



Date: February 9, 2010
 Current Meeting: February 18, 2010
 Board Meeting: March 3, 2010

BOARD MEMORANDUM

TO: Santa Clara Valley Transportation Authority
 Congestion Management Program & Planning Committee

THROUGH: General Manager, Michael T. Burns

FROM: Chief CMA Officer, John Ristow

SUBJECT: Transportation System Monitoring Program Final Report

Policy-Related Action: No

Government Code Section 84308 Applies: No

ACTION ITEM

RECOMMENDATION:

Accept the recommendations from the Transportation System Monitoring Program (TSMP) Final Report.

BACKGROUND:

The work plan and budget for VTA staff to proceed with the development of a Transportation System Monitoring Program (TSMP) was approved by the Technical Advisory Committee (TAC), Policy Advisory Committee (PAC), Congestion Management Program & Planning (CMPP) Committee and the VTA Board of Directors in late 2008. Since then, staff has worked with the TAC Members in assessing the data and defining the performance measures for the TSMP. A presentation on the preliminary recommendations and draft report was presented to the TAC and PAC in December 2009. Attached (Attachment A) is a copy of the final report that incorporates the comments received from these committees. The comments were editorial in nature and the questions asked at the meetings focused on clarification of the data being presented. Additional background information on the initial TSMP development, program objectives, and program benefits are provided below:

Program Development

The concept of developing a countywide transportation system monitoring program stemmed from an earlier effort by Santa Clara Valley Transportation Authority's (VTA's) Technical Advisory Committee (TAC) to study the issue of litter control and landscape maintenance along

the freeways in Santa Clara County. This initial effort was followed by a pilot program to monitor and assess in detail the resources needed to address litter control and vegetation management.

After the completion of the Litter Control and Landscape Maintenance Study and the Litter Control Pilot Program, the TAC Subcommittee discussed the potential benefits of developing a comprehensive countywide transportation system monitoring program (TSMP) for Santa Clara County. The conclusion was that VTA, in its capacity as the Congestion Management Agency for Santa Clara County, would be the appropriate agency to lead this effort. VTA retained Cambridge Systematics Inc. to assist with this effort based on their experience in developing similar monitoring programs for other public transportation agencies.

Program Purpose

The purpose of developing and implementing a transportation system monitoring program would be the ability to provide to local jurisdictions, VTA committees, and the VTA Board with current information on the condition and performance of transportation systems in Santa Clara County in a single, public friendly report format. The following are specifics of the TSMP:

- Development of a comprehensive TMSP providing current information and over time, historical trend data, on the condition and performance of transportation systems in Santa Clara County.
- Implementation of the TSMP in phases with the initial program relying solely on available data and input from VTA's TAC.
- Designing a modular program so that additional transportation system elements can be added in subsequent phases.

Key Program Benefits

Although there are monitoring programs in place that provide performance assessments such as VTA's Congestion Management Program (CMP) Monitoring and Conformance Report that reports on the performance of CMP facilities and VTA's quarterly Transit Operations Report that reports on the performance of VTA's transit system, a countywide transportation monitoring mechanism that provides a comprehensive assessment of the county's transportation system in a single report does not exist. The key benefits of developing and implementing a transportation monitoring program would be the following:

- Provide a comprehensive reporting mechanism that measures the conditions and performance of Santa Clara County's transportation system in a single report format.
- Serve as an asset management tool that could be used to identify specific areas in the county's transportation system that are deficient or need maintenance or improvements.

- Communicate progress towards stated transportation system goals and objectives.
- Provide additional context for funding and policy decisions.
- Establish a foundation for evaluating the implications of future funding scenarios in terms of their impact on future transportation system performance.
- Provide a mechanism for benchmarking performance between Santa Clara County and other Bay Area counties.
- TSMP findings could be used as a basis for developing grant applications to enhance, maintain, and/or remedy deficient areas of the county's transportation system infrastructure.

DISCUSSION:

Recommended Transportation System Components and Measures

Table 1 from Attachment B presents a list of recommended transportation systems and performance measures for the initial TSMP. These recommended measures are based on existing data sources, and previous discussions with TAC members and VTA staff on key policy issues regarding the performance of the county's transportation systems.

The table identifies a series of recommended performance measures for each component. An indication of timing for implementation of each measure is also provided. This distinction between the Initial Measure and Potential Future Measures is based on the availability of data to support each measure.

Transportation System Conditions

Table 2 from Attachment C summarizes the findings on the current conditions of selected transportation systems in Santa Clara County. These conditions are reported at the county level as originally intended. More detailed information can be found in Chapter 3 of the TSMP Report.

In brief, the conditions of Santa Clara County's roadway pavement, bridges, and freeways are generally in good condition. However, there is a need for improvement in the operations and maintenance of the county's roadside assets (e.g., roadside litter control and vegetation management, pavement markings, and light poles). Based on the survey responses from Member Agencies, the condition of the roadside assets is fair and their ability to maintain these assets with existing resources is marginal. The State (Caltrans) roadway facilities are in similar conditions and have similar issues with lack of resources related to maintenance.

As for the non-auto transportation systems such as Santa Clara County's transit system (VTA's

bus and light rail system) and bicycle network, VTA's transit on-time performance for 2009 was 90% for bus service, and 80 % for light rail service. Three other measures were used to assess the conditions of VTA's transit system and are listed in Table 2.

Assessing the completion of VTA's Cross County Bicycle Network and Across Barrier Connections (ABCs, overcrossings over major roadways) were measured by comparing completed miles and connections with planned bicycle lanes and ABCs. As of 2008, 45% of the planned cross county bicycle network and 79% of the planned ABCs have been completed.

Three measures related to environmental sustainability were also included in the TSMP: vehicle miles traveled per person, average fuel efficiency for vehicles, and number of air quality infractions. From 2005 to 2007, the number of vehicle miles traveled per person based on the county's population and fuel consumption marginally increased from 8.49 to 8.7 million gallons of fuel per year, and the number of air infractions increased from 21 to 27 infractions per year.

Next Steps

Implementing the TSMP is the first step to establishing a comprehensive and consistent reporting mechanism for Santa Clara County's transportation systems. From this point forward, a data baseline can be developed and used as a benchmark for monitoring progress towards the county's transportation goals. In addition, the data collected could be used to build the case for resources to improve deficient areas identified from the TSMP.

Project Schedule

The tentative schedule for implementing the TSMP is as follows:

- TAC, PAC and CMPP approval of TSMP final report - January 2010 (Action)
- Board Consideration - February 2010 (Action)
- First Mid-Year Monitoring Progress Report - July 2010 (Progress Report)
- First Year Annual Monitoring Report Results - March 2011 (First Annual Report)

ALTERNATIVES:

The Board may request staff to make changes to the TSMP or direct staff to not continue the TSMP.

FISCAL IMPACT:

There is no fiscal impact as a result of this action. The monitoring work is already included in the Congestion Management Program work plan and the FY 2010 and FY 2011 Adopted Congestion Management Program Operating Budget.

STANDING COMMITTEE DISCUSSION/RECOMMENDATION:

Prepared by: Eugene Maeda
Memo No. 2469

Transportation System Monitoring Program

final report

prepared for

Santa Clara Valley Transportation Authority

prepared by

Cambridge Systematics, Inc.

Transportation System Monitoring Program

prepared for

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January 2010

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1.0 Introduction

1.1 BACKGROUND

The concept of developing a countywide transportation system monitoring program stemmed from an earlier effort by Santa Clara Valley Transportation Authority's (VTA's) Technical Advisory Committee (TAC) to study the issue of litter control and landscape maintenance along the freeways in Santa Clara County. This initial effort was followed by a pilot program to monitor and assess in detail the resources needed to address litter control and vegetation management.

After reviewing the findings from the Litter Control and Landscape Maintenance Study and Litter Control Pilot Program, the TAC initiated an effort to develop an expanded program that would provide a comprehensive snapshot of the health and performance of Santa Clara County's transportation systems in a single report format. This program, the Transportation System Monitoring Program (TSMP), would essentially serve as an asset management tool and reporting mechanism for Santa Clara County's transportation system infrastructure.

This report presents the framework, findings and recommendations for implementing a transportation system monitoring program for Santa Clara County.

1.2 PERFORMANCE MANAGEMENT FRAMEWORK

Public agencies throughout the U.S. are facing increasing pressure to demonstrate accountability for their investment decisions. In response to these pressures, many transportation agencies are employing performance management programs. The overall goal of these programs is to improve transparency, make the best use of limited resources in terms of achieving agency objectives, and build the case for allocating resources to support transportation investments.

