### USER'S GUIDE FOR CL4: A USER-FRIENDLY INTERFACE FOR THE CALINE 4 MODEL FOR TRANSPORTATION PROJECT IMPACT ASSESSMENTS

USER'S GUIDE STI-997480-1814-UG

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**June 1998** 

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### 1. INTRODUCTION

CALINE4 (Caltrans, 1989) is a dispersion model that predicts carbon monoxide (CO) impacts near roadways. Its purpose is to help planners protect public health from the adverse effects of excessive CO exposure. The Caltrans publication, *Transportation Project-Level Carbon Monoxide Protocol* (CO Protocol) (Garza et al., 1997), recommends the use of CALINE4 when a proposed transportation project fails an initial screening analysis (described in Appendix A of the CO Protocol), and therefore, requires a more detailed analysis.

CALINE4 is a simple line source Gaussian plume dispersion model. The user defines the proposed roadway geometry, worst-case meteorological parameters, anticipated traffic volumes, and receptor positions. The user must also define CO emission factors for each roadway link. CO emission factors should be generated with the California Air Resources Board's EMFAC7f model or CT-EMFAC¹, which was adapted from EMFAC7f by Caltrans to be easier to use. (Note that CT-EMFAC modeling requires a similar level of user-effort as CL4.)

CL4 is a graphical windows-based user interface, designed to ease data entry and increase the on-line help capabilities of CALINE4. The CL4 setup program is self-contained with both programs (the CL4 interface and the CALINE4 dispersion model), so the user only needs to complete a single installation step. The original CALINE4 executable files are copied to the CL4 program directory.

### 1.1 INSTALLATION OF CL4

CL4 requires a 486/66 or better PC with 16+ Mb of RAM. CL4 runs with Windows 95 or Windows NT V4.0. To install, CL4 requires approximately 3 Megabytes (Mb) of free storage space on the destination drive.

To install CL4 from the Caltrans website:

- 1. Log in to the Caltrans internet site, <a href="http://www.dot.ca.gov/hq/InfoSvcs/EngApps/">http://www.dot.ca.gov/hq/InfoSvcs/EngApps/</a> and obtain the CL4 installation program.
- 2. Save the CL4 installation program to a temporary directory.
- 3. Double-click on the CL4 installation program icon to run the program.
- 4. Follow the prompts to install. Choose a destination directory for the program files, then click the "Install" button to begin.

To install CL4 from floppy disks:

- 1. Insert the floppy disk labeled "Disk 1".
- 2. Run the program, "Setup.exe" from the floppy drive.
- 3. Follow the prompts to complete the installation.

<sup>&</sup>lt;sup>1</sup> Download CT-EMFAC from the Caltrans web page.

To remove CL4 from your computer:

- 1. From the Windows 95 Start menu, click Start | Settings | Control Panel.
- 2. Double-click Add/Remove Programs.
- 3. Select CL4 from the list of programs.
- 4. Click the "Add/Remove" button.

### 1.2 GETTING STARTED

To start CL4, go to the Windows 95 Start menu, and click Start | Programs | CL4. A splash screen will appear briefly. (You may also click < Enter> or the button shown below to hide the splash screen.)

← Hide splash screen.

When the splash screen disappears, the first of five data entry screens becomes available and you can begin entering data (**Figure 1-1**).

Figure 1-1. CL4 user interface: Job Parameters data entry screen.

### 1.2.1 Create and Save a New Job

As you begin to enter data, it is very important to periodically save your work to avoid accidental loss. Create a new file (or "job") and save your work from the File menu (circled in Figure 1-1, upper left). Click File | Save, then type a name for the job. (Note that the standard file extension for CALINE4 input files is .dat, which CL4 assigns automatically.)

### 1.2.2 Open a Previously Saved Job

Previously saved jobs may be opened from the  $\underline{F}$ ile menu. Click  $\underline{F}$ ile | Open, then type (or point-and-click) the name for the file you wish to open, then click the  $\underline{O}$ pen button (or press < Enter>).

