



## METHODOLOGY MEMORANDUM

DATE: October 20, 2020

TO: Natalie Porter, P.E., T.E. Senior Traffic Engineer, El Dorado County DOT

FROM: Jim Damkowitz | DKS

SUBJECT: El Dorado County Traffic Impact Mitigation Fee Update: Needs Analysis Peer Review Project # 19203-000

### EL DORADO COUNTY TIM FEE UPDATE

This memorandum summarizes the methodology, parameters and analysis steps that DKS will use to perform peer review services for the El Dorado County TIM Fee deficiency assessment. The traffic analysis will be performed Kimley-Horn using the approved tools and methods identified in the 2004 El Dorado County General Plan (Amended December 10, 2019) and are consistent with the analysis approach performed as part of the 2016 Western Slope CIP and TIM Fee Update (December, 2016 with minor amendments in 2017 and 2018).

This memorandum includes the following sections. The last section (Analysis Steps) will include the recommended sequencing of peer review tasks.

- Traffic Analysis Methodology
- Traffic Analysis Assumptions
- Level of Service Standards
- Analysis Steps

### TRAFFIC ANALYSIS METHODOLOGY

The following sections establish the methodologies used to determine operating conditions on roadways within El Dorado County.

#### 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<sup>1</sup>.

## 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 6<sup>th</sup> Edition (Transportation Research Board, 2015).

**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	-	-	1,430	2,910	3,180
	6	-	-	2,210	4,480	4,790
Arterial, Undivided	2	-	-	640	1,310	1,510
	3	-	-	890	1,620	1,730
	4	-	-	1,360	2,770	3,030
	5	-	-	1,850	3,220	3,290
Multi-Lane Highway	4	-	1,770	2,540	3,160	3,600

Notes:  
 Two-lane highway (and arterial 2-lane) thresholds are based on HCM 6<sup>th</sup> Edition, Exhibit 15-30, Class II Rolling, .09 K-factor, and D-factor of 0.6  
 Arterial volume thresholds are based on HCM 6<sup>th</sup> Edition, Exhibit 16-14, K-factor of 0.09, posted speed 45 mi/h  
 Volumes are for both directions

Volume thresholds for the seven or more arterial lanes will be calculated by linear extrapolation.

## STATE HIGHWAYS

State highway LOS will be determined using the methodologies for freeways, multilane highways, and two-lane highways outlined in the HCM 6<sup>th</sup> Edition, Chapters 11, 14, and 15. For freeways and multilane highways density of the traffic stream determines LOS. Density measures the proximity of vehicles to each other in the traffic stream. Freeways and multilane highways will be evaluated using the HCM 6<sup>th</sup> Edition compatible spreadsheet models.

<sup>1</sup> SB 743 was signed into law in 2013 and becomes effective Statewide on July 1, 2020. Under SB 743, automobile delay, traditionally measured as level of service (LOS) will no longer be considered an environmental impact under CEQA. Instead, environmental impacts will be determined by changes to VMT. However, SB 743 has no bearing on the use of LOS for impact fee programs under AB1600 and subsequent legislation as codified in Government Code Section 66000 et seq ("Mitigation Fee Act").

For two-lane highways, the LOS calculation is dependent on the class of the roadway. The HCM defines the following two classes of two-lane highways:

- Higher Speed Highways: two-lane highways where the posted speed limit is greater than or equal to 50 mph and motorists expect to travel at high speeds.
- Lower Speed Highways: two-lane highways where the posted speed limit is less than 50 mph typically found along scenic routes, areas of rugged terrain, or moderately developed areas with higher densities of local traffic and roadside access.

All two-lane highway LOS is based on Follower Density expressed as passenger cars per mile per lane (pcpmpl). Two-lane highway analysis will be performed using the Highway Capacity Software (HCS) or HCS compatible Excel worksheets.

**Table 2** and **Table 3** show the segment LOS criteria for multilane highways and two-lane highways, respectively, according to the HCM 6<sup>th</sup> Edition.

**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 6<sup>th</sup> Edition*, Transportation Research Board, Washington D.C., Exhibit 14-4

**TABLE 3. TWO-LANE STATE HIGHWAYS LOS CRITERIA**

LOS	High-Speed Highways: Follower Density (pc/mi/l) Posted Speed Limit >= 50 mph	Low-Speed Highways: Follower Density (pc/mi/l) Posted Speed Limit < 50 mph
A	<= 2.0	<= 2.5
B	> 2 - 4	> 2.5 - 5
C	> 4 - 8	> 5 - 10
D	> 8 - 12	> 10 - 15
E	> 12	> 15

Based on *Highway Capacity Manual 6<sup>th</sup> Edition*, Transportation Research Board, Washington D.C., 2019 Supplement

**U.S. HIGHWAY 50**

U.S. 50 mainline segments will be evaluated using the methodologies contained in the HCM 6<sup>th</sup> Edition. The LOS will be reported for each study segment type based on density measures.

