

1 | Introduction

Every two years, the Alameda County Transportation Commission (Alameda CTC) performs level of service (LOS) monitoring on its Congestion Management Program (CMP) designated roadway network as required by state law. This monitoring gives Alameda CTC a better understanding of how the county's key roadways perform and informs transportation decisions for future improvements.

The objectives of this monitoring effort are to:

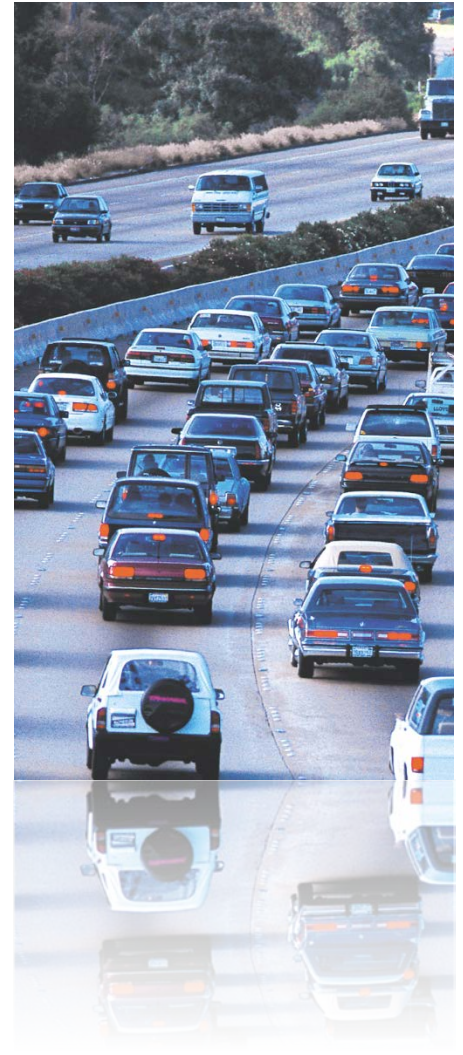
- Determine the average travel speeds and LOS on Alameda County's CMP network;
- Identify the congested segments (i.e. those operating at LOS F); and
- Identify the long-term traffic congestion trends across the CMP network.

This report is organized into nine sections and includes a number of appendices with supportive information. The first section, Introduction, provides a context for undertaking this LOS Monitoring Report. Section 2 summarizes the methodology used to collect travel time data and the days of collection. Sections 3, 4, 5 and 6 present the LOS monitoring results for the Tier 1/Tier 2 network, HOV/express lanes, bridges and OD surveys, respectively. Section 7 introduces new Big Data performance metrics such as reliability and congestion duration, and Section 8 presents a comparison of the results and additional insight on economic, technology, and transportation trends that affect CMP network performance. Lastly, Section 9 provides conclusions, future improvements and recommendations for next steps. The Appendices contain maps and tables of the LOS monitoring results, and additional details on the data collection methodology.

1.1 | The CMP Network

The Alameda County CMP network is divided into two tiers. Tier 1 roadways are part of the CMP network initially adopted in 1991 and updated in 1992. As part of the LOS monitoring program, Tier 1 roadways are monitored for CMP conformity during the afternoon peak period and for information only during the morning peak period. Tier 2 roadways were added during an update to the CMP network in 2011. Tier 2 roadways are monitored for informational purposes only.

The entire CMP network consists of approximately 328 miles of roadways. Of this, Tier 1 roadways comprise approximately 239 miles and include all freeways, all state highways, principal and major arterials, as well as 23 ramp connections. Tier 2 roadways make up the remaining 89 miles of the network and include other major arterials and rural roadways. Table 1-1 summarizes the distances monitored for each roadway type during the



2016 CMP LOS monitoring. Tables 1-2 and 1-3 provide a full list of routes for Tier 1 and Tier 2 summarized by jurisdiction. Figure 1-1 shows a map of the CMP Network.

