2002 REGIONAL TRANSPORTATION IMPROVEMENT PROGRAM (RTIP)

COST EFFECTIVENESS AND PERFORMANCE EVALUATION

Performance Evaluation of the 2002 RTIP Submittal

MTC views the RTIP as one piece of what is necessarily a larger investment plan designed to meet the region's transportation goals. The Regional Transportation Plan (RTP) is a comprehensive investment plan designed to achieve the RTP goals through state, federal, and local funds anticipated over the next 25 years. A key element of MTC's evaluation of the 2002 RTP submittal is the *Performance Measures Report for the 2001 RTP* (August 2001). The report, which follows, considers the performance of the proposed RTP relative to the RTP Goals. The RTIP moves the region closer to meeting the RTP goals, and as such, is evaluated in its whole. Exhibit 2 demonstrates the linkages between the 2002 RTIP submittal and the RTP performance measures.

For each RTP Goal, we have identified categories of projects expected to impact that associated RTP performance measures. The analysis notes the number of projects and total funding in the RTIP submittal and gives several examples of projects in each category. The analysis is intended to demonstrate that the RTIP makes a definite contribution toward the goals; however, the analysis does not attempt to quantify the particular level of contribution since the RTIP is just one element of the region's broader investment program.

The *Performance Measures Report for the 2001 RTP* is MTC's first effort to identify and use performance measures for the RTP. The report identifies quantitative performance measures for five adopted RTP goals:

- Mobility of people and freight
- Safety
- Economic vitality
- Community vitality
- The environment
- Equity

Exhibit 1 shows the performance measures associated with each RTP Goal. The measures were developed in consultation with stakeholders representing partner agencies and the business and environmental communities.

MTC views the *Performance Measures Report for the 2001 RTP* as significant first step in an evolving process to evaluate plans and programs through the use of performance measures. We are enthusiastic about the exploration of the measures in the report, yet we remain cautious about the specific values generated by some of the measures. In particular, we have identified a need for methodology improvements for measures of accessibility, community vitality, and economic efficiency. We expect a higher level of confidence as we make these refinements in the future.

MTC has not pursued project-level evaluation for the RTP or RTIP submittal at this time. With respect to cost effectiveness, a measure of cost-effectiveness is included under the Economic Vitality Goal of the report; this particular measure compares user benefits, including savings in travel time and out-of-pocket expense, with public expenditures for the proposed RTP. Project level evaluation remains of interest to a number of stakeholders, and will be the subject of further

discussions on the use of performance measures in the planning process. In the mean time, we recognize that major projects in the RTP or RTIP submittal are subject to extensive analysis through corridor studies and environmental review, which reveal a project's adherence to performance measure factors such as travel time savings, cost effectiveness, and environmental benefits.

Exhibit 1

RTP Goals and Performance Measures from in the Performance Report for the 2001 RTP

RTP Goal	Performance Measures
Mobility of People and Freight	Travel time: regional, aggregate travel time and travel time distribution (average, median, and 90th percentile travel times); aggregate and average travel time by corridor Travel time between selected geographic origins and destinations Accessibility to jobs and shopping opportunities
Safety	No measures included. Difficult to assess impacts of future RTP investments on safety for system users and for different travel modes given tools at hand.[1]
Economic Vitality	Accessibility of the region's work force to employers in selected job centers Economic efficiency of transportation investments: benefit cost ratio reflecting the value of travel time, out-of-pocket user costs, and public expenditures
Community Vitality	Population and employment within walking distance (1/2 mile) of major transit intermodal/rail stations Use of walking to access transit
The Environment	Air quality and global warming: vehicle emissions (ROG, NOx, PM_{10}, CO_2)
Equity	Comparison of changes in: • Travel time: aggregate, median, 90th percentile • Accessibility to jobs • Transit travel time from target communities to major job centers for low-income and minority communities relative to other communities

[1] At this level of analysis, any forecasts would be extrapolations of current accident rates factored up by growth in VMT. It will be more meaningful to address safety through a program, under development, to monitor the conditions of the existing transportation system (e.g. track accident rates over time based on data already collected by safety and law enforcement agencies).

Exhibit 2

Relationship of RTIP Submittal to RTP Performance Measures[2]

RTP Goal **Mobility**

Performance Measures: **Travel Time**
Accessibility

1. Roadway and transit maintenance/rehabilitation projects maintain travel times by keeping the existing system in working order. **The RTIP submittal contains 10 transit maintenance/ rehabilitation projects worth a total of $34.1million and 26 roadway maintenance/ rehabilitation projects worth a total of $32.5 million.** (The combined total represents 12% of total funds proposed for programming, excluding Reserve).

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010043	BART	BART 'A' / 'B' Car Rehabilitation	$ 8,800	94003
Various	Various Marin Cities and County	Local street pavement rehabilitation and overlays	$ 4,973	94055, 94056
SF-010026	GGBHTD	Golden Gate Ferry's SF Terminal Facilities Rehabilitation	$ 2,250	94572
SF-010017	S.F Dept of Public Works	Third Street Pavement Rehabilitation - Donner to Bayshore	$ 5,078	94078
SF-991030	San Francisco Transportation Authority	Doyle Drive Replacement	$ 8,000	94089
SM-010047	Caltrans	Route 101 / Willow Road Interchange Reconstruction	$11,990	21606

2. Transit expansion and improvement projects are expected to improve travel times and accessibility by transit. **The RTIP submittal contains 14 transit expansion/improvement projects worth a total of $62.6 million** (12% of total funds proposed for programming, excluding Reserve).

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010038	AC Transit	Bus Acquisition	$ 8,500	94004, 21137
CC-010027	BART	BART Richmond Additional Station Parking	$ 2,000	98197
SF-010028	PCJPB	Caltrain Electrification Project	$10,000	94634
SOL-010032	Hercules	Fairfield/Vacaville Intercity Rail Station	$ 2,250	94148

[2] Analysis does not reflect amendments to projects programmed in prior STIP cycles or new projects proposed for funding with reserves, unless noted.

3. New HOV lanes are expected to reduce travel times and increase accessibility for carpools and express buses. **The RTIP submittal contains 3 new carpool lane projects worth a total of $26.0 million** (5% of total funds proposed for programming, excluding Reserve).

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010054	Caltrans	I-580 EB and WB HOV Lanes - Santa Rita to Vasco Road	$16,000	21116
SON-010018	Caltrans	Route 101 HOV Lanes - Old Redwood to Rohnert Park Expwy	$ 4,000	21904
SON-010019	Caltrans	Route 101 HOV Lanes - from Steele Lane to Windsor	$ 6,000	98183

4. Roadway expansion projects are expected to reduce travel time and increase accessibility for autos. **The RTIP submittal contains 9 roadway expansion projects (excluding carpool lane expansion projects counted above) worth a total of $117.4 million** (22%of total funds proposed for programming, excluding Reserve).

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
CC-010023	CCTA	SR4 East Widening from Loveridge to Somersville	$27,000	98142
NAP-01008	Caltrans	Jamison Canyon Road (Route 12) Widening	$ 2,000	94074
SM-010046	Caltrans	Route 101 Auxiliary Lane from Santa Clara County Line to Marsh Rd	$19,641	94100
SCL-010019	San Jose	Reconstruct I-880/Coleman Ave Interchange	$55,500	21703

RTP Goal Safety

Performance Measures: No measures identified for the RTP.

1. The Performance Report for the 2001 RTP did not identify any performance measures for safety because, forecasts of future accidents would have been based on current accident rates applied to future VMT and would not have recognized the contribution of specific safety projects. Nonetheless, several safety projects are proposed for the RTIP. **The RTIP submittal contains 9 safety projects worth a total of $14.7 million** (3% of total funds proposed for programming, excluding Reserve).

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010046	Alameda Co.	Vasco Road Safety Improvements	$ 3,900	98198
SF-010020	SF Dept of Parking & Traffic	Addison & Digby Traffic Circle Safety Improvements	$ 200	21503
SF-010024	SF Muni	1401 Bryant Overhead Lines Building Seismic Rehabilitation	$ 9,200	94080

RTP Goal **Economic Vitality**

Performance Measures: **Access to the Region's Workforce from Selected Job Centers**
Benefit Cost Ratio

1. Projects adding carpool lanes, widening roadways, and expanding transit services increase accessibility to the workforce by employers in regional job centers. These are largely the same expansion and improvement projects reflected under the RTP Mobility Goal.

Examples:
(See also examples of transit, HOV, and roadway expansion and improvement projects under Mobility)

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010042	BART	BART Warm Springs Extension	$19,700	94035
CC-010029	Hercules	New Hercules Intercity Rail Station	$ 3,000	21210
SF-010027	PCJPB	Caltrain Rapid Rail Improvements	$ 3,000	94634
SCL-010022	Caltrans	Route 101 Auxiliary Lane from Route 87 to Trimble Road	$ 1,300	94119

2. The *Performance Report for the 2001 RTP* compares benefits, composed largely of savings in travel time and out-of-pocket costs, with public expenditures. The report estimates a benefit cost ratio of approximately 2 to 1 for the proposed RTP, taken as a whole. While it is difficult to identify the contribution of individual RTIP projects in this regard, they are clearly critical elements of the broader investment program. In particular, roadway and transit expansion projects generate travel time savings.

See examples of transit, HOV, and roadway expansion and improvement projects above and under Mobility.

RTP Goal **Community Vitality**

Performance Measures: **Walk Access to Transit**
Transit Trips with Walk Access

1. New transit centers and transit center improvements are expected to increase walk access to transit. **The RTIP submittal contains 6 transit center improvement projects (excluding those in Reserve) worth a total of $17.3 million** (3% of total funds proposed for programming, excluding Reserve).

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010051	Emeryville	Emeryville Amtrak Station Intermodal Improvements	$ 890	21142
CC-010028	Richmond	Richmond Parkway Transit Center and Access Improvements	$ 8,700	21208
CC-010029	Hercules	New Hercules Intercity Rail Station	$ 3,000	21210
SOL-010031	Benicia	Benicia Intermodal Transportation Station	$ 1,100	94148
The following projects proposed for the Reserve are also worth noting:				
SF-010031	BART	16th St. Mission Northeast Plaza Improvements	$ 2,176	21507
TBD	Various San Mateo Cities and County	Transit Oriented Development Incentive Program	$ 4,773	21624

2. Many bicycle/pedestrian improvements are expected to increase walk access to transit. Bike and pedestrian facilities are also more generally recognized as important elements of community vitality. **The RTIP submittal contains 22 bicycle and pedestrian improvements projects worth a total of $9.7 million.** (2% of total funds proposed for programming, excluding Reserve.)

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
SF-010019	SF Dept of Parking & Traffic	Ladder Crosswalk and Pedestrian Crossing Warning Signing	$ 1,300	21502
MRN-010014	County of Marin	Sausalito - Mill Valley Multi-Use Path Rehabilitation	$ 151	21-302
SCL-010021	Santa Clara County	San Tomas Aquino Creek Trail	$ 2,000	21748

RTP Goal **The Environment**

Performance Measures: Vehicle Emissions (ROG, NOx, PM_{10}, CO_2)

1. Traditional Congestion Management Air Quality Projects are generally recognized to reduce ROG, NOx and CO_2, emissions. Such projects include ITS/arterial traffic management projects (including signal timing), the Regional Rideshare program, bicycle and pedestrian projects, carpool lane improvements, and transit service enhancements.

   The levels of commitment to transit service enhancements, carpool lanes, and bicycle and pedestrian projects are identified above under Mobility, Economic Vitality, and Community Vitality. **In all, the RTP submittal contains 54 CMAQ eligible projects worth a total of $123.6 million in the identified categories.** (This is equal to 23% of total funds proposed for programming, excluding Reserve).

   Examples:
   (See projects listed under Mobility, Economic Vitality, and Community Vitality for examples of carpool lane and transit expansion and for more examples of bicycle and pedestrian projects)

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-990048	Berkeley	I-80 Bicycle/Pedestrian Overcrossing access enhancements	$ 800	94008
CC-010025	Alameda County CMA	San Pablo Ave SMART Corridor	$ 1,500	94048
MRN-010016	County of Marin	Countywide Bicycle Signing and Striping - Initial Phase	$ 151	21302
SF-010018	SF Dept of Parking & Traffic	Oak and Fell Streets Integrated Traffic Management System (ITMS)	$ 1,271	21506
MTC990003	MTC	Regional Rideshare Program	$ 530	21007
SCL-010020	Sunnyvale	Borregas Ave. Bike/Ped Bridges over Routes 101 and 237	$ 3,700	21748

RTP Goal	Equity

Performance Measures: **Changes in**

1) Travel Time

2) Accessibility to Jobs

3) Transit Travel Times to Job Centers

for low-income and minority communities relative to other communities

1. The *Environmental Justice Report for the 2001 RTP* found that low-income and minority communities fared at least as well as other communities in terms of accessibility and travel time improvements offered by the proposed RTP. This is because low-income and minority communities are largely located in the urban core, characterized by high proximity to jobs and robust transit and highway networks. Additionally, the regional commitment to maintaining and the existing system results in substantial investment in these areas. The outstanding question raised by the report, concerns the needs of low-income, transit dependent people who have lower levels of accessibility than those with access to automobiles. Examples of projects in the RTIP that contribute toward the RTP Equity goal include those that maintain and sustain the network in the urban core and transit improvements serving low-income and minority communities.

Examples:

TIP ID#	Implementing Agency	Description	Total ($1,000)	RTP ID#
ALA-010036	AC Transit	Berkeley/Oakland/San Leandro Corridor MIS Phase 2	$ 2,700	21136
CC-010029	Richmond	Richmond Parkway Transit Center and Access Improvements	$ 8,700	21208
SF-010017	San Francisco	Third Street-Donner to Bayshore/Sunnydale Pavement Renovation	$ 5,078	94078

Joseph P. Bort MetroCenter
101 Eighth Street
Oakland, California 94607
TEL (510) 464-7700
TDD/TTY (510) 464-7769
FAX (510) 464-7848
E-MAIL info@mtc.ca.gov
WEB www.mtc.ca.gov

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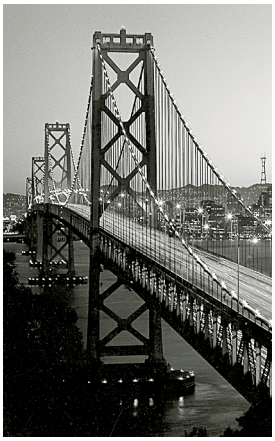

PERFORMANCE MEASURES REPORT FOR THE 2001 REGIONAL TRANSPORTATION PLAN FOR THE SAN FRANCISCO BAY AREA

AUGUST 2001

Project Manager, 2001 RTP Performance Report
Lisa Klein

Meeting Facilitator
Carolyn Verhyan, MIG

Travel Demand Forecasting
Chuck Purvis
Miguel Iglesias
Rupinder Singh
Kenneth Vaughn
Vamsee Modugula, Cambridge Systematics, Inc.

Geographic Information System Analysis
Amy Lee
Mike Skowroneck

Equity Analysis
Trent Lethco

Performance Measures Working Group Participants
Janet Abelson, Albany-El Cerrito Access
Brad Beck, Contra Costa Transportation Authority
Steve Beraldo, Rides for Bay Area Commuters
Mark Brucker, US EPA
Lisa Carboni, Caltrans District 4, Transportation Planning
Dan Christians, Solano Transportation Authority
Michael Cunningham, Bay Area Council
Patrick Duffey, Association of Bay Area Governments
Carolyn Gonot, Santa Clara Valley Transportation Authority
Corrine Goodrich, Samtrans/Joint Powers Board
Steve Gregory, Port of Oakland
Jean Hart, Alameda County CMA
Henry Hilken, Bay Area Air Quality Management District
John Holtzclaw , Sierra Club
Tina Konvalinka, AC Transit
Marian Lee-Skowronek, San Francisco County Transportation Authority
Sherman Lewis
David Reinke, BART
Ezra Rapport, Senate Select Committee on Bay Area Transportation
David Schonbrunn, TRANSDEF
Ethan Veneklasen, California Alliance for Jobs
Todd Vogel, US EPA

Advisors and Consultants
From the Institute of Transportation Studies, UC Berkeley:

Steve Buckley
Noreen McDonald
Professor Martin Wachs

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Overview

The Performance Measures Report is a new feature of the 2001 Regional Transportation Plan (RTP). The Metropolitan Transportation Commission (MTC) has pursued the development of performance measures with three purposes in mind:

1) to define quantifiable performance measures for long range transportation planning;

2) to test the efficacy of the measures by analyzing three alternative long-term transportation investment strategies described in the RTP Draft Environmental Impact Report (DEIR); and

3) to develop suggestions for improving the use of performance measures in future RTPs.

MTC's effort reflects a national trend to incorporate system performance measurement in the transportation planning process. Performance measurement is viewed as a tool to inform investment decisions and increase accountability for these decisions. Current efforts also place greater emphasis on making performance data accessible to the public, through readily-understood measures.

Performance measurement is hardly new to the field of transportation. What is new is the strong emphasis on how the customer experiences the performance of the transportation system (customer-based measures) and institutional accountability. Traditionally, measures of performance have reflected the interests of the providers of transportation facilities and services and have tended to measure "outputs" rather than "outcomes". For example, the number of new lane miles of roadway provided in a program or plan is an output, whereas the travel time savings for the customer is an outcome, and one that is important to system users. The shift in focus to the customer's perspective also requires that a more holistic view of the system be taken, one that accounts for the fact that many trips involve multiple travel modes (automobile, transit, biking and walking).

Other transportation agencies are integrating performance measures into their planning process as well. The California Department of Transportation has been engaged in a multi-year effort to identify performance measures for use in the California Transportation Plan and in statewide monitoring efforts. In 2000, the California Legislature passed AB 2140 which encourages the use of performance measures in long range plans for metropolitan regions. Subsequent legislation currently before the legislature (SB 473) would require MTC to expand upon the current initiative by developing measurable performance objectives for major travel corridors identified in the RTP and to evaluate new projects that are proposed to be added to the RTP.

Planned future work by MTC also includes development of a monitoring program to gauge how the existing transportation system is performing. Periodic updates of the information would be included in a "state of the system" report to the public. This monitoring program could include important types of data that cannot be forecasted and are therefore difficult to assess in plans that cover extended periods in the future. Examples include trends in safety and system reliability.

This report is organized into four chapters:

- Chapter 1 provides an overview of the RTP and the process used to develop the RTP performance measures.
- Chapter 2 provides general descriptions of the measures themselves.
- Chapter 3 summarizes the results of the performance analysis. Subsequent work may be needed to revise or refine the measures based on the information in this report.
- Chapter 4 provides observations and suggestions for consideration in future work.

Appendix A, included at the end of this report, contains tables showing the detailed results of the analysis for all measures in the report.

The report has two additional appendices that are available as a separate document from the MTC-ABAG Library: Appendix B contains detailed, technical descriptions of the methodologies used to calculate the performance measures; Appendix C contains meeting summaries from all of the meetings of the Performance Measures Working Group, the stakeholder group that advised MTC staff in development of the performance measures for this report.

Chapter 1
Performance Measures Development Process

1.1 OVERVIEW OF THE 2001 RTP

The 2001 RTP will guide the transportation investments in the nine-county Bay Area for the next 25-years. MTC is required by state and federal law to update the RTP at least every three years using the latest projections of population and employment growth and estimates of future transportation funding levels. The 2001 RTP identifies six broad goals:

- Mobility of people and freight
- Safety
- Economic vitality
- Community vitality
- The environment
- Equity

The 2001 RTP estimates that funding for transportation over the next 25 years will total $82 billion (in 2001 dollars). Roughly 90% of the funding ($74 billion) is dedicated to prior funding commitments. These commitments include the region's adopted three-year Transportation Improvement Program (TIP), transportation projects funded through voter-approved county sales initiatives, and the long term costs of operations, management, and maintenance/rehabilitation of existing roads and transit systems. The remaining $7.7 billion is new discretionary federal and state funding that will be generated over the planning period and must be divided between maintenance shortfalls, system management and customer service programs, and system expansion.

1.2 TRANSPORTATION ALTERNATIVES IN THE RTP ENVIRONMENTAL IMPACT REPORT (EIR)

The RTP is developed in consultation with Bay Area transportation agencies, other regional agencies, and the public. The proposed investments in programs and projects recommended by MTC is then released for further review and comment. In addition, MTC prepares a companion draft environmental impact report (DEIR) which considers the impact of the proposed RTP along with various transportation alternatives to the RTP. MTC solicited comments on these alternatives and ultimately defined three new alternatives to the RTP "Project" alternative analyzed in the DEIR. These alternatives are substantially different in terms of the mix of projects and programs and are therefore deemed to be a good test of how performance measures can be applied to discern differences in the performance of the overall transportation system. The alternatives evaluated in the DEIR are described in Figure 1.

Figure 1: 2001 RTP Alternatives

No Project Alternative (Baseline for purposes of the DEIR)

Highway, transit, local roadway, bicycle, and pedestrian projects that are reasonably foreseeable, that will go forward, primarily based on current funding commitments. These projects are identified in the federally required 2001 Transportation Improvement Program (TIP) and include fully funded sales tax projects authorized by voters in Alameda and Santa Clara Counties during the November 2000 election.

Proposed "Project" Alternative (Financially constrained)

The financially constrained RTP proposed for Commission adoption in November 2001. Projects in this alternative are based on MTC's regional priorities (e.g., filling transit operator shortfalls, pavement shortfalls on the metropolitan transportation system (MTS), and system management programs) and the county congestion management agency (CMA) adopted project lists.

System Management Alternative (Financially constrained)

This alternative includes a set of projects that could address corridor mobility issues that are primarily operational in nature, such as more express bus service, reversible carpool lanes, and a better connected HOV and transit system. It also provides more funding for streets and roads pavement shortfalls. Freeway ramp metering is assumed for the most congested corridors. Congestion pricing is assumed on the Bay Bridges to generate additional revenues, including transit operating revenues, and some highway projects are deferred to provide additional capital funding.

Blueprint 1 Alternative (Not financially constrained)

The 2001 RTP plus Blueprint projects that could be funded if new revenue sources are developed. These are reasonable revenue sources to consider as they represent extensions of existing funding sources, higher levels, or legislative authorization exists to pursue a particular fund source, but has not taken place. Potential sources of new revenue include up to a 10-cent Regional Gas Tax, Bridge Tolls, new and extended sales taxes in various counties, BART bonds, and continuation of higher state transportation funding levels as recently provided in the Governor's 2000 Transportation Congestion Relief Program.

Blueprint 2 Alternative (Not financially constrained)

This set of projects include a number of projects considered in MTC's 2000 *Transportation Blueprint for the 21st Century*. Many of these projects are being considered in other ongoing planning studies, including expanded ferry service, a California High Speed Rail system, and other long-term highway and transit improvements. For many of these projects a funding source has not yet been identified. This alternative is in addition to projects in Blueprint 1 and therefore provides the most extensive set of transportation projects that could be funded with the most optimistic assumptions about future revenues.

1.3 PERFORMANCE MEASURES DEVELOPMENT PROCESS

Recognizing that considerable work has been done in the transportation field on the topic of performance measures, MTC retained the Institute of Transportation Studies (ITS) at UC Berkeley in the fall of 2000 to conduct a review of existing literature and to identify a set of candidate performance measures for the RTP. The ITS team considered nearly 200 measures and

ultimately identified roughly 30 for further consideration. The results of this study were published in a report, "Background Studies on Performance Measurement for the Metropolitan Transportation Commission" (January 2001) which is available from the MTC-ABAG Library.

Following this research phase, MTC convened a stakeholder working group representing the environmental community, business community, and MTC's transportation partners in early 2001. The role of the stakeholder group was to review and advise MTC on a final set of measures for incorporation into the current RTP planning process. Major considerations in this review were:

- Ensure relevance of the measures to the actual RTP investment decisions as much as possible,
- Work within the existing capabilities of the MTC travel demand forecasting model[1], at least for now.
- Identify measures that are relevant to users (customers) of the transportation system.
- Identify measures that are relevant across multiple transportation modes.
- Identify measures that are relevant for all trips, not just work trips.
- Identify measures that are sensitive to policy issues, such as changes in land use and transportation system pricing, as well as investment decisions.

The working group engaged in extensive discussion about the usefulness of specific measures as applied to the six RTP goals, the capabilities of the regional travel model, methodologies for calculating specific measures, and the scale of the analysis (e.g., analysis of the RTP as a whole or of specific projects contained in the RTP). Due to the complexity of the topics, diversity of views, and the need to make progress in a short period of time, MTC retained a professional facilitator to assist with the process. Ultimately, the working group was able to identify a short list of measures shown in Figure 2. This list was subsequently approved by the MTC's Planning and Operations Committee in June 2001.

The selection of this initial set of performance measures was based on the following understandings:

- First, the Performance Measures Report for the 2001 RTP is considered an important first step in which the initial set of measures will be used to test their ability to draw useful distinctions between the performance of alternative RTP investment packages. It is not expected that the measures will be used for selection of a preferred RTP alternative at this time, given the early stage of their development.

- Second, several performance measures were actively discussed, but did not have sufficient support from the group for inclusion in the short list. (See Figure 3.) Developing information on these measures would be a lower priority and would be conducted as time allowed. (In the end, there was not sufficient time to include them in

[1] This computer model is developed and maintained by MTC to forecast future travel behavior given a range of socio-economic variables, future regional demographics, and potential transportation investments.

this report given other more pressing analyses required to produce the draft RTP and EIR.)

- Third, there is a need for a work plan to continue the development of performance measurement. Continuing work will most likely focus on: 1) refining the use of performance measures in the RTP; 2) responding to the requirements of SB 473 if passed into law, and 3) developing a program to monitor performance of the existing system.

Figure 2: Performance Measures Selected for the 2001 RTP

RTP Goal	Performance Measures
Mobility of people and freight	Travel time: aggregate travel time and travel time distribution (average, median, and 90th percentile travel times) Travel time between selected geographic origins and destinations Accessibility to jobs and shopping opportunities
Safety	No measures included. Difficult to assess impacts of future RTP investments on safety for system users and for different travel modes given tools at hand.
Economic vitality	Accessibility of regions work force to employers Economic efficiency of transportation investments (value of travel time as well as user costs and public expenditures)
Community vitality	Population and employment within walking distance of transit intermodal/rail stations Use of walking to access transit
The environment	Air quality and global warming – vehicle emissions
Equity	Comparison of changes in: • Travel time: aggregate, median, 90th percentile • Accessibility to jobs • Transit travel time from target communities to major job centers for low-income and minority communities relative to other communities

Figure 3: Performance Measures Identified for Testing

RTP Goal	Performance Measures
Mobility of people and freight	Accessibility to shopping opportunities based on a threshold number of retail jobs
	Person trips in the peak period
Economic vitality	Economic efficiency measured as net discounted benefits, accounting for the value of travel time as well as user costs and public expenditures
	Inclusion of safety and air quality costs and benefits in the calculation above (to be conducted by interested working group members).

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Chapter 2
Overview of Individual Performance Measures

This chapter provides general descriptions of the performance measures selected for each RTP goal, as shown in Figure 2. The discussion addresses why the measures were chosen and what they are intended to demonstrate.

2.1 MOBILITY OF PEOPLE AND FREIGHT

The measures selected for this goal address travel time and accessibility, two critical aspects of mobility from the customer's perspective. Travel time is fairly intuitive as a good measure of mobility since it is a primary concern for those making both work and non-work trips. Accessibility refers to the ability to reach desired destinations within a reasonable amount of time and is affected by local land use as well as transportation decisions. Mobility improves if travel time decreases or people can get to more desired destinations within a given amount of travel time. These measures are relatively easy to calculate from the MTC travel demand forecasting model.

Measure 1: Aggregate Travel Time and Travel Time Distribution

Some travelers have very short travel times while others have very long travel times, depending on the type of trip and desired destination. The projected time spent by people in the Bay Area for work and non-work travel in the future can be analyzed with standard statistical measures as shown below. Travel times can also be calculated for trips made by trucks transporting goods. At the regional level, the measure includes:

- Aggregate travel time (the sum of individual travel times for all system users for an average day);
- Average travel time (aggregate travel time divided by the total number of trips);
- Median travel time (the midpoint where 50% of trips are shorter in time and 50% are longer);
- 90th percentile travel time (the point at which only 10% of trips are longer in time).

Measure 2: Travel Time between Selected Origins and Destinations

This measure is useful for assessing how proposed future transportation investments in a corridor affect travel time for users of various modes (people who drive alone, people who carpool, and people who take transit). The origins and destinations are selected to be representative of the trips most likely to be affected by the proposed RTP investments. The primary focus is on investments that would increase capacity in a corridor, such as major rail extensions or bus service enhancements, new carpool lanes, and highway widenings.

Measure 3: Accessibility to Jobs and Shopping

Accessibility is a significant measure of mobility because transportation is rarely an end in itself; it is most often a means for getting to other activities. Accessibility is defined as the share of all regional work and shopping opportunities (retail jobs are used as a proxy for shopping opportunities) that Bay Area residents can reach within specified amounts of time

from their neighborhood of residence[2]: 15, 30, and 45 minutes by automobile or transit; and 15 and 30 minutes by biking or walking.

2.2 SAFETY

Safety was added this year as an RTP goal, primarily in response to comments received during public outreach about pedestrian safety and transit security. While an important goal, the working group found it difficult to say how user safety would change in the future and how these changes could be forecast using the regional travel demand model. There are multiple dimensions to safety concerns for any particular mode; for example, transit has security issues on vehicles, in parking lots, at stations, as well as safety concerns associated with grade crossings where train tracks cross local roads at grade. More useful assessments of safety issues would probably be made at the project development level. However, having said this, the group did feel that monitoring of safety impacts was something that could be achieved in the forthcoming system monitoring effort.

2.3 ECONOMIC VITALITY

The gross regional product (GRP) of the Bay Area rivals that of many countries. If the Bay Area were its own country, the regional GRP would rank about 24th in the world. Transportation plays a significant role in the economic health of all metropolitan regions; yet it is difficult to make a direct connection between transportation investment and economic output. The two performance measures selected for this goal take very different approaches. The first, access of employers to the region's workforce, is based on the theory that companies will find it easier to attract and retain employees and employees will be more productive if they spend less time getting to work. The second measure, economic efficiency, addresses the use of valuable capital for making investments in transportation. Basically, the expenditure of transportation funding on future improvements should generate benefits (such as travel time savings) of greater value than the funds invested. Also note that the travel time and accessibility measures under the Mobility Goal (Measures 1, 2, and 3), are reflective of the RTP Economic Vitality Goal.

Measure 4: Access of Employers to the Region's Workforce

Accessibility to employed residents of the Bay Area is an important consideration in business location decisions. This measure calculates the number of workers located within various travel time intervals of eighteen major regional job centers.

This measure is essentially the other side of the coin for Measure 3 (Access to Jobs), which calculates the number of jobs that can be reached from home for employed residents of the Bay Area. As for Measure 3, travel times are defined to be 15, 30, and 45 minutes for auto and transit, and 15 and 30 minutes for biking and walking.

Measure 5: Economic Efficiency – Net Benefit and Benefit Cost Ratio

The economic efficiency of transportation investment decisions is of concern for two reasons: first, the revenues spent on projects are generated through user fees and taxes and entrusted to transportation agencies to spend wisely; second, projected transportation

[2] For regional transportation planning, the Bay Area is divided into 1,099 neighborhoods (travel analysis zones).

revenues are not enough to meet Bay Area transportation needs. These circumstances provide a motivation to measure the comparative benefits of different types of transportation investments at the regional/system level. Project level analyses are typically performed in corridor and major investment studies to evaluate investments choices at a smaller scale.

This measure calculates the user benefits of a transportation investment alternative and the public costs of that alternative in order to assess cost effectiveness. All other things being equal, a transportation investment alternative that provides a greater level of user-benefit for the same or less public cost than another transportation investment alternative is considered a better use of resources.

The measure can be expressed in two forms:

(1) Net benefit which is calculated by subtracting the total annualized cost from total annual user benefits

Net Benefit = [total benefits] – [total cost]

(2) Benefit cost ratio which is calculated by dividing total benefits by total costs.