### 1.2.3 Enter Data

Input devices are available to assist with data entry: data entry fields, radio buttons, drop lists, and page tabs (illustrated in Figure 1-1). Data entry fields allow alphanumeric entries; radio buttons and drop lists permit choices between options; page tabs change views between five data entry screens (more detail in Section 1.5.2). Use the mouse to point-and-click and move between the input devices. Note that Microsoft tool-tip° help is available for many of the input devices; if you rest the mouse pointer over an input device, a text flag appears with guidance.

Data on all five data entry screens, listed below, must be complete in order to run CALINE4.

- Job Parameters
- Link Geometry
- Link Activity
- Run Conditions
- Receptor Conditions

### 1.2.4 Run CALINE4, View and Save Output Files

You may run CALINE4 by pressing the green "Run" button on the Job Parameters screen. Alternatively, you may click  $\underline{F}$ ile | Run from the CL4 menu. You will be prompted to save your work if you have not already done so, and you will be notified if the data on any of the five data entry screens appear to be incomplete.

CALINE4 produces a temporary output text file that is automatically named *C4\$.out*. CL4 automatically invokes the Windows 95 Notepad program (included with Windows 95 installations) and displays the *C4\$.out* text file for viewing after CALINE4 is finished. Click the File | SaveAs command from the Notepad menu in order to save the output file with a different name; otherwise, *C4\$.out* will be overwritten the next time CALINE4 is run.

In order to view previously saved output files, move to the Windows 95 Start menu and press Start | Programs | Accessories | Notepad. Select  $\underline{F}$ ile | Open from the Notepad menu; choose the name of the file you wish to open, and press the "Open" button.

### 1.3 FOR MORE HELP WITH CALINE4

For more guidance than provided by this manual and CL4's on-line help files, check the Caltrans web page, www.dot.ca.gov/hq/InfoSvcs/EngApps/.

### 2. DETAILED USER INFORMATION

### 2.1 CL4 MENU ITEMS

CL4 carries a menu bar with the following choices,  $\underline{\underline{F}}$ ile,  $\underline{\underline{F}}$ dit,  $\underline{\underline{V}}$ iew, and  $\underline{\underline{H}}$ elp (see Figure 1-1). With the mouse pointer, click and select the following menu choices to perform the general file management and computing tasks listed below.

### File

New: Discard all data entries and begin a new job.

Open: Open a previously saved data file.

Save: Save the current data file.

Save As: Assign a new file name and save work.

Run: Run the job based on the current data file.

Exit: Exit CL4.

### Edit

| Cut: Cut selected text or data and temporarily save it in the Windows clipboard memory (shortcut key, < Ctrl> X).

|Copy: Save selected text or data in the Windows clipboard memory (shortcut key, < Ctrl> C).

| Paste: Copy the clipboard contents to replace selected text, or insert the clipboard contents at the cursor position (shortcut key, < Ctrl> V).

### View

Menu choices switch views to the corresponding data-entry screens:

|Job Parameters

Link Geometry

Link Activity

Run Conditions

|Receptor Conditions

### Help

The following menu choices will display on-line help and tips extracted from this user's guide that describe features on the corresponding data-entry screens (shortcut key, < F1>):

Job Parameters

Link Geometry

Link Activity

Run Conditions

Receptor Conditions

### 2.2 DATA ENTRY SCREENS

CL4 contains five data entry screens. The following sections provide definitions, guidance, and tips to help the user complete the data entry process.

### 2.2.1 Job Parameters Screen (see Figure 1-1)

The Job Parameters Screen contains general information that identifies the job, defines general modeling parameters, and sets the units (feet or meters) that will be used to input data on the Link Geometry and Receptor Positions Screens.

<u>File Name</u>: *Display only, not editable.* Displays the name of the file where the current job is stored.

<u>Job Title</u>: *Optional.* Provides a space for the user to enter a brief job description, up to 40 characters in length.