Table 1-1: Alameda CTC CMP Network

CMP Network Category	Distance Monitored
Freeways (Tier 1)	140 miles ⁴
Ramps & Special Segments (Tier 1)	23 connections
Arterials (Tier 1) ¹	99 miles ⁴
Arterials (Tier 2)	89 miles ⁴
HOV/Express Lanes	86 miles ⁴ (each direction included separately)
Bridges ²	10 miles
OD surveys ³	10 routes

¹ Includes 70 miles of conventional state highways.

² A section of bridges outside Alameda County are grouped under this category. The freeways category (Tier 1) contains Alameda County portions.

³ Includes nine auto, nine transit, one high occupancy vehicle (HOV), and one bike survey.

⁴ As measured in 2016 based on actual changes to the network observed in the field and the updated GIS shape file for the CMP network.

Alameda CTC also separately evaluates traffic levels on ten high occupancy vehicle (HOV)/express lane routes covering 86 miles of freeway and compares their performance to the freeway performance as a whole (as shown in Figure 1-2). For this comparison, each direction of the HOV/express route is considered separately as the end points are often different.

Further, Alameda CTC also monitors congestion levels on three bridges connecting Alameda County to San Francisco and San Mateo counties. These bridges are monitored for informational purposes to understand travel from and through Alameda County to the Peninsula and San Francisco.

Lastly, Alameda CTC conducts travel time surveys between selected origin and destination (OD) pairs for auto, transit, HOV, and bicycle trips. The purpose of the OD surveys is to evaluate the comparative performance of various transportation modes between major employment centers and residential areas across the county. These surveys provide insight into the journey-to-work travel times.



Table 1-2: Tier 1 – Alameda County CMP Designated Roadway Network Routes by Jurisdiction

Jurisdiction	Freeway	Miles	Other State Highways	Miles	Other Arterials	Miles		
Albany	I-80	1.11	State Route (SR) 123 (San Pablo Ave.)	1.2	None	-		
	I-580	0.8						
Berkeley	I-80	2.4	SR 123 (San Pablo Ave.)	2.3	University Ave.	2.1		
			SR 13 (Ashby/Tunnel Rd.)	3.5	Shattuck Ave., Adeline	1.8		
Emeryville	I-80	1.2	SR 123 (San Pablo Ave.)	0.5	None	-		
Oakland	I-80	3.3	SR 123 (San Pablo Ave.)	1.3	MLK Jr. Blvd.	1.4		
	I-880	11.3	SR 13 (Tunnel Rd.)	0.4	Hegenberger Rd.	2.5		
	I-980	2.5	SR 61/260 (Tubes)	0.6	29 th Ave./23 rd Ave.	0.5		
	I-580	11.7	SR 61 (Doolittle Dr.)	2.3	See Park St.-Alameda			
	SR 24	4.6	SR 77 (42 nd Ave.)	0.4				
	SR 13	5.9	SR 185 (E 14 th St.)	4.0				
Piedmont	None	-	None	-	None	-		
Alameda	None	-	SR 61 (Doolittle Dr., Otis, Broadway, Central, Encinal Ave.)	3.9	Webster St.	0.6		
			SR 260 (Tubes)	0.8	Atlantic Ave.	0.8		
					Park St.	1.0		
San Leandro	I-880	3.9	SR 61 (Doolittle Dr.)	0.9	150 th Ave.	0.5		
	I-580	1.6	SR 61/112 (Davis St.)	1.8	Hesperian Blvd.	1.0		
	I-238	0.5	SR 185 (E 14 th St.)	3.2				
Hayward	I-880	4.5	SR 185 (Mission Blvd.)	0.6	A St.	1.5		
			SR 92	6.7	SR 238 (Mission Blvd.)	4.8	Hesperian Blvd.	2.7
					SR 238 (Foothill Blvd.)	1.2	Tennyson Rd.	2.4
					SR 92 (Jackson St.)	1.7		
Union City	I-880	1.9	SR 238 (Mission Blvd.)	3.1	Decoto Rd.	1.8		
Fremont	I-680	7.5	SR 238 (Mission Blvd.)	4.8	Decoto Rd.	1.2		
	I-880	11.7	SR 262 (Mission Blvd.)	1.6	Mowry Ave.	2.8		
	SR 84	3.8	SR 84 (Thornton, Fremont, Peralta, Mowry Ave.)	10.7				
Newark	SR 84	2.4	None	-	None	-		
Pleasanton	I-580	7.6	None	-	None	-		
	I-680	3.6						
Livermore	I-580	5.6	SR 84	5.1	1 st St.	1.7		
					Airway Blvd. (old SR 84)	1.1		
Dublin	I-680	1.9	None	-	None	-		
Unincorporated Areas	I-680	8.4	SR 84 (Vallecitos Rd.)	6.1	Hesperian Blvd.	2.0		
	I-580	19.4	SR 185 (Mission Blvd. & E 14 th St.)	2.4				
	I-238	2.1	SR 238 (Foothill Blvd.)	0.8				
	I-880	2.0						
Totals	139.7 mi			69.7 mi		29.0 mi		

