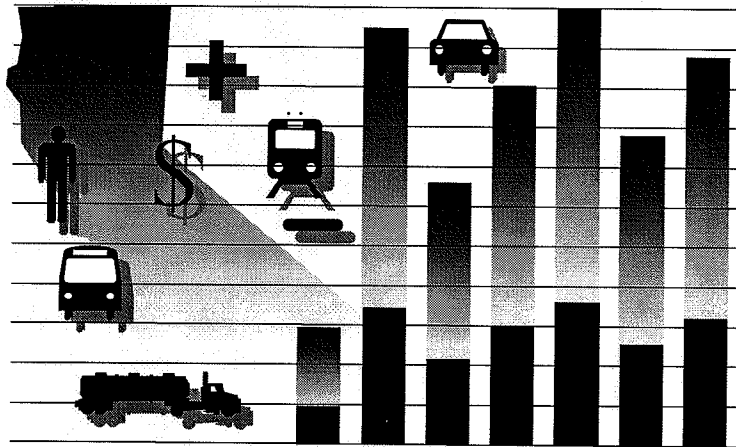




California
Department
Of
Transportation

California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) Version 3.2



Office of Transportation Economics
Division of Transportation Planning

June 2004

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

Instructions

Contents

General model description and assumptions

1) Project Information

2) Model Inputs

Project input data
Highway speed, volume and accident data estimated by model

3) Results

Travel Time

Summary results of analysis

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 shown in the Highway Capacity Manual. Other adjustments are made for weaving and pavement conditions. 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 user to see, but calculations are performed automatically by the model. Some projects (i.e., bypasses, interchanges, and connectors) require the user to enter return, sets of highway data, since two roads are involved. The model calculates benefits for the first road before the user enters information about 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

User can analyze most projects simply by entering limited data on the Project Information Sheet and obtaining results on the Results page. The Model Inputs page allows the user to enter more detailed data and adjust estimated speeds, volumes, and accidents rates.

PROJECT DATA (Box 1A)

This section provides general information about the project and is used for both highway 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.

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

Type of Project

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

For an interchange or bypass 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 the end of the worksheet to prepare model for information on the bypass or intersecting road. The user may also enter information for connector projects involving two roads using the same button.

Project Location

- 2 Insert a 1, 2, or 3 for the appropriate region of the State. This information is used to calculate emissions benefits.

Length of Construction Period

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

Length of Peak Period

- 4 Insert the number of peak period hours per typical day. The model provides a default of 5 hours (statewide average from Statewide Travel Survey). Model estimates total % daily traffic occurring during peak period by multiplying peak length by % traffic occurring during a typical peak hour (7.8% from Statewide Travel Survey). Model does not distinguish between weekdays and weekends.

For peak periods longer than 8 hours, default % must be adjusted in Parameters. To model a 24-hour HOV, figures must be adjusted 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)

Statewide default values are provided for some inputs for transit projects.

Highway Design

- 5 **Number of General Traffic Lanes:** Insert number of general purpose (not HOV or bus) lanes in both directions for the existing and new facilities.
- 6 **Number of HOV Lanes:** Insert number of HOV lanes in both directions for the existing and new facilities. A value must be provided if an HOV restriction is entered on the next row.
- 7 **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.
- 8 **Exclusive ROW for Buses:** If bus project, indicate (with "Y" or "N") whether buses have an exclusive right-of-way. This information is used to estimate emissions.
- 9 **Highway Free-Flow Speed:** Insert free-flow speed for existing and new facilities. Model assumes new is same as existing, if not entered.
- 10 **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.
- 11 **Highway Segment:** Insert segment length for existing and new facility. Model assumes new is same as existing, if not entered.
- 12 **Affected Area:** 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)

- 13 **Current:** For most projects, insert current two-way ADT on facility. For operational improvements, enter only the one-way ADT applicable to the project.
- 14 **Forecast (Year 20):** Insert projected ADT for 20 years after construction completion for the facility with and without project. Model assumes with is the same as without, 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.

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

Average Hourly HOV Traffic

- 15 Insert hourly HOV volumes on the facility with and without project for a typical peak hour.

Percent Traffic in Weave

- 16 For operational improvements, insert the % traffic affected by weaving. Model suggests a % based on the type of project. For auxiliary lanes, traffic in the 2 right-most lanes is assumed to be affected. For off-ramp widening, traffic in the 3 right-most lanes is assumed. For freeway connectors, 2.5% of all traffic is assumed. For HOV connectors and drop ramps, 4% of HOV traffic is assumed. Users can change the values for actual project conditions.

Percent Trucks

- 17 Insert estimated % of ADT that is trucks with and without project. Model provides a default value of 9% (statewide average).

Truck Speed

- 18 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

- 19 **Hourly Ramp Volume:** If auxiliary lane or on-ramp widening project, insert the average hourly ramp volume. This is used to estimate the volume of traffic affected by weaving for auxiliary lanes and the effectiveness of ramp metering for on-ramp widening projects. No entry needs to be made for ramp metering projects.

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

Pavement Condition (for Pavement Rehab. Projects)

- 21 If pavement rehabilitation project, enter base (Year 1) International Roughness Index (IRI) with and without project. Model will calculate Year 20 values using standard parameters unless entered by user.

Average Vehicle Occupancy

- 22 Model provides default values (from Statewide Travel Survey). The figures change automatically, depending on whether HOV lanes are present. 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 for Facility

- 23 Insert the total number of fatal, injury, and property damage only accidents on the segment over the 3 most recent years.

Statewide Average for Highway Classification

- 24 Insert statewide average accident rates per million vehicle-miles for road classifications similar to existing and proposed facilities. Include Base Rate and ADT Factor where applicable.
- 25 Insert statewide % of accidents that are fatal and injury accidents for road classifications similar to existing and proposed 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.

TRANSIT DATA (Box 1D)

This section is used only for transit projects.

Annual Person-Trips

- 26 **Base (Year 1):** Insert estimated annual transit person-trips for first year after construction completion with and without project. 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.

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

27 **Forecast (Year 20):** Insert forecasted annual transit person-trips for 20 years after construction completion with and without project.

Percent Trips during Peak Period

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

Percent New Trips from Parallel Highway

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

Annual Vehicle-Miles

30 **Base (Year 1):** Insert estimated annual vehicle-miles for first year after construction completion with and without project. For passenger rail projects, multiply the number of train-miles by the average number of train cars per consist.

31 **Forecast (Year 20):** Insert forecasted annual vehicle-miles for 20 years after construction completion with and without project.

Average Vehicles per Train

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

Reduction in Transit Accidents

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

Average Transit Travel Time

34 **In-Vehicle:** Insert average in-vehicle transit travel time in minutes during peak and non-peak periods for the existing and new facilities. For TMS Projects, insert the average for all transit routes impacted. Model assumes new is same as existing for most projects. Signal priority and bus rapid transit projects reduce travel time. User can adjust new travel times.

35 **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.

Transit Agency Costs (for Transit TMS Projects)

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

37 **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 new expenditures 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 0 is the first year that costs are incurred.

38 Insert project's initial costs in constant (Year 2000) 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).

39 Insert estimated future incremental maintenance/operating and rehabilitation costs in constant (Year 2000) dollars. These figures should be entered in the years after the project opens.

40 Insert estimated mitigation costs (e.g., wetlands, community, soundwalls) in constant (Year 2000) dollars during construction and for 20 years after construction completion.

41 Model adds annual agency cost savings due to transit TMS automatically.

42 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.

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

- 43 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 regional planning 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 with and without the project. Speeds are estimated using a BPR curve. Adjustments are made to speed and volumes to account for weaving, transit mode shifts, pavement condition, and TMS projects.
- 44 If TMS project and detailed simulation data are available, the highway results should be inputted in the green cells. The model will use the data in place of the figures estimated by the model.

HIGHWAY ACCIDENT RATES (Box 2B)

User may also adjust accident rates calculated by the model.

- 45 **Existing Facilities:** Fatality, injury and PDO accident rates for the existing facility are estimated using inputs from Box 1C of the Project Information sheet. User may change these rates in the green boxes.
- 46 **Weaving or TMS Safety Improvement:** Model assumes an overall safety improvement for off-ramp and ramp metering projects. User may adjust this percentage.
- 47 **Adjustment Factor:** User may change the ratios of facility accident rates to statewide averages, which are used in calculating rates for the new facility. These factors are also adjusted by the weaving or TMS safety improvement factor.
- 48 **New Facility:** User may modify the fatality, injury, and PDO accident rates for the new facility. Model estimates these accident rates using statewide average rates and the adjustment factors.

For questions and comments, please contact:

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.

- 49 **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.
- 50 **Aggregate Segment Length:** Input the total segment lengths for the ramps and arterials. These can be estimated from model data as VMT/total volume.
- 51 User may enter speeds and volumes on ramps and arterials during peak and non-peak periods in Year 1 and Year 20 with and without the project. If arterial signal management project, user must enter arterial data. User benefits are estimated assuming all vehicles are automobiles.
- NEXT STEPS**
- 52 For bypass, interchange, and connector projects, click button on Project Information page after data for the first road are verified. 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. User may want to save an interim version of the analysis before clicking button.
- 53 Summary results are available immediately in the Results worksheet.

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District:

7

PROJECT:

Widen SR-138 to 4 Lanes (PM&4-67.3)

EA:
PPNO:127281
3331

1A

PROJECT DATA

Type of Project

Select project type from list

Project Location (enter 1 for So. Cal., 2 for No. Cal., or 3 for rural)

Length of Construction Period

4 years

Length of Peak Period(s) (up to 8 hrs)

Existing 5 hours

1B

HIGHWAY DESIGN AND TRAFFIC DATA

Highway Design

Number of General Traffic Lanes
Number of HOV Lanes
HOV Restriction (2 or 3)
Exclusive ROW for Buses (Y/N)

Existing	New
2	4
N	

Highway Free-Flow Speed
Ramp Design Speed (if aux. lane/off-ramp proj.)
Length (in miles)
Highway Segment
Affected Area

55	55
35	35
3.3	3.3
3.3	3.3

Average Daily Traffic

Current

16,200

	w/o Project	w/ Project
Base (Year 1)	20,513	20,513
Forecast (Year 20)	41,000	41,000
Average Hourly HOV Traffic (if HOV lanes)		0
Percent Traffic in Weave (if oper. improvement)		
Percent Trucks (include RVs, if applicable)	10%	10%
Truck Speed (if passing lane project)		

On-Ramp Volume

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

Peak	Non-Peak
0	0

Pavement Condition (if pavement project)

IRI (inches/mile)

w/o Project	w/ Project

Average Vehicle Occupancy

General Traffic

Non-Peak

Peak

Existing	New
1.15	1.15
1.10	1.10
0.00	0.00

1C

HIGHWAY ACCIDENT DATA

Actual 3-Year Accident Data for Facility

	Count (No.)	Rate
Fatal Accidents	4	0.07
Injury Accidents	60	1.02
Property Damage Only (PDO) Accidents	80	1.37

Statewide Average for Highway Classification

	Existing	New
Accident Rate (per million vehicle-miles)	0.97	0.90
Percent Fatal Accidents	3%	3%
Percent Injury Accidents	47%	43%

1D

TRANSIT DATA

Annual Person-Trips

	w/o Project	w/ Project
Base (Year 1)		
Forecast (Year 20)		
Percent Trips during Peak Period	39%	100%
Percent New Trips from Parallel Highway		

Annual Vehicle-Miles

	w/o Project	w/ Project
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

	Existing	New
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

Transit Agency Costs (if TMS project)

	Existing	New
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.

Prepare Model for Second Road

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.

