APPENDIX N

A Comparison of Alternatives with Respect to Localized Diesel Particulate Matter Concentrations, Parsons Brinckerhoff, Inc., May 2003

I-710 Major Corridor Study – IDAS Parameters, Rates, Technical Memorandum, Cambridge Systematics, Inc., February 2003

A Comparison of Alternatives with Respect to Localized Diesel Particulate Matter Concentrations, Parsons Brinckerhoff, Inc., May 2003

I-710 MAJOR CORRIDOR STUDY

A COMPARISON OF ALTERNATIVES WITH RESPECT TO LOCALIZED DIESEL PARTICULATE MATTER CONCENTRATIONS

Prepared for

LOS ANGELES COUNTY
METROPOLITAN TRANSPORTATION AUTHORITY

Prepared by

PARSONS BRINCKERHOFF

May 2003

Introduction

Particulate matter from diesel-fueled engines has been identified as a toxic air contaminant (TAC) by the California Air Resources Board (ARB) and diesel particulate matter (DPM) is considered a TAC under California's air toxics program. The I-710 corridor is a major route that is heavily utilized by heavy-duty diesel truck traffic, and alternative design concepts for the expansion of this freeway are being considered that may affect DPM levels along the corridor. The purpose of this analysis is to estimate the potential effects of these concepts on localized DPM levels.

To estimate the relative health effects of the alternatives under consideration for the I-710 Major Corridor Study (MCS), a screening level mobile source air quality dispersion analysis was conducted. The purpose of this analysis was to understand the implications of different actions based on their estimated effect on DPM levels to help identify which elements of the alternatives should be carried forward into the environmental phase for further study. The screening analysis estimated DPM concentrations at selected distances from the I-710 freeway corridor for different design options near two representative roadway segments of I-710 – (1) between I-405 and Willow Street, and (2) between Rosecrans Avenue and Alondra Boulevard. These two sites were selected because residences are located very close to the existing I-710 travel lanes, heavy duty truck volumes are high, and because these locations capture differences in the physical attributes of the proposed alternatives. Future truck volumes for each lane of the various freeway segments were considered under AM peak, midday, PM peak, and nighttime traffic conditions.

The planning horizon year for the I-710 MCS is 2025. Federal planning guidelines and requirements for regionally significant transportation investment studies conducted in the Southern California Association of Governments (SCAG) region, such as the I-710 MCS, require future year analyses. The screening level mobile source air quality dispersion analysis was conducted at a level of environmental detail on par with the general design concepts of the proposed alternatives that were developed for the major corridor study.

It follows that the environmental studies on the Locally Preferred Strategy(ies) prepared in the subsequent environmental phase will include added, more detailed, air quality and health risk analysis consistent with California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) requirements for these environmental documents. This analysis will include consideration of potential mitigation measures, if applicable.

Diesel Particulate Matter

Diesel exhaust, which is produced when an engine burns diesel fuel and is commonly found throughout the environment, is emitted from a broad range of diesel engines: on road diesel engines of trucks, buses and cars and off road diesel engines that include locomotives, marine vessels and heavy duty equipment. Diesel exhaust is a complex mixture of thousands of gases and fine particles (commonly known as soot) that contains more than 40 toxic air contaminants. These include many known or suspected cancer-causing substances, such as benzene, arsenic, formaldehyde, and nickel. The sizes of DPM that are of greatest health concern are those that are in the categories of fine and ultra fine particles. The composition of these particles may be composed of elemental carbon with absorbed compounds such as organic compounds, sulfate, nitrate, metals and other trace elements.

Diesel exhaust particles and gases are suspended in the air, so exposure occurs whenever a person breathes air that contains these substances. The fine and ultra fine particles are

respirable, which means that they can avoid many of the human respiratory system defense mechanisms and enter deeply into the lung. Exposure to diesel exhaust matter comes from both on road and off road engine exhaust that is either directly emitted from the engines or aged through lingering in the atmosphere.

There is limited information on human exposure to just diesel particulate matter but there is enough evidence to indicate that inhalation exposure to diesel exhaust causes acute and chronic health effects. Based upon human and laboratory studies, there is considerable evidence that diesel exhaust is a likely carcinogen. In 1998, the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA) completed a comprehensive health assessment of diesel exhaust. OEHHA developed a cancer potency factor using DPM as a surrogate measure for diesel exhaust exposure. This assessment formed the basis for a decision by the California Air Resources Board (ARB) to formally identify particles in diesel exhaust as a toxic air contaminant that may pose a threat to human health. While potential impacts are of concern for diesel exhaust as a carcinogen, DPM also has non-carcinogen adverse health effects. In a recent review, the United State Environmental Protection Agency (USEPA) concluded that diesel exhaust is likely to be carcinogenic to humans, but considered that the exposure estimates in human studies were too uncertain to develop a confident carcinogenic unit risk for USEPA's use. [*Health Assessment Document for Diesel Engine Exhaust*. USEPA EPA/600/8-90/057F. May 01, 2002. U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, DC.]

The Scientific Review Panel (SRP) of the OEHHA, after reviewing the available health evidence, concluded the 3×10^{-4} $(\mu g/m^3)^{-1}$ is a reasonable unit risk factor (URF) for DPM. For evaluating potential risks, based on related studies ARB considers an increased cancer risk greater than ten in a million to be significant. [*Risk Management Guidance for the Permitting of New Stationary Diesel-Fueled Engines*. California Air Resources Board. October 2000.] Since the potential cancer risk of an action is calculated by multiplying the annual average concentration from inhalation by the URF, a change in DPM concentrations of 0.03 $\mu g/m^3$ would be considered significant.

Microscale Analysis

Analytical Approach

Mobile source dispersion models are the basic analytical tools used in air quality analyses to estimate pollutant concentrations expected under given conditions of traffic, roadway geometry, and meteorology.

CAL3QHC is a line-source dispersion model that predicts pollutant concentrations near congested intersections and heavily traveled roadways. Input parameters include emission rates of free flow and idling vehicles, roadway geometries, site characteristics, background pollutant concentrations, signal timing, and meteorological conditions. CAL3QHC predicts inert pollutant concentrations, averaged over a one-hour period, near roadways using stable meteorological conditions and peak-hour traffic flow. Pollutant concentrations for longer averaging times (e.g., 8-hours, 24-hour, and annual) are then estimated by multiplying the estimated 1-hour values by reasonably conservative persistence factors.

CAL3QHCR is a refinement to CAL3QHC in that it uses actual meteorological data as opposed to an assumed worst-case set of meteorological conditions. A comprehensive data set of hourly meteorological observations, provided by USEPA and compiled by the National Weather Service at the Los Angeles Airport over a period of one year, was used as inputs to the air quality analysis.

[*Meteorological Data*, U.S. Environmental Protection Agency, Technology Transfer Network, Support Center for Regulatory Air Models, through www.epa.gov/scram001/tt24.htm.] CAL3QHCR also allows the use of multiple sets of traffic conditions over a 24-hour period.

In summary, CAL3QHCR was used as the dispersion model for this analysis because of the following reasons:

- High traffic volumes and close proximity to sensitive land uses required more accurate pollutant estimates;
- Forecast traffic conditions for multiple traffic periods (i.e., AM peak, midday, PM peak, and nighttime) could be incorporated; and
- Health-risk assessments are based on estimated annual average pollutant concentrations, and CAL3QHCR can be utilized to directly estimate annual values.

Each freeway segment was considered in the modeling analysis to be an infinite line source. DPM concentrations at fixed distances from the center of the existing roadway were estimated for each design concept. The absolute coordinates from a fixed point, the roadway centerline, were used in order to take into account the different roadway widths of the different I-710 alternatives for purposes of directly comparing their estimated emissions levels to sensitive receptors located adjacent to the freeway.

Pollutant Emission Rates

Vehicular emissions were estimated for the 2025 analysis year using ARB's vehicular emission factor algorithm, EMFAC2002 v2.2. This model is recommended for use by ARB and guidance is given for its use in Caltrans's The U*se of EMFAC 2002 to replace CT-EMFAC A Users Guide*, dated February 27, 2003.

Emission factors were calculated for the South Coast Air Basin using an annual average season. Air basin specific default vehicle registration data, inspection and maintenance program parameters and mileage distribution parameters were used to calculate DPM emission factors.

Since the focus of this analysis is the potential health risks associated with diesel emissions, only tailpipe emissions, and not re-entrained dust from vehicle tires (or break or engine wear), were considered. Emission rates were calculated separately for each lane of I-710 traffic.

Two variables -- analysis year and vehicular (truck) speeds -- notably affected the estimated pollutant concentrations for this analysis, as follows:

- DPM emission factors are forecast to decrease in future years (as compared to existing values) due to increasingly stringent emission controls and the replacement or older, higher polluting, vehicles with newer, less polluting, ones. See Figure 1, which shows the relationship DPM emission factors with analysis year that is included in the EMFAC2002 v2.2 algorithm.
- DPM emission factors decrease with increased vehicular speeds (see Figure 2). This is based on ARB's belief that DPM emission trend closely resembles hydrocarbons. The fact that the I-710 Build alternatives all result in increased vehicular speeds, as compared to the future No Build scenario, is a major reason why estimated concentrations are lower with the Build alternatives. [Note: these results are closely tied with EMFAC2002 v2.2 (most recent version of this model currently available in April

2003). It is presumed that future environmental studies and DPM emissions analyses will incorporate ARB's future updates to the EMFAC model when these occur.]

Traffic Data

The amount of traffic, particularly heavy duty trucks, is projected to more than double on I-710 by the Year 2025. Future year truck volumes for each lane of the various I-710 segments were allocated based on traffic volumes and speeds developed by Cambridge Systematics, Inc. over a 24-hour timeframe according to four time periods. The 24-hour timeframe was divided into AM (6 AM-9 AM), Midday (9 AM-3 PM), PM (3 PM-7 PM) and nighttime (7 PM-6 AM) time periods. Heavy duty truck volumes tend to be highest during the Midday time period, which is why all four time periods were utilized in the analysis rather than relying exclusively on the AM and PM peak periods.

I-710 Design Concepts

Critical distances were estimated at the two analysis sites for the different alternatives given the truck volumes forecast on each lane of travel of each design concept. The alternatives are described in detail in *I-710 Major Corridor Study Final Set of Alternatives, Revised January 2003*. Since the vertical and horizontal configuration of each alternative varies along the full 18-mile length of the I-710 Corridor, typical sections were utilized in the screening level analysis to represent the physical characteristics of the roadway near the two analysis sites. At one of the sites, the truck lanes in Alternative E are transitioning from an at-grade configuration (E1) to an elevated configuration (E2) and thus both options were examined to bracket the results.

The following provides a summary description of some of the key roadway elements near the two sites in each alternative for I-710. See *I-710 Major Corridor Study Final Set of Alternatives, Revised January 2003* for the full list of all of the elements included in each alternative.

Alternative A – No Build

Future travel conditions on I-710 without any new changes. No new construction.

Alternative B – Transportation Systems Management/Transportation Demand Management (TSM/TDM)

Improve signage and aesthetics, provide additional ramp metering, and promote programs that encourage trucks to reduce emissions and to travel during off-peak hours. No new travel lanes.

Alternative C – Medium General Purpose/Medium Truck

a. Add one mixed flow lane in each direction between Imperial Blvd. & Atlantic Blvd.
b. Add one mixed flow lane in each direction between the Shoemaker Bridge Complex & I-405.
c. Add truck bypass lanes between Long Beach Blvd. and Imperial Blvd. Include truck inspection station between Long Beach Blvd. and Del Amo Blvd.
d. Provide collector-distributor system between Atlantic Blvd. & I-5.