Table 1-3: Tier 2 – Alameda County CMP Designated Network Routes by Jurisdiction

Jurisdiction	Arterials	Miles	Arterials	Miles
Alameda County	A St.*	0.6	Grove Way	0.9
	Crow Canyon Rd.	7.1	Tassajara Rd.	0.5
	Sunol Blvd.-1 st St.-Stanley Blvd.*	2.8		
Alameda	High St.	1.1	Telegraph Ave.*	1.1
Berkeley	Bancroft/Durant Ave.	0.7	Powell St.-Stanford Ave.	0.1
	College Ave.*	1.2	Shattuck Ave.*	0.7
Dublin	Dougherty Rd.	1.9	San Ramon Rd.	1.6
	Dublin Blvd.	3.6	Tassajara Rd.	2.2
Emeryville	40th St.-Shellmound Ave.	1.4	Powell St.-Stanford Ave.	0.6
Fremont	Automall Pkwy.	1.6	Alvarado Blvd.	1.2
	Fremont Blvd.	8.6		
Hayward	A St.*	0.6	Winston Ave.-D St.	2.2
	Hesperian Blvd.-Union City Blvd.*	1.6		
Livermore	E. Stanley Blvd.-Railroad Ave.-1 st St.	2.4	Vasco Rd.	6.5
Oakland	12th St.-Lakeshore Ave.	2.4	International Blvd.	2.9
	51 st St.	0.8	Powell St.-Stanford Ave.	0.8
	Broadway	3.7	Shattuck Ave.*	0.8
	College Ave.*	1.0	Telegraph Ave.*	1.1
	E. 15 th St.	1.0	W. Grand Ave. to Grand Ave.	3.1
	Foothill Blvd.	5.4	73 rd Ave.	1.1
Pleasanton	High St.	2.4		
	Santa Rita Rd.	1.2	Sunol Blvd.-1 st St.-Stanley Blvd.*	2.9
	Stoneridge Dr.	2.5		
Union City	Alvarado Blvd.	1.0	Hesperian Blvd.-Union City Blvd.*	1.3
Total		88.2 miles		

* Denotes that roadway traverses more than one jurisdiction.

