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Contra Costa
Sub-regional Action Plans for
the Routes of Regional Significance
Multimodal Traffic Service Objectives (MTSO)
Draft 2017 Monitoring Report

DRAFT

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ES Executive Summary

This report documents the 2017 monitoring results of Contra Costa County's multi-modal traffic service objectives (MTSOs). The MTSOs are applied to the roads of significance as designated by each Regional Transportation Planning Committee (RTPC) within the County. The MTSO monitoring efforts evaluate whether the transportation system achieves the MTSO standards adopted in the RTPC's 2014 Action Plan. The majority of MTSOs were monitored using the combination of (INRIX Analytics or Caltrans PeMS) commercial speed data, the manual turning movement counts, and in-field observations.

The 2017 MTSO monitoring results are summarized below:

- **Intersection Level of Service**: A total of 231 intersections were monitored in 2017. 6% (15) locations operated at LOS lower than MTSO standards during the AM or PM peak period
- **Roadway Segment Level of Service**: A total of 20 roadway segments in the East County were analyzed. Ten segments (in the AM peak) and eleven segments (in the PM peak) didn't achieve the MTSO standards
- **Average Speed**: All 16 monitored roadway segment in the Central County met the MTSO standards
- **Delay Index**: A total of 34 roadway segment were monitored using delay index. 1% (5) segments didn't achieve the MTSO standards
- **Duration of Congestion**: One roadway segment was analyzed; it met the MTSO standard
- **HOV Lane Utilization**: A total of four roadway segments were monitored; all met the MTSO standards, except for the I-80 WB segment in the West County during the AM peak period
- **Vehicle Ridership**: A total of three roadway segments were monitored; none met the MTSO standards
- **Vehicle Occupancy**: A total of two roadway segments were monitored; neither met their MTSO standard

- **Transit Ridership**: BART loading factors were monitored in Lamorinda; all monitored loading factors met the MTSO standard
- **Maximum Side Street Wait Time**: three out of the total of 13 roadway segments exceeded MTSO standards

Several additional measures were monitored and reported this MTSO report at CCTA's request. Since no specific MTSO standards are defined in the Action Plans for these MTSOs, they are reported as informational only MTSOs:

- vehicle volumes,
- pedestrian or bicycle volumes,
- frequency of collision,
- bus ridership,
- pedestrian delay at the signalized intersection, and
- pavement condition.

1 Introduction

As part of Contra Costa County's transportation planning and growth management responsibilities, Contra Costa County Transportation Authority (CCTA) regularly monitors the performance of the transportation system in Contra Costa. Two of the main components of this transportation performance monitoring effort are the Countywide Comprehensive Transportation Plan (CTP), and the monitoring of the Multimodal Transportation Service Objectives (MTSOs) as part of updates of the Action Plan for Routes of Regional Significance.

The CCTA Action Plan designates and defines the County's transportation performance measures (for performance monitoring purposes) and the service objective for each of the designated intersections and roadway segments.

On a quadrennial basis (i.e., once every four years) through the CCTA's Multi-Modal Monitoring program, CCTA evaluates the performance of the County's transportation system and identifies those monitored locations which operated below the predetermined MTSO standards (which were last updated in 2014) and highlights long-term transportation utilization, growth and congestion trends.

CCTA has monitored the achievement of the level-of-service standards established in the County's Congestion Management Program since the first CMP in 1991; and CCTA has regularly maintained and updated this MTSO monitoring report since 2009.

This 2017 MTSO monitoring report is divided into four chapters:

- **Chapter 1 — Introduction**: provides an introduction and describes the background for the 2017 MTSO monitoring efforts
- **Chapter 2 — Methodology**: documents the performance evaluation (analytical) methodologies and describes the underlying data sources
- **Chapter 3 — Results:** presents the MTSO results—the study's findings, divided into three parts including intersection analysis, roadway segment analysis and other MTSO reporting elements (e.g., pedestrian, bicycle and transit)
- **Chapter 4 — Summary of Findings:** summarizes the monitoring results and highlights the locations that failed to meet the designated 2014 MTSO standards

1.1 Changes to Transportation System

Since the last MTSO monitoring in 2013, there were some significant changes made to the County's transportation system, including:

- State Route 4 / State Route 160 Connector Ramps
- State Route 4 East Widening: Loveridge Road to Somersville Road
- Interstate 680 Express Lane Conversion(s)
- Interstate 80 / San Pablo Dam Road Interchange Improvements

1.2 Additional MTSO Measures

The following MTSO measurements are new in this MTSO monitoring, which are subject to the MTSOs identified in each Action Plan.

- Duration of congestion
- Average trail user delay
- Frequency of collision
- Pavement condition

2 Methodology

This chapter describes the methodology and underlying assumptions used to quantify the performance on the MTSO intersections, roadway segments and transportation elements. This chapter of the MTSO report is divided into three sections by the type of monitored locations (roadway intersections, roadway segments and other transportation elements or facilities).

2.1 Intersection Analysis

This section summarizes the two-step methodology of calculating the MTSO measures for the designated MTSO reported roadway intersections. The first step in the reporting process is to collect intersection turning movement count data, in accordance with CCTA's Technical Procedures. For reporting side street wait times, the number of signal cycles required for "back of queue" vehicles to clear the intersection was recorded during the AM and PM peak hours for 60 minutes (7:00 AM to 8:00 AM and 5:00 PM to 6:00 PM) at each intersection.

The second step in the evaluation process is to evaluate the performance of the roadway intersection and report the mandated MTSO measures – and compare the current performance of the roadway intersections to the performance thresholds in the CCTA Action Plan.

2.1.1 Data Collection

The project team selected the data collection days to ensure that all count data were collected on Tuesdays, Wednesdays and Thursdays during AM and PM peak hours in April 2017. The days in the following categories were removed or excluded from the data collection period:

- Public Holidays and School Vacations (including Spring Breaks);
- Special Events (no special events were observed to impact traffic conditions during the 2017 monitoring period); and
- Road Closures and Construction Activities.

2.1.2 Intersection Level of Service, V/C and Average Stopped Delay

The intersection Level of Service (LOS) measures were estimated using the Transportation Research Board's Highway Capacity Manual (HCM) 2000 and HCM 2010 methodologies. The

MTSO analyses were performed using the Synchro intersection analysis software. The evaluation input data prepared by the project team included the turning movement volume (i.e., count) data, intersection geometry and roadway network data, and intersection signal-timing plans. The team consulted with CCTA staff to resolve conflicts when inconsistencies were identified between current timing plans and the Contra Costa member agency provided signal timing information. The Synchro intersection analysis software generated the vehicular delays (in seconds) and LOS for the AM and PM peak hours of operation.

The HCM's LOS thresholds were established as a function of the intersection's vehicular delay values, as shown in Table 1. A LOS value of "A" describes a state of very low traffic volumes and no significant traffic delays. This means that most of vehicles arrive during the signal's green time. On the other hand, a LOS of "F" represents an intersection with high levels of congestion, over saturated traffic conditions, and long queues upstream of the intersection. For MTSO reporting, the average stopped delays were expressed in units of signal cycles – the number of signal cycles needed to clear the intersection. The MTSO reported delays (in units of signal cycles) was estimated by dividing the average stopped delay (in seconds) by the signal's cycle length (in seconds per cycle).

The previously described MTSO evaluation was performed for:

- 82 locations in the Tri Valley sub area (LOS);
- 56 locations in the West County (LOS);
- 41 locations in the East County (LOS);
- 50 locations in the Central County (LOS, V/C and Average Stopped Delay).

Table 1: HCM 2010 & 2000 Level of Service Criteria for Signalized Intersections

Level of Service	Average Control Delay (seconds/vehicle)	General Description
A	0 - 10	Free Flow
B	>10 - 20	Stable Flow (slight delays)
C	>20 - 35	Stable flow (acceptable delays)
D	>35 - 55	Approaching unstable flow (tolerable delay, occasionally wait through more than one signal cycle before proceeding)
E	>55 - 80	Unstable flow (intolerable delay)
F	> 80	Forced flow (congested and queues fail to clear)

2.1.3 Maximum Side Street Wait Time

The Lamorinda Action Plan contains a MTSO for "Side Street Wait Time". The maximum side street wait time is reported directly from field observations at each of the designated roadway intersections. The locations where side street wait time analyses were performed are:

- Pleasant Hill Road - Maintain a maximum wait time for drivers on side streets wishing to access Pleasant Hill Road or Taylor Boulevard of one signal cycle or less; and
- Camino Pablo/ San Pablo Dam Road- The maximum wait time for drivers on side streets wishing to access San Pablo Dam Road or Camino Pablo should be no greater than one signal cycle.

2.2 Roadway Segment Analysis

This section summarizes the methods for data collection and data analyses for freeway and arterial roadway segment MTSO reporting. The vast majority of the roadway segment evaluations were performed using commercially available vehicular speed data (i.e., INRIX Analytics speed data). Roadway travel time data were collected via floating car runs (sometimes called probe vehicles or tach runs) for roadway segments where the commercial speed data were unavailable or deemed insufficient because of sample size limitations.

2.2.1 Speed, LOS, Delay Index

The average vehicular speeds, Level of Service (LOS), and delay index estimation use similar inputs and data processing and evaluation techniques. Peak hour average vehicular speeds is the most influential variable (input) in the roadway segment LOS estimation process. Further, the LOS estimation and reporting processes are consistent with previous reporting periods.

2.2.1.1 Data Collection

The roadway segment travel time data were collected (i.e., downloaded) from the INRIX Analytics website, or were obtained via floating car runs for segments where the INRIX data were not available.

A) INRIX Data

The downloaded segment-based INRIX data were filtered to remove:

- Holidays during the monitoring period;

- Times outside the morning and afternoon peak periods (times outside the 6:00 - 10:00 A.M. and 3:00 -7:00 P.M. windows);
- Days other than Tuesdays – Thursdays;
- Data points impacted by construction and special events, as applicable; and
- Data points with low INRIX quality scores (INRIX data quality scores of 10 and 20)[1].

