



## MEMORANDUM

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Project: CIP & TIM Fee Update: Western Slope

Subject: Draft Final Technical Memorandum 2-1: Traffic Analysis Methodology

This memorandum summarizes the analysis methodology, assumptions and tools for the technical analysis associated with the Major Capital Improvement Program (CIP) & Traffic Impact Mitigation (TIM) Fee Update. The purpose of this memorandum is to describe the technical methodologies used to perform the traffic analysis.

The subsequent chapters in this memorandum describe the following:

- Traffic Analysis Methodology
- Traffic Analysis Assumptions
- Level of Service Standards/Criteria

### TRAFFIC ANALYSIS METHODOLOGY

Traffic Analysis will be performed using the approved tools and methods identified in the 2004 El Dorado County General Plan.

#### Level of Service (LOS)

LOS is a scoring system that evaluates traffic conditions at intersections or along roadway segments based on the amount of delay drivers are likely to experience due to congestion. LOS is a qualitative measure of the effect of a number of factors, including speed and travel time, traffic interruptions, freedom to maneuver, driving comfort and convenience. Levels of service are designated "A" through "F" from best to worst, which cover the entire range of traffic operations that might occur. Level of

Service (LOS) "A" through "E" generally represents traffic volumes at less than roadway capacity, while LOS "F" represents over capacity and/or forced flow conditions.

### County Roadways

Roadway segment LOS will be determined by comparing traffic volumes on the study roadway segments with peak hour LOS capacity thresholds. The planning level capacity thresholds for different roadway classifications are shown in Table 1. These capacity thresholds are calculated based on the methodology contained in the Highway Capacity Manual (Transportation Research Board, 2010) and these thresholds were applied for the analysis of the 2004 El Dorado County General Plan.

**Table 1. Local Roadways Level off Service LOS Criteria**

Functional Classification	Number of Lanes	Planning Level Volume Threshold (vehicles per hour)				
		LOS A	LOS B	LOS C	LOS D	LOS E
Arterial, Divided	4	-	-	1,850	3,220	3,290
	6	-	-	2,760	4,680	4,710
Arterial, Undivided	2	-	-	850	1,540	1,650
	4	-	-	1,760	3,070	3,130
Multi-Lane Highway	4	-	2,240	3,230	4,250	4,970
Notes: Two-lane highway (and arterial 2-lane) thresholds are based on HCM 2010, Exhibit 15-30, Class II Rolling, .09 K-factor, and D-factor of 0.6 Arterial volume thresholds are based on HCM 2010, Exhibit 16-14, K-factor of 0.09, posted speed 45 mi/h Volumes are for both directions						

Volume thresholds for 3-lane and 5-lane arterials were derived by linear interpolation between the 2- and 4-lane and between 4- and 6-lane thresholds respectively. Similarly, the volume thresholds for the seven lanes or more arterial will be calculated by linear extrapolation between 4-lane and 6-lane volumes.

### State Highways

State highway LOS will be determined using the methodologies for freeways, multilane highways, and two-lane highways outlined in the HCM 2010, Chapters 11, 14, and 15. For multilane highways the calculation of the density of the traffic stream determines level of service. Density measures the proximity of vehicles to each other in the traffic stream. Multilane highways will be evaluated using the HCM 2010 compatible spreadsheet models developed in-house.

For two-lane highways, the level of service calculation is dependent on the class of the roadway. Class I two-lane highways are highways where motorists expect to travel at high speeds. Class II two-lane highways are lower speed highways and serve scenic routes or areas of rugged terrain. Class III two-lane highways serve moderately developed areas with higher densities of local traffic and roadside access. For Class II highways, LOS is determined based on the percent time spend following (PTSF). This measure is calculated as the percentage of vehicles traveling at headways of less than three

seconds. For Class III highways, the percent of free-flow speed is used to determine LOS. This measure represents the ability of vehicles to travel at the posted speed limit. The two-lane highway analysis will be performed using the Highway Capacity Software (HCS).

Table 2 and Table 3 show the segment LOS criteria for multilane highways and two-lane highways, respectively, according to the HCM 2010.

**Table 2. Multi-Lane State Highways LOS Criteria**

LOS	Free Flow Speed (mi/h)	Density (pc/mi/ln)
A	All	>0 -11
B	All	>11-18
C	All	>18-26
D	All	>26-35
E	60	>35-40
	55	>35-41
	50	>35-43
	45	>35-45
F	Demand Exceeds Capacity	
	60	>40
	55	>41
	50	>43
	45	>45

Based on *Highway Capacity Manual*, Transportation Research Board, Washington D.C, 2010, Exhibit 14-4

**Table 3. Two-Lane State Highways LOS Criteria**

LOS	Class II Highways: Percent Time Spent Following (%)	Class III Highways: Percent Free-Flow Speed (%)
A	0-40	>91.7
B	>40-55	>83.3-91.7
C	>55-70	>75.0-83.3
D	>70-85	>66.7-75.0
E	>85	0-66.7

Based on *Highway Capacity Manual*, Transportation Research Board, Washington D.C., 2010, Exhibit 15-3

### U.S. Highway 50

U.S. 50 mainline segments will be evaluated using the methodologies contained in the HCM 2010. The LOS will be reported for each study segment type based on density measures.

Given a limitation of the latest Highway Capacity Software (HCS 2010) for evaluating freeway segments with HOV lanes, freeway mainline segments will be evaluated using the HCM 2010

compatible spreadsheet models developed in-house. The freeway LOS criteria are provided in Table 4.

