



MEMORANDUM

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Project: Missouri Flat Master Circulation and Financing Plan Phase II

Subject: Draft Technical Memorandum 1-5: Traffic Analysis Locations, Methodology & Assumptions

This memorandum defines the study area and summarizes the analysis methodology, assumptions and tools for the technical analysis associated with the Missouri Flat Master Circulation and Financing Plan Phase II (MC&FP-II). Early buy-in on the contents of this memorandum will allow it to serve as a “blueprint” for all requisite traffic analyses and avoid the need for costly do-overs.

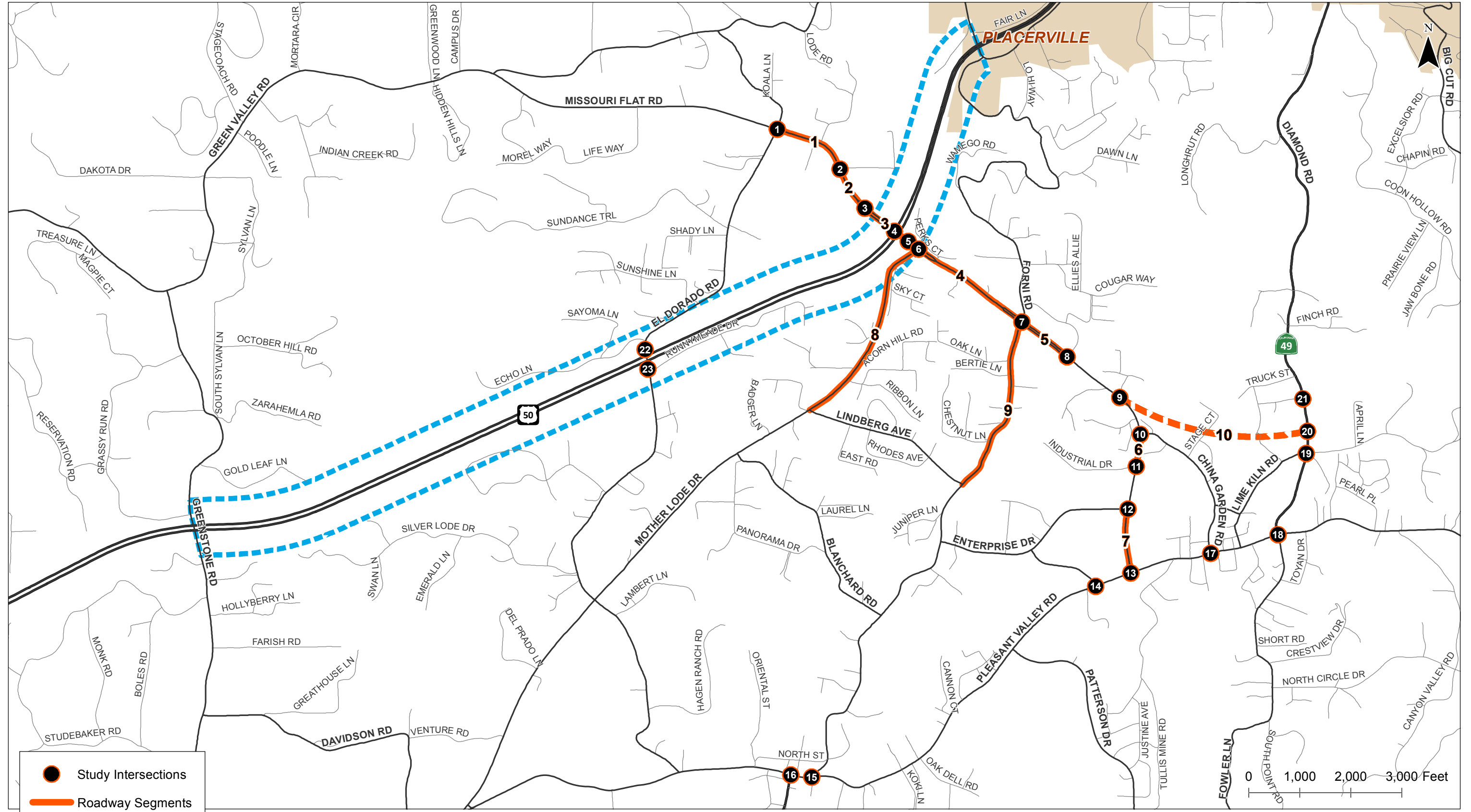
The subsequent chapters in this memorandum describe the following:





- Study Locations
- Traffic Analysis Methodology
- Traffic Counts and Analysis Assumptions
- Level of Service Standards/Criteria
- Travel Demand Forecasting

STUDY LOCATIONS

The study locations were identified based on most recent projects, local circulation issues and the meeting with County staff on February 16, 2016.