Similar to CMP Monitoring, roadways undergoing short-term construction and/or with ongoing incidents were reviewed for anomalies in the reported vehicular speeds. To be conservative, the data collected on the MTSO segments which might have been impacted on those identified construction/incident days were excluded. This filtration process insures that the speeds data used in the MTSO monitoring is reflective of the traffic conditions experienced on an average workday by commuters. Additionally, data collected on days with significant weather events were removed. While there were some public holidays during the spring of 2017, none occurred on Tuesdays, Wednesdays or Thursdays. Local schools were also in session during the data collection period.

B) Floating Car Data

The speed data for the Pleasant Hill Road MTSO segment between Geary Road and Taylor Boulevard was supplemented with floating car runs, due to the insufficient sample size from INRIX data. In accordance with Technical Procedures[2], the floating data were collected on Tuesday, September 26, 2017.

2.2.1.2 Data Processing

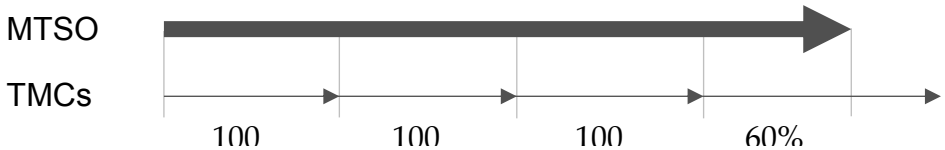
The (MTSO) performance measure computation is a four-step process that entails: 1) spatial conflation; 2) spatial coverage check; 3) temporal aggregation; and 4) computation of required performance measure. The following sections provide additional detail. Note that the floating car data were collected on the designated MTSO segment during the peak periods. Therefore, the steps one through three do not apply to the floating car data.

[1] INRIX includes a data quality score that accompanies every INRIX data point. A score of 30 indicates data are exclusively generated from real-time sources; a mix of historical and real-time sources are used (indicated by a score of 20); and data are exclusively generated from historical data (indicated by a score of 10).
[2] Technical Procedures, CCTA, January 16 2013

1) Spatial Conflation

Raw INRIX data provides travel time data along each Traffic Message Channels (TMC) in one-minute intervals. A TMC is a relatively short section of a roadway, generally in the range of a half-mile or so. The first step of analysis includes mapping the INRIX TMCs (and the raw speed data to the County's MTSO segments. The INRIX-TMC→CCTA-Segment mapping file completed for the County's CMP efforts was used as a starting point for MTSO Monitoring spatial conflation efforts. A thorough review of TMC links over each MTSO segment was performed. Figure 1 shows a schematic example of mapping or combining four TMC links to one MTSO reporting segment. Note that the end of the last TMC link does not align with the end of the MTSO Segment. In these instances, only the overlapping portion of the TMC is used in subsequent steps in the evaluation process.

Figure 1: End points of MTSO and TMC do not align



2) Coverage Check

Prior to the temporal aggregation, a reality check was performed to assure that small sample estimation errors did not negatively impact the reliability of the reported MTSOs. The project team performed a check to ensure that time-periods with excess TMCs removals were not included in the further analysis. To do this, the team removed all one-minute time periods where the total mapped TMC data available was less than 99%. Using the 99% threshold, only a small minority of the time periods were flagged as having inadequate sample size. In these cases, the threshold was lowered to 70% to ensure adequate sample size. The number of one-minute data points for MTSO segment varies as a result of removing data points during this filtering process. The team selected a minimum sample size threshold for sample sizes of 100 observations (i.e., data points). Locally collected floating car surveys were performed where the MTSO segment failed the minimum sample size criteria. In the 2017 MTSO monitoring, this occurred at only one location - Pleasant Hill Road between Geary Road and Taylor Boulevard.

3) Temporal Aggregation

In this step, the one-minute intervals for each MTSO segment were aggregated to peak periods. The peak hour speeds were estimated in 15-minute moving average time-periods, e.g., from 6:00 to 7:00 A.M., then from 6:15 to 7:15 A.M., etc. Next, the lowest peak hour speed (during the peak period) was used as an input to the LOS and delay estimation process, which is described in the next section.

4) Compute Required Performance Measure (Speed, LOS, and Delay Index)

The procedure of calculating LOS and delay index is in conformance with CCTA's Technical Procedures.

- For floating car runs, the speeds were averaged to estimate the peak hour speed.
- The LOS assignment process is consistent with previous MTSO reporting efforts and consistent with legislative requirements from the California Government Code – as shown in Table 2 for freeway segments, and Table 3 for arterial street segments.

Table 2: Freeway Level of Service Standards (HCM 1985)

Level of Service	Traffic Speed (miles/hour)
A	≥ 60
B	≥ 57
C	≥ 54
D	≥ 46
E	≥ 30
F	< 30

Table 3: Arterial Level of Service Standards (HCM 1985)

Level of Service	Traffic Speed (miles/hour)
A	≥ 55
B	≥ 50
C	≥ 45
D	≥ 40
E	< 40

- The Delay Index is an expression of the amount of time required to travel between two points during the peak hour as compared to a baseline. The numerator of the delay index formula, the free flow travel time is defined as "the time it takes to traverse a roadway segment at the posted speed limit". The denominator of the delay index formula measured or actual peak hour travel time experienced by motorists, which was the peak hour speed identified in the third step as mentioned above.

2.2.2 Duration of Congestion, HOV Lane Utilization

The Tri-valley Action Plan includes MTSOs for duration of congestion for the mixed-flow or general-purpose lanes on I-680 south of SR-84. The duration of congestion captures or measures the number of congested hours per average workday.

MTSO standards for HOV lane utilization (in vehicles per hour) were established in the East County and West County.

2.2.2.1 Data Collection

Vehicular speed data were downloaded from the Caltrans PeMS website for the vehicle detector station (VDS) locations along the freeway's MTSO segments during non-holiday Tuesdays, Wednesdays and Thursdays for the months of February, March, and April of 2017.

2.2.2.2 Data Processing

Duration of congestion is defined as the number of congested hours during a normal or average non-holiday workday. The MTSO standard of no more than five (5.0) hours was established for I-680 south of SR-84 in the Tri-valley. First, the five-minute speeds were aggregated to each half-hour periods for each PeMS detector location. Second, a congested half-hour period was flagged if it performed at a speed below 35 miles per hour. Finally, the number of congested half-hour periods were summed and reported as total (daily) hours of congestion.

HOV lane usage is measured by the number of vehicles using the HOV lane at the highest HOV volume along the MTSO reporting section. The East County established MTSO standard for freeways with HOV lane utilization exceeding 600 vehicles per lane in the peak direction during the peak hour. The maximum volume was identified by aggregating five-minute traffic volumes (obtained from the Caltrans PeMS website) to peak hour volume.

2.2.3 Average Vehicle Ridership

The Tri-valley Action Plan contains a MTSO for I-580 and I-680 that specifies the ratio of total person commute trips to vehicles used for commuting on I-580 and I-680 increased by 10% from 1.1 to 1.2.

2.2.3.1 Data Collection

Average vehicle ridership was estimated using data from the Bay Area Manage Lane Report published by Caltrans in 2013 and 2015.

2.2.4 Average Vehicle Occupancy

The MTSO standard for average vehicle occupancy is included in the Lamorinda Action Plan. It is a measure of the average number of passengers (including the driver) per vehicle on Pleasant Hill Road and Camino Pablo/ San Pablo Dam Road. The MTSO standards include:

- Increase the average vehicle occupancy on Pleasant Hill Road/Taylor Boulevard to at least 1.3 during the peak commute hours by 2018; and
- Increase the average vehicle occupancy on Camino Pablo/San Pablo Dam Road to at least 1.3 during the peak commute hours by 2018.

2.2.4.1 Data Collection

Vehicle occupancy data were collected from a stationary position along Pleasant Hill Road and Camino Pablo/ San Pablo Dam Road. Video data captured traffic flow during AM and PM peak periods on May 23rd and May 25th, 2017. In accordance with the Technical Procedures, the data were collected on mid-week workdays (i.e., Tuesdays, Wednesdays and Thursdays) on non-holiday days while local area schools were in session.

2.2.4.2 Data Processing

The field data were reported in 15-minute intervals during AM and PM peak periods. The occupancy counts were then aggregated to estimate the average per peak period vehicle occupancy.

2.3 Transit Ridership

The usage of public transit was monitored in the East County and the Lamorinda. There is no specified goal in the East County Action Plan.

- Lamorinda
  - Maintain an hourly average transit load factor (ratio of passengers to seats) of 1.5 or less when approaching Lafayette Station westbound and Orinda Station eastbound during each and every hour of service.
- East County
  - A measure of the average number of riders boarding a fixed-route bus during an hour of scheduled bus service when persons may board with a fare or pass.
  - A measure of the average number of weekday riders on all BART trains between the Bay Point and North Concord Stations.

2.3.1 Data Collection

The transit ridership data were obtained directly from Tri Delta Transit, LAVTA and BART.

2.3.2 Description and Method of Calculation

For East County, the average ridership per service hour was derived from the ridership for Tri Delta Transit fixed-route buses in a sample month (May 2017); BART passenger counts between the Bay Point and North Concord Stations (April 2017) were averaged to obtain the average number of weekday riders. For Lamorinda, BART ridership approaching the Lafayette Station westbound and Orinda Station eastbound was tallied and then averaged per service hour.

2.4 Additional Performance Measures

The Tri-valley and Lamorinda Action Plans now contains MTSOs not reported in the previous monitoring cycles.

- **Pedestrian and Bicycle Volumes**: The Tri-valley Action Plans includes a MTSO for pedestrian and bicycle volumes using Iron Horse Trail (directly measured from field observations).