Alternative D – High General Purpose/High HOV

a. Add two mixed flow lanes in each direction and add one HOV Lane in each direction, generally at grade, between Pacific Coast Highway & I-405.
b. Add one mixed flow lane in each direction at grade and add two HOV Lanes in each direction generally elevated in the median, between I-405 and Slauson Avenue.

Alternative E – High Truck Alternative

a. Configuration E1 - Add two truck lanes in each direction, generally at grade on the outside shoulder.
b. Configuration E2 – Add two truck lanes in each direction, generally on elevated structures located on each side of outside shoulder.

Results of the Microscale Analysis

The results of the analysis, which are provided in Tables 1 and 2 and highlighted in Figures 3 and 4, are as follows:

- DPM concentrations are lower under the future Build alternatives than the future No Build scenario due to lower emission rates associated with the higher vehicular speeds;
- Among the Build alternatives, DPM concentrations increase when ground-level truck-only lanes are located in the right-hand lanes (i.e., lanes closest to sensitive land uses);
- DPM concentrations with elevated truck-only lanes (Alternative E2) are lower compared to the ground-level truck-only lanes (Alternative E1), particularly at distances closest to the freeway.
- Alternative C and Alternative E2 exhibit the lowest DPM concentrations of the Build alternatives. Note: The truck bypass lanes contained in Alternative C results in lower DPM concentrations as trucks are able to maintain better speeds since they are routed around pockets of congestion. Between Rosecrans and Alondra, the configuration of the truck bypass lanes is similar to the elevated truck-only lanes in Alternative E2. Between I-405 and Willow Road, some trucks are drawn to the Terminal Island Freeway extension and away from I-710.

FIGURE 1 -
PM10 EMISSION FACTOR TRENDS FOR HHDT
EMISSION vs. YEAR (1990-2025)

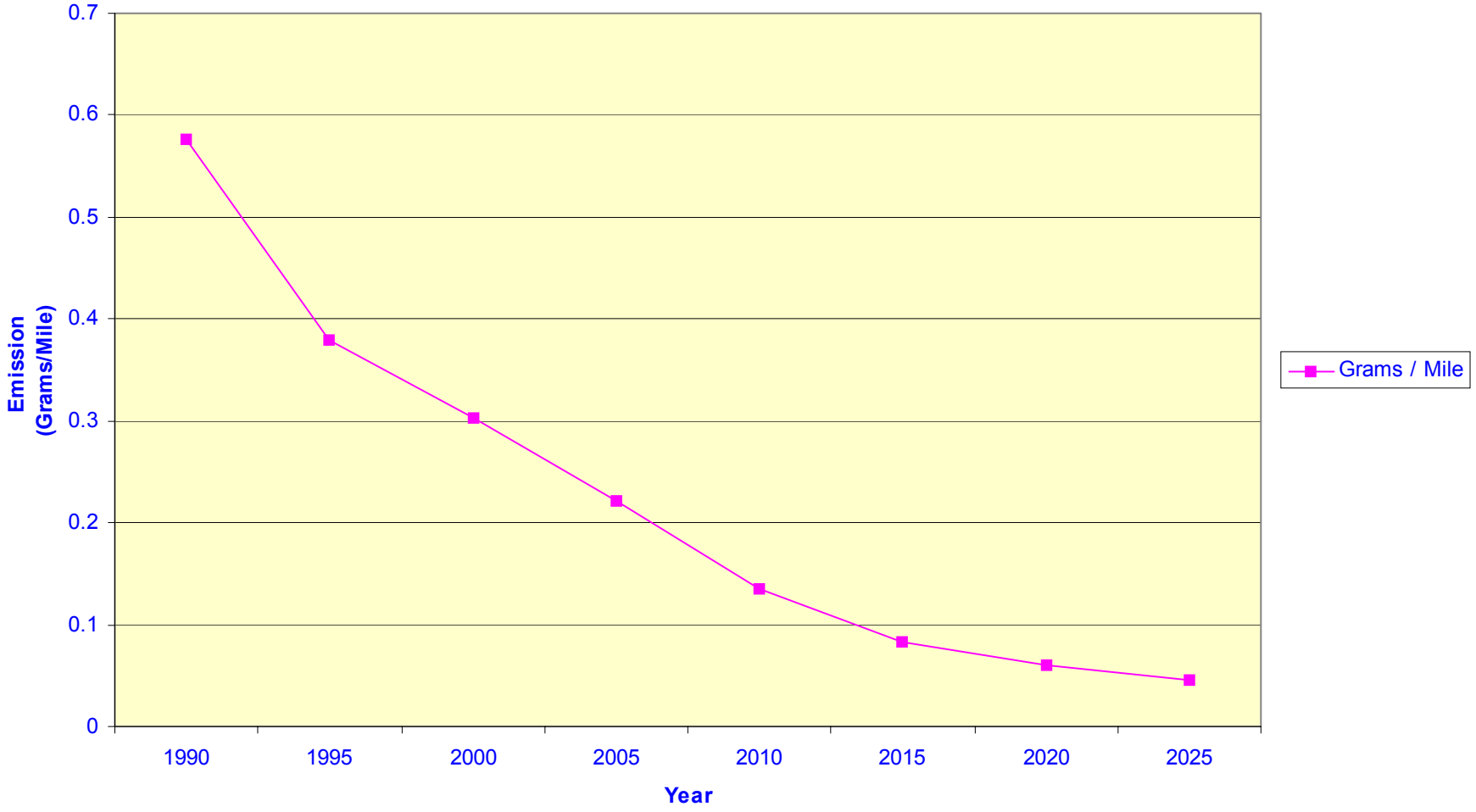


FIGURE 2 -
PM10 EMISSION FACTOR TRENDS FOR HHDT
EMISSION vs. SPEED

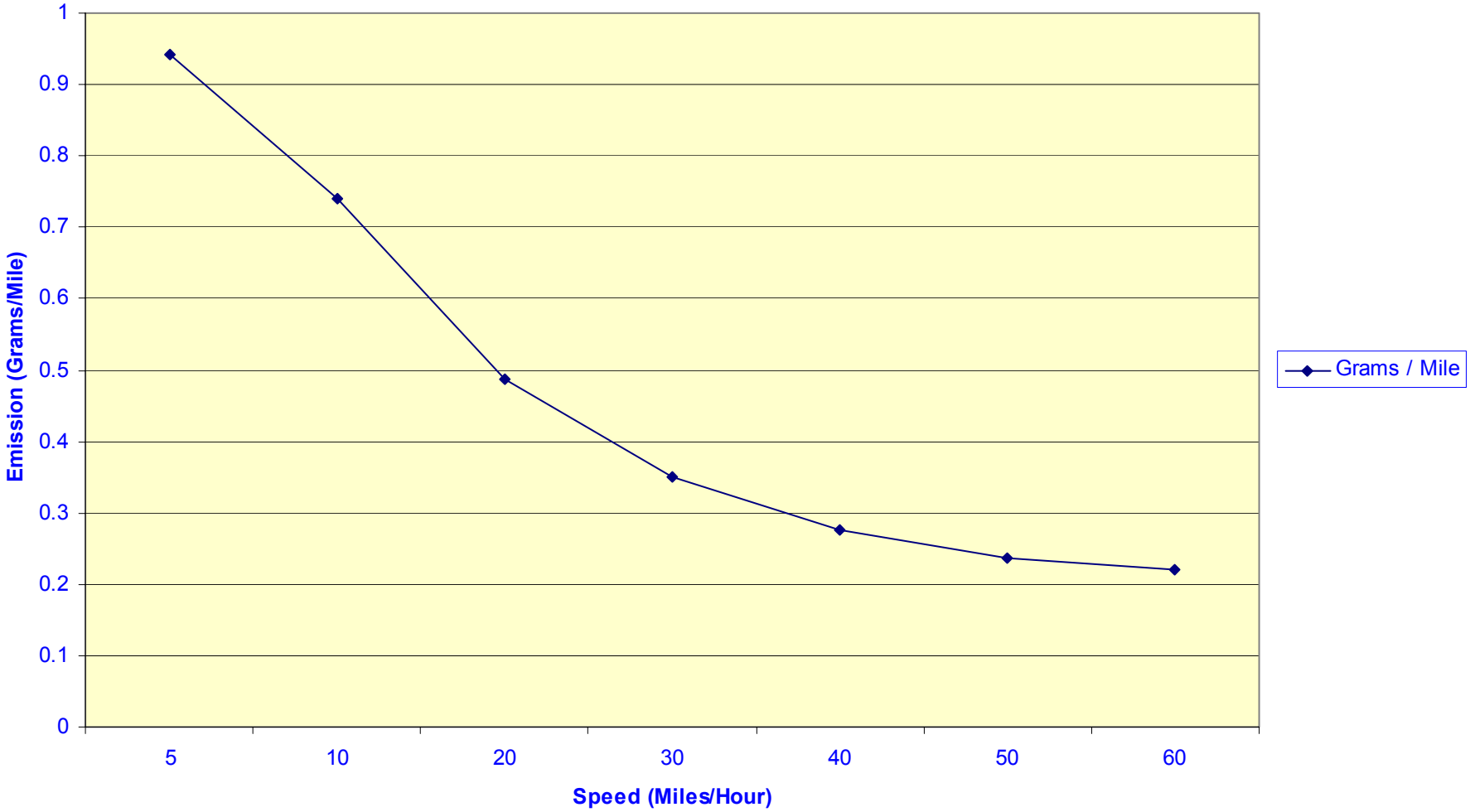


Table 1 - I-710 Corridor, between I-405 and Willow Road
Annual Exhaust DPM Concentrations and Comparison Between Alternatives ($\mu g/m^3$)

Receptor Distance from Centerline of Roadway	Alt. A (No Build)	Alt. B	Alt. C	Alt. D	Alt. E1 at-grade	Alt. E2 elevated	Impact of Alternatives over the No Build				
							B-A	C-A	D-A	E1-A	E2-A
117	0.41	0.32	0.27	0.41	0.38	0.25	-0.09	-0.14	0.00	-0.03	-0.16
162	0.31	0.24	0.20	0.30	0.27	0.21	-0.07	-0.11	-0.01	-0.04	-0.10
212	0.24	0.19	0.16	0.23	0.20	0.17	-0.05	-0.08	-0.01	-0.04	-0.07
262	0.20	0.16	0.13	0.18	0.16	0.14	-0.04	-0.07	-0.02	-0.04	-0.06
312	0.17	0.13	0.11	0.16	0.13	0.12	-0.04	-0.06	-0.01	-0.04	-0.05
362	0.14	0.12	0.10	0.13	0.11	0.11	-0.02	-0.04	-0.01	-0.03	-0.03
412	0.13	0.10	0.08	0.12	0.10	0.10	-0.03	-0.05	-0.01	-0.03	-0.03
462	0.11	0.09	0.08	0.10	0.09	0.08	-0.02	-0.03	-0.01	-0.02	-0.03
512	0.10	0.08	0.07	0.09	0.08	0.08	-0.02	-0.03	-0.01	-0.02	-0.02
562	0.09	0.07	0.06	0.08	0.07	0.07	-0.02	-0.03	-0.01	-0.02	-0.02
612	0.08	0.07	0.06	0.07	0.06	0.06	-0.01	-0.02	-0.01	-0.02	-0.02
662	0.08	0.06	0.05	0.07	0.06	0.06	-0.02	-0.03	-0.01	-0.02	-0.02
712	0.07	0.06	0.05	0.06	0.05	0.05	-0.01	-0.02	-0.01	-0.02	-0.02
762	0.06	0.05	0.04	0.06	0.05	0.05	-0.01	-0.02	0.00	-0.01	-0.01
812	0.06	0.05	0.04	0.05	0.04	0.04	-0.01	-0.02	-0.01	-0.02	-0.02
862	0.05	0.04	0.04	0.05	0.04	0.04	-0.01	-0.01	0.00	-0.01	-0.01
912	0.05	0.04	0.03	0.05	0.03	0.03	-0.01	-0.02	0.00	-0.02	-0.02
962	0.05	0.04	0.03	0.04	0.03	0.03	-0.01	-0.02	-0.01	-0.02	-0.02
1012	0.04	0.03	0.03	0.04	0.03	0.03	-0.01	-0.01	0.00	-0.01	-0.01
1062	0.04	0.03	0.02	0.04	0.02	0.02	-0.01	-0.02	0.00	-0.02	-0.02
1112	0.04	0.03	0.02	0.03	0.02	0.02	-0.01	-0.02	-0.01	-0.02	-0.02

