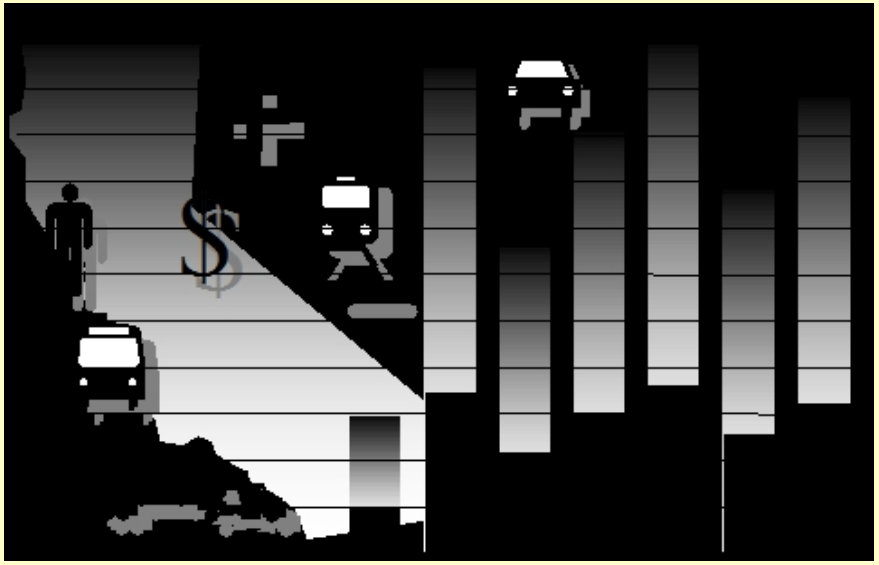
California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) Version 4.0 Modified for TIGER Grants



Office of Transportation Economics
Division of Transportation Planning

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CALIFORNIA LIFE-CYCLE BENEFIT/COST ANALYSIS MODEL (CAL-B/C)

INTRODUCTION

This spreadsheet model provides a method for preparing a simple economic analysis of both highway and transit projects. Given certain input data for a project, the model calculates its life-cycle costs, life-cycle benefits, net present value, benefit/cost ratio, internal rate of return, and payback period. Annual benefits are also calculated.

The model is arranged by worksheets and contains the following information, data, and results:

Worksheets	Contents
Instructions	General model description and assumptions
1) Project Information	Project input data
2) Model Inputs	Highway speed, volume, accident data, and trips estimated by model
3) Results	Summary results of analysis
Travel Time	Calculation of travel time and induced demand impacts
Vehicle Operating Costs	Calculation of highway vehicle operating cost impacts
Accident Costs	Calculation of accident cost impacts
Emissions	Calculation of emission impacts
Final Calculations	Calculation of net present value, internal rate of return, and payback period
Parameters	Economic assumptions, lookup tables, and other model parameters

The model is designed so that the user generally needs to enter data only in the green boxes on the Project Information worksheet. The model estimates detailed highway speed, volume, and accident data for the user to review on the Model Inputs worksheet. Highway speeds are estimated from volumes using relationships found in the Highway Capacity Manual. Other adjustments are made for weaving and pavement conditions. An option is also available to conduct a simple queuing analysis. Accidents are estimated from statewide averages and recent data for the facility. If available, inputs from regional planning or traffic simulation models can be entered to override model calculations. Summary results are shown in Results worksheet.

The remaining worksheets are provided for the user to see, but model performs calculations automatically. Some projects (i.e., bypasses, interchanges, and connectors) require the user to enter two sets of highway data, since two roads are involved. The model calculates benefits for the first road before the user enters information about the second road. The user clicks a button and the model clears the Project Information worksheet to receive information on the other road.

In the process of economic analysis, some generally accepted economic assumptions are necessary. These assumptions include: the real and nominal discount rates, unit user costs (e.g., value of time), consumption rates (e.g., fuel consumption and vehicle emissions), and accident rates. These assumptions are given in the Parameters worksheet and should not be changed by the user.

After reading the instructions in this worksheet, the user should proceed to the Project Information worksheet and input data for the specific project in the green boxes (light gray when printed). The model provides default values in the red boxes (medium gray when printed). These values can be changed by the user, if information specific to the project is available. The model calculates some values based on relationships or assumptions, with results shown in the blue boxes (dark gray when printed). These values can be changed by the user.

INSTRUCTIONS

The user can analyze most projects simply by entering limited data on the Project Information Sheet and getting results on the Results page. The Model Inputs page allows the user to enter more detailed data adjust estimated speeds, volumes, and accidents rates, and check the number of trips estimated for projects that affect vehicle occupancy.

PROJECT DATA (Box 1A)

This section provides general information about the project and is used for highway, rail, and transit projects. At the top of the sheet, the user can enter information about the project, such as the project name, Caltrans district, and funding information.

Type of Project

1 Please select the appropriate type of highway, rail, or transit project from the pull-down menu. The menu appears if user clicks on the green box next to the project type.

For a bypass or intersection project, model reminds user that information must be entered for both roads impacted by project. After entering information for the first road, the user clicks a button at bottom of the worksheet to prepare model for data on the bypass or intersecting road. The user may also enter information for connector projects involving two roads.

Project Location

2 Insert a 1, 2, or 3 for the appropriate region of California. This information is used to estimate peak traffic and emissions benefits.

Length of Construction Period

3 Insert the number of construction years before benefits begin. This must be a whole number (round to next higher integer).

One- or Two-Way Data

4 Indicate whether Highway Design and Traffic Data to be entered in Box 1B is for a single direction or both directions of highway.

Length of Peak Period(s)

5 Insert the number of peak period hours per typical day. The model provides a default of 5 hours (statewide average). Model estimates total % daily traffic occurring during peak period using a lookup table developed from Traffic Census data. Model does not distinguish between weekdays and weekends.

To model a 24-hour HOV or HOT lane, enter 24 hours so peak is 100% of ADT. To model a ramp metering project, user should enter the number of hours per day that metering is operational.

HIGHWAY DESIGN AND TRAFFIC DATA (Box 1B)

Highway design and traffic data must be entered for highway projects. Enter data consistent with one- or two-way answer in Box 1A. Statewide default values are provided for some inputs.

Highway Design

6 **Roadway Type:** Indicate if the road is a freeway, expressway, or conventional highway in build and no build cases.

7 **Number of General Traffic Lanes:** Insert number of general purpose (not HOV or bus) lanes in both directions for build and no build cases. Enter data consistent with Box 1A.

8 **Number of HOV Lanes:** Insert number of HOV lanes in both directions for the build and no build cases. A value must be provided if an HOV restriction is entered on the next row.

9 **HOV Restriction:** If highway facility has/will have HOV lanes, enter the HOV restriction (e.g., 2 means 2 people per vehicle). Must be entered for an HOV project. Enter for a non-HOV project, if facility has HOV lanes. Changes in HOV restrictions are special project types and handled automatically by model.

10 **Exclusive ROW for Buses:** If bus project, indicate (with "Y" or "N") whether buses have exclusive right-of-way. This information is used to estimate emissions.

11 **Highway Free-Flow Speed:** Insert free-flow speed for build and no build cases. Model assumes build is same as no build, if not entered.

12 **Ramp Design Speed:** If auxiliary lane or off-ramp project, enter the design speed of the appropriate on- or off-ramp. This is used to estimate the speed of traffic affected by weaving.

13 **Highway Segment:** Insert segment length for build and no build cases. Model assumes build is same as no build, if not entered.

14 **Impacted Length:** The model estimates an area affected by the project. In most cases, this equals the segment length. For passing lane projects, the default affected area is 3 miles longer than the project area. For auxiliary lane and off-ramp projects, the default affected area is 1500 feet. For connectors and HOV drop ramps, default affected area is 3250 feet. User can change these lengths.

Average Daily Traffic (ADT)

15 **Current:** For most projects, insert current two-way ADT on facility. For operational improvements, enter only the one-way ADT applicable to the project. Enter data consistent with one-way or two-way answer in Box 1A.

16 **Forecast (Year 20):** Insert projected ADT for 20 years after construction completion for build and no build cases. Model assumes build is same as no build, if not entered.

The model uses the current and forecasted ADT to estimate annual traffic for 20 years after construction, assuming a linear trend. User can change base (Year 1) forecasts.

Average Hourly HOV/HOT Lane Traffic

17 Insert hourly HOV/HOT volumes for build and no build cases in a typical peak hour.

Percent Traffic in Weave

18 For operational improvements, insert % traffic affected by weaving. Model suggests a % based on the type of project (2 right lanes for auxiliary lanes, 3 right lanes for off-ramps, 2.5% of all traffic for freeway connectors, and 4% of HOV traffic for HOV connectors and drop ramps). Users can change values for project conditions.

Percent Trucks

19 Insert estimated % of ADT comprised of trucks in build and no build cases. Model provides a default value (statewide average).

Truck Speed

20 If passing lane project, enter estimated speed (in MPH) for slow vehicles (trucks, recreational vehicles, etc.). Values must be entered for passing lane projects.

On-Ramp Volume

21 **Hourly Ramp Volume:** If auxiliary lane or on-ramp widening project, insert average hourly ramp volume to estimate traffic affected by weaving for auxiliary lanes and metering effectiveness for on-ramp widening. No entry needed for ramp metering projects.

22 **Metering Strategy:** If on-ramp widening project, enter 1, 2, or 3 for vehicles allowed per green signal. Enter "D" for dual metering. No entry should be made for ramp metering projects.

Queue Formation

23 **Arrival Rate:** For queuing and rail grade crossing projects, enter vehicles per hour contributing to queue. Arrival rate should be estimated only for time queue grows. Model estimates queue dissipation automatically.

24 **Departure Rate:** For queuing and rail crossing projects, enter vehicles per hour leaving queue.

Pavement Condition (for Pavement Rehab. Projects)

25 If pavement rehabilitation project, enter base (Year 1) International Roughness Index (IRI) for build and no build. Model will calculate Year 20 values using standard parameters unless entered by user.

Average Vehicle Occupancy (AVO)

26 Model provides default values. The figures change automatically, depending on presence of HOV lanes. Adjust if project-specific data are available.

HIGHWAY ACCIDENT DATA (Box 1C)

Statewide default values are provided for transit projects. The model uses information provided to calculate accident rates for each accident type in the Model Inputs worksheet.

Actual 3-Year Accident Data (from Table B)

27 Insert the total number of fatal, injury, and property damage only accidents on the segment over the 3 most recent years. For rail grade crossing projects, enter 10-year accident data from FRA WBAPS in fatal and injury rows and collision prediction in total accident row.

Statewide Basic Average Accident Rate

28 Insert statewide average accident rates per million vehicle-miles (or million vehicles, as appropriate) for build and no build highway rate groups. Include Base Rate and ADT Factor where applicable.

29 Insert statewide % of accidents that are fatal and injury accidents for road classifications similar to build and no build facilities.

The model uses adjustment factors (the ratio of actual rates to statewide rates for existing facility) to estimate accident rates by accident type for the new road classification. Additional adjustments (accident savings) are made for highway TMS projects. Results are presented in the Model Inputs worksheet and can be changed by the user.

RAIL AND TRANSIT DATA (Box 1D)

This section is used for rail and transit projects only.

Annual Person-Trips

30 **Base (Year 1):** Insert estimated annual transit person-trips for first year after construction completion in build and no build cases. For a transit TMS project, enter only person-trips on routes affected. If the routes are substantially different, the benefits analysis should be split into pieces.

31 **Forecast (Year 20):** Insert forecasted annual transit person-trips for 20 years after construction completion in build and no build cases.

Percent Trips during Peak Period

32 Insert % annual person-trips that occur during peak period.

Percent New Trips from Parallel Highway

33 Insert % new transit person-trips originating on parallel highway.

Annual Vehicle-Miles

34 **Base (Year 1):** Insert estimated annual vehicle-miles for first year after construction completion in build and no build cases. For passenger rail projects, multiply the number of train-miles by the average number of rail cars per train consist.

35 **Forecast (Year 20):** Insert forecasted annual vehicle-miles for 20 years after construction completion in build and no build cases.

Average Vehicles per Train

36 If passenger rail project, insert the average number of rail cars per train consist. This is used to calculate emissions.

Reduction in Transit Accidents

37 If project affects transit/rail safety, insert estimated percent accident reduction due to project. Increases should be entered as negative %.

Average Transit Travel Time

38 **In-Vehicle:** Insert average in-vehicle transit travel time in minutes during peak and non-peak periods in build and no build cases. For TMS Projects, insert the average for all transit routes impacted. Model assumes build is same as no build for most projects. Signal priority and bus rapid transit projects reduce time. User can adjust build travel times.

39 **Out-of-Vehicle:** Insert average out-of-vehicle transit travel time in minutes during peak and non-peak periods. Model monetizes out-of-vehicle travel time at a higher value.

Highway Grade Crossing

40 **Annual Number of Trains:** Insert annual number of passenger and freight trains entering highway-rail crossing.

41 **Average Gate Down Time:** Insert average time per train that crossing gate is down for passenger and freight trains.

Transit Agency Costs (for Transit TMS Projects)

42 **Annual Capital Expenditure:** If transit TMS project, insert annual agency capital expenditures for routes impacted by project. Model calculates cost reductions for expenditures in build case due to transit TMS. Agency cost savings are entered automatically as a negative cost in Box 1E.