- **Crash frequency**: The Tri-valley and Lamorinda Action Plan includes MTSOs for vehicle crash frequency and/or pedestrian or bicycle injury crash frequency. The collision data were obtained from the Caltrans Statewide Integrated Traffic Records System (SWITRS) for the calendar year 2013-2016.
- **Average Trail User Delay at Major Road Crossings**: The Tri-valley Action Plans includes a MTSO for pedestrian delay at the signaled intersection. The delays (in units of seconds) were determined by the cycle length and the green times for vehicles when pedestrians are prohibited to enter crosswalk with an assumption of uniform pedestrian arrival rate.
- **Pavement Condition**: The Tri-valley Action Plans includes a MTSO for Iron Horse Trail that measures the relative comfort of the trail for its users using the pavement condition. This MTSO was reported using Pavement Condition Index.
- **Frequency of Lane Closure**: The Lamorinda Action Plan includes a MTSO for the frequency of lane closure.
- **Inventory of pedestrian and bicycle facilities**: The Lamorinda Action Plan includes a MTSO for the inventory of pedestrian and bicycle facilities.

3 Monitoring Results

This chapter summarizes the results from the 2017 MTSO monitoring at the designated MTSO roadway intersections and segments.

3.1 Intersection Analysis

This section on roadway intersection analysis is divided into two sub-sections:

1) Intersection Level of Service (LOS) and Volume-to-Capacity ratio (V/C), and
2) Average Stopped Delay and Maximum Side Street Wait Time.

The intersection analysis MTSO monitoring results are summarized in Table 4 for Tri-valley County, Table 5 for the East County, Table 6 for the West County and in Table 7 for the Central County sub-region.

3.1.1 Intersection LOS and V/C

The LOS and/or V/C ratios were analyzed for 231 MTSO locations: 82 locations in the Tri Valley sub area, 56 locations in the West County, 41 locations in the East County, and 50 locations in the Central County. Of these 231 locations, 13 locations currently exceed the standard threshold either in the AM and/or PM peak periods.

The following MTSO locations are reported for each sub-region:

Tri Valley: two (2) locations operate at a lower LOS:

- T9: San Ramon Valley Boulevard/Alcosta Boulevard; (HCM 2010 AM Peak); and
- T60: Stanley Boulevard/Murrieta Boulevard. (HCM 2000 AM and PM Peak)

West County: five (5) locations operate at a lower LOS:

- W1: San Pablo Avenue/John Muir Parkway; (HCM 2010 AM and PM Peak, HCM 2000 PM Peak)
- W5: San Pablo Avenue/Rumrill Boulevard; (HCM 2010 and 2000 PM Peak)
- W30: San Pablo Avenue/Richmond Parkway; (HCM 2010 and 2000 PM Peak)
- W49: Richmond Parkway/Westbound I-80 Ramps/Blume Drive; (HCM 2010 AM and PM Peak) and
- W55: Richmond Parkway/Pittsburgh Avenue. (HCM 2010 and 2000 PM Peak)

East County: four (4) locations operate at a lower LOS:

- E12: Main Street/Delta Road; (HCM 2010 and 2000 AM and PM Peak) Stop Control
- E23: Bailey Road/Leland Road; (HCM 2010 AM Peak)
- E24: Railroad Avenue/Leland Road; (HCM 2010 AM Peak) and
- E31: Lone Tree Way/West Tregallas Road. (HCM 2010 PM Peak)

Central County: all locations operate at an acceptable level for LOS and/or V/C standards.

- The V/C standard threshold of 1.5 for Central County intersections on Pacheco Blvd, Pleasant Hill Rd, Taylor Blvd, Treat Blvd, and Ygnacio Valley Blvd reflect the level of congestion on a given roadway.
- All intersections analyzed with V/C are at an acceptable level.

Table 4: 2017 MTSO Intersection Draft LOS Results – Tri Valley Sub Area

[MTSO = LOS E]

Intersection			HCM Method	AM			PM		
ID	Facility	Cross Street		Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
T1	Danville Boulevard	Livorna Road	2010	27.3	C		33.6	C	
T2	Danville Boulevard	Stone Valley Road	2010	43.0	D		36.3	D	
T3	Hartz Avenue	Diablo Road	2010	25.3	C		24.6	C	
T4	Hartz Avenue-San Ramon Valley Boulevard	Railroad Avenue (South)	2000	26.6	C		29.8	C	
T5	San Ramon Valley Boulevard	Sycamore Valley Road	2000	33.7	C		41.1	D	
T6	San Ramon Valley Boulevard	Crow Canyon Road	2010	35.2	D		46.9	D	
T7	San Ramon Valley Boulevard	Norris Canyon Road	2020	51.1	D		36.2	D	
T8	San Ramon Valley Boulevard	Bollinger Canyon Road	2010	50.9	D		52.1	D	
T9	San Ramon Valley Boulevard	Alcosta Boulevard	2010	**83.4**	**F**		58.8	E	
T10	Sycamore Valley Road	Northbound I–680 Ramp	2000	16.7	B	B	21.5	C	B
T11	Sycamore Valley Road	Southbound I–680 Ramps	2000	10.3	B	B	8.5	A	B

Intersection			HCM Method	AM			PM		
ID	Facility	Cross Street		Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
T12	Sycamore Valley Road	Brookside Drive	2010	15.9	B	B	11.5	B	B
T13	Sycamore Valley Road	Camino Tassajara	2010	11.2	B	C	17.1	B	B
T14	Camino Tassajara	Sherburne Hills Road	2010	15.2	B	B	14.1	B	C
T15	Camino Tassajara	Crow Canyon Road-Blackhawk Road	2000	41.4	D	D	43.4	D	D
T16	Crow Canyon Road	Bollinger Canyon Road	2010	29.5	C	C	28.9	C	D
T17	Crow Canyon Road	Northbound I–680 Ramp	2000	19.0	B	B	19.0	B	C
T18	Crow Canyon Road	Southbound I–680 Ramp	2010	33.2	C	B	29.6	C	C
T19	Crow Canyon Road	Crow Canyon Place	2010	26.4	C	C	46.2	D	D
T20	Crow Canyon Road	Camino Ramon	2010	57.6	E	C	53.0	D	D
T21	Crow Canyon Road	Alcosta Boulevard	2010	14.2	B	B	15.6	B	C
T22	Crow Canyon Road	Dougherty Road	2010	16.7	B	B	22.9	C	C
T23	Bollinger Canyon Road	Northbound I–680 Ramp	2000	34.5	C	B	22.4	C	C
T24	Bollinger Canyon Road	Southbound I–680 Ramp	2000	44.4	D	C	67.8	E	D
T25	Bollinger Canyon	Sunset Drive-Chevron	2000	51.1	D	D	31.8	C	D

Intersection			HCM Method	AM			PM		
ID	Facility	Cross Street		Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
	Road	Circle							
T26	Bollinger Canyon Road	Camino Ramon	2000	33.1	C	F	41.5	D	F
T27	Bollinger Canyon Road	Alcosta Boulevard	2010	50.4	D	D	56.0	E	F
T28	Alcosta Boulevard	Northbound I–680 Ramps	2010	79.0	E	C	65.7	E	D
T29	San Ramon Valley Boulevard	Southbound I–680 Ramps	2000	29.3	C		45.1	D	
T30	Alcosta Boulevard	Village Parkway	2010	13.1	B	B	16.9	B	B
T31	Dougherty Road	Westbound I-580 Ramps	2010	16.3	B		17.0	B	
T32	Dougherty Road	Dublin Boulevard							
T33	Dougherty Road	Amador Valley Road	2000	47.9	D		28.9	C	
T34	Tassajara Road	Fallon Road	2010	26.7	C	C	23.1	C	D
T35	Tassajara Road	Dublin Boulevard							
T36	Tassajara Road	Gleason Road	2010	30.3	C		18.9	B	
T37	Tassajara Road	Westbound I-580 Ramps							
T38	Dublin Boulevard	Amador Plaza	2010	23.2	C		41.1	D	
T39	Dublin Boulevard	Regional Street							
T40	Dublin Boulevard	Hacienda Drive					24.5	C	
T41	Dublin Boulevard	Fallon Road							
T42	Dublin Boulevard	San Ramon Road							
T43	Dublin	Viiage							

Intersection			HCM Method	AM			PM		
ID	Facility	Cross Street		Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
	Boulevard	Parkway							
T44	San Ramon Road	Amador Valley Road							
T45	Fallon Road	Gleason Drive							
T46	Fallon Road	Eastbound I-580 Ramps							
T47	El Charro Road	Westbound I-580 Ramps							
T48	Stanley Boulevard	Isabel Avenue	2010	36.3	D		14.9	B	
T49	Isabel Avenue	Airway Boulevard							
T50	Isabel Avenue	Jack London Boulevard							
T51	Isabel Avenue	Vallecitos Road							
T52	Isabel Avenue	Vineyard Avenue							
T53	First Street	Eastbound I-580 Ramps	2010	10.1	B		18.9	B	
T54	First Street	Westbound I-580 Ramps	2010	7.4	A		8.2	A	
T55	North Canyons Parkway	Collier Canyon Road							
T56	North Canyons Parkway / Portola Avenue	Isabel Ave Extension							
T57	Holmes Street	Murrieta Blvd/4th Street							
T58	Holmes Street	Concannon Boulevard							
T59	Airway Boulevard	Eastbound I-580 Ramp							
T60	Stanley	Murrieta	2000	**125.5**	**F**		**140.4**	**F**	