Table 2 - I-710 Corridor, between Rosecrans and Alondra
Annual Exhaust DPM Concentrations and Comparison Between Alternatives ($\mu g/m^3$)

Receptor Distance from Centerline of Roadway	Alt. A (No Build)	Alt. B	Alt. C	Alt. D	Alt. E2 elevated	Impact of Alternatives over the No Build			
						B-A	C-A	D-A	E2-A
117	0.29	0.25	0.19	0.28	0.19	-0.04	-0.10	-0.01	-0.10
162	0.22	0.19	0.17	0.21	0.17	-0.03	-0.05	-0.01	-0.05
212	0.17	0.15	0.14	0.17	0.14	-0.02	-0.03	0.00	-0.03
262	0.14	0.12	0.12	0.14	0.11	-0.02	-0.02	0.00	-0.03
312	0.12	0.10	0.10	0.11	0.10	-0.02	-0.02	-0.01	-0.02
362	0.10	0.09	0.08	0.10	0.08	-0.01	-0.02	0.00	-0.02
412	0.09	0.08	0.07	0.09	0.07	-0.01	-0.02	0.00	-0.02
462	0.08	0.07	0.06	0.08	0.06	-0.01	-0.02	0.00	-0.02
512	0.07	0.06	0.05	0.07	0.05	-0.01	-0.02	0.00	-0.02
562	0.06	0.06	0.04	0.06	0.05	0.00	-0.02	0.00	-0.01
612	0.06	0.05	0.04	0.06	0.04	-0.01	-0.02	0.00	-0.02
662	0.05	0.05	0.03	0.05	0.04	0.00	-0.02	0.00	-0.01
712	0.05	0.04	0.03	0.05	0.03	-0.01	-0.02	0.00	-0.02
762	0.05	0.04	0.02	0.04	0.03	-0.01	-0.03	-0.01	-0.02
812	0.04	0.04	0.02	0.04	0.02	0.00	-0.02	0.00	-0.02
862	0.04	0.03	0.02	0.03	0.02	-0.01	-0.02	-0.01	-0.02
912	0.03	0.03	0.01	0.03	0.02	0.00	-0.02	0.00	-0.01
962	0.03	0.03	0.01	0.03	0.02	0.00	-0.02	0.00	-0.01
1012	0.03	0.02	0.01	0.03	0.01	-0.01	-0.02	0.00	-0.02
1062	0.02	0.02	0.01	0.02	0.01	0.00	-0.01	0.00	-0.01
1112	0.02	0.02	0.01	0.02	0.01	0.00	-0.01	0.00	-0.01

Figure 3 - DPM Concentrations Versus Distances From the Centerline of Roadway (between I-405 and Willow Road)

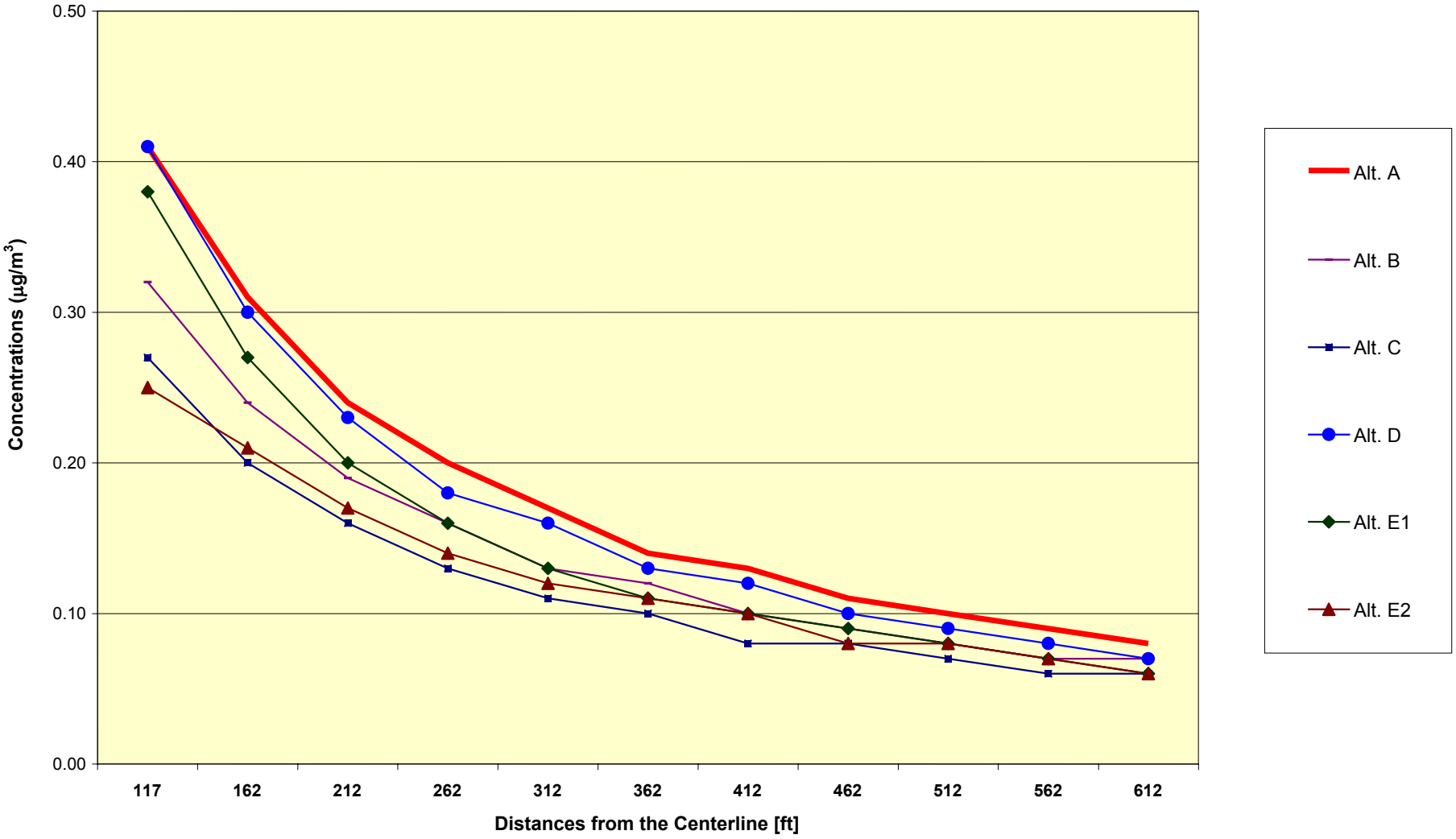
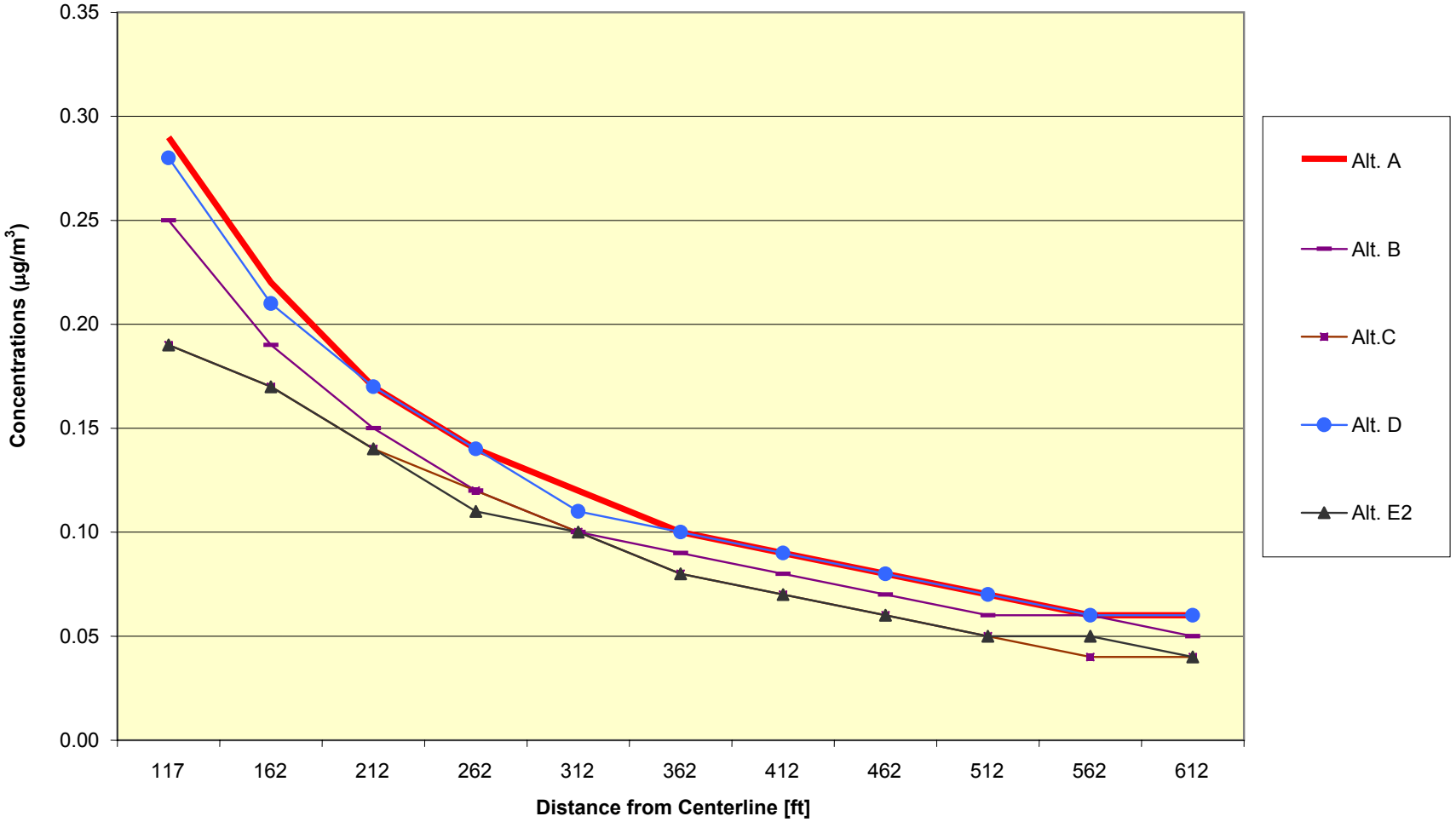


Figure 4 - DPM Concentrations versus Distances From the Roadway Centerline (between Rosecrans and Alondra)



I-710 Major Corridor Study – IDAS Parameters, Rates, Technical Memorandum, Cambridge Systematics, Inc., February 2003

Memorandum

TO: **David Levinsohn, PB**

FROM: **Janine Waliszewski, Krista Jeannotte, and Michael Fischer**

DATE: **February 28, 2003**

RE: **I-710 MCS – IDAS Parameters, Rates**

The purpose of this document is to present the proposed model parameters and rates which will be used in IDAS for the I-710 MCS. IDAS has been designed such that the user may adjust the assumptions and default parameter values for the alternatives analysis. This not only allows the user to tailor the analysis to reflect local conditions, but it ensures that IDAS is a transparent and systematic approach to benefits evaluation.