Benefit Cost Ratio = [total benefits] ÷ [total costs]

Benefits include travel time saved by system users (as measured in Measure 1) and reductions in out-of-pocket expenses such as transit fares, parking fees, and auto operating costs (fuel costs and automobile wear and tear). The travel time saved by users is assigned a monetary value in order to compare it directly with the costs. The costs include annualized public expenditures on construction, operation, and maintenance of new transportation facilities and services.

This report includes economic efficiency calculations for the RTP Project Alternative. It does not include calculations for the other alternatives in the DEIR since the cost information was less detailed. Continuing work to be conducted this fall will provide a more complex calculation based on a discounted stream of future costs and benefits, which will be summed over the full 25-year planning period.

2.4 COMMUNITY VITALITY

The working group found it very difficult to define what constitutes "community vitality", and therefore, to develop focused performance measures for this RTP goal. Furthermore, the effect of transportation investment on community vitality is not straightforward. After discussion with the Commission, two performance measures were identified that focused on the connection between transit and community vitality: the number of people and jobs within walking distance of transit and the number of transit trips that involve walk access to transit.

Measure 6: Population and employment within Walking Distance (1/2 mile) of Transit
Residents in communities with good access to transit and residents of new developments specifically oriented around major transit stops have more choices in terms of how they get

to work, shopping, or entertainment destinations. The pedestrian activity in and around transit stations can enhance the feeling of cohesiveness within neighborhoods as well as stimulate commercial activity along the routes to the transit stations.

This measure is based on estimates of the population and employment within walking distance (1/2 mile) of defined major bus, rail, and ferry stops. For this analysis, the land use assumptions are provided by ABAG and are constant; therefore, differences between alternatives will reflect the impact of new or expanded transit service. In the future, it will be possible to factor in land use changes where local jurisdictions have made a commitment to transit-oriented development and increased residential densities near transit centers. This measure is also used for evaluating transit projects proposed for federal funding programs for transit, such as the New Starts Program, for the reason just noted.

Measure 7: Transit Trips with Walk Access
This measure calculates the number of transit trips where access to the transit stop is by walking as opposed to driving. Whereas Measure 6 estimates the potential for walk access to transit based on the number of people located around transit stops, this measure forecasts the actual number of walk-access-transit trips as projected by the MTC travel demand forecast model.

2.5 THE ENVIRONMENT

Different transportation system investment alternatives will produce varying amounts of vehicle activity as a result of the mix of projects that affect travel time and cost among alternatives. Because certain air quality pollutants are regional in nature and because transportation sources are a major contributor to these pollutants, the environmental performance measure selected is vehicle emissions. The measure is defined to address health based air quality (ozone, particulates, and carbon monoxide) as well as transportation contributions to global warming (carbon dioxide). Ozone, or smog, is formed by a photochemical reaction involving reactive organic gases (ROG) and nitrogen oxide (NOx). Particulates are very small particles that can enter the lungs and cause respiratory illness. Particulates are formed by engine combustion and by travel over roads which kicks up road dust. While not subject to state or federal regulation, CO_2 is of interest since it is known to contribute to global warming. Federal and state air quality standards are in effect for the health based pollutants; however, there is no regulatory framework for moderating carbon dioxide emissions from mobile sources at present. Automobile emissions are stringently controlled by the California Air Resources Board; however, carbon dioxide emissions are strongly correlated with automobile fuel economy standards which have not changed for many years.

Measure 8: Air Quality and Global Warming – Vehicle Emissions
Depending on the specific pollutant, emissions are calculated by applying emission rates provided by the California Air Resources Board to vehicle activity forecasts, such as the number of vehicle trips, the amount of travel (vehicle miles of travel), and the average speed of travel. The major factors of interest are whether the emissions are increasing or decreasing over time and how emissions compare to the No Project Alternative, that does not provide any new transportation improvements beyond those that are already committed. Decreased

emissions indicate improved air quality trends, which is the case for some pollutants like ozone. Increased emissions indicate an increasing contribution from the transportation to pollutants. In addition, for ozone, MTC has a specific transportation emission budget identified in the federal air quality plan which must be maintained to demonstrate "conformity" with the air quality goals in that plan.

2.6 EQUITY

The performance measures for this goal are drawn from work conducted separately by the Environmental Justice Advisory Group to refine the social equity analysis methodology for the RTP. Consistent with federal Environmental Justice guidance, the social equity analysis assesses whether the RTP would produce disproportionately high and adverse human health or environmental effects on minority or low-income communities. The Environmental Justice Report is available as a separate report from the MTC-ABAG Library.

The equity performance measures assess mobility and accessibility of certain defined "target communities" compared to the rest of the Bay Area (non-target communities). The target communities are defined in the equity analysis as those communities in which the number of minority or low-income residents surpasses a defined threshold. Minority is defined as Black or African American, Asian American/Pacific Islander, Hispanic or Latino, and Native American. To account for the high cost of living in the Bay Area, low-income is defined as having household income at or below an amount that is twice the US Department of Health and Human Services Poverty Guidelines.

Measure 9: Travel time distribution for target communities
This measure is comparable to the more general measures of travel time distribution listed under the RTP mobility goal and is useful for the same reasons.

Measure 10: Accessibility to jobs from target communities
This measure is comparable to Measure 3, Accessibility to Jobs, listed under the RTP mobility goal and is useful for the same reasons. Accessibility is measured as the percent of all regional jobs within 15, 30, and 45 minutes of home by auto and transit.

Measure 11: Transit travel time from target communities to major job centers.
This measure reflects the important role that the quality and quantity of transit service plays in the mobility of low-income households, which generally have lower auto-ownership rates. The measure uses the same job centers used in Measure 4, Access to the Region's Workforce.

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Chapter 3
Testing Performance Measures Using RTP EIR Alternatives

This chapter contains the test results of applying the performance measures in Chapter 2 to the EIR alternatives listed in Figure 1. The analysis of each measure is presented in two parts. First, the changes over time in performance are discussed, that is performance measures are compared for 1998[3] and 2025. Second, the performance measures are tested by comparing differences among the transportation alternatives defined in the EIR for the year 2025 (Project, System Management, Blueprint 1, and Blueprint 2).[4]

As discussed above, the performance measure results are calculated using MTC's set of travel demand forecasting models. These computer models forecast future travel behavior based on socio-economic factors and assumptions about future demographics, land use, and changes to the roadway and transit networks and services. This chapter presents highlights of the results for each of the eleven performance measures; more detailed tables are presented in Appendix A.

3.1 Overview: Demographics, Transportation Supply, and Travel Behavior

It is helpful in reviewing the performance results to understand the basic assumptions about future demographics and transportation system supply (capacity). Table 1 shows projected changes in population, employed residents, and total employment between 1998 and 2025. Table 2 displays changes in the transportation capacity between the EIR alternatives, i.e., new lane miles of roadway and transit seats per hour. Each EIR alternative includes different amounts of funding for transit and highway maintenance and operations, system management, and system expansion. Of these categories, transportation expansion projects that add capacity will affect the performance measures to the greatest extent. System management/traffic operations programs that affect the flow of autos and transit vehicles through the system will have lesser effects on performance outcomes. Table 3 shows a snapshot of general travel patterns.

Table 1: Demographic Characteristics for 1998 and 2025

			Change: 1998 to 2025	
	1998	2025	value	pct
Total Population	6,716,000	8,224,000	1,508,000	22%
Employed Residents	3,738,000	4,625,000	887,000	24%
Total Employment	3,504,000	4,907,000	1,403,000	40%

[3] 1998 is the latest year for which the MTC travel demand model has been validated, or compared and adjusted to match real conditions.

[4] The RTP Environmental Impact Report actually defines two versions of the RTP Project Alternative. For this purposes of this analysis only the Project-A alternative is included. Project-B was not determined to represent a significantly different alternative since it is identical to Project-A except for transit service in two corridors. The Project-B service in these corridors is comparable to that in the System Management Alternative. Thus, the inclusion of Project-B would not have provided much additional information about the use of performance measures for a range of RTP alternatives.

Table 2: Transportation Capacity (Supply), 2025 EIR Alternatives

	1998 Base	2025 Alternatives				
		No Project	Project	System Management	Blueprint 1	Blueprint 2
Roadway Supply (lane miles)						
Freeways	4,400	5,400	5,600	5,700	5,800	5,800
Mixed flow	4,200	5,000	5,100	5,100	5,200	5,200
Carpool	300	400	500	600	600	600
Expressways	900	1,000	1,100	1,100	1,100	1,200
Mixed flow	900	1,000	1,000	1,000	1,100	1,100
Carpool	50	70	70	70	70	90
Arterial/other	14,000	13,600	13,600	13,600	13,600	13,600
TOTAL Roadway Supply	19,400	20,000	20,400	20,400	20,600	20,700
Transit Supply (seat miles per hour)						
Bus Transit	1,365,300	1,410,300	1,470,100	1,486,200	1,573,700	1,680,500
Light Rail Transit	143,000	249,900	268,100	268,900	275,100	328,500
Rapid Rail Transit (BART)	1,058,100	1,279,200	1,452,000	1,281,300	1,629,400	2,946,800
Commuter Rail Transit	473,000	645,200	672,600	822,700	1,416,000	2,149,300
Ferry Transit	96,700	115,900	115,900	115,900	238,600	597,300
TOTAL Transit Supply	3,136,200	3,700,500	3,978,700	3,975,000	5,132,800	7,702,300

	Percent Change	Percent Change Relative to No Project			
	1998 Base to 2025 Project	Project	System Management	Blueprint 1	Blueprint 2
Roadway Supply (lane miles)					
Freeways	27%	4%	6%	8%	9%
Mixed flow	23%	2%	2%	4%	4%
Carpool	104%	38%	59%	54%	68%
Expressways	18%	5%	5%	10%	17%
Mixed flow	17%	4%	4%	10%	16%
Carpool	40%	0%	0%	0%	29%
Arterial/other	-3%	0%	0%	0%	0%
TOTAL Roadway Supply	5%	2%	2%	3%	3%
Transit Supply (seat miles per hour)					
Bus Transit	8%	4%	5%	12%	19%
Light Rail Transit	87%	7%	8%	10%	31%
Rapid Rail Transit (BART)	37%	14%	0%	27%	130%
Commuter Rail Transit	42%	4%	28%	119%	233%
Ferry Transit	20%	0%	0%	106%	416%
TOTAL Transit Supply	27%	8%	7%	39%	108%

The magnitude of the demographic and geographic changes between 1998 and 2025 are significant: in 2025, there will be 1.4 million more jobs (40% increase) and 1.5 million more residents (22% increase), and a greater percentage of the regional growth will occur in outlying communities in the Bay Area.

In contrast, the underlying demographic assumptions are identical for all the EIR alternatives in 2025, and the only differences are in the capacity of the transportation network. Compared to the No Project, the Project Alternative makes relatively modest increases (4%) in overall freeway capacity due mostly to expansion of the region's carpool network (38%). The increase in transit capacity is also notable at 8% overall.

The System Management Alternative provides a slightly greater increase in roadway capacity on freeways, composed almost entirely of new carpool lanes. The primary characteristic of this alternative is the shift in emphasis of transit expansion to commuter rail and express bus from rapid rail transit.

The Blueprint 1 and Blueprint 2 Alternatives, which are not financially constrained, provide for significantly more investment much of which would be directed toward transit expansion. Both alternatives include a 9% increase in freeway capacity, composed largely of new carpool lanes. Blueprint 1 includes a 39% increase in transit capacity, with the largest increases in percent change in commuter rail and ferries. Blueprint 2 provides a 108% increase in overall transit capacity, with even larger increases in rapid rail transit, commuter rail, and ferries.

Table 3: Regional Travel Characteristics, 1998 and 2025

	1998 Base	2025 Alternatives: No Project	Project	System Management	Blueprint 1	Blueprint 2
Daily Person Trips by Mode						
Auto	16,986,000	21,597,000	21,566,000	21,555,000	21,536,000	21,536,000
Transit	1,129,000	1,585,000	1,618,000	1,631,000	1,653,000	1,653,000
Bike	270,000	346,000	343,000	343,000	342,000	342,000
Walk	1,855,000	2,699,000	2,700,000	2,697,000	2,695,000	2,695,000
TOTAL All Modes	20,240,000	26,227,000	26,227,000	26,227,000	26,227,000	26,227,000
Daily Transit Boardings	1,605,000	2,330,000	2,397,000	2,444,000	2,486,000	2,564,000
Daily Vehicle Trips	12,874,000	16,660,000	16,629,000	16,613,000	16,605,000	16,574,000
Daily Vehicle Miles of Travel	128,369,000	191,768,000	190,587,000	189,976,000	190,163,000	189,391,000
Daily Vehicle Hours of Delay	339,000	959,000	855,000	863,000	839,000	836,000
Avg Delay per Vehicle Trip (minutes)	1.6	3.5	3.1	3.1	3.0	3.0

	Percent Change: 1998 Base to 2025 Project	Percent Change Relative to No Project: Project	System Management	Blueprint 1	Blueprint 2
Person Trips by Mode					
Auto	27%	-0.1%	-0.2%	-0.3%	-0.3%
Transit	43%	2.1%	2.8%	4.2%	4.1%
Bike	27%	-0.9%	-0.9%	-1.2%	-1.2%
Walk	46%	0.0%	-0.1%	-0.1%	-0.1%
TOTAL All Modes	30%	0.0%	0.0%	0.0%	0.0%
Daily Transit Boardings	49%	2.9%	4.8%	6.4%	9.4%
Daily Vehicle Trips	29%	-0.2%	-0.3%	-0.3%	-0.5%
Daily Vehicle Miles of Travel	48%	-0.6%	-0.9%	-0.8%	-1.2%
Daily Vehicle Hours of Delay	152%	-10.8%	-11.2%	-13.9%	-14.7%
Avg Delay per Vehicle Trip (minutes)	95%	-10.8%	-11.0%	-13.6%	-14.1%

3.2 MOBILITY OF PEOPLE AND FREIGHT

Measure 1: Aggregate Travel Time and Travel Time Distribution

See Table A-1 in Appendix A for the complete results for Measure 1.

Comparison of 1998 to 2025

Total aggregate travel time is expected to increase from 1998 to 2025 by 1.7 million person hours (75%) for work trips and by approximately 60,000 vehicle hours (58%) for truck trips. The number of trips also grows, though less than the aggregate travel time. This suggests that longer individual travel times per trip, not just growth in trips, account for the increase in aggregate travel time. Comparison of the average, median and 90th percentile travel times confirms that this is the case; for example, the average travel time for work trips increases by about 7 minutes and travel time for the 90th percentile increases by 14 minutes.

Comparison of Alternatives in 2025

Among the 2025 alternatives, larger investments in system expansion tend to correspond with larger decreases in travel time compared to the No Project Alternative. For example, person hours for work trips decrease by 301,000 (7%) in Blueprint 2; by 225,000 in Blueprint 1; by 210,000 in System Management; and by 189,000 in the Project. Though the System Management Alternative contains less system expansion than the Project Alternative, it offers a comparable decrease in aggregate travel time due to congestion pricing (higher peak period bridge tolls) and projects that improve travel time for drive alone and carpool trips.

The level of the decrease in aggregate travel time does differ among the transportation modes, as shown in Figure 4. The largest decrease in aggregate travel time occurs for drive alone trips, where small decreases in average travel time occur for a large number of trips. There are also significant decreases in travel time for carpools. Transit service improvements increase ridership in all the alternatives which leads to an increase in aggregate travel time for trips made by transit. (However, average transit travel times do not generally increase.) The slight decrease in the number of trips and aggregate travel time for non-motorized modes occurs because some former cyclists and walkers are attracted to the enhanced transit services.

The average, median and 90th percentile travel times for the 2025 alternatives also decrease compared to the No Project. Figure 5 shows that changes in the 90th percentile travel times are the most pronounced. For example, compared to the No Project, Blueprint 2 results in a 6 minute decrease in 90th percentile travel time for work trips.

Figure 4: Change in Aggregate Travel Time for Work Trips by Mode, 2025 Alternatives

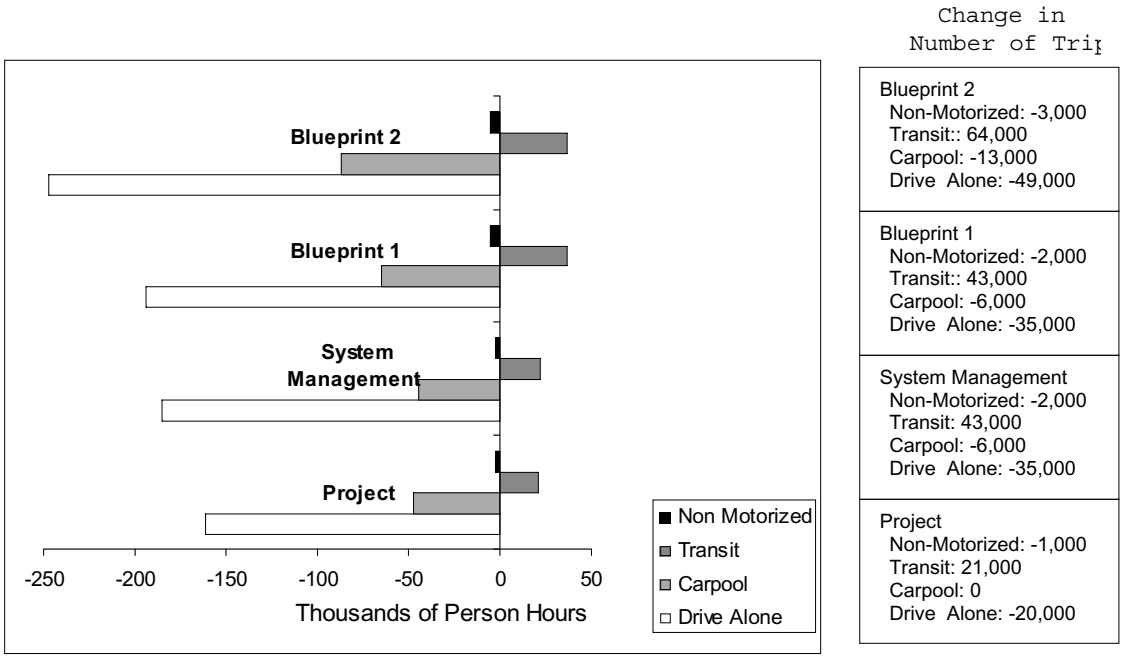
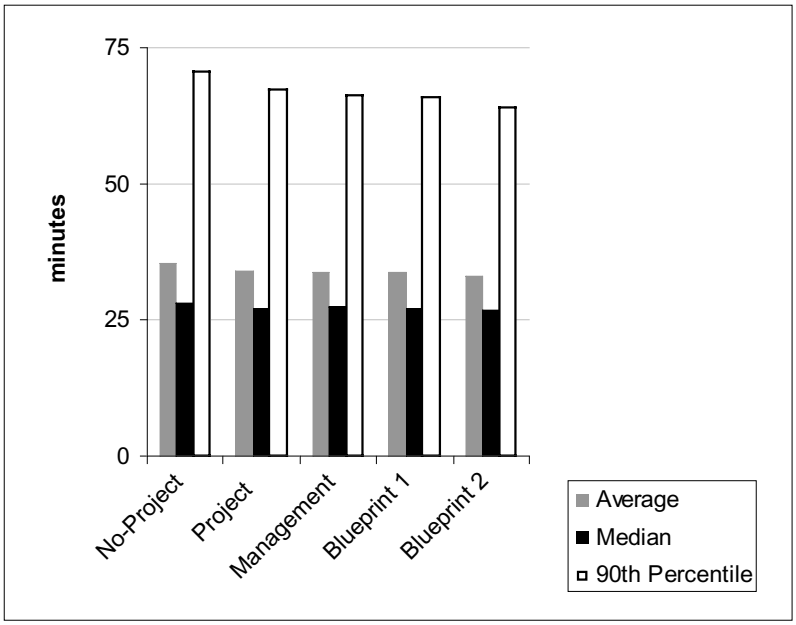


Figure 5: Travel Time Distribution for Work Trips, 2025 Alternatives



RTP GOAL: MOBILITY OF PEOPLE AND FREIGHT (CONTINUED)

Measure 2: Travel Times between Select Origins and Destinations

See Tables A-2(1) - (2) in Appendix A for the complete results for Measure 2.

The tables in Appendix A compare travel time for 41 origin-destination pairs for passenger travel and 12 origin-destination pairs for truck travel. Travel times are shown for 1998 and each of the 2025 alternatives.

Comparison of 1998 to 2025

For most origin-destination pairs, drive alone and truck travel times increase between the 1998 Base and the 2025 Project. The increase for drive alone trips is often 10 minutes or more. The addition of carpool lanes in many corridors causes carpool travel times to decrease or remain constant. Transit travel times improve in 2025 in some corridors due to service enhancements, new rail extensions, or carpool lane improvements that serve express buses. For example, in the Golden Gate Corridor new carpool lanes reduce carpool and transit travel times, while auto travel times increase. In the Fremont South Bay Corridor, BART and VTA light rail extensions reduce transit travel time, while auto travel times increase.

Comparison of Alternatives in 2025

With few exceptions, the 2025 alternatives offer travel time savings compared to the No Project. The System Management Alternative offers greater savings than the Project Alternative for drive alone, carpool, and truck trips where express bus services are added and where peak period bridge tolls affect travelers. Travel times in the Blueprint 2 Alternative tend to be comparable to or better than those in the other alternatives for all modes because it is the most inclusive of roadway and transit expansion projects.

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RTP GOAL: MOBILITY OF PEOPLE AND FREIGHT (CONTINUED)

Measure 3: Accessibility to Jobs and Shopping

See Table A-3 in Appendix A for the complete results for Measure 3.

Comparison of 1998 to 2025

Figure 6 and Figure 7 show accessibility to jobs by auto and transit in 1998 and the 2025 alternatives. The figures show that, between 1998 and the 2025 Project, accessibility to jobs would generally decrease for auto, especially for longer trips, and increase for transit. These changes result from two factors: changing land use patterns over this period, and the transportation investments in the RTP Project itself. The decrease in accessibility to jobs by auto is primarily due to increases in travel times on the region's roadways and, to a lesser extent, changes in land use. The increase in accessibility by transit is due to significant transit improvements and to the overall growth in the number of jobs within the region.

However, even though the number of jobs accessible by transit increases by 2025, the share of all regional jobs accessible remains constant or decreases. This suggests that the location of these new jobs and new housing is more dispersed. On average, people will have access to a smaller share of the region's jobs in 2025 than they did in 1998.

Comparison of Alternatives in 2025

The 2025 RTP alternatives generally increase accessibility compared to the No Project. Figure 6 and Figure 7 show that as the amount of money spent on system expansion increases, so does accessibility to jobs. This is most apparent when considering the number of jobs accessible within 45 minutes. Compared to the No Project Alternative, the RTP Project offers access to an additional 81,000 jobs by auto and 4,000 jobs by transit within 45 minutes. Blueprint 2, with the largest budget for expansion, increases these numbers to 104,000 for auto and 23,000 for transit.

Figure 6: Accessibility to Jobs by Automobile, 1998 and 2025

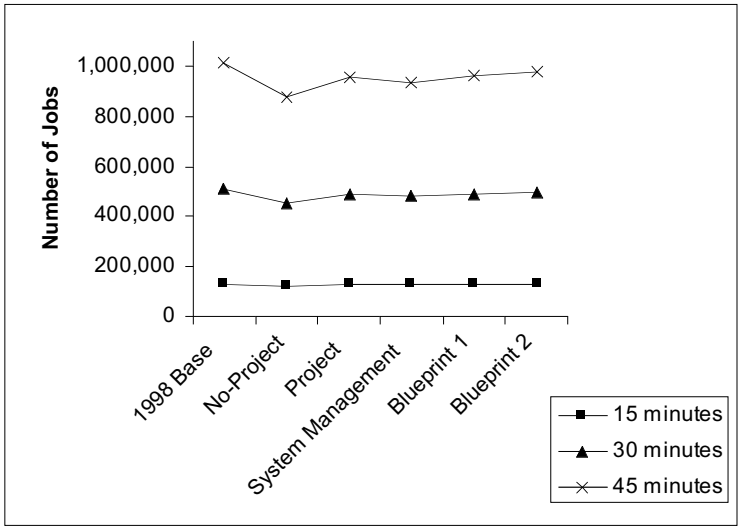


Figure 7: Accessibility to Jobs by Transit, 1998 and 2025

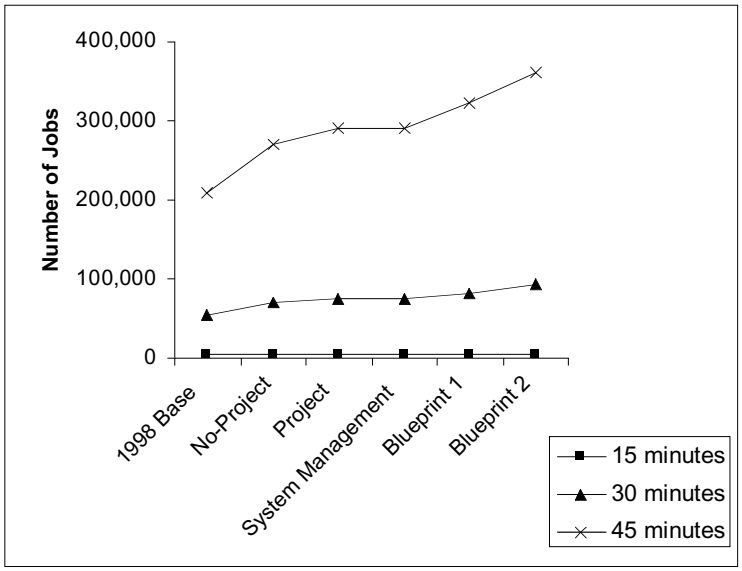
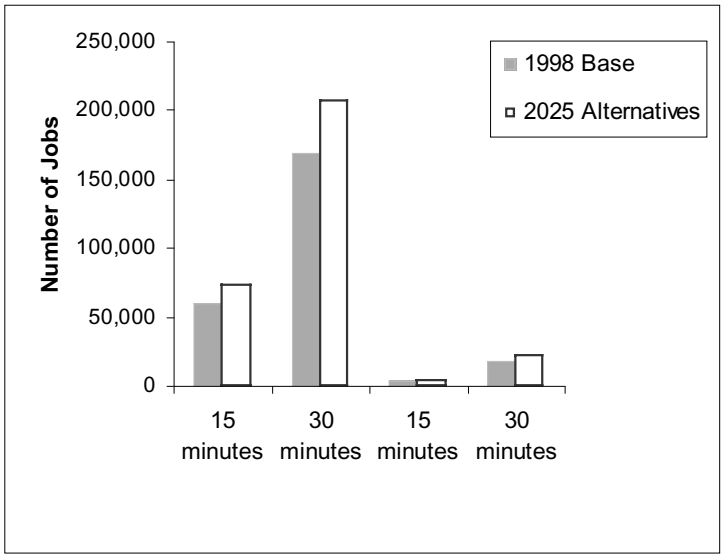


Figure 8 shows the number of jobs accessible by walking and biking in 1998 and 2025. It is interesting to note that for any given alternative, the numbers of jobs accessible by bicycle in 15 minutes and 30 minutes are comparable to those accessible by transit in 30 minutes and 45 minutes. These results are probably explained by the "access penalty" involved in transit travel. Even a short transit trip requires walking or driving to the transit stop and waiting for the vehicle; this time will amount to 15 minutes or more in most cases, particularly in communities located outside the urban core, where transit service is less frequent. The analysis does not include comparison of walk and bike access among 2025 alternatives because the MTC travel model would not calculate significant changes in non-motorized trips, absent changes in the underlying land use assumptions.

Figure 8: Accessibility to Jobs by Bicycle and Walking, 1998 and 2025



3.3 ECONOMIC VITALITY

Measure 4: Access of Employers to the Region's Work Force

See Table A-4 in Appendix A for the complete results for Measure 4.

Comparison of 1998 to 2025

This measure is the flip side of Measure 3, accessibility to jobs, since it uses the employment centers as the focus and measures the number of employees with access within specified travel time thresholds. As expected, the results are quite similar. Typically, the numbers of workers within each time interval decrease between 1998 and 2025 for access by automobile, and increase for transit, biking, and walking. The explanation is also similar: longer auto travel times decrease the number of workers with access to the jobs sites while improved transit services combined with overall population growth in the region increase the number of workers with access by transit, bicycling and walking.

Comparison of Alternatives in 2025

Likewise, the 2025 RTP alternatives offer increased accessibility compared to the No Project. Blueprint 1 and Blueprint 2 offer the biggest increase in accessibility, particularly by transit. This is due to the heavy investment in transit expansion in these alternatives. At the same time, none of the 2025 alternatives, not even Blueprint 2, restores the level of automobile access existing in 1998.

To illustrate this point, Figure 9 and Figure 10 show accessibility of the workforce to Downtown Oakland, one employment site.

Figure 9: Access to the Region's Workforce from Downtown Oakland - Auto, 1998 and 2025

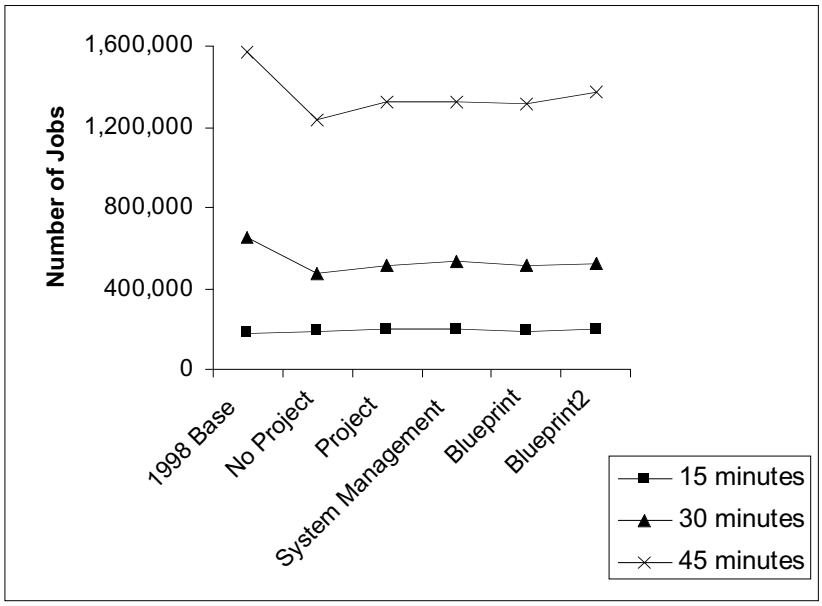
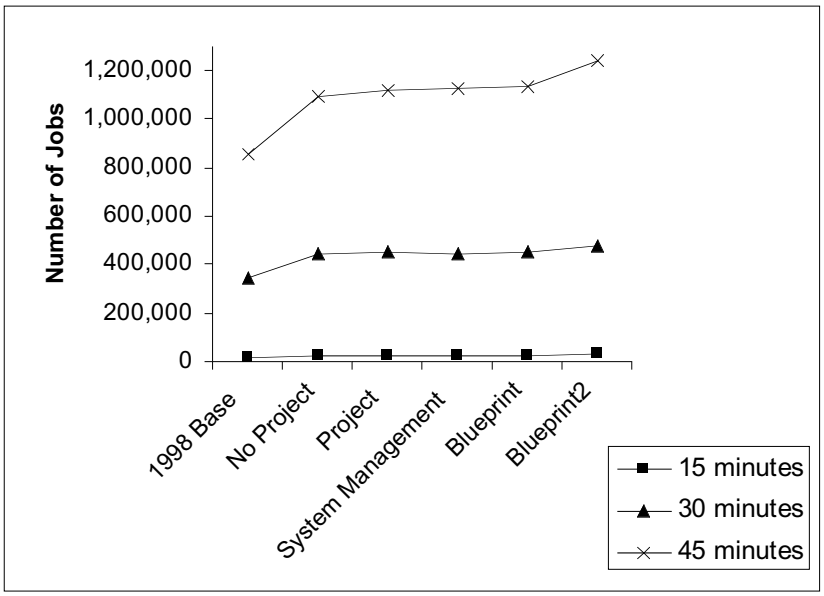


Figure 10: Access to the Region's Workforce from Downtown Oakland - Transit, 1998 and 2025



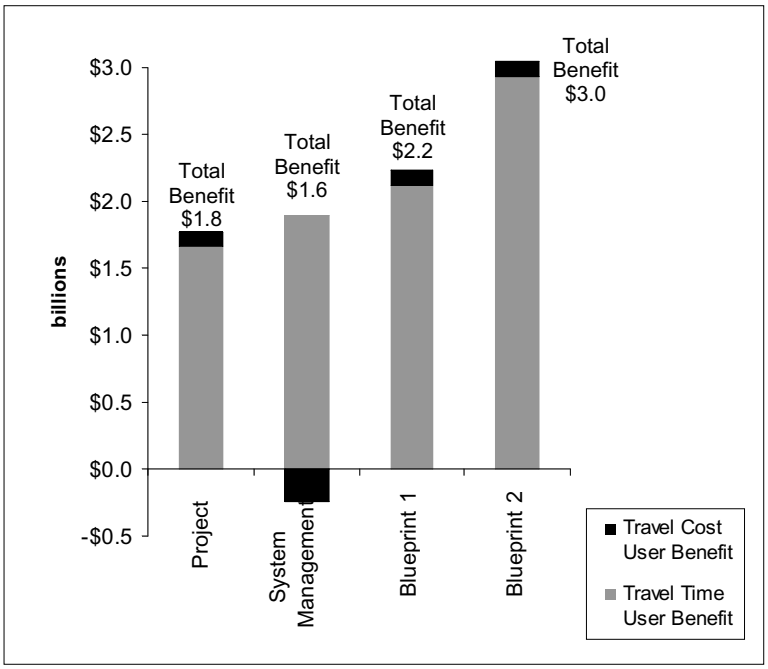
Measure 5: Economic Efficiency – Net Benefit and Benefit Cost Ratio

See Tables A-5(1) – (3) in Appendix A for the complete results for Measure 5.