43 **Annual Ops. and Maintenance Expenditure:** If transit TMS project, insert the annual average operating and maintenance costs for routes impacted by project. Model calculates cost reductions for expenditures in build case due to transit TMS. Agency cost savings are entered automatically as a negative cost in Box 1E.

PROJECT COSTS (Box 1E)

Net project costs should be entered in the years they are expected to occur. Costs should be entered for construction period and for twenty years after construction completion. Construction Year 1 is the first year that costs are incurred. All costs should be entered in thousands of dollars.

44 Insert project's initial costs in constant (Year 2007) dollars for project development, right-of-way, and construction. The number of construction years with costs should equal the length of the construction period (Box 1A, Input 5).

45 Insert estimated future incremental maintenance/operating and rehabilitation costs in constant (Year 2007) dollars. These figures should be entered in the years after the project opens.

46 Insert estimated mitigation costs (e.g., wetlands, community, and sound walls) in constant (Year 2007) dollars during construction and for 20 years after construction completion.

47 Model adds agency cost savings due to transit TMS automatically.

48 Insert any other costs not already included.

HIGHWAY SPEED AND VOLUME INPUTS (Box 2A)

This section allows user to review detailed speed and volume data estimated by the model. These values are estimated from the inputs provided in the Project Information sheet.

49 User may enter new speed and volume data for the highway in the green boxes to override model calculations, if detailed data are available from a travel demand or micro-simulation model. The model estimates speeds and volumes on highway for HOVs, non-HOVs, weaving vehicles, and trucks during the peak and non-peak periods in Year 1 and Year 20 in build and no build cases. Speeds are estimated using a BPR curve (or queuing analysis). Adjustments are made to speed and volumes to account for weaving, transit mode shifts, pavement condition, and TMS.

50 If TMS project and detailed simulation data are available, the highway results should be inputted in the green cells. Model will use the data in place of figures estimated by the model.

HIGHWAY ACCIDENT RATES (Box 2B)

User may adjust accident rates calculated by the model. User may also enter TASAS highway accident data for rail grade crossing projects in this box.

51 **No Build:** Fatality, injury and PDO accident rates for no build facility are estimated using inputs from Box 1C of the Project Information sheet. User may change these rates in green boxes.

52 **Highway Safety or Weaving Improvement:** Model assumes an overall safety improvement for off-ramp and ramp metering projects. User may adjust this percentage. For safety projects, user should enter collision reduction factor from HSIP Guidelines.

53 **Adjustment Factor:** User may change the ratios of facility accident rates to statewide averages used in calculating rates for the build facility. These factors are also adjusted by the collision reduction factor.

54 **Build Facility:** User may modify the fatality, injury, and PDO accident rates for build facility. Model estimates these accident rates using statewide average rates and the adjustment factors.

RAMP AND ARTERIAL INPUTS (Box 2C)

This section allows users to enter detailed arterial information for an arterial signal management project or detailed ramp and arterial data for a highway TMS project.

55 **Detailed Information Available:** Input "Y" if detailed arterial and/or ramp data are available. Model automatically selects "Y" if other data are inputted. User should enter detailed ramp and arterial data for TMS highway project if detailed highway data are entered in Box 2A.

56 **Aggregate Segment Length:** Input the total segment lengths for the ramps and arterials. These can be estimated from travel demand or micro-simulation model data as VMT/total trips.

57 User may enter speeds and volumes on ramps and arterials during peak and non-peak periods in Year 1 and Year 20 in build and no build cases. If arterial signal management project, user must enter arterial data. Benefits are estimated assuming all vehicles are automobiles.

ANNUAL PERSON-TRIPS (Box 2D)

This section is for information purposes only. It allows user to examine number trips estimated for projects that affect AVO (e.g., HOT lane and HOV conversions).

NEXT STEPS

58 For bypass, interchange, and connector projects, click button on Project Information page after data are verified for the first road. Enter data for the second road in Boxes 1B and 1C. As with the first road, detailed data may be verified on Model Inputs page. Model prompts user to save interim version of analysis before proceeding.

59 Summary results are available immediately in the Results worksheet.

District: City of Anaheim

PROJECT: Gene Autry Way & Interstate 5 Interchange Construction Project

EA: 23
PPNO:

Enter all project costs (in today's dollars) in columns 1 to 7. Costs during construction should be entered in the first eight rows. Project costs (including maintenance and operating costs) should be net of costs without project.

1A

Type of Project		
Select project type from list	General Highway	
Project Location (enter 1 for So. Cal., 2 for No. Cal., or 3 f		1
Length of Construction Period	2	years
One- or Two-Way Data	1	enter 1 or 2
	Current	
Length of Peak Period(s) (up to 24 hrs)	4	hours

1B

Highway Design		No Build	Build
Roadway Type (Fwy, Exp, Conv Hwy)		C	C
Number of General Traffic Lanes		4	4
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)		N	
Highway Free-Flow Speed		35	35
Ramp Design Speed (if aux. lane/off-ramp proj.)		35	35
Length (in miles)	Highway Segment	0.6	0.1
	Impacted Length	0.6	0.1

Average Daily Traffic			
	Current	11,881	
		No Build	Build
	Base (Year 1)	12,560	16,293
	Forecast (Year 20)	19,010	24,660
Average Hourly HOV/HOT Lane Traffic			0
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)			100%
Percent Traffic in Weave			0.0%
Percent Trucks (include RVs, if applicable)		3%	3%
Truck Speed			

On-Ramp Volume	Peak	Non-Peak
Hourly Ramp Volume (if aux. lane/on-ramp proj.	0	0
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)		

Queue Formation (if queuing or grade crossing	Year 1	Year 20
Arrival Rate (in vehicles per hour)	0	0
Departure Rate (in vehicles per hour)	0	0

Pavement Condition (if pavement project)		No Build	Build
IRI (inches/mile)	Base (Year 1)		
	Forecast (Year 20)		

Average Vehicle Occupancy (AVO)		No Build	Build
General Traffic	Non-Peak	1.30	1.30
	Peak	1.15	1.15
High Occupancy Vehicle (if HOV/HOT lanes)		2.15	2.15

1C

PROJECT COSTS (thousands of dollars)

Actual 3-Year Accident Data (from Table B)	Count (No.)	DIRECT PROJECT COSTS (thousands of dollars)
Total Accidents (Tot)		
Fatal Accidents (Fat)		0.009
Injury Accidents (Inj)		0.31
Property Damage Only (PDO) Accidents		0.65

<-- Must enter a cost -->
<-- Must enter a cost -->

Statewide Basic Average Accident Rate	No Build	Build
Rate Group		
Accident Rate (per million vehicle-miles)		
Percent Fatal Accidents (Pct Fat)		
Percent Injury Accidents (Pct Inj)		

HIGHWAY DESIGN AND TRAFFIC DATA

1D

RAIL AND TRANSIT DATA

Annual Person-Trips		No Build	Build
	Base (Year 1)		
	Forecast (Year 20)		
Percent Trips during Peak Period		34%	
Percent New Trips from Parallel Highway			100%

Annual Vehicle-Miles		No Build	Build
	Base (Year 1)		
	Forecast (Year 20)		
Average Vehicles/Train (if rail project)			

Reduction in Transit Accidents	
Percent Reduction (if safety project)	

Average Transit Travel Time		No Build	Build
In-Vehicle	Non-Peak (in minutes)		0.0
	Peak (in minutes)		0.0
Out-of-Vehicle	Non-Peak (in minutes)	0.0	0.0
	Peak (in minutes)	0.0	0.0

Highway Grade Crossing	Current	Year 1	Year 20
Annual Number of Trains			
Avg. Gate Down Time (in min.)		0.0	

Present Value Or Future Value (in Constant Dollars)

Transit Agency Costs (if TMS project)	No Build	Build
Annual Capital Expenditure		$0
Annual Ops. and Maintenance Expenditure		$0

Model should be run for both roads for intersection or bypass highway projects, and may be run twice for connectors. Press button below to prepare model to enter data for second road. After data are entered, results reflect total project benefits.

Col. no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Year	Project Support	R / W	Construction	Maint./ Op.	Rehab.	Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
Construction Period									
1								$0	$0
2								0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0
Project Open									
1								$0	$0
2								0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0
9								0	0
10								0	0
11								0	0
12								0	0
13								0	0
14								0	0
15								0	0
16								0	0
17								0	0
18								0	0
19								0	0
20								0	0
Total	$0	$0	$0	$0	$0	$0	$0	$0	$0

(1 + Real Discount Rate) ^ Year

2A

	Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
No Build				
Year 1				
Peak Period				
HOV Volume	0		0	
Non-HOV Volume	4,155		4,155	
Weaving Volume	0		0	
Truck Volume	128		128	
HOV Speed	55.0		55.0	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Non-Peak Period				
Non-HOV Volume	8,029		8,029	
Weaving Volume	0		0	
Truck Volume	248		248	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Year 20				
Peak Period				
HOV Volume	0		0	
Non-HOV Volume	6,288		6,288	
Weaving Volume	0		0	
Truck Volume	194		194	
HOV Speed	55.0		55.0	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Non-Peak Period				
Non-HOV Volume	12,152		12,152	
Weaving Volume	0		0	
Truck Volume	376		376	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Build				
Year 1				
Peak Period				
HOV Volume	0		0	
Non-HOV Volume	5,389		5,389	
Weaving Volume	0		0	
Truck Volume	167		167	
HOV Speed	55.0		55.0	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Non-Peak Period				
Non-HOV Volume	10,415		10,415	
Weaving Volume	0		0	
Truck Volume	322		322	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Year 20				
Peak Period				
HOV Volume	0		0	
Non-HOV Volume	8,157		8,157	
Weaving Volume	0		0	
Truck Volume	252		252	
HOV Speed	55.0		55.0	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	
Non-Peak Period				
Non-HOV Volume	15,763		15,763	
Weaving Volume	0		0	
Truck Volume	488		488	
Non-HOV Speed	35.0		35.0	
Weaving Speed	55.0		55.0	
Truck Speed	35.0		35.0	

Model speed estimates based on Highway Capacity Manual, pavement research, and research on weaving impacts

2B **HIGH[illegible] INPUTS**

(for HOV and HOT lane projects that affect average vehicle occupancy)

	Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
No Build				
Fatal Accidents	0.008		0.008	
Injury Accidents	0.33		0.33	
PDO Accidents	0.65		0.65	
Total Accidents	0.969			

Hwy Safety or Weaving Improvement 0% collision reduction factor (per HSIP Guidelines)

Adjustment Factor (Actual/Statewide Avg. Existing)

Fatal Accidents	1.0000		1.0000
Injury Accidents	1.0000		1.0000
PDO Accidents	1.0000		1.0000
Build			
Fatal Accidents	0.008		0.008
Injury Accidents	0.33		0.33
PDO Accidents	0.65		0.65
Total Accidents	0.969		

2C **RAMP AND ARTERIAL INPUTS**

(if detailed information is available for a TMS or an arterial signal management project)

Detailed Information Available? (y/n) N

Aggregate Segment Length (estimate as VMT/total volume)

All Ramps		miles
Arterials		miles

	Entered by User	Used for Proj. Eval.	Source/Notes
No Build (Peak Period Only)			
Year 1			
Aggregate Ramp Volume		0	
Aggregate Arterial Volume		0	
Average Ramp Speed		5.0	
Average Arterial Speed		5.0	
Year 20			
Aggregate Ramp Volume		0	
Aggregate Arterial Volume		0	
Average Ramp Speed		5.0	
Average Arterial Speed		5.0	
Build (Peak Period Only)			
Year 1			
Aggregate Ramp Volume		0	
Aggregate Arterial Volume		0	
Average Ramp Speed		5.0	
Average Arterial Speed		5.0	
Year 20			
Aggregate Ramp Volume		0	
Aggregate Arterial Volume		0	
Average Ramp Speed		5.0	
Average Arterial Speed		5.0	

2D

	No Build	Build
Year 1		
Peak Period		
HOV Trips	0	0
Non-HOV Trips	1,743,864	2,262,161
Truck Trips	46,899	60,833
Non-Peak Period		
Non-HOV Trips	3,809,686	4,941,970
Truck Trips	90,635	117,573
Total Trips	5,691,084	7,382,542
Year 20		
Peak Period		
HOV Trips	0	0
Non-HOV Trips	2,639,362	3,423,812
Truck Trips	70,982	92,079
Non-Peak Period		
Non-HOV Trips	5,766,011	7,479,739
Truck Trips	137,177	177,948
Total Trips	8,613,533	11,173,578

District: City of Anaheim

PROJECT: Gene Autry Way & Interstate 5 Interchange Construction Project

EA: 23
PPNO:

3

INVESTMENT ANALYSIS

SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$0.0
Life-Cycle Benefits (mil. $)	$28.6
Net Present Value (mil. $)	$28.6
Benefit / Cost Ratio:	N/A
Rate of Return on Investment:	#DIV/0!
Payback Period:	N/A

ITEMIZED BENEFITS (mil. $)	Average Annual	Total Over 20 Years
Travel Time Savings	$0.6	$12.6
Veh. Op. Cost Savings	$0.6	$12.6
Accident Cost Savings	$0.1	$2.7
Emission Cost Savings	$0.0	$0.6
TOTAL BENEFITS	$1.4	$28.6
Person-Hours of Time Saved	102,176	2,043,517
Additional CO2 Emissions (tons)	-1,082	-21,648
Additional CO2 Emissions (mil. $	-$0.0	-$0.4