The study locations are shown in Figure 1 below. A total of 23 intersections and 10 roadway segments will be analyzed for AM and PM hour conditions.



-  Study Intersections
-  Roadway Segments
-  Future Roadway
-  US 50 Segments

Missouri Flat Master Circulation and Financing Plan Phase II
El Dorado County, California

Figure 1

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TRAFFIC ANALYSIS METHODOLOGY

Traffic Analysis will be performed using the approved tools and methods identified in the 2004 El Dorado County General Plan and *Transportation Impact Study Guidelines* (November 2014).

Intersection Analysis

In an urban, suburban and rural setting, roadway capacity is generally most constrained at intersections. The methodology used to analyze intersection levels of service (LOS) is described in the Transportation Research Board's 2010 Highway Capacity Manual (HCM). LOS is a qualitative measure that defines the experience of motorists using an intersection. LOS is designated by the letters A through F, with A being the best condition (little or no delay) and F being the worst (high delay and congestion).

Traffic operations at the study intersections will be analyzed using the procedures and methodologies contained in the HCM 2010. For signalized intersections, HCM procedures calculate an average control delay per vehicle, and assign a level of service designation based upon the delay. For unsignalized intersections, this methodology determines the LOS by calculating an average total delay per vehicle for the stop controlled movements and for the intersection as a whole.

HCM methodologies will be applied using Synchro/SimTraffic software packages (Version 8), developed by Trafficware. Table 1 displays the delay range associated with each LOS category for signalized and unsignalized intersections based on the HCM.

Table 1: Signalized and Unsignalized Intersection Level of Service Criteria

LOS	Average Delay (sec/veh)		Description
	Signalized	Unsignalized	
A	≤10.0	≤10.0	Very Low Delay: This occurs when progression is extremely favorable and most vehicles arrive during a green phase. Most vehicles do not stop at all.
B	>10.0 & ≤20.0	>10.0 & ≤15.0	Minimal Delays: This generally occurs with good progression, short cycle lengths, or both. More vehicles stop than at LOS A, causing higher levels of average delay.
C	>20.0 & ≤35.0	>15.0 & ≤25.0	Acceptable Delay: Delay increases due to only fair progression, longer cycle lengths, or both. Individual cycle failures (<i>to service all waiting vehicles</i>) may begin to appear at this level of service. The number of vehicles stopping is significant, though many still pass through the intersection without stopping.
D	>35.0 & ≤55.0	>25.0 & ≤35.0	Approaching Unstable/Tolerable Delays: The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	>55.0 & ≤80.0	>35.0 & ≤50.0	Unstable Operation/Significant Delays: These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.
F	>80.0	>50.0	Excessive Delays: This level, considered to be unacceptable to most drivers, often occurs with oversaturation (i.e., when arrival flow rates exceed the capacity of the intersection). It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Source: *Highway Capacity Manual*, Transportation Research Board, Washington D.C., 2010

HCM analyses do not explicitly address the interaction of operations of closely spaced signalized intersections. Several conditions can occur when intersections are located in close proximity on a corridor: 1) spill-back potential from the downstream intersection to the upstream intersection; 2) effects of downstream queues on upstream saturation flow rate; and, 3) atypical dispersion or compression of the traffic stream between intersections disrupting normal progression of vehicle platoons. These queue interactions can potentially distort the HCM procedures and subsequent findings of the analyses. As such, the following intersections will be analyzed with micro-simulation using calibrated SimTraffic models:

- Missouri Flat Road and Plaza Drive
- Missouri Flat Road and US-50 Eastbound Ramps
- Missouri Flat Road and US-50 Westbound Ramps
- Missouri Flat Road and Mother Lode Drive

Simulation analysis will be performed in accordance with the recommended SimTraffic procedures as outlined in the County’s *Transportation Impact Study Guidelines*. The observed road and traffic conditions will be utilized to relate the traffic analysis back to the “ground truth”. The field observations, particularly queue lengths will be used to calibrate the micro-simulation model. The calibration criteria will be based on the FHWA’s Traffic Analysis Tools Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software.

