



***2000 UPDATE TO THE COUNTYWIDE
COMPREHENSIVE TRANSPORTATION
PLAN***

**TRAFFIC SERVICE OBJECTIVE
MONITORING REPORT**

August 19, 1999

TRAFFIC SERVICE OBJECTIVE MONITORING REPORT

The preparation of this report has been financed through a grant from the U.S. Department of Transportation and the Federal Highway Administration. Content of this report does not necessarily reflect the official views or policy of the U.S. Department of Transportation.

MTC and the federal funding agencies shall have the right to reproduce, publish or otherwise use, and authorize others to use, the information developed from federally reimbursed projects.

Prepared for

Contra Costa Transportation Authority

Prepared by

CCS Planning and Engineering, Inc.

1440 Broadway, Suite 402

Oakland, CA 94612

(510) 267-1800

August 19, 1999

TABLE OF CONTENTS

SECTION	PAGE
EXECUTIVE SUMMARY	1
INTRODUCTION AND BACKGROUND	5
Background	5
Measure C	5
Regional Routes	6
Action Plans	7
Adopted Traffic Service Objectives	7
Incorporation of TSOs and Action Plans Into the 1995 Plan	8
Purpose Of Traffic Service Objective Data Monitoring	8
METHODOLOGY	11
Intersection Level of Service	11
Roadway Segment Level of Service	13
Delay Index	15
Peak Period Congestion	16
Average Speed	17
Vehicle Occupancy	17
Transit Ridership	18
Park and Ride Lot Utilization	18
Truck Traffic	20
Accident Reduction	21
MONITORING RESULTS	23
Intersection Level of Service	23
Roadway Segment Level of Service	24
Delay Index and Average Speed	25
Peak Period Congestion	27
Vehicle Occupancy	27
Transit Ridership	29
Park and Ride Lot Utilization	30
Truck Traffic	31
Accident Reduction	31

TABLE OF CONTENTS

TABLES	PAGE
1 Multilane Highway Maximum Service Flow Rates	14

FIGURES

1 Regional Transportation Planning Committee Boundaries and Routes of Regional Significance
2 West Contra Costa Transportation Advisory Committee
3 Transportation Partnership and Cooperation (Central County)
4 Transportation Planning Committee (East County)
5 Tri-Valley Transportation Council
6 Southwest Area Transportation Planning Committee

APPENDIX A

A-1 Routes of Regional Significance
A-2 Intersection Level of Service in the West County Area
A-3 Intersection Level of Service in the East County Area
A-4 Intersection Level of Service in the Tri-Valley Area
A-5 Roadway Segment Level of Service
A-6 AM Peak Hour Roadway Travel Speeds and Delay Index
A-7 PM Peak Hour Roadway Travel Speeds and Delay Index
A-8 Overall Travel Speed on Route 24 Between Route 13 and Route 680
A-9 Travel Time Runs on San Pablo Dam Road
A-10 Vehicle Occupancy Rates
A-11 Transit Ridership in the I-80 Corridor
A-12 Daily Passengers at West County BART Stations
A-13 Average Daily Ridership on Capitol Corridor
A-14 Transit Ridership on Solano County BART Feeder Service
A-15 Transit Ridership on San Pablo Dam Road
A-16 Transit Ridership on BART Along State Route 24
A-17 Occupancy of Park-and-Ride Lots Along Interstate 80 During 1998
A-18 Trucks on Parker Avenue in Rodeo- 1999
A-19 Accident Reduction on SR-4 (John Muir Parkway)
A-20 Detailed AM Peak Hour Roadway Travel Speeds and Delay Index
A-21 Detailed PM Peak Hour Roadway Travel Speeds and Delay Index

EXECUTIVE SUMMARY

This Traffic Service Objective (TSO) Monitoring Report presents the results of data collection performed to monitor the achievement of the various TSOs adopted as part of the 1995 Countywide Comprehensive Transportation Plan (the 1995 Plan), and the sub-county Action Plans upon which the 1995 Plan was built. Since the adoption of the 1995 Plan, a number of changes have affected the transportation system in Contra Costa, both changes in the capacity of the system and in the demands placed on it. Improvements such as the completion of parts of the I-680/State Route 24 interchange and the extension of BART to Bay Point/Pittsburg have increased the capacity of the system, while continuing funding shortfalls for transit have resulted in the discontinuance or reorganization of transit lines resulting in reduced transit service in some areas. On the demand side, economic growth in the Bay Area has increased significantly since 1995 which has been associated with substantial increases in development and traffic in Contra Costa. Both these demand- and supply-side changes have affected the operation of the Routes of Regional Significance that are the focus of the Action Plans. And these effects show up in changes in the measures of effectiveness found in this monitoring report.

This report presents:

- an introduction to, and background information relevant to, this Monitoring Report;
- the methodology used in calculating the measures of effectiveness used to set the TSOs;
- a summary of the results of the monitoring effort; and
- an appendix with tables outlining the details of the monitoring.

The 1995 Plan and the Actions Plans contain several types of TSOs. The majority of the TSOs applied to the Routes of Regional Significance in Contra Costa use intersection level of service (LOS), roadway segment LOS, travel delay or speed, and vehicle occupancy rates (VORs) as the TSO's measure of effectiveness. However, the Action Plans apply several other types of TSOs at a few locations as well. Table ES-1 presents a description of the types of TSOs and a summary of the degree to which the TSOs are being achieved.

The categories with the largest number of individual TSOs are being achieved in most, but not all, cases:

- the intersection LOS TSOs are being achieved in 97 percent of locations,
- the roadway segment LOS TSOs are being achieved in 68 percent of locations,
- the vehicle delay or speed TSOs are being achieved in 93 percent of locations, and
- the VOR TSOs are being achieved in 69 percent of locations.

Table ES-1. Summary of Monitoring Results

TSO	Locations/Subjects	Achieving TSO		Not Achieving TSO	
		Number	Percent	Number	Percent
Intersection Level-of-Service	120	117	97%	3	3%
Roadway Level-of-Service	19	12	63%	7	37%
Delay Index or Average Speed	29	27	93%	2	7%
Peak Period Congestion	2	2	100%	0	0%
Vehicle Occupancy	19	13	68%	6	32%
Transit Ridership	6	1	17%	5	83%
Park-and-Ride Lot Use	1	1	100%	0	0%
Truck Traffic	1	1	100%	0	0%
Accident Reduction	1	1	100%	0	0%

The TSOs related to peak period congestion, use of park-and-ride lots, truck traffic and accident rates are being achieved. It should be noted that the TSO related to a reduction in accident rates has been achieved even though the project proposed to improve safety – the State Route 4 gap closure – is not yet completed; construction on this project will start this summer.

The category of TSOs that have the highest percentage of not achieving the TSOs are those related to transit use. Of the TSOs related to transit ridership, 83 percent have not been

achieved. Partly, this level of achievement reflects one key difference between transit TSOs and vehicle TSOs, namely that, in almost cases, the transit TSOs were not being met when they were set while the vehicle TSOs were. Even if transit ridership was increasing and the TSO was on its way towards achievement, the actual levels might be below the TSO. For some TSOs and for some transit lines this is the case. TSOs addressing vehicle travel, however, were generally set at levels above then-current conditions. These levels established reasonable standards while recognizing projected future increases in traffic volumes.

Monitoring conducted for three of the TSOs that have not been achieved — a 20 percent increase in transit use in the I-80 corridor, a 25 percent increase in bus ridership on San Pablo Dam Road, and a 20 percent increase in ridership on the Concord BART line by 2010 — have actually shown a decrease in transit use, however. That is, the trends are going in the opposite direction than what achievement would require.

Delay index TSOs, which are applied to entire routes, are being achieved in 93 percent of the locations where they are applied. In several cases, while an overall route achieves the delay index TSO, the delay index for specific segments of the route may exceed the TSO value. This report identifies where the delay index for these segments exceed the TSO value, and may be useful in identifying areas where additional congestion relief measures are needed.

INTRODUCTION AND BACKGROUND

This Traffic Service Objective (TSO) Monitoring Report presents the results of data collection performed to monitor the achievement of the various TSOs adopted as part of the 1995 *Countywide Comprehensive Transportation Plan* (the 1995 Plan), and the sub-county Action Plans upon which the 1995 Plan was built. Data collection performed for this TSO Monitoring Report was conducted according to the TSO Monitoring Plan approved by the Contra Costa Transportation Authority Technical Coordinating Committee in March 1999. Based on analysis of the monitoring data, this TSO Monitoring Report describes progress towards achievement of the TSOs.

This TSO Monitoring Report presents:

- an introduction to, and background information relevant to, this Monitoring Report;
- the status of TSOs;
- the methodology used in preparing this Monitoring Report; and
- conclusions regarding achievement of TSOs.

Background

This TSO Monitoring Report was prepared to carry out the requirements of Measure C, which was passed by the voters of Contra Costa County in 1988. The following is a description of Measure C and requirements set forth in the Measure that affect this Monitoring Report.

Measure C Measure C established a sales tax to be used to fund transportation improvements in Contra Costa County. The Measure includes an innovative growth management program and requires the Contra Costa Transportation Authority (the Authority) to develop a comprehensive transportation plan and update it every other year. The first Plan was adopted in 1995. For the 1997 update, the Authority reaffirmed the policies and proposed actions contained in the 1995 Plan instead of preparing a full update. The Authority, however, is now in the process of preparing a full update of the 1995 Plan. This TSO Monitoring Report is a part of that effort.

Regional Routes To receive a share of the sales tax generated by Measure C, local jurisdictions must adhere to the level-of-service (LOS) standards that Measure C applied to local streets and roads. These standards, which are keyed to character of adjoining land uses, are applied to those streets and roads for which the jurisdictions are responsible. Each jurisdiction must take appropriate action to ensure that those LOS standards are met. The Measure C Growth Management Program (GMP), however, recognized that because the majority of congestion occurs on the most regionally significant roadways, those roadways should be subject to a more flexible standard that would be established and maintained cooperatively by the jurisdictions those roadways serve. For each of these designated Routes of Regional Significance, the Regional Transportation Planning Committees (RTPCs), which are comprised of all the jurisdictions within the different sub-county regions in Contra Costa, must prepare an Action Plan. Each jurisdiction must participate in their RTPC and work to implement the Action Plans to continue receiving return-to-source funds from Measure C.

Designated Regional Routes include all the freeways and State highways, and the most significant arterials in Contra Costa. Some of these Regional Routes were established directly by Measure C. Others were designated later by the Authority and RTPCs. Each of these Regional Routes:

- connects two or more of the sub-county regions; or
- carries a significant amount of through traffic not tied to one jurisdiction; or
- provides access to a regional highway or transit facility; or
- enters or leaves the county.

For each Regional Route, the RTPCs have adopted TSOs and actions for achieving them. The Authority has incorporated these TSOs — or, in the case of Camino Pablo and Pleasant Hill Road in Lafayette, are considering their incorporation — into the *Countywide Comprehensive Transportation Plan*. Figure 1 shows, on a countywide level, the existing designated Regional Routes. Figures 2 through 6 show the RTPC areas in greater detail.

Action Plans In its Implementation Documents, the Authority established the following requirements for each Action Plan:

1. long-range assumptions on future land use;
2. adopted TSOs that use a quantifiable measure of effectiveness and include a target date for attaining the objective;
3. specific actions to be implemented by each participating jurisdiction;
4. requirements for consultation on environmental documents;
5. a procedure for review of impacts resulting from General Plan amendments; and
6. a schedule for reviewing progress in attaining the TSOs and revising the Action Plans as needed.

In 1994 and 1995, Action Plans were developed and adopted for:

- West County by the West Contra Costa Transportation Advisory Committee (WCCTAC);
- Central County by the Transportation Partnership and Cooperation Committee (TRANSPAC);
- East County by the Transportation Planning Committee (TRANSPLAN);
- Lamorinda by the Lamorinda Project Management Committee (LPMC); and
- Tri-Valley (Contra Costa portions) by the Tri-Valley Transportation Council (TVTC).

Adopted Traffic Service Objectives Table A-1 in the Appendix lists the adopted or proposed TSOs by Regional Route and by sub-county region. Each TSO uses one of following measures of effectiveness:

- intersection LOS;
- roadway segment LOS;
- delay index;
- peak period congestion;

- average speed;
- vehicle occupancy;
- transit ridership; or
- other, including accident reduction rate, midday park-and-ride lot usage, and reduction in truck traffic.

