10 million in future Santa Clara County STIP(RIP) funds share
  - $10 million may be considered in future ITIP funds.
- Recognizing that any ITIP and/or STIP funds that might be programmed for this project would not be available until late in the STIP cycle, VTA has agreed to advance local funds as necessary to keep the process going and 'cash flow' the project - subject to VTA Board approval.

The PA&ED support cost was developed by VTA using two different approaches and placed in the project file.

(a) PA&ED cost as a percentage of capital cost by corridor segment, and
(b) PA&ED cost based on labor requirements to complete the various activities and deliverables required.

Following PSR-PDS approval, oversight budget for the project will be agreed upon and allocated to each district by the district directors.

12. SCHEDULE

Project Milestones	Delivery Date
Begin Initial Environmental Studies	October 2009
PSR-PDS Approval	February 2015
Begin Final Environmental Studies	January 2017
Circulate Draft Environmental Document	December 2018
Project Approval and Environmental Document	December 2019

13. RISKS

Project risks are provided in Attachment G: Project Risk Register, and will be updated during the PA&ED phase in coordination with the project stakeholders. Completion of PA&ED in 36 months, R/W acquisition timeline, flood plain impacts (Soap Lake) and the potential for

[2] FHWA has advised VTA that funds from this earmark may be used for the project (limited to work within 1 mile of the SR 152/SR 156 Interchange).

changes to existing geometrics requested by state or federal agencies have all been identified as a high risk.

14. FHWA COORDINATION

This project is considered to be a High Profile Project (HPP) in accordance with the current FHWA and Caltrans Joint Stewardship and Oversight Agreement. A Project Oversight Agreement will need to be prepared and executed with signatures by FHWA, Caltrans and local agencies.

VTA has an ongoing coordination effort for the project with the Federal Highway Administration. At a September 2012 workshop of the California Transportation Commission FHWA indicated support for efforts to advance the SR 152 project and indicated a willingness to assist Caltrans and VTA in the development of the project. VTA, Caltrans and FHWA also discussed the project, and the eligibility of existing federal funds, in a meeting at FHWA’s Office and in a later telephone call. FHWA has indicated their preliminary concurrence to reallocate existing funding for a portion of the improvements (SR 152/SR 156 Interchange improvements) within the overall project limits.

At the I-5 and SR 152 interchange, and other applicable locations along SR 152, an FHWA "engineering and operational acceptability" (EOA) determination needs to be obtained in the PA&ED phase prior to circulation of the draft environmental document for access change/modification. Final approval would be given immediately after the NEPA process is completed, if there are no major changes in the proposed design since the approval of EOA. Exceptions to Mandatory Design Standards proposed on the Interstate System would also require FHWA approval.

Sufficient funding is expected to be available at the time of the circulation and/or approval of the environmental determination/document to allow for the inclusion of the fully funded preferred alternative in the financially constrained Regional Transportation Plan (RTP) and Federal Transportation Improvement Program (FTIP).

This project is expected to be a Public-Private-Partnership with tolls as the primary source of revenue to finance the project. Actual sources of the funding are to be determined but may include local funds, state funds, federal loans and private equity.

FHWA Contact Lanh Phan, Senior Transportation Engineer, at (916)498-5046

15. PROJECT CONTACTS

The following persons should be contacted concerning questions on this document:

Nick Saleh (510) 286-6355 Oversight Project Manager Caltrans District 4	Kathy Boltz (510) 286-5530 Oversight Environmental Planner Caltrans District 4
Richard Rosales (805) 549-3792 Oversight Project Manager Caltrans District 5	Chris Metzger(408) 952-4219 Project Manager Santa Clara Valley Transportation Authority
Peter Jemerigbe (209) 948-7008 Oversight Project Manager Caltrans District 10	Tom Fitzwater (408) 321-5705 Environmental Programs Manager Santa Clara Valley Transportation Authority

16. PROJECT REVIEWS

The document was reviewed in draft form by FHWA and Caltrans Districts 4, 5 and 10 in November 2012. The final draft document was reviewed by Caltrans District 4 in 2014.