Comparison of Alternatives in 2025

The economic efficiency measures compare user benefits (travel time savings and savings in out-of-pocket costs) with the incremental public expenditure for each 2025 alternative.[5] This analysis includes a calculation of user benefits for all the 2025 alternatives, and calculation of net benefit and benefit cost ratio for the Project Alternative only.

Figure 11: Value of User Benefits of 2025 Alternatives



* There is a net increase in out-of-pocket costs in the system management alternative due to increased peak period tolls. Revenues would typically be reinvested in transportation improvements and would generate additional revenues not reflected in this table.

Figure 11 shows that, as expected, increasing levels of investment generate increasing total user benefits. The RTP Project offers user benefits worth $1.8 billion; System Management offers $1.6 billion, Blueprint 1 offers just over $2 billion; and Blueprint 2 offers $3 billion. Most of the user benefit is generated by travel time savings for people and trucks. The change in out-of-pocket costs is small and nearly identical for all alternatives except the System Management Alternative, which costs people more due to

[5] Benefits are travel time savings and savings in out-of-pocket costs compared to the No Project Alternative. Similarly, public expenditures for each alternative are those expenditures on system capacity and system management beyond the No Project.

implementation of higher peak period bridge tolls. In reality, the revenues generated by new tolls would likely be reinvested in the transportation system and would generate additional user benefits that are not reflected in Figure 11. As a result, it is possible that the System Management Alternative would have a greater user benefit than the RTP Project Alternative.

The total annualized cost of projects and programs in the RTP Project Alternative is $777 million[6]. As shown in Table 4, this includes the annualized capital cost and annual operating cost for all new roadway and transit projects in the RTP Project Alternative.

Table 4: Total Public Expenditure, RTP Project Alternative ($millions)

	Transit Expansion	Roadway Expansion
Total Annualized Capital Expenditure	$ 498	$ 231
Total Annual Operations and Maintenance Expenditure	$ 43	$ 4
TOTAL Expenditure	$ 541	$ 235

The net benefit and benefit cost ratio calculations are shown in Table 5. The results suggest that for every dollar invested in the expansion projects in the Project Alternative, the region should realized more than $2 worth of benefits in terms of travel time savings and savings in out-of-pocket costs.

Table 5: Net Benefit and Benefit Cost Ratio, RTP Project Alternative

	Value
(a) Total User Benefits ($millions)	$ 1,771
(b) Total RTP Track 1 Public Expenditures ($millions)	$ 777
Net Benefit = (a) - (b) ($millions)	$ 994
Benefit Cost Ratio = (a) / (b)	2.3

[6] This number assumes a 4% discount rate. The measure was also calculated using a 7% discount rate. The results are shown in Tables A-5(2) - (3) in Appendix A.

3.4 COMMUNITY VITALITY

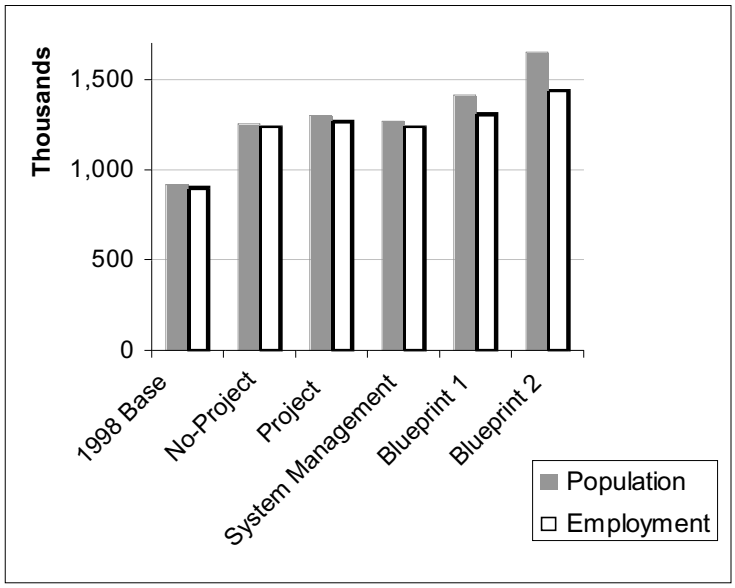
Measure 6: Population and Employment within Walking Distance of Major Transit Intermodal/Rail Stations

Tables A-6 in Appendix A for the complete results for Measure 6.

Comparison of 1998 to 2025

Both population and employment within walking distance of major transit stations are projected to increase from 1998 to the 2025 Project. (See Figure 12.) This results from regional growth in population and jobs and transit expansion projects that include new stations.

Figure 12: Population and Employment within 1/2 Mile of Major Intermodal/Rail Stations, 1998 and 2025



Comparison of Alternatives in 2025

Since land use assumptions are identical in all the 2025 alternatives, differences between alternatives simply reflect the number of new transit intermodal/rail stations in each alternative and where they are located (e.g., dense urban core versus less dense suburban areas).

The System Management Alternative adds the fewest major transit stations because of its emphasis on system operations and express buses rather than rail extensions; the alternative has roughly the same number of people and jobs within walking distance of major transit intermodal/rail stations as does the No Project. The Project Alternative adds more stations with major rail extensions such as BART to San Jose and new Amtrak stations in Solano County and thus results in a slight increase in the number of people and jobs within walking distance of major transit stops at the regional level. Blueprint 1 and

Blueprint 2 add substantially more stations and result in large increases in the number of people and jobs within walking distance: in Blueprint 1, there are 150,000 more people and 70,000 more jobs within walking distance of major transit intermodal/rail stations; in Blueprint 2, there are nearly 400,000 more people and 200,000 more jobs within walking distance of major intermodal/rail stations.

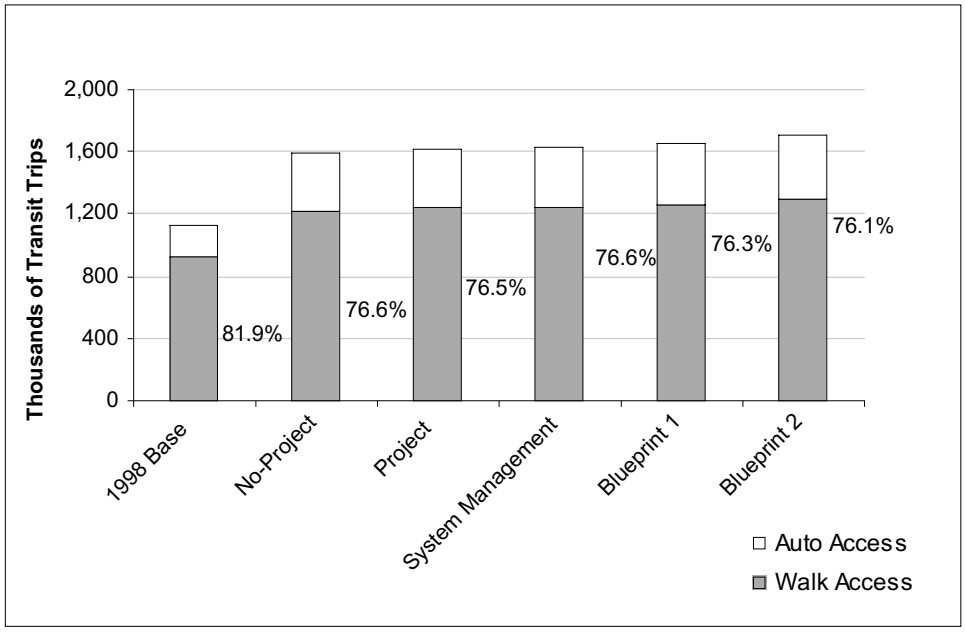
Measure 7: Transit Trips with Walk Access

Tables A-7 in Appendix A for the complete results for Measure 7.

Comparison of 1998 to 2025

Between 1998 and 2025, the number of transit trips with walk access is projected to increase by 300,000. (See Figure 13.) This reflects the significant growth in transit trips overall (about 500,000 new transit trips). However, there will be a decline in the share of regional transit trips with walk access from roughly 82% in 1998 to 77% in the 2025 Project.

Figure 13: Number and Share of Transit Trips with Walk Access, 1998 and 2025



Comparison of Alternatives in 2025

The 2025 alternatives offer only very slight increases, compared to the No Project, in the number of trips with walk access to transit. (See Figure 13.) The differences range from an increase of 23,000 trips (2%) in the Project to nearly 80,000 in Blueprint 2 (7%). These increases are comparable in percentage terms to the increases in total transit trips in the various alternatives, which were shown in Table 3.

It is interesting to note, that while total number of trips with walk access increases from the Project to Blueprint 2, the share of all transit trips that that involve walk access actually decreases somewhat. This may be explained by the fact that many of the new transit trips in the Blueprint Alternatives originate at new stations outside of the urban core, which require more automobile access.

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3.5 THE ENVIRONMENT

Measure 8: Air Quality – Vehicle Emissions

Tables A-8 in Appendix A for the complete results for Measure 8.

Comparison of 1998 to 2025

Vehicle emissions are expected to decrease for some pollutants and increase for others by 2025 as seen in Table 6. Reactive organic gases (ROG) and nitrogen oxide (NOx) are projected to decrease by 74% and 42% respectively. These reductions result from stringent regulations on automobile engines and fuels enacted by the California Air Resources Board. In contrast, both particulate matter (PM_{10}) and carbon dioxide (CO_2) emissions are projected to increase by more than 40% from 1998 to 2025. PM_{10} is related closely to vehicle miles traveled and the major component, road dust, would not be controlled by regulations on emissions from automobile engines (although a portion of the particulates would be produced through combustion). The increase in CO_2 is about the same as that in PM_{10}; CO_2 emissions could be sharply reduced if fuel economy standards were made more stringent by Congress in the future.

Table 6: Motor Vehicle Emissions, 1998 and 2025

			Change 1998 to 2025	
	1998 Base	2025 Project	value	pct.
Transportation Activity Data				
In-Use Vehicles	5,109,000	6,283,000	1,174,000	23%
VMT (000s)	128,000	191,000	63,000	49%
Engine Starts	21,264,000	27,726,000	6,462,000	30%
Vehicle Emissions (Tons/Day)*				
ROG	178.4	46.8	-131.6	-74%
NO_X	251.4	146.3	-105.0	-42%
PM_{10}	60	90	30	50%
CO_2	473.1	671.9	198.8	42%
ROG Budget	TBD once the new Federal air quality plan is submitted			
NO_X Budget	TBD once the new Federal air quality plan is submitted			

* Emissions based on CARB EMFAC-7G / BURDEN-7G Models except PM10 which includes entrained road dust.

Comparison of Alternatives in 2025

Generally, the 2025 alternatives result in decreases in vehicle emissions from the No Project Alternative, though, Blueprint 1 and Blueprint 2 result in small increases in NOx emissions. (See Table 7.) The Project would have slightly lower emissions than the No Project as a result of investments that increase transit trips, decrease VMT, and improve vehicle operating speeds. The System Management Alternative achieves the most reductions in all pollutants.

Table 7: Motor Vehicle Emissions, 2025 Alternatives

		Change Relative to No Project			
	No Project	Project	System Management	Blueprint 1	Blueprint 2
Transportation Activity Data					
In-Use Vehicles	6,283,000	0	0	0	0
VMT (000s)	192,000	-1,000	-2,000	-2,000	-3,000
Engine Starts	27,777,000	-51,000	-76,000	-90,000	-139,000
Vehicle Emissions (Tons/Day)*					
ROG	49.3	-2.5	-2.9	-2.8	-3.0
NO_X	146.5	-0.2	-0.6	0.7	0.2
PM_{10}	92.0	0.6	0.9	0.9	1.3
CO_2	687.5	-15.7	-21.1	-18.4	-21.0

Conformity Budget	
ROG	TBD once the new Federal air quality plan is submitted
NO_X	TBD once the new Federal air quality plan is submitted

* Emissions based on CARB EMFAC-7G / BURDEN-7G Models except PM10 which includes entrained road dust.

2.4 EQUITY[7]

Measure 9: Travel Time Distribution for Minority and Low-Income Communities

Tables A-9(1) – (2) in Appendix A for the complete results for Measure 9.

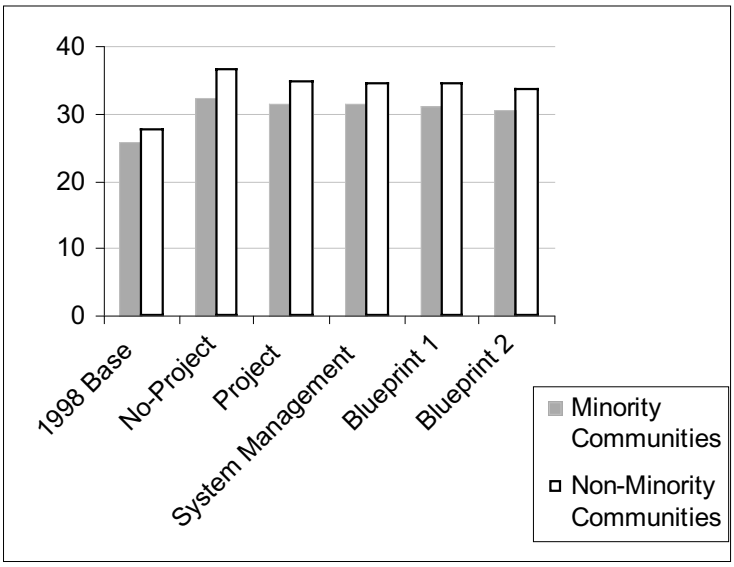
Comparison of 1998 to 2025

In both 1998 and the 2025 Project, travel times are expected to be lower for low-income and minority communities than for other communities. Also, the increases in travel time for minority and low-income communities is lower than that for other communities between 1998 and 2025. Figure 14 shows that the average travel time is expected to increases from 26 to 31 minutes for minority communities and from 28 to 35 minutes for non-minority communities. The change in travel times for low-income communities and not-low-income communities is almost identical, as shown in Figure 15.

Comparison of Alternatives in 2025

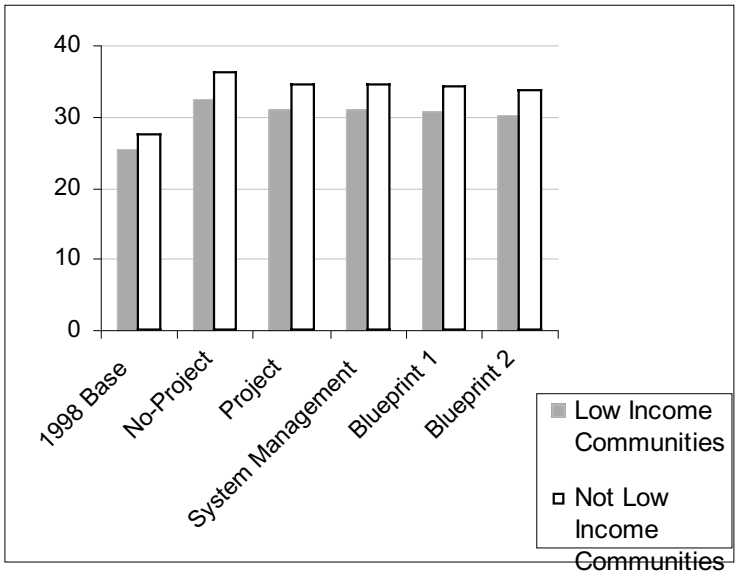
These patterns hold for the 2025 alternatives as well. The figures show that the reductions in average travel time for minority and low-income areas are comparable or better than those for non-minority and not-low-income areas for all 2025 alternatives.

Figure 14: Average Travel Time for Work Trips, Minority and Non-Minority Areas, 1998 and 2025



[7] This report includes only a summary of performance measures under the equity goal. A more complete analysis is included in the Equity Analysis for the 2001 RTP.

Figure 15: Average Travel Time For Work Trips, Low-Income and Not-Low-Income Areas, 1998 and 2025



RTP GOAL: EQUITY (CONTINUED)

Measure 10: Accessibility to Jobs for Minority and Low-Income Communities

Tables A-10 in Appendix A for the complete results for Measure 10.

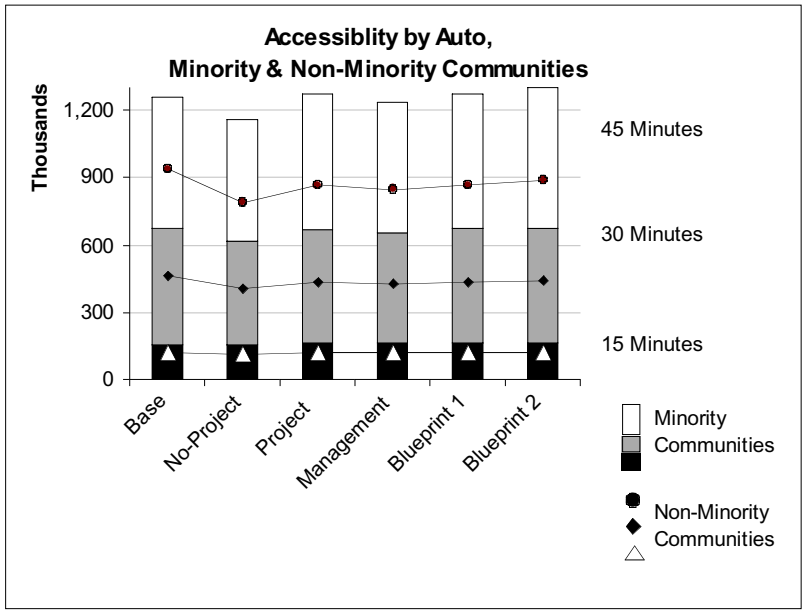
Comparison of 1998 to 2025

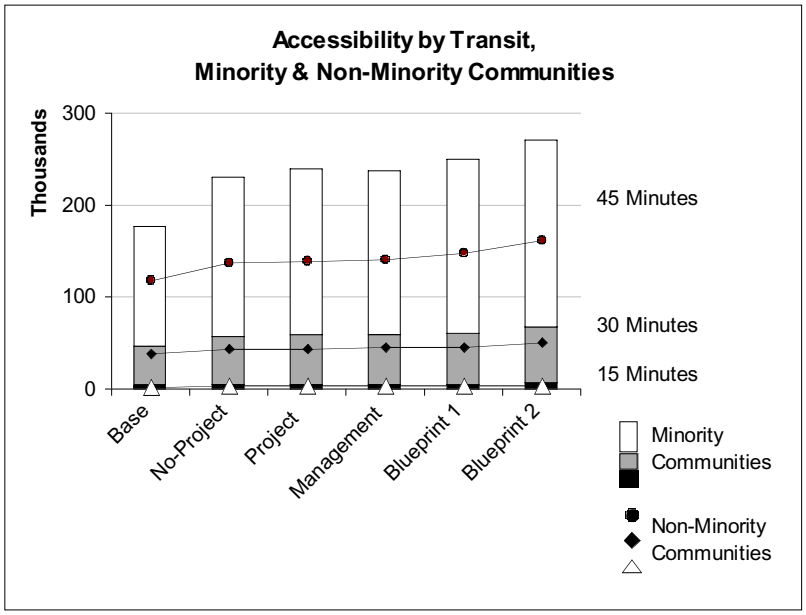
In Measure 3 (Accessibility to Jobs and Shopping) accessibility to jobs by transit, bicycle, and walking is projected to increase from 1998 to the 2025 Project while that by auto is projected to decrease. Figure 16 shows that low-income and minority communities tend to fare as well or better than other communities under these changes. Specifically, auto accessibility decreases the same or less for minority and low-income communities than for other communities, while transit accessibility increases as much or more. Figure 16 also shows that minority and low-income communities are expected to have higher accessibility to jobs by auto and transit than other communities in the 1998 Base and the 2025 Project. The explanation for these results lies in the fact that the low-income and minority communities tend to be located in the urban core and along the region's major transportation corridors.

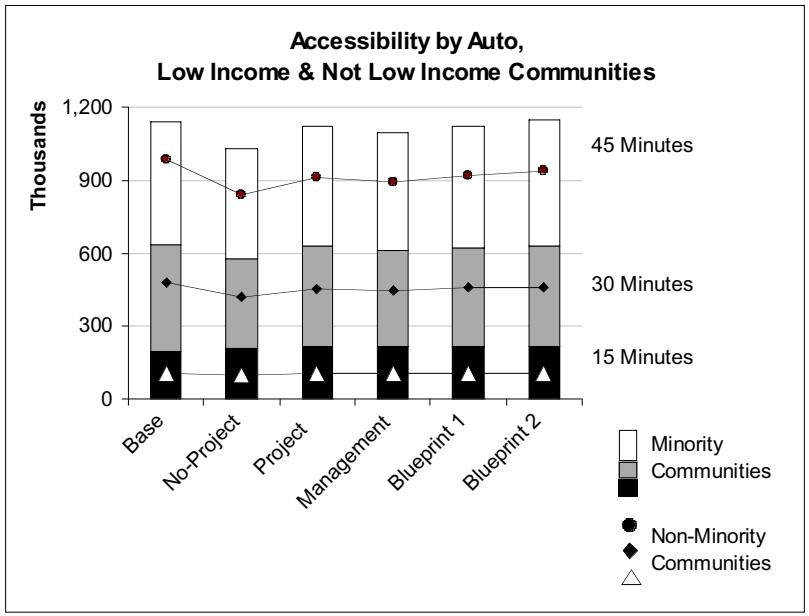
Comparison of Alternatives in 2025

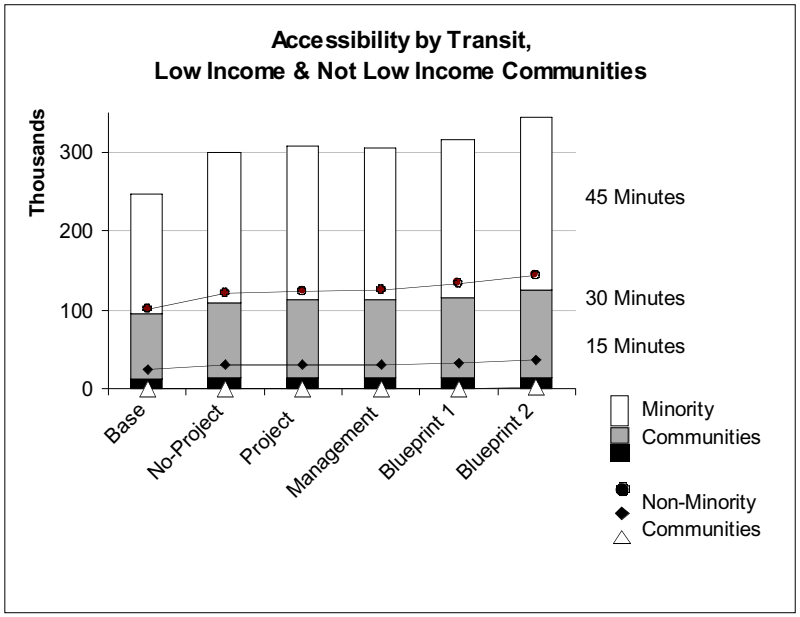
As with Measure 3, the RTP alternatives increase accessibility across the board, with the greatest increases for transit occurring in the Blueprint 2 Alternative. Again, Figure 16 demonstrates that low-income and minority communities will tend to fare as well or better than other communities in the 2025 alternatives. The number of jobs accessible by auto and transit from these communities remains higher than that for other non-target communities for all alternatives.

Figure 16: Accessibility to Jobs for Minority and Low-Income Communities Compared to Other Communities, 1998 and 2025









RTP GOAL: EQUITY (CONTINUED)

Measure 11: Transit Travel Time to Select Job Centers from Low-Income and Minority Communities

Tables A-11 in Appendix A for the complete results for Measure 11.

Comparison of 1998 to 2025

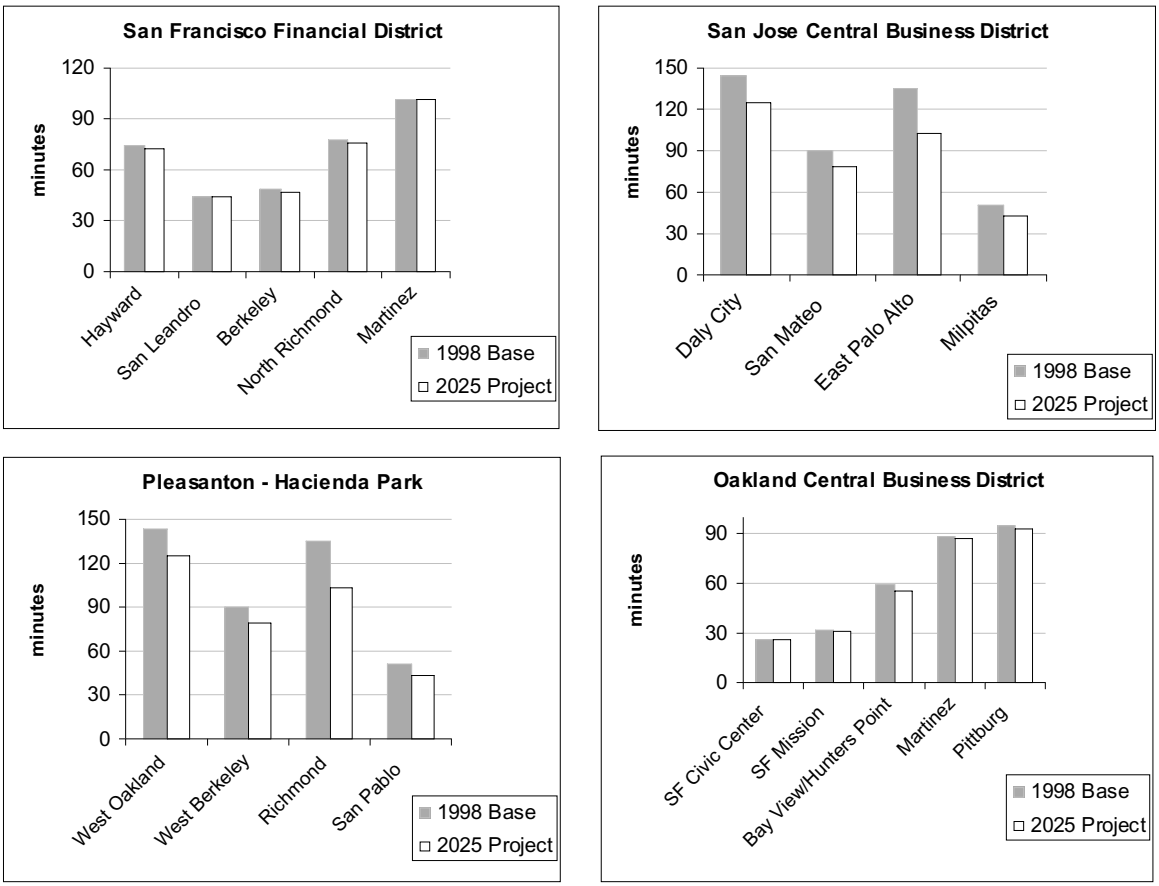
Several of the measures in this report have demonstrated that transit travel times are expected to decrease from 1998 to the 2025 Project due to rail extensions and other transit service enhancements. This is also generally true of transit travel times from low-income and minority communities to the region's job centers. Figure 17 shows transit travel times from the low-income and minority communities to selected job centers.

In some cases, such as travel to the San Francisco Financial Center and the Oakland Central Business District, the improvements in transit travel times are small because the existing transit system is already robust. Transit travel times to the other job centers show larger improvements. For example, travel times to San Jose would decrease as a result of Caltrain improvements and the BART extension included in the 2025 Project Alternative. Transit travel times to Hacienda Business Park would decrease as a result of more BART service.

Comparison of Alternatives in 2025

In most cases, the RTP 2025 alternatives are expected to reduce travel times compared to the No Project as well. (See Tables 11A and 11B in Appendix A.) Again, the reductions are due principally to rail extensions, new express buses, other transit service enhancements, and new carpool lanes. The Blueprint 2 Alternative, which includes the largest number of projects to expand and enhance transit service, produces the greatest reductions in travel time. For example, improvements in transit travel time to San Jose Central Business District from points on the Peninsula reflect Caltrain improvements (such as electrification) in the Project, Blueprint 1 and Blueprint 2 Alternatives. Travel time improvements to Pleasanton and Oakland reflect service improvements in BART and in BART-bus connections.

Figure 17: Transit Travel Times[8] from Minority and Low-Income Communities to Selected Job Centers, Comparison of 1998 Base and 2025 Project



[8] Transit travel times assume walk access.

Chapter 4
Observations and Suggestions for Future RTP Performance Analyses

This section offers preliminary observations and suggestions about the use of performance measures in assessing the RTP and comparing RTP alternatives. These comments relate to the results in this report as well as earlier discussions with the Performance Measure Working Group that helped develop the measures. As the report is reviewed by a larger audience, additional suggestions will certainly emerge and be considered in the ongoing efforts addressing this topic.

OBSERVATIONS

Differences between EIR Alternatives

The $7.7 billion investment program in the RTP Project Alternative represents a rather limited set of improvements on the margin of a well-established system. As reviewed in Chapter 3, new roadway and transit capacity in the RTP Project amounts to increases of 2% and 8% respectively from the No Project Alternative, and thus the performance results were not expected to be significantly different between these two options. The analysis also demonstrates that the improvements and strategies in the System Management and Blueprint Alternatives do have a measurable impact on the performance measures results. Furthermore, the impact occurs in the expected direction, i.e., a more robust system provide across-the-board improvements in the measures.

Travel Demand Models

There has been a concern among some working group participants that the existing MTC travel demand model may not support some measures that will ultimately prove to be useful. The regional travel demand model was developed to provide credible results at the regional and corridor levels to support major investment decisions. Some people would like to see greater focus on non-motorized trips or consideration of the impacts of smaller-scale projects on local communities. This would require a major investment in data collection and model refinement.