Given a limitation of the latest Highway Capacity Software (HCS) for evaluating freeway segments with HOV lanes, freeway mainline segments will be evaluated using the HCM compatible spreadsheets. 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 6<sup>th</sup> Edition*, Transportation Research Board, Washington D.C., 2010, Exhibit 11-5

## TRAFFIC ANALYSIS ASSUMPTIONS

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

Ideal Saturation Flow Rate:	Freeway General Purpose Lanes: HCM 6 <sup>th</sup> Edition Exhibit 10-5; Multi-lane Highway Lanes: HCM 6 <sup>th</sup> Edition Exhibit 14-4 Freeway HOV Lanes: 1,650 <sup>2</sup> vehicles per hour per lane (vphpl); Freeway Auxiliary Lanes > 1 mile: 900 <sup>3</sup> vphpl Freeway Auxiliary Lanes < 1 mile: 400 vphpl Intersection Approach Lanes: 1,900
Base Free Flow Speeds:	All: Posted speed limit plus 5 mph
Peak Hour Factor (PHF):	<u>Freeway mainline:</u> Existing: where counts exist: Caltrans Performance Measurement System (PeMS) and Caltrans Published Volumes; where counts do not exist: 0.92; Future: 0.92  <u>State Highways:</u> 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
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:	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

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<sup>2</sup> Caltrans High-Occupancy Vehicle Guidelines, Caltrans 2003.

<sup>3</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.

## LEVEL OF SERVICE STANDARDS

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

### COUNTY ROADWAYS

Circulation Policy TC-Xd of the El Dorado County General Plan provides LOS 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.*

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 LOS 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 the exception of the locations specified in Table TC-3.

### U.S. Highway 50

**Table 5** presents LOS thresholds used for US 50. These standards are consistent with the concept LOS established by Caltrans, the County, and the Table TC-2 of the El Dorado County General Plan.

**TABLE 5. US 50: CALTRANS CONCEPT LEVEL OF SERVICE**

Location Description	Begin Post Mile	End Post Mile	Concept LOS
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 SR 49 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 SR 193 Transportation Concept Report (Caltrans, 2011), the concept LOS through El Dorado County is LOS D. The concept LOS is consistent with the County standard.

### **State Route 153**

In the SR 153 Transportation Concept Report (Caltrans, 2011) a concept LOS of E is established 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.

## **ANALYSIS STEPS**

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This section describes the requisite steps required to perform the Needs Assessment for the 2020 Western Slope CIP and TIM Fee Update. This section will also include the recommended sequencing of peer review tasks as denoted by **[DKS....]**. The peer review sequence implies that subsequent work will not commence until the peer review check had been performed and confirmed correct. Peer review time frames will be abbreviated to reduce delays. In this way, costly do-overs will be avoided if issues are discovered and work is allowed to proceed.

### **Baseline Deficiency Assessment – Roadway Segments**

The following steps are needed to perform the baseline analysis:

#### State Highways

- Coordinate with County to establish updated traffic volumes for state highways within El Dorado County. This includes the following:
  - State Highway System baseline volumes for US 50, SR 49 and SR 193.
  - Segmentation and volume based on most recently published Caltrans State Highway Volume Report.
  - Compute bi-direction AM/PM peak hour State Highway volumes through application of adjusting AADT by K and D factors (see Traffic Analysis Assumptions on p. 5)
  - Re-confirm HCM Class definitions for two-lane highway segments

**[DKS Peer Review: 2-Days]:** Baseline State Highway AM/PM Peak Hour Traffic Volume Development; Pre-analysis HCM 6<sup>th</sup> Edition Compatible Worksheets

- For Freeway and Multilane Highway Segments compute LOS based on HCM 6<sup>th</sup> Edition Operational Method (HCS or HCM compatible worksheets). For Two-Lane Highway Segments compute LOS based on HCM 6<sup>th</sup> Edition Operational Method (HCS).