1E

PROJECT COSTS

Col. no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS	Present Value
Year	Project Support	R / W	Construction	Maint./ Op.	Rehab.	Mitigation	Transit Agency Cost Savings	Constant Dollars	
0	Construction Begins		\$8,397,000					\$8,397,000	\$8,397,000
1			8,397,000					8,397,000	7,997,143
2			8,397,000					8,397,000	7,616,327
3			8,397,000					8,397,000	7,253,644
4								0	0
5								0	0
6								0	0
7								0	0
Project Opens									
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	\$33,588,000	\$0	\$0	\$0	\$33,588,000	\$31,264,114

Present Value = $\frac{\text{Future Value (in Constant Dollars)}}{(1 + \text{Real Discount Rate})^n \times \text{Year}}$

HIGHWAY SPEED AND VOLUME INPUTS

Calculated by Model
Changed by User
Used for Proj. Eval.
Reason for Change

Without Project			
Year 1			
Peak Period			
HOV Volume	0	7,200	0
Non-HOV Volume	0	800	0
Truck Volume	0	800	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Non-Peak Period			
HOV Volume	0	7,200	0
Non-HOV Volume	0	800	0
Truck Volume	0	800	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Year 20			
Peak Period			
HOV Volume	0	14,391	0
Non-HOV Volume	0	1,599	0
Truck Volume	0	1,599	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Non-Peak Period			
HOV Volume	0	14,391	0
Non-HOV Volume	0	1,599	0
Truck Volume	0	1,599	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
With Project			
Year 1			
Peak Period			
HOV Volume	0	7,200	0
Non-HOV Volume	0	800	0
Truck Volume	0	800	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Non-Peak Period			
HOV Volume	0	7,200	0
Non-HOV Volume	0	800	0
Truck Volume	0	800	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Year 20			
Peak Period			
HOV Volume	0	14,391	0
Non-HOV Volume	0	1,599	0
Truck Volume	0	1,599	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Non-Peak Period			
HOV Volume	0	14,391	0
Non-HOV Volume	0	1,599	0
Truck Volume	0	1,599	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0

With Project			
Year 1			
Peak Period			
HOV Volume	0	7,200	0
Non-HOV Volume	0	800	0
Truck Volume	0	800	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Non-Peak Period			
HOV Volume	0	7,200	0
Non-HOV Volume	0	800	0
Truck Volume	0	800	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Year 20			
Peak Period			
HOV Volume	0	14,391	0
Non-HOV Volume	0	1,599	0
Truck Volume	0	1,599	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0
Non-Peak Period			
HOV Volume	0	14,391	0
Non-HOV Volume	0	1,599	0
Truck Volume	0	1,599	0
HOV Speed	55.0	55.0	55.0
Non-HOV Speed	55.0	55.0	55.0
Weaving Speed	55.0	55.0	55.0
Truck Speed	55.0	55.0	55.0

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

2C

RAMP AND ARTERIAL INPUTS

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

Detailed Information Available? (y/n)

Aggregate Segment Length (estimate as VMT/total volume)

miles

miles

Without Project (Peak Period Only)		Year 1		Year 20	
Aggregate Ramp Volume		Aggregate Ramp Volume		Aggregate Ramp Volume	
Aggregate Arterial Volume		Aggregate Arterial Volume		Aggregate Arterial Volume	
Average Ramp Speed		Average Ramp Speed		Average Ramp Speed	
Average Arterial Speed		Average Arterial Speed		Average Arterial Speed	

With Project (Peak Period Only)		Year 1		Year 20	
Aggregate Ramp Volume		Aggregate Ramp Volume		Aggregate Ramp Volume	
Aggregate Arterial Volume		Aggregate Arterial Volume		Aggregate Arterial Volume	
Average Ramp Speed		Average Ramp Speed		Average Ramp Speed	
Average Arterial Speed		Average Arterial Speed		Average Arterial Speed	

Entered by User

Used for Proj. Eval.

Source/Notes

Without Project (Peak Period Only)		Year 1		Year 20	
Aggregate Ramp Volume		Aggregate Ramp Volume		Aggregate Ramp Volume	
Aggregate Arterial Volume		Aggregate Arterial Volume		Aggregate Arterial Volume	
Average Ramp Speed		Average Ramp Speed		Average Ramp Speed	
Average Arterial Speed		Average Arterial Speed		Average Arterial Speed	

With Project (Peak Period Only)		Year 1		Year 20	
Aggregate Ramp Volume		Aggregate Ramp Volume		Aggregate Ramp Volume	
Aggregate Arterial Volume		Aggregate Arterial Volume		Aggregate Arterial Volume	
Average Ramp Speed		Average Ramp Speed		Average Ramp Speed	
Average Arterial Speed		Average Arterial Speed		Average Arterial Speed	

2B

HIGHWAY ACCIDENT RATES

Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
Existing Facility			
Fatal Accidents	0.07		
Injury Accidents	1.02		
PDO Accidents	1.37		
All Accident Types	2.46		
Weaving or TMS Safety Improvement			
Adjustment Factor (Actual/Statewide Avg. Existing)	2.07		
Fatal Accidents	2.25		
Injury Accidents	2.84		
PDO Accidents	2.84		
New Facility			
Fatal Accidents	0.05		
Injury Accidents	0.86		
PDO Accidents	1.40		
All Accident Types	2.31		

0% reduction

District:

7

PROJECT:

Widen SR-138 to 4 Lanes (PM64-67.3)

EA:

127281

PPNO:

3331

3

INVESTMENT ANALYSIS SUMMARY RESULTS

Life-Cycle Costs (mil. \$)	\$31.3
Life-Cycle Benefits (mil. \$)	\$30.4
Net Present Value (mil. \$)	-\$0.8
Benefit / Cost Ratio:	1.0
Rate of Return on Investment:	4.8%
Payback Period:	13 years

ITEMIZED BENEFITS (mil. \$)	Average	Total Over
	Annual	20 Years
Travel Time Savings	\$0.0	\$0.9
Veh. Op. Cost Savings	\$0.0	\$0.0
Accident Cost Savings	\$1.5	\$29.5
Emission Cost Savings	\$0.0	\$0.0
TOTAL BENEFITS	\$1.5	\$30.4
Person Hours of Delay Saved	8,518	170,353

Should results include:

- 1) Induced Travel? (y/n)
- 2) Vehicle Emissions? (y/n)

Y
Default = Y
N
Default = N

Travel Time Benefits

This sheet calculates total travel time benefits on highway and transit.

Formulas:

Avg. Annual Traffic = Avg. Daily Traffic x 365 days vehicles / yr		Delay Savings = Travel Time Reduction x Avg. Value of Time \$ / year	
Travel Time = AVO x Avg. Annual Traffic x Affected Length / Speed vehicles-trs / yr vehicles / yr x miles miles/hour		Avg. Value of Time varies by vehicle type	
		Induced = Change in Traffic x Change in Travel Time x AVO * 0.5	

A

HIGHWAY BENEFITS

Peak Period HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
20	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
2	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
3	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
4	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
5	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
6	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
7	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
8	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
9	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
10	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
11	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
12	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
13	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
14	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
15	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
16	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
17	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
18	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
19	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
Total										\$0

B

TRANSIT BENEFITS

Peak Period In-Vehicle Transit

Year	ANNUAL PERSON-TRIPS			AVERAGE IN-VEH TRAVEL TIME			TIME BENEFIT			Constant Dollars	Present Value
	Existing Facility	New Facility (trips/yr)	Mode Shifts	Existing Facility (hours)	New Facility (hours)	Existing Highway	Existing Users	Mode Shifts (person-hours/yr)	New (Induced)		
1	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
20	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
2	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
3	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
4	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
5	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
6	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
7	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
8	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
9	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
10	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
11	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
12	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
13	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
14	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
15	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
16	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
17	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
18	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
19	0	0	0	0.00	0.00	0.06	0	0	0	\$0	\$0
Total											\$0

Peak Period Non-HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	2,628,029	2,628,029	55.0	55.0	0.06	0.06	0	0	\$195,244	\$0
20	5,252,715	5,252,715	52.1	54.9	0.06	0.06	18,665	0		\$63,566
2	2,766,170	2,766,170	54.8	55.0	0.06	0.06	491	0	\$5,182	\$4,021
3	2,904,311	2,904,311	54.7	55.0	0.06	0.06	1,033	0	\$10,807	\$8,064
4	3,042,453	3,042,453	54.5	55.0	0.06	0.06	1,628	0	\$17,030	\$12,103
5	3,180,594	3,180,594	54.4	55.0	0.06	0.06	2,276	0	\$23,807	\$16,114
6	3,318,736	3,318,736	54.2	55.0	0.06	0.06	2,977	0	\$31,142	\$20,074
7	3,456,877	3,456,877	54.1	55.0	0.06	0.06	3,732	0	\$39,039	\$23,967
8	3,595,018	3,595,018	53.9	55.0	0.06	0.06	4,541	0	\$47,505	\$27,775
9	3,733,160	3,733,160	53.8	55.0	0.06	0.06	5,405	0	\$56,543	\$31,485
10	3,871,301	3,871,301	53.6	55.0	0.06	0.06	6,325	0	\$66,158	\$35,085
11	4,009,442	4,009,442	53.5	54.9	0.06	0.06	7,300	0	\$76,357	\$38,565
12	4,147,584	4,147,584	53.3	54.9	0.06	0.06	8,331	0	\$87,143	\$41,918
13	4,285,725	4,285,725	53.2	54.9	0.06	0.06	9,419	0	\$98,523	\$45,135
14	4,423,867	4,423,867	53.0	54.9	0.06	0.06	10,564	0	\$110,502	\$48,212
15	4,562,008	4,562,008	52.9	54.9	0.06	0.06	11,767	0	\$123,054	\$51,144
16	4,700,149	4,700,149	52.7	54.9	0.06	0.06	13,028	0	\$136,276	\$53,929
17	4,838,291	4,838,291	52.6	54.9	0.06	0.06	14,348	0	\$150,062	\$56,564
18	4,976,432	4,976,432	52.4	54.9	0.06	0.06	15,727	0	\$164,508	\$59,049
19	5,114,574	5,114,574	52.3	54.9	0.06	0.06	17,166	0	\$179,561	\$61,383
Total										\$698,152

Peak Period Out-of-Vehicle Transit

Year	ANNUAL PERSON-TRIPS			AVERAGE OUT-VEH TRAVEL TIME			TIME BENEFIT			Constant Dollars	Present Value
	Existing Facility	New Facility (trips/yr)	Mode Shifts	Existing Facility	New Facility (hours)	Existing Highway	Existing Users	Mode Shifts (person-hours/yr)	New (Induced)		
1	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
20	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
2	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
3	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
4	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
5	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
6	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
7	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
8	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
9	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
10	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
11	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
12	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
13	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
14	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
15	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
16	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
17	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
18	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
19	0	0	0	0.00	0.00	0.00	0	0	0	\$0	\$0
Total											\$0

Non-Peak Period In-Vehicle Transit

Year	ANNUAL PERSON-TRIPS			AVERAGE IN-VEH TRAVEL TIME			TIME BENEFIT		Constant Dollars	Present Value
	Existing Facility	New Facility (trips/yr)	Mode Shifts	Existing Facility (hours)	New Facility (hours)	Existing Highway	Existing Users (person-hours/yr)	New (Induced)		
1	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
20	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
2	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
3	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
4	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
5	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
6	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
7	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
8	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
9	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
10	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
11	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
12	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
13	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
14	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
15	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
16	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
17	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
18	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
19	0	0	0	0.00	0.00	0.06	0	0	\$0	\$0
Total										\$0

Peak Period Weaving

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
20	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
2	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
3	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
4	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
5	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
6	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
7	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
8	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
9	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
10	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
11	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
12	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
13	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
14	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
15	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
16	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
17	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
18	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
19	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
Total										\$0

Peak Period Truck

Year	AVERAGE VOLUME (Vehicles/Yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	292,003	292,003	55.0	55.0	0.06	0.06	0	0	\$0	\$0
20	583,635	583,635	52.1	54.9	0.06	0.06	1,885	0	\$52,471	\$17,083
2	307,352	307,352	54.8	55.0	0.06	0.06	50	0	\$1,379	\$1,081
3	322,701	322,701	54.7	55.0	0.06	0.06	104	0	\$2,904	\$2,167
4	338,050	338,050	54.5	55.0	0.06	0.06	164	0	\$4,577	\$3,253
5	353,399	353,399	54.4	55.0	0.06	0.06	230	0	\$6,398	\$4,330
6	368,748	368,748	54.2	55.0	0.06	0.06	301	0	\$8,369	\$5,395
7	384,097	384,097	54.1	55.0	0.06	0.06	377	0	\$10,492	\$6,441
8	399,446	399,446	53.9	55.0	0.06	0.06	459	0	\$12,767	\$7,464
9	414,796	414,796	53.8	55.0	0.06	0.06	546	0	\$15,196	\$8,461
10	430,145	430,145	53.6	55.0	0.06	0.06	639	0	\$17,720	\$9,429
11	445,494	445,494	53.5	54.9	0.06	0.06	737	0	\$20,521	\$10,364
12	460,843	460,843	53.3	54.9	0.06	0.06	842	0	\$23,419	\$11,265
13	476,192	476,192	53.2	54.9	0.06	0.06	951	0	\$26,478	\$12,130
14	491,541	491,541	53.0	54.9	0.06	0.06	1,067	0	\$29,697	\$12,957
15	506,890	506,890	52.9	54.9	0.06	0.06	1,189	0	\$33,078	\$13,745
16	522,239	522,239	52.7	54.9	0.06	0.06	1,316	0	\$36,624	\$14,493
17	537,588	537,588	52.6	54.9	0.06	0.06	1,449	0	\$40,334	\$15,201
18	552,937	552,937	52.4	54.9	0.06	0.06	1,589	0	\$44,211	\$15,869
19	568,286	568,286	52.3	54.9	0.06	0.06	1,734	0	\$48,256	\$16,496
Total										\$187,626