Interest in Measures not Analyzed

There was extensive discussion among the working group participants about the appropriateness of a few measures that ultimately were not included in this report: congestion, vehicle miles traveled (VMT) and transportation mode share. (These statistics are reported elsewhere, such as in the RTP itself and the EIR.) Some feel that the lack of a measure of congestion is a significant shortcoming since data and common experience suggest that traffic congestion increased dramatically with the recent economic boom, focusing public attention on the need for increased efforts to reduce congestion. Other people feel that measuring congestion puts too much emphasis on congestion relief for automobiles and that there ought to be an equal emphasis on improvements for users of all modes of transportation. Similarly, participants in the working group differed on the importance of including VMT and transportation mode share as performance measures. Some argue that reduction of VMT and a shift in mode share away from automobiles should be pursued as objectives in and of themselves. Others argue that these are ambiguous measures. For example, increasing VMT may represent greater mobility and, as

shown in this report does not imply a worsening of air quality in the form of ozone once the tough controls on auto emissions and fuels are factored into the calculations.

The issue of project evaluation has also been well discussed and remains unresolved. There are over 200 projects in the 2001 RTP. Major projects undergo extensive analysis and public review at the local level through corridor studies and in the environmental review process. These studies are based on specific project objectives and are conducted at a more detailed level than is possible in the RTP. Some working group participants felt it would be beneficial to conduct a less detailed but uniform analysis of all projects proposed for inclusion in the RTP based on a common set of objectives and methodologies. Others believe this would duplicate the project-level studies that are already required and would lead to "second guessing" of the conclusions from more comprehensive local analyses. These participants point out that many of the studies have already undergone extensive public review and involvement by the time the projects are submitted for inclusion in the RTP.

SUGGESTIONS

Implement a Program to Monitor Performance of the Existing System

A number of aspects of system performance of interest to the public cannot be reasonably forecasted into the future as is required in the RTP development, e.g., reliability of travel time, safety, and customer satisfaction. All members of the working group agreed it is possible and worthwhile to assess these aspects through a system monitoring program which could show how the performance of the existing system is changing over time.

Streamline the Performance Measure Report by Reducing the Amount of Data

This report should be streamlined by reducing rather than expanding the number of measures and the number of elements reported for each measure. A primary objective is to present the performance results in a manner that is easy to understand and that focuses attention on the most important measures. The number of measures and, in particular, the fact that several measures have numerous sub-elements, made this task extremely challenging. Ultimately, the performance results for many of the sub-elements were relegated to the appendices as the amount of data was simply overwhelming.

Develop Objectives for the Goals

A recurrent theme was the lack of specific objectives for each RTP goal. Several working group members believed that having explicit objectives was a necessary element in the design of a performance measures approach. However, some objectives may, like the goals themselves, be difficult to assess quantitatively. One possibility may be to use qualitative measures for certain goals, thus replacing more complicated measures with less complicated and more intuitive measures.

Suggestions for Specific Measures

Table 8 lists suggestions for specific performance measures based on the preparation of this report. Some suggestions apply to more than one measure. These are discussed below:

- Measures that rely on selection of a few individual geographic /analysis zones may under-represent trends in a larger market. Measures 2, 4, and 10 are examples. As currently

calculated, they require identification of specific neighborhoods/zones which are represented in the MTC . Performance measures results are potentially overly sensitive to modeling assumptions. It may be better to use a method that allows groups of neighboring zones to be analyzed as being more representative of a market, if such a method could be developed.

- The accessibility measures under mobility, economic vitality and equity (Measures, 3, 4 and 11) are compromised since they likely underestimate benefits because they depend on specific travel time contours (or isochrones). For example, a case in which travel time improves from 29 minutes to 20 minutes will not be recognized as a benefit because the change does not cross one of the travel time thresholds (15, 30, 45 minutes); yet this change is more significant than a shift from 46 to 44 minutes, which would be counted. The isochron-bsed measures chosen for this report were used because it was felt that they were more readily understood than alternative methodologies; however, it is probably worthwhile to give further consideration to alternatives.

Table 8: Suggestions for Specific Measures

Measure	Suggestion
Measure 1: Aggregate travel time and travel time distribution (average, median, and 90th percentile travel time)	• Not clear that it is useful to report the median and 90th percentile travel time, given the additional work required. The changes in these values are consistent with those for the average travel time.
Measure 2: Travel time between select origin and destination pairs	• Results are highly dependent on the specific origins and destinations selected and thus may not be totally representative. • Simplify by reducing the number of pairs considered in the appendices.
Measure 3: Accessibility to jobs and shopping	• Likely underestimates benefits. • Simplify by eliminating accessibility to shopping, as the differences among alternatives mirrored those for all jobs. • If isochronal method is retained, simplify by measuring the number of accessible jobs rather than the share. • Do not report walk and bike access unless there are changes in land use assumptions.
Measure 4: Access of employers in major job centers to the region's workforce	See notes for Measure 3. This measure is less useful than Measure 3 due to need to identify a few specific zones.
Measure 5: Net benefit/Cost benefit ratio	• Limited information on project costs prohibited calculation of the complete measure for alternatives other than the Project.

Measure	Suggestion
Measure 6: Population and employment within _ mile of major rail/transit intermodal stations	• Measure is most meaningful if there are changes in land use assumptions.
Measure 7: Number of trips that use walking to access transit	• Measure is most meaningful if there are changes in land use assumptions.
Measure 8: Vehicle emissions	None
Measure 9: Travel time distribution for minority and low-income communities	See comments for Measure 1
Measure 10: Accessibility to jobs from minority and low-income communities	See comments above for Measure 3.
Measure 11: Transit travel time to major job centers from minority and low-income communities	See comments for Measure 4.

Joseph P. Bort MetroCenter
101 Eighth Street
Oakland, California 94607
TEL (510)464-7700
TDD/TTY (510)464-7769
FAX (510)464-7848
E-MAIL info@mtc.ca.gov
WEB www.mtc.ca.gov

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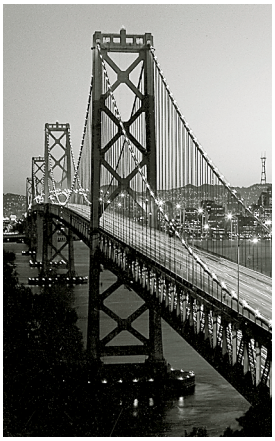

PERFORMANCE MEASURES REPORT FOR THE 2001 REGIONAL TRANSPORTATION PLAN FOR THE SAN FRANCISCO BAY AREA

APPENDIX A
DETAILED ANALYSIS RESULTS

AUGUST 2001

RTP Goal: Mobility of Persons and Freight

Measure 1: Aggregate Travel Time and Travel Time Distribution

Table A-1(1): Aggregate Travel Time and Travel Time Distribution

	1998	2025				
	Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Aggregate Travel Time (daily person hours of travel)						
Work Trips						
Drive Alone	1,437,000	2,705,000	**2,544,000**	**2,520,000**	**2,511,000**	**2,458,000**
Carpool	355,000	680,000	**633,000**	**635,000**	**615,000**	**593,000**
Transit	389,000	672,000	693,000	694,000	**709,000**	**709,000**
Bicycle	17,000	27,000	26,000	26,000	**25,000**	**25,000**
Walk	80,000	104,000	102,000	102,000	101,000	101,000
TOTAL	2,279,000	4,187,000	3,998,000	**3,977,000**	**3,962,000**	**3,886,000**
Non-Work Trips						
Auto	2,751,000	3,765,000	3,680,000	3,661,000	3,663,000	3,630,000
Transit	374,000	504,000	510,000	516,000	517,000	522,000
Bicycle	70,000	90,000	89,000	89,000	88,000	88,000
Walk	681,000	988,000	988,000	988,000	987,000	985,000
TOTAL	3,876,000	5,347,000	5,267,000	5,253,000	5,254,000	5,224,000
Total Personal Trips	6,154,000	9,534,000	9,265,000	9,230,000	9,216,000	9,110,000
Truck Trips (vehicle hours of travel)						
Truck Trips	110,000	180,000	174,000	174,000	173,000	171,000
Aggregate Trips (daily person trips)						
Work Trips						
Drive Alone	3,679,000	5,109,000	5,089,000	5,079,000	5,074,000	5,060,000
Carpool	687,000	998,000	998,000	1,001,000	992,000	985,000
Transit	471,000	726,000	747,000	754,000	**769,000**	**790,000**
Bicycle	49,000	65,000	64,000	64,000	64,000	64,000
Walk	148,000	180,000	179,000	179,000	179,000	178,000
TOTAL	5,034,000	7,078,000	7,078,000	7,078,000	7,078,000	7,078,000
Non-Work Trips						
Auto	12,619,000	15,490,000	15,479,000	15,474,000	15,470,000	15,449,000
Transit	658,000	859,000	871,000	878,000	884,000	**909,000**
Bicycle	222,000	281,000	279,000	279,000	278,000	277,000
Walk	1,707,000	2,520,000	2,520,000	2,518,000	2,517,000	2,513,000
TOTAL	15,206,000	19,149,000	19,149,000	19,149,000	19,149,000	19,149,000
Total Personal Trips	20,240,000	26,227,000	26,227,000	26,227,000	26,227,000	26,227,000
Truck Trips						
Truck Trips	257,000	356,000	356,000	356,000	356,000	356,000

Bold indicates more than 5% decrease from the No Project

Bold indicates more than 5% increase from the No Project

Table A-1(1): Aggregate Travel Time and Travel Time Distribution (continued)

	1998	2025				
	Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Average Travel Time (average minutes per trip)						
Work Trips						
Drive Alone	23	32	30	30	30	29
Carpool	31	41	38	38	37	36
Transit	50	56	56	55	55	54
Bicycle	21	25	24	24	24	24
Walk	33	35	34	34	34	34
TOTAL	27	35	34	34	34	33
Non-Work Trips						
Auto	13	15	14	14	14	14
Transit	34	35	35	35	35	34
Bicycle	19	19	19	19	19	19
Walk	24	24	24	24	24	24
TOTAL	15	17	17	16	16	16
Total Personal Trips	18	22	21	21	21	21
Truck Trips - Total	26	30	29	29	29	29
Median Travel Time (minutes per trip)						
Work Trips						
Drive Alone	19	25	24	24	24	24
Carpool	25	32	31	31	30	30
Transit	44	50	50	50	50	49
Bicycle	15	17	17	17	17	17
Walk	20	20	20	20	20	20
TOTAL	22	28	27	27	27	27
Non-Work Trips						
Auto	10	10	10	10	10	10
Transit	31	32	31	31	31	31
Bicycle	13	13	13	13	13	13
Walk	20	20	20	20	20	20
TOTAL	12	13	13	13	13	13
Total Personal Trips	14	15	15	15	15	15
Truck Trips - Total	20	23	23	23	23	23
90th Percentile Travel Time (minutes per trip)						
Work Trips						
Drive Alone	46	65	60	**60**	**60**	**58**
Carpool	58	79	**72**	**72**	**69**	**67**
Transit	83	94	94	92	93	90
Bicycle	45	56	54	54	53	53
Walk	61	67	66	66	65	65
TOTAL	53	70	67	66	66	**64**
Non-Work Trips						
Auto	25	29	28	28	28	28
Transit	56	58	58	58	58	57
Bicycle	42	43	43	43	43	43
Walk	44	41	41	41	41	41
TOTAL	27	30	29	29	29	29
Total Personal Trips	35	45	43	43	43	**42**
Truck Trips - Total	52	61	60	60	60	59

Bold indicates more than 5 minute decrease from the No Project
Bold indicates more than 5 minute increase from the No Project

Table A-1(2): Aggregate Travel Time and Average Travel Time by Corridor

Description	1998	No Project	Project	System Management	Blueprint 1	Blueprint 2
Aggregate Travel Time (person hours)						
Golden Gate	633,000	1,043,000	**981,000**	**993,000**	1,001,000	1,002,000
North Bay East-West	53,000	115,000	**107,000**	**107,000**	**107,000**	**104,000**
Transbay - Richmond / San Rafael	47,000	105,000	**96,000**	**97,000**	**96,000**	**94,000**
San Francisco/Oakland	443,000	756,000	735,000	731,000	732,000	699,000
Dumbarton, San Mateo-Hayward	130,000	242,000	234,000	233,000	231,000	**218,000**
San Francisco	1,576,000	2,188,000	2,153,000	2,144,000	2,148,000	2,101,000
Peninsula	1,075,000	1,561,000	1,539,000	1,535,000	1,526,000	1,507,000
Santa Clara	1,811,000	2,756,000	2,711,000	2,695,000	2,695,000	2,688,000
Fremont/South Bay	319,000	482,000	471,000	473,000	468,000	467,000
Metro East Bay	684,000	935,000	912,000	912,000	908,000	901,000
Sunol Gateway	92,000	227,000	221,000	**215,000**	**213,000**	**207,000**
Tri-Valley Livermore	130,000	287,000	280,000	278,000	279,000	274,000
Diablo	350,000	613,000	591,000	**584,000**	**581,000**	**568,000**
Delta	150,000	295,000	287,000	288,000	284,000	276,000
Eastshore-North	329,000	570,000	546,000	**537,000**	**538,000**	**533,000**
Napa Valley	97,000	199,000	**176,000**	**170,000**	**166,000**	**164,000**
Number of Trips (person trips)						
Golden Gate	1,997,000	2,676,000	2,676,000	2,676,000	2,676,000	2,676,000
North Bay East-West	59,000	102,000	102,000	102,000	102,000	102,000
Transbay - Richmond / San Rafael	48,000	86,000	86,000	86,000	86,000	86,000
San Francisco/Oakland	540,000	769,000	769,000	769,000	769,000	769,000
Dumbarton, San Mateo-Hayward	177,000	262,000	262,000	262,000	262,000	262,000
San Francisco	3,300,000	3,915,000	3,915,000	3,915,000	3,915,000	3,915,000
Peninsula	2,994,000	3,675,000	3,675,000	3,675,000	3,675,000	3,675,000
Santa Clara	6,154,000	7,885,000	7,885,000	7,885,000	7,885,000	7,885,000
Fremont/South Bay (screenline)	212,000	296,000	296,000	296,000	296,000	296,000
Metro East Bay	2,577,000	3,034,000	3,034,000	3,034,000	3,034,000	3,034,000
Sunol Gateway	119,000	226,000	226,000	226,000	226,000	226,000
Tri-Valley Livermore	503,000	872,000	872,000	872,000	872,000	872,000
Diablo	1,449,000	1,951,000	1,951,000	1,951,000	1,951,000	1,951,000
Delta	514,000	910,000	910,000	910,000	910,000	910,000
Eastshore-North	1,591,000	2,196,000	2,196,000	2,196,000	2,196,000	2,196,000
Napa Valley	352,000	531,000	531,000	531,000	531,000	531,000
Average Travel Time (mintes per trip)						
Golden Gate	19	23	22	22	22	22
North Bay East-West	54	68	63	63	63	**61**
Transbay - Richmond / San Rafael	59	73	67	**68**	**67**	**66**
San Francisco/Oakland	49	59	57	57	57	55
Dumbarton, San Mateo-Hayward	44	55	54	53	53	**50**
San Francisco	29	34	33	33	33	32
Peninsula	22	25	25	25	25	25
Santa Clara	18	21	21	21	21	20
Fremont/South Bay (screenline)	90	98	95	96	95	95
Metro East Bay	16	18	18	18	18	18
Sunol Gateway	46	60	59	57	57	55
Tri-Valley Livermore	16	20	19	19	19	19
Diablo	14	19	18	18	18	17
Delta	18	19	19	19	19	18
Eastshore-North	12	16	15	15	15	15
Napa Valley	17	22	20	19	19	19

Bold indicates a decrease of 5% or more in aggregate travel time or 5 minutes or more in average travel time

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Table A-2(1): Travel Time between Selected Origins and Destinations (AM Peak Period, minutes)

Corridor		1998 Base			2025 No Project			2025 Project			
From	**To**	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	
San Francisco											
Bayshore 3rd/Palou	Financial District	15	22	43	15	22	41	14	21	**35**	Central Subway
Sunset Dist UCSF	Fort Mason	26	32	58	26	33	60	25	32	60	
North Beach	South of Market Moscone Ctr	12	19	31	12	19	28	12	19	28	
Silicon Valley											
Gilroy	San Jose Market\Santa Clara	46	50	78	52	52	83	51	48	83	
Milpitas Northeast	Lockheed	27	28	71	41	36	40	37	35	40	
Los Gatos	San Jose Airport	23	30	81	25	32	83	24	31	82	
Palo Alto	Santa Clara Agnews West	29	29	80	33	32	81	32	31	78	
Eastshore-South											
Fremont Mission SJ	Oakland City Center	46	51	53	54	53	53	52	52	57	
Hawyard Hills	Fremont Warm Springs	37	43	n/a	50	42	67	**42**	39	**36**	Hayward Bypass, BART to Warm Springs
Emeryville	Oakland Airport	20	27	41	23	30	44	23	30	43	
Tri-Valley											
Livermore	Pleasanton Hacienda	17	24	64	33	40	78	29	**30**	**73**	I-580 HOV, Improved transfers
Pleasanton	Hayward CSU	37	44	79	60	67	79	56	63	79	I-580 HOV, Improved transfers
Diablo											
Cordelia	Walnut Creek BART area	36	43	49	60	67	72	57	**58**	**64**	I-680 HOV lanes (Contra Costa)
Clayton	San Ramon Bishop Ranch	48	50	68	68	62	73	64	60	73	
Lafayette	Concord	15	22	34	17	24	32	17	24	32	
Delta											
Brentwood East	Walnut Creek BART area	59	66	62	68	67	60	64	62	56	
Martinez South of SR 4	Richmond Chevron	46	47	89	65	62	102	**59**	**52**	102	SR 4 widening
Eastshore-North											
Vacaville North	Vallejo	42	49	n/a	94	101	n/a	**68**	**68**	n/a	I-80 HOV lanes (Solano)
Fairfield	Berkeley UC	69	67	90	132	110	109	**107**	**77**	109	I-80 HOV lanes (Solano & Contra Costa) & express bus
Richmond Hilltop Mall	Emeryville	25	24	50	32	27	47	31	26	48	
North Bay East West											
Vallejo Columbus Pwky	Novato	49	56	n/a	63	70	n/a	62	69	n/a	
Petaluma	Fairfield	80	87	n/a	104	110	n/a	**87**	**88**	n/a	I-80 HOV lanes (Solano); Rtes. 12 and 29 improvements

Bold indicates a decrease of 5 minutes or more from the No Project

Bold indicates an increase of 5 minutes or more from the No Project

Table A-2(1): Travel Time between Selected Origins and Destinations (AM Peak Period, minutes) (continued)

Corridor		2025 System Management			2025 Blueprint 1			2025 Blueprint 2			
From	**To**	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	
San Francisco											
Bayshore 3rd/Palou	Financial District	15	22	**35**	14	21	**35**	14	21	37	Central Subway
Sunset Dist UCSF	Fort Mason	26	32	59	25	32	59	25	32	**49**	Geary LRT
North Beach	South of Market Moscone Ctr	12	19	28	12	19	28	12	19	28	
Silicon Valley											
Gilroy	San Jose Market\Santa Clara	48	**43**	**61**	51	47	**59**	51	48	**36**	Caltrain/ bus improvements & High Speed Rail (BP 2)
Milpitas Northeast	Lockheed	36	36	40	36	33	40	37	36	39	
Los Gatos	San Jose Airport	24	31	84	25	32	84	25	32	84	
Palo Alto	Santa Clara Agnews West	32	30	**68**	32	31	**67**	32	31	**67**	
Eastshore-South											
Fremont Mission SJ	Oakland City Center	54	53	55	52	52	55	52	53	53	
Hawyard Hills	Fremont Warm Springs	**42**	37	**36**	**43**	41	**36**	**42**	39	**35**	Hayward Bypass, BART to Warm Springs
Emeryville	Oakland Airport	23	30	43	23	30	43	23	30	42	
Tri-Valley											
Livermore	Pleasanton Hacienda	33	**35**	**72**	34	36	**49**	29	**32**	**47**	I-580 HOV lanes, Hayward Bypass, Rail Ext. to Livermore
Pleasanton	Hayward CSU	**53**	**60**	77	**51**	**57**	79	**51**	**57**	75	
Diablo											
Cordelia	Walnut Creek BART area	50	**41**	**48**	**46**	**46**	**52**	**44**	**46**	**48**	I-680 HOV lanes (Contra Costa)
Clayton	San Ramon Bishop Ranch	66	63	76	65	62	75	**59**	58	70	
Lafayette	Concord	17	24	32	17	24	32	17	24	29	
Delta											
Brentwood East	Walnut Creek BART area	66	64	55	64	**61**	**66**	**58**	**57**	**52**	Rail to Brentwood & SR 4 impr
Martinez South of SR 4	Richmond Chevron	**54**	**52**	97	**56**	**52**	101	**54**	**51**	**85**	
Eastshore-North											
Vacaville North	Vallejo	**63**	**63**	n/a	**63**	**55**	n/a	**60**	**53**	n/a	I-80 HOV lanes (Solano)
Fairfield	Berkeley UC	**93**	**71**	109	**100**	**71**	108	**93**	**69**	**93**	I-80 HOV lanes (Solano), BART improvements
Richmond Hilltop Mall	Emeryville	29	25	44	31	25	44	30	26	**36**	BART Ext. to Hilltop
North Bay East West											
Vallejo Columbus Pwky	Novato	62	68	n/a	62	69	n/a	60	65	n/a	
Petaluma	Fairfield	**86**	**87**	n/a	**81**	**84**	n/a	**80**	**76**	n/a	I-80 HOV lanes (Solano); Rtes. 12 and 29 improvements

Bold indicates a decrease of 5 minutes or more from the No Project
Bold indicates an increase of 5 minutes or more from the No Project

Table A-2(1): Travel Time between Selected Origins and Destinations (AM Peak Period, minutes) (continued)

Corridor		1998 Base			2025 No Project			2025 Project			
From	**To**	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	
Transbay - San Rafael Bridge											
Novato	El Cerrito del Norte BART	40	41	96	47	41	120	46	41	107	Express bus on 101
Transbay - Bay Bridge											
Walnut Creek BART area	San Francisco Market/Embarcadero	66	56	47	103	91	46	100	88	46	
Oakland Laney College	San Francisco Mission Bay	42	32	39	63	51	40	62	50	40	
San Francisco Civic Center	Berkeley UC	27	34	47	36	42	45	33	40	45	
Transbay - Dumbarton/ San Mateo Bridges											
Union City BART	Redwood Shores	46	38	112	62	49	n/a	62	50	n/a	Dumbarton Express
Hayward Hills	Foster City	39	41	106	56	47	n/a	53	45	n/a	Bus slowed by bridge traffic
Fremont South Bay											
Union City BART	Lockheed	45	43	89	60	46	104	55	44	**63**	BART to San Jose
Fremont Mission SJ	San Jose Market\Santa Clara	28	35	70	34	36	83	34	34	**41**	BART to San Jose
Sunol Gateway											
Livermore	Fremont Warm Springs	50	57	n/a	66	58	114	64	57	**82**	BART to San Jose
Danville	Lockheed	72	72	141	123	94	98	**116**	91	98	
Golden Gate											
Santa Rosa	Petaluma	28	35	55	33	37	66	31	**30**	**54**	US 101 HOV lanes & Express bus
Santa Rosa	San Rafael	72	74	109	103	97	133	**84**	**59**	**99**	US 101 HOV lanes & Express bus
San Rafael	San Francisco Market/Embarcadero	55	56	69	73	74	68	71	73	69	
Peninsula											
Los Altos Hills	San Francisco Airport	44	51	135	58	65	140	59	66	142	
Palo Alto	San Francisco Mission Bay	52	58	69	61	67	75	60	66	72	
Daly City Westmoor Park	Redwood Shores	37	44	136	43	50	95	40	47	93	
San Francisco Market/Embarcadero	Foster City Civic Center	41	48	110	46	53	116	44	51	116	
Napa Valley											
Callistoga	Napa	69	76	127	67	74	125	68	75	125	
Napa	Vallejo	30	37	68	50	57	105	**36**	**43**	**79**	Rte. 29 interchange improvements

Bold indicates a decrease of 5 minutes or more from the No Project

Bold indicates an increase of 5 minutes or more from the No Project

Table A-2(1): Travel Time between Selected Origins and Destinations (AM Peak Period, minutes) (continued)

Corridor		2025 System Management			2025 Blueprint 1			2025 Blueprint 2			
From	**To**	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	Drive Alone	Carpool	Transit	
Transbay - San Rafael Bridge											
Novato	El Cerrito del Norte BART	45	41	109	47	41	91	47	41	83	Express bus on 101 & NWP Rail
Transbay - Bay Bridge											
Walnut Creek BART area	San Francisco Market/Embarcadero	98	**85**	46	101	**85**	46	**88**	**76**	45	HOV improvements
Oakland Laney College	San Francisco Mission Bay	61	49	40	61	49	40	**56**	**44**	39	
San Francisco Civic Center	Berkeley UC	34	41	45	34	41	45	34	40	42	
Transbay - Dumbarton/ San Mateo Bridges											
Union City BART	Redwood Shores	58	**33**	**<u>117</u>**	60	48	**<u>127</u>**	**52**	**40**	**<u>126</u>**	Express bus on Dumbarton Br &
Hayward Hills	Foster City	51	**32**	**<u>127</u>**	51	44	**<u>139</u>**	**47**	**34**	**<u>125</u>**	Dumbarton Br & Rail in BP alts
Fremont South Bay											
Union City BART	Lockheed	57	41	**66**	**54**	43	**63**	56	46	**62**	BART to SJ (Blueprint 1 & 2)
Fremont Mission SJ	San Jose Market\Santa Clara	34	35	**40**	35	36	**39**	32	35	**38**	BART to SJ (Blueprint 1 & 2)
Sunol Gateway											
Livermore	Fremont Warm Springs	66	54	**81**	**<u>73</u>**	57	**90**	**<u>72</u>**	**52**	**78**	BART to San Jose & Rail to Livermore
Danville	Lockheed	**112**	**75**	94	**111**	**78**	93	**106**	**74**	**92**	I-680 HOV improvements
Golden Gate											
Santa Rosa	Petaluma	31	**30**	**54**	31	**30**	**54**	31	**30**	**54**	US 101 HOV, NWP Rail
Santa Rosa	San Rafael	**85**	**60**	**103**	**83**	**60**	**76**	**83**	**60**	**76**	US 101 HOV, NWP Rail
San Rafael	San Francisco Market/Embarcadero	69	71	68	72	74	68	70	71	68	
Peninsula											
Los Altos Hills	San Francisco Airport	57	63	**115**	56	63	**114**	56	63	**112**	Caltrain Improvements
Palo Alto	San Francisco Mission Bay	60	62	**62**	59	65	**62**	59	65	**62**	Caltrain Improvements
Daly City Westmoor Park	Redwood Shores	40	47	**94**	40	47	**83**	40	47	**80**	
San Francisco Market/Embarcadero	Foster City Civic Center	44	51	**105**	44	51	**94**	44	51	**90**	Caltrain Improvements
Napa Valley											
Callistoga	Napa	68	75	125	68	75	126	68	75	126	
Napa	Vallejo	**35**	**42**	**80**	**26**	**34**	**70**	**27**	**34**	**70**	Rte. 29 interchange improvements

Bold indicates a decrease of 5 minutes or more from the No Project
<u>Bold</u> indicates an increase of 5 minutes or more from the No Project

RTP Goal: Mobility of Persons and Freight

Measure 2: Travel Time between Selected Origins and Destinations

Table A-2(2): Travel Time between Selected Truck Origins and Destinations (AM Peak Period, minutes)

		1998	2025				
From	**To**	Base	No Project	Project	System Management	Blueprint 1	Blueprint 2
San Francisco Central Business Disrtrict	San Francisco Airport	32	36	34	33	34	33
Mountain View	Oakland Airport	62	75	**67**	**81**	73	73
Santa Clara	Port of Oakland	62	79	76	77	75	76
Gilroy	Santa Clara	57	67	62	**59**	62	62
Livermore (Altamont Pass)	Warm Springs (NUMMI Plant)	54	67	68	69	72	**74**
Livermore (Altamont Pass)	Port of Oakland	59	89	84	**81**	**79**	**78**
Pleasanton	Oakland Airport	49	71	**64**	66	66	66
Wam Springs (NUMMI Plant)	Port of Oakland	51	60	58	59	58	56
Vallejo	San Francisco Central Business Disrtrict	80	128	**121**	**113**	**118**	**104**
Dixon (Sacramento County Line)	Port of Oakland	93	178	**148**	**134**	**138**	**128**
Napa	Port of Oakland	80	129	**110**	**100**	**98**	**90**
Petaluma	Port of Oakland	73	106	**88**	**87**	**86**	**86**

Bold indicates a decrease of 5 minutes or more from the No Project
Bold indicates an increase of 5 minutes or more from the No Project

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Table A-3: Accessibility to All Jobs and Retail Jobs

	1998	2025				
	Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Number of Total Jobs Accessible by Auto						
Within 15 minutes	127,000	122,000	128,000	128,000	129,000	129,000
Within 30 minutes	513,000	452,000	490,000	481,000	491,000	496,000
Within 45 minutes	1,016,000	876,000	957,000	933,000	961,000	**981,000**
Number of Total Jobs Accessible by Transit*						
Within 15 minutes	4,000	5,000	5,000	5,000	5,000	**6,000**
Within 30 minutes	55,000	70,000	74,000	74,000	**81,000**	**93,000**
Within 45 minutes	209,000	269,000	291,000	291,000	**322,000**	**362,000**
Number of Retail Jobs Accessible by Auto						
Within 15 minutes	21,000	18,000	19,000	20,000	20,000	20,000
Within 30 minutes	81,000	65,000	70,000	69,000	71,000	72,000
Within 45 minutes	161,000	125,000	136,000	133,000	137,000	**141,000**
Number of Retail Jobs Accessible by Transit*						
Within 15 minutes	1,000	1,000	1,000	1,000	1,000	1,000
Within 30 minutes	8,000	9,000	10,000	10,000	**11,000**	**13,000**
Within 45 minutes	30,000	35,000	38,000	38,000	**42,000**	**47,000**
Regional Total Jobs	3,504,000	4,907,000	4,907,000	4,907,000	4,907,000	4,907,000
Regional Retail Jobs	556,000	711,000	711,000	711,000	711,000	711,000
Average Share of Regional Jobs Accessible by Auto						
Within 15 minutes	4%	2%	3%	3%	3%	3%
Within 30 minutes	15%	9%	10%	10%	10%	10%
Within 45 minutes	29%	18%	20%	19%	20%	**20%**
Average Share of Regional Jobs Accessible by Transit						
Within 15 minutes	0%	0%	0%	0%	0%	**0%**
Within 30 minutes	2%	1%	2%	2%	**2%**	**2%**
Within 45 minutes	6%	5%	6%	6%	**7%**	**7%**
Average Share of Regional Retail Jobs Accessible by Auto						
Within 15 minutes	4%	3%	3%	3%	3%	3%
Within 30 minutes	15%	9%	10%	10%	10%	10%
Within 45 minutes	29%	18%	19%	19%	19%	**20%**
Average Share of Regional Retail Jobs Accessible by Transit						
Within 15 minutes	0%	0%	0%	0%	0%	**0%**
Within 30 minutes	1%	1%	1%	1%	**2%**	**2%**
Within 45 minutes	5%	5%	5%	5%	**6%**	**7%**

* Transit accessibility is based on walk-access OR auto-access to transit.
Bold indicates greater than 10% decrease in accessibility from the No Project
Bold indicates greater than 10% increase in accessibility from the No Project

Table A-3: Accessibility to All Jobs and Retail Jobs (continued)

	1998 Base	2025 Alternatives **
Number of Total Jobs Accessible by Bicycle		
Within 15 minutes	60,000	73,000
Within 30 minutes	169,000	207,000
Number of Total Jobs Accessible by Walk		
Within 15 minutes	4,000	4,000
Within 30 minutes	18,000	22,000
Number of Retail Jobs Accessible by Bicycle		
Within 15 minutes	9,000	10,000
Within 30 minutes	26,000	29,000
Number of Retail Jobs Accessible by Walk		
Within 15 minutes	3,000	1,000
Within 30 minutes	4,000	3,000
Regional Total Jobs	3,504,000	4,907,000
Regional Retail Jobs	556,000	711,000
Average Share of Regional Jobs Accessible by Bicycle		
Within 15 minutes	2%	1%
Within 30 minutes	5%	4%
Average Share of Regional Jobs Accessible by Walk		
Within 15 minutes	0%	0%
Within 30 minutes	1%	0%
Average Share of Regional Retail Jobs Accessible by Bicycle		
Within 15 minutes	2%	1%
Within 30 minutes	5%	4%
Average Share of Regional Retail Jobs Accessible by Walk		
Within 15 minutes	1%	0%
Within 30 minutes	1%	0%

** The model analysis of accessibility for non-motorized modes does not change absent changes in land use assumptions. There is no difference among the 2025 alternatives.