Figure 1.1 represents a typical performance management framework. The framework includes the following steps:

Selecting Measures. The first step is to select measures that can be used throughout the process. These measures should reflect the agency's priorities and goals, and answer performance related questions such as "how are we doing?" The selected measures should also focus on out-put results that reflect the impact of decisions made, rather than simply measuring the amount of resources being devoted to a particular activity.

Setting Targets. Performance targets are specific values used as benchmarks that an agency would like to achieve. These benchmarks are useful in communicating agency goals and tracking progress towards them.

Using Measures in Decision-Making. A fundamental part of a successful performance management program is the use of measures that can be used by decision makers to make informed decisions. For example, performance results can be used to improve decisions about where an agency needs to focus its resources. These results can also be used to help decision makers understand the implications of funding decisions. For example, different scenarios can be presented to describe the changes to a budget for a particular activity and the impacts to the performance of a network. If the budget is decreased, the expected result can be a decrease in the network performance. Likewise, if the budget is increased, improvements to the network performance can be expected.

Evaluating the System. This step involves communicating performance results on a regular basis. Although measures should be updated periodically to ensure consistency with agency priorities and strategic plans, there are significant benefits associated with maintaining and reporting using a stable set of measures. Internally, this allows for in-depth analysis of long term trends. Externally, consistent reporting can make it easier for elected officials and the public to fully appreciate progress that is being made or new challenges that arise.

Figure 1.1 Performance Management Framework

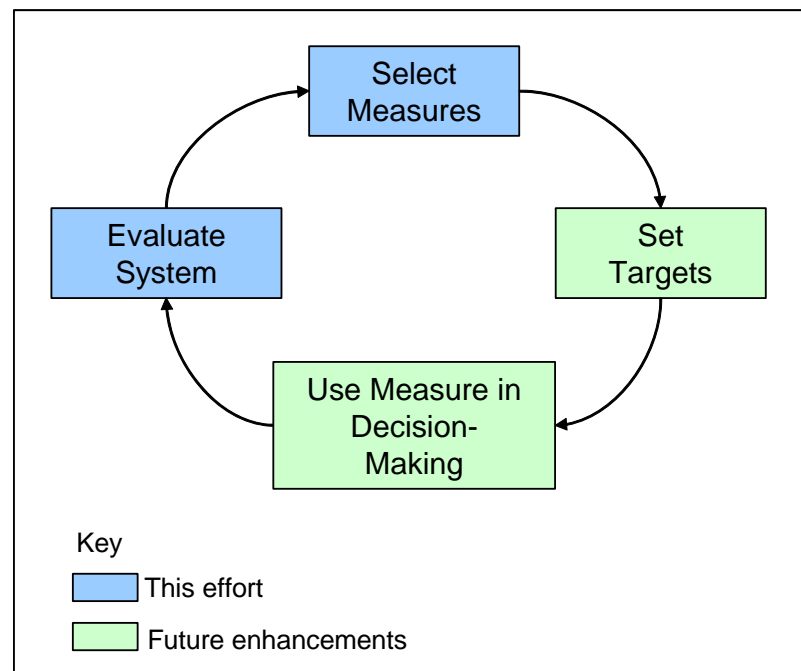


Figure 1.1 also illustrates how the initial development of the TMSP fits into the overall performance framework. The scope of this initial effort includes

identifying measures to use in TSMP and conducting an initial analysis of Santa Clara County's transportation systems.

1.3 TSMP PURPOSE

The residents of Santa Clara County have made significant investments in its transportation infrastructure. One of the major concerns raised by local agencies was the growing deferred maintenance backlog and ongoing maintenance needs resulting from the recent decline in funding resources.

The purpose of developing and implementing a transportation system monitoring program would be the ability to provide to local jurisdictions, VTA Advisory Committees, and the VTA Board with current information on the health condition and performance of transportation systems in Santa Clara County in a single, public friendly report format. The specific objectives for developing the TSMP were:

- Develop a comprehensive TMSP that provides current information and over time, historical trend data, on the condition and performance of transportation systems in Santa Clara County.
- Implement the TSMP in phases with the initial program (first year of monitoring) relying solely on available data.
- Design a modular program so that additional transportation system elements can be added in subsequent phases.

1.4 TSMP BENEFITS

When fully implemented, the TSMP will:

- Enable the county and external stakeholders to better understand the current performance of the county's transportation system and the effectiveness of transportation investments.
- Communicate progress towards stated transportation system goals and objectives.
- Provide additional context for funding and policy decisions;
- Establish a foundation for evaluating the implications of future funding scenarios in terms of their impact on future transportation system performance.
- Provide a mechanism for benchmarking performance between Santa Clara and other Bay Area counties.

1.5 REPORT ORGANIZATION

The remainder of this report is organized as follows:

- Chapter 2 lists the performance measures recommended for the TSMP;
- Chapter 3 presents a snap shot on the conditions and performance of Santa Clara County's transportation systems using the recommended measures;
- Chapter 4 describes how the data was compiled and calculated for use in the initial assessment; and
- Chapter 5 provides recommendations for implementing the TSMP in Santa Clara County.

2.0 Recommended Transportation System Components and Measures

Table 2.1 below presents a list of recommended components and performance measures for the TSMP. These recommendations are based on discussions with TAC members and VTA staff on key policy issues regarding the performance of the county's transportation systems and available data.

The table identifies a set of recommended performance measures for each component. An indication of timing for each measure is also provided. The System Components describe the various transportation systems that are part of the transportation infrastructure. The Initial Measures are recommended performance measures that can be used to report the condition or performance of the corresponding system component. The Potential Future Measures are measures that could be used for reporting but require additional or more detailed data in order to be considered valid. The distinction between these measures is based solely on the data that is currently available to support each measure. If the data required calculating the measure is available, it is listed in the Initial Program column. If not, it is listed as a Potential Future Measure.

Table 2.1 Recommended System Components and Measures

System Components	Initial Measures	Potential Future Measures
Pavement condition	1. Average pavement condition (based on pavement inspections)	
Freeway mobility	2. Percent of freeways with traffic moving freely (based level of service)	<ul style="list-style-type: none"> • Travel time reliability
Bridge condition	3. % of bridges in good condition (based on bridge Sufficiency Rating)	
Signals	4. Percent of signals in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Frequency of traffic signal maintenance • Average age of equipment compared to expected life cycle • Response time to complaints/incidents
Pavement markings	5. Percent of markings in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspections

System Components	Initial Measures	Potential Future Measures
Roadway signs	6. Percent of signs in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspections • Average age of signs compared to estimated service life • Response time to complaints/incidents
Light poles	7. Percent of light poles in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Average age of equipment compared to estimated service life • Response time to complaints/incidents
Curb and gutter	8. Percent of curb and gutter in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspections • Response time to complaints
Roadside litter management	9. Percent of roadside with virtually no or some litter (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspection (as recommended in Litter study) • Response time to complaints/incidents
Bicycle mobility	10. % of cross county bike network completed 11. % of planned across barrier connections completed	<ul style="list-style-type: none"> • Access to bike network (using GIS mapping)
Bus and light rail	12. On-time transit performance 13. Percent of planned transit service provided 14. Transit trips per person 15. Remaining service life of transit vehicles	<ul style="list-style-type: none"> • Access to transit service
Sustainability	16. Vehicle miles traveled per person 17. Average fuel economy 18. Number of recorded air quality infractions	<ul style="list-style-type: none"> • Mode split (percent of trips that occur on transit vs. automobiles vs. bike/pedestrians) • Total carbon footprint (vehicles and transit)