Incorporation of TSOs and Action Plan Into the 1995 Plan Each Action Plan established TSOs, actions to implement the TSOs, and a timetable for achieving them. The 1995 Plan incorporated the TSOs and actions adopted in these Action Plans into the body of the Plan, and extracted relevant portions of the Action Plans as Exhibits A–E to the 1995 Plan. Each RTPC and jurisdiction are responsible for implementing those parts of the Action Plans included in those exhibits.

In 1995, the Authority designated — or extended the designation of — two additional Regional Routes: Camino Pablo in Orinda and Pleasant Hill Road in Lafayette. Both Camino Pablo, which becomes San Pablo Dam Road north of Bear Creek Road, and Pleasant Hill Road connect to roadways that were previously designated Regional Routes. The RTPCs have prepared and adopted Action Plans for those more recently designated Regional Routes — LPMC and Southwest Area Transportation Committee (SWAT) in the case of Pleasant Hill Road and LPMC, SWAT and WCCTAC in the case of San Pablo Dam Road/Camino Pablo. The Authority is currently reviewing those Action Plans, and their provisions will be incorporated into the 2000 Update of the *Countywide Comprehensive Transportation Plan*. Given the recentness of these Action Plans and the information used in their development, however, monitoring of the TSOs in those plans was not conducted for this TSO Monitoring Report.

Purpose Of Monitoring of Traffic Service Objective

The second and sixth of the Action Plan requirements described above — adopting TSOs that use a quantifiable measure of effectiveness and monitoring their achievement — are the impetus for the TSO Monitoring Report. The overall purpose of the TSO Monitoring Report is to report on the progress made in achieving the TSOs adopted in the 1995 Plan and various Action Plans. More specifically, the process of preparing the TSO Monitoring Report involved:

- establishing a consistent methodology for collecting data and calculating the adopted TSOs;
- collecting the necessary data and calculating the current status of the measures of effectiveness adopted in the TSOs; and
- reporting on the current status of the TSOs.

The monitoring results contained in this report will provide the RTPCs with the information necessary to review their TSOs — and the actions designed to meet them — and to make focused revisions to the Action Plans where they are needed.

METHODOLOGY

This section describes the method used to calculate each TSO and measure of effectiveness, and the method and extent of data collection conducted for this calculation. The description of methodologies are grouped by the measures of effectiveness used in the TSOs. For each measure of effectiveness, the applicable intersections, roadways, or other facilities are listed in the following sections.

For the most part, the TSOs adopted and their application were unambiguous. Where the TSO or its application were ambiguous, a good faith effort was made to reflect the intentions of the RTPCs and the Authority.

Two TSOs — “transit mode share” and “vehicle-employee ratio” — were adopted as part of the Central County Action Plan to measure achievement of the Bay Area Air Quality Management District’s regulations. Since these regulations are no longer in place, these two TSOs were not monitored for this report.

Intersection Level of Service

Description and Method of Calculation Level of service (LOS) is one of the most traditional measures of transportation system performance. It rates the traffic conditions as perceived by the driver by assigning a letter value (A through F), with A corresponding to excellent conditions and F used when traffic is bad. Through extensive collection of empirical data, traffic researchers have correlated level of service to the ratio of volume to capacity (v/c). While v/c ratios are the method most commonly used, a variety of other methods may be used to calculate LOS at signalized intersections. The Authority’s method for calculating LOS is based on the Transportation Research Board’s Circular 212 Planning Method of intersection operations analysis. The CCTALOS software was used to calculate this TSO at signalized intersections. Four of the monitored intersections are unsignalized. LOS at these unsignalized intersections were calculated using methods described in Chapter 10 of the Transportation Research Board’s 1994 Highway Capacity Manual – Special Report 209.

Data Gathered and Method Used to Collect Data To run the CCTALOS software, turning movement counts are needed. Turning movement counts were conducted by counting the

number of vehicles making each of the three possible movements (i.e., left turn, through, and right turn) on each of the intersection approaches. The counts were conducted for a two-hour period during the AM and PM peak periods. The counts were recorded in 15-minute periods and the consecutive one-hour period with the highest traffic volumes was used to calculate LOS. Intersection lane geometrics and signal light phasing information were also used in calculating LOS, and were typically recorded at the same time turning movement count data were collected. Counts were typically conducted Tuesdays through Thursdays, since Mondays or Fridays are sometimes found to be unrepresentative.

Turning movement counts have recently been conducted at some of the intersections that were monitored for this report. Where available and valid, these previously-collected data were used in this TSO Monitoring Report. The previously-collected data generally came from data collection conducted for:

- the Congestion Management Program (CMP),
- on-going local traffic counting programs, and
- recently-conducted traffic impact analyses.

Previously-collected counts were used only if the data were collected in 1998 or 1999. Where previously-collected counts were not available, new counts were conducted for this TSO Monitoring Report.

Monitored Intersections Many TSOs that apply intersection LOS specify a certain LOS at “all signalized intersections”. Because there are a large number of signalized intersections along these routes, it would be prohibitively expensive to analyze all of them. Accordingly, this TSO Monitoring Report analyzes a smaller list of “monitoring” intersections, which are intended to represent overall conditions. The selection of monitoring intersections was based on a review of the 1997 Contra Costa CMP Update, the Action Plans, and sub-regional models, and discussions with local staff. Appendix A includes an inventory of signalized intersections and indicates which of these were selected for monitoring.

Some of the key intersection chosen included:

- CMP intersections,
- intersections identified in tables and figures in the Action Plans, and
- signalized intersections where Routes of Regional Significance meet.

Tables A-2, A-3, and A-4 in the Appendix list the intersections that were monitored in this TSO Monitoring Report and the TSO and calculated level of service for each.

Roadway Segment Level of Service

Description and Method of Calculation As in intersection LOS, roadway segment LOS can be characterized through a letter (A through F) corresponding to observed traffic conditions. Roadway segment LOS is generally used on freeways and rural roads where signalized intersections are infrequent or nonexistent and therefore have little effect on the overall flow of traffic.

Two different methods of calculating roadway segment LOS were used in this TSO Monitoring Report. One method was used for freeways and expressways, while a second method was used for two-lane roadways.

Methods described in Chapters 3 and 7 of the Transportation Research Board's (TRB's) *1994 Highway Capacity Manual – Special Report 209* were used to determine LOS on freeways and expressways. These methods apply “ideal capacities”, adjustment factors, and v/c ratios to calculate LOS. Ideal capacities are also referred to as “maximum service flow rates” and are measured in passenger cars per hour per lane (pcphpl). The *Highway Capacity Manual* presents maximum service flow rates of 2,200 pcphpl for four-lane freeways and 2,300 pcphpl for six-or-more-lane freeways. The *Highway Capacity Manual* correlates maximum flow rates for multi-lane expressways based on facility design speeds. These maximum flow rates are shown in Table 1.

The v/c ratios and LOS for freeways and expressways are calculated by adjusting the maximum service flow rates to reflect local conditions, and then dividing the measured volume of traffic on a roadway by the adjusted service flow rate of the roadway.

The operational analysis method described in Chapter 8 of the *Highway Capacity Manual* was used to determine LOS on two-lane rural roads (one lane in each direction). This method of calculating LOS is sensitive to drivers' ability to pass slower vehicles. Therefore, this method also directly addresses the terrain the roadway passes through, the directional distribution of traffic, and the percent of no passing zones.

Table 1.

Multilane Highway Maximum Service Flow Rates

Design Speed (in miles per hour)	Maximum Service Flow Rate (in pcphpl)
60	2,200
55	2,100
50	2,000
45	1,900

Source: Transportation Research Board 1994 Highway Capacity Manual – Special Report 209

Data Gathered and Method Used to Collect Data To calculate roadway segment LOS, AM and PM peak hour directional traffic volume values were collected. On State Routes, traffic volume counts were collected from Caltrans. On roadways that are not State Routes, new data were collected. To collect these data, machine traffic counts were conducted. Directional hourly counts were collected for a 3-day period at each location.

Monitoring Locations Roadway segment LOS monitoring locations and calculated levels of service are presented in Table A-5. Data were collected at multiple locations for each of the non-State Route roadways in the West County area. The locations were selected to represent locations where segments experience different levels of traffic volumes. For example, the segment of Willow Avenue north of I-80 experiences levels of traffic volumes different from the segment south of I-80. Therefore, monitoring locations on both sides of I-80 are used.

Delay Index

Description and Method of Calculation A delay index measures travel congestion. It is expressed as the ratio of the time required to travel between two points during the peak hour — the congested travel time —to the time required during uncongested off-peak times. A delay index of 2.0 means that congestion is such that it would take twice as long to make the trip at peak hour as compared to off-peak times. The following shows the formula for calculating delay indices:

$$\text{Delay Index} = \frac{\text{Observed Peak Hour Travel Time}}{\text{Free Flow Travel Time}}$$

The numerator of the delay index formula, observed peak hour travel time, was measured by conducting speed runs along the Regional Routes with delay index TSOs. The denominator of the delay index formula, free flow travel time, was generally based on previously-collected data. Where the data were not available, new free-flow travel speed runs were conducted.

Data Gathered and Method Used to Collect Data Travel speed surveys were used to determine peak hour travel times.

Peak hour travel times for all freeways were drawn from floating car runs conducted by Caltrans for the 1998 *Highway Congestion Report*. The Caltrans data included both free-flow and congested travel speeds. Generally, the data from Caltrans were only available for the peak direction of travel. New travel speed surveys were conducted as needed for other Regional Routes.

For each new travel speed survey, three travel speed runs were conducted in the peak direction during both the AM and PM peak periods. Current travel speeds during the peak hour were compared to free flow speeds used originally to calculate the delay index for the Regional Route. If data from those previous travel speed surveys were not available, additional travel speed surveys were conducted to establish a free flow travel time. These additional surveys were conducted during the evening off-peak period (8–10 P.M.). In some

cases, the measured free-flow speeds, even including delay at intersections, were greater than the speed limit. In these cases, the free-flow speeds used to calculate the delay index were set to the speed limit.

Both free-flow and congested travel speed data collected for this report were disaggregated to segments of entire routes by using intermediate check points. In some cases where previously-collected free-flow travel speed data were available, these data were not disaggregated by segments.

The driver of the speed run test vehicle operated in accordance with the floating-car technique as defined in Chapter 4 of the Institute of Transportation Engineers' *Manual of Transportation Engineering Studies*. Using this method, the driver "floated" with traffic by attempting to safely pass as many vehicles as pass the test vehicle.

Monitoring Locations Delay index monitoring locations are presented in Tables A-6 and A-7 in the Appendix. Monitoring was conducted along the Regional Routes with designated delay index TSOs (Note: locations for monitoring of delay index TSOs, and average travel speed TSOs are all shown on Tables A-6 or A-7 since all the measurement activities involve determining travel speed). Tables A-6 and A-7 also indicate checkpoints along some of the routes. In general, checkpoints were used where two Regional Routes intersect, which would result in speed runs being generally conducted from one Regional Route intersection to another. Deviations from this general approach occurred where resulting segments would have been short, been long, or included dissimilar sub-segments. Delay indices were calculated separately for each of the Regional Route segments defined by the checkpoints.

Peak Period Congestion

Description and Method of Calculation The Lamorinda Action Plan includes TSOs that specify a maximum "duration of congestion". The Plan defines congestion on SR 24 as "typical travel speeds dropping below an overall average of 35 mph", and sets a maximum duration of 4 hours. The Plan defines congestion on San Pablo Dam Road as "typical travel speeds dropping below an overall segment average of 25 mph", and sets a maximum duration of 2 hours.

Data Gathered and Method Used to Collect Data Travel speed data along these routes were collected. As shown in Tables A-8 and A-9, the travel speed data reflects various points in time during the peak period. Data collected for Caltrans 1998 Congestion Monitoring Report was used for SR 24. Floating car speed runs, as defined above, were collected for San Pablo Dam Road.

Average Speed

Description and Method of Calculation The TSOs included in the Central County Action Plan specify both a delay index and minimum peak hour average travel speed. Peak hour average travel speeds were calculated from the same data used to calculate delay indices (described previously). The length of the speed runs was divided by the travel times of the runs to calculate average travel speeds. Similar to the methods used for delay indices, the monitoring of Regional Routes was divided into segments, generally at intersections of Regional Routes.

Data Gathered and Method Used to Collect Data The data needed to calculate the measures of effectiveness were the length of the speed runs and the travel times. The methods used to collect the data are presented above in the description of delay index TSOs.