DAVE CORTESE
PRESIDENT, BOARD OF SUPERVISORS
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June 16, 2016

Mr. Steve Heminger
Executive Director
Metropolitan Transportation Commission
375 Beale Street, Suite 800
San Francisco, CA 94105-2006

RE: Compelling Case Process and Capitol Expressway LRT-Phase 2

Dear Steve,

I am following up on my own comments in MTC public meetings regarding the Commission's process for incorporating the Project Performance results into the transportation investment element of the preferred scenario for Plan Bay Area 2040. I understand that the full Commission approved the criteria currently being used. However, as I stated in past meetings, the notion that the modeling being utilized by MTC does not take into account weighting in the point scoring for Communities of Concern is extremely problematic. I say this as Chair of the Commission and as a broad-based statement with regard to the application of the criteria over all projects in the 9 county region. The modeling and scoring system seems to turn the federal civil rights scheme on its head. It does so by making it more difficult for projects surrounded by Communities of Concern to qualify and/or compete for funding.

From a more parochial vantage point, as President of the Board of Supervisors and as a commissioner from Santa Clara County, I draw your attention to the above issue as it relates to the so-called Capitol Expressway LRT-Phase 2. This project is environmentally cleared, shovel ready, and prioritized by VTA as the second highest *Measure A* local funding priority behind only the BART extension. It creates regional station-to-station connectivity with the BART extension at Milpitas and it locally creates direct connectivity between Santa Clara County's #1 Transit Hub in East San Jose and entertainment venues in downtown San Jose and elsewhere in the county, such as Levi Stadium, and indirect connectivity through the BART extension to similar entertainment venues in Oakland and San Francisco. Furthermore, it connects this same population with the Bay Trail and numerous Bike/Ped alignments. Moreover, it is the only VTA project of its kind which is completely enveloped by Communities of Concern. This project has a B/C Ratio of 6 and a Targets score of 5.5, scoring it just below the threshold for High Performance assessment. One can only assume that if this project's overwhelming status as a Community of Concern were weighted as part of the scoring that it would have met the High Performance Threshold. The outcome is the difference between equity being served vs equity being disregarded.

I understand that VTA has submitted its compelling case documents to further support this case regarding Capitol Expressway LRT-Phase 2 and perhaps other cases/projects for which VTA would like to make a case. I am writing to encourage you and the commission to favorably review Capitol Expressway LRT-Phase 2 in light of the information provided.

As to the broader issue of constructing Plan Bay Area criteria and modeling in the future I continue to urge MTC administration and my colleagues to re-think the appropriateness of excluding Communities of Concern from base-case assessments in the future especially when funding and competition for funding hangs in the balance.

Thank you for your consideration.

Sincerely,

Dave Cortese
President, Board of Supervisors, Chair MTC

Cc: General Manager Nuria Fernandez, VTA
Mayor Sam Liccardo, MTC Commissioner
Rep. Zoe Lofgren, United States Congress
Hon. Cindy Chavez, Chair VTA
Board of Directors, VTA

Committee on the Judiciary
•*Ranking Member*-Subcommittee on Immigration and Border Security
•Subcommittee on Courts, Intellectual Property and the Internet

Committee on Science, Space and Technology
•Subcommittee on Space
•Subcommittee on Oversight

Committee on House Administration
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Chair, California Democratic Congressional Delegation
Co-Chair, Congressional Caucus on Vietnam

June 29, 2016

Mr. Steve Heminger
Executive Director
Metropolitan Transportation Commission
375 Beale Street, Suite 800
San Francisco, CA 94105-2006

RE: Compelling Case Process and Capitol Expressway LRT-Phase 2

Dear Steve,

I write you to express support for the letter Supervisor Dave Cortese sent you recommending that the Commission give greater weight to projects serving Communities of Concern. Among the many benefits that public transit offers to the public, we must not overlook its social justice function. Communities of Concern often do not enjoy the same degree of transportation options and too often live farther away from employment and entertainment venues. In addition to decreasing congestion and greenhouse gases while improving safety, public transit is also a means to integrate Communities on Concern within our broader community.

I support the project to extend the Capitol Expressway LRT-Phase 2. As Supervisor Cortese notes, this project is entirely surrounded by Communities of Concern and would not just provide connections to entertainment and job centers along VTA's existing Light Rail corridor (such as downtown San Jose and Levi Stadium), but also it would provide intermodal connectivity with BART and Caltrain. It would provide a reliable means of transportation to connect one of the Bay Area's most economically disadvantaged and densely populated areas with bustling job markets in places such as Palo Alto and San Francisco.

As the Bay Area continues to prosper economically, we must strive for a more inclusive community. I hope the MTC approves the Capitol Expressway LRT-Phase 2 project because it

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would advance these goals. I urge MTC to include service to Communities of Concern as a base-case assessment for future projects, consistent with all applicable laws and regulations.