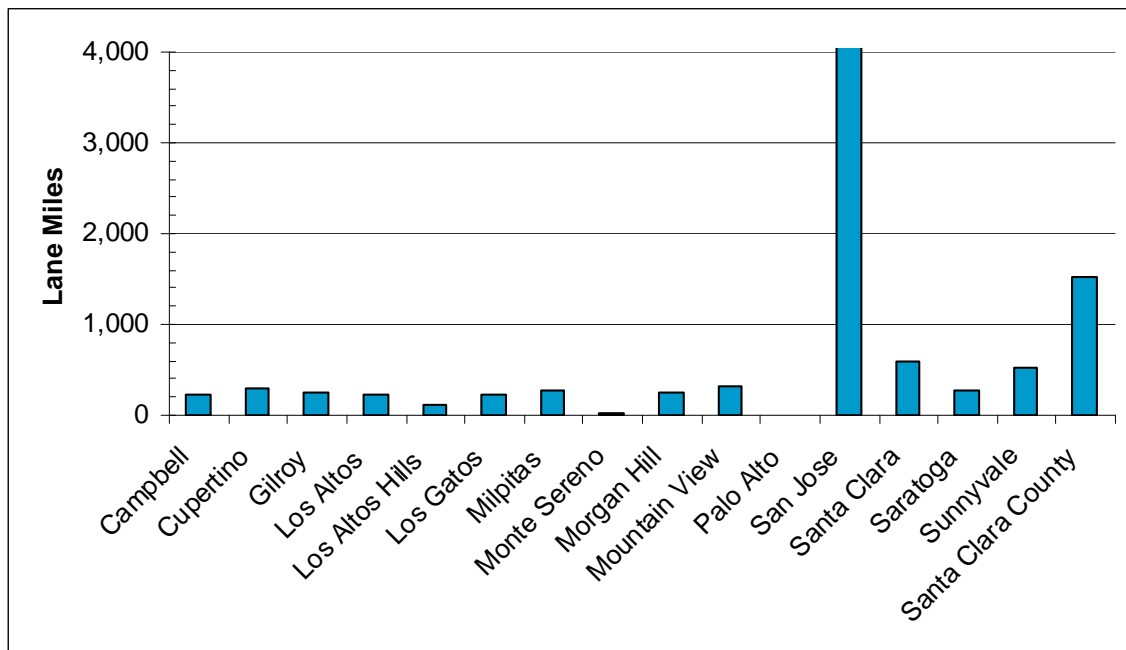
3.0 Current System Conditions

This section presents a snap shot on the conditions and performance of Santa Clara County's transportation system components listed in Table 2.1 of the previous chapter, including information on inventory for each component. One of the goals for TSMP is to present a report at the county level. However, in many cases, the underlying supporting data have been compiled by municipality and are shown in this chapter for a few system components. The list of data sources and details of how each performance was calculated is provided in Appendix A.

3.1 PAVEMENT

Figure 3.1 presents a breakdown of city and county pavements in Santa Clara County by jurisdiction. San Jose and Santa Clara County are responsible for the vast majority of the pavement.

Figure 3.1 Pavement Inventory by Jurisdiction



Source: MTC

Table 3.1 presents the average pavement condition in Clara County. These results are based on annual pavement inspection data submitted by local jurisdictions to the MTC. The results in each year represent a 3-year moving

average. Pavement conditions are reported as either poor, at risk, fair, good or very good.

Table 3.1 Average Pavement Condition for Santa Clara County

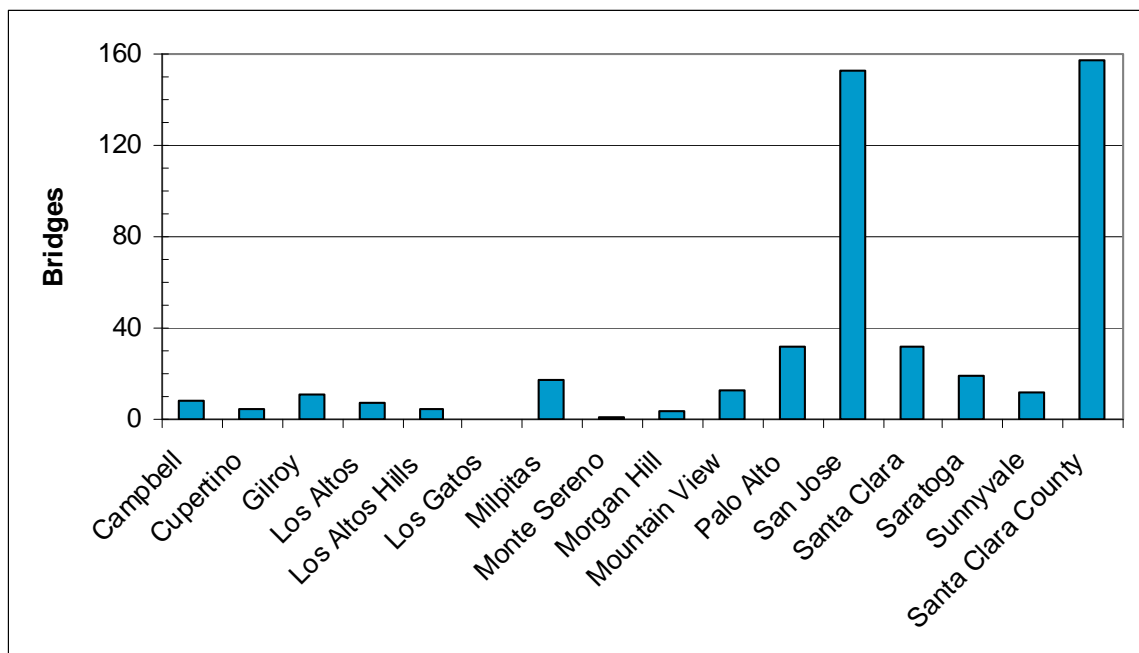
	2004	2005	2006	2007
Average pavement condition	Good	Good	Good	Good

Source: MTC

3.2 BRIDGE

Figure 3.2 presents a breakdown of city and county bridges in Santa Clara County by jurisdiction. San Jose and Santa Clara County are responsible for the vast majority of local bridges, with each maintaining over 150 bridges. In contrast, Caltrans maintains over 525 bridges in the county.

Figure 3.2 Bridge Inventory by Jurisdiction



Source: MTC

A common measure of bridge performance in the U.S. is sufficiency rating. The Federal Highway Administration uses this rating to determine the degree to which bridges in the U.S. are sufficient to remain in service. The rating is based on bridge inspections that are performed every two years. Bridges that have a sufficiency rating less than or equal to 80 qualify for federal bridge rehabilitation funds. For the purposes of the TSMP it is recommended that “good bridge

condition” be defined as bridges with sufficiency rating greater than 80. Table 3.2 summarizes the condition of bridges in the county.

Table 3.2 2008 Bridge Condition for Santa Clara County

	Number of Bridges	Percent in Good Condition
Local bridges	476	64%
State bridges	529	72%
TOTAL	1,005	68%

Source: Caltrans

3.3 FREEWAYS AND URBAN HIGHWAYS

Table 3.3 shows a breakdown of the freeways in Santa Clara County by use – for both general purpose lanes and High Occupancy Vehicle (HOV) lanes.

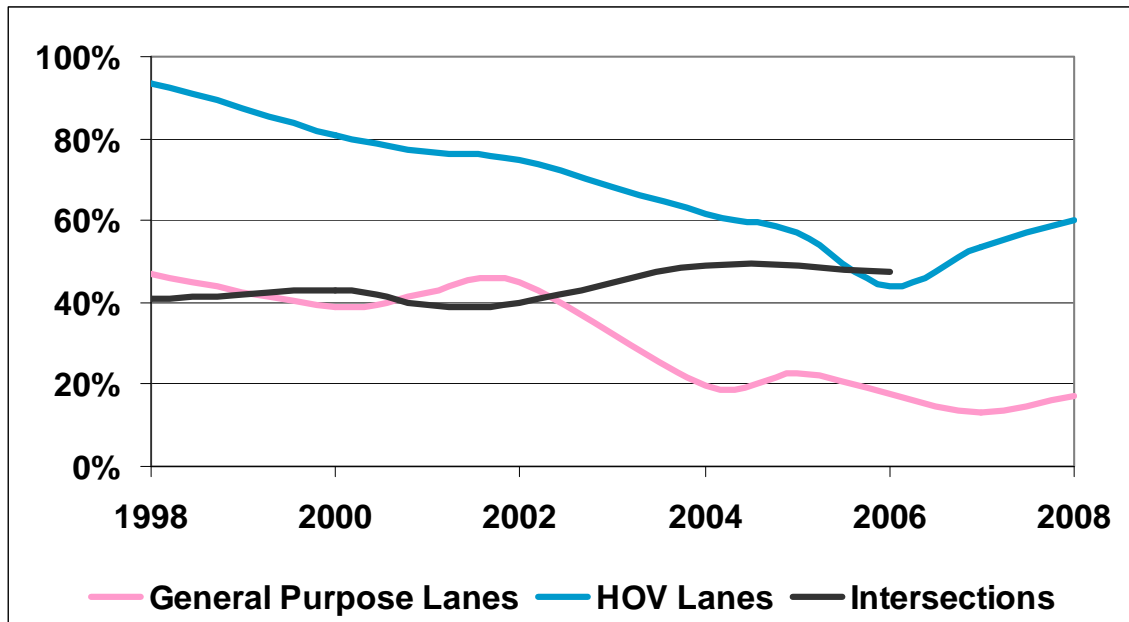
Table 3.3 Freeway Inventory for Santa Clara County

Category	Lane Miles
Freeway – general purpose lanes	850
Freeway – high occupancy vehicle (HOV) lanes	174

Source: VTA

Figure 3.3 on the next page illustrates the portion of the freeway system in which traffic moves freely throughout the entire day. It shows that traffic movement has worsened on both HOV lanes and general purpose lanes, it is better on HOV lanes. The figure also shows that traffic movement at intersections has improved slightly above 1997 levels. This information was compiled by the VTA using aerial photographs and calculations of vehicle density to describe the traffic conditions during AM and PM peak commute hours.