Non-Peak Period Out-of-Vehicle Transit

Year	ANNUAL PERSON-TRIPS			AVERAGE OUT-VEH TRAVEL TIME			TIME BENEFIT		Constant Dollars	Present Value
	Existing Facility	New Facility (trips/yr)	Mode Shifts	Existing Facility (hours)	New Facility (hours)	Existing Highway	Existing Users (person-hours/yr)	New (Induced)		
1	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
20	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
2	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
3	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
4	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
5	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
6	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
7	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
8	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
9	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
10	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
11	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
12	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
13	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
14	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
15	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
16	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
17	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
18	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
19	0	0	0	0.00	0.00	0.00	0	0	\$0	\$0
Total										\$0

Peak Period Ramp

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
20	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
2	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
3	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
4	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
5	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
6	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
7	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
8	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
9	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
10	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
11	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
12	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
13	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
14	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
15	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
16	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
17	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
18	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
19	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
Total										\$0

Peak Period Arterial

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
20	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
2	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
3	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
4	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
5	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
6	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
7	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
8	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
9	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
10	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
11	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
12	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
13	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
14	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
15	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
16	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
17	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
18	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
19	0	0	5.0	5.0	0.00	0.00	0	0	\$0	\$0
Total										\$0

Non-Peak Period Non-HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	4,110,506	4,110,506	55.0	55.0	0.06	0.06	0	0	\$0	\$0
20	8,215,785	8,215,785	55.0	55.0	0.06	0.06	0	0	\$0	\$0
2	4,326,574	4,326,574	55.0	55.0	0.06	0.06	0	0	\$0	\$0
3	4,542,641	4,542,641	55.0	55.0	0.06	0.06	0	0	\$0	\$0
4	4,758,708	4,758,708	55.0	55.0	0.06	0.06	0	0	\$0	\$0
5	4,974,775	4,974,775	55.0	55.0	0.06	0.06	0	0	\$0	\$0
6	5,190,843	5,190,843	55.0	55.0	0.06	0.06	0	0	\$0	\$0
7	5,406,910	5,406,910	55.0	55.0	0.06	0.06	0	0	\$0	\$0
8	5,622,977	5,622,977	55.0	55.0	0.06	0.06	0	0	\$0	\$0
9	5,839,045	5,839,045	55.0	55.0	0.06	0.06	0	0	\$0	\$0
10	6,055,112	6,055,112	55.0	55.0	0.06	0.06	0	0	\$0	\$0
11	6,271,179	6,271,179	55.0	55.0	0.06	0.06	0	0	\$0	\$0
12	6,487,247	6,487,247	55.0	55.0	0.06	0.06	0	0	\$0	\$0
13	6,703,314	6,703,314	55.0	55.0	0.06	0.06	0	0	\$0	\$0
14	6,919,381	6,919,381	55.0	55.0	0.06	0.06	0	0	\$0	\$0
15	7,135,448	7,135,448	55.0	55.0	0.06	0.06	0	0	\$0	\$0
16	7,351,516	7,351,516	55.0	55.0	0.06	0.06	0	0	\$0	\$0
17	7,567,583	7,567,583	55.0	55.0	0.06	0.06	0	0	\$0	\$0
18	7,783,650	7,783,650	55.0	55.0	0.06	0.06	0	0	\$0	\$0
19	7,999,718	7,999,718	55.0	55.0	0.06	0.06	0	0	\$0	\$0
Total										\$0

Non-Peak Period Weaving

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
20	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
2	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
3	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
4	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
5	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
6	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
7	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
8	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
9	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
10	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
11	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
12	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
13	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
14	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
15	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
16	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
17	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
18	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
19	0	0	55.0	55.0	0.06	0.06	0	0	\$0	\$0
Total										\$0

Non-Peak Period Truck

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		AVERAGE TRAVEL TIME (hours)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Existing Users	New (Induced)		
1	456,723	456,723	55.0	55.0	0.06	0.06	0	0	\$0	\$0
20	912,865	912,865	55.0	55.0	0.06	0.06	0	0	\$0	\$0
2	480,730	480,730	55.0	55.0	0.06	0.06	0	0	\$0	\$0
3	504,738	504,738	55.0	55.0	0.06	0.06	0	0	\$0	\$0
4	528,745	528,745	55.0	55.0	0.06	0.06	0	0	\$0	\$0
5	552,753	552,753	55.0	55.0	0.06	0.06	0	0	\$0	\$0
6	576,760	576,760	55.0	55.0	0.06	0.06	0	0	\$0	\$0
7	600,768	600,768	55.0	55.0	0.06	0.06	0	0	\$0	\$0
8	624,775	624,775	55.0	55.0	0.06	0.06	0	0	\$0	\$0
9	648,783	648,783	55.0	55.0	0.06	0.06	0	0	\$0	\$0
10	672,790	672,790	55.0	55.0	0.06	0.06	0	0	\$0	\$0
11	696,798	696,798	55.0	55.0	0.06	0.06	0	0	\$0	\$0
12	720,805	720,805	55.0	55.0	0.06	0.06	0	0	\$0	\$0
13	744,813	744,813	55.0	55.0	0.06	0.06	0	0	\$0	\$0
14	768,820	768,820	55.0	55.0	0.06	0.06	0	0	\$0	\$0
15	792,828	792,828	55.0	55.0	0.06	0.06	0	0	\$0	\$0
16	816,835	816,835	55.0	55.0	0.06	0.06	0	0	\$0	\$0
17	840,843	840,843	55.0	55.0	0.06	0.06	0	0	\$0	\$0
18	864,850	864,850	55.0	55.0	0.06	0.06	0	0	\$0	\$0
19	888,858	888,858	55.0	55.0	0.06	0.06	0	0	\$0	\$0
Total										\$0

$$\text{Present Value} = \frac{\text{Future Value (in Constant Dollars)}}{(1 + \text{Real Discount Rate})^n \text{ Year}}$$

SUMMARY OF TRAVEL TIME BENEFITS

SUMMARY OF TRAVEL TIME BENEFITS (continued)

Year	HIGHWAY										TRANSIT				Present Value of Travel Time Benefits	Constant Dollars	Total Per-Hrs of Delay Saved
	Peak HOV	Peak Non-HOV	Peak Weaving	Peak Truck	Peak Ramp	Peak Arterial	Non-Peak Non-HOV	Non-Peak Weaving	Non-Peak Truck	Peak In-Vehicle	Peak Out-of-Veh	Non-Peak In-Vehicle	Non-Peak Out-of-Veh				
1	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$247,716	20,551	
20	\$0	\$63,566	\$0	\$17,083	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0			

2	\$0	\$4,021	\$0	\$1,081	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$6,511	540
3	\$0	\$8,064	\$0	\$2,167	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$13,711	1,137
4	\$0	\$12,103	\$0	\$3,253	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$21,607	1,793
5	\$0	\$16,114	\$0	\$4,330	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$30,205	2,506
6	\$0	\$20,074	\$0	\$5,395	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$39,511	3,278
7	\$0	\$23,967	\$0	\$6,441	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$49,531	4,109
8	\$0	\$27,775	\$0	\$7,464	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$60,271	5,000
9	\$0	\$31,485	\$0	\$8,481	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$71,738	5,952
10	\$0	\$35,085	\$0	\$9,429	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$83,938	6,964
11	\$0	\$38,565	\$0	\$10,364	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$96,877	8,037
12	\$0	\$41,918	\$0	\$11,265	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$110,583	9,172
13	\$0	\$45,135	\$0	\$12,130	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$125,001	10,370
14	\$0	\$48,212	\$0	\$12,957	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$140,199	11,631
15	\$0	\$51,144	\$0	\$13,745	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$156,162	12,955
16	\$0	\$53,929	\$0	\$14,493	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$172,899	14,344
17	\$0	\$56,564	\$0	\$15,201	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$190,416	15,797
18	\$0	\$59,049	\$0	\$15,869	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$208,719	17,316
19	\$0	\$61,383	\$0	\$16,496	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$227,817	18,900

Total	\$0	\$698,152	\$0	\$187,626	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$2,053,393	170,353
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Vehicle Operating Cost Benefits

This sheet calculates changes in highway vehicle operating costs as benefits for highway and transit projects.
Net changes in transit operating costs should be included as project costs.

Formulas:

Vehicle-Miles Traveled = Affected Length x Average Volume
veh-miles/yr miles vehicles/yr

Non-Fuel Cost = VMT x Cost Per Mile
dollars \$/miles

Fuel Cost = VMT x Fuel Consumption x Fuel Price
dollars gallons/mile \$/gallon

Benefit = Existing Cost - New Cost

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HIGHWAY BENEFITS

Peak Period HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
20	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
2	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
3	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
4	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
5	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
6	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
7	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
8	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
9	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
10	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
11	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
12	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
13	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
14	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
15	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
16	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
17	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
18	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
19	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
Total										\$0

Peak Period Non-HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	2,628,029	2,628,029	55.0	55.0	8,672,494	8,672,494	\$0	\$0	\$0	\$0
20	5,252,715	5,252,715	52.1	54.9	17,333,960	17,333,960	(\$25,009)	\$0	(\$25,009)	(\$8,142)
2	2,766,170	2,766,170	54.8	55.0	9,128,361	9,128,361	\$0	\$0	\$0	\$0
3	2,904,311	2,904,311	54.7	55.0	9,584,227	9,584,227	\$0	\$0	\$0	\$0
4	3,042,453	3,042,453	54.5	55.0	10,040,094	10,040,094	\$0	\$0	\$0	\$0
5	3,180,594	3,180,594	54.4	55.0	10,495,961	10,495,961	\$0	\$0	\$0	\$0
6	3,318,736	3,318,736	54.2	55.0	10,951,827	10,951,827	\$0	\$0	\$0	\$0
7	3,456,877	3,456,877	54.1	55.0	11,407,694	11,407,694	\$0	\$0	\$0	\$0
8	3,595,018	3,595,018	53.9	55.0	11,863,560	11,863,560	(\$8,558)	\$0	(\$8,558)	(\$5,004)
9	3,733,160	3,733,160	53.8	55.0	12,319,427	12,319,427	(\$8,887)	\$0	(\$8,887)	(\$4,949)
10	3,871,301	3,871,301	53.6	55.0	12,775,294	12,775,294	(\$9,216)	\$0	(\$9,216)	(\$4,887)
11	4,009,442	4,009,442	53.5	54.9	13,231,160	13,231,160	(\$9,545)	\$0	(\$9,545)	(\$4,821)
12	4,147,584	4,147,584	53.3	54.9	13,687,027	13,687,027	(\$9,874)	\$0	(\$9,874)	(\$4,749)
13	4,285,725	4,285,725	53.2	54.9	14,142,893	14,142,893	(\$10,202)	\$0	(\$10,202)	(\$4,674)
14	4,423,867	4,423,867	53.0	54.9	14,598,760	14,598,760	(\$10,531)	\$0	(\$10,531)	(\$4,595)
15	4,562,008	4,562,008	52.9	54.9	15,054,627	15,054,627	(\$21,720)	\$0	(\$21,720)	(\$9,025)
16	4,700,149	4,700,149	52.7	54.9	15,510,493	15,510,493	(\$22,378)	\$0	(\$22,378)	(\$8,856)
17	4,838,291	4,838,291	52.6	54.9	15,966,360	15,966,360	(\$23,036)	\$0	(\$23,036)	(\$8,682)
18	4,976,432	4,976,432	52.4	54.9	16,422,226	16,422,226	(\$23,693)	\$0	(\$23,693)	(\$8,505)
19	5,114,574	5,114,574	52.3	54.9	16,878,093	16,878,093	(\$24,351)	\$0	(\$24,351)	(\$8,324)
Total										(\$85,212)

Peak Period Weaving

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
20	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
2	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
3	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
4	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
5	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
6	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
7	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
8	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
9	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
10	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
11	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
12	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
13	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
14	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
15	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
16	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
17	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
18	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
19	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
Total										\$0