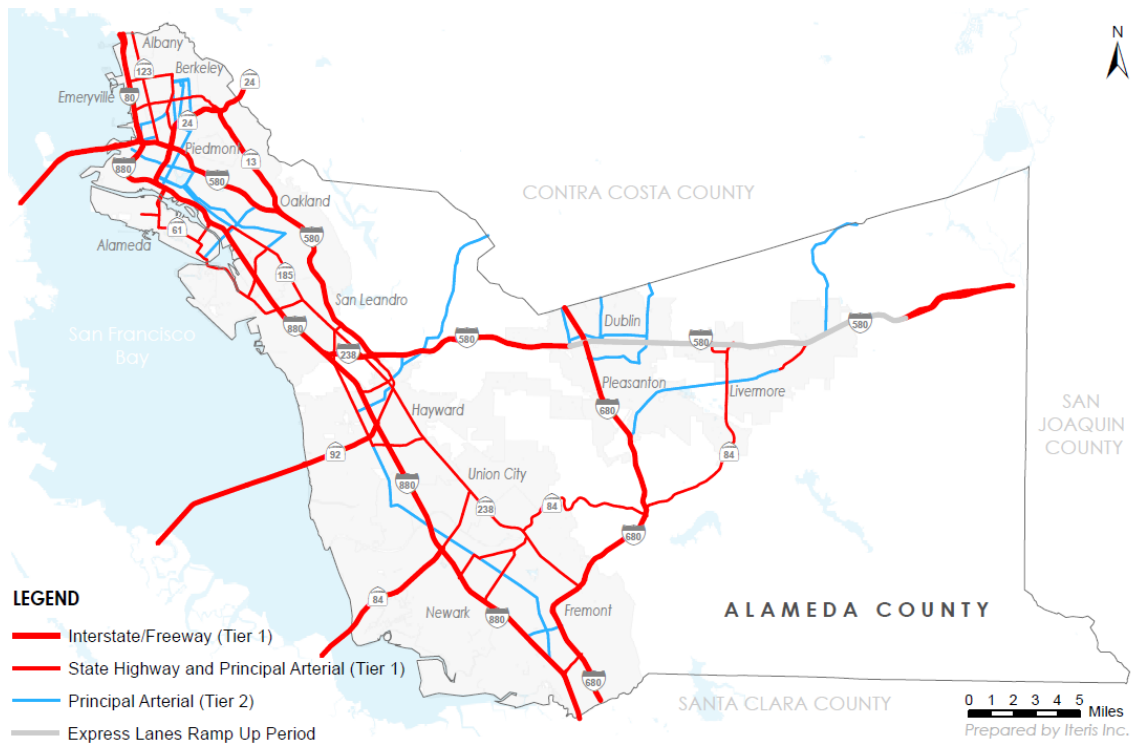


Figure 1-1: Alameda County CMP Network

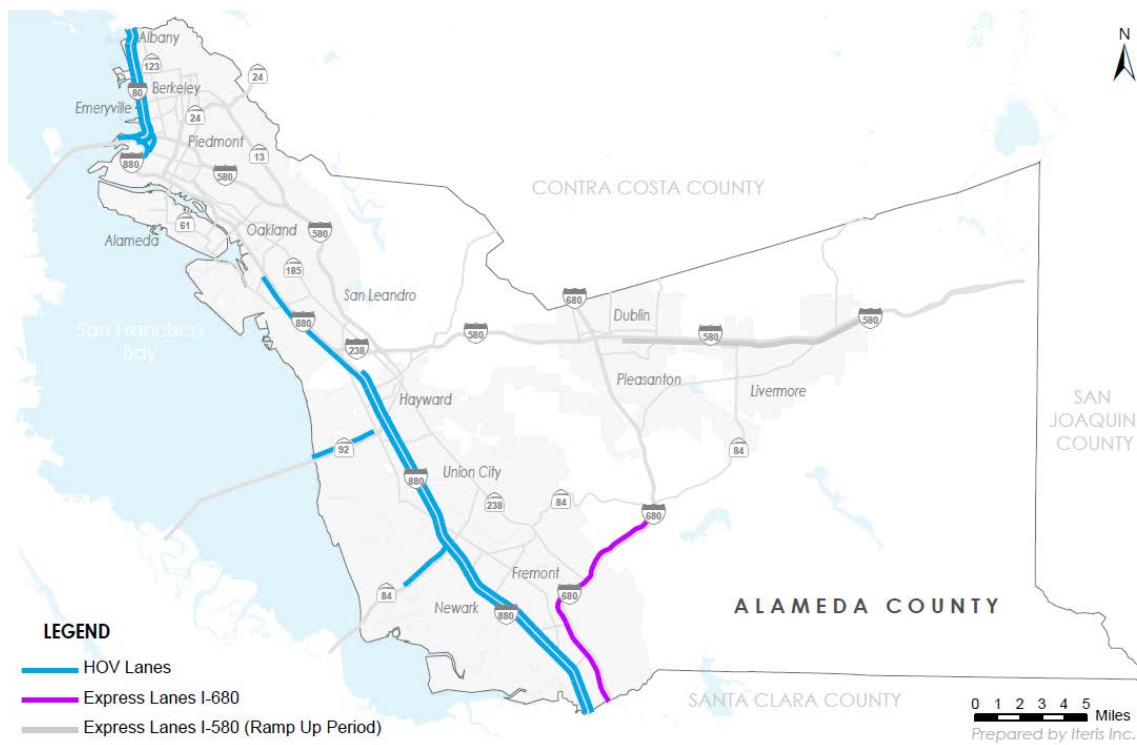


Figure 1-2: Monitoring of HOV/Express Lanes and Bridges

1.1.1 | CMP Network Update

During each CMP update, the CMP network is reviewed for any potential update including expansion of the network or changes due to construction. These changes are incorporated into the CMP network and in the subsequent updates. For example, in 2016 new HOV segments were added along I-880 in the southbound direction. Appendix C details all such road network changes.

One other significant change to the network occurred along I-580 in the east county. Existing HOV lanes in the eastbound direction were converted into express lanes and an additional lane was added as an express lane in the westbound direction. This new facility opened to traffic in February 2016. Separate performance monitoring will be conducted by Alameda CTC after the initial ramp up period has passed. For this reason, the I-580 express lanes were not monitored in this study.

1.1.2 | Division of CMP Network

For LOS monitoring purposes, the entire CMP network is divided into shorter lengths of roads called CMP segments. The limits for the **freeway** segments are typically at major interchanges. Where traffic volumes entering and exiting the freeway were minor, the length between three or more sections were combined into longer segments. However, where land use changes over the years impact the traffic pattern significantly, Alameda CTC reviews the segment limits and, if needed, develops appropriate shorter segments. For example, the I-580 corridor in the east county was segmented in 2007 to develop short segments using this approach.

For **arterials**, break points between segments generally occur at:

- Jurisdiction boundaries;
- Points where the number of travel lanes change;