This document addresses the model specific parameters and rates (e.g., value of travel time, accident rates, etc.) and another memo will address the impact values (e.g., capacity improvements, ATIS market penetration and time savings, etc.) associated with the specific ITS components to be included in the No Build and TSM/TDM alternatives. We have identified whether we propose to use the IDAS default values or data specific to the Long Beach or Los Angeles County area, and the source of that data.

Several tables in this memo may be highly technical to someone unfamiliar with IDAS or modeling, in general. If you have any questions about the data or its relevance to IDAS, please feel free to contact us. For most of the data included, we suggest that you focus on the source of the data. Please indicate to us whether these are agreeable to you and, if not, what source/value you would rather we use. Note that complete tables are included for reference and documentation purposes.

In order to proceed with the post processor work in a timely fashion, we are requesting that you provide us with your feedback by Wednesday, March 5, 2003.

We appreciate your time and input. Please feel free to contact us if you have any questions or concerns.

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IDAS Setup

Facility Types

Table 1. Facility Type Description and V/C Curves Per Alternative

Facility Type	Description	V/C Curve
Alternatives A – D		
1	Freeway	Freeway
2	Major Arterial	Arterial
3	Minor Arterial	Arterial
4	Collector	Arterial
5	HOV	Freeway
6	Centroid Connector	Arterial
7	Ramp	Ramp
8	HOV MF	Freeway
9	Toll	Freeway
31	Ext Freeway	Freeway
35	Ext HOV	Freeway
38	Ext HOV MF	Freeway
Alternative E		
1	Freeway	Freeway
2	Major Arterial	Arterial
3	Minor Arterial	Arterial
4	Collector	Arterial
5	HOV	Freeway
6	Centroid Connector	Arterial
7	Ramp	Ramp
8	HOV MF	Freeway
9	Toll	Freeway
10	Truck Lanes	Freeway
11	Truck Connectors	Freeway
31	Ext Freeway	Freeway
35	Ext HOV	Freeway
38	Ext HOV MF	Freeway

Source: Kaku.

District

Table 2. District Assignment and Description

District Number	Description
1	Rest of Network
2	Study Area
3	I-710 Mainline

TPM Data

Table 3. Regionalized TPM Data

Centroid Data	
Maximum Centroid Connector	1,392
Area Type Data	**Description**
1	Urban
2	Suburban/Rural

Source: Kaku.

Import/Travel Demand Model Data

Market Sector

Table 4. Market Sectors Included in Model

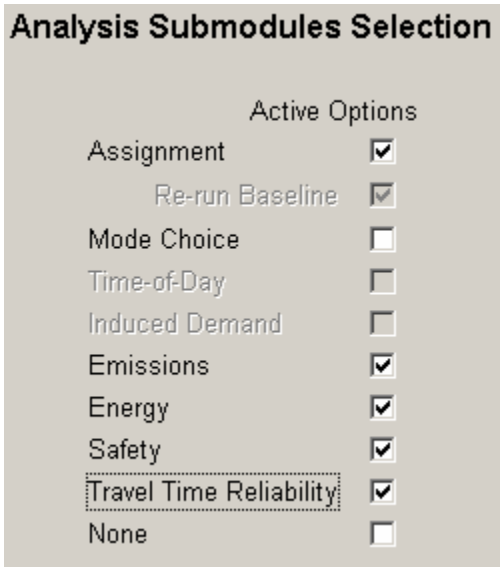
Sector Name	Type	Trip Type	Auto Vehicle Occupancy
Drive alone	Auto, single occupancy	Vehicle	1
Carpool	Auto, multiple occupancy	Vehicle	2.3
Light truck	Truck, commercial	Vehicle	1
Medium truck	Truck, commercial	Vehicle	1
Heavy truck	Truck, commercial	Vehicle	1

Source: Kaku.

Benefits Module

Analysis Options

Figure 1. IDAS Analysis Submodules Selection



Source: FHWA, IDAS.

Table 5. I-710 V/C Curve Modification

V/C Ratio	Urban Freeway	Suburban/ Rural Freeway (External Freeways)	Urban Arterial	Suburban/ Rural Arterial	Ramp
0	1.0000	1.0000	1.0000	1.0000	1.0000
0.2	0.9998	1.0000	0.9998	0.9998	0.9998
0.3	0.9988	1.0000	0.9988	0.9988	0.9988
0.5	0.9907	1.0000	0.9907	0.9907	0.9907
0.7	0.9652	0.9999	0.9652	0.9652	0.9652
0.8	0.9421	0.9999	0.9421	0.9421	0.9421
0.9	0.9104	0.9998	0.9104	0.9104	0.9104
1	0.8696	0.9998	0.8696	0.8696	0.8696
1.1	0.8199	0.9996	0.8199	0.8199	0.8199
1.2	0.7628	0.9995	0.7628	0.7628	0.7628
1.4	0.6344	0.9991	0.6344	0.6344	0.6344
1.6	0.5043	0.9984	0.5043	0.5043	0.5043
1.8	0.3884	0.9975	0.3884	0.3884	0.3884
2	0.2941	0.9962	0.2941	0.2941	0.2941
2.5	0.1458	0.9907	0.1458	0.1458	0.1458
3	0.0760	0.9809	0.0760	0.0760	0.0760
4	0.0254	0.9421	0.0254	0.0254	0.0254
5	0.0106	0.8696	0.0106	0.0106	0.0106
6	0.0051	0.7628	0.0051	0.0051	0.0051
12	0.0003	0.1673	0.0003	0.0003	0.0003

Source: Kaku.

Market Sector Selections

Table 6. Market Sectors Prohibited by Facility Type

Facility Type	Market Sector				
	Drive Alone	Carpool	Light Truck	Medium Truck	Heavy Truck
Alternative A–D					
Freeway					
Major Arterial					
Minor Arterial					
Collector					
HOV[1]					
Centroid Connector					
Ramp					
HOV MF	X		X	X	X
Toll					
Ext Freeway					
Ext HOV[1]					
Ext HOV MF	X		X	X	X
Alternative E					
Freeway					
Major Arterial					
Minor Arterial					
Collector					
HOV[1]					
Centroid Connector					
Ramp					
HOV MF	X		X	X	X
Toll					
Truck Lanes	X	X			
Truck Connectors	X	X			
Ext Freeway					
Ext HOV[1]					
Ext HOV MF	X		X	X	X

Source: Kaku.

[1] Prohibiting travel on HOV MF facilities will also prohibit travel on the HOV facilities.

Assignment Run Parameters

Table 7. Assignment Run Parameters

Maximum number of iterations	100
Percent equilibrium closure	0.005

Source: Kaku.

Emissions

The emission rates were obtained from the Emfac2002 V2.2 software tool using the parameters listed below.

- Geographical area = Los Angeles County;
- Method = Simple average;
- Calendar year = 2025;
- Season or month = Annual;
- Starting model year = 1980;
- Ending model year = 2025;
- Scenario type = Emfac;
- Output particulate = PM10;
- Output Hydrocarbons = ROG;
- Temperature = 65 degrees (average for Long Beach);
- Relative humidity = 60 percent (average for Long Beach); and
- Speed = 5 to 65 mph (at 5 mph speed intervals).

Table 8. Vehicle Class Percentages for EMFAC2002 Rates

Vehicle Type	Market Sector				
	Drive Alone	Carpool	Light-Heavy Trucks	Medium-Heavy Trucks	Heavy-Heavy Trucks
Light-Duty Auto (Passenger Cars), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Light-Duty Auto (Passenger Cars), Catalytic	0.56	0.96	0.00	0.00	0.00
Light-Duty Auto (Passenger Cars), Diesel	0.00	0.00	0.00	0.00	0.00
Light-Duty Trucks (Weight Class 0-3750), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Light-Duty Trucks (Weight Class 0-3750), Catalytic	0.18	0.00	0.00	0.00	0.00
Light-Duty Trucks (Weight Class 0-3750), Diesel	0.00	0.00	0.00	0.00	0.00
Light-Duty Trucks (Weight Class 3751-5750), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Light-Duty Trucks (Weight Class 3751-5750), Catalytic	0.17	0.00	0.00	0.00	0.00
Light-Duty Trucks (Weight Class 3751-5750), Diesel	0.00	0.00	0.00	0.00	0.00
Medium-Duty Trucks (Weight Class 5751-8500), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Medium-Duty Trucks (Weight Class 5751-8500), Catalytic	0.06	0.00	0.00	0.00	0.00
Medium-Duty Trucks (Weight Class 5751-8500), Diesel	0.00	0.00	0.00	0.00	0.00
Light-Heavy-Duty Trucks (Weight Class 8501-10000), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Light-Heavy-Duty Trucks (Weight Class 8501-10000), Catalytic	0.00	0.00	0.65	0.00	0.00
Light-Heavy-Duty Trucks (Weight Class 8501-10000), Diesel	0.00	0.00	0.14	0.00	0.00
Light-Heavy-Duty Trucks (Weight Class 10000-14000), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Light-Heavy-Duty Trucks (Weight Class 10000-14000), Catalytic	0.00	0.00	0.14	0.00	0.00
Light-Heavy-Duty Trucks (Weight Class 10000-14000), Diesel	0.00	0.00	0.07	0.00	0.00

Table 8. Vehicle Class Percentages for EMFAC2002 Rates (continued)

Vehicle Type	Market Sector				
	Drive Alone	Carpool	Light-Heavy Trucks	Medium-Heavy Trucks	Heavy-Heavy Trucks
Medium-Heavy-Duty Trucks (Weight Class 14001-33000), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Medium-Heavy-Duty Trucks (Weight Class 14001-33000), Catalytic	0.00	0.00	0.00	0.20	0.00
Medium-Heavy-Duty Trucks (Weight Class 14001-33000), Diesel	0.00	0.00	0.00	0.80	0.00
Heavy-Heavy-Duty Trucks (Weight Class 33001-60000), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Heavy-Heavy-Duty Trucks (Weight Class 33001-60000), Catalytic	0.00	0.00	0.00	0.00	0.00
Heavy-Heavy-Duty Trucks (Weight Class 33001-60000), Diesel	0.00	0.00	0.00	0.00	0.99
Line Haul Vehicles (Weight Class 60001+), Non-catalytic	0.00	0.00	0.00	0.00	0.00
Line Haul Vehicles (Weight Class 60001+), Catalytic	0.00	0.00	0.00	0.00	0.00
Line Haul Vehicles (Weight Class 60001+), Diesel	0.00	0.00	0.00	0.00	0.01
Urban Buses, Non-catalytic	0.00	0.00	0.00	0.00	0.00
Urban Buses, Catalytic	0.00	0.00	0.00	0.00	0.00
Urban Buses, Diesel	0.00	0.00	0.00	0.00	0.00
Motorcycles, Non-catalytic	0.01	0.00	0.00	0.00	0.00
Motorcycles, Catalytic	0.02	0.00	0.00	0.00	0.00
Motorcycles, Diesel	0.00	0.00	0.00	0.00	0.00
School Buses, Non-catalytic	0.00	0.00	0.00	0.00	0.00
School Buses, Catalytic	0.00	0.00	0.00	0.00	0.00
School Buses, Diesel	0.00	0.01	0.00	0.00	0.00
Motor Homes, Non-catalytic	0.00	0.00	0.00	0.00	0.00
Motor Homes, Catalytic	0.00	0.03	0.00	0.00	0.00
Motor Homes, Diesel	0.00	0.00	0.00	0.00	0.00

Notes:
[1] Used 2025 Emfac2002 vehicle percentages for Los Angeles County.
[2] Drive-alone percentages a function of LDA, LDT1, LDT2, MDT, and MCY.
[3] Carpool percentages a function of LDA, UB, SBUS, and MH. Increased value of 0.004 for SBUS to 0.01.
[4] Light-heavy truck percentages a function of LHDT1 and LHDT2.
[5] Medium-heavy truck percentages a function of MHDT.
[6] Heavy-heavy truck percentages a function of HHDT and LH. Increased LH to 0.01.