Peak Period Truck

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	292,003	292,003	55.0	55.0	963,610	963,610	\$0	\$0	\$0	\$0
20	533,635	533,635	52.1	54.9	1,925,996	1,925,996	(\$1,765)	\$0	(\$1,765)	(\$575)
2	307,352	307,352	54.8	55.0	1,014,262	1,014,262	\$0	\$0	\$0	\$0
3	322,701	322,701	54.7	55.0	1,064,914	1,064,914	\$0	\$0	\$0	\$0
4	338,050	338,050	54.5	55.0	1,115,566	1,115,566	\$0	\$0	\$0	\$0
5	353,399	353,399	54.4	55.0	1,166,218	1,166,218	\$0	\$0	\$0	\$0
6	368,748	368,748	54.2	55.0	1,216,870	1,216,870	\$0	\$0	\$0	\$0
7	384,097	384,097	54.1	55.0	1,267,522	1,267,522	\$0	\$0	\$0	\$0
8	399,446	399,446	53.9	55.0	1,318,173	1,318,173	(\$604)	\$0	(\$604)	(\$353)
9	414,796	414,796	53.8	55.0	1,368,825	1,368,825	(\$627)	\$0	(\$627)	(\$349)
10	430,145	430,145	53.6	55.0	1,419,477	1,419,477	(\$650)	\$0	(\$650)	(\$345)
11	445,494	445,494	53.5	54.9	1,470,129	1,470,129	(\$674)	\$0	(\$674)	(\$340)
12	460,843	460,843	53.3	54.9	1,520,781	1,520,781	(\$697)	\$0	(\$697)	(\$335)
13	476,192	476,192	53.2	54.9	1,571,433	1,571,433	(\$720)	\$0	(\$720)	(\$330)
14	491,541	491,541	53.0	54.9	1,622,084	1,622,084	(\$743)	\$0	(\$743)	(\$324)
15	506,890	506,890	52.9	54.9	1,672,736	1,672,736	(\$1,533)	\$0	(\$1,533)	(\$637)
16	522,239	522,239	52.7	54.9	1,723,388	1,723,388	(\$1,579)	\$0	(\$1,579)	(\$625)
17	537,588	537,588	52.6	54.9	1,774,040	1,774,040	(\$1,626)	\$0	(\$1,626)	(\$613)
18	552,937	552,937	52.4	54.9	1,824,692	1,824,692	(\$1,672)	\$0	(\$1,672)	(\$600)
19	568,286	568,286	52.3	54.9	1,875,344	1,875,344	(\$1,718)	\$0	(\$1,718)	(\$587)
Total										(\$6,013)

Peak Period Arterial

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
20	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
2	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
3	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
4	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
5	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
6	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
7	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
8	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
9	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
10	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
11	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
12	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
13	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
14	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
15	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
16	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
17	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
18	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
19	0	0	5.0	5.0	0	0	\$0	\$0	\$0	\$0
Total										\$0

Non-Peak Period Non-HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	4,110,506	4,110,506	55.0	55.0	13,564,671	13,564,671	\$0	\$0	\$0	\$0
20	8,215,785	8,215,785	55.0	55.0	27,112,091	27,112,091	\$0	\$0	\$0	\$0
2	4,326,574	4,326,574	55.0	55.0	14,277,693	14,277,693	\$0	\$0	\$0	\$0
3	4,542,641	4,542,641	55.0	55.0	14,990,715	14,990,715	\$0	\$0	\$0	\$0
4	4,758,708	4,758,708	55.0	55.0	15,703,737	15,703,737	\$0	\$0	\$0	\$0
5	4,974,775	4,974,775	55.0	55.0	16,416,759	16,416,759	\$0	\$0	\$0	\$0
6	5,190,843	5,190,843	55.0	55.0	17,129,781	17,129,781	\$0	\$0	\$0	\$0
7	5,406,910	5,406,910	55.0	55.0	17,842,803	17,842,803	\$0	\$0	\$0	\$0
8	5,622,977	5,622,977	55.0	55.0	18,555,825	18,555,825	\$0	\$0	\$0	\$0
9	5,839,045	5,839,045	55.0	55.0	19,268,847	19,268,847	\$0	\$0	\$0	\$0
10	6,055,112	6,055,112	55.0	55.0	19,981,869	19,981,869	\$0	\$0	\$0	\$0
11	6,271,179	6,271,179	55.0	55.0	20,694,892	20,694,892	\$0	\$0	\$0	\$0
12	6,487,247	6,487,247	55.0	55.0	21,407,914	21,407,914	\$0	\$0	\$0	\$0
13	6,703,314	6,703,314	55.0	55.0	22,120,936	22,120,936	\$0	\$0	\$0	\$0
14	6,919,381	6,919,381	55.0	55.0	22,833,958	22,833,958	\$0	\$0	\$0	\$0
15	7,135,448	7,135,448	55.0	55.0	23,546,980	23,546,980	\$0	\$0	\$0	\$0
16	7,351,516	7,351,516	55.0	55.0	24,260,002	24,260,002	\$0	\$0	\$0	\$0
17	7,567,583	7,567,583	55.0	55.0	24,973,024	24,973,024	\$0	\$0	\$0	\$0
18	7,783,650	7,783,650	55.0	55.0	25,686,046	25,686,046	\$0	\$0	\$0	\$0
19	7,999,718	7,999,718	55.0	55.0	26,399,068	26,399,068	\$0	\$0	\$0	\$0
Total										\$0

Non-Peak Period Weaving

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
20	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
2	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
3	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
4	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
5	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
6	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
7	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
8	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
9	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
10	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
11	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
12	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
13	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
14	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
15	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
16	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
17	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
18	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
19	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
Total										\$0

Non-Peak Period Truck

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility	Fuel Costs	Non-Fuel Costs		
1	456,723	456,723	55.0	55.0	1,507,186	1,507,186	\$0	\$0	\$0	\$0
20	912,865	912,865	55.0	55.0	3,012,455	3,012,455	\$0	\$0	\$0	\$0
2	480,730	480,730	55.0	55.0	1,586,410	1,586,410	\$0	\$0	\$0	\$0
3	504,738	504,738	55.0	55.0	1,665,635	1,665,635	\$0	\$0	\$0	\$0
4	528,745	528,745	55.0	55.0	1,744,860	1,744,860	\$0	\$0	\$0	\$0
5	552,753	552,753	55.0	55.0	1,824,084	1,824,084	\$0	\$0	\$0	\$0
6	576,760	576,760	55.0	55.0	1,903,309	1,903,309	\$0	\$0	\$0	\$0
7	600,768	600,768	55.0	55.0	1,982,534	1,982,534	\$0	\$0	\$0	\$0
8	624,775	624,775	55.0	55.0	2,061,758	2,061,758	\$0	\$0	\$0	\$0
9	648,783	648,783	55.0	55.0	2,140,983	2,140,983	\$0	\$0	\$0	\$0
10	672,790	672,790	55.0	55.0	2,220,208	2,220,208	\$0	\$0	\$0	\$0
11	696,798	696,798	55.0	55.0	2,299,432	2,299,432	\$0	\$0	\$0	\$0
12	720,805	720,805	55.0	55.0	2,378,657	2,378,657	\$0	\$0	\$0	\$0
13	744,813	744,813	55.0	55.0	2,457,882	2,457,882	\$0	\$0	\$0	\$0
14	768,820	768,820	55.0	55.0	2,537,106	2,537,106	\$0	\$0	\$0	\$0
15	792,828	792,828	55.0	55.0	2,616,331	2,616,331	\$0	\$0	\$0	\$0
16	816,835	816,835	55.0	55.0	2,695,556	2,695,556	\$0	\$0	\$0	\$0
17	840,843	840,843	55.0	55.0	2,774,780	2,774,780	\$0	\$0	\$0	\$0
18	864,850	864,850	55.0	55.0	2,854,005	2,854,005	\$0	\$0	\$0	\$0
19	888,858	888,858	55.0	55.0	2,933,230	2,933,230	\$0	\$0	\$0	\$0
Total										\$0

$$\text{Present Value} = \frac{\text{Future Value (in Constant Dollars)}}{(1 + \text{Real Discount Rate})^{\text{Year}}}$$

C

SUMMARY OF VEHICLE OPERATING COST BENEFITS

Year	HIGHWAY							TRANSIT			Present Value of Veh Op Cost Benefits	Constant Dollars
	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		
1	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
20	\$0	(\$8,142)	\$0	(\$575)	\$0	\$0	\$0	\$0	-	-	(\$8,717)	(\$26,773)
2	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
3	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
4	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
5	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
6	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
7	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	-	-	\$0	\$0
8	\$0	(\$5,004)	\$0	(\$353)	\$0	\$0	\$0	\$0	-	-	\$0	\$0
9	\$0	(\$4,949)	\$0	(\$349)	\$0	\$0	\$0	\$0	-	-	(\$5,357)	(\$9,162)
10	\$0	(\$4,887)	\$0	(\$345)	\$0	\$0	\$0	\$0	-	-	(\$5,298)	(\$9,514)
11	\$0	(\$4,821)	\$0	(\$340)	\$0	\$0	\$0	\$0	-	-	(\$5,232)	(\$9,866)
12	\$0	(\$4,749)	\$0	(\$335)	\$0	\$0	\$0	\$0	-	-	(\$5,161)	(\$10,218)
13	\$0	(\$4,674)	\$0	(\$330)	\$0	\$0	\$0	\$0	-	-	(\$5,084)	(\$10,570)
14	\$0	(\$4,595)	\$0	(\$324)	\$0	\$0	\$0	\$0	-	-	(\$5,004)	(\$10,922)
15	\$0	(\$9,025)	\$0	(\$637)	\$0	\$0	\$0	\$0	-	-	(\$4,919)	(\$11,274)
16	\$0	(\$8,856)	\$0	(\$625)	\$0	\$0	\$0	\$0	-	-	(\$9,662)	(\$3,253)
17	\$0	(\$8,682)	\$0	(\$613)	\$0	\$0	\$0	\$0	-	-	(\$9,481)	(\$3,957)
18	\$0	(\$8,505)	\$0	(\$600)	\$0	\$0	\$0	\$0	-	-	(\$9,294)	(\$24,661)
19	\$0	(\$8,324)	\$0	(\$587)	\$0	\$0	\$0	\$0	-	-	(\$9,105)	(\$25,365)
											(\$8,912)	(\$26,069)
Total	\$0	(\$85,212)	\$0	(\$6,013)	\$0	\$0	\$0	\$0	-	-	(\$91,225)	(\$221,606)

TRANSIT BENEFITS

Net changes in transit operating costs should be included as project costs.

Accident Reduction Benefits

This sheet calculates accident benefits for highway and transit.

Formulas:

Vehicle-Miles Traveled = Affected Length x Avg Volume
veh-miles/yr miles vehicles/yr

Transit Acc Cost = Veh-Miles x Acc Cost/Mile

Hwy Acc Cost = (VMT x Rate x Cost/Mile) by Acc Type

Transit Acc Cost/Mile from PARAMETERS

A

HIGHWAY BENEFITS

Peak Period HOV

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	\$0	\$0	\$0	\$0
Total								\$0

Peak Period Non-HOV

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	2,628,029	2,628,029	8,672,494	8,672,494	\$2,780,568	\$2,099,952	\$680,616	\$559,945
20	5,252,715	5,252,715	17,333,960	17,333,960	\$5,557,600	\$4,197,233	\$1,360,367	\$442,896
2	2,766,170	2,766,170	9,128,361	9,128,361	\$2,926,728	\$2,210,335	\$716,393	\$561,312
3	2,904,311	2,904,311	9,584,227	9,584,227	\$3,072,887	\$2,320,718	\$752,169	\$561,280
4	3,042,453	3,042,453	10,040,094	10,040,094	\$3,219,047	\$2,431,101	\$787,945	\$559,978
5	3,180,594	3,180,594	10,495,961	10,495,961	\$3,365,206	\$2,541,485	\$823,722	\$557,527
6	3,318,736	3,318,736	10,951,827	10,951,827	\$3,511,366	\$2,651,868	\$859,498	\$554,040
7	3,456,877	3,456,877	11,407,694	11,407,694	\$3,657,525	\$2,762,251	\$895,274	\$549,621
8	3,595,018	3,595,018	11,863,560	11,863,560	\$3,803,685	\$2,872,634	\$931,051	\$544,366
9	3,733,160	3,733,160	12,319,427	12,319,427	\$3,949,845	\$2,983,017	\$966,827	\$538,366
10	3,871,301	3,871,301	12,775,294	12,775,294	\$4,096,004	\$3,093,401	\$1,002,603	\$531,702
11	4,009,442	4,009,442	13,231,160	13,231,160	\$4,242,164	\$3,203,784	\$1,038,380	\$524,452
12	4,147,584	4,147,584	13,687,027	13,687,027	\$4,388,323	\$3,314,167	\$1,074,156	\$516,688
13	4,285,725	4,285,725	14,142,893	14,142,893	\$4,534,483	\$3,424,550	\$1,109,933	\$508,473
14	4,423,867	4,423,867	14,598,760	14,598,760	\$4,680,642	\$3,534,933	\$1,145,709	\$499,869
15	4,562,008	4,562,008	15,054,627	15,054,627	\$4,826,802	\$3,645,317	\$1,181,485	\$490,932
16	4,700,149	4,700,149	15,510,493	15,510,493	\$4,972,962	\$3,755,700	\$1,217,262	\$481,712
17	4,838,291	4,838,291	15,966,360	15,966,360	\$5,119,121	\$3,866,083	\$1,253,038	\$472,257
18	4,976,432	4,976,432	16,422,226	16,422,226	\$5,265,281	\$3,976,466	\$1,288,814	\$462,610
19	5,114,574	5,114,574	16,878,093	16,878,093	\$5,411,440	\$4,086,850	\$1,324,591	\$452,811
Total								\$10,370,837

Peak Period Weaving

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	\$0	\$0	\$0	\$0
Total								\$0