Should benefit-cost results include:

1) Induced Travel? (y/n)	Y (Default = Y)
2) Vehicle Operating Costs? (y/n)	Y (Default = Y)
3) Accident Costs? (y/n)	Y (Default = Y)
4) Vehicle Emissions? (y/n)	Y

includes value for CO2e	Default = Y

C

SUMMARY OF TRAVEL TIME BENEFITS (continued)

Year	Peak HOV	Peak Non-HOV	Peak Weaving	Peak Truck	Peak Ramp	Peak Arterial	Non-Peak Non-HOV	Non-Peak Non-HOV Weaving	Non-Peak Truck	Peak In-Vehicle	Peak Out-of-Veh	Non-Peak In-Vehicle	Non-Peak Out-of-Veh	Present Value of Travel Time Benefits	Constant Dollars	of Time Saved
1	$0	$279,921	$0	$12,166	$0	$0	$611,523	$0	$23,511	$0	$0	$0	$0	$927,122	$1,061,462	81,301
20	$0	$117,147	$0	$5,091	$0	$0	$255,922	$0	$9,840	$0	$0	$0	$0	$388,000	$1,606,537	123,050
2	$0	$268,679	$0	$11,677	$0	$0	$586,963	$0	$22,567	$0	$0	$0	$0	$889,887	$1,090,150	83,499
3	$0	$257,710	$0	$11,201	$0	$0	$563,000	$0	$21,646	$0	$0	$0	$0	$853,556	$1,118,838	85,696
4	$0	$247,026	$0	$10,736	$0	$0	$539,659	$0	$20,748	$0	$0	$0	$0	$818,170	$1,147,526	87,893
5	$0	$236,637	$0	$10,285	$0	$0	$516,963	$0	$19,876	$0	$0	$0	$0	$783,761	$1,176,214	90,091
6	$0	$226,550	$0	$9,846	$0	$0	$494,927	$0	$19,029	$0	$0	$0	$0	$750,353	$1,204,902	92,288
7	$0	$216,771	$0	$9,421	$0	$0	$473,562	$0	$18,207	$0	$0	$0	$0	$717,961	$1,233,591	94,485
8	$0	$207,301	$0	$9,010	$0	$0	$452,874	$0	$17,412	$0	$0	$0	$0	$686,596	$1,262,279	96,683
9	$0	$198,142	$0	$8,612	$0	$0	$432,866	$0	$16,643	$0	$0	$0	$0	$656,262	$1,290,967	98,880
10	$0	$189,295	$0	$8,227	$0	$0	$413,537	$0	$15,899	$0	$0	$0	$0	$626,959	$1,319,655	101,077
11	$0	$180,757	$0	$7,856	$0	$0	$394,885	$0	$15,182	$0	$0	$0	$0	$598,681	$1,348,343	103,274
12	$0	$172,526	$0	$7,498	$0	$0	$376,904	$0	$14,491	$0	$0	$0	$0	$571,419	$1,377,031	105,472
13	$0	$164,598	$0	$7,154	$0	$0	$359,585	$0	$13,825	$0	$0	$0	$0	$545,162	$1,405,720	107,669
14	$0	$156,970	$0	$6,822	$0	$0	$342,919	$0	$13,184	$0	$0	$0	$0	$519,895	$1,434,408	109,866
15	$0	$149,634	$0	$6,503	$0	$0	$326,895	$0	$12,568	$0	$0	$0	$0	$495,601	$1,463,096	112,064
16	$0	$142,587	$0	$6,197	$0	$0	$311,500	$0	$11,976	$0	$0	$0	$0	$472,261	$1,491,784	114,261
17	$0	$135,822	$0	$5,903	$0	$0	$296,720	$0	$11,408	$0	$0	$0	$0	$449,853	$1,520,472	116,458
18	$0	$129,331	$0	$5,621	$0	$0	$282,540	$0	$10,863	$0	$0	$0	$0	$428,356	$1,549,160	118,656
19	$0	$123,109	$0	$5,351	$0	$0	$268,946	$0	$10,340	$0	$0	$0	$0	$407,746	$1,577,848	120,853
Total	**$0**	**$3,800,514**	**$0**	**$165,179**	**$0**	**$0**	**$8,302,691**	**$0**	**$319,217**	**$0**	**$0**	**$0**	**$0**	**$12,587,600**	**$26,679,983**	**2,043,517**

C

SUMMARY OF VEHICLE OPERATING COST BENEFITS

Year	Peak HOV	Peak Non-HOV	Peak Weaving	Peak Truck	Peak Arterial	Non-Peak Non-HOV	Non-Peak Weaving	Non-Peak Truck	Peak Period	Non-Peak Period	Present Value of Veh Op Cost Benefits	Constant Dollars
1	$0	$298,650	$0	$17,936	$0	$577,156	$0	$34,662	-	-	$928,404	$1,062,930
20	$0	$124,985	$0	$7,506	$0	$241,539	$0	$14,506	-	-	$388,536	$1,608,759
2	$0	$286,656	$0	$17,216	$0	$553,977	$0	$33,270	-	-	$891,118	$1,091,658
3	$0	$274,952	$0	$16,513	$0	$531,360	$0	$31,912	-	-	$854,737	$1,120,386
4	$0	$263,554	$0	$15,828	$0	$509,331	$0	$30,589	-	-	$819,302	$1,149,114
5	$0	$252,470	$0	$15,163	$0	$487,911	$0	$29,303	-	-	$784,846	$1,177,842
6	$0	$241,708	$0	$14,516	$0	$467,113	$0	$28,053	-	-	$751,391	$1,206,569
7	$0	$231,274	$0	$13,890	$0	$446,948	$0	$26,842	-	-	$718,954	$1,235,297
8	$0	$221,170	$0	$13,283	$0	$427,423	$0	$25,670	-	-	$687,546	$1,264,025
9	$0	$211,399	$0	$12,696	$0	$408,539	$0	$24,536	-	-	$657,170	$1,292,753
10	$0	$201,960	$0	$12,129	$0	$390,297	$0	$23,440	-	-	$627,826	$1,321,481
11	$0	$192,850	$0	$11,582	$0	$372,693	$0	$22,383	-	-	$599,509	$1,350,209
12	$0	$184,069	$0	$11,055	$0	$355,722	$0	$21,364	-	-	$572,210	$1,378,936
13	$0	$175,611	$0	$10,547	$0	$339,377	$0	$20,382	-	-	$545,916	$1,407,664
14	$0	$167,472	$0	$10,058	$0	$323,648	$0	$19,437	-	-	$520,615	$1,436,392
15	$0	$159,646	$0	$9,588	$0	$308,524	$0	$18,529	-	-	$496,287	$1,465,120
16	$0	$152,127	$0	$9,136	$0	$293,994	$0	$17,656	-	-	$472,914	$1,493,848
17	$0	$144,909	$0	$8,703	$0	$280,044	$0	$16,819	-	-	$450,475	$1,522,576
18	$0	$137,984	$0	$8,287	$0	$266,662	$0	$16,015	-	-	$428,948	$1,551,303
19	$0	$131,346	$0	$7,888	$0	$253,832	$0	$15,244	-	-	$408,310	$1,580,031
Total	**$0**	**$4,054,791**	**$0**	**$243,519**	**$0**	**$7,836,091**	**$0**	**$470,613**	**-**	**-**	**$12,605,014**	**$26,716,893**

C

SUMMARY OF ACCIDENT REDUCTION BENEFITS

Year	Peak HOV	Peak Non-HOV	Peak Weaving	Peak Truck	Peak Arterial	Non-Peak Non-HOV	Non-Peak Weaving	Non-Peak Truck	All Periods	Present Value of Accident Benefits	Constant Dollars
1	$0	$66,757	$0	$2,065	$0	$129,011	$0	$3,990	$0	$201,823	$231,067
20	$0	$27,938	$0	$864	$0	$53,991	$0	$1,670	$0	$84,463	$349,723
2	$0	$64,076	$0	$1,982	$0	$123,830	$0	$3,830	$0	$193,717	$237,312
3	$0	$61,460	$0	$1,901	$0	$118,774	$0	$3,673	$0	$185,808	$243,557
4	$0	$58,912	$0	$1,822	$0	$113,850	$0	$3,521	$0	$178,105	$249,802
5	$0	$56,434	$0	$1,745	$0	$109,062	$0	$3,373	$0	$170,615	$256,047
6	$0	$54,029	$0	$1,671	$0	$104,413	$0	$3,229	$0	$163,342	$262,292
7	$0	$51,696	$0	$1,599	$0	$99,906	$0	$3,090	$0	$156,291	$268,537
8	$0	$49,438	$0	$1,529	$0	$95,541	$0	$2,955	$0	$149,463	$274,782
9	$0	$47,254	$0	$1,461	$0	$91,320	$0	$2,824	$0	$142,860	$281,027
10	$0	$45,144	$0	$1,396	$0	$87,243	$0	$2,698	$0	$136,481	$287,272
11	$0	$43,108	$0	$1,333	$0	$83,308	$0	$2,577	$0	$130,325	$293,517
12	$0	$41,145	$0	$1,273	$0	$79,514	$0	$2,459	$0	$124,391	$299,762
13	$0	$39,254	$0	$1,214	$0	$75,861	$0	$2,346	$0	$118,675	$306,007
14	$0	$37,435	$0	$1,158	$0	$72,345	$0	$2,237	$0	$113,175	$312,252
15	$0	$35,685	$0	$1,104	$0	$68,964	$0	$2,133	$0	$107,886	$318,497
16	$0	$34,005	$0	$1,052	$0	$65,716	$0	$2,032	$0	$102,805	$324,743
17	$0	$32,391	$0	$1,002	$0	$62,598	$0	$1,936	$0	$97,927	$330,988
18	$0	$30,844	$0	$954	$0	$59,607	$0	$1,844	$0	$93,248	$337,233
19	$0	$29,360	$0	$908	$0	$56,739	$0	$1,755	$0	$88,761	$343,478
Total	**$0**	**$906,363**	**$0**	**$28,032**	**$0**	**$1,751,594**	**$0**	**$54,173**	**$0**	**$2,740,162**	**$5,807,896**

C

SUMMARY OF EMISSION REDUCTION BENEFITS (continued)

Year	Peak HOV	Peak Non-HOV	Peak Weaving	Peak Truck	Peak Ramp	Peak Arterial	Non-Peak Non-HOV	Non-Peak Weaving	Non-Peak Truck	Peak Bus	Non-Peak Bus	Passenger Rail	Light Rail	Present Value of Emission Benefits	Constant Dollars	tons/yr	PV $/yr
								ADDITIONAL CO2 EMISSIONS									
1	$0	$11,526	$0	$3,591	$0	$0	$22,274	$0	$6,939	$0	$0	$0	$0	$44,330	$50,753	(866)	($26,967)
20	$0	$6,803	$0	$933	$0	$0	$13,148	$0	$1,804	$0	$0	$0	$0	$22,689	$93,943	(1,300)	($17,571)
2	$0	$11,251	$0	$3,470	$0	$0	$21,744	$0	$6,705	$0	$0	$0	$0	$43,171	$52,886	(889)	($26,505)
3	$0	$10,977	$0	$3,351	$0	$0	$21,214	$0	$6,476	$0	$0	$0	$0	$42,018	$55,078	(913)	($26,033)
4	$0	$10,704	$0	$3,234	$0	$0	$20,686	$0	$6,250	$0	$0	$0	$0	$40,875	$57,330	(936)	($25,553)
5	$0	$10,432	$0	$3,120	$0	$0	$20,161	$0	$6,030	$0	$0	$0	$0	$39,744	$59,645	(960)	($25,065)
6	$0	$10,163	$0	$3,009	$0	$0	$19,640	$0	$5,814	$0	$0	$0	$0	$38,626	$62,024	(983)	($24,573)
7	$0	$9,895	$0	$2,900	$0	$0	$19,123	$0	$5,604	$0	$0	$0	$0	$37,522	$64,471	(1,006)	($24,076)
8	$0	$9,713	$0	$1,351	$0	$0	$18,772	$0	$2,611	$0	$0	$0	$0	$32,448	$59,654	(1,022)	($23,392)
9	$0	$9,446	$0	$1,312	$0	$0	$18,256	$0	$2,536	$0	$0	$0	$0	$31,551	$62,065	(1,045)	($22,895)
10	$0	$9,183	$0	$1,274	$0	$0	$17,747	$0	$2,463	$0	$0	$0	$0	$30,667	$64,550	(1,068)	($22,398)
11	$0	$8,924	$0	$1,237	$0	$0	$17,246	$0	$2,390	$0	$0	$0	$0	$29,797	$67,109	(1,091)	($21,901)
12	$0	$8,669	$0	$1,200	$0	$0	$16,753	$0	$2,319	$0	$0	$0	$0	$28,942	$69,746	(1,115)	($21,405)
13	$0	$8,419	$0	$1,164	$0	$0	$16,270	$0	$2,250	$0	$0	$0	$0	$28,102	$72,463	(1,138)	($20,912)
14	$0	$8,173	$0	$1,129	$0	$0	$15,795	$0	$2,182	$0	$0	$0	$0	$27,278	$75,262	(1,161)	($20,421)
15	$0	$7,932	$0	$1,094	$0	$0	$15,330	$0	$2,115	$0	$0	$0	$0	$26,471	$78,147	(1,184)	($19,934)
16	$0	$7,696	$0	$1,061	$0	$0	$14,874	$0	$2,050	$0	$0	$0	$0	$25,680	$81,119	(1,208)	($19,451)
17	$0	$7,465	$0	$1,028	$0	$0	$14,427	$0	$1,986	$0	$0	$0	$0	$24,906	$84,182	(1,231)	($18,973)
18	$0	$7,240	$0	$995	$0	$0	$13,991	$0	$1,924	$0	$0	$0	$0	$24,150	$87,338	(1,254)	($18,500)
19	$0	$7,019	$0	$964	$0	$0	$13,565	$0	$1,863	$0	$0	$0	$0	$23,410	$90,591	(1,277)	($18,033)
Total	**$0**	**$181,633**	**$0**	**$37,418**	**$0**	**$0**	**$351,015**	**$0**	**$72,312**	**$0**	**$0**	**$0**	**$0**	**$642,378**	**$1,388,355**	**(21,648)**	**($444,559)**