Both running exhaust emissions (grams per mile) and starting emissions (grams per trip) will be included in the analysis. The following list defines the acronyms used in the following emission tables:

- LDA = Light-Duty Auto (Passenger Cars);
- LDT1 = Light-Duty Trucks (Weight Class 0-3750);
- LDT2= Light-Duty Trucks (Weight Class 3751-5750);
- MDV = Medium-Duty Trucks (Weight Class 5751-8500);
- LHD1= Light-Heavy-Duty Trucks (Weight Class 8501-10000);
- LHD2 = Light-Heavy-Duty Trucks (Weight Class 10000-14000);
- MHD= Medium-Heavy-Duty Trucks (Weight Class 14001-33000);
- HHD = Heavy-Heavy-Duty Trucks (Weight Class 33001-60000);
- LHV= Line-Haul Vehicles (Weight Class 60001+);
- UB = Urban Buses;
- MCY= Motorcycles;
- SBUS = School Buses;
- MH= Motor Homes;
- NCAT = Non-catalytic;
- CAT = Catalytic; and
- DSL = Diesel.

Table 9. Reactive Org Gases – Running Exhaust Emissions (Grams/Mile)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.096	0.061	0.042	0.03	0.023	0.018	0.015	0.013	0.013	0.012	0.013	0.014	0.016
	DSL	0.433	0.34	0.273	0.224	0.187	0.161	0.141	0.126	0.116	0.108	0.104	0.101	0.101
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.179	0.118	0.082	0.059	0.045	0.036	0.031	0.027	0.025	0.024	0.025	0.027	0.031
	DSL	0.384	0.302	0.242	0.199	0.167	0.143	0.125	0.112	0.103	0.096	0.092	0.09	0.09
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.184	0.117	0.08	0.058	0.043	0.035	0.029	0.026	0.024	0.023	0.024	0.026	0.03
	DSL	0.225	0.177	0.142	0.116	0.098	0.084	0.073	0.066	0.06	0.056	0.054	0.053	0.053

Table 9. Reactive Org Gases – Running Exhaust Emissions (Grams/Mile) (continued)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
MDV	NCAT	6.56	4.644	3.436	2.659	2.153	1.825	1.622	1.511	1.476	1.514	1.629	1.837	2.171
	CAT	0.301	0.195	0.134	0.097	0.074	0.059	0.05	0.044	0.041	0.04	0.042	0.046	0.053
	DSL	0.226	0.177	0.142	0.117	0.098	0.084	0.074	0.066	0.06	0.057	0.054	0.053	0.053
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.073	0.047	0.032	0.023	0.017	0.013	0.01	0.009	0.008	0.007	0.007	0.006	0.007
	DSL	0.349	0.274	0.22	0.18	0.151	0.13	0.114	0.102	0.093	0.087	0.084	0.082	0.082
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.064	0.041	0.028	0.02	0.015	0.011	0.009	0.007	0.006	0.006	0.006	0.006	0.006
	DSL	0.327	0.257	0.206	0.169	0.142	0.122	0.107	0.095	0.087	0.082	0.078	0.077	0.077
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.326	0.211	0.143	0.1	0.073	0.056	0.044	0.036	0.031	0.028	0.027	0.027	0.028
	DSL	0.401	0.315	0.253	0.207	0.174	0.149	0.131	0.117	0.107	0.1	0.096	0.094	0.094
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	5.208	3.382	2.283	1.604	1.172	0.893	0.709	0.589	0.51	0.463	0.438	0.435	0.451
	DSL	0.535	0.42	0.337	0.276	0.232	0.199	0.174	0.156	0.143	0.134	0.128	0.125	0.125
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	5.998	3.923	2.675	1.899	1.406	1.085	0.872	0.731	0.639	0.583	0.554	0.55	0.569
	DSL	1.853	1.344	1.01	0.786	0.633	0.528	0.456	0.408	0.379	0.363	0.361	0.372	0.396
MCY	NCAT	5.764	4.532	3.729	3.212	2.898	2.74	2.715	2.819	3.067	3.496	4.172	5.212	6.812
	CAT	4.213	3.066	2.352	1.903	1.626	1.468	1.401	1.414	1.51	1.704	2.031	2.554	3.385
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2.565	1.67	1.132	0.797	0.585	0.446	0.355	0.295	0.256	0.232	0.22	0.218	0.226
	DSL	1.065	0.836	0.671	0.551	0.462	0.396	0.347	0.311	0.285	0.266	0.255	0.249	0.249
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.195	0.126	0.085	0.059	0.043	0.033	0.026	0.022	0.019	0.017	0.016	0.016	0.016
	DSL	0.211	0.165	0.133	0.109	0.091	0.078	0.069	0.061	0.056	0.053	0.05	0.049	0.049

Table 10. Carbon Monoxide – Running Exhaust Emissions (Grams/Mile)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1.414	1.272	1.151	1.047	0.958	0.88	0.812	0.753	0.702	0.657	0.619	0.586	0.558
	DSL	2.558	1.763	1.273	0.961	0.76	0.628	0.544	0.493	0.467	0.464	0.481	0.523	0.595
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2.779	2.441	2.169	1.947	1.764	1.612	1.486	1.381	1.295	1.225	1.172	1.135	1.117
	DSL	2.526	1.742	1.257	0.949	0.75	0.621	0.537	0.487	0.461	0.458	0.476	0.517	0.588
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2.713	2.429	2.189	1.986	1.813	1.664	1.535	1.424	1.328	1.246	1.177	1.119	1.073
	DSL	1.969	1.358	0.98	0.74	0.585	0.484	0.419	0.379	0.36	0.357	0.371	0.403	0.458
MDV	NCAT	100.7	73.38	56.32	45.53	38.76	34.75	32.8	32.62	34.15	37.66	43.73	53.47	68.87
	CAT	3.616	3.189	2.846	2.565	2.332	2.138	1.974	1.837	1.724	1.634	1.566	1.522	1.508
	DSL	1.979	1.364	0.985	0.744	0.588	0.486	0.421	0.381	0.361	0.359	0.373	0.405	0.46
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.987	0.657	0.462	0.343	0.269	0.223	0.195	0.181	0.177	0.183	0.199	0.23	0.28
	DSL	2.706	1.866	1.346	1.017	0.804	0.665	0.575	0.521	0.494	0.491	0.509	0.554	0.63
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.934	0.621	0.437	0.324	0.255	0.211	0.185	0.171	0.167	0.173	0.189	0.217	0.265
	DSL	2.587	1.784	1.287	0.972	0.768	0.636	0.55	0.498	0.473	0.469	0.487	0.529	0.602
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	4.368	2.906	2.043	1.517	1.19	0.987	0.864	0.8	0.782	0.808	0.882	1.017	1.239
	DSL	4.604	3.175	2.291	1.73	1.367	1.131	0.979	0.887	0.841	0.835	0.867	0.942	1.071
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	116.9	77.76	54.66	40.59	31.85	26.41	23.13	21.4	20.93	21.62	23.6	27.21	33.15
	DSL	3.972	2.739	1.976	1.493	1.18	0.976	0.845	0.765	0.726	0.72	0.748	0.813	0.924
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	34.9	23.22	16.32	12.12	9.511	7.885	6.907	6.392	6.249	6.456	7.046	8.125	9.9
	DSL	11.3	7.113	4.754	3.373	2.542	2.034	1.728	1.559	1.493	1.519	1.64	1.881	2.291
MCY	NCAT	41.81	34.29	29.62	26.94	25.81	26.03	27.65	30.94	36.45	45.23	59.1	81.32	117.8
	CAT	13.55	12.2	11.11	10.23	9.515	8.945	8.516	8.236	8.132	8.256	8.71	9.675	11.49
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	29.36	19.54	13.73	10.2	8.002	6.634	5.811	5.377	5.258	5.431	5.928	6.836	8.329
	DSL	9.718	6.701	4.836	3.652	2.886	2.388	2.067	1.872	1.775	1.762	1.829	1.988	2.261
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	3.046	2.027	1.425	1.058	0.83	0.688	0.603	0.558	0.545	0.564	0.615	0.709	0.864
	DSL	2.327	1.605	1.158	0.875	0.691	0.572	0.495	0.448	0.425	0.422	0.438	0.476	0.542

Table 11. Oxides of Nitrogen – Running Exhaust Emissions (Grams/Mile)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.118	0.102	0.09	0.08	0.074	0.069	0.065	0.063	0.062	0.062	0.064	0.067	0.072
	DSL	1.914	1.588	1.365	1.216	1.122	1.073	1.063	1.091	1.161	1.28	1.461	1.729	2.12
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.264	0.223	0.194	0.172	0.156	0.145	0.138	0.135	0.134	0.137	0.143	0.152	0.167
	DSL	1.878	1.558	1.339	1.193	1.101	1.053	1.043	1.071	1.139	1.255	1.434	1.696	2.08
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.308	0.264	0.231	0.207	0.189	0.176	0.167	0.162	0.16	0.161	0.166	0.175	0.189
	DSL	1.981	1.644	1.413	1.258	1.161	1.111	1.1	1.13	1.202	1.324	1.512	1.789	2.194
MDV	NCAT	2.387	2.51	2.636	2.764	2.895	3.027	3.162	3.298	3.435	3.573	3.711	3.85	3.989
	CAT	0.462	0.394	0.344	0.308	0.281	0.262	0.25	0.243	0.242	0.246	0.255	0.271	0.295
	DSL	1.977	1.64	1.41	1.256	1.159	1.108	1.098	1.127	1.199	1.322	1.509	1.786	2.19
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.105	0.11	0.116	0.121	0.126	0.132	0.137	0.142	0.148	0.153	0.158	0.164	0.169
	DSL	1.862	1.545	1.328	1.183	1.092	1.044	1.034	1.062	1.129	1.245	1.421	1.682	2.062
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.104	0.109	0.114	0.12	0.125	0.13	0.135	0.141	0.146	0.151	0.156	0.162	0.167
	DSL	1.689	1.401	1.205	1.073	0.99	0.947	0.938	0.963	1.024	1.129	1.289	1.526	1.87
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.291	0.305	0.32	0.335	0.35	0.364	0.379	0.394	0.409	0.423	0.438	0.453	0.468
	DSL	2.509	2.082	1.79	1.594	1.471	1.407	1.394	1.431	1.522	1.677	1.915	2.266	2.779
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	3.778	3.969	4.161	4.352	4.544	4.735	4.927	5.118	5.31	5.501	5.693	5.884	6.076
	DSL	2.188	1.815	1.561	1.39	1.283	1.227	1.215	1.248	1.327	1.463	1.67	1.976	2.423
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2.282	2.397	2.513	2.628	2.744	2.86	2.975	3.091	3.207	3.322	3.438	3.554	3.669
	DSL	24.42	18.68	15.02	12.7	11.28	10.54	10.35	10.69	11.6	13.24	15.89	20.03	26.56
MCY	NCAT	0.998	1.046	1.095	1.145	1.196	1.247	1.298	1.35	1.401	1.453	1.505	1.556	1.608
	CAT	1.211	1.112	1.038	0.984	0.947	0.926	0.917	0.922	0.939	0.97	1.016	1.079	1.162
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1.276	1.34	1.405	1.47	1.534	1.599	1.664	1.728	1.793	1.858	1.922	1.987	2.052
	DSL	11.65	9.669	8.312	7.403	6.832	6.533	6.473	6.645	7.069	7.791	8.897	10.53	12.91
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.201	0.211	0.222	0.232	0.242	0.252	0.262	0.273	0.283	0.293	0.303	0.313	0.324
	DSL	3.432	2.848	2.448	2.18	2.012	1.924	1.906	1.957	2.082	2.294	2.62	3.1	3.801