Peak Period Truck

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	292,003	292,003	963,610	963,610	\$308,952	\$233,328	\$75,624	\$62,216
20	583,635	583,635	1,925,996	1,925,996	\$617,511	\$466,359	\$151,152	\$49,211
2	307,352	307,352	1,014,262	1,014,262	\$325,192	\$245,593	\$79,599	\$62,368
3	322,701	322,701	1,064,914	1,064,914	\$341,432	\$257,858	\$83,574	\$62,364
4	338,050	338,050	1,115,566	1,115,566	\$357,672	\$270,122	\$87,549	\$62,220
5	353,399	353,399	1,166,218	1,166,218	\$373,912	\$282,387	\$91,525	\$61,947
6	368,748	368,748	1,216,870	1,216,870	\$390,152	\$294,652	\$95,500	\$61,560
7	384,097	384,097	1,267,522	1,267,522	\$406,392	\$306,917	\$99,475	\$61,069
8	399,446	399,446	1,318,173	1,318,173	\$422,632	\$319,182	\$103,450	\$60,485
9	414,796	414,796	1,368,825	1,368,825	\$438,872	\$331,446	\$107,425	\$59,818
10	430,145	430,145	1,419,477	1,419,477	\$455,112	\$343,711	\$111,400	\$59,078
11	445,494	445,494	1,470,129	1,470,129	\$471,352	\$355,976	\$115,376	\$58,272
12	460,843	460,843	1,520,781	1,520,781	\$487,591	\$368,241	\$119,351	\$57,410
13	476,192	476,192	1,571,433	1,571,433	\$503,831	\$380,506	\$123,326	\$56,497
14	491,541	491,541	1,622,084	1,622,084	\$520,071	\$392,770	\$127,301	\$55,541
15	506,890	506,890	1,672,736	1,672,736	\$536,311	\$405,035	\$131,276	\$54,548
16	522,239	522,239	1,723,388	1,723,388	\$552,551	\$417,300	\$135,251	\$53,524
17	537,588	537,588	1,774,040	1,774,040	\$568,791	\$429,565	\$139,226	\$52,473
18	552,937	552,937	1,824,692	1,824,692	\$585,031	\$441,830	\$143,202	\$51,401
19	568,286	568,286	1,875,344	1,875,344	\$601,271	\$454,094	\$147,177	\$50,312
Total								\$1,152,315

Peak Period Arterial

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	\$0	\$0	\$0	\$0
Total								\$0

Non-Peak Period Non-HOV

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	4,110,506	4,110,506	13,564,671	13,564,671	\$4,349,093	\$3,284,540	\$1,064,554	\$875,811
20	8,215,785	8,215,785	27,112,091	27,112,091	\$8,692,656	\$6,564,903	\$2,127,754	\$692,736
2	4,326,574	4,326,574	14,277,693	14,277,693	\$4,577,702	\$3,457,190	\$1,120,512	\$877,960
3	4,542,641	4,542,641	14,990,715	14,990,715	\$4,806,311	\$3,629,841	\$1,176,469	\$877,900
4	4,758,708	4,758,708	15,703,737	15,703,737	\$5,034,919	\$3,802,492	\$1,232,427	\$875,863
5	4,974,775	4,974,775	16,416,759	16,416,759	\$5,263,528	\$3,975,142	\$1,288,385	\$872,030
6	5,190,843	5,190,843	17,129,781	17,129,781	\$5,492,136	\$4,147,793	\$1,344,343	\$866,576
7	5,406,910	5,406,910	17,842,803	17,842,803	\$5,720,745	\$4,320,444	\$1,400,301	\$859,663
8	5,622,977	5,622,977	18,555,825	18,555,825	\$5,949,353	\$4,493,094	\$1,456,259	\$851,444
9	5,839,045	5,839,045	19,268,847	19,268,847	\$6,177,962	\$4,665,745	\$1,512,217	\$842,059
10	6,055,112	6,055,112	19,981,869	19,981,869	\$6,406,571	\$4,838,396	\$1,568,175	\$831,637
11	6,271,179	6,271,179	20,694,892	20,694,892	\$6,635,179	\$5,011,046	\$1,624,133	\$820,297
12	6,487,247	6,487,247	21,407,914	21,407,914	\$6,863,788	\$5,183,697	\$1,680,090	\$808,152
13	6,703,314	6,703,314	22,120,936	22,120,936	\$7,092,396	\$5,356,348	\$1,736,048	\$795,304
14	6,919,381	6,919,381	22,833,958	22,833,958	\$7,321,005	\$5,528,998	\$1,792,006	\$781,846
15	7,135,448	7,135,448	23,546,980	23,546,980	\$7,549,613	\$5,701,649	\$1,847,964	\$767,867
16	7,351,516	7,351,516	24,260,002	24,260,002	\$7,778,222	\$5,874,300	\$1,903,922	\$753,447
17	7,567,583	7,567,583	24,973,024	24,973,024	\$8,006,830	\$6,046,951	\$1,959,880	\$738,658
18	7,783,650	7,783,650	25,686,046	25,686,046	\$8,235,439	\$6,219,601	\$2,015,838	\$723,570
19	7,999,718	7,999,718	26,399,068	26,399,068	\$8,464,048	\$6,392,252	\$2,071,796	\$708,243
Total							\$16,221,052	

Non-Peak Period Weaving

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	\$0	\$0	\$0	\$0
Total							\$0	

Non-Peak Period Truck

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	456,723	456,723	1,507,186	1,507,186	\$483,233	\$364,949	\$118,284	\$97,312
20	912,865	912,865	3,012,455	3,012,455	\$965,851	\$729,434	\$236,417	\$76,971
2	480,730	480,730	1,586,410	1,586,410	\$508,634	\$384,132	\$124,501	\$97,550
3	504,738	504,738	1,665,635	1,665,635	\$534,035	\$403,316	\$130,719	\$97,544
4	528,745	528,745	1,744,860	1,744,860	\$559,435	\$422,499	\$136,936	\$97,318
5	552,753	552,753	1,824,084	1,824,084	\$584,836	\$441,682	\$143,154	\$96,892
6	576,760	576,760	1,903,309	1,903,309	\$610,237	\$460,866	\$149,371	\$96,286
7	600,768	600,768	1,982,534	1,982,534	\$635,638	\$480,049	\$155,589	\$95,618
8	624,775	624,775	2,061,758	2,061,758	\$661,039	\$499,233	\$161,807	\$94,605
9	648,783	648,783	2,140,983	2,140,983	\$686,440	\$518,416	\$168,024	\$93,562
10	672,790	672,790	2,220,208	2,220,208	\$711,841	\$537,600	\$174,242	\$92,404
11	696,798	696,798	2,299,432	2,299,432	\$737,242	\$556,783	\$180,459	\$91,144
12	720,805	720,805	2,378,657	2,378,657	\$762,643	\$575,966	\$186,677	\$89,795
13	744,813	744,813	2,457,882	2,457,882	\$788,044	\$595,150	\$192,894	\$88,367
14	768,820	768,820	2,537,106	2,537,106	\$813,445	\$614,333	\$199,112	\$86,872
15	792,828	792,828	2,616,331	2,616,331	\$838,846	\$633,517	\$205,329	\$85,319
16	816,835	816,835	2,695,556	2,695,556	\$864,247	\$652,700	\$211,547	\$83,716
17	840,843	840,843	2,774,780	2,774,780	\$889,648	\$671,883	\$217,764	\$82,073
18	864,850	864,850	2,854,005	2,854,005	\$915,049	\$691,067	\$223,982	\$80,397
19	888,858	888,858	2,933,230	2,933,230	\$940,450	\$710,250	\$230,200	\$78,694
Total							\$1,802,339	

$$\text{Present Value} = \text{Future Value} \text{ (in Constant Dollars)} \\ (1 + \text{Real Discount Rate})^{-\text{Year}}$$

B

TRANSIT BENEFITS

All Transit

Year	VEHICLE MILES (veh-mi/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	\$0	\$0	\$0	\$0
20	0	0	\$0	\$0	\$0	\$0
2	0	0	\$0	\$0	\$0	\$0
3	0	0	\$0	\$0	\$0	\$0
4	0	0	\$0	\$0	\$0	\$0
5	0	0	\$0	\$0	\$0	\$0
6	0	0	\$0	\$0	\$0	\$0
7	0	0	\$0	\$0	\$0	\$0
8	0	0	\$0	\$0	\$0	\$0
9	0	0	\$0	\$0	\$0	\$0
10	0	0	\$0	\$0	\$0	\$0
11	0	0	\$0	\$0	\$0	\$0
12	0	0	\$0	\$0	\$0	\$0
13	0	0	\$0	\$0	\$0	\$0
14	0	0	\$0	\$0	\$0	\$0
15	0	0	\$0	\$0	\$0	\$0
16	0	0	\$0	\$0	\$0	\$0
17	0	0	\$0	\$0	\$0	\$0
18	0	0	\$0	\$0	\$0	\$0
19	0	0	\$0	\$0	\$0	\$0
Total						\$0

SUMMARY OF ACCIDENT REDUCTION BENEFITS

Year	Peak HOV	Peak Non-HOV	Peak Weaving	HIGHWAY						TRANSIT	Present Value of Accident Benefits	Constant Dollars
				Peak Truck	Peak Arterial	Non-Peak Non-HOV	Non-Peak Weaving	Non-Peak Truck	All Periods			
1	\$0	\$559,945	\$0	\$62,216	\$0	\$675,811	\$0	\$97,312	\$0	\$0	\$1,595,284	\$7,939,078
20	\$0	\$442,896	\$0	\$49,211	\$0	\$692,736	\$0	\$76,971	\$0	\$0	\$1,261,813	\$3,876,690
2	\$0	\$561,312	\$0	\$62,368	\$0	\$677,950	\$0	\$97,550	\$0	\$0	\$1,599,181	\$2,041,005
3	\$0	\$561,280	\$0	\$62,364	\$0	\$677,900	\$0	\$97,544	\$0	\$0	\$1,599,089	\$2,142,932
4	\$0	\$559,978	\$0	\$62,220	\$0	\$675,853	\$0	\$97,318	\$0	\$0	\$1,595,379	\$2,244,859
5	\$0	\$557,527	\$0	\$61,947	\$0	\$672,030	\$0	\$96,892	\$0	\$0	\$1,588,397	\$2,346,786
6	\$0	\$554,040	\$0	\$61,560	\$0	\$666,576	\$0	\$96,286	\$0	\$0	\$1,578,462	\$2,448,712
7	\$0	\$549,621	\$0	\$61,069	\$0	\$659,663	\$0	\$95,518	\$0	\$0	\$1,565,871	\$2,550,639
8	\$0	\$544,366	\$0	\$60,485	\$0	\$651,444	\$0	\$94,605	\$0	\$0	\$1,550,901	\$2,652,566
9	\$0	\$538,366	\$0	\$59,818	\$0	\$642,059	\$0	\$93,562	\$0	\$0	\$1,533,805	\$2,754,498
10	\$0	\$531,702	\$0	\$59,078	\$0	\$631,637	\$0	\$92,404	\$0	\$0	\$1,514,821	\$2,856,420
11	\$0	\$524,452	\$0	\$58,272	\$0	\$620,297	\$0	\$91,144	\$0	\$0	\$1,494,166	\$2,958,347
12	\$0	\$516,688	\$0	\$57,410	\$0	\$608,152	\$0	\$89,795	\$0	\$0	\$1,472,044	\$3,060,274
13	\$0	\$508,473	\$0	\$56,497	\$0	\$795,304	\$0	\$88,367	\$0	\$0	\$1,448,641	\$3,162,201
14	\$0	\$499,869	\$0	\$55,541	\$0	\$781,846	\$0	\$86,672	\$0	\$0	\$1,424,128	\$3,264,128
15	\$0	\$490,932	\$0	\$54,548	\$0	\$767,867	\$0	\$85,319	\$0	\$0	\$1,398,665	\$3,366,055
16	\$0	\$481,712	\$0	\$53,524	\$0	\$753,447	\$0	\$83,716	\$0	\$0	\$1,372,398	\$3,467,982
17	\$0	\$472,257	\$0	\$52,473	\$0	\$738,658	\$0	\$82,073	\$0	\$0	\$1,345,461	\$3,569,909
18	\$0	\$462,610	\$0	\$51,401	\$0	\$723,570	\$0	\$80,397	\$0	\$0	\$1,317,977	\$3,671,836
19	\$0	\$452,811	\$0	\$50,312	\$0	\$708,243	\$0	\$78,694	\$0	\$0	\$1,290,060	\$3,773,763
Total	\$0	\$10,370,837	\$0	\$1,152,315	\$0	\$16,221,052	\$0	\$1,802,339	\$0	\$0	\$29,546,544	\$38,147,574