Vehicle Occupancy

Description and Method of Calculation The West County, Central County, and East County Action Plans include TSOs for vehicle occupancy rates (VORs). Measurements of VORs identify the average number of occupants per vehicle passing a given point on a route during peak traffic periods. The objective of many travel demand management (TDM) programs and air quality improvement programs is to increase VORs.

Vehicle occupancy rates were calculated by determining the number of people and the number of vehicles passing a certain point on a route, and dividing the number of people by the number of vehicles.

Data Gathered and Method Used to Collect Data Vehicle occupancy rates were determined manually by observers at a safe location away from the travel way. One-day peak direction counts were conducted during AM and PM peak periods.

Monitoring Locations Monitoring locations and observed vehicle occupancy rates are presented in Table A-10.

The West County Action Plan specifies VORs monitored for baseline conditions along I-80. The specific location along I-80 used to gather the baseline data was not identified; however, the Action Plan referenced the 1991 *Existing Travel Conditions* report, which did identify the location. The monitoring conducted for the TSO Monitoring Study was conducted at the same location as baseline conditions. The West County Action Plan also contains a VOR TSO for I-580. I-580 was under construction at the time the *Existing Travel Conditions* report was prepared. Therefore, no baseline I-580 VOR data exist.

The Central County Action Plan did not specify baseline values or locations for VORs. The VOR monitoring locations were based on Figure 3 in the Action Plan. This figure presents representative traffic volumes for roadways in the Central County area. The locations of the representative traffic volumes were used to develop representative VOR monitoring locations.

Two routes in the East County area have VOR TSOs: the freeway portion of SR 4 and Vasco Road. These locations were surveyed for VOR data.

Transit Ridership

Description and Method of Calculation The West County Action Plan contains five TSOs related to transit ridership. The Lamorinda Action Plan contains one TSO related to transit ridership. Four of the West County TSOs and the one Lamorinda TSO refer to specific percent changes in transit use from baseline levels.

The Action Plans contain some of the baseline data necessary to calculate percent change in ridership. In other cases, the baseline data was gathered from the transit operators or the West County *Existing Travel Conditions* report. All of the current conditions transit data

was gathered from transit operators. To ensure valid comparisons are made, the current conditions data was verified as being comparable to the baseline values used in developing the TSOs. Where specific corridors or transit stations were used to establish baseline data, the same corridors or stations were used for TSO monitoring.

Data Gathered and Method Used to Collect Data The following is a description of background information gathered and monitoring conducted for transit ridership TSOs.

The West County Action Plan contains several TSOs for I-80. One specifies an increase in daily passengers at the three West County BART stations (El Cerrito Plaza, El Cerrito Del Norte, and Richmond) by 10 percent by 2000 from 13,275 in 1990. To collect the necessary information for this TSO, BART was contacted to gather current daily passenger boardings at the three West County BART stations.

A second West County Action Plan TSO for I-80 specifies 6,400 daily ridership on commuter rail in the I-80 and Highway 4 corridors by 2000. BART currently operates the Capitol Corridor rail service within the West County area. BART was contacted to gather current ridership data for the Capitol Corridor rail service. While the Capitol Corridor does provide rail service, the type of service offered may not be appropriate to measure “commuter” rail service patronage.

A third West County Action Plan TSO for I-80 specifies an increase in daily trips on the Solano County BART feeder bus service of 20 percent from 1990 levels by 1995. The West County Action Plan notes that, “Vallejo Transit provides express bus service from Fairfield, Vallejo, and Suisun City to the Del Norte BART station. Transfers on some routes are permitted in Crockett and at Hilltop Drive.” Vallejo Transit was contacted to determine the current ridership levels on Solano County BART bus feeder service.

The West County Action Plan also established an overall TSO for I-80 — a 20 percent increase in transit use — that incorporates information from the preceding three TSOs as well as bus transit use. The Plan noted that, at the time the Plan was prepared, BART provided the primary rail service in the I-80 corridor along the Richmond line, and that AC Transit, WestCAT, and BART Express Bus provided bus service in the I-80 corridor.

BART, AC Transit, and WestCAT were contacted to gather ridership data for the I-80 corridor from these agencies. For all transit ridership TSOs, comparable 1990 ridership data was used as baseline levels, when available. In some cases, changes in transit service do not allow a direct comparison between baseline and current ridership values. However, the ridership data that is most comparable was used in this TSO Monitoring Report.

In addition to TSOs for I-80, the West County Action Plan contains a TSO for San Pablo Dam Road that specifies an increase in daily bus ridership on San Pablo Dam Road by 25 percent over 1992 levels. The Action Plan does not describe 1992 ridership levels and does not set a target year. However, the West County Action Plan notes that the “County Connection provides bus service during the peak periods between the Orinda BART station and El Sobrante. In El Sobrante, service is connected with AC Transit.” County Connection was contacted for 1992 through 1998 ridership levels on buses traveling along San Pablo Dam Road. Passenger exit data provided by BART was used to estimate ridership levels.

The Lamorinda Action Plan contains a TSO for the SR 24 corridor that specifies an increase in daily ridership on the Concord/Daly City BART line by 20 percent by 2010. The Lamorinda Action Plan also presents baseline 1993 BART ridership for the Orinda and Lafayette stations. This baseline data, which are in the form of passenger exits per day, were collected by BART. BART provided the most recent available ridership data for these two stations.

Park and Ride Lot Utilization

Description and Method of Calculation The West County Action Plan contains a TSO that specifies a peak midday utilization rate of 50 percent by 2000 at park and ride lots in the I-80 corridor.

Data Gathered and Method Used to Collect Data Parking occupancy surveys were conducted by Caltrans at six park-and-ride lots in the West County area. Both the number of vehicles parked and the total number of spaces were counted. Each park-and-ride lot was surveyed multiple times during 1998. Since the TSO specifies a peak value, the highest utilization rate reported by Caltrans was used in this Monitoring Report.

Truck Traffic

Description and Method of Calculation The West County Action Plan contains a TSO that specifies a 90 percent reduction in truck traffic from current values in Rodeo. The West County Action Plan notes that the “Truck traffic is particularly heavy on Parker Avenue in Rodeo where Wickland and Unocal [now Tosco-Rode] generate an average of 250 truck trips per day. The trucks typically travel from Parker Avenue to Willow and State Route 4.”

Data Gathered and Method Used to Collect Data Truck classification counts were conducted on Parker Avenue in Rodeo. The counts were conducted using standard vehicle classifications used by Caltrans. All trucks were counted, with an emphasis placed on identifying trucks associated with the petroleum processing industry.

Accident Reduction

Description and Method of Calculation The West County Action Plan contains a TSO that specifies a 10 percent reduction in the accident rate on SR 4 (John Muir Parkway) below 1993 levels. 1993 accident rates are not presented in the Plan.

Data Gathered and Method Used to Collect Data Caltrans provided three-year SR 4 accident rate information for both the three years ending in 1993, and the three years ending in 1998, which is the most recent three-year period available .

Monitoring Results

This section describes the results of the monitoring of TSOs. The description of results are grouped by the measures of effectiveness used in the TSOs. All the data used to calculate these TSOs were collected in conformance with the Authority's *Technical Procedures*.

Intersection Level of Service

Intersection LOS was monitored at 120 locations. As shown in Table A-2, 49 of the locations are in the West County area. As shown in Table A-3, 41 locations are in the East County area. As shown in Table A-4, 30 locations are in the Tri-Valley area.

Overall, 117 of the 120 intersections operate at an LOS equal to or better than the TSO. Of the four intersections that do not achieve the TSO, improvements are planned at two of the intersections. These improvements would improve their operation to LOS better than the TSO.

In the West County area, all except one location operate at an LOS equal to or better than the TSO. The only intersection in the West County area that did not achieve the TSO was San Pablo Dam Road and the EB I-80 on-off ramps-Amador Street.

In the East County area, one intersection does not achieve the TSO: the intersection of Lone Tree Way and Fairview Avenue. However, planned improvements at this intersection will improve operating conditions to LOS that will be better than the TSO.

In the Tri-Valley area, all except one location operate at an LOS better than the TSO. The only intersection in the Tri-Valley area that did not achieve the TSO was Danville Boulevard and Stone Valley Road.

The CCTALOS method does not include the impacts of queuing in the calculation of levels of service. If queuing was included in the LOS calculation, some intersections would likely be shown to operate at lower levels of service. The CCTALOS method was used, however, for two reasons: first, it provides a consistent methodology throughout Contra Costa, and second, the TSOs were originally established from measures of LOS using the basic CCTA

methodology, and using a different method for this report could create a problem of comparing the “apples” of the TSO and the “oranges” of the current monitored result.

Roadway Segment Level of Service

Roadway segment LOS was monitored at 19 locations. As shown in Table A-5, 9 of the locations are in the West County area, 9 locations are in the East County area, and 1 location is in the Tri-Valley area.

Overall, 13 of the 19 roadway segments operate at an LOS equal to or better than the TSO. In the West County area, 4 of the 9 segments operate at an LOS equal to or better than the TSO during both the AM and PM peak hours. The following three roadway segments in the West County area achieve the TSO in the AM peak hour, but do not achieve the TSO in the PM peak hour:

- Appian Way south of the I-80 Eastbound Ramps,
- Appian Way north of San Pablo Dam Road, and
- Cummings Skyway north of SR 4.

During the PM peak hour along Appian Way south of the I-80 Eastbound Ramps, the TSO is achieved in the southbound direction, but not in the northbound direction. In assessing achievement of the roadway segment LOS TSO, Appian Way was analyzed using the two-lane rural highway analysis method. However, Appian Way functions as a suburban collector, as opposed to a two-lane rural highway. Therefore, this measurement may not present a representative assessment of how the roadway operates. WCCTAC may want to consider focusing on the intersection LOS as the TSO measurement that is most representative of how this roadway operates.

The following two roadway segments in the West County area fail to meet the TSO in both the AM nor the PM peak hours:

- SR 4, and
- Cummings Skyway west of I-80.

In the East County area, 8 of the 9 roadway segments operate at an LOS equal to or better than the TSO. Vasco Road south of Camino Diablo Road fails to meet the TSO in both the AM and PM peak hours.

In the Tri-Valley area, the one roadway segment that was monitored, I-680, achieves the TSO.

SR 4 in West County and Vasco Road in East County both fail to meet the TSO, primarily due to high traffic volumes. For the following three roadway segments, not achieving the TSO is primarily due to inadequate opportunities for vehicles to pass one another:

- Appian Way north of San Pablo Dam Road,
- Cummings Skyway west of I-80, and
- Cummings Skyway north of SR 4.

Delay Index and Average Speed

The monitoring of delay index and average speed involved similar monitoring activities, measurements, and calculations. A summary of the results of the monitoring are presented in Table A-6 and Table A-7. Table A-6 shows the results of AM peak period monitoring and Table A-7 shows the results of PM peak period monitoring. Both tables present monitored delay index and average speed for entire routes. Table A-20 and Table A-21 present more detailed information, showing data for whole routes and, where appropriate, portions of routes between check points.

Monitoring of delay index and average speed was conducted along 29 routes. As shown in Table A-6 and Table A-7, 11 of the locations are in the Central County area, and 18 locations are in the East County area.

Overall, 27 of the 29 routes have delay indices or average speed better than the TSO. In the Central County area, 10 of the 11 routes have delay indices or average speed equal to or better than the TSO. The route that does not achieve the TSO is SR 242 between I-680 and SR 4 in the AM peak period. The delay index on this route is based on data collected prior to the ongoing SR 242 project, which involves adding 1 lane in each direction.

As shown in Table A-20 and A-21, the following three routes in the Central County area also have individual segments of routes that do not achieve the TSO. However, the overall route achieves the TSO:

- I-680 between Solano County and the Tri-Valley/TRANSPAC boundary in both the AM peak period and the PM peak period, and
- Taylor Boulevard and Willow Pass Road between Pleasant Hill Road (south) and Concord Avenue in the PM peak period, and
- Ygnacio Valley Road between I-680 and Clayton Road in the AM peak period.

It should be noted that the northern terminus of the Taylor Boulevard/Willow Pass Road route is SR 242. However, the delay index was calculated for a route that extends to Concord Avenue because previously-collected data for this route used a terminus at Concord Avenue.