Table A-4: Number of Employed Residents with Access to Selected Job Centers

		1998	2025 Alternatives				
		Base	NoProject	Project	System Management	Blueprint	Blueprint2
San Francisco Financial District							
	By Auto within 15 minutes	134,000	189,000	189,000	189,000	189,000	189,000
	within 30 minutes	486,000	565,000	565,000	565,000	565,000	565,000
	within 45 minutes	699,000	642,000	667,000	673,000	676,000	667,000
*	By Transit within 15 minutes	25,000	32,000	32,000	32,000	32,000	33,000
	within 30 minutes	250,000	321,000	316,000	335,000	335,000	**405,000**
	within 45 minutes	782,000	995,000	992,000	992,000	997,000	**1,216,000**
San Francisco - Mission Bay							
	By Auto within 15 minutes	215,000	229,000	225,000	238,000	231,000	234,000
	within 30 minutes	544,000	620,000	620,000	624,000	624,000	624,000
	within 45 minutes	791,000	711,000	711,000	745,000	736,000	738,000
*	By Transit within 15 minutes	0	1,000	1,000	1,000	1,000	1,000
	within 30 minutes	40,000	60,000	**67,000**	**67,000**	**67,000**	**77,000**
	within 45 minutes	297,000	300,000	**331,000**	**416,000**	**416,000**	**531,000**
San Francisco International Airport							
	By Auto within 15 minutes	5,000	0	0	0	0	0
	within 30 minutes	405,000	198,000	217,000	**263,000**	**243,000**	**308,000**
	within 45 minutes	860,000	803,000	818,000	855,000	842,000	876,000
*	By Transit within 15 minutes	0	0	0	0	0	0
	within 30 minutes	0	126,000	**113,000**	114,000	**110,000**	128,000
	within 45 minutes	42,000	377,000	367,000	392,000	382,000	449,000
Redwood City							
	By Auto within 15 minutes	56,000	16,000	**20,000**	**20,000**	**20,000**	**23,000**
	within 30 minutes	347,000	202,000	**231,000**	**226,000**	**269,000**	**290,000**
	within 45 minutes	890,000	538,000	584,000	584,000	**617,000**	**627,000**
	By Transit within 15 minutes	0	0	0	0	3,000	3,000
	within 30 minutes	2,000	3,000	3,000	3,000	3,000	18,000
	within 45 minutes	45,000	23,000	23,000	**51,000**	**137,000**	**203,000**
Sunnyvale							
	By Auto within 15 minutes	79,000	6,000	**32,000**	**13,000**	**13,000**	6,000
	within 30 minutes	506,000	212,000	**348,000**	**279,000**	**261,000**	228,000
	within 45 minutes	1,129,000	716,000	**1,122,000**	**982,000**	**984,000**	**867,000**
	By Transit within 15 minutes	0	0	0	0	0	0
	within 30 minutes	15,000	66,000	68,000	**73,000**	**73,000**	68,000
	within 45 minutes	157,000	265,000	**228,000**	245,000	**328,000**	**336,000**

* Results may not be representative. Transit accessibility for adjacent zones remains constant or increases.
Bold indicates 10% or greater decrease from No Project.
Bold indicates 10% or greater increase from No Project.

San Jose Central Business District							
	By Auto within 15 minutes	170,000	158,000	**177,000**	**184,000**	**189,000**	**182,000**
	within 30 minutes	784,000	938,000	988,000	963,000	911,000	963,000
	within 45 minutes	1,079,000	1,265,000	1,319,000	1,282,000	1,320,000	1,308,000

Table A-4: Number of Employed Residents with Access to Selected Job Centers (continued)

	1998	2025
	Base	Alternatives
San Francisco Financial District		
By Bike within 15 minutes	143,000	167,000
30 minutes	315,000	363,000
By Walking within 15 minutes	13,000	16,000
30 minutes	62,000	75,000
San Francisco - Mission Bay		
By Bike within 15 minutes	114,000	137,000
30 minutes	312,000	361,000
By Walking within 15 minutes	0	1,000
30 minutes	5,000	10,000
San Francisco International Airport		
By Bike within 15 minutes	17,000	21,000
30 minutes	96,000	123,000
By Walking within 15 minutes	0	0
30 minutes	0	0
Redwood City		
By Bike within 15 minutes	26,000	35,000
30 minutes	102,000	130,000
By Walking within 15 minutes	0	0
30 minutes	5,000	6,000
Sunnyvale		
By Bike within 15 minutes	18,000	25,000
30 minutes	136,000	194,000
By Walking within 15 minutes	0	0
30 minutes	0	0
San Jose Central Business District		
By Bike within 15 minutes	84,000	115,000
30 minutes	288,000	380,000

Table A-4: Number of Employed Residents with Access to Selected Job Centers

	1998	2025 Alternatives				
	Base	NoProject	Project	System Management	Blueprint	Blueprint2
By Transit within 15 minutes	4,000	9,000	**14,000**	9,000	**14,000**	**31,000**
within 30 minutes	105,000	174,000	**416,000**	**379,000**	**416,000**	**462,000**
within 45 minutes	376,000	697,000	**979,000**	**788,000**	**1,028,000**	**1,195,000**
Milpitas						
By Auto within 15 minutes	127,000	126,000	114,000	**110,000**	114,000	**107,000**
within 30 minutes	739,000	589,000	597,000	614,000	613,000	619,000
within 45 minutes	1,183,000	1,324,000	1,358,000	1,356,000	1,376,000	1,379,000
* By Transit within 15 minutes	0	0	0	0	0	0
within 30 minutes	0	0	0	0	0	0
within 45 minutes	30,000	36,000	**27,000**	**27,000**	**27,000**	**25,000**
Pleasanton - Hacienda Business Park						
By Auto within 15 minutes	65,000	22,000	**19,000**	**13,000**	**9,000**	22,000
within 30 minutes	375,000	98,000	**120,000**	96,000	**84,000**	**128,000**
within 45 minutes	1,091,000	413,000	**548,000**	379,000	**285,000**	**469,000**
By Transit within 15 minutes	0	0	0	0	0	0
within 30 minutes	6,000	9,000	9,000	9,000	9,000	9,000
within 45 minutes	32,000	26,000	**70,000**	**70,000**	**70,000**	**121,000**
Hawyard - Downtown						
By Auto within 15 minutes	166,000	131,000	**151,000**	**164,000**	**186,000**	**180,000**
within 30 minutes	687,000	568,000	603,000	588,000	**652,000**	**700,000**
within 45 minutes	1,685,000	1,157,000	1,252,000	1,165,000	**1,342,000**	**1,376,000**
* By Transit within 15 minutes	0	2,000	2,000	2,000	2,000	2,000
within 30 minutes	245,000	315,000	311,000	311,000	320,000	**361,000**
within 45 minutes	448,000	588,000	**661,000**	615,000	**651,000**	**746,000**
Oakland - Central Business District						
By Auto within 15 minutes	176,000	187,000	197,000	199,000	190,000	200,000
within 30 minutes	650,000	474,000	513,000	**537,000**	510,000	**528,000**
within 45 minutes	1,575,000	1,239,000	1,322,000	1,325,000	1,313,000	**1,371,000**
By Transit within 15 minutes	16,000	21,000	21,000	21,000	21,000	**33,000**
within 30 minutes	346,000	444,000	450,000	444,000	450,000	478,000
within 45 minutes	858,000	1,094,000	1,115,000	1,127,000	1,133,000	**1,238,000**

* Results may not be representative. Transit accessibility for adjacent zones remains constant or increases.
Bold indicates 10% or greater decrease from No Project.
Bold indicates 10% or greater increase from No Project.

Concord						
By Auto within 15 minutes	128,000	147,000	147,000	149,000	155,000	153,000
within 30 minutes	446,000	297,000	**412,000**	**358,000**	**387,000**	**418,000**
within 45 minutes	1,058,000	1,020,000	1,100,000	1,081,000	1,119,000	**1,140,000**
By Transit within 15 minutes	0	0	0	0	0	1,000
within 30 minutes	23,000	24,000	**27,000**	24,000	**27,000**	**74,000**
within 45 minutes	236,000	307,000	**372,000**	**362,000**	299,000	**477,000**

Table A-4: Number of Employed Residents with Access to Selected Job Centers (continued)

	1998	2025
	Base	Alternatives
By Walking within 15 minutes	12,000	18,000
30 minutes	30,000	44,000
Milpitas		
By Bike within 15 minutes	42,000	58,000
30 minutes	98,000	140,000
By Walking within 15 minutes	0	0
30 minutes	5,000	6,000
Pleasanton - Hacienda Business Park		
By Bike within 15 minutes	19,000	28,000
30 minutes	54,000	92,000
By Walking within 15 minutes	0	0
30 minutes	9,000	13,000
Hawyard - Downtown		
By Bike within 15 minutes	66,000	87,000
30 minutes	147,000	190,000
By Walking within 15 minutes	2,000	2,000
30 minutes	13,000	18,000
Oakland - Central Business District		
By Bike within 15 minutes	78,000	106,000
30 minutes	223,000	288,000
By Walking within 15 minutes	6,000	9,000
30 minutes	25,000	34,000
Concord		
By Bike within 15 minutes	50,000	65,000
30 minutes	129,000	173,000
By Walking within 15 minutes	1,000	1,000
30 minutes	16,000	20,000

RTP Goal: Economic Vitality

Measure 4: Accessibility to the Region's Work Force from Major Job Centers

Table A-4: Number of Employed Residents with Access to Selected Job Centers

	1998	2025 Alternatives				
	Base	NoProject	Project	System Management	Blueprint	Blueprint2
San Ramon - Bishop Ranch						
By Auto within 15 minutes	76,000	108,000	114,000	103,000	109,000	114,000
within 30 minutes	353,000	189,000	196,000	192,000	201,000	**222,000**
within 45 minutes	1,046,000	609,000	**742,000**	645,000	**728,000**	**864,000**
By Transit within 15 minutes	5,000	13,000	13,000	13,000	13,000	13,000
within 30 minutes	9,000	27,000	27,000	27,000	27,000	27,000
within 45 minutes	23,000	57,000	57,000	57,000	57,000	59,000
Vallejo						
By Auto within 15 minutes	79,000	92,000	89,000	92,000	89,000	92,000
within 30 minutes	371,000	291,000	308,000	320,000	319,000	**326,000**
within 45 minutes	1,031,000	737,000	**833,000**	**853,000**	**866,000**	**951,000**
By Transit within 15 minutes	2,000	0	0	0	1,000	3,000
within 30 minutes	15,000	16,000	16,000	16,000	16,000	16,000
within 45 minutes	48,000	66,000	66,000	66,000	66,000	**85,000**
Napa Airport Area						
By Auto within 15 minutes	41,000	48,000	**62,000**	**62,000**	**58,000**	**58,000**
within 30 minutes	70,000	69,000	74,000	87,000	**99,000**	**104,000**
within 45 minutes	218,000	106,000	**145,000**	**187,000**	**217,000**	**231,000**
* By Transit within 15 minutes	0	0	0	0	0	0
within 30 minutes	0	0	0	0	0	0
within 45 minutes	19,000	14,000	**24,000**	14,000	**24,000**	**24,000**
Petaluma - Central Business District						
By Auto within 15 minutes	41,000	46,000	46,000	42,000	42,000	42,000
within 30 minutes	181,000	117,000	**170,000**	127,000	**143,000**	**134,000**
within 45 minutes	422,000	306,000	**358,000**	324,000	**338,000**	321,000
* By Transit within 15 minutes	5,000	7,000	7,000	7,000	7,000	7,000
within 30 minutes	12,000	21,000	**18,000**	**18,000**	**18,000**	**18,000**
within 45 minutes	43,000	40,000	40,000	40,000	40,000	44,000

* Results may not be representative. Transit accessibility for adjacent zones remains constant or increases.

Bold indicates 10% or greater decrease from No Project.

Bold indicates 10% or greater increase from No Project.

Table A-4: Number of Employed Residents with Access to Selected Job Centers (continued)

	1998	2025
	Base	Alternatives
San Ramon - Bishop Ranch		
By Bike within 15 minutes	30,000	63,000
30 minutes	65,000	123,000
By Walking within 15 minutes	0	0
30 minutes	5,000	13,000
Vallejo		
By Bike within 15 minutes	32,000	46,000
30 minutes	50,000	72,000
By Walking within 15 minutes	4,000	5,000
30 minutes	11,000	15,000
Napa Airport Area		
By Bike within 15 minutes	9,000	13,000
30 minutes	41,000	63,000
By Walking within 15 minutes	0	0
30 minutes	3,000	5,000
Petaluma - Central Business District		
Bike - 15 minutes	21,000	30,000
Bike - 30 minutes	33,000	48,000
Walk - 15 minutes	0	0
Walk - 30 minutes	14,000	21,000

RTP Goal: Economic Vitality

Measure 4: Accessibility to the Region's Work Force from Major Job Centers

Table A-4: Number of Employed Residents with Access to Selected Job Centers

		1998	2025 Alternatives				
		Base	NoProject	Project	System Management	Blueprint	Blueprint2
Santa Rosa - Central Business District							
*	By Auto within 15 minutes	55,000	20,000	20,000	15,000	20,000	20,000
	within 30 minutes	161,000	89,000	**104,000**	97,000	**67,000**	**67,000**
	within 45 minutes	217,000	146,000	**165,000**	158,000	143,000	143,000
*	By Transit within 15 minutes	3,000	4,000	4,000	4,000	4,000	4,000
	within 30 minutes	35,000	38,000	34,000	34,000	34,000	38,000
	within 45 minutes	84,000	102,000	111,000	**131,000**	**173,000**	**173,000**
Novato							
	By Auto within 15 minutes	44,000	43,000	43,000	43,000	39,000	**35,000**
	within 30 minutes	167,000	112,000	118,000	120,000	121,000	**124,000**
	within 45 minutes	544,000	182,000	**250,000**	**245,000**	**248,000**	**301,000**
	By Transit within 15 minutes	5,000	6,000	6,000	6,000	6,000	6,000
	within 30 minutes	17,000	20,000	**26,000**	**26,000**	**26,000**	**26,000**
	within 45 minutes	30,000	37,000	37,000	37,000	**96,000**	**101,000**
San Rafael - Central Business District							
	By Auto within 15 minutes	53,000	56,000	56,000	56,000	52,000	52,000
	within 30 minutes	207,000	124,000	126,000	126,000	117,000	**152,000**
	within 45 minutes	712,000	307,000	322,000	324,000	327,000	**465,000**
*	By Transit within 15 minutes	0	0	0	0	0	0
	within 30 minutes	21,000	21,000	21,000	21,000	21,000	**27,000**
	within 45 minutes	68,000	92,000	84,000	93,000	106,000	**111,000**
Total Employed Residents		3,738,000	4,625,000	4,625,000	4,625,000	4,625,000	4,625,000

* Results may not be representative. Transit accessibility for adjacent zones remains constant or increases.

Bold indicates 10% or greater decrease from No Project.

Bold indicates 10% or greater increase from No Project.

Table A-4: Number of Employed Residents with Access to Selected Job Centers (continued)

	1998	2025
	Base	Alternatives
Santa Rosa - Central Business District		
By Bike within 15 minutes	34,000	49,000
30 minutes	81,000	117,000
By Walking within 15 minutes	3,000	4,000
30 minutes	13,000	20,000
Novato		
By Bike within 15 minutes	22,000	26,000
30 minutes	28,000	35,000
By Walking within 15 minutes	0	0
30 minutes	14,000	17,000
San Rafael - Central Business District		
By Bike within 15 minutes	35,000	44,000
30 minutes	66,000	82,000
By Walking within 15 minutes	0	0
30 minutes	6,000	7,000
Total Employed Residents	3,738,000	4,625,000

RTP Goal: Economic Vitality

Measure 5: Economic Efficiency - Net Benefit and Benefit Cost Ratio

TableA- 5(1): User Benefits

		Travel Time Savings			Out-of-Pocket Cost Savings	TOTAL
	Change in Trips	Total Time Saved (1,000s of hrs)	Value of Time ($ per hr)	Total Value of Time Saved ($1,000s)	Total ($1,000s)	Annual User Benefits ($1,000s)
Project Alternative						
Auto-Person Trips	-9,200	80,100	$ 17.03	$ 1,364,100	$ 95,700	$ 1,459,800
Transit-Person Trips (in-vehicle)	9,800	5,600	$ 17.03	$ 95,000	$ 9,800	$ 104,800
Transit-Person Trips (out-of-vehicle)	0	1,800	$ 37.50	$ 67,800	$ -	$ 67,800
Non-Motorized Person Trips	-600	0	$ 17.03	$ 400	$ -	$ 400
Truck Trips	0	1,700	$ 80.00	$ 135,900	$ 2,700	$ 138,600
TOTAL All Trips	0	89,200		$ 1,663,100	$ 108,300	$ 1,771,400
System Management Alternative						
Auto-Person Trips	-12,500	88,900	$ 17.03	$ 1,514,900	$ (240,100)	$ 1,274,900
Transit-Person Trips (in-vehicle)	13,900	7,500	$ 17.03	$ 127,600	$ 5,900	$ 133,500
Transit-Person Trips (out-of-vehicle)	0	2,800	$ 37.50	$ 106,000	$ -	$ 106,000
Non-Motorized Person Trips	-1,400	0	$ 17.03	$ (100)	$ -	$ (100)
Truck Trips	0	1,900	$ 80.00	$ 149,100	$ (15,300)	$ 133,800
TOTAL All Trips	0	101,100		$ 1,897,500	$ (249,500)	$ 1,648,000
Blueprint 1 Alternative						
Auto-Person Trips	-18,100	93,500	$ 17.03	$ 1,593,100	$ 105,900	$ 1,699,000
Transit-Person Trips (in-vehicle)	20,400	11,700	$ 17.03	$ 198,700	$ 3,900	$ 202,500
Transit-Person Trips (out-of-vehicle)	0	4,400	$ 37.50	$ 164,400	$ -	$ 164,400
Non-Motorized Person Trips	-2,300	0	$ 17.03	$ 400	$ -	$ 400
Truck Trips	0	2,000	$ 80.00	$ 161,400	$ 2,900	$ 164,300
TOTAL All Trips	0	111,600		$ 2,117,900	$ 112,700	$ 2,230,600
Blueprint 2 Alternative						
Auto-Person Trips	-30,600	116,400	$ 17.03	$ 1,983,400	$ 136,200	$ 2,119,600
Transit-Person Trips (in-vehicle)	34,300	18,400	$ 17.03	$ 313,700	$ (29,900)	$ 283,800
Transit-Person Trips (out-of-vehicle)	0	11,500	$ 37.50	$ 429,600	$ -	$ 429,600
Non-Motorized Person Trips	-3,700	0	$ 17.03	$ 300	$ -	$ 300
Truck Trips	0	2,600	$ 80.00	$ 204,400	$ 4,100	$ 208,500
TOTAL All Trips	0	148,900		$ 2,931,400	$ 110,400	$ 3,041,800

Table A-5(2): Total Annualized Public Expenditures for the RTP Project Alternative ($millions)

Track 1 Capital Costs	Total	Annualized @ 4%	Annualized @ 7%
Transit Expansion	$ 5,602.7	$ 497.9	$ 613.3
Roadway Expansion	$ 3,123.4	$ 232.0	$ 296.9
TOTAL Capital Cost	$ 8,726.0	$ 729.9	$ 910.2
Annual Operating and Maintenance (O&M) Costs		Annual	Annual
Transit Expansion (net of transit fares)			
TOTAL Transit		$ 43.3	$ 43.3
Roadway Expansion			
Freeways (241 lane miles)		$ 2.7	$ 2.7
Expressways (46 lane miles)		$ 0.5	$ 0.5
Arterials (52 lane miles)		$ 0.6	$ 0.6
TOTAL Roadway		$ 3.7	$ 3.7
TOTAL Annual O&M Costs		$ 47.0	$ 47.0
TOTAL ANNUALIZED COST (Capital and O&M)		$ 776.9	$ 957.2

Table A-5(3): Net Benefit and Benefit Cost Ratio for RTP Project Alternative ($millions)

	4% Discount Rate	7% Discount Rate
(a) Total User Benefits (from Table 5A)	$ 1,771.4	$ 1,771.4
(b) Total RTP Track 1 Public Expenditures (from Table 5B)	$ 776.9	$ 957.2
Net Benefit = (a) - (b)	$ 994.5	$ 814.2
Benefit Cost Ratio = (a) / (b)	2.3	1.9

RTP Goal: Community Vitality

Measure 6: Population and Employment within Walking Distance of Intermodal/Rail Stations

Table A-6: Population and Employment within 1/2 Mile of Major Intermodal/Rail Stations

	1998	2025				
	Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Population within 1/2 Mile						
San Francisco	422,000	462,000	475,000	475,000	475,000	**596,000**
San Mateo	84,000	103,000	103,000	100,000	107,000	**114,000**
Santa Clara	159,000	380,000	405,000	376,000	**441,000**	**438,000**
Alameda	165,000	210,000	220,000	217,000	228,000	**280,000**
Contra Costa	62,000	74,000	74,000	74,000	**92,000**	**156,000**
Solano	10,000	9,000	**10,000**	**13,000**	**19,000**	**19,000**
Napa	0	0	0	0	0	0
Sonoma	5,000	6,000	6,000	6,000	**32,000**	**33,000**
Marin	10,000	11,000	11,000	11,000	**16,000**	**17,000**
TOTAL Population within 1/2 mile	917,000	1,254,000	1,303,000	1,270,000	**1,410,000**	**1,652,000**
TOTAL Regional Population	6,716,000	8,224,000	8,224,000	8,224,000	8,224,000	8,224,000
Employment within 1/2 Mile						
San Francisco	435,000	528,000	543,000	543,000	543,000	**609,000**
San Mateo	72,000	94,000	94,000	90,000	102,000	**115,000**
Santa Clara	164,000	319,000	336,000	312,000	330,000	322,000
Alameda	162,000	209,000	212,000	209,000	218,000	**242,000**
Contra Costa	38,000	50,000	50,000	50,000	**61,000**	**99,000**
Solano	7,000	9,000	9,000	**11,000**	**14,000**	**14,000**
Napa	0	0	0	0	0	0
Sonoma	13,000	18,000	18,000	18,000	**27,000**	**27,000**
Marin	9,000	11,000	11,000	11,000	**15,000**	**16,000**
TOTAL Employment within 1/2 mile	900,000	1,238,000	1,273,000	1,244,000	1,311,000	**1,443,000**
TOTAL Regional Employment	3,504,000	4,907,000	4,907,000	4,907,000	4,907,000	4,907,000

Bold indicates 10% or greater increase from No Project

RTP Goal: Community Vitality

Measure 7: Use of Walking to Access Transit

Table A-7: Transit Trips with Walk Access

	1998	2025				
	Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Peak Period						
Number of Transit Trips with Walk Access	519,000	658,000	669,000	674,000	680,000	**696,000**
Total Transit Trips	723,000	1,028,000	1,049,000	1,056,000	1,072,000	**1,101,000**
Off-Peak						
Number of Transit Trips with Walk Access	406,000	557,000	569,000	575,000	581,000	**598,000**
Total						
Number of Transit Trips with Walk Access	925,000	1,215,000	1,238,000	1,249,000	1,261,000	**1,294,000**
Total Number of Transit Trips	1,129,000	1,585,000	1,618,000	1,631,000	1,653,000	**1,700,000**
Total Number of Person Trips	20,240,000	26,227,000	26,227,000	26,227,000	26,227,000	26,227,000
Trips with Walk Access to Transit as:						
Percent of all Transit Trips in the Peak	71.8%	64.0%	63.8%	63.8%	63.4%	63.2%
Percent of all Transit Trips	81.9%	76.6%	76.5%	76.6%	76.3%	76.1%
Percent of all Trips	4.6%	4.6%	4.7%	4.8%	4.8%	**4.9%**

Note: All off-peak period transit trips are assumed to use walk access.

Bold indicates 5% or greater increase from the No Project

Bold indicates 5% or greater decrease from the No Project

RTP Goal: The Environment

Measure 8: Air Quality and Global Warming

Table A-8: Vehicle Emissions

	1998	2025				
	Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Transportation Activity Data						
In-Use Vehicles	5,109,000	6,283,000	6,283,000	6,283,000	6,283,000	6,283,000
VMT (000s)	128,000	192,000	191,000	190,000	190,000	189,000
Engine Starts	21,264,000	27,777,000	27,726,000	27,701,000	27,687,000	27,638,000
Vehicle Emissions (Tons/Day)						
CO	2,044.4	795.3	779.3	774.2	776.3	773.7
ROG	178.4	49.3	**46.8**	**46.4**	**46.5**	**46.3**
NO_X	251.4	146.5	146.3	145.9	147.2	146.7
PM_{10}	63.8	92.0	91.4	91.1	91.1	90.7
CO_2	473.1	687.5	671.9	666.4	669.2	666.5

ROG Budget	TBD once the new Federal air quality plan is submitted
NO_X Budget	TBD once the new Federal air quality plan is submitted

* Emissions based on CARB EMFAC-7G / BURDEN-7G Models except PM_{10} which includes entrained road dust.
Bold indicates greater than 5% decrease from No Project.

Table A-9(1): Travel Time Distribution for Minority and Non-Minority Communities

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Minority Communities						
Aggregate Travel Time (Person Hours of Travel)						
Work Trips						
Drive Alone	259,000	446,000	425,000	425,000	420,000	413,000
Carpool	75,000	131,000	124,000	125,000	121,000	118,000
Transit	99,000	164,000	170,000	171,000	173,000	171,000
Bicycle	3,000	5,000	5,000	5,000	5,000	5,000
Walk	18,000	22,000	22,000	22,000	22,000	21,000
TOTAL	454,000	769,000	746,000	747,000	741,000	728,000
Non-Work Trips						
Auto	595,000	764,000	750,000	746,000	746,000	740,000
Transit	112,000	144,000	147,000	148,000	148,000	149,000
Bicycle	18,000	22,000	22,000	22,000	22,000	22,000
Walk	176,000	212,000	212,000	212,000	212,000	211,000
TOTAL	901,000	1,143,000	1,132,000	1,128,000	1,128,000	1,122,000
Total Personal Trips	1,355,000	1,911,000	1,878,000	1,875,000	1,869,000	1,851,000
Aggregate Trips (Person Trips)						
Work Trips						
Drive Alone	723,000	948,000	944,000	944,000	941,000	938,000
Carpool	169,000	238,000	235,000	234,000	233,000	232,000
Transit	123,000	191,000	198,000	198,000	203,000	207,000
Bicycle	9,000	12,000	11,000	11,000	11,000	11,000
Walk	37,000	43,000	43,000	43,000	43,000	43,000
TOTAL	1,061,000	1,431,000	1,431,000	1,431,000	1,431,000	1,431,000
Non-Work Trips						
Auto	2,691,000	3,173,000	3,168,000	3,168,000	3,166,000	3,161,000
Transit	191,000	245,000	250,000	251,000	253,000	259,000
Bicycle	53,000	63,000	63,000	63,000	63,000	62,000
Walk	444,000	533,000	533,000	532,000	532,000	532,000
TOTAL	3,379,000	4,014,000	4,014,000	4,014,000	4,014,000	4,014,000
Total Personal Trips	4,441,000	5,444,000	5,444,000	5,444,000	5,444,000	5,444,000

Table A-9(1): Travel Time Distribution for Minority and Non-Minority Communities (contd.)

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Minority Communities						
Average Travel Time (average minutes per trip)						
Work Trips						
Drive Alone	21	28	27	27	27	26
Carpool	27	33	32	32	31	31
Transit	48	52	52	52	51	50
Bicycle	20	25	27	27	27	27
Walk	29	31	31	31	31	29
TOTAL	26	32	31	31	31	31
Non-Work Trips						
Auto	13	14	14	14	14	14
Transit	35	35	35	35	35	35
Bicycle	20	21	21	21	21	21
Walk	24	24	24	24	24	24
TOTAL	16	17	17	17	17	17
Total Personal Trips	18	21	21	21	21	20
Median Travel Time (minutes per trip)						
Work Trips						
Drive Alone	18	24	23	23	22	22
Carpool	23	28	27	27	27	27
Transit	44	46	46	46	46	45
Bicycle	18	20	19	19	19	19
Walk	18	18	18	18	18	18
TOTAL	23	28	27	27	27	26
Non-Work Trips						
Auto	11	11	11	11	11	11
Transit	32	33	33	33	33	32
Bicycle	16	17	17	17	16	16
Walk	20	20	20	20	20	20
TOTAL	14	14	14	14	14	14
Total Personal Trips	15	16	16	16	16	16
90th Percentile Travel Time (minutes per trip)						
Work Trips						
Drive Alone	40	54	51	51	51	50
Carpool	46	60	57	58	56	54
Transit	80	87	86	85	85	82
Bicycle	47	57	55	55	55	54
Walk	61	64	63	63	63	62
TOTAL	45	59	58	58	57	55
Non-Work Trips						
Auto	25	28	27	27	27	27
Transit	57	58	58	58	57	56
Bicycle	42	44	44	44	44	44
Walk	45	45	45	45	45	45
TOTAL	27	30	29	29	29	29
Total Personal Trips	32	40	39	39	38	38

Table A-9(1): Travel Time Distribution for Minority and Non-Minority Communities (contd.)

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Non-Minority Communities						
Aggregate Travel Time (Person Hours of Travel)						
Work Trips						
Drive Alone	1,178,000	2,258,000	2,119,000	2,096,000	2,091,000	2,045,000
Carpool	280,000	549,000	509,000	510,000	494,000	475,000
Transit	290,000	508,000	523,000	523,000	536,000	537,000
Bicycle	14,000	22,000	21,000	21,000	21,000	20,000
Walk	62,000	82,000	81,000	80,000	80,000	79,000
TOTAL	1,825,000	3,418,000	3,252,000	3,230,000	3,221,000	3,157,000
Non-Work Trips						
Auto	2,156,000	3,001,000	2,930,000	2,915,000	2,917,000	2,890,000
Transit	263,000	360,000	363,000	368,000	368,000	373,000
Bicycle	51,000	67,000	66,000	66,000	66,000	65,000
Walk	505,000	776,000	776,000	776,000	775,000	773,000
TOTAL	2,975,000	4,204,000	4,136,000	4,125,000	4,126,000	4,102,000
Total Personal Trips	4,800,000	7,622,000	7,388,000	7,354,000	7,347,000	7,259,000
Aggregate Trips (Person Trips)						
Work Trips						
Drive Alone	2,956,000	4,161,000	4,145,000	4,135,000	4,133,000	4,122,000
Carpool	518,000	761,000	763,000	768,000	760,000	754,000
Transit	348,000	536,000	550,000	555,000	566,000	584,000
Bicycle	40,000	54,000	53,000	53,000	53,000	52,000
Walk	111,000	137,000	136,000	136,000	136,000	136,000
TOTAL	3,973,000	5,647,000	5,647,000	5,647,000	5,647,000	5,647,000
Non-Work Trips						
Auto	9,928,000	12,317,000	12,311,000	12,307,000	12,304,000	12,288,000
Transit	467,000	614,000	621,000	627,000	631,000	651,000
Bicycle	168,000	218,000	216,000	216,000	215,000	215,000
Walk	1,264,000	1,987,000	1,988,000	1,986,000	1,984,000	1,982,000
TOTAL	11,827,000	15,135,000	15,135,000	15,135,000	15,135,000	15,135,000
Total Personal Trips	15,799,000	20,782,000	20,782,000	20,782,000	20,782,000	20,782,000

Table A-9(1): Travel Time Distribution for Minority and Non-Minority Communities (contd.)