**Table 4. Freeway Mainline Level of Service (LOS) Criteria**

LOS	Density (passenger cars per lane per mile)
A	≤11
B	>11-18
C	>18-26
D	>26-35
E	>35-45
F	>45 or Demand > Capacity

Based on *Highway Capacity Manual*, Transportation Research Board, Washington D.C., 2010, Exhibit 11-5

## TRAFFIC ANALYSIS ASSUMPTIONS

Generalized operational parameters that will be used for the traffic analysis are provided below:

Ideal Saturation Flow Rate: Freeway General Purpose Lanes: HCM 2010 Exhibit 10-5;  
 Freeway HOV Lanes: 1,650<sup>1</sup> vehicles per hour per lane (vphpl);  
 Freeway Auxiliary Lanes > 1 mile: 900<sup>2</sup> vphpl  
 Freeway Auxiliary Lanes < 1 mile: 400 vphpl

Base Free Flow Speeds: All: Posted speed limit plus 5 mph

Peak Hour Factor (PHF): Freeway mainline:  
 Existing: where counts exist: Caltrans Performance Measurement System (PeMS) and Caltrans Published Volumes; where counts do not exist: 0.92;  
 Future: 0.92  
 State Highways:  
 Existing: where counts exist: PeMs and Caltrans Published Volumes; where counts do not exist: 0.92;  
 Future: 0.92

Peak Hour Directional (D) Factor: Existing: Caltrans PeMS or Caltrans/County published reports  
 Future: Same as Existing if available – other model D Factor

<sup>1</sup> Caltrans High-Occupancy Vehicle Guidelines, Caltrans 2003.

<sup>2</sup> 900 vphpl is a typical default assumption for auxiliary lanes greater than 1 mile and has been accepted by Caltrans in previous reports. See SC101 HOV Report June 2010.

Peak Hour (K) Factor:	Existing: PeMS or Caltrans/County published reports Future: Same as Existing if available – other model K Factor
Traffic Volumes:	Existing: Freeways/State Highways: Caltrans published reports Existing: Local Roadways: County published data Future: Counts adjusted by model growth per NCHRP 255
Lane Width:	All: 12 feet, or consult Caltrans or County Staff
Driver Population Factor	All: 1.00
Ramp Density (ramps/mi)	Freeway mainline: Aerial measured
Access Density (points/mi)	State Highways/Local Roadways: Aerial measured
Heavy Vehicles:	Freeway/State Highways– Caltrans published Truck Annual Average Daily Traffic (AADT) Data, or 5 percent default (4% on US 50); State Highways/Local Roadways – 5 percent default, or consult Caltrans or County staff

## LEVEL OF SERVICE STANDARDS

The following criteria are established to determine whether the vehicular traffic on a roadway facility exceeds the standard operating conditions.

### County Roadways

Circulation Policy TC-Xd of the El Dorado County General Plan provides level of service standards for County-maintained roads and state highways as follows:

*Level of Service (LOS) for County-maintained roads and state highways within the unincorporated areas of the county shall not be worse than LOS E in the Community Regions or LOS D in the Rural Centers and Rural Regions except as specified in Table TC-2. The volume to capacity ratio of the roadway segments listed in Table TC-2 shall not exceed the ratio specified in that table.*

As such, the local roadways in the community regions will be evaluated against LOS E standard, while those in the rural regions and rural centers will be analyzed against LOS D. Figure 1 shows level of service threshold on the local roadways, with exceptions listed in the Table TC-2 of the County's Circulation Element.

## State Facilities

County’s Policy TC-Xd is applicable not only to the County roadways, but also to the state facilities. As such, traffic conditions for state facilities within the unincorporated areas of the County shall not be worse than LOS E in the community regions and LOS D in the rural center and rural regions, with except to the locations specified in Table TC-3.

### U.S. Highway 50

Table 5 presents LOS thresholds used for US50. These standards are consistent with the concept LOS established by Caltrans, the County, and the Table TC-2 of the 2004 El Dorado County General Plan

**Table 5. US 50: Caltrans Concept Level of Service**

Location Description	Begin Post Mile	End Post Mile	Concept Level of Service
Sacramento/El Dorado County Line to Latrobe Road	0	0.857	LOS E
Latrobe Road to Cambridge Road	0.857	4.962	LOS D
Cambridge Road to Shingle Springs Drive	4.962	8.564	LOS E
Shingle Springs Drive to El Dorado Road	8.564	14.011	LOS D
El Dorado Road to Canal Street	14.011	17.52	LOS E
Canal Street to Mosquito Road	17.52	18.517	LOS F
Mosquito Road to Point View Drive	18.517	20.296	LOS E
Point View Drive to Old Highway, Camino	20.296	23.957	LOS D
Old Highway, Camino to Old Carson Road	23.957	34.219	LOS E
Old Carson Road to Ice House Road	34.219	39.772	LOS D
Ice House Road to Echo Lake Road	39.772	65.619	LOS F

Source: US 50 Transportation Concept Report and Corridor System Management Plan, Caltrans District 3, June 2014, 2004 El Dorado County General Plan, July 2004.

### State Route 49

In the Transportation Concept Report (Caltrans, 2000), the concept LOS is F south of the community of El Dorado and through the City of Placerville. All other segments have a concept LOS E. Since the County adopted exceptions for this roadway, County’s LOS standard for rural community (LOS D) was used as the operational criteria for segments from Amador/El Dorado County Line to Union Mine Road and from SR193 (south) to SR193 (north).

### State Route 193

In the Transportation Concept Report (Caltrans, 2011), the concept LOS through El Dorado County is LOS D. The concept LOS is consistent with the County standard.

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### **State Route 153**

The Transportation Concept Report (Caltrans, 2011) established a concept LOS of E for SR 153 within El Dorado County. Since the roadway runs through a defined rural community, the County's LOS D standard was used as the operational standard for this analysis.

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Figure 1. Level of Service Thresholds for Roadways