Sincerely,

Zoe Lofgren
Member of Congress

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June 23, 2016

The Honorable Dave Cortese
Board of Supervisors, County of Santa Clara
70 West Hedding Street, 10th Floor
San Jose, California 95110

RE: Capitol Expressway LRT (Phase 2) and Compelling Case Process

Dear Chair Cortese:

Thank you for your letter of June 16th regarding the consideration of Communities of Concern in the project evaluation process for Plan Bay Area 2040, including its potential implication for the Capitol Expressway LRT (Phase 2) project. We recognize how important it is to prioritize projects that benefit low-income and minority communities across the Bay Area; therefore, we wanted to provide some additional information regarding the Plan evaluation framework and some specifics on how the Capitol Expressway LRT (Phase 2) can move forward through this planning process as a medium-performing project.

First of all, we would like to emphasize that the project performance assessment has strong emphasis on issues critical to residents of Communities of Concern. In fact, six of the thirteen performance targets have a nexus with social equity, meaning that nearly half of the thirteen-point targets score is assigned based on issues ranging from affordability to displacement risk. Taking the Capitol Expressway LRT project as an example, it did indeed score quite strongly on many of those targets, reflecting the role that VTA plays in serving the lower-income communities of East San Jose. The project also scored well in the benefit-cost analysis, as reflected by a benefit-cost ratio that is an order of magnitude greater than in the original Plan Bay Area. In particular, the denser land use vision along South Bay light rail corridors like Capitol Expressway boosted its benefit-cost ratio. Importantly, that assessment relied on the regional travel demand model, which forecasts benefits to all Bay Area residents including those that reside or work in Communities of Concern.

Beyond benefit-cost and targets, the project performance assessment specifically evaluated all major uncommitted projects to identify those that improved access to Communities of Concern. Notably, all 11 of the high-performing projects identified by Commission-adopted thresholds provide improved access to such communities, including both the BART to Silicon Valley (Phase 2) and El Camino Real BRT projects in the South Bay.

We believe this is reflective of the fact that the performance criteria emphasize investment in Communities of Concern and make projects in those communities more competitive for regional funding. Beyond the project performance assessment, Commission staff is actively working on the Plan Bay Area 2040 equity analysis, which examines differences across various planning scenarios and ultimately results in a Title VI analysis for the preferred investment strategy.

Due to its medium-performing designation, no formal compelling case is required at this time. That process, slated for the July Planning Committee meeting, is instead designed to further scrutinize the lowest-performing projects, with benefit-cost ratios and targets scores much lower than the Capitol Expressway LRT project.

The Capitol Expressway LRT (Phase 2) project fell just short of the threshold to achieve a high-performing rating as defined by the Commission last month. The project now enters the investment tradeoffs process, during which the project will be considered with other medium-performing investments for both local and regional funds within fiscal constraint. While high-performing projects may receive a higher priority for regional discretionary funding, remaining funding will be prioritized towards medium-performing projects, including potentially this project. As we move forward crafting a transportation investment strategy with our CMA partners, we will certainly recognize this project as a key local priority, as well as a cost-effective transportation improvement that demonstrably supports adopted performance targets.

In conclusion, however, I do believe you have raised a valid concern about whether we should have some kind of appellate process for medium-performing projects to seek reclassification as high-performers – just as we have such a process to reevaluate low-performing projects as medium-performers. While we are out of time for this round of project evaluation, I propose that we revisit this issue when we develop the framework for performance review for the third Plan Bay Area in 2021. I would be happy to discuss this matter with you further at your convenience.

Sincerely,

Steve

Steve Heminger
Executive Director

SH:DV

METROPOLITAN
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COMMISSION

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July 6, 2016

Representative Zoe Lofgren
House of Representatives
1401 Longworth House Office Building
Washington, DC 20515

RE: Capitol Expressway LRT (Phase 2) and Compelling Case Process

Dear Representative Lofgren:

Thank you for your letter of June 29th regarding the consideration of Communities of Concern in the project evaluation process for Plan Bay Area 2040, including its potential implication for the Capitol Expressway LRT (Phase 2) project. We recognize how important it is to prioritize projects that benefit low-income and minority communities across the Bay Area; therefore, we wanted to provide some clarifying information regarding the Plan evaluation framework and some specifics on how the Capitol Expressway LRT (Phase 2) can move forward through this planning process as a medium-performing project.

First of all, we would like to emphasize that the project performance assessment has a strong emphasis on issues critical to residents of Communities of Concern. In fact, six of the thirteen performance targets used to score transportation projects have a direct nexus with social equity. Taking the Capitol Expressway LRT project as an example, it did indeed score quite strongly on many of those targets, reflecting the role that VTA plays in serving the lower-income communities of East San Jose. The project also scored well in the benefit-cost analysis, which included benefits to all Bay Area residents including those that reside or work in Communities of Concern such as East San Jose.