In the East County area, 17 of the 18 routes have delay indices or average speed better than the TSO. The one route that does not achieve the TSO is Buchanan Road between Railroad Road and Sommersville Road in the AM peak period.

As shown in Table A-20 and Table A-21, the following 4 routes in the East County area also have individual segments of routes that do not achieve the TSO. However, the overall route achieves the TSO:

- Kirker Pass Road between Clayton Road and the Contra Costa County Line, and Railroad Road between Pittsburg and SR 4 in the both the AM and PM peak periods,
- Somersville Road between W 10th Street and James Donlon Boulevard in the PM peak period,
- Lone Tree Way between SR 4 and SR 4 in the PM peak period, and
- Walnut Boulevard between Oak Street and Camino Diablo in both the AM and PM peak periods.

Peak Period Congestion

The duration of peak period congestion was monitored along 2 routes in the Lamorinda area: SR 24 and San Pablo Dam Road.

The Lamorinda Action Plan defines congestion on SR 24 as “typical travel speeds dropping below an overall average of 35 mph.” Caltrans travel speed data, presented in Table A-8, was divided into two segments: a western segment from SR 13 to Acalanes Road, and an eastern segment from Acalanes Road to SR 680. Travel speed data along these different segments were collected at different time. As presented in Table A-8, the travel speed along the western segment of SR 24 was lower than 35 mph for a period of time in the eastbound direction during the AM peak hour, and period of time in the westbound direction during the PM peak hour. Congestion along this western segment was strongly affected by the Caldecott Tunnel and the fact that fewer bores are opened to travel in the off-peak direction. The travel speed along the eastern segment of SR 24 was lower than 35 mph for a period of time in the eastbound direction during the PM peak hour. With the two segments combined, the overall travel speed along SR 24 did not drop below 35 mph. This TSO was achieved since the duration of congestion along SR 24 was less than 4 hours.

The Lamorinda Action Plan defines congestion on San Pablo Dam Road as “typical travel speeds dropping below an overall segment average of 25 mph.” As presented in Table A-9, the travel speed along San Pablo Dam Road was lower than 25 mph for a brief period of time in the southbound direction during the AM peak hour. However, the TSO was achieved since the duration of congestion was less than 2 hours.

Vehicle Occupancy

Peak hour VOR was monitored at 19 locations. As shown in Table A-10, 2 of the locations are in the West County area, 15 locations are in the Central County area, and 2 locations are in the East County area.

The monitoring of VOR was generally conducted in the peak direction during both AM and PM peak hours. Exceptions included locations where VOR data for both directions were available.

Overall, 12 of the 19 locations have VOR values greater than or equal to the TSO during both peak hours, 4 locations do not achieve the TSO during one peak hour, and 3 locations do not achieve the TSO during either peak hour.

In the West County area, one location does not achieve the TSO during one peak hour, and one location does not achieve the TSO during either peak hour. The location in the West County area that does not achieve the TSO during one peak hour is along I-80. The TSO at this location specifies a 15 percent increase from 1990 to 1998. This TSO is achieved in both directions during the AM peak hour and is achieved in the westbound direction during the PM peak hour. However, the VOR in the eastbound direction during the PM peak hour increased by 9 percent from 1990 to 1998, which is less than the 15 percent increase, and therefore does not achieve the TSO.

The location in the West County area that does not achieve the TSO during either peak hour is along I-580. The TSO at this location specifies a 1.35 VOR. The VOR reported in the 1998 Caltrans HOV Report for this location is 1.3 in both the AM and PM peak hours. Caltrans reports the VOR ratio with precision to the tenths (i.e., 1.3). However, the TSO for this location specifies a ratio with precision to the hundredths (i.e., 1.35). In response to this difference, the VOR for I-580 was re-calculated to the hundredths using Caltrans' supporting data. The re-calculated VORs are 1.26 in the eastbound direction and 1.27 in the westbound direction; both of these values were rounded up to 1.3 for presentation in the HOV report. Since the VORs along I-580 are less than 1.35, this TSO is not achieved.

In the Central County area, 12 of the 15 locations have VOR values equal to or greater than the TSO during both peak hours, and three locations do not achieve the TSO during one peak hour. (The actual wording of this TSO from the Central County Action Plan is "to increase peak period *work-trip* AVO . . . to 1.2 by 2010" (emphasis added). While the monitoring data for this route is for the peak period, it was not possible to safely measure only work-trips. Instead, this report measured only VOR for the peak period.) Two of the locations in Central County do not meet the TSO are on SR 4; the first is west of SR 242 (measured west of Alhambra Avenue) and the other is east of SR 242 between Willow Pass Road and Bailey Road. At the location west of SR 242, the PM peak hour VOR (measured in the eastbound, or peak, direction) is 1.2, which equals the TSO. The AM peak hour

VOR, however (measured in the westbound direction), is 1.1, which does not achieve the TSO of a VOR of 1.2. Similarly, the TSO of a VOR of 1.2 is met in the PM peak hour on SR 4 between Willow Pass Road and Bailey Road but is not met in the AM peak hour (it was measured at a VOR of 1.1).

A third location in the Central County has not yet achieved the TSO, namely along Ygnacio Valley Road east of Oak Grove Road. The TSO for this route specifies a VOR of 1.2. The PM peak hour VOR in the eastbound direction is 1.2, which equals the TSO. The AM peak hour VOR, however (measured in the westbound direction), for this route is 1.1, which does not achieve the 1.2 VOR value.

The East County Action Plan established TSOs using VOR as the measure of effectiveness at two locations: SR 4 between Willow Pass Road and Bailey Road, and Vasco Road south of Camino Diablo. The TSO for SR 4 is set at 1.25 while the TSO for Vasco Road is set at 1.3 in the AM peak hour. Neither TSO, however, is being achieved. The VOR on SR 4 was observed to be 1.1 during the AM peak hour in the westbound, peak direction and 1.21 during the PM peak hour in the eastbound, peak direction. Both are below the TSO of 1.25. On Vasco Road, the monitored VOR was less than 1.3 in both peak hours: 1.1 in the AM peak hour and 1.2 in the PM peak hour.

Transit Ridership

Monitoring of 5 transit-related TSOs in the West County area and one transit-related TSO in the Lamorinda area was conducted. Overall, 1 of the 6 transit-related TSO was achieved.

The West County Action Plan includes a TSO specifying a 20 percent increase in transit use in the I-80 corridor from 1990 levels. As shown in Table A-11, this TSO has not been achieved. While the WestCAT transit routes and BART Richmond line both show increases of 8 percent from 1990 levels, the AC Transit routes show a decrease of 22 percent, resulting in an overall decrease of 6 percent

A second transit-related West County Action Plan TSO specifies an increase in daily passengers at the three West County BART stations by 10 percent by 2000 from 13,275.

As shown in Table A-12, average daily passenger exits at these stations has increased by 8 percent from 1990 to 1998. Therefore, this TSO has not been achieved.

A third transit-related West County Action Plan TSO specifies 6,400 daily ridership on commuter rail in the I-80 and Highway 4 corridors by 2000. As shown in Table A-13, ridership on the Capitol Corridor service was measured at 1,286, far less than the TSO of 6,400 daily ridership on commuter rail in the I-80 and Highway 4 corridors by 2000.

A fourth transit-related West County Action Plan TSO specifies an increase in daily trips on the Solano County BART feeder bus service of 20 percent from 1990 levels by 1995. As shown in Table A-14, ridership on the BART feeder bus service has increased by 65 percent from 1990 to 1998.

The West County Action Plan contains a TSO that specifies an increase in daily bus ridership on San Pablo Dam Road by 25 percent over 1992 levels. As shown in Table A-15, bus ridership along San Pablo Dam Road has varied over time. Ridership, however, has actually *decreased* from 1992 levels overall and on most routes.

The Lamorinda Action Plan contains a TSO that specifies an increase in daily ridership on the Concord/Daly City BART line along SR24 of 20 percent by 2010. As shown in Table A-16, since average daily exits — which is the information that was used to set the TSO — have decreased by 11 percent, this TSO has not been achieved. Average daily exits at the Lafayette and Orinda stations, however, may not accurately reflect changes in ridership on the Concord/Daly City (now Bay Point/Colma) BART line. Some measure of the number of passengers on BART crossing some point in the SR 24 corridor would provide such information, but such data is not now available. Although measuring total daily or peak period passengers in the corridor would better reflect changes in the TSO, collecting that information can be costly since it requires manual counting of passengers in train cars.

Park and Ride Lot Utilization

Caltrans monitored the utilization of six park-and-ride lots on eight days during 1998. As shown in Table A-17, single-day peak utilization of all 6 lots was 52 percent on August 13.

A compilation of the peak days for each of the 6 lots was 55 percent. Therefore, the TSO of a midday peak usage of 50 percent has been achieved. This table also shows a steady and dramatic increase in park and ride lot use during 1998, from 26 percent in January to 52 percent in August.

Truck Traffic

Truck classification counts were conducted on Parker Avenue in Rodeo. For this TSO, the West County Action Plan specifies a 90 percent reduction in truck traffic on this roadway. The text in the Action Plan notes that the local refineries generated 250 truck trips per day during the time the Action Plan was being developed. As shown in Table A-18, the refineries were observed to generate only 24 trucks per day on Parker Avenue, which is a 90.4 percent reduction. Therefore, this TSO has been achieved.

Accident Reduction

Table A-19 presents three-year accident rate information for SR 4 (John Muir Parkway) for three years periods ending in 1993 and 1998. The accident reduction TSO for SR 4 specifies a 10 percent reduction in the accident rate. Data are presented both by type of accident and by direction of travel on SR 4. Accident rates for all types of accidents have decreased: fatal accidents have decreased 40 percent, injury accidents have decreased 16 percent, and accidents involving property damage only have decreased 19 percent.

Accident rates in the eastbound direction have decreased by 37 percent. Accident rates in the westbound direction have increased by 1 percent. The overall accident rate has decreased by 19 percent. Therefore, this TSO has been achieved.

Appendix A Tables of Monitoring Results

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
West County (WCCTAC)	
I-80 Solano County to Alameda County	+ 15% peak direction Vehicle Occupancy Rate (VOR) + 20% transit use + 50% midday utilization of park & ride lots + 10% avg daily passengers at 3 BART stations 6400 = daily ridership of commuter rail + 20% daily trips on Solano Bart feeder bus
SR-4 (John Muir Parkway) I-80 to TRANSPAC/WCCTAC boundary [at Cummings Skyway]	Level of Service (LOS) E on roadway -10% annual accident rates from 1993
I-580 Marin Co. to I-80	Peak Hour (pk hr) VOR = 1.35
23rd Street San Pablo Ave/Road 20 to I-580	LOS D at all signalized intersections
Appian Way San Pablo Ave to San Pablo Dam Rd	LOS D on all roadway segments LOS D at all signalized intersections (except at San Pablo Ave & San Pablo Dam Rd intersections)
Carlson Boulevard 23rd St to San Pablo Ave	LOS D at all signalized intersections
Cummings Skyway San Pablo Ave to SR-4	LOS D on all roadway segments
Cutting Boulevard Garrard Blvd to San Pablo Avenue	LOS D at all signalized intersections
El Portal Drive San Pablo Ave to San Pablo Dam Rd	LOS D at all signalized intersections
San Pablo Avenue (Old Highway 40 / Parker Avenue) - North of CCC/Hercules boundary I-80/Pomona Street to Hercules city limit	LOS E at all signalized intersections LOS E at SB I-80/San Pablo Ave & NB I-80/Pomona St ramp intersections (in Crockett section of CCC) -90% trucks
San Pablo Avenue (Old Highway 40 / Parker Avenue) - South of CCC/Hercules boundary CCC/Hercules city limit to Alameda Co.	LOS E at all signalized intersections

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
San Pablo Dam Road San Pablo Ave-Broadway Avenue to WCCTAC/ Lamorinda boundary [s/o Castro Ranch Road]	LOS D at all signalized intersections (except at I-80 ramps) LOS E at Appian Way intersection + 25% daily bus ridership
Willow Avenue San Pablo Ave [Parker Ave] to SR-4	LOS D on all roadway segments
Rumrill Boulevard / 13th Street / (Kearney Street) / Pennsylvania Avenue ¹	LOS D at all signalized intersections
Rumrill Blvd - (San Pablo Ave to San Pablo/Richmond city limit)	
13th Street - (San Pablo/Richmond city limit to RR tracks)	
Kearney Street - (RR tracks to Harbour Way-10th St)	
Pennsylvania Avenue - (Harbour Way-10th St to 3rd Street [dead end])	
Garrard Boulevard Near Pennsylvania Avenue to I-580	LOS D at all signalized intersections
Richmond Parkway ² I-680-Fitzgerald Dr to near Pennsylvania Avenue	None
Central County (TRANSPAC) ³	
I-680 Solano Co. to Tri-Valley/TRANSPAC boundary [between Rudgear Rd & Livorna Rd interchanges]	Delay Index = 2.0 / min pk hr avg speed = 30 mph Pk hr VOR = 1.2 for work trips
SR-242 I-680 to SR-4	Delay Index = 2.0 / min pk hr avg speed = 30 mph Pk hr VOR = 1.2 for work trips

- 1 Corridor comprised of Rumrill/13th/Pennsylvania/Garrard is listed as a single Route of Regional Significance within the WCCTAC Action Plan. Kearney has been added since it connects 13th with Pennsylvania. Garrard is listed separately since Pennsylvania and Garrard are no longer connected.
- 2 Richmond Parkway is listed within the 1995 CCTA Countywide Transportation Plan as a “Future” Route of Regional Significance which has subsequently been opened.
- 3 In the parts of the Central County with a current (1994) delay index (DI) of < 2.0 and a DI TSO 2.0, the TSO is to maintain current levels. In the parts of the Central County with a current DI of > 2.0, the TSO is to achieve a DI of 2.0 or better.