Intersection			HCM Method	AM			PM		
ID	Facility	Cross Street		Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
	Boulevard	Boulevard							
T61	Hopyard Road	Owens Drive	2000	37.2	D		68.5	E	
T62	Hopyard Road	Stoneridge Drive	2010	37.4	D		39.9	D	
T63	Hopyard Road	Eastbound I-580 Ramps	2010	44.2	D		19.5	B	
T64	Hopyard Road	West Las Positas Boulevard	2010	32.3	C		35.3	D	
T65	Hopyard Road	Valley Avenue	2000	23.8	C		33.5	C	
T66	Santa Rita Road	West Las Positas Boulevard	2000	32.8	C		25.3	C	
T67	Santa Rita Road	Valley Avenue	2010	49.9	D		45.2	D	
T68	Santa Rita Road	Eastbound I-580 Ramps	2000	37.9	D		40.9	D	
T69	Santa Rita Road	Stoneridge Drive	2010	60.6	E		75.8	E	
T70	Stanley Boulevard	Valley Avenue/Bernal Avenue	2000	48.4	D		36.7	D	
T71	Stanley Boulevard	Main Street	2000	20.7	C		18.9	B	
T72	Stoneridge Drive	West Las Positas Boulevard	2010	22.7	C		38.2	D	
T73	Stoneridge Drive	Northbound I–680 Ramps	2010	16.2	B		8.3	A	
T74	Stoneridge Drive	Southbound I–680 Ramps	2010	11.2	B		14.1	B	
T75	Sunol Boulevard	Bernal Avenue	2010	43.9	D		34.4	C	
T76	Sunol Boulevard	Northbound I–680 Ramps	2010	22.5	C		46.1	E	
T77	Sunol Boulevard	Southbound I–680 Ramps	2010	20.1	C		21.8	C	
T78	West Las	Hacienda	2000	22.8	C		21.1	C	

Intersection			HCM Method	AM			PM		
ID	Facility	Cross Street		Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
	Positas Boulevard	Drive							
T79	Bernal Avenue	Northbound I–680 Ramps	2000	21.1	C		29.8	C	
T80	Bernal Avenue	Southbound I–680 Ramps	2010	15.7	B		20.9	C	
T81	Hacienda Drive	Eastbound I-580 Ramps	2000	25.2	C		14.1	B	
T82	Hacienda Drive	Westbound I-580 Ramps	2010	10.3	B		8.8	A	

Table 5: 2017 MTSO Intersection Draft LOS Results – West County Sub Area

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
W1	San Pablo Avenue	John Muir Parkway	E	2010	**185.8**	**F**	D	**239.0**	**F**	E
W2	San Pablo Avenue	Pinole Valley Road	E	2010	4.9	A	B	13.8	B	B
W3	San Pablo Avenue	Appian Way	E	2010	21.6	C	C	39.6	D	D
W4	San Pablo Avenue	Hilltop Drive	E	2010	42.5	D	C	57.7	E	E
W5	San Pablo Avenue	Rumrill Boulevard	E	2010	37.8	D	C	**98.3**	**F**	D
W6	San Pablo Avenue	El Portal Drive	E	2010	33.2	C	C	33.5	C	C
W7	San Pablo Avenue	Road 20	E	2000	42.2	D	D	47.4	D	D
W8	San Pablo Avenue	San Pablo Dam Road	E	2000	32.5	C	C	37.2	D	D
W9	San Pablo Avenue	McBryde Avenue	E	2000	24.0	C	C	27.4	C	C
W10	San Pablo Avenue	Westbound I–80 Ramps	E	2000	38.4	D	B	22.9	C	D
W11	San Pablo Avenue	Eastbound I–80 Ramps / Roosevelt Avenue	E	2000	16.8	B	C	30.7	C	D
W12	San Pablo Avenue	Barrett Avenue	E	2010	33.8	C	C	34.2	C	C
W13	San Pablo Avenue	Cutting Boulevard	E	2010	29.3	C	C	27.5	C	C
W14	San Pablo Avenue	Central Avenue	E	2000	41.4	D	C	47.2	D	C
W15	San Pablo Dam Road	Westbound I–80 Ramps	E	2000	24.2	C	C	35.9	D	C
W16	San Pablo Dam Road	Eastbound I-80 Ramps /Amador Street	E	2000	51.4	D	C	49.7	D	E
W17	San Pablo Dam Road	El Portal Drive	E	2000	45.2	D	D	32.0	C	D

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
W18	San Pablo Dam Road	Appian Way	E	2010	62.4	E	C	50.4	D	D
W19	San Pablo Dam Road	Castro Ranch Road	E	2010	25.2	C	C	27.5	C	C
W20	San Pablo Dam Road	Bear Creek Road	E	2000	44.1	D		63.6	E	
W26	Cutting Boulevard	Carlson Boulevard	D	2010	26.2	C		24.1	C	
W27	San Pablo Avenue /Parker Avenue	Willow Avenue	E	2000	9.7	A		9.4	A	
W28	San Pablo Avenue	Sycamore Avenue	E	2000	10.8	B	C	13.3	B	C
W29	San Pablo Avenue	Tennant Avenue	E	2000	13.7	B	B	74.3	E	A
W30	San Pablo Avenue	Richmond Parkway	E	2010	63.6	E	C	**98.7**	**F**	C
W31	San Pablo Avenue	Robert H Miller Drive	E	2000	23.3	C	B	26.1	C	B
W32	San Pablo Avenue	Church Lane	E	2010	32.4	C	B	35.9	D	C
W33	San Pablo Avenue	Potrero Avenue	E	2010	27.8	C	C	27.5	C	B
W34	San Pablo Avenue	Schmidt Lane	E	2000	11.2	B	B	13.8	B	B
W35	San Pablo Avenue	Carlson Boulevard	E	2010	57.4	E	C	45.9	D	C
W36	23rd Street	Rheem Avenue	D	2010	10.7	B	C	12.6	B	C
W37	23rd Street	Barrett Avenue	D	2010	15.7	B	B	19.2	B	B
W38	23rd Street	Macdonald Avenue	D	2010	9.7	A	A	12.4	B	A
W39	23rd Street	Cutting Boulevard	D	2010	34.4	C	B	31.9	C	C
W40	Appian Way	Tara Hills Drive-Canyon Drive	D	2000	47.5	D	C	40.9	D	C
W41	Appian Way	Westbound I-80 Ramps	D	2000	23.4	C	D	22.9	C	D

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
W42	Appian Way	Eastbound I-80 Ramps	D	2000	8.6	A	A	11.3	B	B
W43	Appian Way	Fitzgerald Drive-Sarah Drive	D	2000	23.8	C	C	34.3	C	D
W44	Carlson Boulevard	Bayview Avenue	D	2000	38.2	D	D	25.3	C	C
W45	Carlson Boulevard	Central Avenue	D	2010	21.6	C	B	20.5	C	B
W46	Central Avenue	Pierce Street	D	2010	10.5	B	B	12.6	B	B
W47	Central Avenue	Westbound I-80 Ramps	D	2000	11.4	B	B	14.2	B	C
W48	Central Avenue	Eastbound I-80 Ramps	D	2000	16.1	B	B	25.7	C	C
W49	Richmond Parkway	Westbound I-80 Ramps /Blume Drive	D	2010	**95.1**	**F**	B	64.4	E	B
W50	Castro Street	Eastbound I-580 Ramps	D	2000	14.9	B		21.2	C	
W51	Castro Street	Westbound I-580 Ramps	D	2000	25.5	C		35.9	D	
W52	Castro Street	Hensley Street	D	2010	27.4	C		48.9	D	
W53	Castro Street	Mills Street	D	2000	4.2	A		6.5	A	
W54	Richmond Parkway	Gertrude Avenue	D	2000	16.0	B	C	31.2	C	D
W55	Richmond Parkway	Pittsburgh Avenue	D	2010	35.9	D	F	59.4	E	F
W56	Richmond Parkway	Parr Boulevard	D	2010	42.4	D	F	40.6	D	C
W57	Richmond Parkway	Hensley Street	D	2010	20.1	C	C	19.1	B	C
W58	Richmond Parkway	Barrett Avenue	D	2010	17.1	B	B	18.5	B	C
W59	Richmond Parkway	McDonald	D	2010	13.5	B	C	18.5	B	C
W60	Richmond Parkway	Eastbound I-580 Ramps	D	2000	30.3	C	C	34.6	C	B
W61	Richmond	Westbound	D	2000	21.0	C	B	29.7	C	B

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
	Parkway	I-580 Ramps								

Table 6: 2017 MTSO Intersection Draft LOS Results – East County Sub Area

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
E1	Railroad Avenue	Westbound SR-4 Ramps /California Avenue	E	2010	27.4	C		16.1	B	
E2	Railroad Avenue	Eastbound SR-4 Ramps	E	2000	29.7	C		39.8	D	
E3	Railroad Avenue	Buchanan Road	E	2000	48.5	D		23.1	C	
E4	Main Street	Neroly Road	E	2000	23.3	C	C	26.8	C	C
E5	Main Street	Big Break Road	E	2010	19.7	B	C	48.5	D	D
E6	Main Street	Oakley Road /Empire Road	E	2010	13.7	B	C	18.3	B	B
E7	Main Street	Cypress Road	E	2010	28.5	C	C	43.1	D	C
E8	Brentwood Boulevard	Balfour Road	E	2010	47.8	D	D	51.3	D	D
E10	18th Street-Main Street	Southbound SR-160 Ramps	D	2010	31.5	C	B	29.5	C	B
E11	Main Street	Northbound SR-160 Ramps	D	2010	13.4	B	B	13.0	B	B
E12	Main Street	Delta Road	D	2010	**63.6**	**F**		**51.3**	**F**	
E13	Brentwood Boulevard	Lone Tree Way	D	2010	27.8	C	C	33.6	C	C
E14	Brentwood Boulevard	Sand Creek Road	D	2010	25.0	C	C	28.5	C	C
E15	Brentwood Boulevard	Central Blvd-Sycamore Road	D	2010	18.3	B	B	17.2	B	B
E16	Brentwood Boulevard	Oak Street	D	2000	25.7	C	C	25.4	C	C
E17	Walnut Boulevard	Oak Street	D	2000	20.5	C	B	22.6	C	B
E18	Walnut Boulevard	Balfour Road	D	2010	33.7	C	D	34.4	C	C