TRANSIT BENEFITS

Peak Period Bus

Year	ANNUAL VEH-MILES (veh-miles/yr)		AVERAGE SPEED (mph)		EMISSIONS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
20	0	0	52.1	54.9	#N/A	#N/A	#N/A	#N/A
2	0	0	54.8	55.0	#N/A	#N/A	#N/A	#N/A
3	0	0	54.7	55.0	#N/A	#N/A	#N/A	#N/A
4	0	0	54.5	55.0	#N/A	#N/A	#N/A	#N/A
5	0	0	54.4	55.0	#N/A	#N/A	#N/A	#N/A
6	0	0	54.2	55.0	#N/A	#N/A	#N/A	#N/A
7	0	0	54.1	55.0	#N/A	#N/A	#N/A	#N/A
8	0	0	53.9	55.0	#N/A	#N/A	#N/A	#N/A
9	0	0	53.8	55.0	#N/A	#N/A	#N/A	#N/A
10	0	0	53.6	55.0	#N/A	#N/A	#N/A	#N/A
11	0	0	53.5	55.0	#N/A	#N/A	#N/A	#N/A
12	0	0	53.3	54.9	#N/A	#N/A	#N/A	#N/A
13	0	0	53.2	54.9	#N/A	#N/A	#N/A	#N/A
14	0	0	53.0	54.9	#N/A	#N/A	#N/A	#N/A
15	0	0	52.9	54.9	#N/A	#N/A	#N/A	#N/A
16	0	0	52.7	54.9	#N/A	#N/A	#N/A	#N/A
17	0	0	52.6	54.9	#N/A	#N/A	#N/A	#N/A
18	0	0	52.4	54.9	#N/A	#N/A	#N/A	#N/A
19	0	0	52.3	54.9	#N/A	#N/A	#N/A	#N/A
Total								#N/A

Non-Peak Period Bus

Year	ANNUAL VEH-MILES (veh-miles/yr)		AVERAGE SPEED (mph)		EMISSIONS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility	Existing Facility	New Facility	Existing Facility	New Facility		
1	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
20	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
2	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
3	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
4	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
5	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
6	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
7	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
8	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
9	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
10	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
11	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
12	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
13	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
14	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
15	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
16	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
17	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
18	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
19	0	0	55.0	55.0	#N/A	#N/A	#N/A	#N/A
Total								#N/A

Passenger Rail

Passenger Rail

Year	ANNUAL TRAIN-MILES (train-miles/yr)			EMISSIONS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility		Existing Facility	New Facility		
1	0	0		#N/A	#N/A	#N/A	#N/A
20	0	0		#N/A	#N/A	#N/A	#N/A
2	0	0		#N/A	#N/A	#N/A	#N/A
3	0	0		#N/A	#N/A	#N/A	#N/A
4	0	0		#N/A	#N/A	#N/A	#N/A
5	0	0		#N/A	#N/A	#N/A	#N/A
6	0	0		#N/A	#N/A	#N/A	#N/A
7	0	0		#N/A	#N/A	#N/A	#N/A
8	0	0		#N/A	#N/A	#N/A	#N/A
9	0	0		#N/A	#N/A	#N/A	#N/A
10	0	0		#N/A	#N/A	#N/A	#N/A
11	0	0		#N/A	#N/A	#N/A	#N/A
12	0	0		#N/A	#N/A	#N/A	#N/A
13	0	0		#N/A	#N/A	#N/A	#N/A
14	0	0		#N/A	#N/A	#N/A	#N/A
15	0	0		#N/A	#N/A	#N/A	#N/A
16	0	0		#N/A	#N/A	#N/A	#N/A
17	0	0		#N/A	#N/A	#N/A	#N/A
18	0	0		#N/A	#N/A	#N/A	#N/A
19	0	0		#N/A	#N/A	#N/A	#N/A
Total							#N/A

Light Rail

Year	ANNUAL VEH-MILES (veh-miles/yr)			EMISSIONS (\$/yr)		Constant Dollars	Present Value
	Existing Facility	New Facility		Existing Facility	New Facility		
1	0	0		#N/A	#N/A	#N/A	#N/A
20	0	0		#N/A	#N/A	#N/A	#N/A
2	0	0		#N/A	#N/A	#N/A	#N/A
3	0	0		#N/A	#N/A	#N/A	#N/A
4	0	0		#N/A	#N/A	#N/A	#N/A
5	0	0		#N/A	#N/A	#N/A	#N/A
6	0	0		#N/A	#N/A	#N/A	#N/A
7	0	0		#N/A	#N/A	#N/A	#N/A
8	0	0		#N/A	#N/A	#N/A	#N/A
9	0	0		#N/A	#N/A	#N/A	#N/A
10	0	0		#N/A	#N/A	#N/A	#N/A
11	0	0		#N/A	#N/A	#N/A	#N/A
12	0	0		#N/A	#N/A	#N/A	#N/A
13	0	0		#N/A	#N/A	#N/A	#N/A
14	0	0		#N/A	#N/A	#N/A	#N/A
15	0	0		#N/A	#N/A	#N/A	#N/A
16	0	0		#N/A	#N/A	#N/A	#N/A
17	0	0		#N/A	#N/A	#N/A	#N/A
18	0	0		#N/A	#N/A	#N/A	#N/A
19	0	0		#N/A	#N/A	#N/A	#N/A
Total							#N/A

SUMMARY OF EMISSION REDUCTION BENEFITS

SUMMARY OF EMISSION REDUCTION BENEFITS (continued)

Year	HIGHWAY										TRANSIT				Present Value of Emission Benefits*	Constant Dollars
	Peak HOV	Peak Non-HOV	Peak Weaving	Peak Truck	Peak Ramp	Peak Arterial	Non-HOV	Non-Peak Weaving	Non-Peak Truck	Peak Bus	Non-Peak Bus	Passenger Rail	Light Rail			
1	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
20	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
2	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
3	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
4	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
5	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
6	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
7	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
8	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
9	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
10	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
11	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
12	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
13	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
14	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
15	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
16	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
17	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
18	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
19	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0
Total	#N/A	#N/A	#N/A	#N/A	\$0	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		\$0	\$0

* Emissions Benefits Not Counted

NET PRESENT VALUE CALCULATION

Year	PRESENT VALUE OF USER BENEFITS				PRESENT VALUE OF USER BENEFITS				Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions			
Construction Begins											
0									\$0	\$8,397,000	(\$8,397,000)
1									\$0	\$7,997,143	(\$7,997,143)
2									\$0	\$7,616,327	(\$7,616,327)
3									\$0	\$7,253,644	(\$7,253,644)
4									\$0	\$0	\$0
5									\$0	\$0	\$0
6									\$0	\$0	\$0
7									\$0	\$0	\$0
Project Opens											
1	\$0		\$1,595,284	\$0					\$1,595,284	\$0	\$1,595,284
2	\$5,101		\$1,599,181	\$0					\$1,604,282	\$0	\$1,604,282
3	\$10,231		\$1,599,089	\$0					\$1,609,320	\$0	\$1,609,320
4	\$15,356		\$1,595,379	\$0					\$1,610,735	\$0	\$1,610,735
5	\$20,444		\$1,588,397	\$0					\$1,608,841	\$0	\$1,608,841
6	\$25,469		\$1,578,462	\$0					\$1,603,931	\$0	\$1,603,931
7	\$30,408		\$1,565,871	\$0					\$1,596,279	\$0	\$1,596,279
8	\$35,239		\$1,550,901	\$0					\$1,586,140	\$0	\$1,586,140
9	\$39,946		\$1,533,805	\$0					\$1,573,751	\$0	\$1,573,751
10	\$44,514		\$1,514,821	\$0					\$1,559,335	\$0	\$1,559,335
11	\$48,930		\$1,494,166	\$0					\$1,543,096	\$0	\$1,543,096
12	\$53,183		\$1,472,044	\$0					\$1,525,227	\$0	\$1,525,227
13	\$57,264		\$1,448,641	\$0					\$1,505,905	\$0	\$1,505,905
14	\$61,168		\$1,424,128	\$0					\$1,485,296	\$0	\$1,485,296
15	\$64,889		\$1,398,665	\$0					\$1,463,554	\$0	\$1,463,554
16	\$68,422		\$1,372,398	\$0					\$1,440,820	\$0	\$1,440,820
17	\$71,766		\$1,345,461	\$0					\$1,417,227	\$0	\$1,417,227
18	\$74,918		\$1,317,977	\$0					\$1,392,896	\$0	\$1,392,896
19	\$77,879		\$1,290,060	\$0					\$1,367,939	\$0	\$1,367,939
20	\$80,649		\$1,261,813	\$0					\$1,342,462	\$0	\$1,342,462
Total	\$885,777	\$0	\$29,546,544	\$0	\$0	\$0	\$0	\$0	\$30,432,321	\$31,264,114	(\$831,793)
170,353 Person Hours of Delay Saved											
Person Hours of Delay Saved											

INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

B

Year	USER BENEFITS IN CONSTANT DOLLARS				USER BENEFITS IN CONSTANT DOLLARS				Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions			
Construction Begins											
0									\$0		(\$8,397,000)
1									\$0		(\$8,397,000)
2									\$0		(\$8,397,000)
3									\$0		(\$8,397,000)
4									\$0		\$0
5									\$0		\$0
6									\$0		\$0
7									\$0		\$0
Project Opens											
1	\$0								\$1,939,078		\$1,939,078
2	\$6,511								\$2,047,515		\$2,047,515
3	\$13,711								\$2,156,643		\$3,986,593
4	\$21,607								\$2,266,466		\$6,143,236
5	\$30,205								\$2,376,991		\$8,409,702
6	\$39,511								\$2,489,224		\$10,786,693
7	\$49,531								\$2,600,170		\$13,274,916
8	\$60,271								\$2,712,838		\$15,875,087
9	\$71,738								\$2,826,231		\$18,587,924
10	\$83,938								\$2,940,358		\$21,414,156
11	\$96,877								\$3,055,225		\$24,354,514
12	\$110,563								\$3,170,837		\$27,409,739
13	\$125,001								\$3,287,202		\$30,580,576
14	\$140,199								\$3,404,327		\$33,867,778
15	\$156,162								\$3,522,217		\$37,272,104
16	\$172,899								\$3,640,881		\$40,794,322
17	\$190,416								\$3,760,324		\$44,435,203
18	\$208,719								\$3,880,555		\$48,195,527
19	\$227,817								\$4,001,579		\$52,076,082
20	\$247,716								\$4,123,405		\$56,077,661
Total	\$2,053,393	\$0	\$58,147,674	\$0	\$0	\$0	\$0	\$0	\$60,201,066	\$33,588,000	\$26,613,066

Total Construction Costs

\$33,588,000

Years After Construction Begins	ANNUAL RETURNS ON INVESTMENT
0	(\$8,397,000)
1	(\$8,397,000)
2	(\$8,397,000)
3	(\$8,397,000)
4	\$1,939,078
5	\$2,047,515
6	\$2,156,643
7	\$2,266,466
8	\$2,376,991
9	\$2,488,224
10	\$2,600,170
11	\$2,712,838
12	\$2,826,231
13	\$2,940,358
14	\$3,055,225
15	\$3,170,837
16	\$3,287,202
17	\$3,404,327
18	\$3,522,217
19	\$3,640,881
20	\$3,760,324
21	\$3,880,555
22	\$4,001,579
23	\$4,123,405
24	\$0
25	\$0
26	\$0
27	\$0

Internal Rate
of Return

4.76%

Payback
Period

13 years

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

The PAYBACK PERIOD is the number of years it takes for the net benefits (benefits minus costs) to equal, or payback, the initial construction costs. For a project with a Payback Period longer than the life-cycle of the project, initial construction costs are not recovered. The Payback Period varies inversely with the Benefit-Cost Ratio: shorter Payback Period yields higher Benefit-Cost.

Parameters

This page contains all economic values and rate tables.

To update economic values automatically, change "Economic Update Factor."