### Local County Roadways

- Coordinate with County to establish updated traffic counts for all County roadways analyzed previously (i.e., 2016 Major Update). If additional County roadway segments are considered, selection of roadways and roadway segmentation was based on the following criteria:
  - roadway/segment is currently listed in the County’s current Capital Improvement Program;
  - roadway/segment was included as part of the County’s Travel Demand Model baseline validation analysis;
  - roadway/segment is a critical high-volume location with known congestion issues;
  - roadway/segment is considered to have future importance for accommodating planned development growth.
  - Given the need for all future traffic projections to be adjusted based on the NCHRP 255 guidance principles, the choice of County roadway segments to analyze was contingent upon the availability of weekday (Tuesday-Thursday) daily and peak hour traffic counts (less than 3 years old).
- Given its geometric and operating characteristics, Green Valley Road segments# 51 and 53-62 will also be analyzed using the HCM 6<sup>th</sup> Edition Two-Lane Highway operational method.
- Determine baseline LOS and identify deficiencies for all roadway segments based on County standards (see Level of Service Methodology) and criteria (see Traffic Analysis Assumptions).

**[DKS Peer Review: 3-Days]:** LOS Analysis; Completed HCM 6<sup>th</sup> Edition Compatible Worksheets and HCS Files; Local County Roadway LOS Threshold Worksheets.

### **Future Deficiency Assessment – Roadway Segments**

The following EDCTC TDM model runs are required to perform the TIM Fee needs analysis:

- Baseline Model Run (AM/PM and Daily assignments): Baseline Network with Baseline Land Use; 5-D Turned Off.
- Future Baseline Model Run (AM/PM and Daily assignments): Future GP Land Use with Baseline network (no CIP improvements reflected); 5-D Turned Off.

**[DKS Peer Review: 2-Days]:** Loaded Network files



Based on the above travel model output – perform the following analysis steps:

- For the baseline and future baseline model loaded networks, script/pull raw volumes for all state highway segments (AM/PM peak hour bi-directional volumes) and identified County roadways (daily volumes) based on the established model A-Node B-Node IDs developed in 2016. For the added segments and script output for baseline and future model volumes.
- Apply NCHRP workbook to perform post-processing of all “raw” model volumes (AM/PM peak hour bi-directional volumes for state highways segments and daily volumes for County roadway segments). The NCHRP process will include both Difference, Ratio and Average of Difference and Ratio Methods. Workbook will compute the Annual Average Growth Rate (AAGR) resulting from the NCHRP 255 Method.
- For segments with a AAGR over 4% flag and examine for reasonableness – explanations for AAGR greater than 4% should be documented. If determined to be a ratio method (multiplicative) issue, the Difference Method result will be used in lieu of Average of Difference and Ratio Methods for these segments.

**[DKS Peer Review: 2-Days]: Segment scripting; NCHRP-255 Post-Processing Workbook**

- Based on the finalized volume sets approved by the County - determine LOS and identify deficiencies for all roadway segments based on County standards (see Level of Service Methodology) and criteria (see Traffic Analysis Assumptions) consistent with the Baseline Deficiency Assessment.
- For segments at the cusp of an LOS deficiency, perform 3% Check. For identified “cusp” segments, adjust future post-processed volume by +3%. If segment triggers LOS deficiency identify as deficient<sup>4</sup>.

**[DKS Peer Review: 2-Days]: Future Baseline LOS Analysis; Completed HCM 6th Edition Compatible Worksheets and HCS Files; Local County Roadway LOS Threshold Worksheets.**

- Finalize list of deficient segments based on future baseline assessment.
- Define logical project limits for identified deficiencies to formalize capital improvement projects (should coordinate this step with County and Civil sub-consultant as needed).

**Future Deficiency Assessment – Parallel Capacity Facilities**

To ensure that capacity increasing CIP improvements that divert demand from parallel deficient roadways will not obviate the need for direct improvements to these facilities, a Parallel Facility Assessment must be performed.

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<sup>4</sup> This step ensures a conservative margin of error is applied for determining if a given roadway segment will operate acceptably under future year forecast conditions.

Based on the prior 2016 update, the following roadway extensions were analyzed.

- Saratoga Way Extension (based on providing parallel capacity to the US 50 segment - County Line to El Dorado Hills Boulevard deficiency)
- Country Club Drive (based on providing parallel capacity to the US 50 segment – El Dorado Hills Boulevard/Silva Valley Parkway to Cambridge Road Interchange deficiency)
- Diamond Springs Parkway (based on providing parallel capacity to Missouri Flat Road)
- Latrobe Connector (based on parallel capacity to the White Rock Road and Latrobe Road deficiencies)
- Headington Road Connector (based on parallel capacity to Missouri Flat Road)

Assuming these and possibly “new” parallel capacity CIP improvements identified in this current analysis are in place, several deficient segments may be shown to operate acceptably due to redistribution of traffic. These facilities would therefore be removed from the TIM Fee CIP list.