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Non-Minority Communities						
Average Travel Time (average minutes per trip)						
Work Trips						
Drive Alone	24	33	31	30	30	30
Carpool	32	43	40	40	39	38
Transit	50	57	57	57	57	55
Bicycle	21	24	24	24	24	23
Walk	34	36	36	35	35	35
TOTAL	28	36	35	34	34	34
Non-Work Trips						
Auto	13	15	14	14	14	14
Transit	34	35	35	35	35	34
Bicycle	18	18	18	18	18	18
Walk	24	23	23	23	23	23
TOTAL	15	17	16	16	16	16
Total Personal Trips	18	22	21	21	21	21
Median Travel Time (minutes per trip)						
Work Trips						
Drive Alone	19	25	24	24	24	24
Carpool	26	34	32	33	32	32
Transit	44	51	52	52	52	51
Bicycle	15	17	16	16	16	16
Walk	20	20	20	20	20	20
TOTAL	22	28	27	27	27	27
Non-Work Trips						
Auto	9	10	10	10	10	10
Transit	30	31	31	31	31	30
Bicycle	12	12	12	12	12	12
Walk	20	20	20	20	20	20
TOTAL	12	13	13	12	13	12
Total Personal Trips	13	15	14	14	15	14
90th Percentile Travel Time (minutes per trip)						
Work Trips						
Drive Alone	48	67	63	62	61	60
Carpool	61	84	77	76	74	71
Transit	84	96	96	94	96	92
Bicycle	45	55	53	53	53	53
Walk	61	67	67	67	66	66
TOTAL	55	73	69	68	68	66
Non-Work Trips						
Auto	25	29	28	28	28	28
Transit	55	58	58	59	58	57
Bicycle	41	43	42	42	42	42
Walk	43	40	40	40	40	40
TOTAL	27	30	29	29	29	29
Total Personal Trips	36	47	45	44	44	44

Table A-9(2): Travel Time Distribution for Low-Income and Not-Low-Income Communities

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Low Income Communities						
Aggregate Travel Time (Person Hours of Travel)						
Work Trips						
Drive Alone	186,000	345,000	323,000	321,000	319,000	312,000
Carpool	59,000	113,000	104,000	105,000	101,000	97,000
Transit	96,000	148,000	152,000	152,000	154,000	153,000
Bicycle	4,000	6,000	5,000	5,000	5,000	5,000
Walk	26,000	31,000	31,000	31,000	31,000	30,000
TOTAL	371,000	642,000	615,000	613,000	610,000	598,000
Non-Work Trips						
Auto	504,000	681,000	664,000	662,000	662,000	655,000
Transit	146,000	190,000	193,000	194,000	194,000	194,000
Bicycle	15,000	19,000	18,000	18,000	18,000	18,000
Walk	220,000	277,000	277,000	277,000	277,000	276,000
TOTAL	885,000	1,166,000	1,152,000	1,151,000	1,150,000	1,143,000
Total Personal Trips	1,256,000	1,809,000	1,767,000	1,764,000	1,761,000	1,741,000
Aggregate Trips (Person Trips)						
Work Trips						
Drive Alone	522,000	708,000	706,000	705,000	704,000	702,000
Carpool	127,000	179,000	178,000	178,000	176,000	175,000
Transit	142,000	202,000	206,000	207,000	210,000	214,000
Bicycle	14,000	18,000	18,000	18,000	18,000	17,000
Walk	69,000	82,000	82,000	82,000	82,000	82,000
TOTAL	874,000	1,189,000	1,189,000	1,189,000	1,189,000	1,189,000
Non-Work Trips						
Auto	2,325,000	2,834,000	2,829,000	2,827,000	2,826,000	2,819,000
Transit	276,000	351,000	356,000	358,000	359,000	368,000
Bicycle	53,000	63,000	63,000	63,000	63,000	63,000
Walk	596,000	740,000	740,000	740,000	740,000	739,000
TOTAL	3,249,000	3,988,000	3,988,000	3,988,000	3,988,000	3,988,000
Total Personal Trips	4,123,000	5,178,000	5,178,000	5,178,000	5,178,000	5,178,000

Table A-9(2): Travel Time Distribution for Low-Income and Not-Low-Income Communities (contd.)

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Low Income Communities						
Average Travel Time (average minutes per trip)						
Work Trips						
Drive Alone	21	29	27	27	27	26.7
Carpool	28	38	35	35	34	33.3
Transit	41	44	44	44	44	42.9
Bicycle	17	20	17	17	17	17.6
Walk	23	23	23	23	23	22.0
TOTAL	25	32	31	31	31	30.2
Non-Work Trips						
Auto	13	14	14	14	14	13.9
Transit	32	32	33	33	32	31.6
Bicycle	17	18	17	17	17	17.1
Walk	22	22	22	22	22	22.4
TOTAL	16	18	17	17	17	17.2
Total Personal Trips	18	21	20	20	20	20.2
Median Travel Time (minutes per trip)						
Work Trips						
Drive Alone	16	21	20	20	20	20.1
Carpool	22	28	27	27	26	26.2
Transit	34	37	37	37	37	36.1
Bicycle	12	13	13	13	13	12.5
Walk	16	16	16	16	16	16.0
TOTAL	21	24	24	24	24	23.6
Non-Work Trips						
Auto	10	10	10	10	10	10.3
Transit	28	29	29	29	28	27.9
Bicycle	12	13	13	13	13	12.7
Walk	18	20	20	20	20	19.6
TOTAL	14	14	14	14	14	14.3
Total Personal Trips	15	16	16	16	16	15.9
90th Percentile Travel Time (minutes per trip)						
Work Trips						
Drive Alone	44	63	59	59	58	56.3
Carpool	53	74	68	69	66	63.7
Transit	73	81	81	80	81	78.7
Bicycle	36	41	40	40	39	38.9
Walk	42	41	41	41	41	41.0
TOTAL	48	66	62	62	62	60.0
Non-Work Trips						
Auto	25	28	27	27	27	27.0
Transit	52	54	54	54	54	52.5
Bicycle	36	37	37	37	37	37.0
Walk	42	42	42	42	42	41.8
TOTAL	28	30	30	30	30	29.6
Total Personal Trips	32	39	38	38	38	37.2

Table A-9(2): Travel Time Distribution for Low-Income and Not-Low-Income Communities (contd.)

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Not Low Income Communities						
Aggregate Travel Time (Person Hours of Travel)						
Work Trips						
Drive Alone	1,251,000	2,360,000	2,221,000	2,199,000	2,192,000	2,145,000
Carpool	295,000	567,000	529,000	530,000	514,000	496,000
Transit	294,000	524,000	541,000	542,000	555,000	556,000
Bicycle	13,000	21,000	20,000	20,000	20,000	20,000
Walk	55,000	73,000	72,000	71,000	71,000	70,000
TOTAL	1,908,000	3,545,000	3,383,000	3,363,000	3,351,000	3,288,000
Non-Work Trips						
Auto	2,247,000	3,084,000	3,016,000	2,999,000	3,001,000	2,975,000
Transit	228,000	314,000	318,000	322,000	323,000	327,000
Bicycle	55,000	71,000	70,000	70,000	70,000	69,000
Walk	461,000	712,000	712,000	711,000	710,000	709,000
TOTAL	2,990,000	4,180,000	4,116,000	4,103,000	4,104,000	4,081,000
Total Personal Trips	4,898,000	7,725,000	7,499,000	7,466,000	7,455,000	7,369,000
Aggregate Trips (Person Trips)						
Work Trips						
Drive Alone	3,157,000	4,400,000	4,383,000	4,375,000	4,370,000	4,359,000
Carpool	560,000	819,000	820,000	823,000	816,000	811,000
Transit	329,000	524,000	541,000	547,000	559,000	576,000
Bicycle	35,000	47,000	47,000	47,000	46,000	46,000
Walk	79,000	97,000	97,000	97,000	97,000	97,000
TOTAL	4,160,000	5,888,000	5,888,000	5,888,000	5,888,000	5,888,000
Non-Work Trips						
Auto	10,294,000	12,656,000	12,650,000	12,647,000	12,644,000	12,630,000
Transit	382,000	508,000	514,000	520,000	525,000	541,000
Bicycle	169,000	217,000	216,000	216,000	215,000	215,000
Walk	1,111,000	1,779,000	1,780,000	1,778,000	1,776,000	1,774,000
TOTAL	11,957,000	15,161,000	15,161,000	15,161,000	15,161,000	15,161,000
Total Personal Trips	16,117,000	21,049,000	21,049,000	21,049,000	21,049,000	21,049,000

Table A-9(2): Travel Time Distribution for Low-Income and Not-Low-Income Communities (contd.)

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Not Low Income Communities						
Average Travel Time (average minutes per trip)						
Work Trips						
Drive Alone	24	32	30	30	30	30
Carpool	32	42	39	39	38	37
Transit	54	60	60	59	60	58
Bicycle	22	27	26	26	26	26
Walk	42	45	45	44	44	43
TOTAL	28	36	34	34	34	34
Non-Work Trips						
Auto	13	15	14	14	14	14
Transit	36	37	37	37	37	36
Bicycle	20	20	19	19	20	19
Walk	25	24	24	24	24	24
TOTAL	15	17	16	16	16	16
Total Personal Trips	18	22	21	21	21	21
Median Travel Time (minutes per trip)						
Work Trips						
Drive Alone	19	25	24	24	24	24
Carpool	26	33	31	32	31	31
Transit	49	55	56	55	55	54
Bicycle	16	19	18	18	18	18
Walk	24	23	23	23	23	23
TOTAL	22	29	28	28	28	28
Non-Work Trips						
Auto	9	10	10	10	10	10
Transit	32	33	33	33	33	32
Bicycle	13	13	13	13	13	13
Walk	20	20	20	20	20	20
TOTAL	12	13	13	12	13	12
Total Personal Trips	13	15	15	15	15	15
90th Percentile Travel Time (minutes per trip)						
Work Trips						
Drive Alone	47	65	61	60	60	58
Carpool	60	80	73	72	70	67
Transit	85	97	97	95	96	92
Bicycle	48	60	58	58	57	57
Walk	78	93	91	90	90	90
TOTAL	53	71	68	67	67	65
Non-Work Trips						
Auto	25	29	28	28	28	28
Transit	58	61	61	61	60	60
Bicycle	43	44	44	44	44	44
Walk	45	41	41	41	41	41
TOTAL	27	29	29	29	29	29
Total Personal Trips	36	46	44	44	44	43

Table A-10: Accessibility to Jobs from Low-Income, Minority and Other Communities

	1998 Base	No-Project	Project	System Management	Blueprint 1	Blueprint 2
Minority Communities						
Number of Total Jobs Accessible by Auto						
Within 15 minutes	153,000	154,000	163,000	162,000	166,000	166,000
Within 30 minutes	676,000	615,000	668,000	654,000	672,000	678,000
Within 45 minutes	1,254,000	1,159,000	1,268,000	1,235,000	1,271,000	1,297,000
Number of Total Jobs Accessible by Transit						
Within 15 minutes	5,000	6,000	6,000	6,000	6,000	6,000
Within 30 minutes	46,000	58,000	60,000	60,000	61,000	68,000
Within 45 minutes	178,000	230,000	239,000	237,000	249,000	270,000
Non-Minority Communities						
Number of Total Jobs Accessible by Auto						
Within 15 minutes	118,000	113,000	118,000	118,000	118,000	118,000
Within 30 minutes	461,000	404,000	436,000	429,000	436,000	441,000
Within 45 minutes	939,000	792,000	864,000	842,000	868,000	886,000
Number of Total Jobs Accessible by Transit						
Within 15 minutes	2,000	3,000	3,000	3,000	3,000	3,000
Within 30 minutes	38,000	43,000	44,000	44,000	46,000	51,000
Within 45 minutes	117,000	137,000	139,000	141,000	147,000	160,000
Low-Income Communities						
Number of Total Jobs Accessible by Auto						
Within 15 minutes	195,000	208,000	215,000	214,000	215,000	215,000
Within 30 minutes	636,000	575,000	630,000	611,000	623,000	630,000
Within 45 minutes	1,139,000	1,031,000	1,124,000	1,097,000	1,124,000	1,147,000
Number of Total Jobs Accessible by Transit						
Within 15 minutes	11,000	14,000	14,000	14,000	14,000	15,000
Within 30 minutes	96,000	109,000	113,000	114,000	116,000	125,000
Within 45 minutes	247,000	299,000	308,000	306,000	315,000	343,000
Non-Low Income Communities						
Number of Total Jobs Accessible by Auto						
Within 15 minutes	108,000	100,000	106,000	106,000	106,000	107,000
Within 30 minutes	480,000	421,000	453,000	447,000	456,000	461,000
Within 45 minutes	982,000	836,000	914,000	890,000	919,000	937,000
Number of Total Jobs Accessible by Transit						
Within 15 minutes	1,000	1,000	1,000	1,000	1,000	1,000
Within 30 minutes	25,000	30,000	30,000	31,000	32,000	36,000
Within 45 minutes	100,000	122,000	124,000	126,000	133,000	145,000
TOTAL Communities						
Number of Total Jobs Accessible by Auto						
Within 15 minutes	127,000	122,000	128,000	128,000	129,000	129,000
Within 30 minutes	513,000	452,000	490,000	481,000	491,000	496,000
Within 45 minutes	1,016,000	876,000	957,000	933,000	961,000	981,000
Number of Total Jobs Accessible by Transit						
Within 15 minutes	3,000	4,000	4,000	4,000	4,000	4,000
Within 30 minutes	40,000	47,000	47,000	48,000	49,000	55,000
Within 45 minutes	132,000	159,000	162,000	163,000	171,000	186,000

Note: Transit accessibility is based on walk-access only to transit.

Table A-10: Accessibility to Jobs from Low-Income, Minority, and Other Communities (continued)

	1998 Base	2025 Alternatives
Minority Communities		
Number of Total Jobs Accessible by Bicycle		
Within 15 minutes	62,000	78,000
Within 30 minutes	203,000	255,000
Number of Total Jobs Accessible by Walk		
Within 15 minutes	6,000	7,000
Within 30 minutes	21,000	25,000
Non-Minority Communities		
Number of Total Jobs Accessible by Bicycle		
Within 15 minutes	59,000	71,000
Within 30 minutes	158,000	192,000
Number of Total Jobs Accessible by Walk		
Within 15 minutes	3,000	3,000
Within 30 minutes	17,000	21,000
Low-Income Communities		
Number of Total Jobs Accessible by Bicycle		
Within 15 minutes	113,000	134,000
Within 30 minutes	240,000	294,000
Number of Total Jobs Accessible by Walk		
Within 15 minutes	11,000	12,000
Within 30 minutes	42,000	48,000
Non-Low Income Communities		
Number of Total Jobs Accessible by Bicycle		
Within 15 minutes	46,000	57,000
Within 30 minutes	150,000	184,000
Number of Total Jobs Accessible by Walk		
Within 15 minutes	2,000	2,000
Within 30 minutes	11,000	15,000
TOTAL Communities		
Number of Total Jobs Accessible by Bicycle		
Within 15 minutes	60,000	73,000
Within 30 minutes	169,000	207,000
Number of Total Jobs Accessible by Walk		
Within 15 minutes	4,000	4,000
Within 30 minutes	18,000	22,000

Table A-11: Transit Travel Time to Select Job Centers from Low-Income and Minority Communities

Community	1998 Base	2025 Alternatives: No-Project	Project	System Management	Blueprint 1	Blueprint 2
San Francisco Finanacial District						
San Francisco Civic Center	14	13	13	13	13	13
San Francisco Mission	20	20	20	20	20	19
Bay View/Hunters Point	41	39	38	40	38	38
Daly City	46	45	45	45	45	44
San Mateo	73	76	77	55	55	55
East Palo Alto	114	146	121	111	111	100
Hayward	74	72	72	72	72	68
San Leandro	44	44	44	44	44	42
West Oakland	25	26	26	26	26	26
Berkeley	49	47	47	47	47	44
West Berkeley	47	57	64	63	62	34
Richmond	57	62	61	62	61	58
San Pablo	67	66	66	66	65	63
Martinez	101	105	101	100	101	67
West Pittsburg	123	121	121	121	121	118
Pittburg	108	107	107	107	107	92
Santa Rosa	133	172	122	121	122	122
Canal Area San Rafael	89	100	93	90	91	90
San Francisco - Mission Bay						
San Francisco Civic Center	22	22	22	22	22	22
San Francisco Mission	31	31	31	31	31	30
Bay View/Hunters Point	25	25	25	25	25	25
Daly City	59	58	59	59	59	59
San Mateo	57	64	61	49	49	49
East Palo Alto	108	141	116	106	106	107
Hayward	90	90	90	90	90	86
San Leandro	61	62	62	62	62	60
West Oakland	42	44	44	44	44	43
Berkeley	66	64	64	64	64	56
West Berkeley	69	74	81	79	72	42
San Francisco International Airport						
San Francisco Civic Center	66	50	50	50	50	47
San Francisco Mission	58	42	42	42	42	39
Bay View/Hunters Point	71	66	66	66	66	63
Daly City	49	44	44	44	44	41
San Mateo	53	63	77	43	43	43
East Palo Alto	112	125	129	100	100	101
Redwood City						
Daly City	145	143	146	138	108	89
San Mateo	82	82	80	89	78	62
East Palo Alto	43	61	62	63	62	62
Sunnyvale						
Daly City	134	131	122	n/a	114	100
San Mateo	81	79	74	137	69	69
East Palo Alto	108	97	96	114	85	85
East San Jose	103	63	63	63	63	63
Milpitas	58	50	58	52	49	52
Gilroy	92	132	117	112	115	81
San Jose Central Business District						
Daly City	144	141	125	130	125	122
San Mateo	90	88	79	76	71	70
East Palo Alto	135	132	103	91	91	87

* Assumes walk access to transit.

Table A-11: Transit Travel Time to Select Job Centers from Low-Income and Minority Communities

Community	1998 Base	2025 Alternatives				
		No-Project	Project	System Management	Blueprint 1	Blueprint 2
East San Jose	28	29	29	29	29	28
Milpitas	51	56	43	43	39	39
Gilroy	109	98	104	105	104	45
Milpitas						
East San Jose	51	57	60	59	60	58
Milpitas	36	37	37	37	37	37
Gilroy	n/a	n/a	n/a	n/a	n/a	88
Pleasanton - Hacienda Business Park						
Hayward	80	93	84	84	84	80
San Leandro	67	81	72	72	72	69
West Oakland	75	91	82	82	82	79
Berkeley	94	108	98	98	98	97
West Berkeley	104	118	109	109	109	107
Richmond	112	123	114	114	114	111
North Richmond	n/a	n/a	n/a	n/a	n/a	127
San Pablo	112	127	118	119	117	116
Martinez	n/a	n/a	n/a	n/a	n/a	134
Hayward - Downtown						
Hayward	35	32	32	32	32	32
San Leandro	51	39	39	39	39	37
West Oakland	51	52	52	52	52	48
Berkeley	62	62	62	62	62	62
West Berkeley	72	72	72	72	72	72
Oakland - Central Business District						
San Francisco Civic Center	26	26	26	26	26	24
San Francisco Mission	32	31	31	31	31	29
Bay View/Hunters Point	59	56	55	56	55	54
Daly City	56	56	56	56	56	54
San Mateo	90	93	93	82	71	69
East Palo Alto	108	127	127	138	127	116
Hayward	57	56	56	56	56	55
San Leandro	30	30	33	33	33	33
West Oakland	27	27	27	27	27	22
Berkeley	32	31	31	31	31	30
West Berkeley	42	42	39	43	43	35
Richmond	62	46	46	46	45	44
North Richmond	61	60	60	60	62	59
San Pablo	50	50	50	50	49	56
Martinez	88	93	87	78	78	72
West Pittsburg	109	108	108	108	108	105
Pittburg	95	93	93	93	93	79
Corelia	108	112	173	160	105	99
Dixon	n/a	n/a	n/a	n/a	136	130

* Assumes walk access to transit.

Table A-11: Transit Travel Time to Select Job Centers from Low-Income and Minority Communities

Community	1998 Base	2025 Alternatives				
		No-Project	Project	System Management	Blueprint 1	Blueprint 2
Concord						
Richmond	88	83	83	84	83	78
North Richmond	99	98	98	99	100	93
San Pablo	89	88	87	89	87	83
Martinez	78	80	80	80	79	79
West Pittsburg	86	86	85	86	85	82
Pittburg	72	71	71	72	71	56
San Ramon - Bishop Ranch						
Hayward	105	124	113	112	112	103
San Leandro	91	112	100	100	100	92
West Oakland	89	92	94	97	96	90
Berkeley	88	88	90	93	92	86
West Berkeley	102	102	104	107	106	99
Richmond	109	107	109	112	111	103
North Richmond	120	122	124	n/a	n/a	118
San Pablo	110	112	113	117	115	108
Martinez	103	103	101	103	103	100
West Pittsburg	125	127	128	131	131	124
Pittburg	110	112	114	117	116	98
Vallejo						
Corelia	139	166	151	113	109	110
Dixon	n/a	n/a	n/a	n/a	151	n/a
Napa	71	109	83	83	74	73
Napa Airport Area						
Napa	30	34	34	34	34	34
Petaluma						
Santa Rosa	60	69	57	57	57	57
Novato						
Santa Rosa	88	107	76	76	75	75
Canal Area San Rafael	76	75	71	69	71	66
San Rafael - Central Business District						
Santa Rosa	115	136	102	106	100	105

* Assumes walk access to transit.

Joseph P. Bort MetroCenter
101 Eighth Street
Oakland, California 94607
TEL (510) 464-7700
TDD/TTY (510) 464-7769
FAX (510) 464-7848
E-MAIL info@mtc.ca.gov
WEB www.mtc.ca.gov

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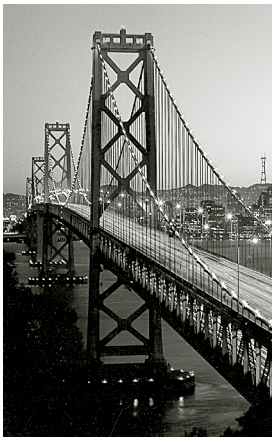

PERFORMANCE MEASURES REPORT FOR THE 2001 REGIONAL TRANSPORTATION PLAN FOR THE SAN FRANCISCO BAY AREA

APPENDIX B
DETAILED METHODOLOGIES FOR PERFORMANCE MEASURES

AND

APPENDIX C
PERFORMANCE MEASURES WORKING GROUP MEETING SUMMARIES

AUGUST 2001

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Appendix B

Detailed Methodologies for Performance Measures

Overview of MTC Travel Forecasts

The 2001 RTP performance measures are based on forecasts of year 2025 demographics and travel. The MTC modeling system, described briefly below, was used to generate separate travel forecasts for each of the five RTP EIR alternatives: Proposed Project, No Project, System Management and Operations, Blueprint 1, and Blueprint 2. Forecasts results were then used to calculate the performance measures for each alternative based on the more detailed methodologies described in this chapter.

Demographic forecasts (population and employment) for 2025 are extrapolated from ABAG projections for 2020 as published in Projections 2000. The underlying demographic and land use assumptions are the same for all of the RTP alternatives. Bay Area population and employment forecasts are allocated to 1099 regional travel analysis zones based on 1990 census geography (tracts, block groups, blocks) for travel demand forecasting. This allows us to forecast travel from one travel analysis zone (or "neighborhood") to another. External gateways to the nine-county Bay Area are represented by 21 additional zones.

Travel forecasts are based on demand and supply-side models. Demand side travel models predict traveler behavior, such as trip frequency choice, trip destination choice, mode choice and time-of-day choice, given demographic factors and transportation network characteristics. Typically, travel demand models are based on a four-step process: trip generation (how much travel?), trip distribution (where do people travel?), mode choice (what mode of travel – transit, highway, bicycle, or walk?), and trip assignment (which road/highway or transit route?) MTC employs three additional steps: time of day models (when do people travel during the day?), auto ownership models (how many cars does a household own?), and working household models (how many workers does a household have?). Demand-side forecasts for 2025 are generated by MTC's BAYCAST-90 model. Detailed information on MTC's BAYCAST model and RTP forecasting assumptions are is available on the MTC website at <http://www.mtc.ca.gov/datamart/forecast.htm>.

Supply side travel models include representations of the 1099 travel analysis zones and transportation networks (transit, highway, and nonmotorized) and the methodologies that determine the best paths for a given origin and destination. Supply side forecasts for 2025 are generated by MTC staff using the network planning software package TP+. The future network representations are based on information provided by project sponsors. Forecasts are generated for the 2-hour AM peak period; these forecasts may then be converted into daily estimates using calibrated "peaking factors".

Due to the way the models forecast non-motorized trips, we do not expect significant changes in the number of walk or bicycle trips based on the various RTP investment alternatives. The models base forecasts of walk and bicycle trips based primarily on proximity of origin and destination and traveler characteristics rather than on the existence of bicycle paths or sidewalks. For example, survey data shows that men are more likely to bike and women are more likely to walk. In addition, certain communities such as Palo Alto have high levels of bicycle usage.

Detailed Methodology

B-1 RTP GOAL: MOBILITY OF PEOPLE AND FREIGHT

Measure 1: Aggregate Travel Time and Travel Time Distribution

Daily aggregate (person/vehicle hours), mean (minutes), median (minutes), and 90th percentile (minutes) travel times by primary travel mode for work, non-work, and truck trips. All statistics are reported at the regional level.

Aggregate travel time and average travel time are also calculated for the 15 RTP travel corridor travel corridors. These travel times estimates provides a more focused geographic picture of how investments affect travel in corridors where major transportation improvements are being considered.

Methodology

Standard model outputs include aggregate travel time, travel time frequency distribution, and person trips by mode and trip type. Travel forecasts are generated for six trip types: home-based-work, non-home-base work, shopping, social/recreation, school, and commercial (truck). For the purposes of this measure, home-based work trips are summed and reported as work trips. Shopping, social/recreation, non-home-based, and school trips are summed and reported as non-work trips.

Statistics are calculated based on the primary mode of travel. Thus, if a trip consists of walking from home to a bus stop, waiting for the bus, riding the bus, and walking from the bus stop to the destination, the entire travel time from home to the destination is reported under transit. For work trips, modes include: drive alone, carpool, transit, walk and bicycle. For non-work trips, the auto driver, auto passenger, drive alone, and carpool trips are combined and reported as simply as auto trips.

This measure is reported at the regional and corridor level. The 2001 RTP defines 15 travel corridors. Trips are assigned to corridors based on origins and destinations. For example, a trip between San Francisco and San Jose is assigned to the Peninsula corridor. This may lead to double counting of trips that span two or more corridors.

At the regional and corridor level, aggregate travel time statistics are divided by person trip statistics to generate mean travel time statistics. At the regional level, median and 90th percentile travel time statistics are interpolated from the frequency distribution. Given the complexity and overlap in the corridor analysis, median and 90th percentile travel time values were not calculated.

Measure 2: Travel Time between Select Origins and Destinations

AM peak period travel times between selected origin - destination pairs (minutes) by primary travel mode for drive alone, carpool, transit, and trucks.

Methodology

Representative origin and destination zone (O-D) pairs in each corridor were selected for passenger and truck travel. O-D pairs were selected to highlight the impacts of major investments and to include ports, airports and major job sites.

TP+ identifies minimum-time paths for drive alone, carpool and transit for every combination of the 1099 travel analysis zones and calculates the total zone-to-zone (or door-to-door) travel time for each mode based on these paths. MTC staff have created TP+ software routines to report the total zone-to-zone travel times for the selected O-D pairs by primary travel mode. The total zone-to-zone travel time for a transit trip typically includes a walk or drive element to access the transit stop, a wait element representing the time the passenger spends waiting for the transit vehicle (or vehicles, if the trip requires a transfer) to arrive, and a walk element to access the destination from the transit stop. The zone-to-zone travel time for drive alone or carpool trip typically involves a terminal time to walk to the vehicle, the time spent in the vehicle driving to the destination, and a terminal time to walk from the vehicle to the destination.

For a given O-D pair, truck travel times are assumed to be the same as drive alone travel times because trucks are most likely to use mixed flow facilities, as opposed to carpool facilities. Truck travel times are addressed by focusing on selected O-D pairs significant for truck movements; these are reported in a separate table.

Measure 3: Accessibility to Jobs and Shopping

Average percent of all regional jobs and retail jobs within X minutes of home: X = 15, 30, 45 minutes for auto and transit; X = 15, 30 minutes for walk and bike.

Methodology

The measure is a weighted average of the number of jobs accessible from each travel analysis zone. Forecasts of 2025 employment locations including retail employment, a proxy for shopping opportunities, are based on ABAG projections.

MTC staff have developed a program that tallies the number of jobs in all zones within a specified travel time contour (or "isochron") by mode from each of the 1099 zones. The regional total value is the average number of accessible jobs from all 1099 zones, weighted by the number of households in all 1099 zones. The calculation is expressed by the equation on the next page.

$$J_k^{\,t} = \frac{\sum J_{ik}^{\,t} H_i}{\sum H_i}$$

Where:

$J_k^{\,t}$ = Average number of jobs accessible by mode k within the travel time t contour for the entire region; k= auto, transit, walk, bicycle; t= 15, 30, 45 minutes.

$J_{ik}^{\,t}$ = Number of jobs accessible by mode k within the travel time contour t from zone i; i=1 to 1099; t=15, 30, 45 minutes.

H_i = Number of households in zone i; i=1 to 1099.

The resulting value is a single number for the region, that represents the average number of jobs accessible per household. This number is then divided by the total number of regional jobs to calculate the percent.

The time dimension of this measure recognizes that people desire different levels of accessibility for different kinds of shopping. People typically wish to make relatively short trips for regular shopping such as groceries, yet are willing to make longer trips for less frequent purchases such as cars, appliances, and furniture. Though differentiating among types of retail is beyond the level of detail of the regional travel model, the 15-minute and 45=minute isochrons reflect the importance of both types of trips.

B-2 ECONOMIC VITALITY

Measure 4: Access of Employers to the Region's Work Force

Number of employed residents within X minutes by mode of major job centers: X = 15, 30, 45 minutes for auto and transit; X = 15, 30 minutes for walk and bike.

Methodology

Eighteen (18) representative job centers were identified throughout the region. These are listed in Table 1. The number of employed residents accessible to the zone in which the job center is located is then calculated for each job center. MTC staff developed a TP+ program to identify all zones within the specified travel time contour of the job-center zone. The employed residents within those zones are then summed together to generate the number of regional workers with access to that job site. The number can also be reported as the share of the region's workforce accessible to each job site.

Table 1: Job Centers Used In Economic Vitality Measure

San Francisco Financial District	Oakland - Central Business District
San Francisco- Mission Bay area	Concord
San Francisco International Airport	San Ramon - Bishop Ranch
Redwood City	Vallejo – Central Business District
Sunnyvale	Napa Airport Area
San Jose Central Business District	Petaluma - Central Business District
Milpitas	Santa Rosa - Central Business District
Pleasanton - Hacienda Business Park	Novato – Central Business District
Hayward - Downtown area	San Rafael - Central Business District

Note that this measure must be reported for each work site since summing the totals for all worksites would double count some workers. At the same time, when we consider results for individual zones we sometimes results that may not be representative of what is actually happening. For example accessibility to one zone may decrease from the No Project to the Project while accessibility to an adjacent zone may stay constant or increase. The true accessibility to the job center located in portions of both zones may not decrease at all, yet if we have chosen to report the first zone, it will appear to decrease. This occurred for the San Francisco Financial District in our analysis. Sometimes this is due to a service improvement that serves one zone directly and forces a new transfer to an adjacent zone.

Measure 5: Economic Efficiency – Net Benefit and Benefit Cost Ratio

Net Benefit = _ [annual user costs] – _ [annualized public expenditures]
Benefit Cost Ratio = _ [annual user costs] / _ [annualized public expenditures]

Where:
User costs = out-of-pocket user + costs travel time costs
Public expenditures = capital and operating expenditures

Methodology

User Costs[1]
Changes in user costs are computed for year 2025 relative to the No Project Alternative. This is essentially a "consumer surplus" factor based on changes in travel time costs and out-of-pocket user costs. Out-of-pocket user costs include transit fares, auto operating costs, parking costs, and tolls.