Run Type: Different choices determine averaging times (for CO concentrations) and how the hourly average wind angle(s) will be determined. (Wind angle is the angle between the roadway link and the wind direction. CALINE4 calculates the angles based on data in the Link Geometry and Run Conditions Screens.) Most users should invoke the "worst-case wind angle" run type and apply a persistence factor of 0.6 to 0.7 in order to estimate an 8-hour average CO concentration.

- Standard Calculates 1-hour average CO concentrations at the receptors. The user must input a wind direction on the Run Conditions Screen.
- Multi-Run Calculates 8-hour average CO concentrations at the receptors. The user must input wind angles for each hour.
- Worst-case wind angle Calculates 1-hour average CO concentrations at the receptors. The model selects the wind angles that produce the highest CO concentrations at each of the receptors. This is the most appropriate choice for most users.
- Multi-Run/Worst-Case hybrid Calculates 8-hour average CO concentrations at the receptors. The model selects the wind angles that produce the highest CO concentrations at each of the receptors.

<u>Aerodynamic Roughness Coefficient</u>: Also known as the Davenport-Wieringa roughnesslength. These choices determine the amount of local air turbulence that affects plume spreading. This subject is usually discussed in elementary meteorology books. CL4 offers the following 4 choices for aerodynamic roughness coefficient:

- Rural: Roughness Coefficient = 10 cm
- Suburban: Roughness Coefficient = 100 cm

• Central Business District: Roughness Coefficient = 400 cm

• Other: Use **Table 2-1** as guidance to select an appropriate value.

Table 2-1. Aerodynamic Roughness Coefficient defined for various types of landscapes.

Roughness	
Coefficient	Landscape
(cm)	Type
.002	Sea, paved areas, snow-covered flat plain, tide flat, smooth desert
.5	Beaches, pack ice, morass, snow-covered fields
3	Grass prairie or farm fields, tundra, airports, heather
10	Cultivated areas with low crops and occasional obstacles (such as bushes)
25	High crops, crops with varied height, scattered obstacles (such as trees or
	hedgerows), vineyards
50	Mixed far fields and forest clumps, orchards, scattered buildings
100	Regular coverage with large obstacles, open spaces roughly equal to obstacle
	heights, suburban houses, villages, mature forests
≥ 200	Centers of large towns or cities, irregular forests with scattered clearings.

Source: Stull, R.B. Meteorology Today for Scientists and Engineers. St. Paul, Minnesota: West Publishing Company. 1995.

Model Information. Provides summary information for convenience and quality assurance.

Link/Receptor Geometry Units: Select whether meters or feet will be used to define the geometry of the roadway links and receptor positions. *This choice only affects the Altitude input choice, and the data shown on the Link Geometry and Receptor Positions pages.* Meteorological inputs always require inputs with metric units. Emission factors are always defined in terms of grams per mile. (Note that CALINE4 reports data in metric units, with the exception of the Altitude<sup>2</sup>.)

Altitude above Sea Level: Define the altitude above mean sea level. This input is used to determine the rate of plume spreading. It does not affect the Link Geometry or Receptor Positions.

Number of Links: The sum total number of links that the user has defined on the Link Geometry Page.

Number of Receptors: The sum total number of receptors that the user has defined on the Receptor Positions page.

Averaging Interval: Indicates whether the user has opted to calculate 1-hour or 8-hour average CO concentrations at the receptors.

<sup>&</sup>lt;sup>2</sup> At present, CALINE4 contains a minor bug. If the user opts to use English units, the CALINE4 output file will contain a value for Altitude that is correct for English units (feet), although it will be incorrectly labeled as metric (meters).

- "Run" Click this button to run the job as specified. First, be sure that the information on all five pages of CL4 is complete: Job Parameters, Link Geometry, Link Activity, Run Conditions, and Receptor Conditions.
- "<u>Exit</u>" Click this button to exit the CL4 program. CL4 issues a warning if changes or new user inputs might be lost.

### 2.2.2 Link Geometry Screen (see Figure 2-1)

Figure 2-1. Link Geometry data entry screen.

Fill in the matrix to define the roadway network to be modeled. Each row in the matrix defines a single link. Up to 20 links may be entered. Links are defined as straight-line segments. The distance between the centerline of the curved roadway, and the straight-line link should be no greater than 3 meters.