- Major arterial street crossings; and
- Points where land use, speed limit, or channelization schemes change significantly.

Segment boundaries for arterial roadways are identical for both directions and the distances are generally the same or sufficiently similar so as to be considered equal. However, the distances for each direction of the same segment may differ slightly in cases of very wide intersections or when the street crossings are staggered.

Additionally, Alameda CTC classified the arterials in order to determine the LOS. Arterial class is based on access control, land use intensity, free flow speed and other factors as defined in the 1985 Highway Capacity Manual (HCM). For this purpose, each section between two adjacent signals was first reviewed to determine its arterial class as Class I, II, or III.

1.2 | LOS Standards and CMP Conformity

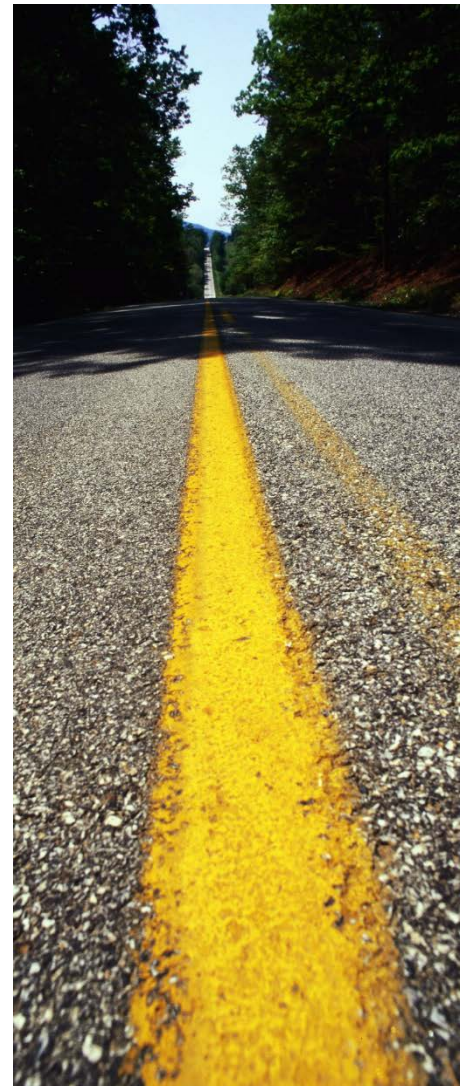
Alameda CTC performs LOS monitoring by measuring the average speed of traffic as vehicles travel a length of roadway on the CMP network. The average speed is then classified from LOS A (best) to LOS F (worst). LOS A represents the best travel conditions from the driver's perspective where roadways are uncongested, and LOS F represents congested conditions or deteriorated traffic flows. These standards are based on the HCM. Tier 1 roadways that report LOS F conditions representing deteriorated traffic flows in the afternoon peak are further analyzed under special requirements (CMP conformity). Based on the CMP conformity analysis, if the roadway is identified to be deficient, the respective local jurisdiction will be required to prepare a deficiency plan that details the cause of the deficiency, identify measures to improve the performance of the roadway, and a funding plan for the proposed improvements. A roadway may be exempt from being identified as deficient for the following reasons:

- It operated at LOS F in the base monitoring years (1991 and 1992 when the CMP network was formed) and is therefore "grandfathered" in at LOS F;
- It is located within an Infill Opportunity Zone (IOZ);
- It is under construction;
- It carries a certain volume of interregional trips (analysis performed using the Alameda Countywide Travel Demand Model);
- It is impacted due to freeway ramp metering or recent traffic signal coordination;
- It operated at LOS F due to traffic generated by developments such as low-income housing, a high-density development, or a mixed-use development subject to certain criteria.

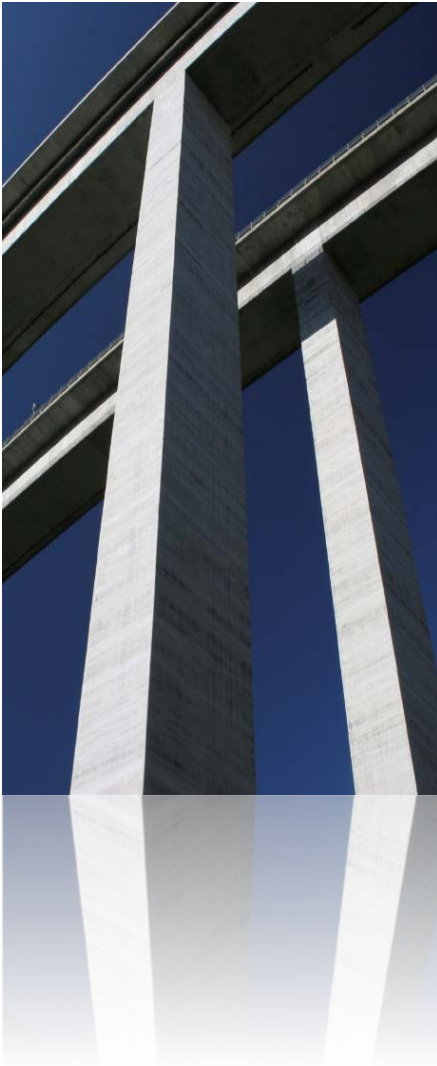
As shown in Table 1-4, only the Tier 1 CMP network in the afternoon peak periods is subject to LOS conformance and associated deficiency planning (where applicable). Additional data monitored or collected is used for information purposes only.

Table 1-4: CMP Network Monitoring Periods and Purpose of Monitoring

Tier	Time Period	CMP Category	Purpose
Tier 1	PM	Freeways	Conformity
		Arterials	
		Ramps & Special Segments	
	AM	Freeways	Informational
		Arterials	
		Ramps & Special Segments	
Weekends	Freeways		
Tier 2	All	Arterials	
Other	All	HOV & Express Lanes	
		Bridges	
		OD Surveys	



1.3 | What's New in this Monitoring Cycle?



Again for 2016, as in 2014, commercial speed data was used where available to analyze the performance of Tier 1 Freeways, Tier 1 Ramps and Tier 2 Arterials. Because the quality and penetration of commercial speed data is evolving from year to year, Alameda CTC re-examined the 2014 results of the commercial speed data in comparison to floating car data for the same CMP segments. The project team found significant differences in arterial speeds between these two sources. Based on the outcome of this 2016 Validation Report and considering the significance that these results bear on CMP conformity and associated deficiency plans, it was recommended that floating car surveys be continued on Tier 1 Arterials for 2016.⁶ Further, it is recommended that, prior to conducting the 2018 CMP monitoring, another validation of the commercial speed data on Tier 1 Arterials be conducted. By that time the accuracy of commercial speed data may have improved. If it is found to be valid, Alameda CTC may be able to realize the potential cost savings from this methodology, when conducting the 2018 Monitoring Report.