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 2. These capacity thresholds are calculated based on the methodology contained in the HCM 2010 and these thresholds are applied for the analysis of the 2004 El Dorado County General Plan, as amended with the Targeted General Plan Amendment-Zoning Ordinance Update (TGPA-ZOU).

Table 2. Local Roadways Level Of 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						

Freeway Mainline Segment and Merge-Diverge Analysis

Basic mainline segments are defined as those freeway segments that are outside the influence of ramp merging, diverging, or weaving maneuvers. The influence area of merge (on-ramp) segments generally extends for 1,500 feet downstream of the merge point. Similarly, influence area of diverge (off-ramp) segments extend for 1,500 upstream of the diverge point. The mainline segment between merge and diverge influence areas are generally categorized as basic freeway.

For US 50, the basic freeway segment and merge-diverge LOS methodologies published in the HCM 2010 will be applied. The HCM methods will be implemented using validated HCM compatible spreadsheets for mainline and ramps analysis. Table 3 and Table 4 present the criteria used to determine the LOS for basic freeway segment and ramp merge-diverge facilities, respectively. All traffic volumes are adjusted to reflect passenger car equivalents based on the truck classification data collected at/near each respective location.

Table 3: Basic Freeway Segment Level of Service Criteria

LOS	Density (pc/mi/ln)
A	≤ 11
B	> 11-18
C	> 18-26
D	> 26-35
E	> 35-45
F	Demand exceeds Capacity
	> 45

Source: *Highway Capacity Manual*, Transportation Research Board, Washington D.C, 2010

Table 4: Ramps Merge-Diverge Level of Service Criteria

LOS	Density (pc/mi/ln)	Comment
A	≤ 10	Unrestricted operations
B	> 10-20	Merging and diverging maneuvers noticeable to drivers
C	> 20-28	Influence area speeds begin to decline
D	> 28-35	Influence area turbulence becomes intrusive
E	> 35	Turbulence felt by virtually all drivers
F	Demand exceeds Capacity	Ramp and freeway queues form

Source: *Highway Capacity Manual*, Transportation Research Board, Washington D.C, 2010

Weaving Analysis

Weaving segments are formed when a diverge segment closely follows a merge segment or when a one-lane off-ramp closely follows a one-lane on-ramp and the two are connected by a continuous auxiliary lane. LOS for weave sections will be calculated using the 2010 HCM methodologies, which is now accepted by Caltrans District 3. Total volumes involved in weaving, length of weaving section, and number of lane on freeway before and within weaving section are inputs to perform analysis.

TRAFFIC COUNTS AND ANALYSIS ASSUMPTIONS

Traffic Counts

Intersection, roadway segment, and freeway counts will be extracted from available sources. Traffic analysis will be based on the most recent traffic counts in the study area. Any counts older than 2014 will be adjusted to reflect an annual growth rate, to be determined based on historical counts along key roadways in the study area. Traffic count sources are summarized in Table 5.

Table 5: Traffic Data Sources

Location Type	Traffic Data Source
Intersection Turning Movements	Recently completed or ongoing transportation impact studies
County Roadway Segments	County's 2015 traffic count reports, or recently completed or ongoing transportation impact studies
US 50 Mainline	Caltrans Performance Measurement System (PeMS), or Caltrans Published Volumes
US 50 Ramps	Turning movement counts at ramp terminal intersections

Table 6 shows the month and year for most recent available turning movement counts at the study intersections.