Table12. Carbon Dioxide – Running Exhaust Emissions (Grams/Mile)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	945.6	714.5	560.4	456.2	385.4	338	307.6	290.6	284.9	289.9	306.1	335.6	381.8
	DSL	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2	353.2
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1,189	898.2	704.4	573.4	484.5	424.8	386.6	365.2	358.1	364.4	384.8	421.8	479.9
	DSL	348	348	348	348	348	348	348	348	348	348	348	348	348
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1,189	898.7	704.8	573.7	484.7	425.1	386.9	365.4	358.3	364.6	385.1	422.1	480.2
	DSL	346.1	346.1	346.1	346.1	346.1	346.1	346.1	346.1	346.1	346.1	346.1	346.1	346.1
MDV	NCAT	1,848	1,396	1,095	891.5	753.2	660.5	601.1	567.8	556.7	566.5	598.3	655.9	746.2
	CAT	1,623	1,226	961.6	782.8	661.3	579.9	527.8	498.6	488.8	497.4	525.3	575.9	655.2
	DSL	345.9	345.9	345.9	345.9	345.9	345.9	345.9	345.9	345.9	345.9	345.9	345.9	345.9
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	519.1	519.1	519.1	519.1	519.1	519.1	519.1	519.1	519.1	519.1	519.1	519.1	519.1
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	519.7	519.7	519.7	519.7	519.7	519.7	519.7	519.7	519.7	519.7	519.7	519.7	519.7
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	2,179	2,179	2,179	2,179	2,179	2,179	2,179	2,179	2,179	2,179	2,179	2,179	2,179
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	2,518	2,518	2,518	2,518	2,518	2,518	2,518	2,518	2,518	2,518	2,518	2,518	2,518
MCY	NCAT	232.5	198.9	172.8	152.5	136.6	124.4	114.9	107.9	102.8	99.56	97.88	97.73	99.1
	CAT	282.6	233.1	199.3	176.5	162	154.2	152	155.5	164.9	181.4	207.2	245.6	302.3
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2,514	1,672	1,175	873	685	567.9	497.4	460.3	450.1	465	507.5	585.2	713
	DSL	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505	1,505

Table 13. Sulfur Dioxide – Running Exhaust Emissions (Grams/Mile)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.009	0.007	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.004
	DSL	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.011	0.009	0.007	0.006	0.005	0.004	0.004	0.004	0.003	0.004	0.004	0.004	0.005
	DSL	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.011	0.009	0.007	0.006	0.005	0.004	0.004	0.004	0.003	0.004	0.004	0.004	0.005
	DSL	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MDV	NCAT	0.02	0.015	0.012	0.009	0.008	0.007	0.006	0.006	0.006	0.006	0.007	0.007	0.008
	CAT	0.016	0.012	0.009	0.008	0.006	0.006	0.005	0.005	0.005	0.005	0.005	0.006	0.006
	DSL	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.024	0.016	0.011	0.008	0.007	0.005	0.005	0.004	0.004	0.004	0.005	0.006	0.007
	DSL	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.024	0.016	0.011	0.008	0.007	0.005	0.005	0.004	0.004	0.004	0.005	0.006	0.007
	DSL	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.024	0.016	0.011	0.008	0.007	0.005	0.005	0.004	0.004	0.004	0.005	0.006	0.007
	DSL	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.026	0.017	0.012	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005	0.006	0.007
	DSL	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.025	0.017	0.012	0.009	0.007	0.006	0.005	0.005	0.004	0.005	0.005	0.006	0.007
	DSL	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024	0.024
MCY	NCAT	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
	CAT	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.025	0.016	0.012	0.009	0.007	0.006	0.005	0.005	0.004	0.005	0.005	0.006	0.007
	DSL	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.024	0.016	0.011	0.008	0.007	0.005	0.005	0.004	0.004	0.004	0.005	0.006	0.007
	DSL	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014

Table 14. PM10 – Running Exhaust Emissions (Grams/Mile)

Vehicle Type	Fuel Type	Speed (mph)												
		5	10	15	20	25	30	35	40	45	50	55	60	65
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.06	0.039	0.026	0.019	0.014	0.012	0.01	0.009	0.008	0.008	0.008	0.009	0.011
	DSL	0.237	0.186	0.149	0.123	0.103	0.088	0.077	0.069	0.063	0.059	0.057	0.056	0.056
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.068	0.044	0.03	0.022	0.017	0.013	0.011	0.01	0.01	0.009	0.01	0.011	0.012
	DSL	0.191	0.15	0.12	0.099	0.083	0.071	0.062	0.056	0.051	0.048	0.046	0.045	0.045
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.149	0.097	0.066	0.048	0.036	0.029	0.025	0.022	0.021	0.02	0.021	0.023	0.027
	DSL	0.12	0.094	0.075	0.062	0.052	0.044	0.039	0.035	0.032	0.03	0.029	0.028	0.028
MDV	NCAT	0.119	0.085	0.063	0.049	0.04	0.034	0.031	0.029	0.028	0.029	0.031	0.035	0.041
	CAT	0.15	0.098	0.067	0.049	0.037	0.03	0.025	0.022	0.021	0.021	0.022	0.024	0.027
	DSL	0.118	0.093	0.075	0.061	0.051	0.044	0.039	0.035	0.032	0.03	0.028	0.028	0.028
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.049	0.032	0.022	0.015	0.011	0.009	0.007	0.006	0.005	0.005	0.005	0.005	0.005
	DSL	0.059	0.046	0.037	0.031	0.026	0.022	0.019	0.017	0.016	0.015	0.014	0.014	0.014
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.046	0.03	0.021	0.015	0.011	0.008	0.007	0.006	0.005	0.005	0.004	0.004	0.004
	DSL	0.074	0.058	0.047	0.038	0.032	0.028	0.024	0.022	0.02	0.019	0.018	0.017	0.017
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.047	0.031	0.021	0.015	0.011	0.009	0.007	0.006	0.005	0.005	0.004	0.004	0.005
	DSL	0.344	0.27	0.216	0.178	0.149	0.128	0.112	0.1	0.092	0.086	0.082	0.08	0.08
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.088	0.057	0.039	0.028	0.021	0.016	0.013	0.011	0.01	0.009	0.008	0.008	0.009
	DSL	0.199	0.156	0.125	0.103	0.086	0.074	0.065	0.058	0.053	0.05	0.048	0.047	0.047
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.091	0.06	0.041	0.029	0.022	0.017	0.013	0.011	0.01	0.009	0.009	0.009	0.009
	DSL	0.68	0.493	0.37	0.288	0.232	0.194	0.167	0.15	0.139	0.133	0.132	0.136	0.145
MCY	NCAT	0.08	0.063	0.052	0.045	0.041	0.039	0.038	0.04	0.043	0.049	0.058	0.073	0.095
	CAT	0.006	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.062	0.041	0.028	0.02	0.015	0.011	0.009	0.008	0.007	0.006	0.006	0.006	0.006
	DSL	0.73	0.573	0.46	0.377	0.316	0.271	0.238	0.213	0.195	0.183	0.175	0.171	0.171
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.017	0.011	0.007	0.005	0.004	0.003	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	DSL	0.254	0.199	0.16	0.131	0.11	0.094	0.083	0.074	0.068	0.063	0.061	0.059	0.059

Table 15. Reactive Org Gases – Starting Emissions (Grams/Trip)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.014	0.028	0.053	0.077	0.098	0.116	0.133	0.181	0.161	0.17	0.179	0.189	0.198	0.207	0.215	0.224	0.232	0.24
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.02	0.04	0.076	0.109	0.139	0.165	0.187	0.242	0.219	0.232	0.245	0.257	0.269	0.281	0.292	0.304	0.315	0.326
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.022	0.044	0.084	0.121	0.155	0.186	0.214	0.306	0.271	0.288	0.304	0.32	0.336	0.351	0.366	0.381	0.396	0.411
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MDV	NCAT	1.088	1.079	1.089	1.138	1.225	1.352	1.405	1.253	1.364	1.475	1.585	1.696	1.807	1.918	2.029	2.14	2.251	2.362
	CAT	0.037	0.073	0.141	0.202	0.258	0.308	0.352	0.479	0.429	0.455	0.48	0.505	0.529	0.553	0.577	0.6	0.622	0.645
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.086	0.17	0.328	0.475	0.61	0.733	0.845	1.199	1.158	1.229	1.299	1.368	1.437	1.504	1.571	1.636	1.701	1.765
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.082	0.162	0.313	0.453	0.581	0.699	0.806	1.147	1.108	1.176	1.243	1.309	1.374	1.439	1.503	1.566	1.628	1.689
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.21	0.41	0.777	1.101	1.383	1.622	1.818	1.868	1.982	2.093	2.199	2.303	2.402	2.498	2.591	2.679	2.764	2.846
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 16. Reactive Org Gases – Starting Emissions (Grams/Trip) (continued)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1.066	2.078	3.939	5.584	7.012	8.224	9.219	9.417	9.992	10.549	11.088	11.608	12.11	12.594	13.06	13.507	13.936	14.347
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.543	1.058	2.006	2.844	3.571	4.188	4.695	4.744	5.034	5.315	5.586	5.848	6.101	6.345	6.579	6.805	7.021	7.228
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCY	NCAT	1.691	1.676	1.692	1.768	1.904	2.1	2.184	1.946	2.119	2.291	2.464	2.636	2.808	2.981	3.153	3.325	3.498	3.67
	CAT	0.275	0.537	1.018	1.443	1.812	2.125	2.382	2.762	2.521	2.661	2.797	2.929	3.055	3.177	3.295	3.408	3.516	3.62
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.327	0.637	1.207	1.711	2.149	2.52	2.825	2.891	3.067	3.238	3.404	3.563	3.717	3.866	4.009	4.146	4.278	4.404
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.119	0.233	0.441	0.626	0.786	0.921	1.033	1.056	1.121	1.183	1.243	1.302	1.358	1.412	1.465	1.515	1.563	1.609
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 17 Carbon Monoxide – Starting Emissions (Grams/Trip)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.188	0.371	0.718	1.043	1.344	1.622	1.878	2.713	2.224	2.373	2.507	2.628	2.734	2.826	2.903	2.966	3.015	3.049
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.293	0.576	1.112	1.609	2.067	2.486	2.866	3.871	3.262	3.451	3.625	3.783	3.927	4.055	4.168	4.266	4.348	4.415
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.307	0.606	1.176	1.71	2.208	2.671	3.098	4.558	3.743	4.012	4.253	4.466	4.652	4.81	4.941	5.044	5.119	5.167
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MDV	NCAT	14.908	13.202	10.191	7.717	5.78	4.379	3.516	10.619	16.78	22.287	27.141	31.343	34.891	37.787	40.03	41.62	42.557	42.842
	CAT	0.455	0.896	1.734	2.515	3.239	3.906	4.515	6.39	5.278	5.619	5.929	6.207	6.454	6.669	6.852	7.004	7.124	7.213
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.948	1.87	3.637	5.299	6.857	8.311	9.661	13.677	11.856	12.763	13.572	14.283	14.895	15.409	15.824	16.14	16.358	16.478
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.989	1.951	3.791	5.521	7.141	8.651	10.051	14.159	12.329	13.256	14.084	14.813	15.443	15.974	16.405	16.737	16.97	17.104
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	3.542	6.94	13.304	19.093	24.306	28.943	33.005	32.597	33.55	34.534	35.55	36.597	37.676	38.786	39.927	41.1	42.304	43.539
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	18.609	36.462	69.9	100.31	127.7	152.07	173.41	170.05	175.02	180.15	185.45	190.91	196.54	202.33	208.28	214.4	220.68	227.13
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 17. Carbon Monoxide – Starting Emissions (Grams/Trip) (continued)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	6.441	12.621	24.194	34.721	44.201	52.635	60.021	58.099	59.797	61.552	63.362	65.228	67.151	69.129	71.163	73.253	75.4	77.602
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCY	NCAT	6.24	5.526	4.266	3.23	2.419	1.833	1.472	4.445	7.023	9.328	11.36	13.119	14.604	15.816	16.755	17.421	17.813	17.932
	CAT	1.582	3.101	5.944	8.53	10.859	12.931	14.746	18.947	14.603	15.032	15.474	15.93	16.399	16.882	17.379	17.89	18.414	18.951
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	5.21	10.208	19.57	28.084	35.752	42.573	48.548	47.737	49.132	50.574	52.061	53.595	55.174	56.8	58.471	60.188	61.952	63.761
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2.15	4.212	8.075	11.588	14.752	17.567	20.032	19.705	20.281	20.876	21.49	22.123	22.775	23.446	24.136	24.845	25.572	26.319
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