Figure 3.3 Percent of Freeways with Traffic Moving Freely in Santa Clara County



Source: VTA

3.4 ROADSIDE ASSETS

Roadside assets consist of a variety of features such as traffic signals, signs, and lighting. The conditions of these assets in Santa Clara County were estimated through the use of a self assessment survey. This survey is included as Appendix B. Table 3.4 on the next page presents the results of the survey. For each asset type, the table lists the percent in terms of “useful condition.” The definition of “useful condition” varies by asset. For example, for traffic signals, “useful condition” is defined as “signal equipment that is within the useful lifespan and meets current visibility and safety standards”. In the roadside litter category, “useful condition” means “roadside with virtually no or some litter (any litter could be quickly collected by one or two individuals)”. Definitions for the other asset categories are listed on the survey form provided in Appendix B.

Table 3.4 also provides an estimate of “ability to maintain with existing categories.” This item reflects an agency’s ability from a staffing resource viewpoint, to properly maintain the assets in its jurisdiction to an acceptable level. The values listed in the table reflect a good/fair/poor scale as described below:

- 1 = poor. The roadside assets are maintained on an as needed basis.
- 2 = fair. There are only enough resources to provide minimum maintenance on the roadside assets. Some maintenance work is being deferred.
- 3 = good. There are enough resources to routinely maintain the assets.

Table 3.4 Santa Clara County Roadside Asset Conditions and Resource Availability

Asset	Local Assets ¹		State Assets	
	Percent in Useful Condition	Ability to Maintain with Existing Resources	Percent in Useful Condition	Ability to Maintain with Existing Resources
Traffic signals	73	2.4	75	3
Pavement markings	70	1.9	60	2
Signs	70	2.3	80	2
Light poles	59	1.6	65	2
Curb and gutter	84	1.4	85	3
Roadside litter	80	2.1	25	1

Source: Self assessment survey completed by Santa Clara County local jurisdictions and Caltrans

¹These values represent a weighted average for the county. Averages were determined by weighting the results from each jurisdiction by its roadway lane miles.

3.5 BIKE MOBILITY

The county vision for bike facilities includes establishing, protecting, and enhancing “bicycling as a viable transportation mode and to assure that bicycling is a practical and safe mode of travel, by itself and in combination with other modes.” In an effort to help achieve this vision, the VTA has developed a bicycle plan that defines a county bike network and identifies needed cross barrier connections. Cross barrier connections enable bicyclists to safely cross freeways, waterways and rail road tracks. Table 3.5 below summarizes the progress that’s been made towards implementing the cross county bike network and addressing the cross barrier connection needs.

Table 3.5 Cross County Bicycle Network for Santa Clara County

Cross County Bike Network	
Completed miles	572
Planned miles	710
Percent complete	45%
Across Barrier Connections	
Existing adequate connections	424
Planned across barrier connections	112
Percent complete	79%

Source: VTA

3.6 TRANSIT

Four measures were selected to describe the condition and performance of Santa Clara County's public transit service provided by VTA. The first measure is VTA's transit inventory. VTA operates and maintains a fleet of 450 buses and 100 light rail vehicles that covers a service area of 326 square miles. In 2008, VTA provided transit service to approximately 43.5 million riders. Table 3.6 below summarizes the fleet inventories used to provide this service.

Table 3.6 VTA Transit Inventory

Bus	
Vehicles	450
Routes	69
Coverage area (square miles)	326
Light Rail	
Routes	3
Rail miles	42
Stations	62
Vehicles	100

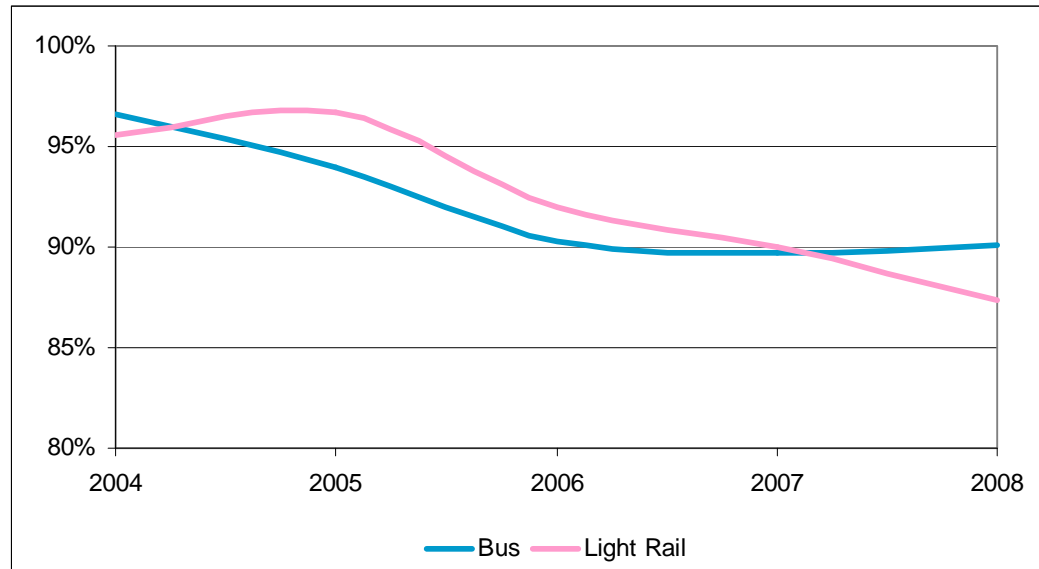
Source: VTA

The second measures describe VTA's transit performance:

- On time performance - defined as the percent of time in which transit vehicles arrive at a destination within 5 minutes of the scheduled time.
- Annual travel trips per person - this measure is calculated by dividing the total number of annual boardings by the population in the county.

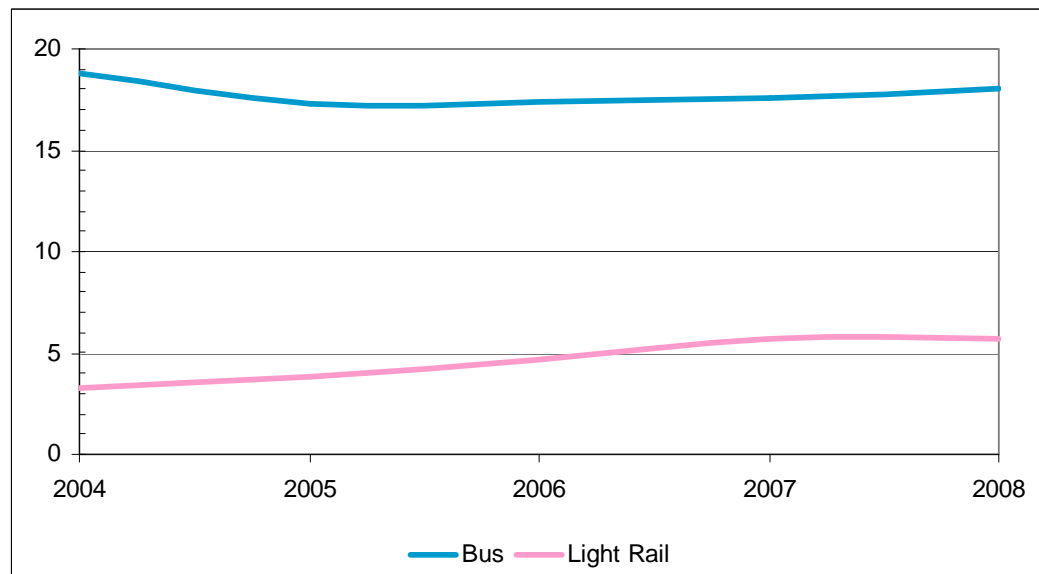
The performance of these measures is graphically shown in Figures 3.4 and 3.5 on the next page.

Figure 3.4 On Time Performance for VTA Transit Services



Source: VTA

Figure 3.5 Annual Transit Trips per Person using VTA Transit Services



Source: VTA

The third measure reports on VTA's quality of service, which is expressed as "percent of planned transit service that is provided." In 2008, a perfect score of 100 percent was achieved.