Figure 1 illustrates the consumer surplus concept for transit, though it applies to all modes. The line D-D is the transit demand curve. P_0 and U_0 represent the generalized price of travel (travel time costs plus out-of-pocket costs) and the forecasted number of transit users in the No Project Alternative. P_1 and U_1 represent the generalized price and number of forecasted users in an alternative with transit enhancements. The new price P_1 results from travel time savings offered by the enhancements and may also reflect changes (positive or negative) in transit fares. Consumer surplus is composed of benefits to existing and new users. The benefits to existing users is represented by the area in square A. The benefits to new users is represented by the area in triangle B. Together areas A and B represent the total value of the benefits to all users.

The following steps are used to estimate the change in user costs:

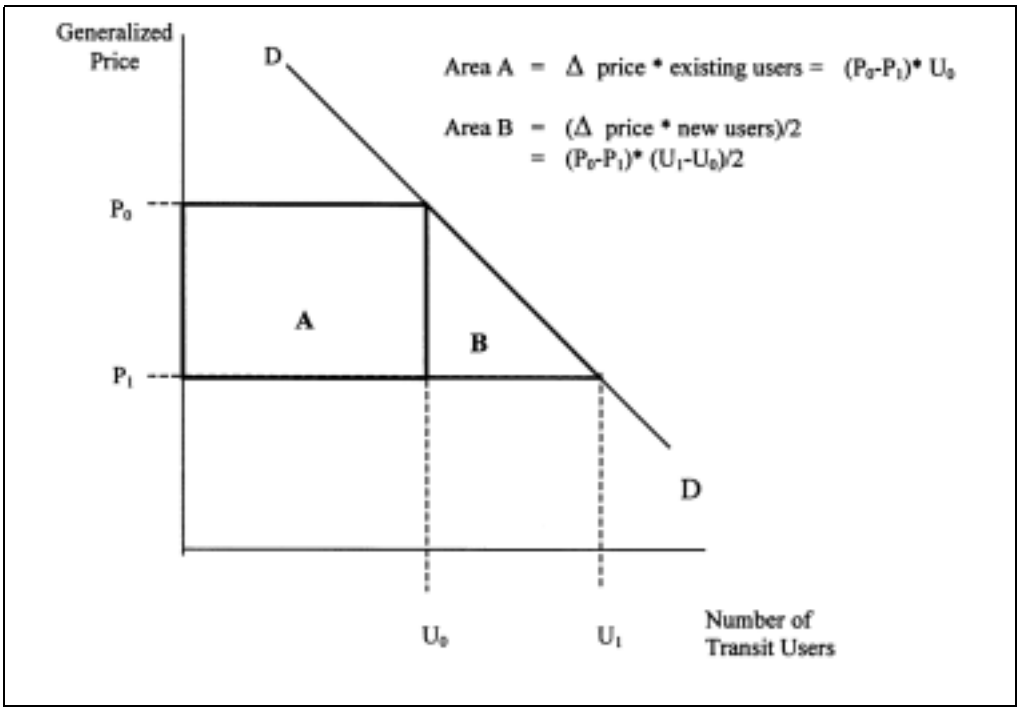
1. **Calculate the change in the number of trips** for each mode (auto, transit, bike, and walk) from travel demand forecasts for the No Project and other alternative.

2. **Estimate daily travel time savings** for existing and new users for each mode. For transit and auto, report in-vehicle and out-of-vehicle travel time separately.[2] A TP+ algorithm compares zone-to-zone travel times for the alternatives for each mode, calculates the savings, and then multiplies the travel time savings by the number of users of each mode. The algorithm is straightforward except when two zones are connected by transit in one alternative but not the other. In this case, the

[1] This section draws heavily from Appendix C in FTA's Technical Guidance on Section 5309 New Starts Criteria (September 1997). This report is currently being updated but the new version of this section was not available at the time of this writing.
[2] In-vehicle travel time is the time spent in the car or transit vehicle. Out-of-vehicle travel time is the time spent walking to the car or transit stop and, in the case of transit, the time spent waiting for the transit vehicle to arrive include time spent waiting to transfer from one route to another. In practice, the out-of-vehicle travel time for a trip by auto between any two zones will not change from one alternative to another; as a result, the change between the two alternatives will always be zero.

alternative in which the zones are connected is assumed to have a 15 minute travel time advantage.

Figure 1: User Benefits



3. **Monetize the travel time savings** by applying the appropriate values of travel time to the travel time savings for existing and new users using the formulae shown in Figure 1. Economic theory bases the value of travel time on opportunity cost, that is activities preferred by people or their employers if they were not traveling. The value of travel time is revealed by the choices people make, though it does not carry an explicit price tag. The analysis of user benefits uses the values of time shown in Table 2. These values are based on three simplifying assumptions:

   - A single value of time is used for in-vehicle travel. This value is assumed to the average post wage rate, which is approximately 75% of the average wage rate ($22.71 per hour) This value is based on home-based-work trips, though economic theory holds that the value of travel time for non-work trips is lower by approximately 50%. This simplification allows a more straightforward calculation of travel time savings instead of calculating savings for each trip type separately. It is likely that approximately 70% of the value of travel time savings in this analysis is attributable to work trips.

   - A single value for out-of-vehicle travel time is used though economic theory holds that the access component is valued differently than the wait

component. The value used in this analysis is roughly 2.2 times the value of in-vehicle travel time. This relationship is based on the relationship of the estimated values of in-vehicle and out-of-vehicle travel time in the regional travel demand model.

- The value of truck travel time includes truck driver wages as well as overhead costs borne by the carrier. The $80 value is based on an economic analysis conducted in Seattle in 1996.

Table 2: Values of Travel Time

Trip Type	*(2001$ per hour)*
Auto person trips – in-vehicle	$ 17.03
Transit person trips – in-vehicle	$ 17.03
Auto/transit trips – out-of-vehicle	$ 37.50
Bicycle trips	$ 17.03
Walk trips	$ 17.03
Truck trips (freight)	$ 80.00

4. **Estimate the change in daily out-of-pocket user costs** by comparing the zone-to-zone user costs for each mode. As with the estimation of travel time savings, this step uses a TP+ algorithm. The TP+ calculations are based on 1990 dollars because the model is calibrated to 1990. As a result, the estimates are adjusted to 2001 dollars based on the ration of the Bay Area CPIs for 1990 and April 2001 (581.3/247.0). If two zones are connected by transit in one alternative and not in the other, a $6.33 advantage ($2.50 in 1990$) is assumed for the alternative in which they are connected. The changes in costs are then multiplied by the number of users by mode.

5. **Annualize the change in user costs.** The estimates of travel time cost and out-of-pocket costs are based estimates of daily trips. The estimates are annualized by multiplying by 300.

Public Expenditures

For this analysis, public expenditures were calculated for the RTP Project Alternative only because limited information on project costs for the other alternatives prohibited further calculations. The following steps are used to calculate the public expenditure for the RTP Project Alternative:

1. **Identify those projects in Track 1 (beyond the Committed projects included in the No Project Alternative) that impact travel time in the travel forecasts.** Because the benefits calculation relies only on travel time savings estimated by the travel demand models, the calculation of public expenditures accounts for only those projects that impact travel time in the travel forecasts. For the most part, this means transit service expansion, arterial, and highway expansion including auxiliary and carpool lanes, interchange improvements, and major

arterial signal interconnect and timing projects. The following types of projects are not included because they do not impact travel time forecasts: transit and roadway rehabilitation, regional customer service programs, planning funds, bike and pedestrian enhancements, safety enhancements, intermodal facilities, and expanded parking for transit stations.

2. **Calculate the annualized capital expenditure in RTP funds for the alternative.** The annualized capital expenditure of a project is the total expenditure cost discounted over the expected lifecycle of the project. Table 3 shows assumptions about the lifecycles of various project types. The measure was calculated using a 4% and a 7% discount rate. The annualized capital expenditures for all projects are summed to get the total RTP Track 1 capital expenditure.

Table 3: Assumed Life Cycles

Improvement	*Life Cycle (years)*
Bus systems	12
Ferry systems (vessels and facilities)	20
Rail systems (vehicles, tracks, stations)	30
New roadway (freeway, arterials, interchanges)*	20
Arterial smart corridors (ITS and signal improvements)	12

3. **Calculate annual operating and maintenance expenditures.** This analysis relied on different methodologies for transit and roadways. For transit expansion projects, the analysis uses net annual operating costs provided by project sponsors. This information was not available for roadway expansion projects. Thus, incremental operating and maintenance costs were estimated by applying a unit cost for pavement maintenance to the lane miles of new roadway in the Project alternative, as represented in the TP+ 2025 Project highway network. This analysis assumed an annual O&M cost for roadways of $11,000 based on the estimated annual O&M cost for the Caltrans District 4 2002 STIP submittal. The annual operating and maintenance costs for all the projects are added to get the total cost for the Project Alternative.

B-3 COMMUNITY VITALITY

Measure 6: Transit Oriented Development - Population and Employment within Walking Distance (1/2 Mile) of Major Intermodal/Rail Stations.

Number of regional population and employment within _ mile of rail stations and major intermodal transit centers

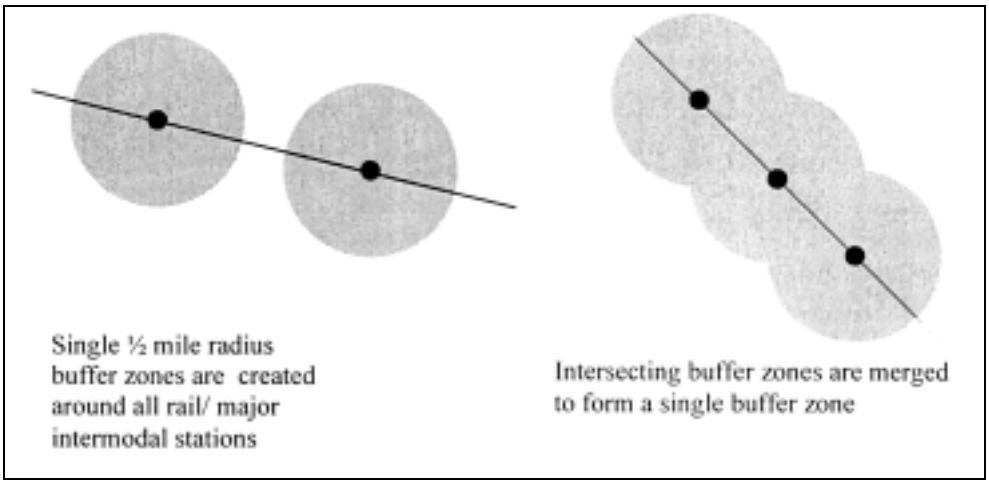
Methodology

We assume that transit oriented development efforts are focused within _ mile of major intermodal and rail stations. At an average rate of 3 miles per hour, walking _ mile would take 20 minutes; this is a reasonable threshold for establishing "walkability" for a regional analysis and is consistent with assumptions in the MTC travel demand model. This analysis includes all rail stations, light rail stops, ferry terminals, and major bus transfer centers with express bus service (such as the Transbay Terminal, San Rafael Transit Center, and Vallejo Transit Center).

This analysis uses MTC's Arcview GIS system to generate estimates of population and employment around each station. The general methodology follows below:

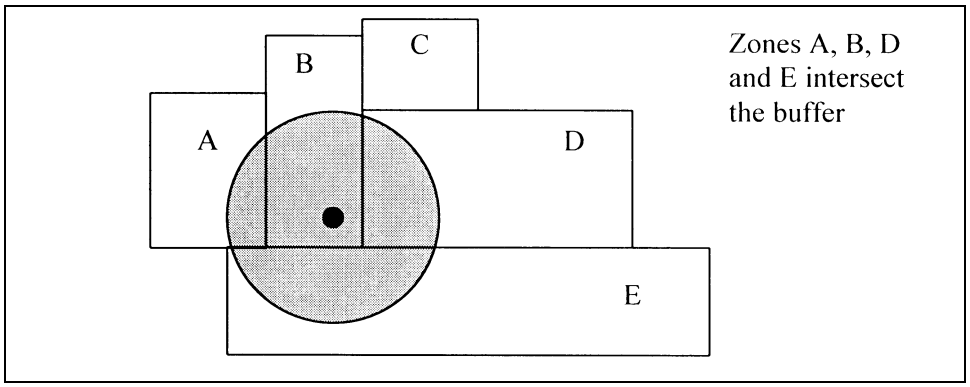
1. **Generate estimates for 2025** based on population and employment forecasts for travel analysis zones.
   - Calculate the average population employment densities for each zone in 2025, assuming even distributions of population and employment within each zone. In general we assume population and employment are evenly distributed within each travel analysis zone, and density is based on the total acreage of the zone. In a few cases where a travel analysis zone contains a large proportion of undeveloped land, density is calculated based on only the developed acreage in the zone.
   - Locate each of the transit stops to be included in this analysis. For this exercise, we converted the TP+ transit network for each alternative to GIS shape files. This is more expedient, though possibly less accurate, than geocoding each station individually.
   - Draw a _ mile radius circle, or "buffer" around each identified major intermodal/rail station in Arcview. Where one buffer intersects another, they are merged to form a single buffer for a group of stations. (See Figure 2.) This step, which is necessary to avoid double counting, is required primarily in San Francisco (where BART and Caltrain stations and the Transbay terminal are close together and along the Muni Metro light rail lines), downtown Oakland (where BART and Amtrak stations are close together), and in Santa Clara (along the VTA light rail lines).

Figure 2: Buffers for TOD Analysis



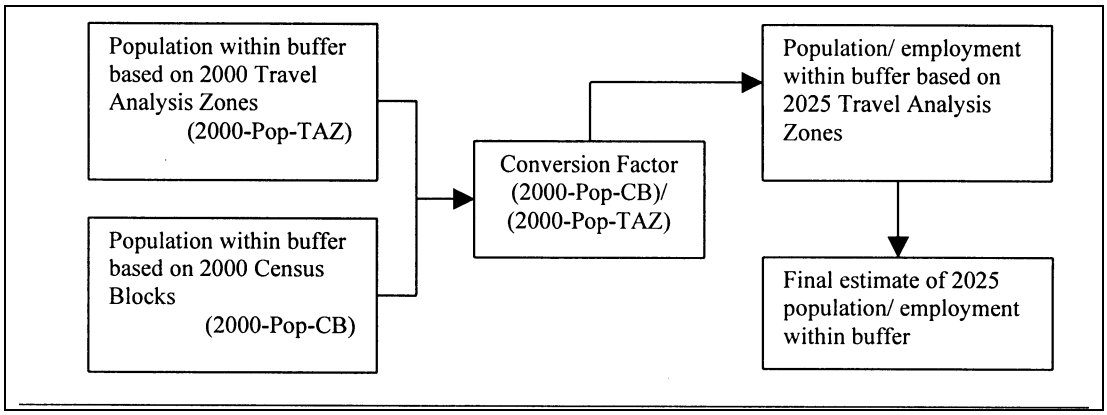
- For each buffer, identify the travel analysis zones that intersect the buffer; calculate area of intersection (See Figure 3.) for each zone and multiply it by the population and employment densities for that zone. The resulting product are estimates of 2025 population and employment for each buffer based on forecasts at the zone-level.

Figure 3: Intersection of Travel Analysis Zones with Buffer



2. **Calculate adjustment factors** based on 2000 population data. In most cases, census blocks are smaller than travel analysis zones and are a better basis for estimating population within the buffers. Census block level data is available for 2000 population only. Thus, we generate conversion factors for each buffer equal to the ratio of population within the buffer based on 2000 census blocks and 2000 travel analysis zones. This method is shown in Figure 4. The population adjustment factor is applied to the 2025 population and employment estimates generated in Step 1.

Figure 4: Calculate Adjustment Factor



3. **Add the adjusted estimates to get totals by county and for the entire region.** This analysis is best suited for reporting at the regional or county level due to the large number of assumptions and a low level of precision in the station locations. Reporting population and employment for individual stations or station groups would imply a level of accuracy higher than that characterizing this analysis.

Measure 7: Transit Trips with Walk Access

Methodology

Standard TP+ outputs include the number of trips for which transit is the primary mode and the number of transit trips with walk access (as opposed to drive access).

B-4 THE ENVIRONMENT

Measure 8: Air Quality and Global Warming –Vehicle emissions

Regulated pollutants (tons per day) –	Reactive Organic Gases (ROG) Nitrogen Oxide (NOx)
Unregulated pollutants (tons per day) –	Particulates (PM_{10}) from entrained road dust Carbon Dioxide (CO_2), surrogate for global warming

Methodology

Estimates of ROG, NOx and PM_{10} are developed at by applying the latest available vehicle emissions factors to MTC's travel demand forecasts for 2025 the regional level. Forecasts of vehicle miles traveled, vehicle trips, and average vehicle speeds are the major demand factors that affect emissions forecasts. MTC staff use the California Air Resources Board model EMFAC 7G/BURDEN 7G to estimate regional vehicular emissions.

B-5 EQUITY

The performance measures for this goal are drawn from one component of the 2001 RTP Equity Analysis which was developed by MTC in consultation with the Environmental Justice Advisory Group. Consistent with federal Environmental Justice guidance, the Equity Analysis assesses whether the RTP results in disparate negative impacts on low-income or minority communities.

The basis of the equity analysis is a comparison of target communities to the rest of the Bay Area according to three measures of mobility. The target communities are minority or low-income communities as defined by federal guidance. According to the guidance, minority refers to as African American, Asian America, Hispanic, and Native American. Data from the 2000 Census is used to identify minority communities. The Bay Area is approximately 50% minority. To focus the analysis on communities with concentrations of minority residents, travel analysis zones are included in the analysis if the combined minority population exceeds 70% of the total population in the zone.

Low-income is defined in federal guidance as having a household income at or below the US Department of Health and Human Services Poverty Guidelines. Due to the high cost of living in the Bay Area, this analysis uses a higher threshold, 200% of poverty. Because 2000 Census data on income is not yet available, this analysis uses 1990 Census data. Travel analysis zones are included in the analysis if 30% or more of the population is low-income.

A total of 333 travel analysis zones qualify under these definitions: 99 zones qualify as low-income, 98 as minority, and 136 as both minority and low-income. These zones can be grouped into 43 target communities based on geographic proximity.

Measure 9: Aggregate Travel Time and Travel Time Distribution for Low-Income and Minority Communities

Aggregate (person/vehicle hours), mean (minutes), median (minutes), and 90th percentile (minutes) travel times by primary travel mode for work and non-work trips for low-income and minority communities compared to the rest of the Bay Area.

<u>Methodology</u>

The general methodology is the same as in Measure 1. To assess whether the RTP has negative, disparate impacts on the target communities, the measure is calculated for minority communities, non-minority communities, low-income communities, non-low-income communities. Communities that are both low-income and minority according to the definition are included in both calculations.

Measure 10: Accessibility to Jobs from Low-Income and Minority Communities

Average percent of all regional jobs and retail jobs within X minutes of home for low-income and minority communities compared to the rest of the Bay Area: X = 15, 30, 45 minutes for auto and transit; X = 15, 30 minutes for walk and bike.

Methodology

The general methodology is the same as in Measure 3. To assess whether the RTP has negative, disparate impacts on the target communities, the measure is calculated for minority communities, non-minority communities, low-income communities, non-low-income communities. Communities that are both low-income and minority according to the definition are included in both calculations.

Measure 11: Transit Travel Time from Low-Income and Minority Communities to Major Job Centers

AM peak period transit travel times for selected pairs of target communities and major job centers.

Methodology

122 selected origin destination pairs are identified based on the 42 target communities (origins) and the 18 major job centers identified in Measure 4 (destinations).

TP+ identifies minimum-time paths for drive alone, carpool and transit for every combination of the 1099 travel analysis zones and calculates the total zone-to-zone (or door-to-door) travel time for each mode based on these paths. MTC staff have created TP+ software routines to report the total zone-to-zone travel times for the selected O-D pairs for all trips involving transit. The total zone-to-zone travel time for a transit trip typically includes a walk or drive element to access the transit stop, a wait element representing the time the passenger spends waiting for the transit vehicle (or vehicles, if the trip requires a transfer) to arrive, and a walk element to access the destination from the transit stop.

Appendix C

Performance Measures Working Group Meeting Summaries

MTC PERFORMANCE MEASURES WORKING GROUP
JANUARY 25, 2001
MEETING SUMMARY

ATTENDANCE

See attached list.

1. INTRODUCTIONS AND WELCOME

After introductions, Lisa Klein and Therese McMillan thanked everyone for participating. Therese acknowledged the challenges before this group. She encouraged the group to set realistic expectations for this RTP and view it as a first step.

Comments/Questions/MTC Staff Response

John Holtzclaw asked whether MTC intended to use performance measures in future RTPs or to pursue project evaluation. He suggested we might see marginal differences between investment packages and project evaluation might reveal bigger differences. Stan Randolph remarked that we will not have time to develop project evaluation measures. Chris Brittle responded that MTC intends to look at a range of alternatives, including land use and pricing, in this and future RTPs. A great deal of project analysis, such as corridor studies, environmental studies, the Blueprint Evaluation, is considered in developing the RTP. Therese McMillan added that the five RTP goals are not always mutually supportive, especially in project level evaluation. For example, a life-line transit route that provide essential access may rank low in cost effectiveness. Investment packages would contain projects that serve different goals well.

2. BACKGROUND ON PERFORMANCE MEASURES AND RTP UPDATE

Lisa Klein stated that much of MTC s past work had been directed at monitoring conditions of the existing transportation system from the customer s perspective; more recently attention has been on applications in the Blueprint and RTP, which require forecasting. Lisa distinguished program level and project level evaluation; the RTP analysis will focus on program evaluation to discern differences among RTP alternatives. The schedule for performance measures for the 2001 RTP is driven by RTP milestones: identifying performance measures and environmental justice (EJ) evaluation measures by the end of March; completing modeling in May; issuing the Draft EIR and performance report in June/July; and adopting the final RTP in October.

Comments/Questions/MTC Staff Response

Tina Konvalinka asked whether we might consider revising or prioritizing the RTP goals. Therese McMillan responded that this would occur in a policy context.

3. OVERVIEW OF ITS (UC BERKELEY) REPORT

Professor Marty Wachs reinforced the importance of monitoring conditions on the existing system and noted that data limitations may force a disconnect between this and what we look at in an RTP forecasting context. He cited the example of safety, for which it is possible to collect good data on existing conditions but for which forecasts are not informative because

they are based on existing accident rates. We should aim to identify outcome oriented measures as opposed to output measures. For example, VMT is an output — rather than outcome — rather than a measure of mobility. In developing the recommended measures in their report, the UC Berkeley team reviewed literature and case studies, formulated a long list of measures, and evaluated them to develop a more manageable list for this group to consider.

Comments/Questions/MTC Staff Response
Michael Cunningham asked whether model accuracy was considered in the evaluation. Professor Wachs responded that it was, and many measures were eliminated because they cannot be forecast at all. Steve Buckley added that we avoided measures that required monetization. Lisa Klein added that we need to view accuracy in terms of comparing alternative forecasts.

Carolyn Gonot remarked that the CMAs use performance measures in their CMPs, yet these are not included in the report. Lisa suggested that CMA staff introduce their measures as appropriate.

Bob Planthold requested that the group revisit the use of VMT and LOS as neither addresses the movement of people. Professor Wachs agreed that this is important but noted it is difficult to get good data on vehicle occupancy.

David Schonbrunn remarked that the report failed to include adequate measures in several categories. He advocated David Jones approach which asks how the system is working. We need more fine-grained measures than congestion. Accessibility and community vitality also were not addressed adequately. Percent of household income spent on transportation should be considered for community vitality. Chris Brittle noted that the group may consider measures of community vitality even though none are recommended in the ITS report.

Jean Hart noted that with the time constraint for this RTP, we need to acknowledge our limitations and look at some things later. Ezra Rapport suggested the group might recommend that MTC revise the RTP goals. Lisa stated that she views the identification of areas for future work to be an important element of the group s work. Therese McMillan added that some goals may not have quantifiable measures. Qualitative analysis is a possibility if it is useful for comparing investment alternatives.

4. WORK GROUP OBJECTIVES AND WORK PLAN

Lisa reiterated the objectives to select measures that allow comparison of investment alternatives in the 2001 RTP update and identify areas for future work. This group will focus on the RTP goals other than equity. The Environmental Justice Working Group (EJAG) will focus on equity during the same time frame, and MTC will provide opportunities for dialog. Work plan milestones include selection of performance measures by the end of March and developing a report in June/July.

Comments/Questions/MTC Staff Response
Jean Hart suggested we spend some time at the next meeting outlining what the group expects to accomplish by March in light of members interests in performance measures.

5. ITEMS FOR FOLLOW-UP

Lisa Klein asked that participants submit comments to her in advance of the next meeting so that we can dive into discussions on the group s expectations as well as specific recommendations for mobility measures. Comments will be due to Lisa on February 2. She will assemble them and distribute them back to the group by February 8.

NEXT MEETING

Two meetings will be held in February:

February 14, 2001	February 27, 2001
3:00 to 5:00 PM	8:30 — 10:30 AM

MTC PERFORMANCE MEASURES WORKING GROUP
ATTENDANCE AT THE JANUARY 25, 2001 MEETING

Name		Representing
Brad	Beck	Contra Costa Transportation Authority
Steve	Beraldo	RIDES
Chris	Brittle	MTC
Mark	Brucker	US EPA (Air 2)
Steve	Buckley	UC Berkeley
Dan	Christians	STA
Melanie	Crotty	MTC
Michael	Cunningham	Bay Area Council
Tom	Goff	California Alliance for Jobs
Carolyn	Gonot	SCVTA
Bill	Gray	William R. Gray and Company
Steve	Gregory	Port of Oakland
Jean	Hart	Alameda County CMA
Pam	Herhold	BART Financial Planning
Henry	Hilken	BAAQMD
John	Holtzclaw	Sierra Club
Dan	Kirshner	Environmental Defense
Lisa	Klein	MTC
Tina	Konvalinka	AC Transit
Mariane	Lee-Skowronek	SFTA
Trent	Lethco	MTC
Noreen	McDonald	
Therese	McMillan	MTC
Gabrielle	Middleton	BART
Bob	Planthold	EDAC
Chuck	Purvis	MTC
Stan	Randolph	California Trucking Assn.
Ezra	Rapport	Senate Select Committee
David	Schonbrunn	TRANDEF
Todd	Vogel	US EPA (Air 2)
Martin	Wachs	ITS, UC Berkeley
Matt	Williams	
Albert	Yee	Caltrans

MTC PERFORMANCE MEASURES WORKING GROUP
FEBRUARY 14, 2001
MEETING SUMMARY

ATTENDANCE —See attached list.

1. **BACKGROUND MATERIALS DISTRIBUTED**
   Per requests by participants, MTC staff distributed the following materials:
   (a) Intermodal Performance Measures for the Bay Area Transportation System, Summary Report by David Jones (1995)
   (b) RTP Task Force Track 2 Questions (1996)
   (c) List of performance measures used in countywide plans (2/14/01).
   (d) 2001 RTP Outreach Schedule

2. **INTERESTS AND OBJECTIVES**
   MTC s objective is twofold: (1) to identify performance measures in the next 2 months for use in the 2001 RTP at the same time and (2) to identify efforts that are important to participants but too complex or time consuming to pursue directly in association with the 2001 RTP. These would be pursued following the 2001 RTP. For the 2001 RTP, MTC staff want to focus on measures that link to the RTP goals and decisions outlined in the agenda packet and that are consistent with the evaluation criteria used by ITS. We recognize that project evaluation is of interest to many participants but cannot overpromise to conduct a complete project evaluation for this RTP. MTC suggested that a Blueprint-like project evaluation could be included for a specific set of high interest projects.

   Professor Wachs responded to comments he had received that the report addressed performance measures too narrowly. ITS stated that the scope of the ITS study was focused on the immediate RTP process rather than on an ideal system of measures. The report therefore only minimally explores monitoring of existing conditions and of quality of life issues that could be addressed through surveys or other means. The RTP context constrains the types of measures that are meaningful. For example measures of safety are not useful in an RTP forecasting context.

   <u>Comments/Questions</u>
   - Project evaluation should include a consumer surplus measure based on the value of time.
   - The Blueprint analysis of travel time savings is flawed because it does not account for delays due to construction or for induced travel demand.
   - At the Lisa Klein s request, participants offered statements of their interests for MTC s use of performance measures. These statements are summarized in Attachment A.

   <u>MTC Staff Response</u>
   - MTC staff will propose a work plan to address the stated concerns in this RTP and in future work.

3. **PERFORMANCE MEASURES FOR THE MOBILITY GOAL**
   MTC staff distributed a hand out showing the 12 measures recommended in the ITS report as well as the approximately 17 suggestions submitted by participants. In an effort to help

reduce the list to 10 or fewer, MTC grouped the measures in tiers based on feasibility for the RTP, ties to RTP decisions, and the other evaluation criteria from the ITS report.

Comments/Questions

- The table should also show which measures are relevant to other RTP goals.
- The measures focus too much on the movement of vehicles and not enough on the movement of people. Measures of speed and congestion should be collapsed.
- Consumer surplus should be considered to illustrate the value of travel time savings.
- The measures focus too much on the peak period and on motorized modes. Mode split would be a good measure of accessibility.
- As part of the LUTRAC study, Cambridge Systematics published a handbook on how to model pedestrian travel.
- The group agreed that the measures of congestion and delay do not address the very important notion of system reliability. We need to note that this data is not available and that this makes the measures weaker.
- VMT per person trip and VHT per person trip show the relationship of persons and vehicle movement and illustrate access, mobility and system efficiency.
- It is important that the measures reflect notions of transit access and of choice.
- VTA used a measure of transit accessibility reflecting access to opportunities by transit.
- VTA has measured mobility benefits as a function of the number of person trips accommodated in the peak hour.

MTC Staff Response

- MTC model capabilities related to off-peak period, non-work trips, and non-motorized modes could be presented at a future meeting.

4. ITEMS FOR FOLLOW-UP

- CMA staff should submit corrections to the list of measures used in countywide plans.

For the next meeting:

- MTC staff will develop a work plan for the longer term issues.
- MTC staff will prepare a presentation on model capabilities related to off-peak period, non-work trips, and non-motorized modes.
- Lisa Klein will work with Carolyn Gonot to develop 5-minute presentations on VTA s measures of transit accessibility and of person trips in the peak period.
- David Reinke will prepare a 5-minute presentation on consumer surplus.
- Chuck Purvis will prepare a brief presentation on measures of accessibility.

After hearing further input, MTC staff will propose a short list of 10 or fewer measures of mobility for the RTP.