<u>Link Name</u>: *Optional*. The user may define a 12-character description for the link.

- <u>Link Type</u>: The user must select one of the following 5 choices to define the type of roadway that each link represents. (Click a cell in this column to view a drop list and select from the following 5 options.)
  - At-Grade For at-grade sections, CALINE does not permit the plume to mix below ground level, which is assumed to be at a height of zero. The height of the link above the ground is defined in the Link Height cell.
  - Fill For fill sections, CALINE4 automatically resets the link height to zero, and assumes that air flow follows the surface terrain, undisturbed. This choice is functionally no different than the At-Grade choice with a link height defined as zero. If you wish to model a link that is slightly elevated above ground, the At-Grade choice is more appropriate.
  - Depressed For depressed sections, CALINE4 increases the residence time of an air parcel in the mixing zone. The residence time increases in relation to the depth of the roadway depression. (Mixing zone = width of traffic lane(s) plus 3 meters on each side.) In such a case, CO concentrations adjacent to the mixing zone are higher than those for an equivalent at-grade or fill section. CO concentration drops more rapidly downwind of a depressed link because vertical mixing increases with residence time.
  - Bridge For bridge sections, CALINE4 allows air to flow above and below the link. The plume is permitted to mix downward from the link, until it reaches the distance defined in the Link Height cell.
  - Parking Lot Parking lot links should be defined to be coincident with the parking lot access ways. The CALINE4 algorithms adjust to account for the reduced mechanical and thermal turbulence anticipated from slow-moving, cold-start vehicles.
- Endpoint Coordinates: Links are defined as straight-line segments. The entire length of each link should deviate no further than 3 meters from the centerline of the actual roadway. The endpoint coordinates,  $(x_1, y_1)$  and  $(x_2, y_2)$ , define the positions of link endpoints.
  - The units of measure (feet or meters) are user-specified on the Job Parameters Page.
  - The user must define the link geometry and receptor positions with a consistent Cartesian coordinate system. The position of the coordinate system origin is arbitrary and at the user's discretion. The y-axis should be oriented north-south, with values increasing in the northward direction. The x-axis should be oriented east-west, with values increasing in the eastward direction. The choice of magnetic north, true north, or some other approximation is at the user's discretion. However, the wind direction must be defined on the Run Conditions page according to the same definition of north.
  - A map of the link geometry is shown on the Receptor Positions Page.
- <u>Link Height</u>: For all link types except bridges, Link Height represents the height of the link above the surrounding terrain. Ground level is defined at 0 meters or feet (z=0). The units of measure (feet or meters) are user-specified on the Job Parameters Page. For

at-grade links, the link height may be defined as 0 or a positive value. For fill links, CALINE4 always treats the link as though its height was zero. For depressed links, the depth of the depression should be indicated as a negative value. For parking lots, the link height should be defined as zero.

For bridges, Link Height defines the height of the bridge above the surface beneath it (a positive value), while the link itself is considered to be at z=0. **Figure 2-2** illustrates.

Figure 2-2. Illustration of link heights.

Mixing Zone Width: 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: CALINE4 is based on two somewhat restrictive assumptions:

1) horizontally homogeneous wind flow, and 2) steady-state meteorological conditions. Complex topography can invalidate each of these assumptions. Land features such as canyons can channel winds. Hills and valleys are likely to cause frequent shifts in wind direction. For these reasons, use of CALINE4 in complex terrain should be approached with care.

CALINE4 handles certain bluff and canyon situations by reflecting the plume at the distances specified on one or both sides of the mixing zone (Turner, 1970). CALINE4 assumes that the topographic barrier and wind direction are parallel to the roadway. CALINE4 also alters the vertical dispersion curve to account for vehicle-related heat flux distributed over the width of the canyon. This is especially important in the case of a narrow urban street canyon.