Beyond benefit-cost and targets, the project performance assessment specifically evaluated all major uncommitted projects to identify those that improved access to Communities of Concern. Notably, all 11 of the high-performing projects identified by Commission-adopted thresholds provide improved access to such communities, including both the BART to Silicon Valley (Phase 2) and El Camino Real BRT projects in the South Bay. We believe this is reflective of the fact that the performance criteria emphasize investment in Communities of Concern and make projects in those communities more competitive for regional funding. Beyond the project performance assessment, Commission staff is actively working on the Plan Bay Area 2040 equity analysis, which examines differences across various planning scenarios and ultimately results in a Title VI analysis for the preferred investment strategy.

Due to its medium-performing designation, no formal compelling case is required at this time. That process, slated for the July MTC Planning Committee meeting, is instead designed to further scrutinize the lowest-performing projects, with benefit-cost ratios and targets scores much lower than the Capitol Expressway LRT project.

The Capitol Expressway LRT (Phase 2) project fell just short of the threshold to achieve a high-performing rating as defined by the Commission last month. The project now enters the investment tradeoffs process, during which the project will be considered with other medium-performing investments for both local and regional funds within fiscal constraint. While high-performing projects may receive a higher priority for regional discretionary funding, remaining funding will be prioritized towards medium-performing projects, including potentially this project. As we move forward crafting a transportation investment strategy with our partners at the county and local levels, we will certainly recognize the value that this project delivers to the residents of Silicon Valley.

Sincerely,

Steve

Steve Heminger
Executive Director

SH:DV

Plan Bay Area 2040

Project Performance Assessment:

Compelling Cases for Low-Performing Projects

Image: Existing SR-152

Image Source: https://www.flickr.com/photos/michaelpatrick/6844959854

Dave Vautin

July 8, 2016 – ***Planning Committee***

Impetus for Project Assessment

Plan BayArea 2040

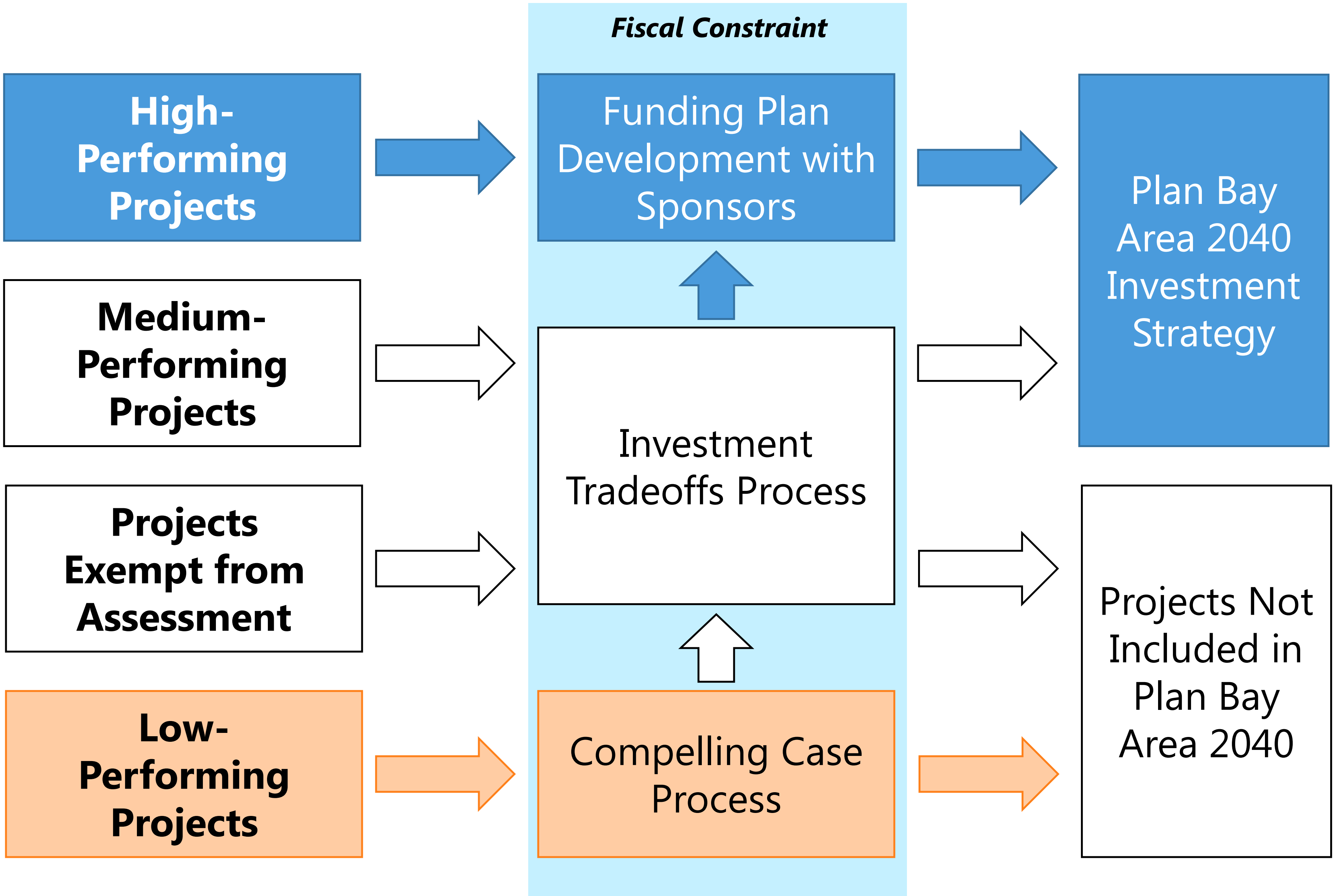
Even as the region has recovered from the Great Recession, transportation funding remains limited.