The fourth measure reports on the service life of VTA's transit fleet vehicles. This is expressed as "average remaining service life" which compares a vehicle's age to the age at which it is eligible for replacement. A value of 0 percent means

a vehicle is brand new, and a value of 100 percent means that a vehicle is at the end of its useful life which is qualifies transit agencies to request federal funding to replace the old vehicles. On average, VTA's buses have a remaining service life of 29 percent while its light rail fleet, which is fairly new, has a remaining service life 76 percent.

3.7 SUSTAINABILITY

Since automobiles and trucks are a major source of air pollution and fuel consumption, calculating the average amount of travel in the county and the fuel efficiency of vehicles provides an indication of movement towards the goal of environmental sustainability. The data presented in Table 3.7 below shows that was an increasing trend in vehicles miles traveled per person and a flat trend in fuel consumption from years 2005 to 2007. The flat trend of fuel consumption can be attributed to several factors such as an increase in transit usage, shorten vehicle trips due to shifting land use patterns, economic cycle that decrease the need for overall travel, and an increase of fuel efficient vehicles.

Table 3.7 Sustainability Measures for Santa Clara County

	2005	2006	2007
Vehicle miles traveled (millions)	14,910	15,396	15,650
Population	1,755,453	1,776,586	1,805,314
Vehicle miles traveled per person	8,493	8,666	8,669
Fuel consumption (millions of gallons)	779	792	799
Average fuel efficiency (miles per gallon)	19.1	19.4	19.6

Source: Santa Clara County Planning Department and Caltrans

Another measure of environmental sustainability is the number of times an air quality monitoring station in the county records contaminant levels exceeding California standards for ozone, carbon monoxide, nitrogen dioxide and particulate matter. Automobiles and trucks are key sources of all of these pollutants. Table 3.8 summarizes annual air quality infractions from Years 2005 to 2008.

Table 3.8 Air Quality Infractions in Santa Clara County

	2005	2006	2007	2008
Air quality infractions	21	64	8	27

Source: Bay Area Air Quality Management District

4.0 Data Compilation and Measure Calculation

One of the main objectives of the initial TSMP effort was to identify a set of initial measures that could be calculated today using existing data. The VTA has made significant investments in data and information technology. Collectively, these tools represent a rich resource that can be incorporated into the TSMP. In developing the set of measures presented in Chapter 3, the project team reviewed existing VTA databases and planning documents, and interviewed VTA staff responsible for compiling and maintaining the data. The data from VTA was augmented with data from other agencies such as the Metropolitan Transportation Commission (MTC) and the California Department of Transportation (Caltrans). A detailed list of data items used to calculate the initial measures and their sources are provided in Appendix A.

The main data gap was in the area of roadside assets (e.g., signs, signals, lighting, etc.). This finding is consistent with the current state of practice throughout the United States. Typically, agencies maintain much more data on their major assets, such as highways, bridges and transit systems, than on their roadside assets. This practice reflects the relative amount of money invested in each type of asset. Public agencies invest significantly more money on roadways, bridges and transit equipment than on signals, signs and other roadside assets.

To compile performance data on the roadside assets in Santa Clara County, two surveys were distributed to the local jurisdictions in the county. The first survey focused on collecting data related to inventory (e.g., number of signs) and funding information (e.g., amount of money spent annually to maintain signs). The second survey was designed as a self-assessment survey with the purpose of obtaining information on the average condition of these assets and the ability of the agencies to maintain its roadside assets at a reasonable level in terms of resources. Based on the number of jurisdictions that responded to the surveys, the results from the second survey are recommended for inclusion in the initial TSMP. This self-assessment survey is provided in Appendix B.

All of the data required for the initial measures have been compiled into a spreadsheet that was delivered along with this report. All calculations used to convert the raw data into the measures have been incorporated into this spreadsheet and are provided in Appendix A. The spreadsheet will enable VTA staff to maintain a record of previous performance results and to complete future updates efficiently.

5.0 Implementation

5.1 NEAR TERM

In the near term, the TSMP should focus on providing consistent reporting on the recommended system components and measures on an annual basis. The intent should be to institutionalize a stable set of measures so that decision makers and the public become accustomed to them. Annual reporting will also enable Santa Clara County and local agency staff to identify and track trends, and begin making decisions based on the monitoring results.

Meeting this initial objective can be achieved by implementing the following activities:

- Finalize the set of measures to be reported and use the information presented in Chapter 3 as the basis for this discussion.
- Finalize a template for reporting the results. In addition to the presentation of the transportation systems described in Chapter 3, a draft summary brochure was also developed as part of developing the TSMP. The brochure or other reporting format such as a web page on VTA's web site should be used to report the results of the annual monitoring as a communications venue. Reporting the measures in a consistent manner is just as important as reporting on the same measures.
- Convert the roadside asset self-assessment survey to a web-based format. This will streamline the process and improve efficiency for collecting this data. (All other data required to calculate the initial measures are maintained in a reasonable and consistent format through other on-going initiatives.

5.2 FUTURE ENHANCEMENTS

Over time, the TSMP should be expanded and enhanced as appropriate to make the annual report more meaningful. This section describes opportunities for program enhancement.

Additional Measures

Table 5.1 identifies measures that should be considered for inclusion in the TSMP. In some cases, these measures reflect movement towards a state-of-the-art in performance monitoring. In others, they reflect an aspect of performance that more explicitly addresses the Santa Clara County's objectives than measures used in the initial assessment. In either case, it was not possible to include these measures in the initial assessment because of missing data or data gaps.

Table 5.1 Potential Future Measures for Santa Clara County's TSMP

System Component	Potential Future Measures
Pavement condition	NA
Freeway mobility	<ul style="list-style-type: none"> Travel time reliability (this measure reflects the amount of time travelers have to build into trip to ensure that they arrive at their destination on time)
Bridge condition	NA
Signals	<ul style="list-style-type: none"> Frequency of traffic signal maintenance Average age of equipment compared to expected life cycle Response time to complaints/incidents
Pavement markings	<ul style="list-style-type: none"> Condition based on visual inspections
Signs	<ul style="list-style-type: none"> Condition based on visual inspections Average age of signs compared to estimated service life Response time to complaints/incidents
Light Poles	<ul style="list-style-type: none"> Average age of equipment compared to estimated service life Response time to complaints/incidents
Curb and gutter	<ul style="list-style-type: none"> Condition based on visual inspections Response time to complaints
Roadside litter management	<ul style="list-style-type: none"> Condition based on visual inspection (as recommended in pilot Litter study) Response time to complaints/incidents
Bicycle mobility	<ul style="list-style-type: none"> Access to bike network (e.g., percent of population and jobs within a specified distance from a cross county bike facility)
Bus and light rail	<ul style="list-style-type: none"> Access to transit service (e.g., percent of population and jobs within a specified distance from transit service)
Sustainability	<ul style="list-style-type: none"> Mode split (percent of trips that occur on transit vs. automobiles vs. bike/pedestrian) Total carbon footprint (vehicles and transit)

Improve Condition Assessment of Roadside Assets

Table 5.1 above illustrates the opportunity to enhance the data collected to assess the conditions of the roadside assets. The recommendation for adding “condition based on visual inspection” for a number of assets is based on a method developed by the National Cooperative Highway Research Program (NCHRP). NCHRP project 14-12 introduced the concept of maintenance quality assurance as “planned and systematic actions needed to provide adequate confidence that highway facilities meet specified requirements. Such

requirements are usually defined by the highway agency but are intended to reflect the needs and expectations of the user.”¹ The performance assessment approach developed in this research effort was based on the concept of maintenance “levels of service,” or LOS. This approach could help in:

- Determining the LOS expectations the traveling public supports and is willing to pay for;
- Communicating to the public how agencies are meeting these expectations;
- Determining the additional funding needed to achieve the desired LOS;
- Developing a “priority strategy” to focus on key maintenance activities when funding is less than requested; and
- Achieving a more uniform LOS by identifying locations of excessively high or low maintenance.

Implementing an LOS approach would require the following activities:

- Establish a set of maintenance standards for roadside assets that define an acceptable level of service for each asset.
- Develop a condition survey to use for inspecting roadside assets.
- Conduct annual inspections of roadside assets at a randomly-selected set of locations.
- Improve the tracking of expenditure levels for roadside assets.

The survey approach recommended in the VTA’s Litter Control and Landscape Maintenance Study is consistent with the LOS approach described above. The assessment of litter and vegetation along the selected corridors within Santa Clara County should be included in the near future of the TSMP. This same approach could be expanded to assess other high priority roadside assets.