General Economic Parameters

Year of Current Dollars for Model	2003
Economic Update Factor (Using GDP Deflator)	1.00
Real Discount Rate	5.0%

Highway Operations Parameters

	Value	Units
Maximum V/C Ratio	1.4	-
Percent ADT in Average Peak Hour	7.8%	%
Capacity per Lane (general)	1250	veh/hr
Capacity per HOV Lane	2000	veh/hr

Travel Time Parameters

Average Hourly Wage		
Transportation and Warehousing	\$ 18.74	\$/hr
Statewide	\$ 20.92	\$/hr
Value of Time		
Automobile	\$ 10.46	\$/hr/person
Truck	\$ 27.63	\$/hr
Transit	\$ 10.46	\$/hr/person
Out-of-Vehicle Travel	2	times
Incident-Related Travel	3	times

Operating Cost Parameters

Fuel Cost Per Gallon (Exclude Taxes)	\$ 2.55	\$/gal
Non-Fuel Cost Per Mile		
Automobile	\$ 0.173	\$/mi
Truck	\$ 0.299	\$/mi

Accident Cost Parameters

Cost of a Fatality	\$ 2,847,668	\$/event
Cost of an Injury		
Level A (Severe)	\$ 157,357	\$/event
Level B (Moderate)	\$ 42,505	\$/event
Level C (Minor)	\$ 22,960	\$/event
Cost of Highway Accident		
Fatal Accident	\$ 3,262,469	\$/accident
Injury Accident	\$ 85,716	\$/accident
PDO Accident	\$ 7,198	\$/accident
Average Cost	\$ 61,509	\$/accident
Statewide Highway Accident Rates		
Fatal Accident	0.009	per million veh-mi
Injury Accident	0.343	per million veh-mi
PDO Accident	0.690	per million veh-mi
Non-Freeway	1.49	per million veh-mi

Project Types

Highway Capacity Expansion		
General Highway	TRUE	GenHwy
HOV Lane	FALSE	HOV
Passing Lane	FALSE	Passing
Interchange	FALSE	Intersect
Bypass	FALSE	Bypass
Pavement	FALSE	Pavement

Transit Capacity Expansion		
Passenger Rail	FALSE	PassRail
Light-Rail (LRT)	FALSE	LRT
Bus	FALSE	Bus

Operational Improvement		
Auxiliary Lane	FALSE	AuxLane
Freeway Connector	FALSE	FreeConn
HOV Connector	FALSE	HOVConn
HOV Drop Ramp	FALSE	HOVDrop
Off-Ramp Widening	FALSE	OffRamp
On-Ramp Widening	FALSE	OnRamp

Transp Mgmt Systems (TMS)		
Ramp Metering	FALSE	RM
Ramp Metering Signal Coord	FALSE	AM
Incident Management	FALSE	IM
Traveler Information	FALSE	TI
Arterial Signal Management	FALSE	ASM
Transit Vehicle Location (AVL)	FALSE	AVL
Transit Vehicle Signal Priority	FALSE	SigPriority
Bus Rapid Transit (BRT)	FALSE	BRT

TMS Lookup Code	NoAdj
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Sources: 1) Highway Capacity Manual, 2) Statewide Travel Survey 1991, 3) Bureau of Labor Statistics (BLS) Covered Wages and Employment Program, 4) AAA Daily Fuel Gauge Report, 5) OPIS Energy Group and Wright Express, 6) Jack Faucett Associates, 7) Paccar, Inc. 8) National Safety Council, 9) Urban Institute, 10) TASAS summary for 2000

Operating Cost Tables

FUEL CONSUMPTION RATES
(gal/veh-mi)

Speed	Auto	Truck
5	0.150	0.218
6	0.142	0.215
7	0.135	0.211
8	0.127	0.208
9	0.120	0.205
10	0.112	0.202
11	0.107	0.198
12	0.102	0.194
13	0.097	0.190
14	0.092	0.186
15	0.087	0.182
16	0.083	0.179
17	0.080	0.177
18	0.076	0.174
19	0.073	0.172
20	0.070	0.169
21	0.067	0.168
22	0.065	0.166
23	0.063	0.165
24	0.060	0.163
25	0.058	0.162
26	0.057	0.161
27	0.055	0.160
28	0.053	0.159
29	0.052	0.158
30	0.050	0.157
31	0.049	0.156
32	0.048	0.156
33	0.047	0.155
34	0.046	0.154
35	0.045	0.154
36	0.045	0.153
37	0.044	0.153
38	0.043	0.153
39	0.043	0.152
40	0.042	0.152
41	0.042	0.152
42	0.042	0.152
43	0.041	0.152
44	0.041	0.151
45	0.041	0.151
46	0.041	0.151
47	0.041	0.151
48	0.041	0.151
49	0.041	0.151
50	0.041	0.151
51	0.041	0.152
52	0.041	0.152
53	0.042	0.152
54	0.042	0.152
55	0.042	0.152
56	0.043	0.153
57	0.043	0.153
58	0.044	0.153
59	0.044	0.154
60	0.045	0.154
61	0.046	0.155
62	0.047	0.155
63	0.048	0.156
64	0.049	0.157
65	0.050	0.157
66	0.051	0.158
67	0.051	0.159
68	0.052	0.161
69	0.053	0.162
70	0.053	0.163

Source: California Air Resources Board,
EMFAC2002, V2.2, 2003 & 2023 average

Accident Tables

COST OF TRANSIT ACCIDENT EVENTS
(\$/event)

Event	Pass Train	Light Rail	Bus
Fatality	\$2,847,668	\$2,847,668	\$2,847,668
Injury	\$68,922	\$68,922	\$68,922
Prop Damage	\$65,097	\$11,296	\$11,060

Sources: National Safety Council, Federal Railroad Administration,
Journal of Safety Research, and California Public Utilities Commission

RATES FOR TRANSIT ACCIDENT EVENTS
(event/million veh-mi)

Event	Pass Train	Light Rail	Bus
Fatality	0.24	0.23	0.05
Injury	0.94	12.80	12.20
All Accidents	1.09	11.13	14.73

Source: USDOT, average of 1994, 1995, 1996 data

TRANSIT ACCIDENT COSTS
(\$/million veh-mi)

Value	Pass Train	Light Rail	Bus
Cost	\$819,183	\$1,662,896	\$1,146,145

Source: Combination of above two tables

PASSING LANE ACCIDENT REDUCTION FACTORS
(rate with passing lane/rate without passing lane)

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

Emissions Tables

HIGHWAY EMISSIONS FACTORS (g/mi)
Model Year 2003

Mode	Speed	CO	NO _x	PM ₁₀	SO _x	VOC
Auto	5	16.97	1.39	0.10	0.01	1.97
	6	16.42	1.35	0.09	0.01	1.87
	7	15.88	1.32	0.09	0.01	1.77
	8	15.34	1.28	0.08	0.01	1.67
	9	14.79	1.24	0.08	0.01	1.58
	10	14.25	1.21	0.07	0.01	1.48
	11	13.84	1.18	0.07	0.01	1.42
	12	13.44	1.15	0.07	0.01	1.36
	13	13.03	1.12	0.06	0.01	1.30
	14	12.63	1.10	0.06	0.01	1.24
	15	12.23	1.07	0.06	0.01	1.18
	16	11.94	1.05	0.06	0.01	1.14
	17	11.65	1.03	0.05	0.01	1.10
	18	11.37	1.01	0.05	0.01	1.07
	19	11.08	0.99	0.05	0.01	1.03
	20	10.79	0.97	0.05	0.01	0.99
	21	10.59	0.96	0.05	0.01	0.97
	22	10.38	0.95	0.05	0.01	0.95
	23	10.17	0.93	0.04	0.01	0.92
	24	9.96	0.92	0.04	0.01	0.90
	25	9.75	0.90	0.04	0.01	0.88
	26	9.60	0.89	0.04	0.01	0.86
	27	9.44	0.88	0.04	0.01	0.85
	28	9.29	0.88	0.04	0.01	0.83
	29	9.13	0.87	0.04	0.00	0.82
	30	8.98	0.86	0.04	0.00	0.80
	31	8.87	0.85	0.04	0.00	0.79
	32	8.76	0.84	0.04	0.00	0.78
	33	8.64	0.84	0.04	0.00	0.77
	34	8.53	0.83	0.04	0.00	0.76
	35	8.42	0.83	0.04	0.00	0.75
	36	8.34	0.82	0.03	0.00	0.75
	37	8.26	0.82	0.03	0.00	0.74
	38	8.18	0.82	0.03	0.00	0.74
	39	8.10	0.81	0.03	0.00	0.73
	40	8.02	0.81	0.03	0.00	0.72
	41	7.97	0.81	0.03	0.00	0.72
	42	7.92	0.81	0.03	0.00	0.72
	43	7.87	0.81	0.03	0.00	0.71
	44	7.82	0.81	0.03	0.00	0.71
	45	7.77	0.81	0.03	0.00	0.71
	46	7.74	0.81	0.03	0.00	0.71
	47	7.72	0.81	0.03	0.00	0.71
	48	7.70	0.81	0.03	0.00	0.71
	49	7.68	0.81	0.03	0.00	0.70
	50	7.66	0.82	0.03	0.00	0.70
	51	7.67	0.82	0.03	0.00	0.70
	52	7.68	0.83	0.03	0.00	0.71
	53	7.69	0.83	0.03	0.00	0.71
	54	7.70	0.84	0.03	0.00	0.71
	55	7.71	0.84	0.03	0.00	0.71
	56	7.76	0.85	0.03	0.00	0.71
	57	7.81	0.86	0.03	0.00	0.72
	58	7.86	0.86	0.03	0.00	0.72
	59	7.92	0.87	0.03	0.00	0.72
	60	7.97	0.88	0.03	0.00	0.73
	61	8.07	0.89	0.03	0.00	0.73
	62	8.18	0.90	0.03	0.00	0.74
	63	8.29	0.91	0.03	0.00	0.74
	64	8.40	0.92	0.03	0.00	0.75
	65	8.51	0.94	0.03	0.00	0.76

HIGHWAY EMISSIONS FACTORS (g/mi)
Model Year 2023

Mode	Speed	CO	NO _x	PM ₁₀	SO _x	VOC
Auto	5	2.57	0.23	0.12	0.01	0.31
	6	2.53	0.23	0.11	0.01	0.29
	7	2.48	0.22	0.10	0.01	0.28
	8	2.43	0.21	0.10	0.01	0.27
	9	2.38	0.21	0.09	0.01	0.26
	10	2.33	0.20	0.08	0.01	0.24
	11	2.29	0.20	0.08	0.01	0.23
	12	2.25	0.19	0.07	0.01	0.23
	13	2.20	0.19	0.07	0.01	0.22
	14	2.16	0.18	0.07	0.01	0.21
	15	2.12	0.18	0.06	0.01	0.20
	16	2.09	0.18	0.06	0.01	0.20
	17	2.05	0.17	0.06	0.01	0.20
	18	2.02	0.17	0.06	0.01	0.19
	19	1.99	0.17	0.05	0.01	0.19
	20	1.95	0.16	0.05	0.01	0.18
	21	1.92	0.16	0.05	0.01	0.18
	22	1.90	0.16	0.05	0.01	0.18
	23	1.87	0.16	0.05	0.01	0.17
	24	1.84	0.15	0.04	0.01	0.17
	25	1.81	0.15	0.04	0.00	0.17
	26	1.79	0.15	0.04	0.00	0.17
	27	1.77	0.15	0.04	0.00	0.16
	28	1.74	0.15	0.04	0.00	0.16
	29	1.72	0.14	0.04	0.00	0.16
	30	1.70	0.14	0.04	0.00	0.16
	31	1.68	0.14	0.04	0.00	0.16
	32	1.66	0.14	0.04	0.00	0.16
	33	1.64	0.14	0.04	0.00	0.16
	34	1.62	0.14	0.04	0.00	0.16
	35	1.60	0.14	0.04	0.00	0.15
	36	1.58	0.13	0.04	0.00	0.15
	37	1.57	0.13	0.03	0.00	0.15
	38	1.55	0.13	0.03	0.00	0.15
	39	1.54	0.13	0.03	0.00	0.15
	40	1.52	0.13	0.03	0.00	0.15
	41	1.51	0.13	0.03	0.00	0.15
	42	1.49	0.13	0.03	0.00	0.15
	43	1.48	0.13	0.03	0.00	0.15
	44	1.47	0.13	0.03	0.00	0.15
	45	1.45	0.13	0.03	0.00	0.15
	46	1.44	0.13	0.03	0.00	0.15
	47	1.43	0.13	0.03	0.00	0.15
	48	1.42	0.13	0.03	0.00	0.15
	49	1.41	0.13	0.03	0.00	0.15
	50	1.41	0.13	0.03	0.00	0.15
	51	1.40	0.13	0.03	0.00	0.15
	52	1.39	0.13	0.03	0.00	0.15
	53	1.38	0.13	0.03	0.00	0.15
	54	1.38	0.13	0.03	0.00	0.15
	55	1.37	0.13	0.03	0.00	0.15
	56	1.37	0.13	0.03	0.00	0.15
	57	1.37	0.14	0.03	0.00	0.15
	58	1.36	0.14	0.03	0.00	0.15
	59	1.36	0.14	0.03	0.00	0.15
	60	1.36	0.14	0.03	0.00	0.15
	61	1.36	0.14	0.03	0.00	0.15
	62	1.36	0.14	0.03	0.00	0.16
	63	1.36	0.14	0.03	0.00	0.16
	64	1.37	0.14	0.03	0.00	0.16
	65	1.37	0.15	0.03	0.00	0.16