In order to maximize the effectiveness of limited taxpayer dollars, it is important to ensure that the region's highest-performing projects can be fully funded.

As funding requests significantly exceed available funds, we first want to work with our partners to review projects that are cost-ineffective or that adversely impact Plan targets.

Image Source: https://www.flickr.com/photos/parksjd/8874816858

Investment Strategy Development



Adopted Thresholds

Plan BayArea 2040

<u>High</u> benefit-cost ratio (B/C) and **<u>medium</u>** targets score (TS)

- Plan Bay Area: B/C ≥ 10 and TS ≥ 2
- **Plan Bay Area 2040: B/C ≥ 7 and TS ≥ 3**

<u>Medium</u> benefit-cost ratio and **<u>high</u>** targets score

- Plan Bay Area: B/C ≥ 5 and TS ≥ 6
- **Plan Bay Area 2040: B/C ≥ 3 and TS ≥ 7**

→ **High-Performing Project**

All other projects → **Medium-Performing Project**

<u>Low</u> benefit-cost ratio or **<u>low</u>** targets score

- Plan Bay Area: B/C < 1 or TS ≤ -1
- **Plan Bay Area 2040: B/C < 1 or TS < 0**

→ **Low-Performing Project**

Plan Bay Area 2040 **Projects Breakdown**	**11** high-performers	**40** medium-performers	**18** low-performers

Funding High-Performing Projects

Plan BayArea 2040

1 Rail Maintenance

2 Bus Maintenance

SHORTFALL COST = $11 BILLION

Image Source: https://en.wikipedia.org/wiki/Sonoma_County_Transit#/media/File:Sonoma_County_Transit_245-a.jpg

3 Columbus Day Initiative

4 Downtown San Francisco Congestion Pricing

5 Treasure Island Congestion Pricing

PROJECTS COST = $2 BILLION

Image Source: https://www.flickr.com/photos/cobrasick/5297980956

Funding High-Performing Projects

Plan BayArea 2040

6 BART Metro Program

7 BART to Silicon Valley: Phase 2

8 Caltrain Modernization + Extension to Transbay

PROJECTS COST = $15 BILLION

Image Source: https://www.instagram.com/p/qexmPMLVrt/?taken-by=gocaltrain

9 El Camino BRT

10 San Pablo BRT

11 Geary BRT

PROJECTS COST = $1 BILLION

Image Source: https://www.flickr.com/photos/pfsullivan 1056/6276359727

Approved Compelling Case Framework

Plan BayArea 2040

CATEGORY 1	CATEGORY 2
Benefits Not Captured by the Travel Model	**Federal Requirements**
a) interregional or recreational corridor b) provides significant goods movement benefits c) project benefits accrue from reductions in weaving, transit vehicle crowding, or other travel behaviors not well represented in the travel model d) enhances system performance based on complementary new funded investments	a) cost-effective means of reducing CO_2, PM, or ozone precursor emissions b) improves transportation mobility/reduces air toxics and PM emissions in communities of concern

Plan BayArea 2040

Implications of Case Approval

Committee approval of a compelling case does not guarantee that the project will ultimately be able to fit within the fiscally-constrained transportation investment strategy.