A

Year	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
Construction Period															
1													$0	$0	$0
2													$0	$0	$0
3													$0	$0	$0
4													$0	$0	$0
5													$0	$0	$0
6													$0	$0	$0
7													$0	$0	$0
8													$0	$0	$0
Project Open															
1	$927,122	$928,404	$201,823	$44,330									$2,101,679	$0	$2,101,679
2	$889,887	$891,118	$193,717	$43,171									$2,017,893	$0	$2,017,893
3	$853,556	$854,737	$185,808	$42,018									$1,936,120	$0	$1,936,120
4	$818,170	$819,302	$178,105	$40,875									$1,856,453	$0	$1,856,453
5	$783,761	$784,846	$170,615	$39,744									$1,778,965	$0	$1,778,965
6	$750,353	$751,391	$163,342	$38,626									$1,703,711	$0	$1,703,711
7	$717,961	$718,954	$156,291	$37,522									$1,630,729	$0	$1,630,729
8	$686,596	$687,546	$149,463	$32,448									$1,556,053	$0	$1,556,053
9	$656,262	$657,170	$142,860	$31,551									$1,487,843	$0	$1,487,843
10	$626,959	$627,826	$136,481	$30,667									$1,421,933	$0	$1,421,933
11	$598,681	$599,509	$130,325	$29,797									$1,358,312	$0	$1,358,312
12	$571,419	$572,210	$124,391	$28,942									$1,296,961	$0	$1,296,961
13	$545,162	$545,916	$118,675	$28,102									$1,237,856	$0	$1,237,856
14	$519,895	$520,615	$113,175	$27,278									$1,180,963	$0	$1,180,963
15	$495,601	$496,287	$107,886	$26,471									$1,126,245	$0	$1,126,245
16	$472,261	$472,914	$102,805	$25,680									$1,073,660	$0	$1,073,660
17	$449,853	$450,475	$97,927	$24,906									$1,023,162	$0	$1,023,162
18	$428,356	$428,948	$93,248	$24,150									$974,701	$0	$974,701
19	$407,746	$408,310	$88,761	$23,410									$928,228	$0	$928,228
20	$388,000	$388,536	$84,463	$22,689									$883,687	$0	$883,687
Total	$12,587,600	$12,605,014	$2,740,162	$642,378	$0	$0	$0	$0	$0	$0	$0	$0	**$28,575,154**	**$0**	**$28,575,154**

2,043,517	Person-Hours of Time Saved		Person-Hours of Time Saved		Person-Hours of Time Saved
(21,648)	Additional CO2 Emissions (tons)		Additional CO2 Emissions (tons)		Additional CO2 Emissions (tons)
($444,559)	Additional CO2 Emissions ($ PV)		Additional CO2 Emissions ($ PV)		Additional CO2 Emissions ($ PV)

B

INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

USER BENEFITS IN CONSTANT DOLLARS (road 2)

Year	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
Construction Period																
1													$0	$0	$0	
2													$0	$0	$0	
3													$0	$0	$0	
4													$0	$0	$0	
5													$0	$0	$0	
6													$0	$0	$0	
7													$0	$0	$0	
8													$0	$0	$0	
Project Open																
1	$1,061,462	$1,062,930	$231,067	$50,753									$2,406,212	$0	$2,406,212	$2,406,212
2	$1,090,150	$1,091,658	$237,312	$52,886									$2,472,006	$0	$2,472,006	$4,878,218
3	$1,118,838	$1,120,386	$243,557	$55,078									$2,537,858	$0	$2,537,858	$7,416,076
4	$1,147,526	$1,149,114	$249,802	$57,330									$2,603,772	$0	$2,603,772	$10,019,847
5	$1,176,214	$1,177,842	$256,047	$59,645									$2,669,747	$0	$2,669,747	$12,689,595
6	$1,204,902	$1,206,569	$262,292	$62,024									$2,735,788	$0	$2,735,788	$15,425,383
7	$1,233,591	$1,235,297	$268,537	$64,471									$2,801,895	$0	$2,801,895	$18,227,278
8	$1,262,279	$1,264,025	$274,782	$59,654									$2,860,740	$0	$2,860,740	$21,088,018
9	$1,290,967	$1,292,753	$281,027	$62,065									$2,926,812	$0	$2,926,812	$24,014,831
10	$1,319,655	$1,321,481	$287,272	$64,550									$2,992,958	$0	$2,992,958	$27,007,788
11	$1,348,343	$1,350,209	$293,517	$67,109									$3,059,178	$0	$3,059,178	$30,066,966
12	$1,377,031	$1,378,936	$299,762	$69,746									$3,125,476	$0	$3,125,476	$33,192,442
13	$1,405,720	$1,407,664	$306,007	$72,463									$3,191,854	$0	$3,191,854	$36,384,296
14	$1,434,408	$1,436,392	$312,252	$75,262									$3,258,314	$0	$3,258,314	$39,642,610
15	$1,463,096	$1,465,120	$318,497	$78,147									$3,324,860	$0	$3,324,860	$42,967,470
16	$1,491,784	$1,493,848	$324,743	$81,119									$3,391,493	$0	$3,391,493	$46,358,963
17	$1,520,472	$1,522,576	$330,988	$84,182									$3,458,217	$0	$3,458,217	$49,817,181
18	$1,549,160	$1,551,303	$337,233	$87,338									$3,525,035	$0	$3,525,035	$53,342,215
19	$1,577,848	$1,580,031	$343,478	$90,591									$3,591,949	$0	$3,591,949	$56,934,164
20	$1,606,537	$1,608,759	$349,723	$93,943									$3,658,962	$0	$3,658,962	$60,593,126
Total	$26,679,983	$26,716,893	$5,807,896	$1,388,355	$0	$0	$0	$0	$0	$0	$0	$0	**$60,593,126**	**$0**	**$60,593,126**	

Total Construction Costs **$0**

Years After Construction Begins	ANNUAL RETURNS ON INVESTMENT
1	$0
2	$0
3	$2,406,212
4	$2,472,006
5	$2,537,858
6	$2,603,772
7	$2,669,747
8	$2,735,788
9	$2,801,895
10	$2,860,740
11	$2,926,812
12	$2,992,958
13	$3,059,178
14	$3,125,476
15	$3,191,854
16	$3,258,314
17	$3,324,860
18	$3,391,493
19	$3,458,217
20	$3,525,035
21	$3,591,949
22	$3,658,962
23	$0
24	$0
25	$0
26	$0
27	$0
28	$0

Internal Rate of Return **#DIV/0!**

The INTERNAL RATE OF RETURN (IRR) is the discount rate at which benefits and costs break even (are equal). For a pr
with an IRR greater than the Discount Rate, benefits are greater than costs, and the project has a positive economic value.
IRR allows projects with different costs, different benefit flows, and different time periods to be compared.

Payback Period **N/A**

The PAYBACK PERIOD is the number of years it takes for the net benefits (benefits minus costs) to equal, or payback, the i
construction costs. For a project with a Payback Period longer than the life-cycle of the project, initial construction costs are
recovered. The Payback Period varies inversely with the Benefit-Cost Ratio: shorter Payback Period yields higher Benefit-C

Parameters

This page contains all economic values and rate tables.
To update economic values automatically, change "Economic Update Factor."

General Economic Parameters

Parameter	Value	Source
Year of Current Dollars for Model	2009	
Economic Update Factor (Using GDP Deflator)	1.04	1
Real Discount Rate	7.0% (Also use 3%)	2

Travel Time Parameters

Parameter	Value	Units	Source
Statewide Average Hourly Wage		$/hr	3
Transportation and Warehousing			
Average Hourly Wage		$/hr	3
Benefits and Costs		$/hr	4
Value of Time			
Automobile	$11.20	$/hr/per	5
Truck	$18.10	$/hr/veh	5
Auto & Truck Composite		$/hr/veh	6
Transit	$11.20	$/hr/per	5
Out-of-Vehicle Travel	2	times	5
Incident-Related Travel	1	times	7

Vehicle Operating Cost Parameters

Parameter	Value	Units	Source
Average Fuel Price			
Automobile (regular unleaded)		$/gal	8
Truck (diesel)		$/gal	8
Sales and Fuel Taxes			
State Sales Tax		%	9
Average Local Sales Tax		%	9
Federal Fuel Excise Tax (gasoline)		$/gal	9
Federal Fuel Excise Tax (diesel)		$/gal	9
State Fuel Excise Tax		$/gal	9
Fuel Cost Per Gallon (Exclude Taxes)			
Automobile	$3.46	$/gal	
Truck	$3.46	$/gal	
Non-Fuel Cost Per Mile			
Automobile	$0.321	$/mi	10
Truck	$0.447	$/mi	11, 12
Idling Speed for Op. Costs and Emissions	5	mph	

Accident Cost Parameters

Parameter	Value	Units	Source
Cost of a Fatality	$6,000,000	$/event	13
Cost of an Injury			
Level A (Severe)	$1,125,000	$/event	13
Level B (Moderate)	$93,000	$/event	13
Level C (Minor)	$12,000	$/event	13
Cost of Property Damage	$2,300	$/event	13
Cost of Highway Accident			
Fatal Accident	$6,700,000	$/accident	
Injury Accident	$131,500	$/accident	
PDO Accident	$9,400	$/accident	
Average Cost	$82,000	$/accident	
Statewide Highway Accident Rates			
Fatal Accident	0.009	per mil veh-mi	14
Injury Accident	0.31	per mil veh-mi	14
PDO Accident	0.65	per mil veh-mi	14
Non-Freeway	1.25	per mil veh-mi	14

Sources: 1) Office of Management and Budget (OMB), 2) Review of OMB and State Treasurer's Office data, 3) Bureau of Labor Statistics (BLS) QCEW, 4) BLS Employment Cost Inde, 5) USDOT Department Guidance, 6) California Department of Tranportation TSI and Traffic Operations, 7) IDAS model, 8) AAA Daily Fuel Gauge Report, 9) Transportation Funding in California, 10) AAA Your Driving Costs, 11) FHWA Office of Freight Management and Operations, 12) Zaniewski et al, 13) National Safety Council, 14) TASAS summary 2006

Highway Operations Parameters

Parameter	Value	Units	Source
Maximum V/C Ratio	1.56	-	15
Percent ADT in Peak Period	34.1%	%	
Percent ADT in Average Peak Hour	8.5%	%	
Annualization Factor	365	days/yr	

	Alpha	Beta	Capacity (vphpl)	Dep. Rate (vphpl)	Source
Freeway	0.20	10	2,000	1,800	15, 16
Expressway	0.20	10	2,000	1,800	15, 16
Conventional Highway	0.05	10	800	1,400	16
HOV Lanes	0.55	8	1,600		17

Non-HOV Lanes	Alpha	Beta	Capacity (vphpl)
No Build	0.05	10	800
Build	0.05	10	800

Sources: 15) Highway Capacity Manual, 16) NCHRP 387, 17) PeMS data

Project Types

Project Type	Selected	Code	Instruction
Highway Capacity Expansion			Please select a type of highway project
General Highway	TRUE	GenHwy	
HOV Lane Addition	FALSE	HOV	Enter HOV restriction in section 1B
HOT Lane Addition	FALSE	HOT	Include toll payers as HOVs & check AVOs
Passing Lane	FALSE	Passing	Enter a truck speed in section 1B
Intersection	FALSE	Intersect	Remember to run model for both roads
Bypass	FALSE	Bypass	Remember to run model for both roads
Queuing	FALSE	Queuing	Add arrival rate & check departure rate in 1B
Pavement	FALSE	Pavement	Enter pavement condition in section 1B
Rail or Transit Cap Expansion			Please select a type of rail or transit project
Passenger Rail	FALSE	PassRail	Enter data in both sections 1B & 1E
Light-Rail (LRT)	FALSE	LRT	Enter data in both sections 1B & 1E
Bus	FALSE	Bus	Enter data in both sections 1B & 1E
Hwy-Rail Grade Crossing	FALSE	HwyRail	Put hwy design in 1B, safety in 1C & crossing in 1D
Hwy Operational Improvement			Please select a type of op. improvement
Auxiliary Lane	FALSE	AuxLane	Enter ramp design speed & on-ramp volume
Freeway Connector	FALSE	FreeConn	Check percent traffic in weave in section 1B
HOV Connector	FALSE	HOVConn	Check percent traffic in weave in section 1B
HOV Drop Ramp	FALSE	HOVDrop	Check percent traffic in weave in section 1B
Off-Ramp Widening	FALSE	OffRamp	Check percent traffic in weave in section 1B
On-Ramp Widening	FALSE	OnRamp	Enter on-ramp volume & metering strategy
HOV-2 to HOV-3 Conv	FALSE	HOV2to3	Check AVOs & trips in sections 1B & 2D
HOT Lane Conversion	FALSE	HOTConv	Check AVOs & trips in sections 1B & 2D
Transp Mgmt Systems (TMS)			Please select a type of TMS project
Ramp Metering	FALSE	RM	Enter model data, if avail, in sections 2A & 2C
Ramp Metering Signal Coord	FALSE	AM	Enter model data, if avail, in sections 2A & 2C
Incident Management	FALSE	IM	Enter model data, if avail, in sections 2A & 2C
Traveler Information	FALSE	TI	Enter model data, if avail, in sections 2A & 2C
Arterial Signal Management	FALSE	ASM	Complete only sections 1A, 1E & 2C
Transit Vehicle Location (AVL)	FALSE	AVL	Enter transit agency costs in section 1D
Transit Vehicle Signal Priority	FALSE	SigPriority	Check travel time in section 1D
Bus Rapid Transit (BRT)	FALSE	BRT	Enter free-flow bus lane speed in section 1B
TMS Lookup Code	NoAdj	TMSLookup	
User Modified Inputs	FALSE	UserAdjInputs	

