

CARBON MONOXIDE DISPERSION MODELING GUIDANCE

1.0 INTRODUCTION

This guidance describes the District's recommended methodologies for quantifying concentrations of local CO for proposed projects that do not meet all of the screening criteria discussed in Section 4.3.2 of the CEQA Guide. As discussed separately below, the District recommends using the On-Road Mobile-Source Emission Factors (EMFAC) and the California Line Source Dispersion Model (CALINE4) in accordance with the methodology recommended in the [University of California Davis Transportation Project-Level Carbon Monoxide Protocol](#) (UC Davis CO Protocol).

2.0 BACKGROUND CONCENTRATION

Ambient (background) 1-hour CO concentrations can be obtained from the U.S. Environmental Protection Agency's (EPA) [Monitor Values Report](#). The CO monitoring data recorded at the monitoring station nearest or most representative of the project site should be obtained ([see map in chapter 1](#)). According to the UC Davis CO Protocol, the second highest concentration recorded during the last two years should be used to represent the ambient CO concentration in the project area.

3.0 PROJECT-GENERATED CONCENTRATION

3.1 EMISSION FACTOR

The District recommends using the most current version of the [EMFAC model](#) to obtain mobile-source emission factors for CO associated with operating conditions that would be representative of the intersection (or facility) being analyzed. In most cases the default composite emission factor that is representative of the fleet of vehicles operating in Sacramento County can be used. A refined emission factor may be developed for an intersection that would have a fleet mix that is atypical in some way (e.g., a high volume of diesel trucks because the intersection is near a distribution center).

3.2 DISPERSION MODELING IN CALINE4

The emission factor and other input parameters should be input into the [CALINE4 model](#) to quantify CO concentrations near roadways (or facilities). The [UC Davis CO Protocol](#) contains detailed methodology for modeling such impacts. Detailed guidance about how to use the CALINE 4 model with the CL4 interface is available in the [CALINE4 User's Guide](#). The CALINE4 model contains five screens that require input data. Input parameters into CALINE4 are summarized by screen, below.

JOB PARAMETERS SCREEN

File Name: Designate the file name, which will be saved with a *.dat file extension, to create the CALINE4 Input file.

Job Title: Provide a name for the modeling scenario (e.g., existing no project, existing plus project).

Run Type: Select the worst-case wind angle.

Aerodynamic Roughness Coefficient: Choose the characteristic (i.e., rural, suburban, central business district, other) that is most representative of the project site.

Model Information: Indicate the unit of measurement (i.e., meters or feet) and input the vertical dimension of the project (i.e., altitude above sea level).

Run: After providing values for the data fields on this screen and all other screens, return to the Job Parameters screen to run the model. The model will generate an output file called C4\$.out. Save the output file under an appropriate filename for future reference before executing another model run.

LINK GEOMETRY SCREEN

On this screen, input the coordinates for the roadway intersection being analyzed.

Link Name: Input names for each roadway segment.

Link Type: Indicate whether the roadway segment is at-grade, depressed, fill, bridge, or a parking lot.

Endpoint Coordinates (X_1 , X_2 , Y_1 , Y_2): Input the dimensions (i.e., coordinates) of the roadway segments using X and Y coordinates of a Cartesian coordinate system. Most users assume that the point of origin is at location 0, 0.

Link Height: Indicate the vertical dimension of the roadway segment. If the roadway segment is at-grade, set this parameter to zero. If the roadway segment is depressed, enter a negative value for this parameter.

Mixing Zone Width: The Mixing Zone is defined as the width of the roadway, plus 3 meters on either side. The minimum allowable value is 10 meters, or 32.81 feet.

Canyon/Bluff (Mix Left/Right): Set these features to zero.

LINK ACTIVITY SCREEN

Traffic Volume: Input hourly traffic volumes for each roadway segment.

Emission Factor: Input the CO emission factor (in units of grams/mile) obtained from EMFAC for the applicable vehicle speed class reflecting operating conditions for the intersection.

RUN CONDITIONS SCREEN

Wind Speed: Input 0.5 meters per second to represent worst-case conditions.

Wind Direction: Set this input parameter to zero. (As described above, the Worst-Case Wind Angle for the Run Type field on the Job Parameters screen has already been selected to override the value in the Wind Direction field.)

Wind Direction Standard Deviation: Use a wind direction standard deviation of 5 degrees to represent worst-case conditions.

Atmospheric Stability Class: Use Stability Class 7 to represent worst-case conditions.

Mixing Height: Indicate the vertical dimension over which vertical mixing may occur. This value represents the height of the atmospheric boundary layer. In most situations, a value of 1,000 meters should be entered. If the analysis is for a bridge underpass, tunnel, or other situation where vertical mixing would be limited then indicate the height of the structure that would hamper vertical mixing (in meters).

Ambient Temperature: Indicate the average temperature of the project site during the time of day at which maximum peak hour traffic volume would occur (in degrees Celsius).

Ambient Pollutant Concentration: It is recommended that a value of zero be entered in this field to determine the contribution of CO from the roadway being analyzed. Add the roadway-generated CO concentration to ambient CO levels outside of the CALINE4 model, as explained in the guidance for processing CALINE4 output below.

RECEPTOR POSITIONS SCREEN

The Receptor Positions screen contains a window that displays a layout of the link and receptor coordinates in the Cartesian grid and relevant data input fields.

Receptor Name: Input names for each receptor.

Receptor Coordinates (X, Y, Z): Input receptor coordinates in a manner similar to the Link Coordinates on the Link Geometry screen. Locate receptors at 3 and 7 meters from the edge of each of the intersection corners, in accordance with the recommendations of the UC Davis CO Protocol. The Receptor Coordinates are oriented in the same plane as the Link Coordinates that represent roadway segments. Thus, receptors located southwest of the intersection would have negative values for their X and Y coordinates. A value of 1.8 meters (5.9 feet)

should be used as the Z dimension, unless otherwise known, because this is the approximate breathing height of a receptor located adjacent to the roadway.

4.0 PROCESSING CALINE4 OUTPUT

After a model run is performed, the CALINE4 output file presents estimated 1-hour CO concentrations, expressed in parts per million (ppm), at the identified receptor points. This output data shall be used to determine the highest concentration estimated for the receptor points.

The highest modeled 1-hour CO concentration estimated by CALINE4 shall be added to the ambient (background) 1-hour CO concentrations obtained from EPA, as described in Section 2.0 above. The sum of these two values represents the modeled worst-case 1-hour CO concentration near the affected intersection.

The highest 1-hour CO concentration estimated by CALINE4 should be multiplied by a persistence factor of 0.7 to estimate the worst-case 8-hour CO concentration. Then the estimated 8-hour CO concentration shall be added to the ambient (background) 8-hour CO concentration obtained from EPA (expressed in ppm), which is also discussed in Section 2.0 above. The sum of these two values represents the modeled worst-case 8-hour CO concentration near the affected intersection.