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
E19	Walnut Boulevard	Marsh Creek Road	D	2010	25.2	C	C	36.2	D	D
E20	Bailey Road	Willow Pass Road	E	2010	29.9	C	C	32.7	C	C
E21	Bailey Road	Westbound SR-4 Ramps	E	2010	27.1	C	C	17.6	B	B
E22	Bailey Road	Eastbound SR-4 Ramps	E	2000	21.3	C	C	28.7	C	C
E23	Bailey Road	Leland Road	E	2010	**92.1**	**F**	D	53.0	D	C
E24	Railroad Avenue	Leland Road	D	2010	**79.0**	**E**	E	47.0	D	F
E25	Somersville Road	Westbound SR-4 Ramps	D	2000	32.4	C	C	24.7	C	C
E26	Somersville Road	Eastbound SR-4 Ramps	D	2000	20.1	C	B	33.9	C	B
E27	Somersville Road	Delta Fair Boulevard	D	2000	34.3	C	C	40.5	D	D
E28	Somersville Road	Buchanan Road	D	2010	28.9	C	D	27.4	C	D
E29	Lone Tree Way-A Street	Westbound SR-4 Ramps	D	2000	29.1	C	C	21.4	C	C
E30	Lone Tree Way	Eastbound SR-4 Ramps	D	2010	24.7	C	C	28.2	C	C
E31	Lone Tree Way	West Tregallas Road	D	2010	54.1	D	**B**	**137.2**	**F**	**C**
E32	Lone Tree Way	James Donlon Boulevard	D	2010	27.9	C	D	28.0	C	D
E33	Lone Tree Way	Deer Valley Road	D	2010	28.6	C	D	28.6	C	D
E34	Lone Tree Way	Hillcrest Avenue	D	2010	27.5	C	C	29.8	C	C
E35	Lone Tree Way	Empire Avenue	D	2010	33.1	C	D	34.3	C	D
E36	Lone Tree Way	Fairview Avenue	D	2000	45.0	D	D	49.8	D	D
E37	Lone Tree Way	O'Hara Avenue	D	2010	43.1	D	D	42.6	D	D

Intersection			MTSO	HCM Method	AM			PM		
ID	Facility	Cross Street			Delay (sec)	2017 LOS	2013 LOS	Delay (sec)	2017 LOS	2013 LOS
E38	Hillcrest Avenue	Westbound SR-4 Ramps	D	2010	4.2	A	C	4.5	A	C
E39	Hillcrest Avenue	Eastbound SR-4 Ramps	D	2000	23.6	C	C	37.2	D	C
E40	Hillcrest Avenue	Deer Valley Road	D	2000	31.1	C	C	32.1	C	C
E41	Leland Road	Loveridge Road	D	2010	32.5	C	D	30.9	C	C
E42	Buchanan Road	Loveridge Road	D	2010	23.2	C	C	17.9	B	C

Table 7: 2017 MTSO Intersection Draft LOS Results – Central County Sub Area

Intersection			MTSO	AM			PM		
ID	Facility	Cross Street		2017 Observed (HCM 2000)		2013 Observed v/c, Delay	2017 Observed (HCM 2000)		2013 Observed v/c, Delay
				V/C, Delay (sec)	LOS		V/C, Delay (sec)	LOS	
C3	Pacheco Boulevard	John Muir Road	1.5	0.38	C	0.34	0.63	D	0.50
C11	North Main Street	Geary Road	E	41.2	D		61.3	E	
C16	Treat Boulevard	Clayton Road	1.5	0.77	D	0.87	0.77	D	0.90
C17	Treat Boulevard	Cowell Road	1.5	0.87	E	1.08	0.79	D	0.97
C18	Treat Boulevard	Oak Grove Road	1.5	0.87	E	0.93	0.78	D	0.98
C19	Treat Boulevard	Bancroft Road	E / 1.5	38.6 / 0.87	D	1.13	39.1 / 0.72	D	1.17
C20	Treat Boulevard	Oak Road	1.5	0.65	D	1.03	0.61	C	0.80
C22	Ygnacio Valley Road	Clayton Road	1.5	0.79	C	0.91	0.69	D	0.78
C23	Ygnacio Valley Road	Alberta Way	1.5	0.82	D	0.98	0.85	D	0.88
C24	Ygnacio Valley Road	Ayers Road	1.5	0.93	D	1.01	0.93	E	0.90
C25	Ygnacio Valley Road	Cowell Road	1.5	0.95	E		1.02	E	
C27	Ygnacio Valley Road	Bancroft Road	E / 1.5	44.1 / 0.86	D	1.08	47.8 / 0.85	D	1.18
C28	Ygnacio Valley Road	Walnut Boulevard	1.5	0.94	C	1.04	0.86	C	0.98
C31	Ygnacio Valley Road	Civic Drive	E / 1.5	46.9 / 0.77	D	0.96	46.5 / 0.80	D	1.22
C32	Pacheco Boulevard	Shell Avenue	1.5	0.68	B	0.65	0.52	B	0.43
C33	Pacheco Boulevard	Howe Road	1.5	0.52	B	0.47	0.51	B	0.53

Intersection			MTSO	AM			PM		
ID	Facility	Cross Street		2017 Observed (HCM 2000)		2013 Observed v/c, Delay	2017 Observed (HCM 2000)		2013 Observed v/c, Delay
				V/C, Delay (sec)	LOS		V/C, Delay (sec)	LOS	
C34	Pacheco Boulevard	Morello Avenue	1.5	0.91	C	0.75	0.91	E	0.80
C35	Pacheco Boulevard	Arthur Road	1.5	0.58	C	0.59	0.60	C	0.65
C36	Pacheco Boulevard	Blum Road / WB SR-4 Ramps	1.5	0.50	D	0.65	0.81	E	0.85
C37	Pacheco Boulevard	Center Avenue	1.5	0.59	D	0.56	0.76	D	0.82
C38	Taylor Boulevard	Ruth Drive	1.5	0.81	D	0.62	0.58	C	0.47
C39	Taylor Boulevard	Norse Drive	1.5	0.82	D	0.91	0.75	D	0.54
C40	Taylor Boulevard	Morello Ave	1.5	0.76	D	0.67	0.66	D	0.55
C41	Taylor Boulevard	Apollo Way	1.5	0.51	B	0.41	0.46	B	0.68
C43	Taylor Boulevard	Grayson Road	1.5	0.85	E	0.85	0.65	C	0.71
C44	Pleasant Hill Road	Paso Nogal Road	1.5	0.65	C	0.77	0.54	C	0.63
C45	Pleasant Hill Road	Devon Avenue	1.5	0.52	B	0.73	0.52	B	0.62
C46	Pleasant Hill Road	Westover Drive	1.5	0.40	B	0.48	0.33	B	0.33
C47	Pleasant Hill Road	Grayson Road	1.5	0.71	D	1.05	0.66	D	0.91
C49	Treat Boulevard	Jones Road	1.5	0.67	C	0.78	0.63	D	0.99
C50	Treat Boulevard	Cherry Lane	1.5	0.78	C	1.02	0.85	D	0.75
C51	Treat Boulevard	Carriage Drive	1.5	0.79	C	1.10	0.53	B	0.64
C52	Treat Boulevard	Winton Drive	1.5	0.51	A	0.91	0.48	B	0.77

Intersection			MTSO	AM			PM		
ID	Facility	Cross Street		2017 Observed (HCM 2000)		2013 Observed v/c, Delay	2017 Observed (HCM 2000)		2013 Observed v/c, Delay
				V/C, Delay (sec)	LOS		V/C, Delay (sec)	LOS	
C53	Treat Boulevard	Oak Grove Plaza	1.5	0.49	B	0.60	0.57	C	0.64
C54	Treat Boulevard	San Simeon Drive	1.5	0.60	C	0.83	0.62	C	0.56
C55	Treat Boulevard	Navarone Way	1.5	0.84	B	0.96	0.74	B	0.72
C56	Treat Boulevard	Turtle Creek Road	1.5	0.51	B	0.59	0.62	B	0.54
C57	Treat Boulevard	Bel Air Drive	1.5	0.60	B	0.70	0.64	B	0.67
C59	Ygnacio Valley Road	North California Boulevard	1.5	0.83	D	0.83	0.83	D	0.87
C60	Ygnacio Valley Road	North Main Street	1.5	0.70	D	0.72	0.73	D	0.95
C61	Ygnacio Valley Road	North Broadway	1.5	0.68	D	0.79	0.70	D	1.01
C62	Ygnacio Valley Road	Homestead Avenue	1.5	0.84	C	0.93	0.97	D	1.09
C63	Ygnacio Valley Road	Tampico Drive	1.5	0.68	B	0.82	0.74	C	0.92
C64	Ygnacio Valley Road	La Casa Via	1.5	0.72	C	0.79	0.74	D	0.99
C65	Ygnacio Valley Road	San Carlos Drive	1.5	0.95	E	0.99	0.98	F	0.90
C66	Ygnacio Valley Road	Wiget Lane	1.5	0.72	D	0.84	0.72	C	1.04
C67	Ygnacio Valley Road	Via Monte	1.5	0.51	C	0.61	0.64	B	0.72
C68	Ygnacio Valley Road	Crystyl Ranch Road	1.5	0.85	B	0.92	0.96	C	0.85
C69	Ygnacio Valley Road	Michigan Boulevard	1.5	0.47	B	0.57	0.75	B	0.72
C70	Ygnacio Valley Road	Park Highlands Boulevard	1.5	0.42	B	0.66	0.51	C	0.53

3.1.2 Average Stopped Delay

The Action Plan for the Central County includes a MTSO for the average stopped delay of vehicles, measuring how many cycles it takes to pass through an intersection.

Table 8 shows the results of the average stopped delay. All intersections analyzed in the Central County meet or pass the average stopped delay threshold.

Table 8: Average Stopped Delay – Central County Sub Area

Sub Area	Facility	Cross/Street Segment	MTSO (cycle)	2017 Observed	
				AM	PM
Central County	Bailey Road	Concord Boulevard	3	0.54	0.40
	Bailey Road	Clayton Road	3	0.24	0.21
	Treat Boulevard	Clayton Road	3	0.33	0.34
	Treat Boulevard	Cowell Road	5	0.39	0.30
	Treat Boulevard	Oak Grove Road	5	0.45	0.32
	Ygnacio Valley Road	Clayton Road	3	0.39	0.31
	Ygnacio Valley Road	Alberta Way	4	0.39	0.29
	Ygnacio Valley Road	Cowell Road	4	0.33	0.42

3.1.3 Maximum Side Street Wait Time

The Action Plan for the Lamorinda area includes a MTSO of the maximum wait time for vehicles on a side street crossing a major street. The maximum number of cycles a vehicle should wait on a side street in Lamorinda is one cycle.