Table 6: Traffic Count Days at Intersections

ID	Intersection		Count Month and Year	Source
	Primary Road	Secondary Road		
1	Missouri Flat Road	El Dorado Road	Apr-14	The Crossings at El Dorado Phase 1 TIA (2014)
2	Missouri Flat Road	Headington Road	Apr-14	The Crossings at El Dorado Phase 1 TIA (2014)
3	Missouri Flat Road	Plaza Drive	May-15	Diamond Springs Parkway Phase 1B Report (2016)
4	Missouri Flat Road	US 50 Westbound Ramps	May-15	Diamond Springs Parkway Phase 1B Report (2016)
5	Missouri Flat Road	US 50 Eastbound Ramps	May-15	Diamond Springs Parkway Phase 1B Report (2016)
6	Missouri Flat Road	Mother Lode Drive	May-15	Diamond Springs Parkway Phase 1B Report (2016)
7	Missouri Flat Road	Forni Road	May-15	Diamond Springs Parkway Phase 1B Report (2016)
8	Missouri Flat Road	Golden Center Drive	May-15	Diamond Springs Parkway Phase 1B Report (2016)
9	Missouri Flat Road	Diamond Springs Parkway	Future	
10	Missouri Flat Road	China Garden Road	May-15	Diamond Springs Parkway Phase 1B Report (2016)
11	Missouri Flat Road	Industrial Drive	Oct-14	El Dorado County Sherriff Headquarters Facility TIA (2015)
12	Missouri Flat Road	Enterprise Drive	Oct-14	El Dorado County Sherriff Headquarters Facility TIA (2015)
13	Missouri Flat Road	Pleasant Valley Road (SR 49)	May-15	Diamond Springs Parkway Phase 1B Report (2016)
14	Pleasant Valley Road (SR 49)	Commerce Way	Sep-12	El Dorado/Diamond Springs Mobility Study

ID	Intersection		Count Month and Year	Source
	Primary Road	Secondary Road		
15	Pleasant Valley Road (SR 49)	Forni Road	Oct-14	El Dorado County Sherriff Headquarters Facility TIA (2015)
16	Pleasant Valley Road	SR 49	Oct-14	El Dorado County Sherriff Headquarters Facility TIA (2015)
17	Pleasant Valley Road (SR 49)	China Garden Road	Jul-14	Piedmont Oaks Estates TIA (2014)
18	Pleasant Valley Road (SR 49)	Diamond Road/Fowler Lane	May-15	Diamond Springs Parkway Phase 1B Report (2016)
19	Diamond Road	Black Rice Lane/Lime Kiln Road	May-15	Diamond Springs Parkway Phase 1B Report (2016)
20	Diamond Road	Diamond Springs Parkway	Future	
21	Diamond Road	Bradley Drive	Jul-14	Piedmont Oaks Estates TIA (2014)
22	El Dorado Road	US 50 Westbound Ramps	Apr-14	The Crossings at El Dorado Phase 1 TIA (2014)
23	El Dorado Road	US 50 Eastbound Ramps	Apr-14	The Crossings at El Dorado Phase 1 TIA (2014)

Source: Kittelson & Associates, 2016

Traffic Analysis Parameters

Generalized operational parameters that will be used for the traffic analysis are provided in Table 7 below.

Table 7: Traffic Analysis Parameters and Assumptions

Parameter	Parameters/Assumptions
Analysis Periods	AM and PM peak hours
Analysis years	Existing: 2015 Future: 2035, County model’s cumulative year
Signal Timings	Existing: Signal timing plans Future: Optimized cycle lengths, splits and offsets
Ped/Bike Timings	Existing: Signal timing plans Future: existing geometry – existing timings, new geometry – calculated pedestrian clearance intervals based on CA MUTCD
Ideal Saturation Flow Rate	<ul style="list-style-type: none"> Freeway General Purpose Lanes: HCM 2010