The following EDCTC TDM model run is required to perform the Parallel Facility Assessment analysis:

- Future year forecast with Parallel Capacity CIP Improvements Model Run (AM/PM and Daily assignments): Future GP Land Use with Baseline Network plus parallel capacity improvements only.

**[DKS Peer Review: 1-Day]:** Loaded Network file

Based on the above travel model output – perform the following analysis steps:

- Apply the “raw” model volume delta to the finalized AM/PM peak hour and daily volume sets approved by the County for identified parallel capacity roadways.
- Based on the adjusted volumes, re-determine LOS for identified parallel capacity roadway segments based on County standards (see Level of Service Methodology) and criteria (see Traffic Analysis Assumptions) consistent with the Baseline Deficiency Assessment.
- For roadways shown to be deficient under future baseline conditions that now meet County standards with parallel facility capacity improvements – remove from TIM Fee CIP list consideration. Note: local County roadway parallel improvements have CIP priority over state highway facility CIP improvements.

**[DKS Peer Review: 2-Days]:** Future Parallel Capacity LOS Analysis for affected segments; Completed HCM 6th Edition Compatible Worksheets and HCS Files; Local County Roadway LOS Threshold Worksheets as appropriate.

### **Future Deficiency Assessment – Interchange Facilities**

The following 21 interchanges operate along US 50 in El Dorado County:

1. El Dorado Hills Boulevard Interchange
12. Placerville Drive (West) Interchange
13. Ray Lawyer Drive Interchange

2. Silva Valley Parkway Interchange (under construction)
3. Bass Lake Road Interchange
4. Cambridge Road Interchange
5. Cameron Park Drive Interchange
6. Ponderosa Road Interchange
7. Shingle Springs Drive Interchange
8. Red Hawk Parkway Interchange
9. Greenstone Road Interchange
10. El Dorado Road Interchange
11. Missouri Flat Road Interchange
14. Placerville Drive (East) Interchange
15. Mosquito Road Interchange
16. Schnell School Road Interchange
17. Point View Drive Interchange
18. Smith Flat Road Interchange
19. Cedar Grove/Camino Interchange
20. Pollock Pines/Cedar Grove Interchange
21. Sly Park Road Interchange

The prior 2016 analysis determined the operating status of interchanges based on the segment LOS of the under- or over-crossing service roads. However, for the interchange listed below, a more detailed screening assessment was performed. For each interchange (both TIM Fee CIP and non-TIM Fee CIP interchange), ramp and interchange over-crossing link volumes were compared between the previous County model and the 2016 updated County model. If the updated model yielded equal or higher volumes (in absolute terms) or an equal or higher traffic growth rate at one or more ramps and/or overcrossing, the previously identified deficiency was considered reaffirmed.

- El Dorado Hills Boulevard Interchange
- Silva Valley Parkway Interchange
- Bass Lake Road Interchange
- Cambridge Road Interchange
- Cameron Park Drive Interchange
- Ponderosa Road Interchange
- El Dorado Road Interchange
- Missouri Flat Road Interchange

If the above screening assessment holistically lower forecasted volumes at a given interchange, a new operationally based analysis was performed. This was required for the following three interchanges.

- Bass Lake Road Interchange
- Missouri Flat Road Interchange
- Cameron Park Drive Interchange

Guidance for the analysis of interchanges is flexible but should be at least as rigorous as what was performed in 2016. Availability of recent AM/PM peak hour turn movement count data (less than 3-years old) and/or collecting new representative data during the COVID-19 pandemic conditions will be challenge. Ostensibly – an operational assessment for each of the eight interchanges is possible and would be the most defensible analysis.

**[DKS Peer Review: 3-Days]:** Future Interchange screening analysis including: model volumes, AM/PM peak hour turn movement counts; and, operational software (Synchro) Worksheets as appropriate.

### **Capacity Threshold Analysis**

The following EDCTC TDM model run is required to perform the Capacity Threshold Analysis:

- Future year forecast with all CIP Improvements (AM/PM and Daily assignments): Future GP Land Use with all CIP improvements reflected)

**[DKS Peer Review: 1-Day]:** Loaded Network file

Based on the above travel model output – perform the following analysis steps:

- Using linear interpolation of projected volumes, re-analyze operations of each deficient segment and interchange to identify when (i.e., analysis year between baseline and 2040) each CIP improvement would be triggered.
- Coordinate with County staff to classify these improvements as short-term – mid-term or long-term improvements.

**[DKS Peer Review: 3-Days]:** Capacity Threshold Analysis LOS Analysis for deficient segments; HCM 6th Edition Compatible Worksheets and HCS Files; Local County Roadway LOS Threshold Worksheets, Synchro analysis files/worksheets etc. as appropriate.