Table 9 shows the results of the side street wait time analysis for 13 intersections. All intersections have acceptable wait times in the PM peak hour. On the other hand, three intersections have an observed side street wait time longer than the MTSO standards in the AM peak hour.

Table 9: Side Street Wait Time – Lamorinda Sub Area

[MTSO = one or less]

Sub Area	Facility	Cross/Street Segment	2017 Observed		2013 Observed	
			AM	PM	AM	PM
Lamorinda	Pleasant Hill Road	Rancho View Drive	1	1	1	1
	Pleasant Hill Road	Green Valley Drive	**2**	1	1	2
	Pleasant Hill Road	Reliez Valley Road	1	1	1	1
	Pleasant Hill Road	Spring Hill Road	1	1		
	Pleasant Hill Road	Deer Hill Road	1	1		
	Camino Pablo	Wildcat Canyon Road	1	1		
	Camino Pablo	Monte Vista Road	1	1		
	Camino Pablo	Los Amigos Court	1	1		
	Camino Pablo	Manzanita Road	**2**	1		
	Camino Pablo	North Lane	1	1		
	Camino Pablo	Miner Road	1	1		
	Camino Pablo	Orinda Way	1	1		
	Camino Pablo	Camino Sobrante	**2**	1		

3.2 Roadway Segment Analysis

Overall, the following location did not meet the MTSO standards:

1) **Central County:** One (1) location operated at a delay index that did not meet MTSO standards
2) **East County:** Ten (10) AM Peak and eleven (11) PM Peak locations operate at a LOS not meeting MTSO standards
3) **Lamorinda:** Two (2) AM Peak and three (3) PM Peak locations operate at a LOS not meeting MTSO standards

4) **West County:** One (1) location operate at a LOS not meeting MTSO standards

2) **Tri-valley**: I-80 Westbound (AM peak hour) failed to meet the MTSO standards for the Duration of Congestion and HOV-Lane Utilization

3) **Tri-valley**: All (PM peak period) locations failed to meet the MTSO standards for average vehicle ridership

4) **Lamorinda**: All locations failed to meet the MTSO standards for vehicle occupancy

This remainder of section on Roadway Segment Analysis is divided into four parts:

3.2.1) LOS, Speed and Delay Index

3.2.2) Duration of Congestion, HOV Lane Utilization

3.2.3) Average Vehicle Ridership

3.2.4) Average Vehicle Occupancy

3.2.1 LOS, Speed, and Delay Index

The delay index, average speed, and LOS are determined by the peak hour speed computed in the same manner as previously described, using INRIX Analytics speed (and/or travel-time) data.

The results for the Central County, East County, Lamorinda County, Tri-valley County and West County are summarized in Table 10 through Table 15.

Table 10-1: Roadway Segment Analysis– Central County (Peak Hour Speed)

[MTSO = 15 mph]

Route	Limits	Dir	Length (mile)	AM		PM	
				2017 Observed	2013 Observed	2017 Observed	2013 Observed
Alhambra Avenue	Arch Street to Taylor Boulevard	NB	4.77	28.1	28	29.4	28.9
Alhambra Avenue	Arch Street to Taylor Boulevard	SB	4.77	26.7	27	27.7	29.5
Clayton Road	Treat Boulevard to Kirker Pass Road	EB	2.12	24.7	33	24.0	27.2
Clayton Road	Treat Boulevard to Kirker Pass Road	WB	2.12	21.8	28	24.3	27.6
Contra Costa Boulevard	Center Avenue to Astrid Drive	NB	3.52	20.1	23	16.6	20.0
Contra Costa Boulevard	Center Avenue to Astrid Drive	SB	3.17	19.1	20	16.9	18.0
Pacheco Boulevard	Warren Street to Center Avenue	NB	4.3	25.6	32	25.5	21.0
Pacheco Boulevard	Warren Street to Center Avenue	SB	4.3	26.5	25	21.2	25.0
Pleasant Hill Road	Geary Road to Taylor Boulevard	NB	0.8	32.1*	30	35.1*	26.0
Pleasant Hill Road	Geary Road to Taylor Boulevard	SB	0.76	41.4*	30	35.0*	27.3
Taylor Boulevard	Withers Avenue to Contra Costa Boulevard	NB	3.26	30.0	33	29.3	25.6
Taylor Boulevard	Withers Avenue to Contra Costa Boulevard	SB	3.26	31.1	28	30.5	27.3

* Floating car runs conducted on 9/26/2017

Table 10-2: Roadway Segment Analysis– Central County (Delay Index)

Route	Limits	Dir	Length (mile)	MTSO	AM		PM	
					2017 Observed	2013 Observed	2017 Observed	2013 Observed
SR-242	I-680 to State Route 4	NB	3.07	3	1.0	1.3	**3.6**	1.3
SR-242	I-680 to State Route 4	SB	3.07	3	1.6	1.4	1.0	1.3
SR-4	Between Central County sub-area boundaries	EB	11.93	5	1.0	1.0	3.0	1.4
SR-4	Between Central County sub-area boundaries	WB	11.87	5	1.3	1.2	1.1	1.0
I-680	Between central sub-area boundaries	NB	14.23	4	1.0	1.4	2.0	1.5
I-680	Between central sub-area boundaries	SB	14.2	4	1.9	1.6	1.1	1.2

Table 11-1: Roadway Segment Analysis– East County (LOS)

[MTSO = LOS D]

Route	Limits	Dir	Length (mile)	AM 2017 Observed	PM 2017 Observed
Deer Valley Road	Prewett Ranch Road to Sand Creek Road	NB	0.6	**E**	**E**
Deer Valley Road	Prewett Ranch Road to Sand Creek Road	SB	0.6	D	**E**
Walnut Boulevard	Camino Diablo to Vasco Road	NB	0.89	**E**	**E**
Walnut Boulevard	Camino Diablo to Vasco Road	SB	0.89	**E**	**E**
Cypress Road	Sellers Avenue to Bethel Island Road	EB	1.96	**E**	**E**
Cypress Road	Sellers Avenue to Bethel Island Road	WB	1.96	**E**	**E**

Route	Limits	Dir	Length (mile)	AM 2017 Observed	PM 2017 Observed
Deer Valley Road	Antioch limit / Marsh Creek	NB	4.87	D	D
Deer Valley Road	Antioch limit / Marsh Creek	SB	4.87	D	D
Sellers Avenue	Laurel Road Extension to Cypress Road	NB	0.5	**E**	**E**
Sellers Avenue	Laurel Road Extension to Cypress Road	SB	0.5	D	**E**
Balfour Road	Deer Valley to Brentwood	NB	4.78	**E**	**E**
Balfour Road	Deer Valley to Brentwood	SB	4.78	**E**	**E**
Vasco Road	Marsh Creek Road to Alameda County Line	NB	12.13	B	**E**
Vasco Road	Marsh Creek Road to Alameda County Line	SB	12.13	**E**	B
Byron Highway	Brentwood Boulevard to Alameda County Line	NB	8.04	D	D
Byron Highway	Brentwood Boulevard to Alameda County Line	SB	8.04	C	C
Marsh Creek Road	Deer Valley Road to SR-4	EB	5.03	D	C
Marsh Creek Road	Deer Valley Road to SR-4	WB	5.03	C	C
Camino Diablo Road	Marsh Creek Road to Vasco Road	EB	3.58	**E**	D
Camino Diablo Road	Marsh Creek Road to Vasco Road	WB	3.58	D	D

Table 11-2: Roadway Segment Analysis– East County (Delay Index)

[MTSO = 2.5]

Route	Limits	Dir	Length (mile)	AM 2017 Observed	PM 2017 Observed
SR-160	Between State Route 4 and the Sacramento County line	NB	2.6	1.2	1.2
SR-160	Between State Route 4 and the Sacramento County line	SB	2.6	1.2	1.1
SR-4	Between East County sub-area boundaries	EB	17.99	1.0	1.1
SR-4	Between East County sub-area boundaries	WB	17.99	2.5	1.0
SR-4	Between East County sub-area boundaries	EB	17.99	1.1	1.4
SR-4	Between East County sub-area boundaries	WB	17.99	1.4	1.3

Table 12: Roadway Segment Analysis– Lamorinda County (Peak Periods Delay Index)

[MTSO = 2]

Route	Limits	Dir	Length (mile)	AM		PM	
				2017 Observed	2013 Observed	2017 Observed	2013 Observed
Camino Pablo / San Pablo Dam Road	Moraga Way to Inspiration Trail	EB	3.8	1.6	1.2	0.9	1.2
Camino Pablo / San Pablo Dam Road	Moraga Way to Inspiration Trail	WB	3.8	0.9	1.2	1.4	1.2
Pleasant Hill Road	SR-24 to Taylor Boulevard	NB	1.8	1.4	1.2	2.0	1.4
Pleasant Hill Road	SR-24 to Taylor Boulevard	SB	1.8	**2.4**	1.2	1.3	1.3
Moraga Way	Moraga Road to Bryant Way	EB	4.7	1.3		1.3	
Moraga Way	Moraga Road to Bryant Way	WB	4.7	1.6		1.4	
Moraga Way	Moraga Way to Mount Diablo Boulevard	NB	4.7	1.6		1.6	
Moraga Way	Moraga Way to Mount Diablo Boulevard	SB	4.7	1.4		1.4	
Mt Diablo Boulevard	Happy Valley to Brown Avenue	EB	1.3	**2.1**		**2.3**	
Mt Diablo Boulevard	Happy Valley to Brown Avenue	WB	1.3	**2.1**		**2.3**	
SR-24	Alameda County Line to I-680	EB	8.5	1.1	1.0	**2.3**	1.4