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
SR-4 (west of SR-242) WCCTAC/TRANSPAC boundary [at Cummings Skyway] to SR-242	Delay Index = 2.0 / min pk hr avg speed = 30 mph Pk hr VOR = 1.2 for work trips
SR-4 (east of SR-242) SR-242 to TRANSPLAN/TRANSPAC boundary [at Willow Pass Grade]	Delay Index = 3.0 / min pk hr avg speed = 20 mph Pk hr VOR = 1.2 for work trips
Alhambra Avenue + northern portion of Pleasant Hill Road⁽⁴⁾	
Alhambra Avenue - (Arch Street to Martinez/Pleasant Hill city limit)	Delay Index = 2.0 / min pk hr avg speed = 15 mph
Pleasant Hill Road (northern portion) ⁴ - (Martinez/Pleasant Hill city limit to Taylor Blvd [north])	Pk hr VOR = 1.2
Clayton Road Treat Blvd to Ygnacio Valley Rd-Kirker Pass Rd	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2
Contra Costa Boulevard Center Ave to Boyd Rd	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2
Geary Road Pleasant Hill Rd to I-680	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2
Kirker Pass Road Clayton Rd to TRANSPLAN/TRANSPAC boundary	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2
North Main Street Boyd Rd to I-680 interchange [n/o downtown Walnut Creek])	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2
Pacheco Boulevard Marina Vista to Center Ave	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2
Pleasant Hill Road (central portion) Geary Rd to Taylor Blvd	Delay Index = 2.0 / min pk hr avg speed = 15 mph Pk hr VOR = 1.2

4 Northernmost section of Pleasant Hill Road is not cited specifically in Action Plan, but rather is included as Alhambra Avenue.

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
Taylor Boulevard + western portion of Willow Pass Road⁵	
Taylor Blvd (Pleasant Hill Blvd to Contra Costa Blvd)	Delay Index = 2.0 / min pk hr avg speed = 15 mph
Willow Pass Road ⁽⁵⁾ (Contra Costa Blvd to SR-242)	Pk hr VOR = 1.2
Treat Boulevard I-680 to Clayton Rd	
	Delay Index = 2.0 / min pk hr avg speed = 15 mph
	Pk hr VOR = 1.2
Ygnacio Valley Road (I-680 to Clayton Rd)	
	Delay Index = 2.0 / min pk hr avg speed = 15 mph
	Pk hr VOR = 1.2
East County (TRANSPLAN)	
SR-4 (freeway) TRANSPLAN/TRANSPAC boundary [at Willow Pass Grade] to Main St-SR-160	AM pk hr VOR \geq 1.25 in pk direction Delay Index \leq 3.0
SR-4 (non-freeway)	
Brentwood Blvd SR-160 to Balfour Rd	LOS D at signalized intersections LOS E at unsignalized intersections Delay Index < 3.0
Brentwood Blvd (Balfour Rd to Byron Hwy)	Pk Hr LOS E for rural highway
Byron Highway (Brentwood Blvd to [unnamed] SR-4)	Delay Index < 2.0
Unnamed SR-4 (Byron Hwy [south] to San Joaquin County)	
Deer Valley Road (rural portion) Dallas Ranch Rd to Marsh Creek Rd	
	Pk hr Roadway LOS \leq mid pt LOS E Delay Index \leq 2.0
Marsh Creek Road/Camino Diablo Deer Valley Road to Vasco Road	
	Pk hr Roadway LOS \leq mid pt LOS E Delay Index \leq 2.0
Marsh Creek Road (eastern section) Future SR-4 Bypass to SR-4	
	Pk hr Roadway LOS \leq mid pt LOS E Delay Index \leq 2.0

5 Westernmost section of Willow Pass Road is not cited specifically in Action Plan, but rather is shown on "Routes of Regional Significance" figure as eastern extension of Taylor Boulevard.

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
Byron Highway (non SR-4 section) (SR-4 to Alameda Co.)	Pk hr Roadway LOS \leq mid pt LOS E Delay Index \leq 3.0
Kirker Pass Road Pittsburg city limit to TRANSPAC/TRANSPAN boundary	Pk hr Roadway LOS \leq mid pt LOS E Delay Index \leq 2.0

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
Vasco Road (newly relocated) Walnut Blvd to Alameda Co.	AM pk hr VOR = 1.3 in pk direction Delay Index \leq 3.0
SUBURBAN ARTERIAL REGIONAL ROUTES	
Bailey Road (northern section) (Willow Pass Rd to Leland Rd)	Delay Index < 2.0
Balfour Road (Deer Valley Rd to Brentwood Blvd [SR 4])	
Buchanan Road (Railroad Ave to Somersville Road)	
Deer Valley Road (northern Section) (Hillcrest Rd-Davison Dr to Dallas Ranch Rd)	
Delta Fair Boulevard (Pittsburg/Antioch city limit to Somersville Rd)	
Evora Road (TRANSPLAN/TRANSPAC boundary to Willow Pass Rd-WB SR-4 off ramp)	
Hillcrest Avenue (SR-4 to Lone Tree Way)	
James Donlon Boulevard ⁶ (Somersville Road to Lone Tree Way)	
Leland Road (Alves Ranch Rd to Pittsburg-Antioch city limit)	
Lone Tree Way (SR-4 Freeway to Brentwood Blvd [SR-4])	
Railroad Avenue (SR-4 to Pittsburg city limit)	
Somersville Road (Pittsburg-Antioch Hwy/10th St to James Donlon Blvd)	
Walnut Boulevard (Oak St to Camino Diablo Rd)	
Willow Pass Road + W. 10th Street ⁷ Willow Pass Rd - (SR-4 to Pittsburg city limit)	
W. 10th St - (Pittsburg + B24 city limit to Railroad Ave)	

6 Route of Regional Significance added in 1997 East County (TRANSPLAN) Action Plan (was not included in 1995 Action Plan).

7 W. 10th Street is not cited specifically in Action Plan, but rather is included as Willow Pass Road east to Railroad Avenue

Table A-1 Routes of Regional Significance and Traffic Service Objectives

Facilities	Traffic Service Objectives
Lamorinda	
SR-24 (Alameda Co. [Caldecott Tunnel] to I-680)	4 hrs max pk hr congestion + 20% daily ridership on BART
San Pablo Dam Road WCCTAC/Lamorinda boundary [s/o Castro Ranch Rd] to Bear Creek Rd	2 hrs max pk hr congestion btwn Castro Ranch Rd & Bear Creek Rd
Tri-Valley (Contra Costa portion)	
Interstate-680 TRANSPAC/Tri-Valley boundary [between Rudgear Rd & Livorna Rd] to Alameda Co.	Max V/C = 0.99
Danville Boulevard (TRANSPAC/Tri-Valley boundary [between Rudgear Rd & Livorna Rd] to La Gonda Way)	LOS D (V/C ≤ 0.90) at signalized intersections
Hartz Avenue⁸ (La Gonda Way to Railroad Ave)	
San Ramon Valley Boulevard (Railroad Ave [south] to Alameda Co.)	
Camino Tassajara-Tassajara Road (Sycamore Valley Rd to Alameda Co.)	
Sycamore Valley Road (San Ramon Valley Blvd to Camino Tassajara)	
Alcosta Boulevard (San Ramon Valley Blvd to Village Parkway)	LOS D (V/C ≤ 0.91) at signalized intersections
Bollinger Canyon Road (San Ramon Valley Blvd to Alcosta Blvd [being extended east to Dougherty Road])	
Crow Canyon Road (Alameda Co. to Camino Tassajara)	
Dougherty Road (Crow Canyon Rd to Alameda Co.)	

8 Hartz Avenue is not cited specifically in Action Plan, but rather is included as Danville Boulevard and San Ramon Valley Boulevard.

Table A-2 Intersection Levels of Service (West County)

#	Study Intersections	AM Peak Hour		PM Peak Hour		Traffic Service Objective
		V/C Ratio	Level of Service	V/C Ratio	Level of Service	
1	San Pablo Avenue / Cummings Skyway (Unsignalized)	(1.9 sec)	A	(2.2 sec)	A	E
2	Parker Avenue-San Pablo Avenue / Willow Avenue	0.36	A	0.24	A	E
3	San Pablo Avenue / John Muir Parkway	—	—	0.67	B	E
4	San Pablo Avenue / Sycamore Avenue	0.50	A	0.49	A	E
5	San Pablo Avenue / Pinole Valley Road	0.63	B	—	—	E
6	San Pablo Avenue / Tennant Avenue (Non-counted CMP)	0.50	A	0.55	A	E
7	San Pablo Avenue / Appian Way-Pinnon Avenue	—	—	0.74	C	E
8	San Pablo Avenue / Richmond Parkway	0.48	A	0.67	B	E
9	San Pablo Avenue / Hilltop Drive	—	—	0.44	A	E
10	San Pablo Avenue / Robert H Miller Drive	0.27	A	0.32	A	E
11	San Pablo Avenue / Rumrill Avenue-College Lane	—	—	0.60	A	E
12	San Pablo Avenue / El Portal Drive-Broadway Avenue	—	—	0.59	A	E
13	San Pablo Avenue / 23rd Street-Road 20	—	—	0.71	C	E
14	San Pablo Avenue / Church Lane	0.31	A	0.62	B	E
15	San Pablo Avenue / San Pablo Dam Road	—	—	0.63	B	E
16	San Pablo Avenue / McBryde Road	—	—	0.60	A	E
17	San Pablo Avenue / WB I-80 off ramp	—	—	0.58	A	E
18	San Pablo Avenue / EB I-80 on-off ramps-Roosevelt Avenue	—	—	0.68	B	E
19	San Pablo Avenue / Barrett Avenue	—	—	0.78	C	E
20	San Pablo Avenue / Cutting Boulevard	—	—	0.66	B	E
21	San Pablo Avenue / Portrero Avenue	0.58	A	0.52	A	E
22	San Pablo Avenue / Schmidt Lane	0.42	A	0.48	A	E
23	San Pablo Avenue / Central Avenue	—	—	0.62	B	E
24	San Pablo Avenue / Carlson Boulevard	0.79	C	0.63	B	E
25	23rd Street / Rheem Avenue	0.41	A	0.53	A	D
26	23rd Street / Barrett Avenue	0.40	A	0.49	A	D

Table A-2 Intersection Levels of Service (West County)

#	Study Intersections	AM Peak Hour		PM Peak Hour		Traffic Service Objective
		V/C Ratio	Level of Service	V/C Ratio	Level of Service	
27	23rd Street / Macdonald Avenue	0.30	A	0.45	A	D
28	23rd Street / Cutting Boulevard	0.40	A	0.53	A	D
29	San Pablo Dam Road / WB I-80 on-off ramps	0.81	D	—	—	D
30	San Pablo Dam Road / EB I-80 on-off ramps-Amador St	—	—	1.28	F	D
31	San Pablo Dam Road / El Portal Drive	—	—	0.67	B	D
32	San Pablo Dam Road / Appian Way-La Colina Road	—	—	0.62	B	E
33	San Pablo Dam Road / Castro Ranch Road	—	—	0.46	A	D
34	Rumrill Boulevard / Brookside Drive	0.37	A	0.39	A	D
35	Kearney Street-Pennsylvania Street / Harbour Way-10th St	0.43	A	0.43	A	D
36	Appian Way / Tara Hills Drive-Canyon Drive	0.58	A	0.52	A	D
37	Appian Way / WB I-80 on-off-ramps	0.71	C	0.60	A	D
38	Appian Way / EB I-80 on-off-ramps	0.43	A	0.57	A	D
39	Appian Way / Fitzgerald Drive-Sarah Drive	0.61	B	0.66	B	D
40	El Portal Avenue / Road 20	—	—	0.32	A	D
41	El Portal Avenue / WB I-80 on ramp	0.64	B	—	—	D
42	El Portal Avenue / WB I-80 off ramp	0.64	B	—	—	D
43	El Portal Avenue / EB I-80 on-off ramps	—	—	0.62	B	D
44	Carlson Boulevard / Cutting Boulevard	—	—	0.39	A	D
45	Carlson Boulevard / Bayview Avenue	0.49	A	0.34	A	D
46	Carlson Boulevard / Central Avenue	0.48	A	0.35	A	D
47	Cutting Boulevard / Canal Boulevard	—	—	0.21	A	D
48	Cutting Boulevard / Harbour Way	—	—	0.47	A	D
49	Cutting Boulevard / WB I-80 off ramp	0.39	A	0.30	A	D

Note: "V/C" means "volume-to-capacity".