For the currently low-performing project submitting a case, it does allow them to compete for funds alongside medium-performing investments.

At the same time, approving a case will make it more difficult for medium-performing projects to be included in the final investment strategy, as it increases the number of projects competing for scarce funds.

Low-Performing Projects *(18 total)*

	Project	B/C	TS	Sponsor-Selected Path Forward	Staff Recommendation
1	**TriLink Tollway + Expressways**	1	-0.5	Downscope + 100% Local Funds	Now Exempt from Performance
2	**Lawrence Freeway**	0.2	+1.0	Downscope + 100% Local Funds	Now Exempt from Performance
3	**Downtown San Jose Subway**	0.5	+6.5	Environmental Only	Now Exempt from Performance
4	**SR-17 Tollway + Santa Cruz LRT**	0.3	+1.0	Environmental Only	Now Exempt from Performance
5	**Bay Bridge West Span Bike Path**	0.1	+2.0	Environmental Only	Now Exempt from Performance
6	**VTA Express Bus Frequency Improvements** *(including capital infrastructure upgrades)*	0.9	+4.5	Environmental Only	Now Exempt from Performance

Plan Bay Area 2040

Low-Performing Projects *(18 total)*

#	Project	B/C	TS	Sponsor-Selected Path Forward	Staff Recommendation
7	**Express Bus Bay Bridge Contraflow Lane**	0.0	+5.0	Environmental Only *(revised path forward)*	**Now Exempt from Performance**
8	**I-80/I-680/SR-12 Interchange**	0.3	+2.5	Compelling Case – Criteria 1A, 1B, 1C	**Case Approved**
9	**SR-262 Connector**	4	-0.5	Compelling Case – Criterion 2A	**Upgrade to Medium-Performer**
10	**East-West Connector**	0.9	+1.5	Compelling Case – Criterion 2B	**Upgrade to Medium-Performer**
11	**Southeast Waterfront Transport. Improvements**	0.6	+6.0	Compelling Case – Criterion 2B	**Upgrade to Medium-Performer**
12	**Geneva-Harney BRT + Corridor Improvements**	0.3	+5.0	Compelling Case – Criterion 2B *(Phase 1)*	**Upgrade to Medium-Performer**

Low-Performing Projects *(18 total)*

Plan BayArea 2040

	Project	B/C	TS	Sponsor-Selected Path Forward	Staff Recommendation
13	**Antioch-Martinez-Hercules-SF Ferry**	**0.6**	**+1.5**	Rescope – B/C >1	**Upgrade to Medium-Performer**
14	**I-680 Express Bus Frequency Improvements**	**0.6**	**+2.5**	Updated Costs – B/C >1	**Upgrade to Medium-Performer**
15	**SR-4 Widening**	**0.5**	**-0.5**	Drop Project	**Drop Project**
16	**Oakland-Redwood City + SF-Redwood City Ferry**	**0.0**	**+2.0**	**Rescope to Terminal for Private Service**	**Environmental Only**
17	**SR-152 Tollway**	**3**	**-1.5**	**100% Local Funding**	**Environmental Only**
18	**SMART – Phase 3**	**0.0**	**+4.0**	**Phase 3A/B (Windsor + South Healdsburg)**	**Phase 3A (Windsor) + Env.**

Redwood City Ferry – Project Info

- **Performance Results**
  - **Benefit-Cost Ratio = 0.0**
  - Targets Score = +2.0
- **Arguments Not Approved**
  - Construct terminal-only project for service by private charter services (e.g. tech company shuttles) – *data indicate that ridership base is limited, regardless of service type*
- **Other Considerations**
  - Private employers could provide service to terminal, but no specific interest was demonstrated in the case submission
  - Project has not yet progressed from conceptual to environmental stage
- **Staff Recommendation**
  - <u>Rescope to environmental phase only</u>

Image Sources: Wikipedia; WETA

SR-152 Tollway – Project Info

Plan BayArea 2040

- **Performance Results**
  - Benefit-Cost Ratio = 3
  - **Targets Score = -1.5**
- **Arguments Not Approved**
  - Cases submitted under Category 1 (Travel Model Limitations) – *targets score does not rely on travel model*
  - 100% toll revenue funded – *requires Board commitment*
- **Other Considerations**
  - If different targets were adopted by the Commission, project performance might be better
  - If Central Valley communities were identified as Communities of Concern, the project would have a compelling case
- **Staff Recommendation**
  - <u>Rescope to environmental phase only</u>