For the first time in an Alameda CTC LOS Monitoring Report, the commercial speed data was used to analyze the reliability in travel times along freeway segments and the duration of time in which congestion is experienced on each segment. This analysis leverages the large sample size of commercial speed data to compute these insightful measures of congestion. The reliability measure quantifies the degree to which travel times vary from day to day. It is perceived by some that a *consistently* congested road is more appealing than an *inconsistently* congested road since drivers can better plan their trip to account for congestion. The duration of congestion measure is extremely relevant for congested corridors since it measures the length of time in which a corridor is considered congested throughout the day. For example, two corridors may be considered congested, and LOS F may be reported in the LOS monitoring Report. However, the first corridor is congested for four hours in the morning peak and the other is congested for two hours. Rightly so, a motorist would perceive the first roadway to be more congested since it is most difficult to delay their trip to avoid congestion.

In prior monitoring cycles, the transit OD surveys were conducted using in-field data collection only. For the 2016 monitoring year only, a pilot study was also conducted using an online transit survey method. At the same time as the in-field transit survey took place, staff at a desktop computer collected similar data using transit information from online sources. Alameda CTC will explore full countywide multimodal monitoring in future monitoring cycles. The following two paragraphs review legislation, which

⁶ Validating the use of Commercial Speed Data for Alameda CTC Level of Service Monitoring. Alameda CTC. 2016.

may not impact the current Alameda CTC LOS Monitoring Report, however should be reviewed for potential implications to future studies.

Senate Bill 743 was approved by Governor Jerry Brown on September 27, 2013. It contains guidelines that will change the way transportation projects are assessed under the California Environmental Quality Act (CEQA). It removes certain CMP LOS standards around CMP-designated Infill Opportunity Zones (IOZ), and replaces them with vehicle miles of travel (VMT) in these IOZ zones. The Office of Planning and Research (OPR) issued new guidelines affecting how transportation impacts are assessed under CEQA. The final guidelines are still under discussion.⁷ Alameda CTC will continue to monitor the status of the guidelines development and assess its implication for LOS monitoring.

Assembly Bill 1098 was introduced on February 27, 2015, and amended on March 26, 2015. It calls for major revisions of the CMP legislation, in particular, the removal of LOS as an element of the CMP. It would also delete related requirements, including the requirement that a city or county prepare a deficiency plan when the highway or roadway LOS standards are not maintained. The bill would revise and recast the requirements for other elements of a CMP by, among other things, requiring performance measures to include VMT, air emissions, and bicycle, transit, and pedestrian mode share. The designated agency would be required to include in the 7-year capital improvement program an analysis of the potential for induced vehicle travel due to roadway capacity expansion projects. The bill, if approved would require the regional agency to evaluate how the CMP contributes to achieving a specified greenhouse gas reduction target for the region established by the State Air Resources Board.⁸

Alameda CTC is proactively working with other Congestion Management Agencies (CMAs) in the region and MTC to follow, inform, and incorporate recommendations related to the above legislation in a meaningful way. Because of the major legislative changes underway, the 2015 Alameda County CMP report was drafted as a “focused, basic update only to incorporate the implementation results for various CMP elements that occurred since the adoption of the last CMP in October 2013.”^{9 10}

Refer to Section 9.4 | for recommendations on potential improvements in the future monitoring cycles.



⁷ Updating the Analysis of Transportation Impacts Under CEQA. California Governor’s Office of Planning & Research (OPR). https://www.opr.ca.gov/s_sb743.php

⁸ AB-1098 Transportation: congestion management. California Legislative Information. (2015-2016)

http://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1098

⁹ Congestion Management Program. Alameda CTC. http://www.alamedactc.org/app_pages/view/5224

¹⁰ Memorandum: Draft 2015 Congestion Management Program. Alameda CTC. October 15, 2015. http://www.alamedactc.org/files/managed/Document/17295/6.6_Combio.pdf