Dashes "—" indicate a CMP intersection. Measured and reported only in the one peak hour where previous monitoring indicates the highest volumes. Seconds of delay, rather than V/C ratio, is shown for unsignalized intersections.

Table A-3 Intersection Levels of Service (East County)

#	Study Intersections	AM Peak Hour		PM Peak Hour		Traffic Service Objective
		V/C Ratio	Level of Service	V/C Ratio	Level of Service	
50	18th Street-Main Street (SR-4) / SB SR-160 on-off ramps	0.50	A	0.47	A	D
51	Main Street (SR-4) / NB SR-160 on-off ramps	0.64	B	0.75	C	D
52	Main St (SR-4) / Nelroy Rd-Bridgehead Rd	—	—	0.78	C	D
53	Main Street (SR-4) / Big Break Road	—	—	0.54	A	D
54	Main Street (SR-4) / Oakley Rd-Charles Way	—	—	0.53	A	D
55	Main Street (SR-4) / Cypress Road	—	—	0.47	A	D
56	Main St-Brentwood Blvd (SR-4) / Delta Road (<i>Unsignalized</i>)	(1.1 sec)	A	(1.4 sec)	A	E
57	Brentwood Blvd (SR-4) / Lone Tree Way	0.35	A	0.57	A	D
58	Brentwood Blvd (SR-4) / Sand Creek Rd	0.62	B	0.70	B	D
59	Brentwood Blvd (SR-4) / Central Blvd-Sycamore Road	0.47	A	0.78	C	D
60	Brentwood Boulevard (SR-4) / Oak Street	0.50	A	0.57	A	D
61	Brentwood Boulevard (SR-4) / Balfour Road	—	—	0.36	A	D
62	Walnut Boulevard / Oak Street	0.43	A	0.35	A	D
63	Walnut Boulevard / Balfour Road	0.44	A	0.35	A	D
64	Walnut Boulevard / Marsh Creek Road	0.64	B	0.76	C	D
65	Bailey Road / Willow Pass Road	0.56	A	0.73	C	D
66	Bailey Road / WB SR-4 on-off ramps-Canal Road	0.75	C	0.88	D	D
67	Bailey Road / EB SR-4 on-off ramps	0.58	A	0.62	B	D
68	Bailey Road / Leland Road	0.83	D	0.63	B	D
69	Railroad Avenue / WB SR-4 on ramp-California Avenue	—	—	0.57	A	D
70	Railroad Avenue / EB SR-4 on-off ramps	—	—	0.45	A	D
71	Railroad Avenue / Leland Road	0.55	A	0.71	C	D
72	Railroad Avenue / Buchanan Road	—	—	0.84	D	D
73	Somersville Road / WB SR-4 on-off ramps	0.32	A	0.61	B	D
74	Somersville Road / EB SR-4 on-off ramps	0.27	A	0.74	C	D

Table A-3 Intersection Levels of Service (East County)

#	Study Intersections	AM Peak Hour		PM Peak Hour		Traffic Service Objective
		V/C Ratio	Level of Service	V/C Ratio	Level of Service	
75	Somersville Road / Delta Fair Boulevard	0.30	A	0.62	B	D
76	Somersville Road / Buchanan Road	0.42	A	0.54	A	D
77	Lone Tree Way-A Street / WB SR-4 on-off ramps	0.58	A	0.70	B	D
78	Lone Tree Way / EB SR-4 on-off ramps	0.47	A	0.70	B	D
79	Lone Tree Way / W. Tregallas Road	0.62	B	0.75	C	D
80	Lone Tree Way / James Donlon Boulevard	0.66	B	0.76	C	D
81	Lone Tree Way / Deer Valley Road	0.55	A	0.52	A	D
82	Lone Tree Way / Hillcrest Avenue	0.43	A	0.46	A	D
83	Lone Tree Way / Empire Avenue (existing unsignalized)	(33.1 sec)	E	(9.8 sec)	B	E
	<i>Lone Tree Way / Empire Avenue (following 1999 signalization)</i>	<i>0.45</i>	<i>A</i>	<i>0.62</i>	<i>B</i>	(1)
84	Lone Tree Way / Fairview Avenue	0.67	B	0.95	E	D
	<i>Lone Tree Way / Fairview Avenue</i>	<i>0.63</i>	<i>B</i>	<i>0.37</i>	<i>A</i>	(2)
85	Lone Tree Way / O'Hara Avenue (Unsignalized)	(1.5 sec)	A	(1.6 sec)	A	E
86	Hillcrest Avenue / WB SR-4 on-off ramps	0.57	A	0.49	A	D
87	Hillcrest Avenue / EB SR-4 on-off ramps	0.50	A	0.66	B	D
88	Hillcrest Avenue / Deer Valley Road-Davison Road	0.56	A	0.54	A	D
89	Leland Road / Loveridge Road	0.55	A	0.70	B	D
90	Buchanan Road / Loveridge Road	0.67	B	0.65	B	D

Note: Dashes “—” indicate a CMP intersection. Measured and reported only in the one peak hour where previous monitoring indicates the highest volumes. Seconds of delay, rather than V/C ratio, is shown for unsignalized intersections.

- 1) Antioch is in the process of signalizing, and adding an exclusive southbound right-turn lane to, intersection #83 - Lone Tree Way/Empire Avenue, which will improve level of service to acceptable levels.
- 2) Brentwood is in the process of adding an exclusive eastbound right-tun lane to intersection #84 — Lone Tree Way/Fairview Avenue, which will improve level of service to acceptable levels.

Table A-4 Intersection Levels of Service (Contra Costa Portion of Tri-Valley)

#	Study Intersections	AM Peak Hour		PM Peak Hour		Traffic Service Objective
		V/C Ratio	Level of Service	V/C Ratio	Level of Service	
91	Danville Boulevard / Livorna Road	0.79	C	0.66	B	D
92	Danville Boulevard / Stone Valley Road	0.94	E	0.92	E	D
93	Hartz Avenue / Diablo Road	0.38	A	0.51	A	D
94	Hartz Ave-San Ramon Valley Blvd / Railroad Ave (South)	0.46	A	0.47	A	D
95	San Ramon Valley Boulevard / Sycamore Valley Road	0.39	A	0.60	A	D
96	San Ramon Valley Boulevard / Crow Canyon Road	0.55	A	0.75	C	D
97	San Ramon Valley Boulevard / Norris Canyon Road	0.52	A	0.62	B	D
98	San Ramon Valley Boulevard / Bollinger Canyon Road	0.74	C	0.65	B	D
99	San Ramon Valley Boulevard / Alcosta Boulevard	0.70	B	0.68	B	D
100	Sycamore Valley Road / SB I-680 on-off ramps	0.50	A	0.58	A	D
101	Sycamore Valley Road / NB I-680 off ramp	0.79	C	0.44	A	D
102	Sycamore Valley Road / Brookside Drive	0.55	A	0.42	A	D
103	Sycamore Valley Road / Camino Tassajara	0.57	A	0.48	A	D
104	Camino Tassajara / Sherburne Hills Road	0.56	A	0.46	A	D
105	Camino Tassajara / Crow Canyon Road-Blackhawk Road	0.59	A	0.67	B	D
106	Crow Canyon Road / Bollinger Canyon Road	0.55	A	0.57	A	D
107	Crow Canyon Road / SB I-680 off ramp	0.60	A	0.51	A	D
108	Crow Canyon Road / NB I-680 off ramp	0.58	A	0.55	A	D
109	Crow Canyon Road / Crow Canyon Place	0.51	A	0.79	C	D
110	Crow Canyon Road / Camino Ramon	0.67	B	0.80	C	D
111	Crow Canyon Road / Alcosta Boulevard	0.44	A	0.76	C	D
112	Crow Canyon Road / Dougherty Road	0.45	A	0.57	A	D
113	Bollinger Canyon Road / SB I-680 off ramp	0.46	A	0.38	A	D
114	Bollinger Canyon Road / NB I-680 off ramp	0.80	C	0.59	A	D
115	Bollinger Canyon Road / Sunset Drive-Chevron Circle	0.57	A	0.82	C	D
116	Bollinger Canyon Road / Camino Ramon	0.45	A	0.40	A	D

Table A-4 Intersection Levels of Service (Contra Costa Portion of Tri-Valley)

#	Study Intersections	AM Peak Hour		PM Peak Hour		Traffic Service Objective
		V/C Ratio	Level of Service	V/C Ratio	Level of Service	
117	Bollinger Canyon Road / Alcosta Boulevard	0.60	A	0.68	B	D
118	Alcosta Boulevard / SB I-680 off ramp	0.62	B	0.74	C	D
119	Alcosta Boulevard / NB I-680 off ramp	0.67	B	0.70	B	D
120	Alcosta Boulevard / Village Parkway	0.22	A	0.34	A	D

Table A-5a Roadway Segment Level of Service (AM Peak Hour)

Location	Geometrics	AM Peak Hour						
		Volume			Directional Split (%)	LOS		TSO
		NB or EB	SB or WB	TOTAL		NB or EB	SB or WB	
West County (WCCTAC)								
SR-4	2-lane	1,310	1,400	2,710	48 – 52	F	F	E
Appian Way n/o I-80 WB Ramps	4-lane	1,161	1,486	2,647	44 – 56	C	D	D
Appian Way s/o I-80 EB Ramps	4-lane	1,447	1,392	2,839	51 – 49	D	D	D
Appian Way n/o San Pablo Dam Road	2-lane	364	590	955	38 – 62	D	D	D
Cummings Skyway e/o I-80	2-lane	119	75	194	61 – 39	B	B	D
Cummings Skyway w/o I-80	2-lane	585	188	773	76 – 24	E	E	D
Cummings Skyway n/o SR-4	2-lane	110	448	558	20 – 80	D	D	D
Willow Avenue n/o I-80	4-lane	881	283	1,164	76 – 24	B	A	D
Willow Avenue s/o I-80	4-lane	696	358	1,054	66 – 34	B	A	D
East County (TRANSPLAN)								
SR-4 (Brentwood Boulevard)	2-lane	348	748	1,096	32 – 68	D	D	E
Byron Highway n/o Mountain Horse Road	2-lane	349	631	980	36 – 64	D	D	Mid-Pt E
Marsh Creek Road e/o Deer Valley Road	2-lane	146	247	393	37 – 63	C	C	Mid-Pt E
Camino Diablo Road w/o Vasco Road	2-lane	151	184	335	45 – 55	C	C	Mid-Pt E
Deer Valley Road s/o Dallas Ranch Road	2-lane	241	383	624	39 – 61	D	D	Mid-Pt E
Deer Valley Road s/o Balfour Road	2-lane	51	271	321	16 – 84	C	C	Mid-Pt E
Kirker Pass Road e/o Concord Boulevard	4-lane	607	1,716	2,323	26 – 74	A	C	Mid-Pt E
Marsh Creek Road w/o SR-4	2-lane	77	166	244	32 – 68	C	C	Mid-Pt E
Vasco Road s/o Camino Diablo Road	2-lane	250	1,607	1,858	13 – 87	F	F	Mid-Pt E
Tri-Valley								
I-680	6-lane	4,342	7,333	11,675	37 – 63	E	C	v/c=0.9 9