The Canyon/Bluff Mix feature has not been validated with field measurements. Only very rare circumstances warrant its use. Use extreme caution with this feature. Users of the Canyon Bluff Mix feature should be thoroughly familiar with dispersion modeling, with the key reference (Turner, 1970), and with the CALINE4 source code. All other users should leave the Canyon/Bluff input values set to zero, which disables the feature.

# 2.2.3 Link Activity Screen (see Figure 2-3) Note: If a multi-run scenario is selected on the Job Parameters page, additional data columns appear to contain data for 8 hours. Figure 2-3. Link Activity data entry screen.

The Link Activity screen defines the level of traffic and auto emission rate observed at each link.

<u>Traffic Volume</u>: The hourly traffic volume anticipated to travel on each link, in units of vehicles per hour. If a multi-run scenario is selected, traffic volume must be defined for 8 hours.

<u>Emission Factor</u>: The weighted average emission rate of the local vehicle fleet, expressed in terms of grams per mile per vehicle. *Emission factors should be modeled using the CT-EMFAC computer model*<sup>3</sup>. Emission rates vary by time of day. Therefore, if a multi-run scenario is selected, emission factors must be defined for 8 hours.

-

<sup>&</sup>lt;sup>3</sup> Download CT-EMFAC from the Caltrans web page.

### 2.2.4 Run Conditions Screen (see Figure 2-4)

Figure 2-4. Run Conditions data entry screen.

The Run Conditions screen contains the meteorological parameters needed to run CALINE4. Users should employ the worst-case meteorological conditions that can be anticipated at the project location. The selection of worst-case conditions should be made in consultation with the local air district.

Wind Speed – Expressed in meters per second. **Table 2-2** recommends worst-case wind speeds that were based on observations, or that represent the minimum choice available for CALINE4 (0.5 m/s). Alternatively, EPA (1992) recommends a value of 1 m/s as the worst-case wind speed. The local air district should be consulted to make a decision that is appropriate for the project location.

Wind Direction – The direction the wind is blowing from, measured clockwise in degrees from the north (0 = north, 90 = east, 180 = south, 270 = west). Most users should opt for the "Worst-Case Wind Angle" choice on the Job Parameters screen. If "Worst-Case" is selected, CALINE4 does not use this input.

Table 2-2. Worst-case meteorological inputs for the estimation of 1-hour CO concentrations (Nokes and Benson, 1985).

		Wind	Standard		
	Geographic	Speed	Deviation	Stability	Temperature
Time Period	Location	(m/s)	(degrees)	Class	Adjustment <sup>a</sup>
Morning	Coastal	0.5	10	G (7)	+ 5°F
(6–10 am)	Coastal Valley	0.5	20	G (7)	+ 5°F
	Central Valley	0.5	5	G (7)	+ 5°F
	Mountain	0.5	30	G (7)	+ 5°F
Midday	Coastal	1.0	25	D (4)	+ 10°F
(10 am-5 pm)	Coastal Valley	0.6	30	D (4)	+ 10°F
	Central Valley	0.5	20	D (4)	+ 10°F
	Mountain	0.9	30	D (4)	+ 10°F
Evening	Coastal	0.5	10	G (7)	+ 5°F
(5–9 pm)	Coastal Valley	0.5	10	G (7)	+ 5°F
	Central Valley	0.5	5	G (7)	+ 5°F
	Mountain	0.5	30	G (7)	+ 5°F
Nighttime	Coastal	0.5	5	G (7)	+ 0°F
(9 pm-6 am)	Coastal Valley	0.5	15	G (7)	+ 0°F
	Central Valley	0.5	10	G (7)	+ 0°F
	Mountain	0.5	20	G (7)	+ 0°F

<sup>a</sup>Add the temperature adjustment to the smallest mean minimum temperature observed in January over the past 3 years.

Source: CO Protocol.

Wind Direction Standard Deviation – The statistical standard deviation of the Wind Direction, sometimes termed "sigma theta". Table 2-2 provides guidance for this choice.

Atmospheric Stability Class – A measure of the turbulence of the atmosphere. This concept is discussed further in elementary meteorological textbooks. Values 1 through 7 correspond to the standard definitions for stability class A through E. Table 2-2 provides guidance for this choice. Stability class E (or 7) represents the most stable conditions.