Travel Demand Tables

Number of Hours in Peak Period	Fwy/Exp	Other	Fwy/Exp	Other	Fwy/Exp	Other
1	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%
2	17.2%	17.2%	17.2%	17.2%	17.2%	17.2%
3	25.8%	25.8%	25.8%	25.8%	25.8%	25.8%
4	34.1%	34.1%	34.1%	34.1%	34.1%	34.1%
5	41.0%	41.0%	41.0%	41.0%	41.0%	41.0%
6	47.3%	47.3%	47.3%	47.3%	47.3%	47.3%
7	53.5%	53.5%	53.5%	53.5%	53.5%	53.5%
8	59.6%	59.6%	59.6%	59.6%	59.6%	59.6%
9	65.6%	65.6%	65.6%	65.6%	65.6%	65.6%
10	71.1%	71.1%	71.1%	71.1%	71.1%	71.1%
11	76.5%	76.5%	76.5%	76.5%	76.5%	76.5%
12	81.7%	81.7%	81.7%	81.7%	81.7%	81.7%
13	86.9%	86.9%	86.9%	86.9%	86.9%	86.9%
14	89.9%	89.9%	89.9%	89.9%	89.9%	89.9%
15	92.7%	92.7%	92.7%	92.7%	92.7%	92.7%
16	95.0%	95.0%	95.0%	95.0%	95.0%	95.0%
17	96.7%	96.7%	96.7%	96.7%	96.7%	96.7%
18	97.9%	97.9%	97.9%	97.9%	97.9%	97.9%
19	98.9%	98.9%	98.9%	98.9%	98.9%	98.9%
20	99.5%	99.5%	99.5%	99.5%	99.5%	99.5%
21	99.7%	99.7%	99.7%	99.7%	99.7%	99.7%
22	99.8%	99.8%	99.8%	99.8%	99.8%	99.8%
23	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
24	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: California Department of Transportation, 2000-2001 California Statewide Travel Survey Weekday Travel Report, June 2003

Operating Cost Tables

Speed	Auto*	Truck
5	0.1519	0.2967
6	0.1442	0.2904
7	0.1365	0.2840
8	0.1288	0.2777
9	0.1212	0.2713
10	0.1135	0.2649
11	0.1083	0.2549
12	0.1032	0.2449
13	0.0980	0.2349
14	0.0928	0.2248
15	0.0877	0.2148
16	0.0842	0.2074
17	0.0808	0.2000
18	0.0773	0.1926
19	0.0739	0.1853
20	0.0704	0.1779
21	0.0681	0.1741
22	0.0658	0.1702
23	0.0634	0.1664
24	0.0611	0.1626
25	0.0588	0.1588
26	0.0572	0.1566
27	0.0556	0.1544
28	0.0541	0.1523
29	0.0525	0.1501
30	0.0509	0.1479
31	0.0499	0.1463
32	0.0489	0.1447
33	0.0478	0.1431
34	0.0468	0.1415
35	0.0458	0.1399
36	0.0451	0.1387
37	0.0445	0.1376
38	0.0439	0.1364
39	0.0433	0.1352
40	0.0426	0.1341
41	0.0423	0.1333
42	0.0420	0.1326
43	0.0417	0.1318
44	0.0415	0.1310
45	0.0412	0.1303
46	0.0412	0.1299
47	0.0412	0.1295
48	0.0412	0.1291
49	0.0411	0.1287
50	0.0411	0.1283
51	0.0414	0.1283
52	0.0417	0.1283
53	0.0420	0.1282
54	0.0423	0.1282
55	0.0426	0.1282
56	0.0432	0.1286
57	0.0438	0.1290
58	0.0444	0.1293
59	0.0450	0.1297
60	0.0457	0.1301
61	0.0467	0.1309
62	0.0477	0.1318
63	0.0487	0.1326
64	0.0497	0.1335
65	0.0507	0.1343
66	0.0514	0.1358
67	0.0521	0.1372
68	0.0528	0.1386
69	0.0535	0.1401
70	0.0542	0.1415
71	0.0542	0.1437
72	0.0543	0.1460
73	0.0543	0.1482
74	0.0544	0.1505
75	0.0544	0.1527
76	0.0545	0.1561
77	0.0545	0.1596
78	0.0546	0.1630
79	0.0547	0.1665
80	0.0547	0.1699

** Includes motorcycles & motorhomes*

Accident Tables

Event	Urban	Suburban	Rural	Average
Severe Injury (A)	4.72%	4.72%	4.72%	4.72%
Other Visible Injury (B)	27.42%	27.42%	27.42%	27.42%
Complaint of Pain (C)	67.87%	67.87%	67.87%	67.87%

Source: 2006 SWITRS Annual Report, Table 7C

Accident Type	Urban	Suburban	Rural	Average
Fatal Accident	1.11	1.10	1.20	1.15

Accident Type	Urban	Suburban	Rural	Average
Fatal Accident	0.94	1.14	1.35	1.16
Injury Accident	1.46	1.47	1.57	1.49

Accident Type	Urban	Suburban	Rural	Average
Fatal Accident	1.68	1.63	1.63	1.65
Injury Accident	2.09	2.00	1.61	1.97
PDO Accident	2.04	1.95	1.63	1.96

Accident Type	Urban	Suburban	Rural	Average
Fatal Accident	0.51%	0.78%	2.30%	0.87%
Injury Accident	31.62%	31.78%	38.44%	32.88%
PDO Accident	67.87%	67.45%	59.26%	66.25%

Source: California Department of Transportation,TASAS Unit, 2004 to 2006 average

Accident Type	Urban	Suburban	Rural	Average
Fatal Accident	$6,700,000	$6,700,000	$7,300,000	$7,000,000
Injury Accident	$131,500	$132,100	$139,900	$133,800
PDO Accident	$9,400	$9,000	$7,500	$9,000
All Types	$82,000	$100,100	$226,200	$110,900

18

Source: 18) Urban Institute

Event	Pass Train	Light Rail	Bus
Fatality	0.0371	0.2163	0.0336
Injury	0.3223	3.6319	4.1381
All Accidents	0.2533	8.6060	3.6557

Source: USDOT,Transportation Statistics Annual Report, Table 43, 2003 to 2005 average

Event	Pass Train	Light Rail	Bus
Fatality	$6,000,000	$6,000,000	$6,000,000
Injury	$244,600	$244,600	$244,600
Prop Damage	$138,600	$7,400	$3,300

Source: FTA, Transit Safety & Security Statistics, 2003 to 2005 average

Value	Pass Train	Light Rail	Bus
Cost	$336,500	$2,249,800	$1,225,800

Source: Combination of above two tables

Value	Incident	Fatality	Injury
Total Events	1,665	331	585
Avg per Incident		0.1988	0.3514
Cost per Event		$6,000,000	$244,600

Source: FRA, Office of Safety Analysis, 5.11 - Hwy/Rail Incidents Summary Tables, California, Jan 1998 to Dec 2007

Minimum ADT	Fatality	Injury	PDO
0	25.0%	69.4%	92.6%
5,000	19.2%	80.3%	96.5%
10,000	84.0%	57.7%	97.8%

Source: Taylor and Jain, 1991

Parameters

This page contains all economic values and rate tables.
To update economic values automatically, change "Economic Update Factor."

General Economic Parameters

Travel Demand Tables

Operating Cost Tables

Note: Five-sixth is best estimate for idling

Source: California Air Resources Board, EMFAC 2007 V2.3, 2007 & 2037 average

Accident Tables

Emissions Tables

HIGHWAY EMISSIONS FACTORS (g/mi)

Model Year 2007

Mode	Speed	CO	CO2	NOX	PM10	SOX	VOC
Auto	0	7.9768	84.89	0.5771	0.0085	0.0000	0.9653
	5	9.1573	1326.71	0.7543	0.1085	0.0131	1.0373
	6	8.8380	1258.78	0.7335	0.1023	0.0124	0.9792
	7	8.5187	1190.85	0.7127	0.0961	0.0118	0.9211
	8	8.1995	1122.93	0.6918	0.0899	0.0111	0.8631
	9	7.8802	1055.00	0.6710	0.0837	0.0104	0.8050
	10	7.5609	987.07	0.6501	0.0775	0.0098	0.7469
	11	7.3231	941.40	0.6346	0.0738	0.0093	0.7112
	12	7.0853	895.74	0.6191	0.0702	0.0089	0.6755
	13	6.8475	850.07	0.6036	0.0665	0.0084	0.6397
	14	6.6098	804.40	0.5881	0.0629	0.0080	0.6040
	15	6.3720	758.74	0.5726	0.0592	0.0076	0.5682
	16	6.2017	728.23	0.5613	0.0570	0.0073	0.5464
	17	6.0314	697.73	0.5500	0.0548	0.0070	0.5246
	18	5.8612	667.23	0.5388	0.0526	0.0067	0.5028
	19	5.6909	636.73	0.5275	0.0504	0.0064	0.4810
	20	5.5206	606.23	0.5162	0.0482	0.0061	0.4592
	21	5.3957	585.62	0.5081	0.0468	0.0059	0.4457
	22	5.2708	565.02	0.5000	0.0455	0.0057	0.4321
	23	5.1459	544.41	0.4919	0.0441	0.0055	0.4186
	24	5.0210	523.81	0.4838	0.0427	0.0053	0.4050
	25	4.8962	503.20	0.4757	0.0414	0.0051	0.3915
	26	4.8037	489.32	0.4700	0.0405	0.0049	0.3829
	27	4.7112	475.43	0.4644	0.0396	0.0048	0.3743
	28	4.6187	461.55	0.4587	0.0388	0.0047	0.3657
	29	4.5262	447.66	0.4531	0.0379	0.0045	0.3571
	30	4.4337	433.78	0.4474	0.0370	0.0044	0.3484
	31	4.3660	424.66	0.4437	0.0365	0.0043	0.3431
	32	4.2983	415.55	0.4401	0.0359	0.0042	0.3377
	33	4.2306	406.43	0.4364	0.0354	0.0041	0.3323
	34	4.1629	397.32	0.4327	0.0348	0.0041	0.3269
	35	4.0952	388.20	0.4291	0.0342	0.0040	0.3216
	36	4.0482	382.68	0.4271	0.0339	0.0039	0.3184
	37	4.0012	377.16	0.4251	0.0335	0.0039	0.3153
	38	3.9542	371.63	0.4231	0.0332	0.0038	0.3121
	39	3.9072	366.11	0.4211	0.0328	0.0037	0.3090
	40	3.8602	360.59	0.4191	0.0325	0.0037	0.3058
	41	3.8324	357.97	0.4186	0.0323	0.0037	0.3044
	42	3.8046	355.36	0.4182	0.0321	0.0036	0.3029
	43	3.7767	352.75	0.4177	0.0319	0.0036	0.3015
	44	3.7489	350.14	0.4172	0.0317	0.0036	0.3000
	45	3.7211	347.53	0.4168	0.0315	0.0036	0.2985
	46	3.7133	347.51	0.4177	0.0314	0.0036	0.2985
	47	3.7055	347.50	0.4187	0.0313	0.0036	0.2985
	48	3.6978	347.48	0.4197	0.0313	0.0036	0.2985
	49	3.6900	347.46	0.4207	0.0312	0.0036	0.2985
	50	3.6822	347.44	0.4217	0.0311	0.0036	0.2984
	51	3.6983	349.99	0.4242	0.0311	0.0036	0.2999
	52	3.7144	352.55	0.4267	0.0312	0.0036	0.3013
	53	3.7304	355.10	0.4292	0.0312	0.0036	0.3027
	54	3.7465	357.65	0.4317	0.0312	0.0037	0.3041
	55	3.7626	360.20	0.4343	0.0313	0.0037	0.3055
	56	3.8105	365.59	0.4385	0.0314	0.0038	0.3086
	57	3.8584	370.98	0.4427	0.0315	0.0038	0.3117
	58	3.9063	376.38	0.4469	0.0317	0.0039	0.3147
	59	3.9542	381.77	0.4511	0.0318	0.0039	0.3178
	60	4.0021	387.16	0.4553	0.0320	0.0040	0.3209
	61	4.0968	396.00	0.4616	0.0322	0.0040	0.3262
	62	4.1916	404.84	0.4679	0.0325	0.0041	0.3315
	63	4.2863	413.68	0.4741	0.0328	0.0042	0.3367
	64	4.3811	422.52	0.4804	0.0331	0.0043	0.3420
	65	4.4758	431.36	0.4867	0.0334	0.0044	0.3473
	66	4.5965	437.44	0.4914	0.0336	0.0044	0.3529
	67	4.7173	443.53	0.4962	0.0338	0.0045	0.3585
	68	4.8380	449.62	0.5010	0.0340	0.0046	0.3640
	69	4.9587	455.71	0.5058	0.0343	0.0046	0.3696
	70	5.0794	461.79	0.5106	0.0345	0.0047	0.3752
	71	5.2254	461.91	0.5124	0.0345	0.0047	0.3804
	72	5.3714	462.03	0.5143	0.0346	0.0047	0.3856
	73	5.5173	462.15	0.5162	0.0347	0.0047	0.3908
	74	5.6633	462.27	0.5181	0.0347	0.0047	0.3960
	75	5.8093	462.39	0.5200	0.0348	0.0047	0.4012
	76	6.0704	462.53	0.5227	0.0349	0.0047	0.4097
	77	6.3316	462.67	0.5255	0.0350	0.0047	0.4181
	78	6.5928	462.81	0.5283	0.0351	0.0047	0.4266
	79	6.8539	462.95	0.5310	0.0352	0.0047	0.4350
	80	7.1151	463.10	0.5338	0.0353	0.0047	0.4435