Develop an Approach for Tracking Response Times

For several assets, Table 5.1 recommends “response time” as a possible future measure for the monitoring program. One option for compiling this data and is to centralize the handling of public input on maintenance issues related to transportation systems in Santa Clara County, such as a toll free phone hotline. For example, all call or emails related to malfunctioning signals or lighting could be forwarded to a single location. The requests could then be recorded in a consistent manner and forwarded to the appropriate agency or municipality in the form of a work order. After the request is addressed, the work order could

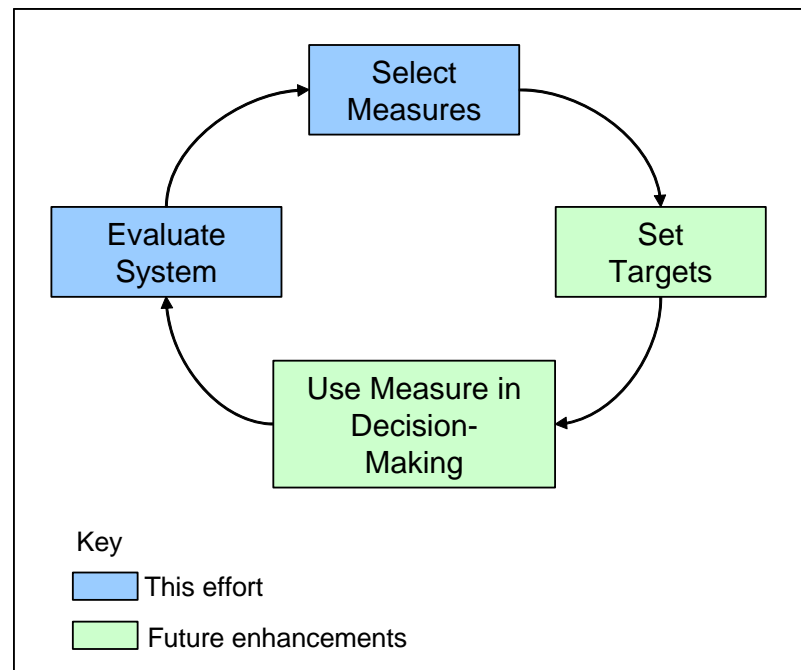
¹ M.L. Stivers, K.L. Smith, T.E. Hoerner, and A.R. Romine, *Maintenance QA Program Implementation Manual*, NCHRP Report 422, National Academy Press, Washington, D.C., 1999.

be closed out. The time between receiving the request and the time in which the work order is complete represents the “response time.” In addition to enabling the county to compile response data in a consistent manner, this approach would improve overall customer service to the traveling public by providing a single point of contact for all of their transportation-related concerns.

Expand to other Areas of the Performance Management Framework

Figure 5.1 repeats the performance management framework described in Section 1. Over time it is recommended that the county work to expand the scope of its TSMP to the boxes shaded in green.

Figure 5.1 Performance Management Framework



Understanding that this will be a long term, evolving process, the first step is to establish the relationship between performance and funding level in key performance areas. Throughout the United States, this capability is most advanced in the areas of pavement and bridge condition and highway mobility. Several agencies have also developed this relationship for roadside assets using an LOS approach described earlier.

Once this capability is developed, it would enable the county to establish meaningful performance targets and provide additional information to decision makers considering the implications of different investment options. For example, it would enable the following types of question to be answered: what would be the impact on the condition of roadside assets if the budget were

increased by 10 percent? What would be the cost of maintaining an average pavement condition of “good” over the next 10 years?

Conduct Peer County Review

One of the overall goals of the TSMP is to provide a mechanism for benchmarking Santa Clara against other Bay Area counties and agencies. In some cases, this type of comparison is currently possible. For example, 5.2 shows the distribution of population and jobs in the Bay Area. The table illustrates that 25 percent of the population and 28 percent of jobs in the Bay Area are in Santa Clara County.

Table 5.2 Population by County in the Bay Area

	Population (2009)	Percent of Population	Jobs (2007)	Percent of Jobs
Alameda	1,556,657	21%	820,300	21%
Contra Costa	1,060,435	14%	398,600	10%
Marin	258,618	4%	128,800	3%
Napa	137,571	2%	74,300	2%
San Francisco	845,559	11%	655,900	16%
San Mateo	745,858	10%	409,600	10%
Santa Clara	1,857,621	25%	1,131,200	28%
Solano	426,729	6%	138,900	3%
Sonoma	486,630	7%	231,700	6%

Source: MTC

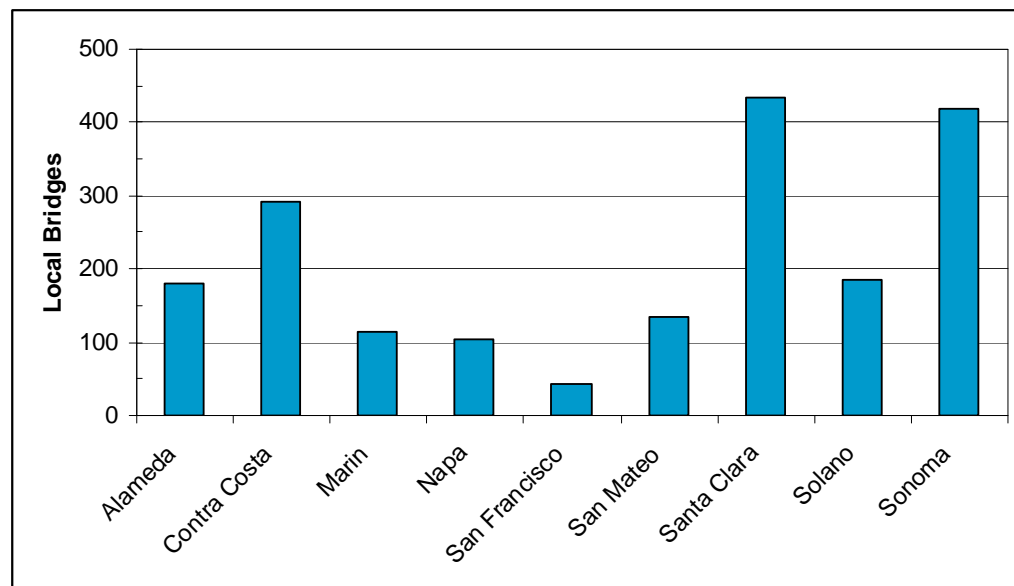
Table 5.3 on the next page summarizes pavement inventory and condition by county in the Bay Area. The data presented indicates that Santa Clara County maintains the most pavements in the region and that the pavement is relatively in good condition compared to pavements in the other counties.

Table 5.3 Local Pavement Condition by County in the Bay Area - 2007

County	Lane Miles of Local Roads	Percent of Lane Miles	Average Pavement Condition
Alameda	7,933	19%	Fair
Contra Costa	6,976	17%	Good
Marin	2,035	5%	At risk
Napa	1,499	4%	At risk
San Francisco	2,044	5%	Fair
San Mateo	3,890	9%	Fair
Santa Clara	9,215	22%	Good
Solano	3,563	8%	Fair
Sonoma	4,869	12%	At risk
Total	42,024		

Source: MTC

Figure 5.2 below shows the number of bridges by county in the Bay Area, and Table 5.3 on the next page shows a comparison of bridge condition by county.

Figure 5.2 Local Bridge Inventory by County in the Bay Area - 2008

Source: MTC

Table 5.4 Local Bridge Condition by County in the Bay Area - 2008

County	Number of Bridges	Average Age	Average Sufficiency Rating
Alameda	179	42	82.6
Contra Costa	291	37	83.6
Marin	115	52	76.2
Napa	105	53	73.5
San Francisco	43	50	74.6
San Mateo	135	46	75.9
Santa Clara	435	36	82.3
Solano	185	34	87.8
Sonoma	418	42	78.3
Average		41	80.7

Source: MTC

Both of these bridge comparisons were developed by MTC.² Taken together, the data shows that 1) there are more bridges in Santa Clara County than in any other Bay Area county, 2) the bridges in Santa Clara County are on average newer than bridges in other counties, and 3) the bridges in Santa Clara County are in slightly better condition than bridges in other counties.

Table 5.5 on the next page shows the number of High Occupancy Vehicle (HOV) lanes and average speed by county. The speeds shown are for both the AM and PM peak commute periods. This table illustrates that Santa Clara County has by far the most HOV lanes in the region and that the average speeds on these roadways is higher the regional average.

² MTC *Local Bridge Needs Update*, prepared for the MTC by Cambridge Systematics, Inc., April 2008.

Table 5.5 HOV Lanes by County in the Bay Area - 2008

County	Miles of HOV Lanes	Average Speed	
		AM Peak Period	PM Peak Period
Alameda	75	53	55
Contra Costa	78	65	63
Marin	23	39	60
Napa	-	-	-
San Francisco	-	-	-
San Mateo	14	65	65
Santa Clara	174	65	64
Solano	1	65	65
Sonoma	12	65	65
TOTAL	376	59	62

Source: Caltrans

In conducting similar comparison of other transportation asset areas, efforts should be made to leverage data already compiled by the VTA, Caltrans and MTC. Caltrans has extensive performance monitoring data. However, their reporting is typically done at the district level rather than the county level. In many cases, it may be possible for Caltrans to provide county comparisons of assets maintained by their agency.