Mixing Height – The altitude to which thermal turbulence occurs due to solar heating of the ground. This concept is discussed further in elementary meteorological textbooks. Reasonable values for the worst-case mixing height rarely have a significant impact on CALINE4 model results. If an extreme condition could be anticipated at the project location (mixing height  $\leq 10$  meters), the local air district should be consulted for guidance.

Ambient Temperature – The ambient air temperature significantly affects vehicle CO emissions. A temperature that reflects wintertime conditions should be selected, expressed in degrees Celsius. Table 2-2 describes a procedure that is appropriate for worst-case 1-hour analyses.

Ambient Pollutant Concentration – This measure reflects the pre-existing background level of carbon monoxide, expressed in parts per million. CALINE4 adds the pre-existing and

modeled CO concentrations together to determine the total impact at each receptor. Consult the CO Protocol and the local Air District for guidance.

### 2.2.5 Receptor Positions Screen (see Figure 2-5)

Figure 2-5. Receptor Positions data entry screen.

The Receptor Positions Screen contains the data inputs for all receptor positions, and also displays a diagram of the link geometry and receptor positions. Receptors should be defined with the same Cartesian coordinate system and units of measure as the link geometry. For each receptor (maximum no. of receptors = 20), space is provided for an 8-character description, the X-coordinate, the Y-coordinate, and the height (Z).

### 2.3 CALINE4 OUTPUT FILE

The CALINE4 output file is divided into four sections, Header, (I) Site Variables, (II) Link Variables, and (III) Receptor Locations and Model Results. **Figure 2-6** is an example output file (accompanies Example No. 2, included with CL4). The variables named in CALINE4 output files are defined below:

U = wind speed

Z0 = aerodynamic roughness coefficient

ALT = altitude above sea level

BRG = wind angle

VD = deposition velocity

CLAS = atmospheric stability class

VS = settling velocity

MIXH = atmospheric mixing height

AMB = ambient CO concentration

SIGTH= standard deviation of wind direction

TEMP= ambient temperature

Type = Link type (AG = at-grade, etc., DP = depressed, FL = fill, PK = parking lot)

VPH = Vehicles per hour

EF = Emission Factor

H = Link Height

W = Mixing Zone Width

Pred Conc = Predicted CO concentration at the receptor, including AMB

Conc/Link = The incremental CO concentration contributed by each link at a receptor position

AVG = Average 8-hour CO concentration predicted at the receptor

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL

JUNE 1989 VERSION

PAGE 1

JOB: Example Two: Rural Curved Alignment

RUN: (MULTI-RUN)
POLLUTANT: Carbon Monoxide

### I. SITE VARIABLES

VD= .0 CM/S Z0= 50. CM ALT= 0. (M) VS= .0 CM/S

### II. METEOROLOGICAL CONDITIONS

	RUN	*	U (M/S)	BRG (DEG)	CLASS	AMB (PPM)	MIXH (M)	SIGTH (DEG)	TEMP (C)
		*							
1. Ho	ur 1	*	.5	50.	7 (G)	3.0	1000.	25.00	5.0
2. Ho	ur 2	*	.5	45.	6 (F)	3.0	1000.	25.00	5.0
3. Ho	ur 3	*	1.0	45.	6 (F)	3.0	1000.	15.00	12.5
4. Ho	ur 4	*	1.5	30.	5 (E)	3.0	1000.	15.00	12.5
5. Ho	ur 5	*	2.5	30.	4 (D)	3.0	1000.	15.00	12.5
6. Ho	ur 6	*	2.5	30.	4 (D)	3.0	1000.	30.00	20.0
7. Ho	ur 7	*	2.5	90.	4 (D)	3.0	1000.	30.00	20.0
8. Ho	ur 8	*	2.5	90.	4 (D)	3.0	1000.	10.00	20.0