Mode	Speed	CO	CO2	NOX	PM10	SOX	VOC
Auto	0	1.9386	81.72	0.1143	0.0098	0.0000	0.2697
	5	1.8543	1311.41	0.1593	0.1307	0.0128	0.2336
	6	1.8184	1244.19	0.1551	0.1226	0.0121	0.2228
	7	1.7825	1176.96	0.1508	0.1145	0.0115	0.2121
	8	1.7467	1109.73	0.1466	0.1063	0.0108	0.2013
	9	1.7108	1042.50	0.1423	0.0982	0.0102	0.1906
	10	1.6750	975.27	0.1380	0.0901	0.0095	0.1798
	11	1.6417	929.97	0.1347	0.0854	0.0091	0.1730
	12	1.6084	884.67	0.1314	0.0808	0.0087	0.1662
	13	1.5751	839.37	0.1281	0.0761	0.0082	0.1594
	14	1.5418	794.07	0.1248	0.0715	0.0078	0.1526
	15	1.5085	748.77	0.1215	0.0668	0.0074	0.1458
	16	1.4808	718.53	0.1191	0.0641	0.0071	0.1418
	17	1.4532	688.29	0.1166	0.0613	0.0068	0.1377
	18	1.4255	658.05	0.1141	0.0586	0.0065	0.1337
	19	1.3979	627.81	0.1116	0.0558	0.0062	0.1297
	20	1.3702	597.57	0.1091	0.0530	0.0059	0.1257
	21	1.3471	577.16	0.1073	0.0514	0.0057	0.1232
	22	1.3239	556.75	0.1054	0.0497	0.0055	0.1207
	23	1.3008	536.34	0.1036	0.0480	0.0053	0.1183
	24	1.2777	515.93	0.1017	0.0463	0.0051	0.1158
	25	1.2545	495.52	0.0998	0.0446	0.0049	0.1134
	26	1.2352	481.77	0.0985	0.0435	0.0048	0.1119
	27	1.2158	468.03	0.0971	0.0425	0.0047	0.1104
	28	1.1964	454.29	0.0958	0.0414	0.0045	0.1089
	29	1.1771	440.55	0.0944	0.0404	0.0044	0.1074
	30	1.1577	426.80	0.0931	0.0393	0.0043	0.1059
	31	1.1417	417.79	0.0921	0.0387	0.0042	0.1050
	32	1.1256	408.77	0.0912	0.0380	0.0041	0.1041
	33	1.1095	399.75	0.0902	0.0373	0.0040	0.1032
	34	1.0935	390.74	0.0893	0.0367	0.0039	0.1023
	35	1.0774	381.72	0.0883	0.0360	0.0038	0.1015
	36	1.0645	376.27	0.0878	0.0356	0.0038	0.1010
	37	1.0515	370.81	0.0872	0.0352	0.0037	0.1006
	38	1.0385	365.36	0.0866	0.0348	0.0037	0.1001
	39	1.0255	359.91	0.0860	0.0344	0.0036	0.0997
	40	1.0126	354.45	0.0854	0.0340	0.0036	0.0993
	41	1.0027	351.89	0.0851	0.0337	0.0035	0.0992
	42	0.9928	349.32	0.0848	0.0335	0.0035	0.0991
	43	0.9829	346.76	0.0845	0.0333	0.0035	0.0990
	44	0.9730	344.20	0.0843	0.0331	0.0035	0.0990
	45	0.9631	341.63	0.0840	0.0328	0.0034	0.0989
	46	0.9567	341.64	0.0840	0.0327	0.0034	0.0992
	47	0.9502	341.64	0.0840	0.0327	0.0034	0.0995
	48	0.9437	341.65	0.0840	0.0326	0.0034	0.0997
	49	0.9373	341.65	0.0840	0.0325	0.0034	0.1000
	50	0.9308	341.66	0.0841	0.0324	0.0034	0.1003
	51	0.9286	344.21	0.0844	0.0324	0.0035	0.1010
	52	0.9263	346.77	0.0847	0.0325	0.0035	0.1016
	53	0.9241	349.32	0.0850	0.0325	0.0035	0.1023
	54	0.9218	351.88	0.0853	0.0326	0.0035	0.1030
	55	0.9196	354.44	0.0857	0.0326	0.0036	0.1036
	56	0.9231	359.81	0.0863	0.0328	0.0036	0.1048
	57	0.9266	365.18	0.0870	0.0330	0.0037	0.1060
	58	0.9302	370.55	0.0876	0.0332	0.0037	0.1072
	59	0.9337	375.92	0.0883	0.0334	0.0038	0.1084
	60	0.9372	381.29	0.0889	0.0335	0.0038	0.1095
	61	0.9496	390.09	0.0899	0.0339	0.0039	0.1115
	62	0.9619	398.89	0.0910	0.0342	0.0040	0.1134
	63	0.9742	407.68	0.0920	0.0346	0.0041	0.1153
	64	0.9865	416.48	0.0930	0.0349	0.0042	0.1172
	65	0.9988	425.28	0.0940	0.0353	0.0042	0.1191
	66	1.0285	431.39	0.0949	0.0355	0.0043	0.1219
	67	1.0582	437.51	0.0957	0.0358	0.0044	0.1246
	68	1.0879	443.62	0.0966	0.0361	0.0044	0.1274
	69	1.1176	449.74	0.0975	0.0363	0.0045	0.1301
	70	1.1473	455.85	0.0983	0.0366	0.0045	0.1329
	71	1.2045	456.12	0.0988	0.0366	0.0045	0.1369
	72	1.2617	456.39	0.0992	0.0366	0.0045	0.1410
	73	1.3189	456.66	0.0997	0.0367	0.0045	0.1450
	74	1.3761	456.92	0.1002	0.0367	0.0045	0.1491
	75	1.4333	457.19	0.1006	0.0367	0.0046	0.1531
	76	1.5363	457.55	0.1012	0.0368	0.0046	0.1598
	77	1.6393	457.92	0.1019	0.0368	0.0046	0.1665
	78	1.7423	458.28	0.1025	0.0369	0.0046	0.1732
	79	1.8452	458.64	0.1031	0.0369	0.0046	0.1799
	80	1.9482	459.00	0.1038	0.0370	0.0046	0.1866

Emissions Tables

Truck	0	11.9473	30.38	1.3921	0.0019	0.0000	1.0193	
	5	22.5401	2812.55	26.1291	1.8338	0.0273	7.6294	
	6	21.8297	2753.56	25.2987	1.7745	0.0267	7.2931	
	7	21.1194	2694.58	24.4683	1.7151	0.0261	6.9568	
	8	20.4090	2635.59	23.6380	1.6557	0.0256	6.6206	
	9	19.6986	2576.61	22.8076	1.5964	0.0250	6.2843	
	10	18.9882	2517.62	21.9772	1.5370	0.0244	5.9480	
	11	17.9389	2424.07	20.7639	1.4411	0.0235	5.4372	
	12	16.8896	2330.52	19.5506	1.3451	0.0226	4.9264	
	13	15.8403	2236.96	18.3373	1.2492	0.0217	4.4156	
	14	14.7910	2143.41	17.1240	1.1532	0.0207	3.9048	
	15	13.7417	2049.86	15.9107	1.0573	0.0198	3.3940	
	16	13.0390	1980.50	15.2844	0.9910	0.0191	3.0871	
	17	12.3362	1911.15	14.6582	0.9247	0.0185	2.7803	
	18	11.6335	1841.80	14.0320	0.8585	0.0178	2.4734	
	19	10.9308	1772.44	13.4057	0.7922	0.0172	2.1665	
	20	10.2280	1703.09	12.7795	0.7259	0.0165	1.8597	
	21	9.8116	1667.41	12.6268	0.6982	0.0162	1.7695	
	22	9.3951	1631.72	12.4741	0.6705	0.0158	1.6793	
	23	8.9786	1596.04	12.3214	0.6428	0.0155	1.5891	
	24	8.5622	1560.35	12.1687	0.6151	0.0152	1.4989	
	25	8.1457	1524.67	12.0160	0.5874	0.0148	1.4086	
	26	7.8695	1504.48	11.9390	0.5708	0.0146	1.3627	
	27	7.5933	1484.29	11.8621	0.5542	0.0144	1.3167	
	28	7.3172	1464.09	11.7851	0.5377	0.0142	1.2707	
	29	7.0410	1443.90	11.7082	0.5211	0.0140	1.2247	
	30	6.7648	1423.71	11.6312	0.5045	0.0138	1.1787	
	31	6.5648	1408.67	11.5829	0.4924	0.0136	1.1449	
	32	6.3648	1393.63	11.5345	0.4802	0.0135	1.1112	
	33	6.1648	1378.58	11.4862	0.4681	0.0133	1.0774	
	34	5.9648	1363.54	11.4378	0.4560	0.0132	1.0436	
	35	5.7648	1348.50	11.3895	0.4438	0.0130	1.0098	
	36	5.6235	1337.56	11.3686	0.4360	0.0130	0.9866	
	37	5.4823	1326.62	11.3477	0.4281	0.0129	0.9634	
	38	5.3410	1315.68	11.3269	0.4202	0.0128	0.9402	
	39	5.1997	1304.75	11.3060	0.4124	0.0128	0.9170	
	40	5.0584	1293.81	11.2852	0.4045	0.0127	0.8938	
	41	4.9665	1286.55	11.2922	0.4009	0.0126	0.8801	
	42	4.8746	1279.29	11.2993	0.3973	0.0125	0.8664	
	43	4.7827	1272.03	11.3064	0.3936	0.0124	0.8528	
	44	4.6908	1264.77	11.3135	0.3900	0.0123	0.8391	
	45	4.5989	1257.51	11.3205	0.3864	0.0122	0.8254	
	46	4.5523	1253.73	11.3572	0.3869	0.0122	0.8208	
	47	4.5057	1249.96	11.3938	0.3874	0.0121	0.8161	
	48	4.4591	1246.19	11.4304	0.3879	0.0121	0.8114	
	49	4.4125	1242.42	11.4671	0.3884	0.0120	0.8068	
	50	4.3659	1238.64	11.5037	0.3889	0.0120	0.8021	
	51	4.3647	1238.29	11.5735	0.3935	0.0120	0.8060	
	52	4.3636	1237.93	11.6434	0.3980	0.0120	0.8099	
	53	4.3624	1237.58	11.7132	0.4026	0.0121	0.8137	
	54	4.3612	1237.22	11.7830	0.4072	0.0121	0.8176	
	55	4.3600	1236.87	11.8528	0.4118	0.0121	0.8215	
	56	4.4085	1240.28	11.9617	0.4204	0.0121	0.8339	
	57	4.4570	1243.70	12.0705	0.4290	0.0121	0.8462	
	58	4.5055	1247.12	12.1793	0.4376	0.0121	0.8585	
	59	4.5540	1250.53	12.2882	0.4462	0.0121	0.8709	
	60	4.6025	1253.95	12.3970	0.4548	0.0121	0.8832	
	61	4.7103	1261.59	12.5545	0.4675	0.0122	0.9039	
	62	4.8181	1269.23	12.7120	0.4801	0.0122	0.9245	
	63	4.9258	1276.87	12.8695	0.4928	0.0123	0.9451	
	64	5.0336	1284.51	13.0270	0.5054	0.0124	0.9658	
	65	5.1414	1292.15	13.1845	0.5181	0.0125	0.9864	
	66	5.3265	1305.25	13.4060	0.5347	0.0126	1.0154	
	67	5.5117	1318.34	13.6275	0.5514	0.0127	1.0445	
	68	5.6968	1331.44	13.8490	0.5681	0.0129	1.0735	
	69	5.8819	1344.54	14.0704	0.5848	0.0130	1.1025	
	70	6.0670	1357.63	14.2919	0.6015	0.0132	1.1315	
	71	6.3619	1377.97	14.6022	0.6222	0.0134	1.1690	
	72	6.6568	1398.30	14.9124	0.6429	0.0136	1.2065	
	73	6.9517	1418.63	15.2226	0.6636	0.0138	1.2440	
	74	7.2466	1438.97	15.5328	0.6843	0.0140	1.2815	
	75	7.5415	1459.30	15.8430	0.7050	0.0142	1.3190	
	76	8.0049	1490.48	16.2826	0.7298	0.0145	1.3652	
	77	8.4683	1521.66	16.7221	0.7546	0.0148	1.4115	
	78	8.9317	1552.83	17.1616	0.7794	0.0151	1.4578	
	79	9.3951	1584.01	17.6011	0.8042	0.0154	1.5040	
	80	9.8585	1615.19	18.0406	0.8290	0.0157	1.5503	