Parameter	Parameters/Assumptions
	Exhibit 10-5 2,350 vphpl <ul style="list-style-type: none"> • Freeway Auxiliary Lanes > 1 mile: 900¹ vphpl • Freeway Auxiliary Lanes < 1 mile: 400 vphpl • Intersections: 1,900 vphpl
Base Free Flow Speeds	Freeway Mainline: Posted speed limit plus 5 mph County Roadways: Posted speed limit
Peak Hour Factor (PHF)	Freeway: <ul style="list-style-type: none"> • Existing and Future: 0.92 Intersections: <ul style="list-style-type: none"> • Existing: Traffic counts • Future: Higher of existing counts and 0.92
Truck Volumes	Freeway and Ramps: <ul style="list-style-type: none"> • Existing and Future: Caltrans published traffic data, or 5% Intersections: <ul style="list-style-type: none"> • Existing and Future: Traffic counts, counts from adjacent intersections, or 3%
Bicycle/Pedestrian Volumes	Existing and Future: Traffic counts, or 2 bicycles per hour and 5 pedestrians per hour
Lane Width	All: 12 feet
Driver Population Factor	All: 1.00
Ramp Density (ramps/mi)	Freeway mainline: Aerial measured

LEVEL OF SERVICE (LOS) STANDARDS

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

¹ 900 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.

County Roadways and Intersections

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. Two segments listed in the Table TC-2 are included in the study area:

1. Missouri Flat Road from US 50 to Mother Lode Drive: maximum allowed volume to capacity ratio is 1.12
2. Missouri Flat Road from Mother Lode Drive to China Garden Road: maximum allowed volume to capacity ration is 1.20

Since the Phase 2 will add more land development projects in the study area, Policy TC-Xe will be applicable, as it defines the volumes threshold for a project impact.

For the purposes of this Transportation and Circulation Element, "worsen" is defined as any of the following number of project trips using a road facility at the time of issuance of a use and occupancy permit for the development project:

- A. A 2 percent increase in traffic during the a.m. peak hour, p.m. peak hour, or daily, or
- B. The addition of 100 or more daily trips, or
- C. The addition of 10 or more trips during the a.m. peak hour or the p.m. peak hour.

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-2.

Caltrans facilities are also subject to Caltrans threshold included in the Transportation Concept Report and Corridor System Management Plan. A threshold of LOS E is documented between US 50 between El Dorado Road and Placerville Drive.

In addition, Caltrans considers off-ramp vehicular queues as significance criteria. Off-ramps with vehicular queues that extend into the ramp's deceleration area or onto the freeway would be

considered as operational deficiencies. The 95th percentile queues will be compared against available storage at the intersections to be analyzed using SimTraffic.

TRAVEL DEMAND FORECASTING

The traffic forecasts for the cumulative (2035) year will be based on the recently modified catalog of El Dorado County Travel Demand Model released on 01/21/2016 which includes amended General Plan. This model also incorporates necessary roadway network changes in the County. Cumulative year forecasts will be developed for three scenarios: 1) cumulative baseline, 2) cumulative baseline plus land use alternative #1 (to be determined), and 3) cumulative baseline plus land use alternative #2 (to be determined).

Base Year Model

As part of the West Slope Traffic Impact Mitigation (TIM) Fee Update study, the 2010 base year network was upgraded to 2015 year based on the following:

- Infrastructure improvements under construction by January 1st 2015.
- Land use projects built and occupied by January 1st 2015.

The 2015 base model developed for the TIM Fee study will provide a basis for developing AM and PM peak hour forecasts.

Cumulative Year Baseline Model

The cumulative model land uses will be modified to reflect buildout of the following projects:

- The Crossings
- Social Security Administration Office
- Public Safety Facility
- Diamond Dorado Retail Center
- Creekside Plaza
- New Placerville Courthouse
- Piedmont Oak Estates
- El Dorado County Apartments

The following two network changes will be made in the cumulative model:

- Reduce capacity classification of Headington Road extension to reflect private roadway status
- Diamond Spring Parkway, consistent with most recent plans

In addition to above changes, TAZ loading, zone connectors and intersection geometries would be verified and updated as appropriate. To the extent possible, link attributes will be preserved. KAI will perform required logical checks before processing and adjusting raw forecasts.

Traffic Forecast Adjustments

Before “raw” model output is considered suitable for operational analysis, post-processing adjustments must be performed. The recommended procedure is based on the National Cooperative Highway Research Program (NCHRP) Report 255, 1982. NCHRP-255 adjustments entail using model generated link-based growth factors (computed variation between base year and forecast year model link volumes) to adjust baseline traffic counts to reflect future conditions. For each count location, traffic growth estimates will be generated using the Difference method.

Draft