Table A-5b Roadway Segment Level of Service (PM Peak Hour)

Location	Geometrics	PM Peak Hour						
		Volume			Directional Split (%)	LOS		TSO
		NB or EB	SB or WB	TOTAL		NB or EB	SB or WB	
West County (WCCTAC)								
SR-4	2-lane	1,242	1,441	2,683	46 – 54	F	F	E
Appian Way n/o I-80 WB Ramps	4-lane	1,501	1,482	2,983	50 – 50	C	D	D
Appian Way s/o I-80 EB Ramps	4-lane	1,658	1,585	3,244	51 – 49	D	D	D
Appian Way n/o San Pablo Dam Road	2-lane	672	713	1,386	49 – 51	D	D	D
Cummings Skyway e/o I-80	2-lane	60	63	124	49 – 51	B	B	D
Cummings Skyway w/o I-80	2-lane	204	199	402	51 – 49	E	E	D
Cummings Skyway n/o SR-4	2-lane	903	147	1,050	86 – 14	D	D	D
Willow Avenue n/o I-80	4-lane	535	490	1,025	52 – 48	B	A	D
Willow Avenue s/o I-80	4-lane	506	474	981	52 – 48	B	A	D
East County (TRANSPLAN)								
SR-4 (Brentwood Boulevard)	2-lane	740	509	1,249	59 – 41	D	D	E
Byron Highway n/o Mountain Horse Road	2-lane	540	562	1,102	49 – 51	D	D	Mid-Pt E
Marsh Creek Road e/o Deer Valley Road	2-lane	227	229	456	50 – 50	C	C	Mid-Pt E
Camino Diablo Road w/o Vasco Road	2-lane	135	152	287	47 – 53	C	C	Mid-Pt E
Deer Valley Road s/o Dallas Ranch Road	2-lane	401	368	769	52 – 48	D	D	Mid-Pt E
Deer Valley Road s/o Balfour Road	2-lane	203	211	414	49 – 51	C	C	Mid-Pt E
Kirker Pass Road e/o Concord Boulevard	4-lane	2,016	1,918	3,934	51 – 49	A	C	Mid-Pt E
Marsh Creek Road w/o SR-4	2-lane	142	152	294	48 – 52	C	C	Mid-Pt E
Vasco Road s/o Camino Diablo Road	2-lane	1,462	1,500	2,962	49 – 51	F	F	Mid-Pt E
Tri-Valley								
I-680	6-lane	6,452	4,853	11,305	57 – 43	E	C	v/c=0.99

Table A-6 AM Peak Hour Roadway Travel Speeds and Delay Index

Route	Northbound or Eastbound		Southbound or Westbound		TSO	
	Average Speed (mph)	Delay Index	Average Speed (mph)	Delay Index	Average Speed	Delay Index
Central County (TRANSPAC)						
I-680 (Solano County to Tri-Valley/TRANSPAC boundary)	NDA	NDA	43	1.51	30	2.0
SR-242 (I-680 to SR-4)	NDA	NDA	20	3.24	30	2.0
SR-4 - West of SR-242 (WCCTAC/TRANSPAC boundary [at Cummings Skyway] to SR-242)	NDA	NDA	58	1.12	30	2.0
SR-4 - East of SR-242 (SR-242 to TRANSPLAN/TRANSPAC boundary)	NDA	NDA	38	1.68	20	3.0
Ygnacio Valley Road (I-680 to Clayton Road)	33	1.17	22	1.73	15	2.0
Clayton Road (Ygnacio Valley Road-Kirker Pass Road to Treat Boulevard)	32	1.10	33	1.07	15	2.0
Treat Boulevard (Clayton Road to I-680)	21	1.75	23	1.66	15	2.0
Geary Road + Pleasant Hill Road (I-680 to Taylor Boulevard (south))	27	1.13	29	1.04	15	2.0
Taylor Boulevard + Willow Pass Road (Pleasant Hill Road (south) to Concord Avenue)	28	1.22	30	1.12	15	2.0
Alhambra Avenue + Pleasant Hill Road (Arch Road to Taylor Boulevard)	30	1.15	30	1.14	15	2.0
Pacheco Boulevard + Contra Costa Boulevard + North Main Street (Marina Vista to I-680 Interchange) *	24	1.25	25	1.23	15	2.0
East County (TRANSPLAN)						
SR-4 - (TRANSPAC/TRANSPLAN boundary to SR-160)	NDA	NDA	37	1.75	N/A	3.0
Evora Road (Willow Pass Road to Willow Pass Road) *	41	1.10	38	1.19	N/A	2.0
Willow Pass Rd (SR-4 EB Off-Ramp to Parkside Dr-W. 10th St) + W. 10th St (Willow Pass Rd-Parkside Dr to Railroad Ave)	34	1.05	28	1.28	N/A	2.0

Table A-6 AM Peak Hour Roadway Travel Speeds and Delay Index

Route	Northbound or Eastbound		Southbound or Westbound		TSO	
	Average Speed (mph)	Delay Index	Average Speed (mph)	Delay Index	Average Speed	Delay Index
Leland Rd (Woodhill Dr to Pittsburg/Antioch city limit) + Delta Fair Blvd (Pittsburg/Antioch city limit to Somersville Rd)	29	1.04	25	1.21	N/A	2.0
Buchanan Road (Railroad Road to Somersville Road)	34	1.11	17	2.28	N/A	2.0
Bailey Road (Willow Pass Road to Leland Road) *	20	1.26	17	1.45	N/A	2.0
Kirker Pass Road (Clayton Road to Pittsburg/CCC boundary) + Railroad Avenue (Pittsburg/CCC boundary to SR-4)			33	1.23	N/A	2.0
Somersville Road (W. 10th Street to James Donlon Boulevard)	21	1.17	23	1.09	N/A	2.0
Hillcrest Avenue (SR-4 to Lone Tree Way)	37	1.14	36	1.15	N/A	2.0
James Donlon Boulevard (Somersville Road to Lone Tree Way)	31	0.96	35	0.87	N/A	2.0
Lone Tree Way (SR-4 to SR-4)	28	1.22	27	1.24	N/A	2.0
Deer Valley Road (Hillcrest Avenue-Davison Drive to Marsh Creek Road)	38	1.15	41	1.08	N/A	2.0
Balfour Road (Deer Valley Road to SR-4) *	41	1.01	40	1.04	N/A	2.0
Walnut Boulevard (Oak Street to Camino Pablo) *	41	1.08	40	1.10	N/A	2.0
Marsh Creek Road (Future SR-4 alignment to SR 4)*	45	0.97	45	0.97	N/A	2.0
Marsh Creek Road (Deer Valley Road to Camino Pablo) + Camino Pablo (Marsh Creek Road to Vasco Road)*	35	1.20	40	1.03	N/A	2.0
Vasco Road (Walnut Boulevard to Alameda County line)*			52	0.98	N/A	3.0
Byron Highway (SR-4 to Alameda County line)	46	0.98	50	0.90	N/A	3.0

Table A-7 PM Peak Hour Roadway Travel Speeds and Delay Index

Route	Northbound or Eastbound		Southbound or Westbound		TSO	
	Average Speed (mph)	Delay Index	Average Speed (mph)	Delay Index	Average Speed	Delay Index
Central County (TRANSPAC)						
I-680 (Solano County to Tri-Valley/TRANSPAC boundary)	46	1.40	NDA	NDA	30	2.0
SR-242 (I-680 to SR-4)	58	1.12	NDA	NDA	30	2.0
SR-4 - West of SR-242 (WCCTAC/TRANSPAC boundary [at Cummings Skyway] to SR-242)	59	1.09	NDA	NDA	30	2.0
SR-4 - East of SR-242 (SR-242 to TRANSPAN/TRANSPAC boundary)	41	1.58	NDA	NDA	20	3.0
Ygnacio Valley Road (I-680 to Clayton Road)	37	1.05	36	1.07	15	2.0
Clayton Road (Ygnacio Valley Road-Kirker Pass Road to Treat Boulevard)	25	1.41	25	1.43	15	2.0
Treat Boulevard (Clayton Road to I-680)	23	1.65	28	1.35	15	2.0
Geary Road + Pleasant Hill Road (I-680 to Taylor Boulevard (south))	26	1.15	25	1.18	15	2.0
Taylor Boulevard + Willow Pass Road (Pleasant Hill Road (south) to Concord Avenue)	25	1.35	24	1.40	15	2.0
Alhambra Avenue + Pleasant Hill Road (Arch Road to Taylor Boulevard)	30	1.15	33	1.03	15	2.0
Pacheco Boulevard + Contra Costa Boulevard + North Main Street (Marina Vista to I-680 Interchange) *	23	1.34	23	1.33	15	2.0
East County (TRANSPAN)						
SR-4 - (TRANSPAC/TRANSPAN boundary to SR-160)	40	1.61	NDA	NDA	N/A	3.0
Evora Road (Willow Pass Road to Willow Pass Road) *	42	1.08	40	1.13	N/A	2.0
Willow Pass Rd (SR-4 EB Off-Ramp to Parkside Dr-W. 10th St) + W. 10th St (Willow Pass Rd-Parkside Dr to Railroad Ave)	28	1.28	30	1.17	N/A	2.0

Table A-7 PM Peak Hour Roadway Travel Speeds and Delay Index

Route	Northbound or Eastbound		Southbound or Westbound		TSO	
	Average Speed (mph)	Delay Index	Average Speed (mph)	Delay Index	Average Speed	Delay Index
Leland Rd (Woodhill Dr to Pittsburg/Antioch city limit) + Delta Fair Blvd (Pittsburg/Antioch city limit to Somersville Rd)	25	1.18	26	1.16	N/A	2.0
Buchanan Road (Railroad Road to Somersville Road)	23	1.64	35	1.08	N/A	2.0
Bailey Road (Willow Pass Road to Leland Road) *	22	1.15	21	1.16	N/A	2.0
Kirker Pass Road (Clayton Road to Pittsburg/CCC boundary) + Railroad Avenue (Pittsburg/CCC boundary to SR-4)	53	0.77			N/A	2.0
Somersville Road (W. 10th Street to James Donlon Boulevard)	19	1.34	23	1.09	N/A	2.0
Hillcrest Avenue (SR-4 to Lone Tree Way)	39	1.08	36	1.15	N/A	2.0
James Donlon Boulevard (Somersville Road to Lone Tree Way)	29	1.04	34	0.88	N/A	2.0
Lone Tree Way (SR-4 to SR-4)	28	1.19	32	1.04	N/A	2.0
Deer Valley Road (Hillcrest Avenue-Davison Drive to Marsh Creek Road)	38	1.15	41	1.07	N/A	2.0
Balfour Road (Deer Valley Road to SR-4) *	43	0.96	41	1.01	N/A	2.0
Walnut Boulevard (Oak Street to Camino Pablo) *	37	1.17	40	1.09	N/A	2.0
Marsh Creek Road (Future SR-4 alignment to SR 4)*	33	1.30	37	1.16	N/A	2.0
Marsh Creek Road (Deer Valley Road to Camino Pablo) + Camino Pablo (Marsh Creek Road to Vasco Road)*	38	1.10	40	1.04	N/A	2.0
Vasco Road (Walnut Boulevard to Alameda County line)*	41	1.25			N/A	3.0
Byron Highway (SR-4 to Alameda County line)	49	0.94	48	0.94	N/A	3.0

Table 8 Overall Travel Speed on SR 24 between SR 13 and I-680

Segment of Route 24	Peak Period	Direction	Minimum Overall Travel Speed (mph)	Duration of Overall Travel Speed < 35 mph	Comments
Route 13 to Acalanes Road	AM	Westbound	45	0 min	June 1998
Route 13 to Acalanes Road	AM	Eastbound	32	50 min	June 1998
Route 13 to Acalanes Road	PM	Westbound	34.7	15 min	June 1998
Route 13 to Acalanes Road	PM	Eastbound	40	0 min	September 1998
Acalanes Road to Route 680	AM	Westbound	57	0 min	November 1998
Acalanes Road to Route 680	PM	Eastbound	22	2 hr 45 min	June 1998 - Previous to opening eastbound SR 24 to northbound I-680 connector.
Acalanes Road to Route 680	PM	Eastbound	59	0 min	October 1998 - After opening eastbound SR 24 to northbound I-680 connector.
Route 13 to Route 680	AM	Westbound	50	0 min	Combination of runs conducted June 1998 and November 1998
Route 13 to Route 680	PM	Eastbound	47	0 min	Combination of runs conducted September 1998 and October 1998

Source: Caltrans 1998 Congestion Monitoring Report

TSO = Maintain duration of congestion (i.e., overall travel speed less than 35 mph) to less than 4 hours.