Truck	0	2.6933	28.33	0.8788	0.0015	0.0000	0.2027	
	5	5.2205	2931.21	5.2336	0.1930	0.0281	1.6681	
	6	5.0216	2869.86	5.1121	0.1899	0.0275	1.5942	
	7	4.8228	2808.52	4.9906	0.1868	0.0269	1.5204	
	8	4.6239	2747.17	4.8691	0.1837	0.0263	1.4465	
	9	4.4251	2685.83	4.7476	0.1806	0.0257	1.3727	
	10	4.2263	2624.48	4.6261	0.1775	0.0251	1.2988	
	11	3.9378	2526.50	4.4341	0.1725	0.0242	1.1891	
	12	3.6493	2428.51	4.2421	0.1674	0.0233	1.0794	
	13	3.3608	2330.52	4.0501	0.1624	0.0223	0.9697	
	14	3.0723	2232.53	3.8580	0.1574	0.0214	0.8599	
	15	2.7838	2134.54	3.6660	0.1523	0.0205	0.7502	
	16	2.6152	2061.31	3.5406	0.1486	0.0198	0.6902	
	17	2.4467	1988.07	3.4152	0.1449	0.0191	0.6301	
	18	2.2781	1914.83	3.2897	0.1411	0.0184	0.5700	
	19	2.1096	1841.59	3.1643	0.1374	0.0177	0.5100	
	20	1.9410	1768.36	3.0388	0.1337	0.0170	0.4499	
	21	1.8755	1730.96	2.9808	0.1315	0.0166	0.4359	
	22	1.8099	1693.56	2.9227	0.1292	0.0163	0.4219	
	23	1.7443	1656.17	2.8647	0.1270	0.0159	0.4079	
	24	1.6788	1618.77	2.8066	0.1248	0.0156	0.3939	
	25	1.6132	1581.37	2.7486	0.1226	0.0152	0.3799	
	26	1.5789	1560.26	2.7118	0.1213	0.0150	0.3728	
	27	1.5445	1539.14	2.6750	0.1201	0.0148	0.3657	
	28	1.5102	1518.03	2.6382	0.1188	0.0146	0.3585	
	29	1.4758	1496.92	2.6014	0.1175	0.0144	0.3514	
	30	1.4415	1475.80	2.5646	0.1162	0.0142	0.3442	
	31	1.4197	1459.94	2.5359	0.1156	0.0140	0.3384	
	32	1.3979	1444.09	2.5072	0.1150	0.0139	0.3325	
	33	1.3761	1428.23	2.4785	0.1145	0.0137	0.3267	
	34	1.3543	1412.38	2.4498	0.1139	0.0136	0.3208	
	35	1.3326	1396.52	2.4211	0.1133	0.0134	0.3150	
	36	1.3202	1384.95	2.4003	0.1132	0.0133	0.3103	
	37	1.3078	1373.39	2.3795	0.1132	0.0132	0.3056	
	38	1.2954	1361.83	2.3588	0.1132	0.0131	0.3009	
	39	1.2830	1350.26	2.3380	0.1131	0.0130	0.2962	
	40	1.2706	1338.70	2.3172	0.1131	0.0129	0.2915	
	41	1.2659	1330.95	2.3044	0.1136	0.0128	0.2878	
	42	1.2611	1323.20	2.2915	0.1141	0.0127	0.2841	
	43	1.2563	1315.45	2.2787	0.1146	0.0127	0.2803	
	44	1.2515	1307.70	2.2659	0.1151	0.0126	0.2766	
	45	1.2467	1299.96	2.2531	0.1156	0.0125	0.2729	
	46	1.2488	1295.81	2.2485	0.1166	0.0125	0.2702	
	47	1.2508	1291.67	2.2439	0.1176	0.0124	0.2674	
	48	1.2529	1287.52	2.2393	0.1186	0.0124	0.2647	
	49	1.2550	1283.38	2.2348	0.1196	0.0123	0.2620	
	50	1.2570	1279.24	2.2302	0.1206	0.0123	0.2592	
	51	1.2658	1278.69	2.2344	0.1220	0.0123	0.2574	
	52	1.2746	1278.15	2.2387	0.1235	0.0123	0.2556	
	53	1.2833	1277.61	2.2429	0.1250	0.0123	0.2538	
	54	1.2921	1277.07	2.2472	0.1265	0.0123	0.2519	
	55	1.3009	1276.53	2.2514	0.1279	0.0123	0.2501	
	56	1.3169	1279.82	2.2654	0.1299	0.0123	0.2491	
	57	1.3329	1283.12	2.2794	0.1318	0.0124	0.2482	
	58	1.3489	1286.41	2.2934	0.1338	0.0124	0.2472	
	59	1.3649	1289.70	2.3074	0.1357	0.0124	0.2462	
	60	1.3809	1292.99	2.3214	0.1377	0.0124	0.2452	
	61	1.4056	1300.78	2.3466	0.1401	0.0125	0.2452	
	62	1.4303	1308.56	2.3719	0.1425	0.0126	0.2451	
	63	1.4551	1316.34	2.3972	0.1449	0.0127	0.2450	
	64	1.4798	1324.12	2.4225	0.1472	0.0128	0.2450	
	65	1.5045	1331.90	2.4477	0.1496	0.0129	0.2449	
	66	1.5406	1345.12	2.4868	0.1525	0.0130	0.2457	
	67	1.5767	1358.34	2.5258	0.1553	0.0131	0.2465	
	68	1.6128	1371.56	2.5648	0.1581	0.0133	0.2473	
	69	1.6489	1384.77	2.6039	0.1609	0.0134	0.2482	
	70	1.6850	1397.99	2.6429	0.1637	0.0135	0.2490	
	71	1.7373	1418.60	2.6996	0.1670	0.0137	0.2506	
	72	1.7897	1439.21	2.7564	0.1703	0.0139	0.2523	
	73	1.8421	1459.81	2.8131	0.1736	0.0141	0.2539	
	74	1.8945	1480.42	2.8698	0.1770	0.0142	0.2556	
	75	1.9468	1501.03	2.9265	0.1803	0.0144	0.2573	
	76	2.0240	1532.35	3.0074	0.1840	0.0147	0.2598	
	77	2.1012	1563.67	3.0883	0.1878	0.0150	0.2624	
	78	2.1784	1594.99	3.1692	0.1916	0.0153	0.2650	
	79	2.2556	1626.31	3.2502	0.1953	0.0157	0.2676	
	80	2.3327	1657.62	3.3311	0.1991	0.0160	0.2702	

Emissions Tables

Bus	0	14.6727	28.69	1.5687	0.0000	0.0000	1.1095
	5	28.3191	2218.86	20.8161	0.7388	0.0210	2.9203
	6	27.2371	2191.74	20.3513	0.7197	0.0210	2.8212
	7	26.1550	2164.62	19.8865	0.7005	0.0210	2.7220
	8	25.0729	2137.50	19.4217	0.6813	0.0210	2.6229
	9	23.9908	2110.37	18.9569	0.6622	0.0210	2.5238
	10	22.9088	2083.25	18.4921	0.6430	0.0210	2.4246
	11	21.4549	2046.78	17.8182	0.6135	0.0206	2.2853
	12	20.0011	2010.30	17.1444	0.5841	0.0201	2.1459
	13	18.5473	1973.83	16.4705	0.5546	0.0196	2.0066
	14	17.0934	1937.35	15.7967	0.5251	0.0192	1.8672
	15	15.6396	1900.88	15.1229	0.4957	0.0187	1.7279
	16	14.7703	1879.37	14.6884	0.4760	0.0187	1.6404
	17	13.9010	1857.86	14.2540	0.4564	0.0187	1.5530
	18	13.0317	1836.35	13.8196	0.4368	0.0187	1.4655
	19	12.1624	1814.84	13.3852	0.4171	0.0187	1.3781
	20	11.2930	1793.33	12.9508	0.3975	0.0187	1.2906
	21	10.7586	1779.77	12.6781	0.3839	0.0182	1.2336
	22	10.2241	1766.20	12.4055	0.3704	0.0178	1.1765
	23	9.6896	1752.64	12.1329	0.3568	0.0173	1.1195
	24	9.1551	1739.08	11.8603	0.3432	0.0168	1.0624
	25	8.6206	1725.52	11.5876	0.3297	0.0164	1.0054
	26	8.2867	1717.10	11.4324	0.3194	0.0164	0.9675
	27	7.9528	1708.69	11.2771	0.3091	0.0164	0.9296
	28	7.6189	1700.27	11.1219	0.2988	0.0164	0.8918
	29	7.2851	1691.85	10.9666	0.2885	0.0164	0.8539
	30	6.9512	1683.44	10.8114	0.2782	0.0164	0.8160
	31	6.7445	1678.29	10.7497	0.2708	0.0164	0.7903
	32	6.5378	1673.15	10.6879	0.2633	0.0164	0.7646
	33	6.3311	1668.00	10.6262	0.2558	0.0164	0.7388
	34	6.1244	1662.86	10.5645	0.2483	0.0164	0.7131
	35	5.9177	1657.72	10.5028	0.2408	0.0164	0.6874
	36	5.7971	1654.91	10.5247	0.2357	0.0164	0.6706
	37	5.6765	1652.11	10.5467	0.2305	0.0164	0.6537
	38	5.5558	1649.30	10.5687	0.2254	0.0164	0.6369
	39	5.4352	1646.49	10.5907	0.2202	0.0164	0.6201
	40	5.3145	1643.69	10.6127	0.2151	0.0164	0.6032
	41	5.2589	1642.29	10.7197	0.2114	0.0164	0.5920
	42	5.2032	1640.88	10.8268	0.2076	0.0164	0.5808
	43	5.1476	1639.48	10.9339	0.2039	0.0164	0.5696
	44	5.0919	1638.08	11.0410	0.2001	0.0164	0.5583
	45	5.0363	1636.67	11.1481	0.1964	0.0164	0.5471
	46	5.0339	1637.14	11.3552	0.1945	0.0164	0.5396
	47	5.0316	1637.61	11.5624	0.1927	0.0164	0.5322
	48	5.0293	1638.08	11.7696	0.1908	0.0164	0.5247
	49	5.0269	1638.54	11.9767	0.1889	0.0164	0.5172
	50	5.0246	1639.01	12.1839	0.1870	0.0164	0.5097
	51	5.0770	1639.95	12.5201	0.1856	0.0164	0.5060
	52	5.1293	1640.88	12.8563	0.1842	0.0164	0.5022
	53	5.1817	1641.82	13.1925	0.1828	0.0164	0.4985
	54	5.2341	1642.75	13.5287	0.1814	0.0164	0.4947
	55	5.2865	1643.69	13.8650	0.1800	0.0164	0.4910
	56	5.4020	1646.96	14.3831	0.1796	0.0164	0.4896
	57	5.5175	1650.23	14.9012	0.1791	0.0164	0.4882
	58	5.6330	1653.51	15.4193	0.1786	0.0164	0.4868
	59	5.7485	1656.78	15.9375	0.1782	0.0164	0.4854
	60	5.8640	1660.05	16.4556	0.1777	0.0164	0.4840
	61	6.0646	1666.13	17.2487	0.1777	0.0164	0.4859
	62	6.2652	1672.21	18.0418	0.1777	0.0164	0.4877
	63	6.4658	1678.29	18.8348	0.1777	0.0164	0.4896
	64	6.6664	1684.37	19.6279	0.1777	0.0164	0.4915
	65	6.8670	1690.45	20.4210	0.1777	0.0164	0.4933
	66	7.1920	1699.33	21.6452	0.1796	0.0164	0.4980
	67	7.5170	1708.22	22.8695	0.1814	0.0164	0.5027
	68	7.8420	1717.10	24.0937	0.1833	0.0164	0.5074
	69	8.1670	1725.99	25.3179	0.1852	0.0164	0.5120
	70	8.4920	1734.87	26.5422	0.1870	0.0164	0.5167
	71	9.0134	1749.37	28.4753	0.1894	0.0168	0.5247
	72	9.5348	1763.87	30.4085	0.1917	0.0173	0.5326
	73	10.0562	1778.36	32.3416	0.1941	0.0178	0.5406
	74	10.5776	1792.86	34.2747	0.1964	0.0182	0.5485
	75	11.0990	1807.36	36.2079	0.1987	0.0187	0.5565
	76	11.9477	1831.67	39.3526	0.2025	0.0187	0.5686
	77	12.7964	1855.99	42.4974	0.2062	0.0187	0.5808
	78	13.6452	1880.30	45.6421	0.2100	0.0187	0.5929
	79	14.4939	1904.62	48.7869	0.2137	0.0187	0.6051
	80	15.3426	1928.94	51.9317	0.2174	0.0187	0.6173