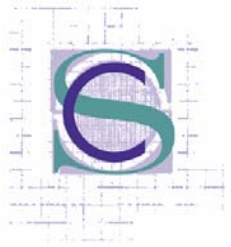


Table 18. Oxides of Nitrogen – Starting Emissions (Grams/Trip)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.059	0.067	0.081	0.092	0.101	0.108	0.112	0.119	0.121	0.12	0.119	0.117	0.115	0.112	0.109	0.105	0.101	0.097
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.077	0.09	0.113	0.131	0.146	0.157	0.164	0.172	0.175	0.174	0.172	0.17	0.167	0.163	0.159	0.154	0.149	0.143
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.157	0.173	0.202	0.226	0.245	0.26	0.27	0.288	0.293	0.291	0.288	0.283	0.278	0.271	0.263	0.253	0.243	0.231
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MDV	NCAT	0.827	0.899	1.03	1.144	1.24	1.318	1.379	1.402	1.368	1.324	1.269	1.203	1.126	1.038	0.94	0.83	0.71	0.579
	CAT	0.19	0.216	0.262	0.301	0.331	0.354	0.369	0.39	0.396	0.393	0.389	0.383	0.376	0.368	0.358	0.346	0.333	0.318
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1.251	1.359	1.553	1.716	1.848	1.95	2.022	2.172	2.176	2.16	2.135	2.1	2.056	2.002	1.939	1.866	1.784	1.693
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1.199	1.314	1.519	1.691	1.83	1.936	2.009	2.151	2.155	2.139	2.115	2.081	2.038	1.987	1.926	1.856	1.777	1.688
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.741	1.116	1.776	2.313	2.728	3.021	3.192	3.228	3.216	3.198	3.173	3.143	3.106	3.062	3.013	2.957	2.895	2.827
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	3.688	5.556	8.838	11.51	13.58	15.04	15.89	16.07	16.01	15.92	15.8	15.64	15.46	15.24	14.998	14.721	14.412	14.073
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 18. Oxides of Nitrogen – Starting Emissions (Grams/Trip) (continued)

Vehicle Type	Fuel Type	Time (Minutes)																
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	2.148	3.237	5.148	6.706	7.91	8.76	9.255	9.358	9.324	9.271	9.201	9.112	9.005	8.88	8.736	8.575	8.395	8.198
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCY	NCAT	0.284	0.309	0.354	0.393	0.426	0.453	0.474	0.482	0.47	0.455	0.436	0.413	0.387	0.357	0.323	0.285	0.244	0.199
	CAT	0.094	0.142	0.226	0.294	0.347	0.385	0.406	0.408	0.409	0.407	0.404	0.4	0.395	0.39	0.384	0.377	0.369	0.36
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	1.042	1.57	2.497	3.253	3.836	4.249	4.489	4.539	4.522	4.497	4.463	4.42	4.368	4.307	4.237	4.159	4.072	3.976
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.421	0.634	1.008	1.313	1.549	1.715	1.812	1.833	1.826	1.816	1.802	1.784	1.763	1.739	1.711	1.679	1.644	1.605
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

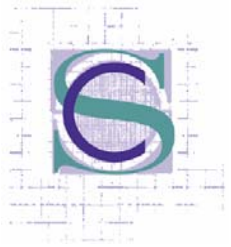


Table 19. Carbon Dioxide – Starting Emissions (Grams/Trip)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	12	13.6	17.27	21.58	26.54	32.14	38.39	88.45	100.5	112.6	124.5	136.5	148.4	160.2	171.976	183.717	195.411	207.057
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	14.85	16.94	21.72	27.28	33.63	40.76	48.68	111.2	126.5	141.7	156.8	171.9	186.8	201.7	216.446	231.132	245.73	260.24
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	15.02	17.05	21.71	27.18	33.45	40.52	48.4	111.2	126.4	141.6	156.7	171.7	186.6	201.5	216.298	231.036	245.706	260.307
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MDV	NCAT	157.4	170.8	196.8	221.7	245.6	268.5	290.3	392.8	393.1	393.4	393.7	394	394.3	394.6	394.947	395.256	395.564	395.873
	CAT	20	22.95	29.65	37.4	46.19	56.03	66.92	151.7	172.7	193.6	214.3	234.9	255.3	275.6	295.664	315.619	335.421	355.071
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	23.72	27.82	36.93	47.23	58.72	71.39	85.26	188.6	215.3	241.8	267.8	293.6	319	344.1	368.922	393.377	417.506	441.309
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	23.8	27.88	36.93	47.17	58.61	71.26	85.1	188.6	215.3	241.7	267.7	293.5	318.9	344	368.813	393.295	417.462	441.314
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	9.546	19.04	37.87	56.48	74.89	93.08	111.1	188.9	223.2	255.4	285.6	313.8	340	364.2	386.319	406.43	424.519	440.585
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	9.546	19.04	37.87	56.48	74.89	93.08	111.1	188.9	223.2	255.4	285.6	313.8	340	364.2	386.319	406.43	424.519	440.585
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 19. Carbon Dioxide – Starting Emissions (Grams/Trip) (continued)

Vehicle Type	Fuel Type	Time (Minutes)																
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	9.546	19.04	37.87	56.48	74.89	93.08	111.1	188.9	223.2	255.4	285.6	313.8	340	364.2	386.319	406.43	424.519	440.586
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCY	NCAT	35.87	38.93	44.85	50.54	55.99	61.19	66.16	89.53	89.6	89.67	89.74	89.81	89.88	89.95	90.018	90.089	90.159	90.23
	CAT	1.77	3.529	7.019	10.47	13.88	17.26	20.59	35.02	41.37	47.35	52.95	58.18	63.03	67.51	71.613	75.341	78.694	81.672
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	9.546	19.04	37.87	56.48	74.89	93.08	111.1	188.9	223.2	255.4	285.6	313.8	340	364.2	386.319	406.43	424.519	440.586
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	9.546	19.04	37.87	56.48	74.89	93.08	111.1	188.9	223.2	255.4	285.6	313.8	340	364.2	386.319	406.43	424.519	440.586
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 20. Sulfur Dioxide – Starting Emissions (Grams/Trip)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	NCAT	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219	0.219
	CAT	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	NCAT	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216	0.216
	CAT	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.003
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MDV	NCAT	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005
	CAT	0	0	0	0	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD1	NCAT	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215	0.215
	CAT	0	0	0	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD2	NCAT	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322	0.322
	CAT	0	0	0	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MHD	NCAT	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323	0.323
	CAT	0	0	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	0.005	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HHD	NCAT	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934
	CAT	0	0.001	0.002	0.002	0.003	0.004	0.004	0.005	0.005	0.006	0.006	0.007	0.007	0.007	0.008	0.008	0.008	0.009
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 20. Sulfur Dioxide – Starting Emissions (Grams/Trip) (continued)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LHV	NCAT	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352	1.352
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0.001	0.001	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.006	0.006
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCY	NCAT	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	CAT	0	0	0	0	0	0	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	DSL	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214	0.214
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.003	0.004	0.004	0.004	0.005	0.005	0.005	0.005	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MH	NCAT	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934	0.934
	CAT	0	0	0.001	0.001	0.001	0.001	0.001	0.002	0.003	0.003	0.003	0.003	0.004	0.004	0.004	0.004	0.005	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 21. PM10 – Starting Emissions (Grams/Trip)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LDA	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.001	0.002	0.003	0.004	0.005	0.006	0.01	0.011	0.012	0.012	0.013	0.014	0.014	0.015	0.015	0.015	0.015
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.001	0.002	0.003	0.004	0.005	0.006	0.01	0.011	0.012	0.013	0.014	0.014	0.015	0.015	0.016	0.016	0.016
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.003	0.005	0.007	0.01	0.012	0.014	0.022	0.025	0.027	0.029	0.03	0.032	0.033	0.034	0.034	0.035	0.035
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MDV	NCAT	0.013	0.011	0.009	0.007	0.005	0.004	0.003	0.008	0.013	0.017	0.021	0.024	0.027	0.029	0.031	0.032	0.033	0.033
	CAT	0.001	0.003	0.005	0.008	0.01	0.012	0.014	0.023	0.025	0.027	0.029	0.031	0.032	0.033	0.034	0.035	0.035	0.035
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD1	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.002	0.003	0.005	0.006	0.008	0.009	0.014	0.015	0.016	0.017	0.018	0.019	0.02	0.02	0.021	0.021	0.021
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LHD2	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.002	0.003	0.005	0.006	0.007	0.008	0.013	0.015	0.016	0.017	0.018	0.018	0.019	0.02	0.02	0.02	0.02
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.002	0.005	0.007	0.008	0.01	0.011	0.016	0.016	0.017	0.017	0.018	0.018	0.019	0.019	0.02	0.02	0.021
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HHD	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.002	0.003	0.007	0.009	0.012	0.014	0.016	0.022	0.023	0.024	0.024	0.025	0.026	0.027	0.027	0.028	0.029	0.03
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 21. PM10 – Starting Emissions (Grams/Trip) (continued)

Vehicle Type	Fuel Type	Time (Minutes)																	
		5	10	20	30	40	50	60	120	180	240	300	360	420	480	540	600	660	720
LHV	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.002	0.003	0.006	0.009	0.011	0.013	0.015	0.02	0.021	0.022	0.022	0.023	0.024	0.024	0.025	0.026	0.027	0.027
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MCY	NCAT	0.02	0.017	0.013	0.01	0.008	0.006	0.005	0.013	0.02	0.026	0.032	0.037	0.041	0.045	0.047	0.049	0.05	0.051
	CAT	0	0	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBUS	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0.001	0.002	0.004	0.006	0.008	0.01	0.011	0.015	0.016	0.016	0.016	0.017	0.017	0.018	0.019	0.019	0.02	0.02
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MH	NCAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	CAT	0	0.001	0.001	0.002	0.002	0.002	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.005	0.005	0.005
	DSL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 22. Vehicle Class Fuel Consumption per Market Sector

	Auto Gas	Truck Gas	Truck Diesel
Drive alone	0.59	0.41	0.00
Carpool	0.96	0.03	0.01
Light truck	0.00	0.79	0.21
Medium truck	0.00	0.20	0.80
Heavy truck	0.00	0.00	1.00

Source: EMFAC2002 for Los Angeles County
Notes:
[1]Drive-alone percentages a function of LDA, LDT1, LDT2, MDT, and MCY.
[2]Carpool percentages a function of LDA, UB, SBUS, and MH.
[3]Light-heavy truck percentages a function of LHDT1 and LHDT2.
[4]Medium-heavy truck percentages a function of MHDT.
[5]Heavy-heavy truck percentages a function of HHDT and LH.