NEXT MEETING

February 27, 2001, 8:30 — 10:30 AM

MTC PERFORMANCE MEASURES WORKING GROUP
ATTENDANCE AT THE FEBRUARY 14, 2001 MEETING

Brad	Beck	Contra Costa Transportation Authority
Steve	Beraldo	Rides for Bay Area Commuters
Chris	Brittle	MTC
Mark	Brucker	US EPA (Air 2)
Steve	Buckley	UC Berkeley
Stuart	Cohen	Transportation Choices Forum
Melanie	Crotty	MTC
Michael	Cunningham	Bay Area Council
Carolyn	Gonot	Santa Clara Valley Transportation Authority
Jean	Hart	Alameda County CMA
Henry	Hilken	Bay Area Air Quality Management District
John	Holtzclaw	Sierra Club
Lisa	Klein	MTC
Tina	Konvalinka	AC Transit
Marian	Lee-Skowronek	San Francisco County Transportation Authority
Trent	Lethco	MTC
Noreen	McDonald	
Dennis	Oliver	California Alliance for Jobs
Chuck	Purvis	MTC
Ezra	Rapport	Senate Select Committee
David	Reinke	BART
David	Schonbrunn	TRANSDEF
Todd	Vogel	US EPA (Air 2)
Martin	Wachs	Institute of Transportation Studies, University of California
Albert	Yee	Caltrans District 4 Hwy Operations

Attachment A
Objectives and Interests
Statements by Participants in the February 14, 2001 Meeting
of the Performance Measures Working Group

Relation to Decision Making

- Improve the quality of analysis and of public discourse
- Illustrate realistic outcomes for decision makers
- Illustrate differences based on existing and future needs; do not shape needs
- Illustrate distinctions among values
- Steer investment decisions to optimize transportation results, equity, and protection of the environment
- Steer decisions to efficient transportation and enhanced livability while minimizing pollution and habitat loss
- Enhance accountability and trust
- Help make efficient use of resources
- Reflect mobility and other RTP goals and reveal deficiencies when county plans are put together
- Recognize conflicts of interest between counties and the region

Goals & Activities for the Working Group and MTC

- Develop consensus for what will be used in this RTP
- Recognize that we may eventually revise measures selected for use in the short term
- Identify a small set of measures to evaluate the relative ability of alternatives to meet the RTP goals using available tools
- Develop standard measures, or at least consistent measures, to evaluate projects and plans and for monitoring.
- Identify enhancements to models and methodologies to enable better measures
- Develop a monitoring system to show trends relative to RTP goals to the public
- Connect monitoring and RTP analysis
- Develop a vision
- Develop (RTP) objectives and use performance measures to help guide investments
- Identify corridor issues and objectives and monitor performance relative to those objectives. Use modeling to show how we will meet the objectives in the future.

Characteristics of Measures

- Measures should incorporate economic valuation
- Individual measures should support multiple goals
- Measures should apply to management of both supply and demand
- Measures should look at access and choice, not just corridor mobility
- We need a variety of measures to reflect the diversity of the Bay Area
- Avoid ambiguous measures

MTC PERFORMANCE MEASURES WORKING GROUP
FEBRUARY 27, 2001
MEETING SUMMARY

ATTENDANCE —See attached list.

1. BACKGROUND MATERIALS DISTRIBUTED

The following materials were provided at the meeting:

From last meeting

- Statements from participants: objectives and interests
- RTP decisions and performance measures table

Follow-up to ongoing discussion

- Continuing work plan
- Notes on issues raised in discussion on mobility
- Relationship between mobility measures and other RTP goals

New

- Draft description of potential RTP EIR alternatives
- Regional transit expansion program draft criteria
- Discussion paper by Sherman Lewis: Performance Measures: Problems of Means and Ends

2. PROCESS FOR NEXT MEETINGS AND CONTINUING WORK PLAN

MTC staff reviewed the objectives for the meeting as well as the topics for the next few meetings. The group will need to meet twice more by early April to develop a recommendation for measures for all the RTP goals, including Mobility, on which we focused to date. Other topics include objectives for the RTP goals, the continuing work plan, and summary of the process and areas of agreement/disagreement for presentation to the Commission. MTC staff presented options for meeting facilitation including the possibility of hiring an outside facilitator for the next two meetings.

Staff welcome suggestions for desired model and analysis capabilities (improvements) and refinements to the RTP performance measures on an ongoing basis. Suggestions requiring significant model improvements would be forwarded for consideration by the existing Model Coordination Task Force.

Phase 1 of the work on performance measures would take us through the end of March and the recommendation to the Commission of measures for the 2001 RTP. Phase 2 work elements for the group include: (1) Review of the 2001 RTP Performance Report; (2) Refinements to the 2001 RTP performance measures for the future; and (3) Development of a monitoring program.

Comments/Questions	MTC Staff Response
• It would be helpful to have an outside facilitator and is important that we find someone skilled an knowledgeable on this topic. This may be difficult on such short notice.	• MTC staff will try to find a skilled facilitator.

Comments/Questions	MTC Staff Response
• It will be important to summarize all the discussion meaningfully for other people and decision makers	• MTC staff will prepare a summary of the process, the discussion and areas of agreement/ disagreement for presentation to the Commission with the recommendation.

3. RTP DECISIONS AND ALTERNATIVES

As context for the group s work, MTC staff gave an overview of nine key RTP decisions and the 4 proposed alternatives for the RTP EIR. Staff encouraged the group to keep them in mind as we will look to the measures to help inform these decision. Three of the four proposed RTP alternatives are financially constrained; the 4th (Blueprint Alternative) would assume some new funding sources as well as the Smart Growth land use scenario and pricing strategies. Staff also encouraged participants to comment more extensively on the structure of the alternatives in the general RTP outreach and in other forums so the group could proceed with its charge to identify performance measures.

Comments/Questions	MTC Staff Response
• MTC customer service projects need to be evaluated. In particular transit operator satisfaction would be an important measure for TransLink¤	• MTC has developed a separate set of measures of effectiveness for these projects. They are reported to the Partnership Planning and Operations Committee as well as individual project oversight committees.
• It would be more informative to run Alternative 3: Other Projects with and without the land use scenario rather than including the land use scenario with the Blueprint Alternative. • It would be best to run the land use scenario separately	• Originally included the land use scenario with the Blueprint Alternative because these are things that MTC does not have the authority to implement. (i.e., MTC can t change land use and can t increase the available funding). The Commission cannot adopt an alternative based on the land use assumptions different from those adopted by ABAG.
• Alternative 2: Maintenance and Operations may not show differences from the others	

4. ISSUES RAISED FOR MOBILITY GOAL

Chuck Purvis from MTC gave a brief presentation on accessibility indicators, highlighting the differences between accessibility indices and isochronal accessibility. The isochronal indicators was used in the equity analysis for the 1998 RTP. David Reinke gave a brief presentation on economic analysis and benefit-cost analysis which has been used in Albany and Seattle. A principle advantage of economic analysis is the potential to compare maintenance, operations, expansion, and supply-side and demand side-strategies. The Group did not have time to review other issues on the agenda, and MTC staff directed the group to review materials in the handouts, which included discussion and specific proposals.

Comments/Questions	MTC Staff Response
• Can surrogates be used for non-work trips with the accessibility measures? • Can all schools be included?	• MTC has looked at using retail jobs (for home based shopping trips) and higher education facilities (for some school trips). Other schools could be included but you must also think about the amount of information you try to present.
• The greatest potential for increasing accessibility is for intra-zonal trips. How are these measured? • It might make more sense to measure accessibility based on distance than on travel time.	• We make assumptions based on accessibility to neighboring zones.
• Professor Wachs expressed concern at benefit-cost analysis would be less sensitive in a regional plan than in a project evaluation context. • Steve Buckley commented that benefit-cost analysis relies heavily on value assumptions on which there does not appear to be consensus. • Benefit cost analysis might work if you limit the number of things you try to value	

5. ITEMS FOR FOLLOW-UP

- MTC staff will try to find a skilled and knowledgeable facilitator for the next meeting

NEXT MEETINGS

March 21, 2001	April 4, 2001
2:00 — 6:00 PM	2:00 — 5:00 PM (shorter, if possible)
MTC Offices	MTC Offices

MTC Performance Measures Working Group
Attendance at the February 27, 2001 Meeting

Janet	Abelson	Albany-El Cerrito Access
Brad	Beck	Contra Costa Transportation Authority
Steve	Beraldo	Rides for Bay Area Commuters
Chris	Brittle	MTC
Mark	Brucker	US EPA (Air 2)
Steve	Buckley	UC Berkeley
Dan	Christians	Solano Transportation Authority
Michael	Cunningham	Bay Area Council
Carolyn	Gonot	Santa Clara Valley Transportation Authority
Steve	Gregory	Port of Oakland
Henry	Hilken	Bay Area Air Quality Management District
John	Holtzclaw	Sierra Club
Lisa	Klein	MTC
Marian	Lee-Skowronek	San Francisco County Transportation Authority
Sherman	Lewis	
Noreen	McDonald	Cambridge Systematics
Dennis	Oliver	California Alliance for Jobs
Chuck	Purvis	MTC
Ezra	Rapport	Senate Select Committee
David	Reinke	BART
David	Schonbrunn	TRANSDEF
Todd	Vogel	US EPA (Air 2)
Prof. Martin	Wachs	Institute of Transportation Studies, University of California
Albert	Yee	Caltrans District 4 Hwy Operations

MTC PERFORMANCE MEASURES WORKING GROUP
MARCH 21, 2001
MEETING SUMMARY

ATTENDANCE —See attached list.

1. **SUMMARY OF LAST MEETING**
   There were no comments on the summary.

2. **MEETING OBJECTIVES AND PROCEDURES**
   MTC staff stated that the primary objective for this meeting is to identify approximately 10 measures that the group can support for use in the 2001 RTP. MTC staff would also like to identify areas for future work for presentation with our recommendation to the Commission. We need to have a recommendation in early April so we can analyze model forecasts and produce a performance report for this RTP. Carolyn Verheyen from Moore Iacofano Goltsman (MIG) will facilitate the next two meetings.

3. **DISCUSSION OF CONTINUING WORK PLAN**
   MTC staff outlined two principle elements of the continuing work plan: 1) refinements to the RTP measures, and 2) development of a complementary program to monitor the existing system. Topic will be addressed in more detail at the next meeting. It is important to show work will continue beyond the 2001 RTP to address a variety of interests.

Comments/Questions	MTC Staff Response
• Participants asked that the following be addressed in the continuing work plan: • Refine the RTP measures, particularly to integrate cost benefit analysis and market pricing. • Address measures related to smart growth (e.g. mode choice and VMT). • Develop objectives by corridor so we know what we are trying to measure. • Develop project-level measures. • Conduct post implementation evaluation of projects. • Monitoring should be based on the refined RTP measures. • Conduct a peer review of MTC s models. • It is a good goal to include cost benefit analysis; we need to retain traditional measures, such as LOS. • Commit to regular meetings	• MTC staff will consider these suggestions in developing the continuing work plan. With regard to model improvements, MTC is willing to consider specific suggestions. We would collect them with suggestions from EJAG and the Air Quality Conformity Task Force and review them all through the Partnership Modeling Coordination Subcommittee.

Comments/Questions	MTC Staff Response
• Members of the group requested an update on the definition of the alternatives and what projects are included in the baseline.	• MTC staff will provide a status report; however, a better forum to comment on these issues is the county and regional RTP outreach process.

4. STATUS REPORT ON EQUITY ANALYSIS

MTC staff introduced the item by noting that the Environmental Justice Advisory Group (EJAG) has been charged to develop the equity analysis. Some but not all elements of the proposed analysis rely on modeling; mapping analyses and financial analyses are also proposed. The lifeline transit network will be one of the mapping elements. The current thought is that we would use the modeling component of the equity analysis in the RTP performance measures.

Comments/Questions	MTC Staff Response
• Has MTC thought about doing accessibility analyses to grocery stores, schools, etc using the models (in addition to the mapping exercise)?	• Many of these trips are intra-zonal, and therefore are better handled by mapping. In addition, the mapping is a good tool to talk to transit operators.

5. DISCUSSION OF SUGGESTED PERFORMANCE MEASURES

MTC staff gave an overview of the memo in the agenda packet. Staff reviewed the following materials received after the packet had already been assembled:

a) David Schonbrunn asked for a comparison between the MTC proposal and a list of sustainable indicators from the Victoria Transport Policy Institute (VTPI). Staff integrated them into the list of other measures for the exercise (Attachment 2).
b) David Schonbrunn and Carolyn Gonot (not present) provided comments in writing and these were distributed.
c) David Reinke proposed an approach to economic analysis that was forwarded to the group by e-mail. MTC staff suggested that differences between MTC s and David s proposed measures be resolved in a separate small group discussion.

Carolyn Verheyen described the exercise. For the proposed measures, she asked each person to indicate whether he or she a) supports the measures as proposed, b) supports it with modifications, or c) does not support it. For the other measures (Attachment 2 from the memo), she asked each person to identify any measures he or she would like to discuss further. The list of other measures was been modified a) to show measures that are either already included in the proposal or that MTC staff feel strongly are not good measures or are not feasible; and b) to include the VTPI sustainability indicators. Participants will be asked to raise their red (disagreement/do not support), yellow (support with qualifications), and green (support) cards at various points in the discussion to document where they stand based on the discussion. The use of the cards does not constitute a formal voting mechanism.

The group conducted the exercise and Carolyn led discussion on each of the proposed measures. (See attached summary of discussion for details — ***Omitted from this version***)

ACTIONS/OUTCOMES

Mobility

- General support for measures 1 and 2, coupled together and with specific modifications as follows:
  1) Aggregate and average person hours of travel reported separately by mode (auto, transit, walk, bike) for work and non-work trips; the measure would be calculated regionally and within corridors to capture short trips as well as longer trips.
  2) Travel time between select O/D pairs, reported separately by mode (transit, drive alone, carpool, trucks) in the AM peak period. O/D pairs will be selected to reflect changes in travel due to major RTP investments and will include ports, airports, CBDs and major employment centers.
- Support in large part for the proposed accessibility measure:
  3) Accessibility to jobs and shopping opportunities: percent of all regional jobs and retail jobs within 20, 40, 60 minutes by transit and auto (separately), within 20, 40 minutes by bike, and within 20 minutes by walk.

Economic Vitality — discussion deferred to 4/4 due to lack of time.

Community Vitality

- There was very little support for the proposed measure
  6) VMT on arterials — daily
- And little support for any alternatives suggested to date. There was somewhat more support, but still not substantial, for use of the accessibility measure for shopping opportunities within 20 minutes.
- There was consensus in large part to a) agree to address this goal through monitoring, b) give it some more thought before the next meeting, and c) at a minimum, include a discussion in the recommended measures and performance report of the goal and the difficulty measuring it for the RTP.

Equity — The group made the following recommendations to EJAG:

8) Average number of jobs within 20, 40, 60 minutes by auto, carpool, transit
   - Measure should be consistent with #3 and should refer to percent of regional jobs .
9) Average travel time for work trips from target communities
   - None
10) Transit access from target zones to major job centers
   - Clarify that transit access will be measured as door to door travel time.
   - After some discussion, the group generally agreed that the list of job centers here should be consistent with those in measure #4.

Economic efficiency — a small group will meet to reconcile different proposals.

ITEMS FOR FOLLOW-UP

- A small group will meet before the next meeting to discuss differences between MTC s and David Reinke s proposed measures of economic efficiency. Volunteers included Sherman Lewis, Ezra Rapport, Mark Brucker, David Reinke, Martin Wachs, Lisa Klein, and Chris Brittle.
- MTC staff will incorporate a discussion of VTA mobility measure person trips in the peak period , as requested in a previous meeting. (This measure has also been proposed for testing.)
- Give more thought to community vitality, as none of the proposed measures was broadly accepted.
- MTC staff will provide a status report on the RTP alternatives and definition of the baseline.
- The group will discuss measures for economic vitality at next meeting.

NEXT MEETING

April 4, 2001
2:00 — 5:00 PM
MTC Offices, Room 171
101 8th Street, Oakland

MTC Performance Measures Working Group
Attendance at the March 21, 2001 Meeting

Brad	Beck	Contra Costa Transportation Authority
Steve	Beraldo	Rides for Bay Area Commuters
Chris	Brittle	MTC
Mark	Brucker	US EPA (Air 2)
Steve	Buckley	UC Berkeley
Lisa	Carboni	Caltrans
Dan	Christians	Solano Transportation Authority
Corrine	Goodrich	SamTrans/JPB
Steve	Gregory	Port of Oakland
Jean	Hart	Alameda County CMA
Henry	Hilken	Bay Area Air Quality Management District
John	Holtzclaw	Sierra Club
Lisa	Klein	MTC
Marian	Lee-Skowronek	San Francisco County Transportation Authority
Trent	Lethco	MTC
Sherman	Lewis	
Noreen	McDonald	Cambridge Systematics
Dennis	Oliver	California Alliance for Jobs
Chuck	Purvis	MTC
Ezra	Rapport	Senate Select Committee
David	Reinke	BART
Todd	Vogel	US EPA (Air 2)
Professor Marty	Wachs	Institute of Transportation Studies, University of California

MTC PERFORMANCE MEASURES WORKING GROUP
APRIL 4, 2001 - REVISED
MEETING SUMMARY

ATTENDANCE —See attached list.

1. SUMMARY OF LAST MEETING

Comments/Questions	MTC Staff Response
• Clarification offered re the comment about VMT in the detailed summary under Environmental Quality: VMT may be better because it better measures MTC s contribution .	• The minutes will be changed to reflect this statement.
• Request for clarification on measure #1 under mobility: is it average or aggregate travel time.	• Both average and aggregate would be reported.
• Requests to revisit #1 to a) consider median and 90th percentile instead of average and b) to understand the measure better.	• Agree to revisit #1.

2. MEETING OBJECTIVES AND PROCEDURES

Carolyn Verheyen from MIG stated that the primary objectives for the meeting are to develop agreement on measures for the remaining RTP goals, working from MTC s proposal and the positions recorded on March 21 for each proposed measure, and to review other measures of interest. As time allows, we the group can discuss ideas for future work. Participants will be asked to raise their red (disagreement/do not support), yellow (support with qualifications), and green (support) cards at various points in the discussion to document where they stand based on the discussion. The use of the cards does not constitute a formal voting mechanism. We are aiming for general support rather than consensus.

3. DISCUSSION OF SUGGESTED PERFORMANCE MEASURES

The group discussed the two proposed measures (#4 and #5) under Economic Vitality and ultimately expressed general support to at least test #4 and to drop #5. The group reviewed the outcome of the small group meeting on the economic efficiency measure (#11), proposed for inclusion under the Economic Vitality Goal, and expressed general support to at least test it. The group revisited selected measures under Mobility (#1 and #3) and endorsed modifications. Members of the group proposed a new measure for consideration under Community Vitality; however, the group did not generally support the proposal. See Actions/Outcomes and the detailed summary sheets for more discussion of the specific measures. ***— Detailed Summary omitted from this version —***

Comments/Questions	MTC Staff Response
• The equity measures be identical to comparable mobility and economic vitality measures	• Staff will coordinate recommendations by the two groups so they are consistent.
• Some of the other indicators of interest to this group should be included in the performance report as well as the RTP EIR.	• One objective in selecting 10 measures for the report was to focus attention on a small number of measures. Not sure we achieve this goal by including a lot of other measures in the performance report. We can decide this at a later point

ACTIONS/OUTCOMES (Based on discussions on 3/21 and 4/4)

Mobility	Status
1. Aggregate, median, and 90th percentile travel time reported separately by primary travel mode (drive alone, carpool, transit, walk, and bike) for: – Work trips (person hours) – Non work trips (person hours) – Truck trips (vehicle hours) For example, the total travel time for a trip with walk access to transit would be reflected under transit. Calculated for the region and by corridor to capture short trips. Mode share or number of trips by mode would be reported with this measure as an explanatory factor.	General support on 4/4 to revise the measure as shown from version accepted on 3/21.
2. Travel time for select O/D pairs reported separately by mode for drive alone, carpool, transit, trucks (AM peak) O/D pairs selected by corridor to show impacts of major RTP investments; include ports, airports, CBDs and major employment sites	General support for measure in combination with #1. (Unchanged from 3/21.)
3. Accessibility to jobs and shopping opportunities Percent of all regional jobs (reported separately by mode) within X minutes X = 30, 60 minutes for auto and transit X = 15, 30 minutes for walk and bike – Look at a threshold for retail jobs (proxy for shopping)	General support on 4/4 for changes as shown from version accepted on 3/21

Economic Vitality	Status
4. Accessibility of employers to the region's workforce Percent of regional workforce within X minutes of select job centers (TBD) X = 30, 60 minutes by drive alone, carpool, transit X = 15,30 minutes by walk, bike	General support to at least test the measures as shown. (revised from original proposal) Mixed support to include as 1 of the 10 measures
	General support to drop this measure.
11. Economic efficiency – defined as one of the following depending on computation complexity: a) net benefit = present value(travel time savings) – present value(costs) b) benefit cost ratio = (value of travel time savings)/(annualized costs) Costs will include direct user costs (auto operating costs and transit fares) and public investments (lifecycle capital and operating costs) in projects that impact travel time in the model. Changes in travel time and costs will be calculated from the base case (no project alternative).	General support to test measure including valuation of safety and air quality (PM_{10}) and include a full discussion of the difficulties in measuring and valuing them. Mixed support for including under Economic Vitality as one of the 10 measures.
See also #1 and #2: aggregate travel time and O/D travel time for trucks	Not discussed by group.

Community Vitality

On the whole, the group felt none of the proposed measures or other suggestions on 3/21 or 4/4 adequately captured the concept of Community Vitality. As a result, staff will not recommend a performance measure for this goal; however, the recommendation will include a discussion of the importance of this goal, the difficulty in measuring in it the RTP context, and the desire that be addressed through the performance monitoring program in the future.

Environmental Quality

6. Emissions: – ROG and NOx emissions (tons per day over/under transportation budget) – PM10 emissions (tons per day) from vehicles, entrained road dust – CO2 emissions (tons per day) from transit, autos/trucks (surrogate for global warming)	Supported as proposed. (Unchanged from 3/21.)

Equity [proposed by EJAG]

7. Percent of all regional jobs with 30, 60 minutes of home by drive alone, carpool and transit from target communities and by income group (includes peak and off-peak)	Suggestion to EJAG: make consistent with #3 (as revised on 4/4)
8. Average travel time for peak and off-peak work trips from the target communities	Suggestion to EJAG: none. (Unchanged from 3/21.)
9. Transit access from target communities to select job centers (SF, Oakland, San Jose, Tri-Valley, Walnut Creek/Concord, and Santa Rosa)	Suggestion to EJAG: make list of job centers consistent with #4 (as revised on 4/4)

ITEMS FOR FOLLOW-UP

- Clarify how the accessibility measures for mobility and economic vitality would be calculated.
- Develop a list of key points to include in the discussion of Community Vitality, its importance as an RTP goal, and the difficulty of measuring it in the RTP context.

NEXT MEETING

April 25, 2001
3:00 — 5:00 PM
MTC Offices, 3rd Floor Conference Room

101 8th Street, Oakland

MTC Performance Measures Working Group
Attendance at the April 4, 2001 Meeting

Janet	Abelson	Albany-El Cerrito Access
Brad	Beck	Contra Costa Transportation Authority
Steve	Beraldo	Rides for Bay Area Commuters
Chris	Brittle	MTC
Lisa	Carboni	Caltrans
Dan	Christians	Solano Transportation Authority
Michael	Cunningham	Bay Area Council
Margurite	Fuller	San Francisco MUNI
Carolyn	Gonot	Santa Clara Valley Transportation Authority
Steve	Gregory	Port of Oakland
Henry	Hilken	Bay Area Air Quality Management District
John	Holtzclaw	Sierra Club
Lisa	Klein	MTC
Tina	Konvalinka	AC Transit
Marian	Lee-Skowronek	San Francisco County Transportation Authority
Sherman	Lewis	
Noreen	McDonald	Cambridge Systematics
Dennis	Oliver	California Alliance for Jobs
Ezra	Rapport	Senate Select Committee
David	Reinke	BART
David	Schonbrunn	TRANSDEF
Ethan	Veneklasen	California Alliance for Jobs
Carolyn	Verheyen	MIG
Todd	Vogel	US EPA (Air 2)
Martin	Wachs	Institute of Transportation Studies, University of California

MTC PERFORMANCE MEASURES WORKING GROUP
APRIL 25, 2001
MEETING SUMMARY

ATTENDANCE —See attached list.

1. SUMMARY OF LAST MEETING

Comments/Questions	MTC Staff Response
• Under Community Vitality, the summary should be amended to reflect the group s with that the recommendation include a discussion of the importance of the goal, and the importance of developing a means to measure community vitality in the future through monitoring.	• The summary will be edited to reflect these changes.

2. MEETING OBJECTIVES

MTC staff stated that the objectives for the meeting were to review the recommendation that will go to the Commission in May, explain any adjustments from where the group left off on April 4, and wrap up discussion on selected topics including the accessibility measure, other measures of interest, and the continuing work plan.

3. STATUS REPORTS

MTC staff gave an overview the three principal elements of the of the proposed equity analysis: (1) a mapping exercise to show the relationship between transit and activity centers; (2) a modeling exercise consistent with the other performance measures; and (3) a funding analysis. The Environmental Justice Advisory Group (EJAG) has reached tentative agreement on the demographic profile for the modeling exercise but more discussion is needed on the three proposed measures. MTC staff gave an overview of developments related performance measures in the Regional Agencies Smart Growth project. The project will use predictors to evaluate alternative land use scenarios for each of the counties. They anticipate using the same measure we are recommending for air quality; however, they are discussing using person-miles of travel and mode share rather than the RTP performance measures.

4. CLARIFICATION OF ACCESSIBILITY MEASURES

Due to confusion at the last meeting, MTC staff reported back to the group with a clarification on the accessibility measure. The measures is a weighted average of the number of percent of jobs accessible within the given travel time contour (e.g. 15 minutes) for each zone. The average is weighted by households because not all zones are comparable.

Comments/Questions	MTC Staff Response
• Would it be better to use the median than the average?	• It is not clear that a median would be meaningful or different from the average.
• We are not likely to see changes among alternatives in the regional number.	• MTC would likely do some mapping of the different alternatives to compare them. The idea of looking at subareas (e.g. superdistricts or counties) seems interesting. We may wish to explore that when it comes down to calculating the measure.
• Does the measures address the need for more jobs where there are more people?	• Yes, in so far as the measures is weighted by households.
• For several measures, MTC may have to see the results and then decide how to most meaningfully report them.	
• It is not clear what we are trying to get at with accessibility. Without objectives by corridor, we cannot target our measures. The alternatives are so similar that our measures will not show differences and decision makers will not see the value of using performance measures.	

5. RECOMMENDATION FOR THE 2001 RTP

MTC staff gave an overview of the draft memo containing staff recommendations to the MTC Planning and Operations Committee (POC). Staff described several adjustments (outlined in the meeting packet) from where the group left off on April 4. The adjustments were made after consideration of technical feasibility and staff work load. The group spent some time discussing the appropriate travel time thresholds for the accessibility measures under Mobility, Economic Vitality, and Equity. The general sense was that 30 minutes was too high for the lower threshold, because it is longer than the average travel time, and 60 minutes is too high for the higher threshold, because it represents a really long trip. We might do better to approximately half below and half above the average travel time. The group discussed 12.5/25/50, 15/30/45, and 20/40/60 minute thresholds for transit and auto trips. There was also substantial about the nature of shopping trips and that many such trips are shorter than work trips. MTC staff also reviewed the measures proposed for testing. MTC staff directed the group s attention to the list of other measures of interest that received 5 or more votes at the April 4 meeting. In the interest of time and desire to move on to the work plan, the group did not discuss this topic. The group offered several comments on the continuing work plan.

Comments/Questions	MTC Staff Response
• May need further explanation of the relevance of measures to RTP decisions.	• We will address this and other suggested edits in the final version.
• Recommend a shorter memo that is more of an advocacy piece. It would talk about the importance of performance measures in the RTP and the need for monitoring.	

Comments/Questions	MTC Staff Response
• The potential value of performance measures does not come across. It is shortsighted not to mention the great future potential. • Many jurisdictions have not signed on to a full program of performance measures and are hesitant or suspicious, particularly of potential project evaluation. There remain issues about how the measures are used that still need to be resolved. • The memo should reflect both the excitement, interest and skepticism about performance measures. • SFTA is in support of performance measurement. We see this RTP as a test phase, given that we don t know how well the measures will work.	
• Will the data be available to others? • Regarding travel time thresholds for accessibility, round numbers such as 15, 20, 30, etc. will be more useful for the public.	• MTC will make it available in Excel files that can be downloaded from our web site. • MTC staff agree.
• Please clarify why the net benefit measure does not appear in the recommendation. It should be clear that the benefit cost ratio is merely a placeholder until we can do the net benefit measure. • The benefit cost and net benefit measures are meaningless unless they account for latent demand, induced demand, and delay due to construction. • We should be especially thorough in the discussion of limitation of the economic efficiency measure because it is a bottom line type of measure. • We should include accident and pollution costs in the net benefit measure	• We will not be able to include the net benefit measure in the performance report in August because we will not have mid-year (2010 and 2020) travel forecasts until the fall; the mid-year forecasts are necessary to estimate the benefits stream for the net benefit calculation. • MTC staff are aware that some participants hold this perspective. MTC staff decided to include the measures despite mixed support from the working group. We will include a discussion of these and other limitations of the measure in the report. • As discussed previously, MTC would provide model output information to members of the group who wish to do these calculations.

Comments/Questions	MTC Staff Response
• In the air quality measure, NOx and ROG should be measured as total tons per day (rather than tons over or under conformity budgets).	• It is significant that these pollutants are decreasing and will be far below the conformity budget in 2025. If we are far below the budget, do we have a problem? We will report total tons per day and include the budget as a footnote.
• Re person trips in the peak period, it is not clear whether we trying to measure capacity expansion or efficiency.	• This is a measure of throughput that assumes a more efficient system will move more people in the peak period.
• How do the measures address the needs of an aging population that won t be able to drive? • The most common way to travel for those used to drive is to be driven by someone else.	• The performance report will look indirectly at the needs of the aging population; however, this is really a larger planning issue.
• Pricing measures are needed to address the pricing things correctly.	• This has been raised a number of times, and while not included on the list of other measures, has not generated a lot of support within the group.

Specific comments about the continuing work plan:

Comments/Questions	MTC Staff Response
• Address the need for goals and objectives. What does it mean where the memo says that MTC is still evaluating this? • Include an analysis of transportation-related problems (regional and corridor). This should include a problem hypothesis. • Address the need for objectives for each corridor. • Address global warming.	
• We should be talking about the agenda for future work in greater detail. We should schedule regular meetings.	• The future meeting schedule needs more discussion. We are hesitant to commit to a series of regular meetings to discuss future work prior to completion of the RTP. This is simply a limitation of staff resources.
• We should meet again after the Commission reviews the recommendation to find out what happened and to continue discussion on continuing work. • Next meeting could be a scoping session.	

ACTIONS/OUTCOMES

- MTC staff will revise the memo to reflect the comments above. In particular, the memo will be revised to include more of an advocacy tone and to convey more about the long term benefits of performance measures and the spirit of the group. Those with additional, specific edits should forward them to Lisa Klein by noon on Friday, April 27.
- MTC staff will revise the travel time thresholds for the accessibility measures under Mobility, Economic Vitality, and Equity so that the lowest threshold is shorter than the average travel time. Staff will likely choose between 15/30/45 and 20/40/60.
- The performance report will list the total emissions for ROG and NOx along with the transportation budget and the tons per day above/below the budget.
- We will schedule a meeting for late May or early June to review Commission reaction to the recommendation and to continue discussion on the continuing work plan.

6. NEXT STEPS AND ITEMS FOR FOLLOW-UP

- MTC staff will revise the recommendation to POC in accordance with suggestions.
- MTC staff will check availability by e-mail for possible meeting dates in late May or early June.
- MTC staff will work on a detailed document to summarize the process. The document will include a more in-depth discussion of key issues covered by the group.

NEXT MEETING

Wednesday, June 6, 2001
3:00 — 5:00 PM
Claremont Conference Room, MTC s Harrison Street Offices
1999 Harrison Street, Suite 1700, Oakland

MTC PERFORMANCE MEASURES WORKING GROUP
ATTENDANCE AT THE APRIL 25, 2001 MEETING

Janet	Abelson	Albany-El Cerrito Access
Brad	Beck	Contra Costa Transportation Authority
Chris	Brittle	MTC
Mark	Brucker	US EPA (Air 2)
Steve	Buckley	UC Berkeley
Lisa	Carboni	Caltrans
Patrick	Duffey	ABAG
Henry	Hilken	Bay Area Air Quality Management District
Lisa	Klein	MTC
Tina	Konvalinka	AC Transit
Marian	Lee-Skowronek	San Francisco County Transportation Authority
Trent	Lethco	MTC
Noreen	McDonald	Cambridge Systematics
Chuck	Purvis	MTC
Ezra	Rapport	Senate Select Committee
David	Reinke	BART
David	Schonbrunn	TRANSDEF
Marty	Wachs	Institute of Transportation Studies, UC Berkeley