Route	Limits	Dir	Length (mile)	AM		PM	
				2017 Observed	2013 Observed	2017 Observed	2013 Observed
SR-24	Alameda County Line to I-680	WB	8.6	2.0	1.7	1.0	1.5

Table 13: Roadway Segment Analysis– Lamorinda County (Off-Peak Periods Delay Index)

[MTSO = 1.5]

Start Time	EB		WB	
	2017 Observed	2013 Observed	2017 Observed	2013 Observed
12:00 AM	1.0	0.93	1.1	1.01
1:00 AM	1.0	0.94	1.0	1.03
2:00 AM	1.0	0.95	1.0	1.04
3:00 AM	1.0	0.95	1.0	1.04
4:00 AM	1.0	0.96	1.0	1.01
5:00 AM	1.0	0.95	1.0	1.03
6:00 AM	1.0	0.95	1.0	1.12
9:00 AM	1.1	0.97	1.5	1.26
10:00 AM	1.0	0.97	1.1	1.05
11:00 AM	1.0	0.97	1.0	1.04
12:00 PM	1.0	0.97	1.0	1.04
1:00 PM	1.0	0.97	1.0	1.05
2:00 PM	1.0	0.99	1.0	1.05
7:00 PM	1.1	1.00	1.0	1.04
8:00 PM	1.0	0.95	1.0	1.02
9:00 PM	1.0	0.93	1.0	1.01
10:00 PM	1.0	0.92	1.0	1.00
11:00 PM	1.0	0.92	1.0	1.01

Table 14-1: Roadway Segment Analysis– Tri-valley County (Peak Hour Speed)

[MTSO = 30.0 mph]

Route	Limits	Dir	Length (miles)	AM		PM	
				2017 Observed	2013 Observed	2017 Observed	2013 Observed
I-580	Between Tri-valley sub-area boundaries	EB	25.61	65.5	62.6	31.8	46.8
I-580	Between Tri-valley sub-area boundaries	WB	25.51	47.5	36.2	63.1	59.2
I-680	Between Tri-valley sub-area boundaries (southern end point: Washington Boulevard)	NB	27.4	52.8	58	36.6	37.5
I-680	Between Tri-valley sub-area boundaries (southern end point: is Washington Boulevard)	SB	27.39	48.5	51.2	61.2	42

Table 14-2: Roadway Segment Analysis– Tri-valley County (Delay Index)

Route	Limits	Dir	Length (miles)	MTSO	AM		PM	
					2017 Observed	2013 Observed	2017 Observed	2013 Observed
I-580	Between Tri-valley sub-area boundaries	EB	25.61	2.0	1.0	1.0	2.0	1.28
I-580	Between Tri-valley sub-area boundaries	WB	25.51	2.0	1.4	1.7	1.0	1.01
I-680	Between Tri-valley sub-area boundaries (southern end point: Washington Boulevard)	NB	27.4	2.0	1.2	1.1	1.8	1.59
I-680	Between Tri-valley sub-area boundaries (southern end point: Washington Boulevard)	SB	27.39	2.0	1.4	1.2	1.1	1.42
SR-84	Between I-580 and I-680	NB	10.18	3.0	1.2	1.5	1.6	1.49
SR-84	Between I-580 and I-680	SB	10.18	3.0	2.0	1.7	1.3	1.44

Table 15: Roadway Segment Analysis– West County (Delay Index)

Route	Limits	Dir	Length (miles)	MTSO	AM		PM	
					2017 Observed	2013 Observed	2017 Observed	2013 Observed
SR-4	I-80 to Cummings Skyway	EB	4.72	2.5	1.2	1.1	1.1	1.1
SR-4	I-80 to Cummings Skyway	WB	4.64	2.5	1.1	1.1	1.1	1.1
I-580	Between West sub-area boundaries (western end point: middle of bridge)	EB	7.67	2	2.0	1.2	1.1	1.3
I-580	Between West sub-area boundaries (western end point: middle of bridge)	WB	7.68	2	**2.8**	1.1	1.2	1.1
I-80	Between west sub-area boundaries	EB	13.75	3	1.1	1	2.8	2.9
I-80	Between west sub-area boundaries	WB	13.81	3	2.4	1.9	1.0	1.0

3.2.2 Duration of Congestion and HOV Lane Utilization

The duration of congestion and HOV lane utilization are determined from Caltrans PeMS peak hour speed and volume data. One location in the West County that did not meet the MTSO standard.

The results of 2017 MTSO monitoring are shown in Table 16 through Table 18.

Table 16: HOV Utilization – East County

Route	MTSO	Dir	Peak Hour	2017 Observed (Max Volume)
SR-4	600 vehicles per lane	WB	AM (7:00-8:00)	1,755
		EB	PM (5:45-6:54)	1,810

Table 17: Duration of congestion – Tri-valley County

Route	Limits	Dir	MTSO (hour)	2017 Observed
I-680	SR-84 to County Line	SB	5.0	4.5

Table 18: HOV Lane Utilization – West County

[MTSO = 10%]

Route	Dir	Peak Hour	2013 Observed	2017 Observed	2017 Observed	2013 Observed
			Max Volume	Max Volume	% Change	% Change
I-80	EB	6:00 -7:00 AM	945	1,399	48%	43%±
		5:00 - 6:00 PM	1,169	1,349	15%	
	WB	7:30 - 8:30 AM	1,401	1,430	**2%**	
		3:00 - 4:00 PM	1,130	1,511	34%	

± Change in directional HOV lane usage was unavailable, in 2013 MTSO report

3.2.3 Average Vehicle Ridership

The Tri-Valley MTSO for average vehicle ridership reflects the number of people in a vehicle during the AM and PM peaks. This data were provided by Caltrans and is shown in Table 19. All three segments in the Tri-Valley area are below the threshold of 1.2 average vehicle ridership. Caltrans has not reported the data for the I-680 northbound segment.

Table 19: Average Vehicle Ridership – Tri-valley County
[MTSO =1.2]

Roadway	Limits	2017 Observed*	
		AM	PM
I-680 Southbound	Rudgear Road to Alcosta Boulevard	1.2	**1.0**
I-680 Northbound	Alcosta Boulevard to Livorna Road	None	**1.0**
I-580 Eastbound	Hacienda Drive to N Livermore Avenue	1.2	**1.1**

* Mixed Flow occupancy rate, excluding buses
*Source: Caltrans Managed Lane Report 2015

3.2.4 Vehicle Occupancy

The field data collected in the Lamorinda (Average vehicle occupancy) area are shown in Table 20. None of the locations analyzed met Lamorinda's average vehicle occupancy standard.

Table 20: Average Vehicle Occupancy – Lamorinda Sub Area
[2018 MTSO = 1.3]

Roadway Segment	Dir	Peak Hour	2017 Observed
Pleasant Hill Road	NB	AM	**1.2**
		PM	**1.2**
	SB	AM	**1.1**
		PM	**1.2**
Camino Pablo/ San Pablo Dam Road	NB	AM	**1.1**
		PM	**1.1**
	SB	AM	**1.2**

		PM	**1.2**

3.3 Transit Ridership

This transit ridership section is divided into two parts: 1) BART Ridership; 2) Bus Ridership. Overall, there is no specific standards defined in the Action Plans.

3.3.1 BART Ridership

The East County Action Plan contains a MTSO that is measure of the average number of weekday riders on all BART trains between Bay Point and North Concord Stations.

Table 21 shows the monitoring results.

Table 21: BART Ridership – East County (weekday)

Origin Station	Destination Station	Total Weekday Ridership*	Average Weekday Ridership (both directions)
Bay Point	**	6,329	12,739
**	Bay Point	6,410	

* Source: BART Ridership Report, April 2017
** Other stations in the BART system

The Lamorinda County Action Plan contains a MTSO that establishes an hourly average loading factor (ratio of passengers to seats) of 1.5 or less approaching Lafayette Station westbound and Orinda Station eastbound during each and every hour of service.

Table 22 shows the monitoring results.

Table 22: BART Loading Factor – Lamorinda County (weekday)

[MTSO = 1.5]

Start Time	2017 Observed	
	Westbound-Lafayette	Eastbound-Orinda
04:00	0.14	0.003
05:00	0.58	0.028
06:00	0.77	0.128
07:00	1.16	0.243
08:00	1.51	0.253
09:00	1.67	0.174
10:00	0.74	0.130
11:00	0.70	0.155
12:00	0.40	0.209
13:00	0.25	0.427
14:00	0.21	0.536
15:00	0.22	0.765
16:00	0.18	1.589
17:00	0.27	2.626
18:00	0.40	2.868
19:00	0.31	1.333
20:00	0.14	0.852
21:00	0.12	0.579
22:00	0.12	0.496

* Source: BART ridership in April 2017

The monthly ridership counts at the BART Pleasanton station in the Tri-valley sub-region were reported in consultation with CCTA.

Table 23 shows the MTSO monitoring results.

Table 23: BART Ridership – Tri-Valley County (weekday)

Station	To	From	Average
Dublin / Pleasanton	8,110	8,210	8,160

* Source: BART ridership in April 2017

3.3.2 Bus Ridership

The East County Action Plan contains a MTSO that is a measure of the average number of riders boarding a fixed-route bus during an hour of scheduled bus service when persons may board with a fare or pass.

Table 24 shows the monitoring results.

Table 24: Tri-delta Bus Ridership – East County

Route Number	Ridership per revenue service hour
200	8.4
201	16.6
300	43.4
379	15.8
380	52.3
383	8.8
385	9.1
386	0.4
387	23.5
388	31.9
389	4.7
390	9.0
391	30.2

The monthly ridership counts for LAVTA transit services in the Tri-valley were reported in consultation with CCTA.

Table 25 presents the results.

