



**General Guidelines  
For Conducting Traffic Studies  
and Determination of  
Intersection Level of Service and Improvement Needs**

**City of Victorville**

**January 20, 2005**

The following supplemental guidelines, in conjunction with SANBAG CMP guidelines, shall be used when preparing traffic impact studies and the traffic impact analysis portion of Environmental Clearance in the City of Victorville. The guidelines specifically address the procedures when determining intersection Level of Service (LOS) and when identifying improvement needs due to project impacts.

- A scoping meeting shall be conducted between the Traffic Engineering Consultant and the City's Traffic Engineering staff prior to conducting the study. The agreed upon scope of the study, including all study intersection locations, shall be summarized and sent to the City.
- All traffic counts required for the study shall be conducted by a professional traffic data collection firm and attached to the report. If counts are taken in a period when traffic counts are unusually low (i.e., January/February), an agreed upon seasonal factor shall be applied to the raw data.
- The Consultant shall send/fax the trip distribution figures to the City for approval prior to commencing the analysis.
- All approved and current planned development projects shall be obtained from the City and added to the proposed development trip generation. These cumulative projects are to be displayed graphically and summarized in a matrix table that includes: reference number, name of project, location, description, ADT, whether included (yes/no), and reason why not included (completed, etc.).

All analyses shall be based on Highway Capacity Manual (HCM) operations methodology for determining LOS and appropriate mitigation measures.

WEBSTER software (available free from the City) is highly recommended for the required operations analysis. Highway Capacity Software (HCS) and Synchro software may also be acceptable, but if results are deemed to be insufficient and/or invalid, then all analysis may have to be resubmitted using the City provided software. TRAFFIX software is allowed for project trip generation, distribution, and assignment but is not acceptable for the required HCM operations methodology for LOS analysis, as it does not properly address the minimum pedestrian timing requirements. Obtain prior approval from the City if you plan on using any other software for HCM operations methodology for determining LOS.

For evaluating operational characteristics at signalized intersections, the following criteria shall be used:

1. A pre-approved list of intersections for analysis shall be obtained from the City. Intersection critical movements LOS shall be maintained at LOS "D" or better, volume-to-capacity (V/C) ratios shall be less than 0.95 for each movement, and queue storage shall be adequate for a design queue as detailed below.

2. Adjust all field turning movement volumes to peak hour volumes using the peak hour factor determined from the count data, or use 4 times the peak 15-minute data.
3. Match existing coordination cycle length; otherwise, use a cycle lengths ranging from a minimum of 70 seconds to a maximum of 120 seconds. A 90-second cycle length is preferred.
4. Use a saturation flow rate recommended in the SANBAG CMP guidelines. Saturation flows may also be field measured. Typically, the saturation flow rates do not need to be adjusted, except when field conditions dictate. Permissive left turns and shared through/left turns require an engineering determination of saturation flow rates.
5. Provide adequate timing (i.e., phase splits) to accommodate pedestrian crossing times per current MUTCD requirements. The existing timing at signalized intersections can be obtained from the City. Walk times shall typically be at least 5 seconds and pedestrian clearance times shall be from curb to at least the far side of the traveled way, and shall include Yellow and All Red intervals. Therefore, the minimum Pedestrian Time =  $\frac{\text{Walk} + \text{FDW} + \text{Yellow} + \text{All Red}}{\text{Walk} + \text{FDW} + \text{Yellow} + \text{All Red}}$ . The crossing distance for each leg of the intersection shall be calculated and documented for each intersection.
6. Additional turn lanes should be considered and incorporated in the LOS analysis when left turn volume exceeds 300 vph. Right Turn Only (RTO) lane should be considered to address operational and safety needs.
7. For intersections that have left turn phasing, provide a minimum of 10 seconds of total split time (Green + Yellow + All Red time), even though vehicular volume could be accommodated with a lower split time. With Protected/Permissive Left Turn (PPLT) phasing, a minimum of 8 seconds is acceptable.
8. Lost Time shall be 2 seconds per critical movement. A two-phase intersection would have a total of 4 seconds lost time. An eight-phase intersection would have a total of 8 seconds of lost time (4 critical movements times 2 seconds each).
9. Right turn overlap timing may be used as a recommended improvement, if appropriate. However, the corresponding through movement minimum timing (i.e., the corresponding pedestrian timing) shall be increased by an amount equal to Yellow plus All Red time to provide adequate time for the pedestrians to clear the crosswalk before the start of right turn overlap phasing (this is because right turn overlaps typically begin at the end of the through Green), unless the controller can be programmed to delay the beginning of the overlap.

10. Progression factors may be used in the analysis as follows:

- a. 0.80 if coordinated move (including lead/lag left turns)
- b. 1.00 for free operation
- c. 1.20 for Leading Left turns

Justification of selected values shall be provided. The above values are not mandatory.

11. Queue lengths shall be calculated on a per lane basis using vehicle spacing of 20 feet. The design queue shall be 1.5 times the average queue at the beginning of Green. The queue determination methodology must be pre-approved by the City Traffic Engineer. One pre-approved methodology is that provided in the City-furnished WEBSTER software package.
12. Design Queue lengths must be tabulated and documented to not extend beyond left turn pocket storage areas or beyond 75% of the distance between the closest stop bars of adjacent signalized intersections. If queue lengths exceed these limits, appropriate mitigations must be provided.
13. Because queuing is a function of signal timing, some typical mitigations include:
  - a. Adjust or implement coordination timing.
  - b. Implement lead/lag left turn phasing with appropriate offsets.
  - c. Implement PPLT phasing, if appropriate.
  - d. Re-stripe for more lanes (and re-time the signals accordingly).
  - e. Widen roadway, re-stripe, and re-time the signals.
14. On-street traffic analysis scenarios, as a minimum, must include Project Opening Day and Year 2025 impacts with required mitigations at all study intersections. The purpose of Opening Day analysis is to determine which of the identified 2025 improvements are needed by project Opening Day. Therefore, Opening Day conditions must include all existing traffic, growth, and traffic from all projects presently being considered for approval by the City. Year 2025 traffic determinations will be made based on modeling or other methodologies approved by the City.

The City will determine fair share cost of mitigations, with consideration given to pre-assessed traffic fees and other funding sources approved for the master plan of needed improvements. In addition to conducting opening and 20 year analyses, the City will require a mid-term (10 year horizon) analysis with agreed upon growth rates on specific intersections.
15. Project access and circulation, along with parking, must be fully analyzed.
16. Cost estimates shall be according to the City's standard unit costs.

17. Project fair share mitigation cost calculations shall be clearly shown in a table as follows: Intersections requiring mitigation improvements shall be listed separately in each row of the table.

The following columns shall also be shown in the table: Intersection, total cost, peak hour (AM or PM), existing traffic, year 2025 with project traffic, project traffic, total new traffic, project % of new traffic, AM project cost share, PM project cost share.

After the project fair share mitigation cost table has been completed, the information is used to calculate a per lot mitigation fee for residential projects. Please refer to the attached spreadsheet for instructions on how to calculate the per lot fee.

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