Image Sources: Google Maps

Plan BayArea 2040

SMART (Phase 3) – Project Info

- **Performance Results**
  - **Benefit-Cost Ratio = 0.0**
  - Targets Score = +4.0
- **Arguments Not Approved**
  - Serves communities of concern – *none are located in northern Sonoma County*
  - Project could be phased to reach South Healdsburg temporary station – *still exceeds $100 million*
- **Other Considerations**
  - Lower-income populations do live in northern Sonoma County, but without sufficient concentrations to merit a Community of Concern
- **Staff Recommendation**
  - <u>Downscope project to match current Plan listing</u> (passenger service extended to Windsor + environmental studies for remaining segment to Cloverdale)

Image Sources: Google Maps

Next Steps

Plan BayArea 2040

July
- Action on compelling cases for low-performing projects

September
- Funding plans for high-performing projects
- Draft transportation investment strategy

October
- Adoption of preferred transportation + land use
- Kick off environmental impact analysis

Image Source: https://www.flickr.com/photos/thomaspix/4743718236

METROPOLITAN TRANSPORTATION COMMISSION

Agenda Item 4

ASSOCIATION OF BAY AREA GOVERNMENTS

BayAreaMetro.gov

Memorandum

TO: Regional Advisory Working Group DATE: April 27, 2018

FR: David Vautin

RE: *Horizon* and *Plan Bay Area 2050*: Project Performance Assessment Overview

Summary

Similar to past long-range planning cycles, staff is proposing to conduct a project performance assessment of major transportation investments as part of both *Horizon* and *Plan Bay Area 2050*. This effort would seek to identify high- and low-performing projects both to understand the efficacy of specific projects under varying external conditions (i.e., futures) and to inform the development of the Preferred Scenario's transportation investment element. In the coming weeks, staff proposes to begin updating information on projects included in *Plan Bay Area 2040* first and to initiate the submission process for transformative investments in early June. Opportunities for input on the specific project performance methodologies will occur at RAWG meetings this summer.

Background and Proposed Approach

Plan Bay Area 2040 was the region's second long-range plan with a comprehensive evaluation of uncommitted transportation investments, scoring them with a quantitative benefit-cost ratio – evaluated using Travel Model One – and a qualitative targets score based on the adopted performance targets of that plan. The project performance assessment helped to identify 11 high-performing projects that were prioritized for regional discretionary funding in the Plan and 18 low-performing projects that were subject to further scrutiny through the compelling case process. The project performance assessment helped to identify the most effective investments and provide a transparent process to redirect billions of dollars from low-performing projects to higher-performers, given the fiscally-constrained nature of the Plan. For those seeking additional information on this effort, documentation[i] and final results[ii] can be found on MTC's website.

Staff recommends conducting a third cycle of project performance assessment using a methodology that would be consistent between *Horizon* and *Plan Bay Area 2050* to ensure comparable results. Each project would be evaluated in the following ways:

- Benefit-cost assessment using Travel Model Two *(primary assessment)*
- Guiding principles assessment using qualitative criteria *(secondary assessment)*
- Supplemental assessments: project-level equity analysis; benefit-cost confidence assessment *(similar to Plan Bay Area 2040)*

[i] http://2040.planbayarea.org/sites/default/files/2017-07/Performance%20Assessment%20Report_PBA2040_7-2017_0.pdf

[ii] http://bayareametro.github.io/performance/dashboard/

Key enhancements/changes from *Plan Bay Area 2040* are highlighted below:

- **Analysis of each transportation project in each future** (i.e., four benefit-cost ratios rather than just one) – this will allow stakeholders to understand how a project would be more or less effective under different external conditions (autonomous vehicle fleet penetration, population/employment, gas prices, etc.). It will also allow for identification of high-performers as projects that are most resilient to changing conditions, rather than a single set of assumptions.
- **Use of Travel Model Two to incorporate wider range of impacts** – upgrades to include autonomous vehicles, TNCs, transit crowding, and other new features will improve our ability to forecast a broader spectrum of benefits; further methodology upgrades to the benefit-cost tool (CoBRA) can be considered this summer.
- **Reforms to the qualitative assessment –** in lieu of the targets assessment, a new "guiding principles assessment" would use qualitative criteria to identify how a project would affect the Guiding Principles being developed for *Horizon*. Unlike past cycles, the assessment would be used solely to flag projects that do not support one or more of the Guiding Principles. It would play a secondary role compared to the benefit-cost analysis.