Table 25: LAVTA Bus Ridership – Tri-valley County

Route Number	Description	2013 Annual Ridership	2017 Annual Ridership	Route Number	Description	2013 Annual Ridership	2017 Annual Ridership
1	East Dublin	37,287	16,856	503*	West Dublin	4,519	NA
2	Dublin Ranch	7,870	8,252	501	Positano Hill	32,047	NA
3	West Dublin	10,017	NA	502	Emerald Glen	12,368	NA
3	Stoneridge	NA	31,972	503	Shannon Park	7,021	NA
8	Hopyard / Vintage Hills	60,536	53,722	601	Ruby Hill	9,880	6,525
9	Hacienda	34,639	2,004	602	Parkside/Valley Trails/Del Prado	15,822	14,375
10	Intermunicipal	560,478	428,870	603	Muirwood Park	10,245	8,216
11	Northeast Livermore	7,611	6,060	604	Muirwood/Hacienda/ Fairlands	22,962	21,406
12	Intermunicipal	158,463	14,566	605	Amaral Park/Fairlands	9,650	13,650
14	Central Livermore	46,204	NA	606	Vintage Hills	8,481	10,592
14	Intermunicipal	NA	94,087	607	Oak Hill/Laguna Oaks	7,727	3,945
15	Springtown	141,627	112,513	608	Amaral Park	15,666	18,775
18	Granada	5,782		609	Del Prado Park	2,572	3,198
20	Intermunicipal	16,849	10,306	610	Fairlands	11,509	11,586
30	Intermunicipal	358,447	461,036	611	Vintage Hills	12,469	10,831
53	Stoneridge	33,924	34,716	580	Intermunicipal Shuttle	NA	8,480
54	Hacienda	23,678	14,444	403	Granada	NA	582
70	Walnut Creek /Pleasant Hill	48,847	38,407	504	Dublin Ranch	NA	19,413
401*	Big Trees Park	4,484	NA	505	Positano Hill	NA	4,017
402*	Hagemann Park	1,234	NA	501*	East Dublin	23,621	NA
502*	East Dublin	13,360	NA				

3.4 Additional performance measures

This section is divided into two parts: 1) Iron Horse Trail; 2) Pleasant Hill Road and Camino Pablo Dam Rd. Overall, there is no specific standards defined in the Action Plans.

3.4.1 Iron Horse Trail (Tri-valley)

The Tri-valley County Action Plan contains a MTSO that is a measure of measure of the use of the facility and potential overcrowding or conflict.

Table 26 presents the result of Pedestrian and Bicycle Volumes.

Table 26: Pedestrian and Bicycle Volumes– Tri-valley County

	AM					
	Bike				Pedestrian	
Crossing Street	**NB**	**EB**	**SB**	**WB**	**NB/SB**	**EB/WB**
San Ramon Valley Boulevard	6	0	3	0	5	0
Camino Ramon	1	1	0	4	91	6
Crow County Road	0	0	7	1	146	7
Bollinger Canyon Road	0	0	0	1	134	11
Alcosta Boulevard	0	0	0	2	56	9
	PM					
	Bike				**Pedestrian**	
Crossing Street	**NB**	**EB**	**SB**	**WB**	**NB/SB**	**EB/WB**
San Ramon Valley Boulevard	13	0	0	0	23	0
Camino Ramon	1	1	0	1	71	9
Crow County Road	0	0	0	1	144	8
Bollinger Canyon Road	0	3	0	0	99	19
Alcosta Boulevard	4	1	0	6	72	17

The Tri-valley County Action Plan contains a MTSO that is a measure of the difficulty crossing roadways along the trail.

Table 27 presents the result of automobile vehicle volume.

Table 27: Automobile Vehicles at Crossing– Tri-valley County

Crossing Street	AM				PM			
	NB	EB	SB	WB	NB	EB	SB	WB
San Ramon Valley Boulevard	1,190	0	865	0	2,830	0	1,447	0
Camino Ramon / Sycamore Valley Road	1,314	2,041	80	3,036	1,225	3,452	207	1,655
Crow County Road	0	2,062	0	3,212	0	3,939	0	2,969
Bollinger Canyon Road	34	1,697	0	4,507	326	4,600	0	2,107
Alcosta Boulevard	60	697	0	1,549	222	1,365	0	1,111

The Tri-valley County Action Plan contains a MTSO that is a measure of the delay to trail users caused by at-grade crossings of the trail. The intersections were chosen in consultation with CCTA.

Table 28 presents the result of the pedestrian delay at the signalized intersection.

Table 28: Average Trail User Delay– Tri-valley County

Crossing Street	AM (seconds)	PM (seconds)
San Ramon Valley Boulevard	20.8	25.7
Camino Ramon/Sycamore Valley Road	45.5	41.5
Crow County Road	55.1	50.1
Bollinger Canyon Road	55.1	50.1
Alcosta Boulevard	41.1	41.1

The Tri-valley County Action Plan contains a MTSO that is a measure of the relative safety of the trail for its pedestrian and bicycling users.

Table 29 presents the result of frequency of pedestrian or bicyclist injury.

Table 29: Frequency of Pedestrian or Bicyclist Injury– Tri-valley County

Year	Number of Pedestrian / Bicyclist Injuries
2013	5
2014	3
2015	0
2016	1

The Tri-valley County Action Plan contains a MTSO that is a measure of relative comfort of the trail for its users.

Table 30 presents the result of pavement condition.

Table 30: Pavement Condition Index (PCI) – Tri-valley County

Street ID	Section ID	Begin Location	End Location	Lanes	FC	Length (FT)	Width (FT)	Area (SF)	ST	PCI Date	PCI
IHT	TR010	Dublin Central Parkway	Dougherty Road	1	C	2,429	10	24,290	AC	2015-12-04	73
IHT	TR020	Dougherty Road	Amador Valley Boulevard	1	C	2,904	12	34,848	AC	2015-12-04	78
IHT	TR030	Amador Valley Boulevard	ALCO / COCO Border	1	C	4,771	13	62,023	AC	2015-12-04	78
IHT	TR180	ALCO / COCO Border	Alcosta Boulevard	1	C	1,760	12	21,120	AC	2015-12-04	76

Street ID	Section ID	Begin Location	End Location	Lanes	FC	Length (FT)	Width (FT)	Area (SF)	ST	PCI Date	PCI
IHT	TR190	Alcosta Boulevard	Pine Valley Road	1	C	4,435	10	44,350	AC	2015-12-04	63
IHT	TR200	Pine Valley Road	Montevideo Road	1	C	5,298	10	52,980	AC	2015-12-04	61
IHT	TR210	Montevideo Road	Bollinger Canyon Road	1	C	4,276	10	42,760	AC	2015-12-04	62
IHT	TR230	Norris Canyon Road	Crow Canyon Road	1	C	2,174	12	26,088	AC	2015-12-02	62
IHT	TR240	Crow Canyon Road	Fostoria	1	C	957	10	9,570	AC	2015-12-02	61

3.4.2 Pleasant Hill Road and Camino Pablo Dam Rd (Lamorinda)

The Lamorinda Action Plan contains MTSOs that monitor pedestrian or bicycle injury crash frequency, and vehicle crash frequency.

The results are presents in Table 31 and 32.

Table 31: Vehicle Crash Frequency– Lamorinda County

Location	Year	Number of Vehicle Crashes (frequency per year)
Pleasant Hill Road	2013	1
	2014	1
	2015	0
	2016	0
San Pablo Dam Road	2013	0
	2014	0
	2015	0
	2016	0

Table 32: Pedestrian or bicycle injury crash frequency– Lamorinda County

Location	Year	Number of Pedestrian/Bicyclist Injuries*
Pleasant Hill Road	2013	0
	2014	0
	2015	1
	2016	0
San Pablo Dam Road	2013	0
	2014	0
	2015	0
	2016	1

* retrieved from the Statewide Integrated Traffic Records System (SWITRS), which contains the records reported by California Highway Patrol (CHP) staff only

3.4.3 Bicycle and Pedestrian Facilities

Results from "Bicycle and Pedestrian Facility" MTSO performance evaluation – forthcoming.

3.4.4 Frequency of Lane Closures

The lane closures data was not provided by the local agencies nor was it available from any other known data source . As such, the frequency of lane closures MTSO could not be calculated and reported.

4 Summary of Findings/Recommendations

A summary of results of the 2017 MTSO analysis for the five sub-areas within the Contra Costa County is shown in Table 33. The table lists the number of locations that do not meet the designated MTSO standards.

Table 33: Summary of Monitoring Results

Sub Area	MTSO Measure	Locations	AM Peak		PM Peak	
			Not Achieving MTSOs		Not Achieving MTSOs	
			No	%	No	%
East	Delay Index	4	0	0.0%	0	0.0%
	Intersection LOS	41	3	7.3%	2	4.9%
	Roadway Segment LOS	20	10	50.0%	11	55.0%
	HOV Lane Usage	2	0	0.0%	0	0.0%
Central	Delay Index	6	0	0.0%	1	16.7%
	Average Speed	12	0	0.0%	0	0.0%
	Average Stopped Delay	8	0	0.0%	0	0.0%
	Intersection LOS V/C	50	0	0.0%	0	0.0%
Lamorinda	Delay Index	12	3	25.0%	3	25.0%
	Side Street Wait Time	13	3	23.1%	0	0.0%
	Average Vehicle Occupancy	2	2	100.0%	2	100.0%
Tri-valley	Delay Index	6	0	0.0%	0	0.0%
	Intersection LOS	82	2	2.4%	1	1.2%
	Average Speed	4	0	0.0%	0	0.0%
	Duration of Congestion	1	0	0.0%	0	0.0%
	Average Vehicle Ridership	3	0	0.0%	3	100.0%
West	Delay Index	6	1	16.7%	0	0.0%
	Intersection LOS	56	2	3.6%	5	8.9%
	HOV Lane Usage	2	1	50.0%	0	0.0%
Total - Countywide		**330**	**27**	**8.2%**	**28**	**8.5%**

5 Appendices

Appendix A – Intersection Turning Movement Counts

Appendix B – INRIX Data Collection and Analysis Technical Details

Appendix C – Intersection LOS Analysis Supplementary Information

Appendix D – Freeway Segment LOS Analysis Supplementary Information