In addition, comparison between local agencies within Santa Clara County for locally maintained roadside assets is also difficult due to the inconsistencies in data collection methodologies, timing of data collection, and level of detail in which data is collected. However, implementation of the TMSF could facilitate benchmarking and best practices in data collection methods of transportation systems within Santa Clara County and among counties within the Bay Area. Such efforts could lead to a local or regional standard that would benefit all agencies in regards to allocating resources for transportation system operations, maintenance, and improvements.

Appendix A

Performance Measures Details

The following tables provide more details on the measures recommended for use in the initial monitoring program. The tables include the following information for each measure - name, definition, description of what the measure indicates, steps required to calculate it, sources for the underlying data, and a recommended level of aggregation. All data required for these measures currently exist, as illustrated by the measure results presented throughout this report. Therefore, many steps in the derivation begin with “obtain” the necessary data items. The sources from which these data can be obtained are provided in the “data sources” section of the tables.

Measure	1. Average pavement condition
Definition	Very good/good/fair/poor/at risk/poor rating based on 3-year weighted average pavement condition index (PCI). PCI is standard measure of pavement condition used by all jurisdictions in the Bay Area.
Indicates	Indication of pavement condition, the future financial need for maintaining existing pavements, and the effectiveness of previous pavement investments.
Derivation	<ol style="list-style-type: none"> 1. Obtain 3-year average PCI for each jurisdiction 2. Obtain lane miles for each jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county. 3. Define thresholds for very good/good/fair/etc. 4. Assign rating by comparing weighted average to thresholds.
Data sources	MTC state of system report
Aggregation	Report single number for the county.

Measure	2. Percent of freeways with traffic moving freely
Definition	Percentage of roadways operating at LOS A, B, or C for the entire day. At LOS A, B, and C, traffic can move relatively freely without significant delay.
Indicates	Indication of congestion levels, future financial needs and effectiveness of previous capital investments.
Derivation	<p><i>Freeways and rural highways</i></p> <ol style="list-style-type: none"> 1. Obtain LOS and directional miles by corridor. 2. Sum directional miles with an LOS of A, B, or C in both AM and PM peak periods. 3. Divide #2 by #1. Report as a percent. <p><i>Expressway interchanges</i></p> <ol style="list-style-type: none"> 1. Obtain percent in LOS A, B, and C. 2. Sum percents. Report as a percent.
Data sources	CMP database
Aggregation	Report for freeways - mixed, and freeways - HOV Report for expressway interchanges.
Measure	3. Percent of bridges in good condition
Definition	Percent of bridges with sufficiency rating (SR) greater than 80. Sufficiency rating is a standard federal measure used to evaluate whether bridges in the U.S. are sufficient to remain in service. Bridges that have a SR less than or equal to 80 qualify for federal bridge rehabilitation funds.
Indicates	Indication of bridge condition, future financial need for maintaining existing bridges and the effectiveness of previous bridge investments.
Derivation	<ol style="list-style-type: none"> 1. Obtain total number of bridges. 2. Obtain total number of bridges with SR > 80. 3. Divide #2 by #1. Report as a percent.
Data sources	<p>Local bridges - http://www.dot.ca.gov/hq/structur/strmaint/local/sr_local.pdf</p> <p>State bridges - Caltrans Pontis database</p>
Aggregation	Report single number for the county.

Measure	4. Percent of signals in useful condition
Definition	Percent of signal equipment that is within the useful lifespan and meets standards.
Indicates	Indication of signal condition and future financial need for maintaining existing signals.
Derivation	<ol style="list-style-type: none"> 1. Obtain lane miles by jurisdiction. 2. Obtain percent of signals in useful condition by jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county.
Data sources	Self assessment survey.
Aggregation	Report single number for the county.

Measure	5. Percent of pavement markings in useful condition
Definition	Percent of pavement markings that have been repainted or replaced within useful life (typical range is from 1 to 3 years).
Indicates	Indication of marking condition and future financial need for maintaining existing markings.
Derivation	<ol style="list-style-type: none"> 1. Obtain lane miles by jurisdiction. 2. Obtain percent of markings in useful condition by jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county.
Data sources	Self assessment survey.
Aggregation	Report single number for the county.

Measure	6. Percent of signs in useful condition
Definition	Percent of signs that have been replaced within useful life (ranges from 7 to 15 years).
Indicates	Indication of sign condition and future financial need for maintaining existing signs.
Derivation	<ol style="list-style-type: none"> 1. Obtain lane miles by jurisdiction. 2. Obtain percent of signs in useful condition by jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county.
Data sources	Self assessment survey.
Aggregation	Report single number for the county.

Measure	7. Percent of light poles in useful condition
Definition	Percent of light poles that have lighting circuitry (e.g., ballast and wiring) that is within its useful like (ranges from 5 to 10 years) and look presentable (no peeling paint or exposed metal).
Indicates	Indication of light pole condition and future financial need for maintaining existing light poles.
Derivation	<ol style="list-style-type: none"> 1. Obtain lane miles by jurisdiction. 2. Obtain percent of light poles in useful condition by jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county.
Data sources	Self assessment survey.
Aggregation	Report single number for the county.

Measure	8. Percent of curb and gutter in useful condition
Definition	Percent of curb and gutter that is even, allowing water to flow down gutter.
Indicates	Indication of curb and gutter condition and future financial need for maintaining existing curb and gutter.
Derivation	<ol style="list-style-type: none"> 1. Obtain lane miles by jurisdiction. 2. Obtain percent of curb and gutter in useful condition by jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county.
Data sources	Self assessment survey.
Aggregation	Report single number for the county.

Measure	9. Percent of roadside with virtually no or some litter
Definition	Same as name.
Indicates	Indication of roadside condition and future financial need for maintaining roadside.
Derivation	<ol style="list-style-type: none"> 1. Obtain lane miles by jurisdiction. 2. Obtain percent of roadside with virtually no or some litter by jurisdiction. 3. Use #1 and #2 to calculate a weighted average for the county.
Data sources	Self assessment survey.
Aggregation	Report single number for the county.

Measure	10. Percent of cross county bike network completed
Definition	Percent length of planned cross county bike corridors that is open to the public.
Indicates	Indication of increased access to bike/pedestrian facilities and improved mode choice.
Derivation	<ol style="list-style-type: none"> 1. Obtain total length of planned bike corridors. 2. Obtain length of existing bike corridors. 3. Divide #2 by #1. Report as a percent.
Data sources	Countywide Bicycle Plan and VTA Planning
Aggregation	Report single number for County.

Measure	11. Percent of planned across barrier connections completed
Definition	Percent of planned across barrier connections that are open to the public.
Indicates	Indication of increased access to bike/pedestrian facilities and improved mode choice.
Derivation	<ol style="list-style-type: none"> 1. Obtain number of existing adequate barriers. 2. Obtain number of planned ABCs. 3. Divided by #1 by sum of #1 and #2. Report as a percent.
Data sources	Santa Clara County Wide Bicycle Plan and VTA Planning
Aggregation	Report single number for county.

Measure	12. Transit on-time performance
Definition	Percent of time in which transit vehicles arrive at destination within 5 minutes of scheduled time.
Indicates	Indication of service reliability and potential customer satisfaction with transit mode.
Derivation	<ol style="list-style-type: none"> 1. Obtain percent on-time for bus service and light rail service.
Data sources	VTA Short Range Transit Plan
Aggregation	Report for bus and light rail.

Measure	13. Percent of planned transit service provided
Definition	Percent of planned bus and light rail service provided.
Indicates	Indication of service reliability.
Derivation	<ol style="list-style-type: none"> 1. Obtain percent of planned service provided for bus and light rail.
Data sources	VTA Short Range Transit Plan
Aggregation	Report for bus and light rail.

Measure	14. Transit trips per person
Definition	Number of annual transit boardings per person living in Santa Clara County.
Indicates	Indication of transit usage and customer satisfaction with transit service.
Derivation	<ol style="list-style-type: none"> 1. Obtain number of annual boarding riders. 2. Obtain population. 3. Divide #1 by #2. Report as an integer.
Data sources	<p>Annual boarding - VTA Short Range Transit Plan</p> <p>Population - Santa Clara County Planning Office</p>
Aggregation	Report for bus and light rail.