Staff is currently looking for input on the revised framework at this time and will return to RAWG this summer for input on the specific methodologies for each component of the *Horizon / Plan Bay Area 2050* Project Performance Assessment. Staff will also be seeking input on the project performance framework from the MTC Planning Committee in June or July, given their interest in both the benefit-cost and targets assessments during *Plan Bay Area 2040*.

Projects Subject to Performance Assessment
Prior cycles of project performance focused on uncommitted[iii] capacity-increasing projects with costs[iv] greater than $50 million (in *Plan Bay Area*) or $100 million (in *Plan Bay Area 2040*). Staff proposes to raise the threshold for major projects subject to analysis this cycle and establish two cost tiers:

- **Tier 1** major projects – greater than **$1 billion**
- **Tier 2** major projects – greater than **$250 million** but less than **$1 billion**

Staff is also looking for input on how to ensure that project costs for new transportation investments ensure that the facility will be protected from sea level rise through year 2100[v], either through project sponsor confirmation of adaptation features or MTC/ABAG-BCDC analysis this summer to assign additional costs to projects in zones at risk.

Several other project types would also be subject to project performance under this proposal:

- **A package of lower-cost projects** (e.g., a network of rapid bus lines) that all fall below the $250 million threshold could be evaluated concurrently in either round of analysis.

[iii] Uncommitted projects are projects that are seeking discretionary funding (i.e., not fully funded), are not yet under construction, and are not 100% funded with local dollars.
[iv] Costs were defined in 2013 dollars for *Plan Bay Area* and 2017 dollars for *Plan Bay Area 2040*. Costs will be in 2021 dollars for *Horizon* and *Plan Bay Area 2050*. Costs include capital costs and gross operating & maintenance costs between years 2021 and 2050.
[v] Per BCDC guidance, transportation projects that would still be operating through 2100 should be prepared for sea level rise ranging from 3 feet to 10 feet above today's mean higher high water level.

- **Non-capacity increasing resilience projects** (i.e., investments needed to protect a pre-existing transportation facility from inundation by 2050[vi]) would be identified by MTC/ABAG in collaboration with BCDC and the asset owner/operator for evaluation using the same framework as capacity-increasing projects.
- **Operational strategies** (e.g., comprehensive road pricing) with costs below the thresholds identified above would be accepted through the Transformative Investments Request process; a small number of the most promising strategies (~5) would be evaluated using the same framework as capital and operating projects.

Transformative Investments Request & Submission Process
Given that the Project Performance Assessment will stretch between spring 2018 and fall 2019 and straddle both long-range planning efforts, staff proposes to break the process into phases as shown in the table below. In addition to a multi-phase process with a more limited number of projects in each phase, staff also plans to allow non-government agencies to submit visionary projects for consideration in the Project Performance Assessment this summer. Major transit operators[vii] also would be able to submit directly to MTC.

	Which Projects?	Who?	When?
Major Projects Update	• Major projects previously assessed in *Plan Bay Area 2040*[viii]	CMAs & major transit operators only	**Direct Consultation** Early May through early July
Round 1 Analysis	• Tier 1 major projects not assessed in *Plan Bay Area 2040* • Operational strategies • Resilience projects	CMAs, public agencies, NGOs, general public	**Transformative Investments Request** Early June through early September
Round 2 Analysis	• Tier 2 major projects not assessed in *Plan Bay Area 2040* • New Tier 1 major projects not submitted in Round 1	CMAs & major transit operators only	**Revised Call for Projects** March to June 2019

Next Steps
As discussed above, the immediate next steps are to begin updating project scope and cost information for projects previously analyzed in *Plan Bay Area 2040* with CMAs and major operators, and to open the submission window for the Transformative Investments Request. Future RAWG items on this element of the *Horizon* and *Plan Bay Area 2050* process include:

- June RAWG – Guiding Principles Assessment Methodology & Supplemental Analyses Methodologies
- July or August RAWG – Benefit-Cost Assessment Methodology

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[vi] For *Horizon*, the worst-case sea level rise scenario for year 2050 is roughly 3 feet above mean higher high water level.
[vii] Major transit operators are defined as multi-county agencies (BART, Caltrain, Capitol Corridor, SMART, ACE, Golden Gate, WETA). All other operators should work with their respective CMAs as in past planning cycles.
[viii] A project assessed but not funded for construction in *Plan Bay Area 2040* may request to be excluded from analysis if the project sponsor does not intend on submitting the project for inclusion in *Horizon* or *Plan Bay Area 2050.*