Table 23. Fuel Consumption Rate (Gallons per VMT) for Freeways

Speed	Auto	Truck Gas	Truck Diesel
0	0.336146	0.886422	0.450
5	0.115161	0.286383	0.696
10	0.087319	0.190539	0.489
15	0.068684	0.133917	0.297
20	0.056054	0.099451	0.185
25	0.047462	0.078033	0.131
30	0.041696	0.064682	0.110
35	0.038009	0.056648	0.112
40	0.035954	0.052416	0.122
45	0.035294	0.051244	0.136
50	0.035959	0.052928	0.153
55	0.038027	0.057759	0.170
60	0.041743	0.066599	0.187
65	0.047566	0.081128	0.204
70	0.047825	0.104425	0.221

Source: EMFAC2002 for Auto and Truck Gas. IDAS for Truck Diesel.
Note: For diesel, use IDAS defaults as Emfac2002 rates do not vary by speed.

Table 24. Fuel Consumption Rate (Gallons per VMT) for Arterials

Speed	Auto	Truck Gas	Truck Diesel
5	0.144	0.275	0.383
10	0.091	0.174	0.241
15	0.073	0.140	0.194
20	0.064	0.123	0.171
25	0.059	0.113	0.157
30	0.056	0.106	0.147
35	0.053	0.101	0.140
40	0.051	0.097	0.135

Source: FHWA, IDAS.

Safety

Table 25. Accident Rates Per Million VMT for Freeway Facilities

V/C Ratio	Fatalities	Injuries	Property Damage Only
0.09	0.0057	0.4473	0.8323
0.19	0.0057	0.4473	0.8323
0.29	0.0057	0.4473	0.8323
0.39	0.0057	0.4473	0.8323
0.49	0.0057	0.4473	0.8323
0.59	0.0057	0.4473	0.8323
0.69	0.0057	0.4473	0.8323
0.79	0.0057	0.499439	0.968762
0.89	0.0057	0.499439	0.968762
0.99	0.0057	0.635815	1.128194
1	0.0057	0.662969	1.240031

Source: 2000 Accident Data on California State Highways (Road Miles, Travel, Accidents, Accident Rates), California Department of Transportation.

Table 26. Accident Rates Per Million VMT for Arterial Facilities

V/C Ratio	Fatalities	Injuries	Property Damage Only
0.09	0.0066	1.5724	2.1949
0.19	0.0066	1.5724	2.1949
0.29	0.0066	1.5724	2.1949
0.39	0.0066	1.5724	2.1949
0.49	0.0066	1.5724	2.1949
0.59	0.0066	1.5724	2.1949
0.69	0.0066	1.5724	2.1949
0.79	0.0066	1.5724	2.1949
0.89	0.0066	1.5724	2.1949
0.99	0.0066	1.5724	2.1949
1	0.0066	1.5724	2.1949

Source: FHWA, IDAS.

Travel Time Reliability

Table 27. Travel Time Reliability

Factor to convert input link capacity to LOS E equivalent	1

Source: FHWA, IDAS.

Table 28. Travel Time Reliability – Three-Hour A.M. Peak Period (Vehicle Hours of Incident Delay per Vehicle Mile)

Volume/1-Hour Level of Service Capacity	Number of Lanes		
	2	3	4+
0.15	3.71E-08	1.62E-09	5.45E-12
0.3	5.66E-07	5.21E-08	7.22E-10
0.45	2.79E-06	3.97E-07	1.26E-08
0.6	8.63E-06	1.68E-06	9.57E-08
0.75	2.07E-05	5.14E-06	4.61E-07
0.9	4.25E-05	1.28E-05	1.67E-06
1.05	7.78E-05	2.77E-05	4.95E-06
1.2	0.000132	5.41E-05	1.27E-05
1.35	0.000209	9.77E-05	2.91E-05
1.5	0.000316	0.000166	6.12E-05
1.65	0.00046	0.000267	0.00012
1.8	0.00065	0.000413	0.000221
1.95	0.000901	0.00062	0.000389
2.1	0.001245	0.000912	0.000656
2.25	0.00177	0.00135	0.001074
2.4	0.002722	0.002115	0.001742
2.55	0.004772	0.003798	0.003011
2.7	0.009674	0.00828	0.006586
2.85	0.014859	0.012966	0.010231
3	0.01986	0.01744	0.01368

Note: Volume is factored to daily estimate to generate volume/one-hour level of service capacity ratio.

Table 29. Travel Time Reliability – Four-Hour P.M. Peak Period (Vehicle Hours of Incident Delay per Vehicle Mile)

Volume/1-Hour Level of Service Capacity	Number of Lanes		
	2	3	4+
0.2	4.22E-08	1.95E-09	7.44E-12
0.4	6.43E-07	6.28E-08	9.86E-10
0.6	3.16E-06	4.79E-07	1.72E-08
0.8	9.80E-06	2.02E-06	1.31E-07
1	2.36E-05	6.19E-06	6.30E-07
1.2	4.82E-05	1.54E-05	2.28E-06
1.4	8.84E-05	3.34E-05	6.75E-06
1.6	0.000149	6.52E-05	1.73E-05
1.8	0.000237	0.000118	3.97E-05
2	0.000359	0.000199	8.35E-05
2.2	0.000524	0.000322	0.000163
2.4	0.000745	0.000499	0.000302
2.6	0.001052	0.000757	0.000531
2.8	0.00153	0.001152	0.000902
3	0.002431	0.001873	0.001519
3.2	0.004498	0.00359	0.002798
3.4	0.008512	0.007224	0.005687
3.6	0.012546	0.010863	0.008552
3.8	0.01612	0.014113	0.011086
4	0.01986	0.01744	0.01368

Note: Volume is factored to daily estimate to generate volume/one-hour level of service capacity ratio.

Table 30. Travel Time Reliability – Off-Peak (Vehicle Hours of Incident Delay Per Vehicle Mile)

Volume/1-Hour Level of Service Capacity	Number of Lanes		
	2	3	4+
1	1.17E-07	8.46E-09	8.16E-11
2	1.79E-06	2.73E-07	1.08E-08
3	8.81E-06	2.08E-06	1.89E-07
4	2.73E-05	8.78E-06	1.43E-06
5	6.56E-05	2.69E-05	6.91E-06
6	0.000134	6.70E-05	2.50E-05
7	0.000248	0.000145	7.41E-05
8	0.000434	0.000289	0.00019
9	0.000824	0.000591	0.000447
10	0.00217	0.00171	0.00125
11	0.00355	0.00299	0.00231
12	0.00519	0.00442	0.00344
13	0.00656	0.0056	0.00435
14	0.00837	0.00718	0.00561
15	0.0106	0.00925	0.00727

Note: Volume is factored to daily estimate to generate volume/one-hour level of service capacity ratio.

Alternatives Comparison Module (ACM)

This may vary depending on time periods being analyzed.

Table 31. Number of Time Periods Per Year

Number of periods per year	247

Source: FHWA, IDAS.

Table 32. Dollar Index Adjustment Factors

Adjustments	Default Value
Inflation Rate	3%
Adjusted to	2003 dollars

Source: FHWA, IDAS.

Table 33. Value of Travel Time (1995 Dollars)

Transportation Mode	Dollar Per Hour					
	In-Vehicle Value		Out-of-Vehicle Value		Travel Time Reliability	
	1995	2003	1995	2003	1995	2003
Single-occupancy auto	$7.04	$8.92	$14.08	$17.83	$21.12	$26.75
Multiple-occupancy auto	$7.04	$8.92	$14.08	$17.83	$21.12	$26.75
Commercial truck	$23.91	$30.29	$23.91	$30.29	$71.73	$90.87

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans.

Table 34. Fuel Cost (1995 Dollars)

Transportation Mode	Default Value (Dollar Per Gallon)
	1995
Single-occupancy auto	$0.98
Multiple-occupancy auto	$0.98
Commercial truck	$0.98
Local bus	$0.98
Express bus	$0.98
Light rail	$0.98
Heavy rail	$0.98
All transit	$0.98
Other	$0.98

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans.

Table 35. Non-Fuel Vehicle Operating Cost (1995 Dollars)

Transportation Mode	Default Value (Dollar Per Gallon) 1995
Single-occupancy auto	$0.142
Multiple-occupancy Auto	$0.142
Commercial truck	$0.246

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans.

Table 36. Emission Costs (1995 Dollars)

Transportation Mode	Default Value (Dollar Per Ton) HC	NOx	CO	Particulates (PM10)	SO_2	CO_2
Single-occupancy auto	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Multiple-occupancy auto	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Commercial truck	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Local bus	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Express bus	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Light rail	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Heavy rail	$2,500	$40,211	$99	$329,395	$123,758	$3.56
All transit	$2,500	$40,211	$99	$329,395	$123,758	$3.56
Other	$2,500	$40,211	$99	$329,395	$123,758	$3.56

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans for VOC, NOx, CO, PM10, and SO_2; and FHWA, IDAS for CO_2.

Table 37. Fatality Costs (1995 Dollars)

Transportation Mode	Default Value (Dollar Per Fatality)	
	Internal	External
Single-occupancy auto	$2,276,448	$401,726
Multiple-occupancy auto	$2,276,448	$401,726
Commercial truck	$2,276,448	$401,726
Local bus	$2,276,448	$401,726
Express bus	$2,276,448	$401,726
Light rail	$2,276,448	$401,726
Heavy rail	$2,276,448	$401,726
All transit	$2,276,448	$401,726
Other	$2,276,448	$401,726

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans.

Table 38. Injury Costs (1995 Dollars)

Transportation Mode	Default Value (Dollar Per Injury)	
	Internal	External
Single-occupancy auto	$59,810	$10,555
Multiple-occupancy auto	$59,810	$10,555
Commercial truck	$59,810	$10,555
Local bus	$59,810	$10,555
Express bus	$59,810	$10,555
Light rail	$59,810	$10,555
Heavy rail	$59,810	$10,555
All transit	$59,810	$10,555
Other	$59,810	$10,555

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans.

Table 39. Property Damage Only Costs (1995 Dollars)

Transportation Mode	Default Value (Dollar Per Property Damage Only)	
	Internal	External
Single-occupancy auto	$5,023	$886
Multiple-occupancy auto	$5,023	$886
Commercial truck	$5,023	$886
Local bus	$5,023	$886
Express bus	$5,023	$886
Light rail	$5,023	$886
Heavy rail	$5,023	$886
All transit	$5,023	$886
Other	$5,023	$886

Source: California Life-Cycle Benefit/Cost Analysis Model, Caltrans.

Table 40. Noise Damage Cost (1995 Dollars)

Transportation Mode	Default Value (Dollar Per VMT)
Single-occupancy auto	$0.0007
Multiple-occupancy auto	$0.0007
Commercial truck	$0.0010
Local bus	$0.00
Express bus	$0.00
Light rail	$0.00
Heavy rail	$0.00
All transit	$0.00
Other	$0.00

Source: IDAS.