### III. LINK GEOMETRY

	LINK	LINK * LINK COORDINATES		INATES	(M)	*		H	W	
	DESCRIPTION	*	X1	Y1	X2	Y2	*	TYPE	(M)	(M)
		_*-					_ * .			
A.	Parking Lot	*	-707	-707	0	0	*	AG	.0	28.0
В.	В	*	0	0	120	175	*	DP	.0	28.0
C.	C	*	120	175	150	350	*	FL	.0	28.0
D.	D	*	150	350	150	1350	*	BG	.0	28.0
Ε.	E	*	150	1350	175	1510	*	PK	.0	28.0
F.	F	*	175	1510	265	1640	*	AG	.0	28.0
G.	G	*	265	1640	350	1760	*	AG	.0	28.0
н.	H	*	350	1760	475	1830	*	AG	.0	28.0
I.	I	*	475	1830	650	1850	*	AG	.0	28.0
J.	J	*	650	1850	1650	1850	*	AG	.0	28.0

Figure 2-6. Example of a CALINE4 output file.

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL

JUNE 1989 VERSION

PAGE 2

JOB: Example Two: Rural Curved Alignment

RUN: (MULTI-RUN)
POLLUTANT: Carbon Monoxide

### IV. EMISSIONS AND VEHICLE VOLUMES

		*	LINK										
]	RUN	*	A	В	С	D	E	F	G	Н	I	J	
		*											
1	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	
2	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.	30.		30.	30.		30.	30.	30.	30.	
		*											
3	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	
4	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
-	EF	*	30.			30.		30.			30.		
		*											
5	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	
6	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.			30.			30.	30.	30.	30.	
		*											
7	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	
		*											
8	VPH	*	8500	8500	8500	8500	8500	8500	8500	8500	8500	8500	
	EF	*	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	

### V. RECEPTOR LOCATIONS AND MULTI-RUN AVERAGE CONCENTRATIONS

*		COOR	DINATES	(M)	-	AVG
RECEPTOR	*	X	Y	Z	* (	PPM)
	_*				-*	
1. 1	*	400	1700	1.8	*	4.8
2. 2	*	100	1500	1.8	*	5.5
3. 3	*	200	1300	1.8	*	3.7
4. 4	*	100	350	1.8	*	6.4

Figure 2-6 (concluded). Example of a CALINE4 output file.

### 2.4 EXAMPLE JOBS INCLUDED WITH CL4

Three example jobs and their output files are included with CL4. In order to view the example jobs, click  $\underline{F}$ ile | Open from the CL4 menus. Select one of the following 3 \*.DAT files:

C:\Program Files\CL4\EX1A.DAT C:\Program Files\CL4\EX2.DAT C:\Program Files\CL4\EX2A.DAT

In order to view the corresponding output files, either run the CL4 program or use Windows 95 Notepad and click  $\underline{F}$ ile | Open. (Notepad is reached from the Windows 95 Start menu: Start | Programs | Accessories | Notepad.) Select one of the following 3 \*. OUT files:

C:\Program Files\CL4\EX1A.OUT C:\Program Files\CL4\EX2.OUT C:\Program Files\CL4\EX2A.OUT

Example 1A is a single-link, single-receptor scenario that uses a user-defined wind direction and calculates an 8-hour average CO concentration at the receptor. Example 2 is a curved road (10-link), 4-receptor scenario that uses the worst-case wind direction and calculates 1-hour CO concentrations at each receptor. Example 2A is similar to Example 2. However, for Example 2A, CALINE4 uses user-input wind directions and calculates 8-hour average CO concentrations at each receptor.

### 3. REFERENCES

- Caltrans (1989) *CALINE4 A Dispersion Model for Predicting Air Pollutant Concentrations Near Roadways*, Final Report prepared by the Caltrans Division of New Technology and Research (Report No. FHWA/CA/TL-84/15).
- EPA (1992) Guideline for Regulatory application of the Urban Airshed Model for Areawide Carbon Monoxide. Volume I: Technical Report. EPA-450/4-92-011a, Office of Air Quality Planning and Standards, Research Triangle Park, NC, June.
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- Turner, D.B. (1970) Workbook of Atmospheric Dispersion Estimates, Environmental Protection Agency.