

*Appendix 3*  
*EPA's Guideline for Modeling*  
*Carbon Monoxide from*  
*Roadway Intersections*

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Air



# GUIDELINE FOR MODELING CARBON MONOXIDE FROM ROADWAY INTERSECTIONS



## SECTION 3

### INTERSECTION SELECTION PROCEDURE

#### 3.1 Rationale

This guidance provides a ranking and selection procedure to allow the discernment of those intersections that could be potential hot spots, i.e., have high CO concentrations. The guidance will be used primarily to determine potential hot spots in a SIP analysis, but will also be useful for project level analysis when more than three intersections are affected. Intersections are first selected for analysis on the basis of the study objectives. Study objectives would include the characterization of potential CO hot spots for the development of a SIP attainment demonstration or a conformity analysis of projects to the SIP. All signalized intersections are reviewed for the potential to create an adverse air quality impact by either significantly increasing traffic or reducing roadway distances from receptors where the general public has access. The selection of intersections for modeling should be based on the ranking procedure discussed in Section 3.3. The calculation of Level-of-Service (LOS) for use in the ranking of intersections is discussed in Section 3.2.

#### 3.2 Level-of-Service Determination

Level-of-Service (LOS) measures the operating conditions in the intersection and how these conditions affect traffic flow and delay. The LOS is a measure of the combined traffic volume, signal timing, and related congestion and delay. It is related both to the physical characteristics of the intersection and to various operating conditions that occur when the intersection is carrying variable traffic volumes (Garber, 1988).

In a signalized intersection, LOS is defined in terms of vehicle delay time (TRB, 1985). The Highway Capacity Manual (HCM) (TRB, 1985) states that LOS delay is:

"... a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, level-of-service criteria are stated in terms of the average stopped delay ..."

The following synopsis of each LOS is given in the HCM.

**Level-of-Service A** - describes operations with very low delay, i.e., less than 5.0 seconds per vehicle.

**Level-of-Service B** - describes operations with delays in the range of 5.1 to 15.0 seconds per vehicle. More vehicles stop at LOS B than at LOS A, which results in higher levels of average delay.

**Level-of-Service C** - describes operations with delays in the range of 15.1 to 25.0 seconds per vehicle. A significant number of vehicles stop at this level; however, many still pass through the intersection without stopping.

**Level-of-Service D** - describes operations with delays in the range of 25.1 to 40.0 seconds per vehicle. At LOS D, the influence of congestion becomes more noticeable. Many vehicles stop, and the proportion of vehicles not stopping declines.

**Level-of-Service E** - describes operations with delays in the range of 40.1 to 60.0 seconds per vehicle. This is considered to be the highest limit of acceptable delay.

**Level-of-Service F** - describes operations with delays in excess of 60.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection.

Intersections with the same LOS can be ranked by degree of delay. As the Level-of-Service decreases, volume-to-capacity ratios increase, progression of vehicles through the intersection decreases, long vehicle queues occur, and idle emissions increase. As part of the procedure for determining critical intersections, those intersections at LOS D, E, or F or those that have changed to LOS D, E, or F because of increased volumes of traffic or construction related to a new project in the vicinity should be considered for modeling. Intersections that are LOS A, B, or C probably do not require further analysis, i.e., the delay and congestion would not likely cause or contribute to a potential CO exceedance of the NAAQS.

### 3.3 Ranking and Selecting Intersections

The following steps should be used for ranking and selecting intersections for modeling:

- 1) Rank the top 20 intersections by traffic volumes;
- 2) Calculate the Level-of-Service (LOS) for the top 20 intersections based on traffic volumes;
- 3) Rank these intersections by LOS;
- 4) Model the top 3 intersections based on the worst LOS; and
- 5) Model the top 3 intersections based on the highest traffic volumes.

- It is assumed that if the selected intersections do not show an exceedance of the NAAQS, none of the ranked intersections will. This assumption is based on the assumption that these intersections will have the highest CO impacts and that intersections with less traffic volumes and congestion will have lower ambient air impacts. Thus, if no exceedances of the CO NAAQS occur for the attainment year when the results of the intersection modeling are added to the urban areawide component of the CO concentration at the intersection, then the CO attainment demonstration is complete. If CO exceedances do occur, then further controls are necessary.