Table 9 Travel Time Runs on San Pablo Dam Road

Peak Period & Direction	Beginning Time	Duration	Average Speed (mph)	High/Low Speed
AM Peak Hour / Northbound	6:53 AM	06:34	50	
	6:54 AM	06:16	53	
	7:12 AM	06:32	51	
	7:31 AM	06:54	48	<-- Low = 48 mph
	8:12 AM	06:40	50	
	8:13 AM	06:30	51	
	8:28 AM	06:14	53	
	8:53 AM	06:23	52	
	8:54 AM	05:54	56	← High = 56 mph
AM Peak Hour / Southbound	6:45 AM	06:14	53	← High = 53 mph
	6:45 AM	06:58	47	
	7:02 AM	06:52	48	
	7:19 AM	09:42	34	
	7:54 AM	17:39	19	← Low = 19 mph
	7:55 AM	12:57	25.5	
	8:19 AM	06:48	49	
	8:46 AM	06:50	48	
	8:47 AM	06:15	53	← High = 53 mph
PM Peak Hour / Northbound	4:00 PM	06:36	50	
	4:00 PM	06:46	49	
	4:16 PM	06:33	50	
	4:32 PM	06:46	49	
	4:58 PM	06:13	53	← High = 53 mph
	4:59 PM	06:33	50	
	5:30 PM	06:30	51	
	6:01 PM	06:29	51	
	6:02 PM	06:58	47	← Low = 47 mph

Table 9 Travel Time Runs on San Pablo Dam Road

Peak Period & Direction	Beginning Time	Duration	Average Speed (mph)	High/Low Speed
PM Peak Hour / Southbound	4:08 PM	06:15	53	
	4:08 PM	06:53	48	
	4:24 PM	06:59	47	← Low = 47 mph
	4:40 PM	06:16	53	
	5:06 PM	05:42	58	← High = 58 mph
	5:07 PM	06:40	50	
	5:37 PM	05:50	57	
	6:08 PM	06:19	52	
	6:09 PM	06:19	52	

Travel Time Run Length = 5.5 miles

TSO = Maintain duration of congestion (i.e., overall travel speed less than 25 mph) to less than 2 hours.

Table 10 Vehicle Occupancy Rates

Roadway	Location	TSO	Vehicle Occupancy Rate			
			AM Peak Hour		PM Peak Hour	
			NB or EB	SB or WB	NB or EB	SB or WB
WEST COUNTY (WCCTAC)						
I-80 (in 1990)			1.31	1.31	1.37	1.37
I-80 (in 1998)			1.5	1.5	1.5	1.6
Percent Change on I-80 from 1990 to 1998		15%	15%	15%	9%	17%
I-580		1.35	1.3	—	—	1.3
CENTRAL COUNTY (TRANSPAC)						
I-680	n/o Monument Boulevard	1.2 (Work Trips)	—	1.2	1.2	—
SR-242	s/o SR-4	1.2 (Work Trips)	—	1.2	1.2	—
SR-4 (w/o SR-242)	w/o Alhambra Boulevard	1.2 (Work Trips)	—	1.1	1.2	—
SR-4 (e/o SR-242)	btwn Willow Pass (west) & Bailey	1.2 (Work Trips)	—	1.1	1.2	—
Alhambra Boulevard	s/o Elderwood Drive	1.2	—	1.3	1.3	—
Clayton Road	e/o Bailey Road	1.2	—	1.2	1.3	—
Contra Costa Boulevard	n/o Taylor Boulevard	1.2	—	1.2	1.3	—
Geary Road	e/o Buena Vista Avenue	1.2	—	1.2	1.3	—
Kirker Pass Road	e/o Concord Boulevard	1.2	—	1.3	1.2	—
N. Main Street	s/o Geary Road	1.2	—	1.2	1.2	—
Pacheco Boulevard	e/o Morello Avenue	1.2	1.2	—	—	1.6
Pleasant Hill Road	w/o Huston Road	1.2	—	1.2	1.2	—
Treat Boulevard	e/o San Miguel Road	1.2	—	1.3	1.2	—
Taylor Boulevard	e/o Morello Avenue	1.2	1.3	—	—	1.3
Ygnacio Valley Road	e/o Oak Grove Road	1.2	—	1.1	1.2	—
EAST COUNTY (TRANSPAN)						
SR-4 (fwy)	between Willow Pass Road (west leg) and Bailey Road	1.25	—	1.09	1.21	—
Vasco Road	s/o Camino Diablo Road	1.3	—	1.1	1.2	—

Table 10 Vehicle Occupancy Rates

Roadway	Location	TSO	Vehicle Occupancy Rate			
			AM Peak Hour		PM Peak Hour	
			NB or EB	SB or WB	NB or EB	SB or WB

Table 11 Transit Ridership in the I-80 Corridor

Route	Average Passenger/Day (1)		
	1990	1998	Increase/Decrease
AC Transit Routes			
7	2,600	(2)	1,499 (2)
72	13,000	(2)	7,727 (2)
73	4,000		6,313
74	2,100		1,460
79		(3)	(discontinued)
G	(not in operation)		543
H	1,400	(2)	466 (2)
L/LX	1,400		629
LA/LB/LC	900		1,242
LD			
SUB-TOTAL	25,400		19,879 -22%
WestCAT Transit Routes			
30Z (Martinez Link)	86		245
J& JX (WestCAT Express)	1,514		2,515
Q (WestCAT Express)	984		(discontinued 2/16/99)
HTX	(began operation 3/30/98)		32
SUB-TOTAL	2,584		2,792 8%
BART Richmond Line			
West county BART Stations	25,886		27,875 8%

Table 10 Vehicle Occupancy Rates

Roadway	Location	TSO	Vehicle Occupancy Rate			
			AM Peak Hour		PM Peak Hour	
			NB or EB	SB or WB	NB or EB	SB or WB
GRAND TOTAL	53,870	50,546			-6%	

Notes: (1) Average Passengers per day for AC Transit Routes rounded to nearest 100

(2) Portion of route serves Alameda County - figures for entire route

(3) Routes 73 and 79 are interlined - figures for combined route

TSO = 20% increase in transit use in the I-80 Corridor

BART data are the sum of entries and exits.

Table 10 Vehicle Occupancy Rates

Roadway	Location	TSO	Vehicle Occupancy Rate			
			AM Peak Hour		PM Peak Hour	
			NB or EB	SB or WB	NB or EB	SB or WB

Table 12 Daily Passengers at West County BART Stations

Station	Average Passenger Exits per Day		Percent Increase/Decrease from 1990 level
	1990	1998	
Richmond	(1)	2,888	
El Cerrito del Norte	(1)	7,530	
El Cerrito Plaza	(1)	3,877	
TOTAL	13,275	14,295	8%

Note: (1) Information not broken down by station, but totaled for all three stations

TSO = 10% increase in average daily passengers at the three West County BART stations from 1990 level of 13,275 passengers

Table 13 Average Daily Ridership on Capitol Corridor

Station	Average Daily Boardings
On at Martinez Station	67
Off at Martinez Station	71
On at Richmond Station	31
Off at Richmond Station	39
ENTIRE SYSTEM	1,286

Note: TSO = Achieve a 6,400 per day ridership on commuter rail

Table 14 Transit Ridership on Solano County BART Feeder Service

Vallejo Transit Route Number	Total Weekday Ridership			% Increase/Decrease from 1990 level	
	6/89 - 6/90		6/97 - 6/98		
80	305,000	(1)	503,489	(2)	65%
90	not in service		125,721	(3)	NA

Notes: (1) Does not include estimated Saturday ridership of 25,000 passengers

(2) Does not include estimated Saturday ridership of 47,000 passengers

TSO = 20% increase in average daily trips on the "Solano County BART Feeder Bus Service" over 1990 levels

Table 15 Transit Ridership on San Pablo Dam Road

Year	Total Passengers	Days in Operation	Average Passenger/Day	Percent Increase/Decrease from 1992 level
1992	30,171	255	118	—
1993	28,780	255	113	-4.61%
1994	30,330	255	119	0.53%
1995	28,883	254	114	-3.89%
1996	27,460	253	109	-8.27%
1997	29,672	254	117	-1.27%
1998	25,387	242	105	-11.34%

Notes: TSO = 25% increase in bus ridership along San Pablo Dam Road over 1992 levels

Ridership values shown are for County Connection Route 950

Table 16 Transit Ridership on BART along State Route 24

Station	Average Passenger Exits per Day		Percent Increase/Decrease
	1990	1998	
Lafayette	3,200	2,867	-10%
Orinda	3,000	2,682	-11%
TOTAL	6,200	5,549	-11%

Note: Entry counts are typically 95% of exit counts

TSO = 20% increase in daily ridership on BART along SR-24

Table 17 Occupancy of Park-and-Ride Lots along I 80 during 1980

Name and Location	Crockett	Willow Avenue	Willow Avenue	Hercules	Richmond Parkway	Hilltop Drive	TOTAL	
		(North)	(South)					
	NW corner of San Pablo Ave I/C in Crockett	NW corner of Willow Avenue I/C	SE corner of Willow Avenue I/C	W of I-80, at San Pablo Rd & Sycamore Ave	SW corner of Blume Dr. & Richmond Pkwy I/C	NW corner of Hilltop Dr I/C in Richmond		
	Number of Spaces	24	41	58	260	192	135	710
January 15	Spaces Used	1	27	9	127	12	6	182
	Percent Used	4%	66%	16%	49%	6%	4%	26%
January 20	Spaces Used	1	19	7	135	13	9	184
	Percent Used	4%	46%	12%	52%	7%	7%	26%
February 4	Spaces Used	1	20	4	148	16	5	194
	Percent Used	4%	49%	7%	57%	8%	4%	27%
April 8	Spaces Used	0	16	4	183	24	8	235
	Percent Used	0%	39%	7%	70%	13%	6%	33%
April 28	Spaces Used	2	27	1	202	22	11	265
	Percent Used	8%	66%	2%	78%	11%	8%	37%
June 11	Spaces Used	1	18	7	228	21	5	280
	Percent Used	4%	44%	12%	88%	11%	4%	39%
August 4 *	Spaces Used	5	19	7	233	71	7	342
	Percent Used	21%	46%	12%	90%	37%	5%	48%
August 13 *	Spaces Used	1	16	6	249	83	15	370
	Percent Used	4%	39%	10%	96%	43%	11%	52%
Maximum	Spaces Used	5	27	9	249	83	15	388
	Percent Used	21%	66%	16%	96%	43%	11%	55%

Source: Caltrans District 4. September 1998. I-80 Carpool Lanes - 2nd Quarter Monitoring Report.

Note: Asterisk (*) indicates a Spare the Air day.

Table 18 Trucks on Parker Avenue in Rodeo, 1990

Truck Type	4-Hour Truck Volumes	
	(7:00–9:00 AM and 4:00–6:00 PM)	24-Hour Truck Volumes
5+ Axle Trucks (Refinery)	6	24
5+ Axle Trucks (Non-Refinery)	4	16
4-axle Trucks	1	4
3-axle Trucks	7	28
Trucks 2/ Dual Rear Tires	40	159
Buses	16	64
Light Delivery Trucks	9	36
TOTAL	83	330

Note: The West County Action Plan reported 250 refinery truck trips per day.

The TSO is to reduce truck traffic by 90 percent by 2010.

Table A-19 Accident Reduction on SR-4 (John Muir Parkway)

Description	Number of Accidents from 1/1/91–2/31/93	Number of Accidents from 1/1/96–12/31/98	Percent Increase/Decrease
Accidents by Type			
Fatal	5	3	-40%
Injury	61	51	-16%
Property Damage Only	79	64	-19%
Total	145	118	-19%
Accidents by Direction			
Eastbound	76	48	-37%
Westbound	69	70	1%
Total	145	118	-19%

Notes: TSO = 10% reduction in accident rate on SR-4 (John Muir Parkway) below 1993 levels.