Bus	0	5.3553	8.37	0.7447	0.0000	0.0000	0.3598
	5	13.1281	2053.23	12.3032	0.5882	0.0197	1.5475
	6	12.6328	2031.71	12.0271	0.5735	0.0197	1.4984
	7	12.1375	2010.19	11.7509	0.5588	0.0197	1.4493
	8	11.6422	1988.67	11.4747	0.5441	0.0197	1.4001
	9	11.1469	1967.15	11.1986	0.5294	0.0197	1.3510
	10	10.6517	1945.63	10.9224	0.5147	0.0197	1.3019
	11	9.9839	1916.94	10.5229	0.4921	0.0190	1.2323
	12	9.3161	1888.25	10.1234	0.4695	0.0183	1.1627
	13	8.6483	1859.56	9.7239	0.4469	0.0176	1.0931
	14	7.9805	1830.87	9.3243	0.4243	0.0169	1.0236
	15	7.3127	1802.18	8.9248	0.4017	0.0161	0.9540
	16	6.9114	1785.32	8.6669	0.3863	0.0161	0.9092
	17	6.5101	1768.46	8.4091	0.3708	0.0161	0.8643
	18	6.1087	1751.61	8.1512	0.3554	0.0161	0.8195
	19	5.7074	1734.75	7.8934	0.3400	0.0161	0.7747
	20	5.3061	1717.89	7.6355	0.3246	0.0161	0.7298
	21	5.0583	1707.49	7.4741	0.3135	0.0161	0.7001
	22	4.8105	1697.09	7.3127	0.3023	0.0161	0.6703
	23	4.5626	1686.69	7.1513	0.2912	0.0161	0.6405
	24	4.3148	1676.29	6.9899	0.2801	0.0161	0.6108
	25	4.0670	1665.89	6.8285	0.2690	0.0161	0.5810
	26	3.9117	1658.72	6.7360	0.2611	0.0158	0.5609
	27	3.7564	1651.55	6.6435	0.2532	0.0154	0.5408
	28	3.6011	1644.37	6.5510	0.2453	0.0151	0.5207
	29	3.4458	1637.20	6.4584	0.2374	0.0147	0.5007
	30	3.2905	1630.03	6.3659	0.2295	0.0143	0.4806
	31	3.1930	1626.44	6.3290	0.2238	0.0143	0.4670
	32	3.0954	1622.85	6.2920	0.2181	0.0143	0.4533
	33	2.9979	1619.27	6.2551	0.2123	0.0143	0.4397
	34	2.9003	1615.68	6.2181	0.2066	0.0143	0.4261
	35	2.8028	1612.10	6.1812	0.2008	0.0143	0.4124
	36	2.7450	1609.58	6.1934	0.1965	0.0143	0.4028
	37	2.6873	1607.07	6.2056	0.1922	0.0143	0.3931
	38	2.6296	1604.56	6.2178	0.1879	0.0143	0.3834
	39	2.5718	1602.05	6.2300	0.1836	0.0143	0.3737
	40	2.5141	1599.54	6.2422	0.1793	0.0143	0.3640
	41	2.4850	1598.11	6.3046	0.1765	0.0143	0.3576
	42	2.4560	1596.67	6.3670	0.1736	0.0143	0.3511
	43	2.4269	1595.24	6.4294	0.1707	0.0143	0.3447
	44	2.3979	1593.80	6.4918	0.1678	0.0143	0.3382
	45	2.3688	1592.37	6.5542	0.1650	0.0143	0.3317
	46	2.3649	1593.09	6.6754	0.1632	0.0143	0.3278
	47	2.3609	1593.80	6.7966	0.1614	0.0143	0.3239
	48	2.3570	1594.52	6.9178	0.1596	0.0143	0.3199
	49	2.3530	1595.24	7.0391	0.1578	0.0143	0.3160
	50	2.3491	1595.96	7.1603	0.1560	0.0143	0.3120
	51	2.3685	1597.03	7.3579	0.1549	0.0143	0.3099
	52	2.3878	1598.11	7.5555	0.1539	0.0143	0.3077
	53	2.4072	1599.18	7.7531	0.1528	0.0143	0.3056
	54	2.4266	1600.26	7.9507	0.1517	0.0143	0.3034
	55	2.4459	1601.34	8.1483	0.1506	0.0143	0.3013
	56	2.4922	1603.85	8.4535	0.1503	0.0143	0.3005
	57	2.5385	1606.36	8.7588	0.1499	0.0143	0.2998
	58	2.5847	1608.87	9.0640	0.1496	0.0143	0.2991
	59	2.6310	1611.38	9.3692	0.1492	0.0143	0.2984
	60	2.6773	1613.89	9.6744	0.1488	0.0143	0.2977
	61	2.7594	1618.55	10.1424	0.1492	0.0147	0.2987
	62	2.8415	1623.21	10.6104	0.1496	0.0151	0.2998
	63	2.9236	1627.88	11.0784	0.1499	0.0154	0.3009
	64	3.0058	1632.54	11.5465	0.1503	0.0158	0.3020
	65	3.0879	1637.20	12.0145	0.1506	0.0161	0.3031
	66	3.2217	1644.37	12.7397	0.1513	0.0161	0.3056
	67	3.3555	1651.55	13.4649	0.1521	0.0161	0.3081
	68	3.4892	1658.72	14.1900	0.1528	0.0161	0.3106
	69	3.6230	1665.89	14.9152	0.1535	0.0161	0.3131
	70	3.7568	1673.06	15.6404	0.1542	0.0161	0.3156
	71	3.9702	1684.54	16.7880	0.1560	0.0161	0.3203
	72	4.1836	1696.02	17.9357	0.1578	0.0161	0.3249
	73	4.3969	1707.49	19.0833	0.1596	0.0161	0.3296
	74	4.6103	1718.97	20.2310	0.1614	0.0161	0.3343
	75	4.8237	1730.45	21.3786	0.1632	0.0161	0.3389
	76	5.1691	1749.10	23.2518	0.1657	0.0161	0.3461
	77	5.5145	1767.75	25.1250	0.1682	0.0161	0.3533
	78	5.8599	1786.40	26.9982	0.1707	0.0161	0.3604
	79	6.2052	1805.04	28.8714	0.1732	0.0161	0.3676
	80	6.5506	1823.69	30.7446	0.1757	0.0161	0.3748

Source: California Air Resources Board, EMFAC 2007 V2.3, Burden Area Planning

Notes: 1) Zero mph corresponds to starts, 2) Other emissions factors include idling emissions and exclude diurnal and evaporative emissions, 3) Five mph is best estimate for idling

Area	Proj Loc	CO	CO2e	NOX	PM10	SOX	VOC
LA/South Coast	1	$0	$34	$4,150	$174,500	$16,600	$1,750
CA Urban Area	2	$0	$34	$4,150	$174,500	$16,600	$1,750
CA Rural Area	3	$0	$34	$4,150	$174,500	$16,600	$1,750

CO2e Upratер: 2.4% increase in value per year

Sources: McCubbin and Delucchi, 1996 for emissions other than CO2e
United Kingdom Department for Environment Food and Rural Affairs (DEFRA) for CO2e

Mode	Year	CO	CO2	NOX	PM10	SOX	VOC
Passenger Train	2002	45.67		583.58	62.02		19.73
	2022	45.67		250.11	31.01		19.73

Mode	Year	CO	CO2	NOX	PM10	SOX	VOC
Light Rail	2002	0.14		1.13	0.17		0.06
	2022	0.14		1.14	0.17		0.05

Source: California Air Resources Board

Pavement Adjustments (used only for pavement projects)

Year 0	Light	Medium	Heavy
0	125	150	350
25	150	200	500
50	175	250	675
75	200	300	750
100	275	400	750
125	325	475	750
150	400	575	750
175	500	700	750
200	575	750	750
225	650	750	750
250	750	750	750
275	750	750	750
300	750	750	750
325	750	750	750
350	750	750	750
375	750	750	750
400	750	750	750
425	750	750	750
450	750	750	750

Source: Paterson, 1987

PEAK HEADWAY ADJUSTMENT FACTORS FOR HOV BENEFITS
(percent adjustment)

IRI	Auto	Truck
0	1.00	1.02
25	1.00	1.02
50	1.00	1.02
75	1.00	1.02
100	1.00	1.02
125	1.00	1.02
150	1.00	1.01
175	1.00	1.00
200	1.00	0.98
225	1.00	0.95
250	1.00	0.92
275	0.99	0.87
300	0.98	0.83
325	0.97	0.83
350	0.96	0.81
375	0.95	0.78
400	0.94	0.76
425	0.93	0.73
450	0.92	0.71

PASSENGER TRAIN EMISSIONS FACTORS
(g/train mile)

TRANSIT TRAVEL TIME AND OPERATING COST SAVINGS
(percent savings)

Source: Botterill, 1996 and 1997

Agency Costs

FREEWAY CONGESTION
(percent adjustment)

IRI	Auto	Truck
0	1.00	1.00
25	1.00	1.00
50	1.00	1.00
75	1.00	1.00
100	1.00	1.00
125	1.00	1.00
150	1.02	1.02
175	1.03	1.04
200	1.05	1.06
225	1.07	1.08
250	1.09	1.10
275	1.11	1.12
300	1.12	1.14
325	1.14	1.16
350	1.16	1.18
375	1.18	1.20
400	1.19	1.22
425	1.21	1.24
450	1.23	1.26

Source: ARRB Research Board TR VOC Model

IRI	Auto	Truck
0	0.97	0.96
25	0.98	0.97
50	0.98	0.97
75	0.98	0.98
100	0.98	0.98
125	0.99	0.99
150	1.00	0.99
175	1.00	1.00
200	1.01	1.01
225	1.01	1.02
250	1.02	1.03
275	1.03	1.04
300	1.03	1.05
325	1.04	1.06
350	1.05	1.07
375	1.06	1.08
400	1.07	1.10
425	1.08	1.11
450	1.09	1.13

Source: Texas Transportation Institute, 1994

Weaving Adjustments (used only for freeway connector, HOV connector, and HOV drop ramp projects)

Percent Weaving	Freeway Conn	HOV Project
0.000	1.00	1.00
0.002	0.98	0.99
0.004	0.96	0.98
0.006	0.95	0.96
0.008	0.93	0.95
0.010	0.91	0.94
0.012	0.89	0.93
0.014	0.87	0.92
0.016	0.85	0.90
0.018	0.84	0.89
0.020	0.79	0.88
0.022	0.75	0.87
0.024	0.71	0.85
0.026	0.66	0.84
0.028	0.62	0.82
0.030	0.58	0.79
0.032	0.54	0.76
0.034	0.50	0.73
0.036	0.48	0.71
0.038	0.47	0.68
0.040	0.47	0.65
0.042	0.47	0.62
0.044	0.47	0.60
0.046	0.46	0.57
0.048	0.46	0.54
0.050	0.46	0.51
0.052	0.46	0.48
0.054	0.45	0.48
0.056	0.45	0.47
0.058	0.45	0.47
0.060	0.45	0.47
0.062	0.45	0.47
0.064	0.45	0.47
0.066	0.45	0.47
0.068	0.45	0.46
0.070	0.45	0.46
0.072	0.45	0.46
0.074	0.45	0.46
0.076	0.45	0.46
0.078	0.45	0.46
0.080	0.45	0.45

Source: Fitzpatrick, Brewer, and Venglar, 2003

TMS Adjustments (used only for ramp metering, ramp metering signal coordination, incident management, traveler information projects, ALV, transit priority, and BRT projects)

TMS Strategy	Speed	Volume	Speed	Volume	TT	VOC	Em	Total Benefit
AMoth	1.02	0.95	1.02	0.95	-5.05	12.81	1.37	0.74
AMsev	1.53	0.94	1.53	0.94	1.21	1.38	-0.37	1.00
IMoth	0.88	1.18	0.98	0.96	0.51	0.15	0.06	0.74
IMsev	1.01	0.97	1.01	0.95	0.30	0.31	0.30	1.00
NoAdj	1.00	1.00	1.00	1.00	0.00	0.00	0.00	1.00
ORoth	0.98	1.03	1.00	1.00	-0.07	-0.03	-0.07	0.00
ORsev	0.95	1.03	1.00	1.00	0.00	0.00	5.67	0.00
RMoth	1.00	1.00	1.03	0.97	-0.07	-0.03	-0.07	1.00
RMsev	1.00	1.00	1.05	0.97	0.00	0.00	5.67	1.00
TIoth	1.00	1.00	1.02	0.97	-0.11	-0.12	-0.35	1.00
TIsev	1.00	1.00	1.01	0.97	-0.39	-0.39	-0.35	1.00

Source: California Department of Transportation TMS Master Plan, 2003
19) Chaudhary and Messer, 2000

TMS Strategy	Travel Time	Capital	O&M
Transit Vehicle Location (AVL)	15%	2%	8%
Transit Vehicle Signal Priority	10%	-	-
Bus Rapid Transit (BRT)	29%	-	-

Sources: FHWA ITS Deployment Analysis System (IDAS), California PATH