Measure	15. Remaining service life of transit vehicles
Definition	Percent of transit vehicle useful life remaining, where useful life is defined as the age at which a vehicle is eligible for replacement.
Indicates	Surrogate for condition of transit fleet and indication of future financial needs.
Derivation	<ol style="list-style-type: none"> 1. Obtain age of bus and light rail vehicles. 2. Define expected life estimates for buses and light rail vehicles. 3. For each vehicle, calculate percent of useful life remaining, this is equal to $1 - (\text{age}/\text{expected life})$ 4. Calculate average of #3. Report as a percent.
Data sources	VTA Short Range Transit Plan
Aggregation	Report for bus and light rail.

Measure	16. Vehicle miles traveled per person
Definition	Average vehicle miles traveled per person living in Santa Clara County.
Indicates	Indication of the extent of vehicle travel in the county and mode choice.
Derivation	<ol style="list-style-type: none"> 1. Obtain vehicle miles traveled (VMT) data. 2. Obtain population. 3. Divide #1 by #2. Report as an integer.
Data sources	VMT - California Motor Vehicle Stock, Travel and Fuel Forecast Population - Santa Clara County Planning Office
Aggregation	Report single value for county.

Measure	17. Average fuel economy
Definition	Average miles per gallon in Santa Clara County.
Indicates	Indication of the efficiency of vehicle travel in the county.
Derivation	<ol style="list-style-type: none"> 1. Obtain vehicle miles traveled data. 2. Obtain gallons of fuel consumed. 3. Divide #1 by #2.
Data sources	California Motor Vehicle Stock, Travel and Fuel Forecast
Aggregation	Report single value for county.

Measure	18. Number of recorded air quality infractions
Definition	Number of times that one of the air quality monitoring stations in the county recorded contaminant levels that exceed California standards for ozone, carbon monoxide, nitrogen dioxide and particulate matter 10. Vehicles are a key source of all of these contaminants.
Indicates	Indication of the impact of transportation system usage on the environment.
Derivation	<ol style="list-style-type: none"> 1. Obtain number of times that the readings at the following stations exceed California standards for 1-hour maximum ozone, 8-hour maximum ozone, carbon monoxide, nitrogen dioxide, and PM10 - Gilroy, Los Gatos, San Jose Central, San Martin and Sunnyvale. 2. Sum values to get a total number of infractions.
Data sources	Bay Area Air Quality Management District's Annual Bay Area Air Quality Summaries
Aggregation	Report single value for county.

Appendix B

Roadside Asset Self Assessment Survey

Roadside Asset Condition Self-Assessment Survey

1. Contact Information

Name: _____ Title: _____
 Phone Number: _____ Email: _____

2. Self-Assessment Survey

Please fill in blue cells. (Click on blue cells)

Jurisdiction (Choose from pull-down menu)	Choose an item.	
Roadside Assets Condition	Percent of Assets in Useful Condition ¹ (0 - 100%)	Level of Accuracy ² (Accurate - Informed Estimate - Guess)
1. Signal Equipment – Provide percentage of signal equipment that is within the useful lifespan and meets current visibility and safety standards		Choose an item.
2. Pavement Markings – Provide percentage of pavement markings that have been repainted or replaced within useful life (ranges from 1 to 3 years)		Choose an item.
3. Signage – Provide percentage of signs that have been replaced within useful life (ranges from 7 to 15 years)		Choose an item.
4. Light Poles & Circuitry – Provide percentage of light poles that have lighting circuitry (e.g. ballasts and wiring) that is within its useful life (ranges from 5 to 10 years) and look presentable (no peeling paint or exposed metal)		Choose an item.
5. Curb & Gutter – Provide percent of curb and gutter that is even, allowing water to flow down gutter		Choose an item.

6. Roadside Litter Management – Provide percent of roadside with virtually no or some litter (any litter could be quickly collected by one or two individuals)		Choose an item.
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Notes:

1. Percent of Assets in Useful Condition (0-100%) – This data inquiry is designed to ascertain the operating condition and needs of the road side assets. For example, a response of 25% means that 25% of specific type of equipment deployed is working within the equipment’s life cycle and the remaining 75% of the equipment is operating beyond its life cycle and may need replacement.

2. Level of Accuracy – This is a request for the respondent to provide a level of accuracy of the data being provided.

- **Accurate** – Data is documented and traceable
- **Informed Estimate** – Based on general knowledge
- **Guess** – Based on limited knowledge

Please fill in blue cells. (Click on blue cells)

Agency Ability to Maintain Roadside Assets ¹	Ability Level ² (Good – Fair – Poor)
7. Signal Equipment – Rate ability to maintain and operate signal equipment in working order.	Choose an item.
8. Pavement Markings – Rate ability to maintain pavement markings.	Choose an item.
9. Signage – Rate ability to maintain roadside signs.	Choose an item.
10. Light Poles & Circuitry– Rate ability to maintain light poles.	Choose an item.
11. Curb & Gutter – Rate ability to maintain curbs & gutters.	Choose an item.
12. Roadside Litter Management – Rate ability to maintain roadsides with virtually no or some litter.	Choose an item.

Notes:

1. Agency Ability to Maintain Roadside Assets – This data inquiry is designed to ascertain an agency’s ability from a staffing resource viewpoint, to properly maintain the listed roadside assets in its jurisdiction to an acceptable level.
2. Ability Level – This rating refers to the agency’s resource level to maintain its current roadside assets.
 - Good – There are enough resources to routinely maintain the roadside assets.
 - Fair – There is only enough resources to provide minimum maintenance on the roadside assets. Some maintenance work is being deferred.
 - Poor – The roadside assets are maintained on an as needed basis.

Table 1 - Recommended System Components and Measures

System Components	Initial Measures	Potential Future Measures
Pavement condition	1. Average pavement condition (based on pavement inspections)	
Freeway mobility	2. Percent of freeways with traffic moving freely (based level of service)	<ul style="list-style-type: none"> • Travel time reliability
Bridge condition	3. % of bridges in good condition (based on bridge Sufficiency Rating)	
Signals	4. Percent of signals in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Frequency of traffic signal maintenance • Average age of equipment compared to expected life cycle • Response time to complaints/incidents
Pavement markings	5. Percent of markings in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspections
Roadway signs	6. Percent of signs in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspections • Average age of signs compared to estimated service life • Response time to complaints/incidents
Light poles	7. Percent of light poles in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Average age of equipment compared to estimated service life • Response time to complaints/incidents
Curb and gutter	8. Percent of curb and gutter in useful condition (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspections • Response time to complaints
Roadside litter management	9. Percent of roadside with virtually no or some litter (based on self assessment survey)	<ul style="list-style-type: none"> • Condition based on visual inspection (as recommended in Litter study) • Response time to complaints/incidents
Bicycle mobility	10. % of cross county bike network completed 11. % of planned across barrier connections completed	<ul style="list-style-type: none"> • Access to bike network (using GIS mapping)
Bus and light rail	12. On-time transit performance 13. Percent of planned transit service provided 14. Transit trips per person 15. Remaining service life of transit vehicles	<ul style="list-style-type: none"> • Access to transit service
Sustainability	16. Vehicle miles traveled per person 17. Average fuel economy 18. Number of recorded air quality infractions	<ul style="list-style-type: none"> • Mode split (percent of trips that occur on transit vs. automobiles vs. bike/pedestrians) • Total carbon footprint (vehicles and transit)

Attachment C

Table 2 – Transportation System Measures and Conditions

System Component	Recommended Measure	Most Recent Value	
Pavement condition	1. Average pavement condition	Good	
Freeway mobility	2. Percent of freeways with traffic moving freely	General purpose lanes – 17% HOV lanes – 60%	
Bridge condition	3. % of bridges in good condition	68%	
Signals	4. Percent of signals in useful condition	73%	
Pavement markings	5. Percent of markings in useful condition	70%	
Roadway signs	6. Percent of signs in useful condition	70%	
Light poles	7. Percent of light poles in useful condition	59%	
Curb and gutter	8. Percent of curb and gutter in useful condition	84%	
Roadside litter management	9. Percent of roadside with virtually no or some litter	80%	
Bicycle mobility	10. % of cross county bike network completed	45%	
	11. % of planned across barrier connections completed	79%	
Bus and light rail	12. On-time transit performance	Bus – 90%	Light rail – 80%
	13. Percent of planned transit service provided	Bus – 100%	Light rail – 100%
	14. Transit trips per person	Bus – 18	Light rail – 5.2
	15. Remaining service life of transit vehicles	Bus – 29%	Light rail – 76%
Sustainability	16. Vehicle miles traveled per person	8,669	
	17. Average fuel economy	19.6 miles per gallon	
	18. Number of recorded air quality infractions	11	