Emissions Tables

Truck	5	31.44	16.57	0.71	0.12	3.60
	6	30.51	16.29	0.70	0.12	3.51
	7	29.58	16.02	0.68	0.12	3.43
	8	28.66	15.74	0.67	0.12	3.35
	9	27.73	15.46	0.65	0.12	3.26
	10	26.81	15.19	0.63	0.12	3.18
	11	25.55	14.77	0.61	0.12	3.06
	12	24.29	14.36	0.58	0.11	2.94
	13	23.03	13.94	0.56	0.11	2.82
	14	21.77	13.52	0.54	0.11	2.70
	15	20.51	13.11	0.51	0.11	2.58
	16	19.74	12.83	0.49	0.11	2.50
	17	18.98	12.54	0.48	0.11	2.42
	18	18.21	12.26	0.46	0.11	2.35
	19	17.44	11.98	0.44	0.11	2.27
	20	16.68	11.70	0.42	0.11	2.19
	21	16.20	11.52	0.41	0.11	2.14
	22	15.72	11.34	0.40	0.11	2.08
	23	15.24	11.16	0.38	0.11	2.03
	24	14.77	10.98	0.37	0.11	1.98
	25	14.29	10.80	0.36	0.11	1.93
	26	13.99	10.69	0.35	0.11	1.89
	27	13.69	10.59	0.34	0.11	1.85
	28	13.38	10.49	0.33	0.11	1.82
	29	13.08	10.38	0.32	0.11	1.78
	30	12.78	10.28	0.31	0.11	1.74
	31	12.59	10.24	0.30	0.11	1.72
	32	12.40	10.20	0.30	0.11	1.69
	33	12.21	10.16	0.29	0.11	1.67
	34	12.02	10.12	0.28	0.11	1.64
	35	11.83	10.08	0.28	0.11	1.62
	36	11.72	10.10	0.27	0.11	1.60
	37	11.61	10.12	0.27	0.11	1.58
	38	11.50	10.14	0.26	0.11	1.56
	39	11.38	10.16	0.25	0.11	1.55
	40	11.27	10.18	0.25	0.11	1.53
	41	11.22	10.27	0.25	0.11	1.52
	42	11.16	10.35	0.24	0.11	1.50
	43	11.11	10.43	0.24	0.11	1.49
	44	11.06	10.51	0.23	0.11	1.48
	45	11.00	10.59	0.23	0.11	1.47
	46	11.00	10.74	0.23	0.11	1.46
	47	10.99	10.90	0.22	0.11	1.45
	48	10.99	11.05	0.22	0.11	1.44
	49	10.98	11.20	0.22	0.11	1.43
	50	10.98	11.35	0.22	0.11	1.42
	51	11.02	11.59	0.22	0.11	1.42
	52	11.06	11.83	0.21	0.11	1.41
	53	11.10	12.06	0.21	0.11	1.41
	54	11.15	12.30	0.21	0.11	1.40
	55	11.19	12.54	0.21	0.11	1.40
	56	11.29	12.89	0.21	0.11	1.39
	57	11.39	13.25	0.21	0.11	1.39
	58	11.49	13.60	0.20	0.11	1.39
	59	11.59	13.95	0.20	0.11	1.39
	60	11.69	14.30	0.20	0.11	1.38
	61	11.86	14.82	0.20	0.11	1.38
	62	12.03	15.33	0.20	0.11	1.38
	63	12.20	15.84	0.20	0.11	1.38
	64	12.38	16.36	0.20	0.11	1.38
	65	12.55	16.87	0.20	0.11	1.38

Truck	5	6.12	3.04	0.24	0.02	0.87
	6	5.95	3.00	0.24	0.02	0.86
	7	5.78	2.96	0.23	0.02	0.85
	8	5.61	2.92	0.23	0.02	0.83
	9	5.44	2.88	0.22	0.02	0.82
	10	5.27	2.84	0.22	0.02	0.81
	11	5.04	2.78	0.21	0.02	0.79
	12	4.81	2.72	0.20	0.02	0.77
	13	4.57	2.66	0.20	0.02	0.75
	14	4.34	2.60	0.19	0.02	0.73
	15	4.10	2.54	0.18	0.02	0.71
	16	3.96	2.49	0.18	0.02	0.69
	17	3.82	2.45	0.17	0.02	0.68
	18	3.67	2.41	0.17	0.02	0.67
	19	3.53	2.37	0.16	0.02	0.65
	20	3.38	2.33	0.15	0.02	0.64
	21	3.29	2.30	0.15	0.02	0.63
	22	3.20	2.28	0.15	0.02	0.62
	23	3.11	2.25	0.14	0.02	0.61
	24	3.01	2.23	0.14	0.02	0.60
	25	2.92	2.20	0.14	0.02	0.59
	26	2.86	2.18	0.13	0.02	0.58
	27	2.81	2.17	0.13	0.02	0.57
	28	2.75	2.15	0.13	0.02	0.57
	29	2.69	2.14	0.12	0.02	0.56
	30	2.63	2.12	0.12	0.02	0.55
	31	2.59	2.12	0.12	0.02	0.55
	32	2.55	2.11	0.12	0.02	0.54
	33	2.51	2.10	0.11	0.02	0.54
	34	2.48	2.10	0.11	0.02	0.53
	35	2.44	2.09	0.11	0.02	0.53
	36	2.42	2.10	0.11	0.02	0.52
	37	2.39	2.10	0.11	0.02	0.52
	38	2.37	2.10	0.11	0.02	0.52
	39	2.35	2.10	0.10	0.02	0.51
	40	2.32	2.11	0.10	0.02	0.51
	41	2.31	2.12	0.10	0.02	0.51
	42	2.30	2.13	0.10	0.02	0.50
	43	2.29	2.14	0.10	0.02	0.50
	44	2.27	2.15	0.10	0.02	0.50
	45	2.26	2.16	0.10	0.02	0.49
	46	2.26	2.19	0.10	0.02	0.49
	47	2.25	2.21	0.10	0.02	0.49
	48	2.25	2.23	0.09	0.02	0.49
	49	2.25	2.25	0.09	0.02	0.49
	50	2.24	2.27	0.09	0.02	0.48
	51	2.25	2.31	0.09	0.02	0.48
	52	2.25	2.34	0.09	0.02	0.48
	53	2.26	2.38	0.09	0.02	0.48
	54	2.26	2.41	0.09	0.02	0.48
	55	2.27	2.44	0.09	0.02	0.48
	56	2.28	2.50	0.09	0.02	0.48
	57	2.30	2.55	0.09	0.02	0.48
	58	2.31	2.60	0.09	0.02	0.48
	59	2.32	2.65	0.09	0.02	0.48
	60	2.34	2.70	0.09	0.02	0.47
	61	2.36	2.77	0.09	0.02	0.47
	62	2.39	2.85	0.09	0.02	0.47
	63	2.42	2.92	0.09	0.02	0.47
	64	2.44	3.00	0.09	0.02	0.47
	65	2.47	3.07	0.09	0.02	0.47

Emissions Tables

Bus	5	70.18	25.23	0.82	0.14	7.81
	6	67.53	24.65	0.79	0.14	7.52
	7	64.89	24.07	0.77	0.14	7.24
	8	62.25	23.50	0.75	0.14	6.96
	9	59.61	22.92	0.72	0.14	6.68
	10	56.97	22.34	0.70	0.14	6.40
	11	53.42	21.51	0.67	0.14	6.01
	12	49.87	20.69	0.64	0.14	5.62
	13	46.32	19.86	0.60	0.14	5.23
	14	42.78	19.03	0.57	0.14	4.84
	15	39.23	18.20	0.54	0.14	4.45
	16	37.10	17.67	0.51	0.14	4.21
	17	34.98	17.14	0.49	0.14	3.96
	18	32.86	16.62	0.47	0.14	3.72
	19	30.74	16.09	0.45	0.14	3.48
	20	28.62	15.56	0.42	0.14	3.24
	21	27.32	15.23	0.41	0.14	3.08
	22	26.01	14.91	0.39	0.14	2.93
	23	24.71	14.58	0.38	0.13	2.77
	24	23.41	14.25	0.36	0.13	2.62
	25	22.10	13.92	0.34	0.13	2.46
	26	21.29	13.74	0.33	0.13	2.36
	27	20.48	13.56	0.32	0.13	2.26
	28	19.67	13.37	0.31	0.13	2.16
	29	18.86	13.19	0.30	0.13	2.06
	30	18.04	13.00	0.29	0.13	1.96
	31	17.54	12.93	0.28	0.13	1.89
	32	17.04	12.86	0.27	0.13	1.82
	33	16.54	12.79	0.27	0.13	1.75
	34	16.04	12.72	0.26	0.13	1.69
	35	15.54	12.65	0.25	0.13	1.62
	36	15.25	12.68	0.25	0.13	1.57
	37	14.96	12.71	0.24	0.13	1.53
	38	14.67	12.74	0.24	0.13	1.48
	39	14.38	12.77	0.23	0.13	1.44
	40	14.09	12.80	0.23	0.13	1.40
	41	13.96	12.93	0.22	0.13	1.36
	42	13.83	13.07	0.22	0.13	1.33
	43	13.70	13.20	0.21	0.13	1.30
	44	13.57	13.33	0.21	0.13	1.27
	45	13.44	13.46	0.21	0.13	1.24
	46	13.45	13.72	0.20	0.13	1.23
	47	13.45	13.97	0.20	0.13	1.21
	48	13.46	14.22	0.20	0.13	1.19
	49	13.47	14.48	0.20	0.13	1.17
	50	13.47	14.73	0.20	0.13	1.15
	51	13.62	15.14	0.19	0.13	1.14
	52	13.76	15.55	0.19	0.13	1.13
	53	13.90	15.96	0.19	0.13	1.12
	54	14.04	16.37	0.19	0.13	1.11
	55	14.19	16.78	0.19	0.13	1.10
	56	14.49	17.42	0.19	0.13	1.10
	57	14.80	18.05	0.19	0.13	1.09
	58	15.10	18.69	0.19	0.13	1.09
	59	15.41	19.32	0.19	0.13	1.09
	60	15.71	19.96	0.19	0.13	1.09
	61	16.24	20.94	0.19	0.13	1.09
	62	16.76	21.92	0.19	0.13	1.09
	63	17.28	22.89	0.19	0.13	1.10
	64	17.81	23.87	0.19	0.13	1.10
	65	18.33	24.85	0.19	0.13	1.11

Source: California Air Resources Board EMFAC2002, V2.2 Burden Area Planning

Bus	5	22.23	12.96	0.49	0.02	3.95
	6	21.41	12.68	0.48	0.02	3.81
	7	20.58	12.40	0.46	0.02	3.67
	8	19.76	12.11	0.45	0.02	3.53
	9	18.93	11.83	0.44	0.02	3.39
	10	18.11	11.55	0.42	0.02	3.25
	11	17.00	11.14	0.40	0.02	3.06
	12	15.89	10.74	0.38	0.02	2.87
	13	14.78	10.33	0.36	0.02	2.67
	14	13.68	9.92	0.35	0.02	2.48
	15	12.57	9.51	0.33	0.02	2.29
	16	11.91	9.26	0.31	0.02	2.16
	17	11.24	9.00	0.30	0.02	2.04
	18	10.58	8.74	0.29	0.02	1.92
	19	9.92	8.48	0.27	0.02	1.80
	20	9.26	8.22	0.26	0.02	1.68
	21	8.85	8.06	0.25	0.02	1.60
	22	8.45	7.90	0.24	0.02	1.52
	23	8.04	7.74	0.23	0.02	1.45
	24	7.63	7.58	0.22	0.02	1.37
	25	7.23	7.42	0.21	0.02	1.29
	26	6.97	7.33	0.21	0.02	1.24
	27	6.72	7.24	0.20	0.01	1.19
	28	6.46	7.15	0.19	0.01	1.14
	29	6.21	7.06	0.19	0.01	1.09
	30	5.96	6.97	0.18	0.01	1.04
	31	5.80	6.94	0.18	0.01	1.00
	32	5.64	6.91	0.17	0.01	0.97
	33	5.49	6.88	0.17	0.01	0.93
	34	5.33	6.84	0.16	0.01	0.90
	35	5.17	6.81	0.16	0.01	0.87
	36	5.08	6.83	0.16	0.01	0.84
	37	4.99	6.85	0.15	0.01	0.82
	38	4.90	6.86	0.15	0.01	0.80
	39	4.80	6.88	0.15	0.01	0.77
	40	4.71	6.90	0.14	0.01	0.75
	41	4.67	6.96	0.14	0.01	0.74
	42	4.63	7.03	0.14	0.01	0.72
	43	4.58	7.10	0.14	0.01	0.71
	44	4.54	7.17	0.13	0.01	0.69
	45	4.50	7.24	0.13	0.01	0.68
	46	4.50	7.37	0.13	0.01	0.67
	47	4.50	7.49	0.13	0.01	0.66
	48	4.50	7.62	0.13	0.01	0.65
	49	4.49	7.75	0.13	0.01	0.64
	50	4.49	7.88	0.13	0.01	0.63
	51	4.53	8.08	0.12	0.01	0.62
	52	4.57	8.29	0.12	0.01	0.62
	53	4.61	8.50	0.12	0.01	0.61
	54	4.65	8.70	0.12	0.01	0.60
	55	4.69	8.91	0.12	0.01	0.60
	56	4.78	9.23	0.12	0.01	0.60
	57	4.87	9.54	0.12	0.01	0.60
	58	4.96	9.86	0.12	0.01	0.59
	59	5.05	10.18	0.12	0.01	0.59
	60	5.13	10.50	0.12	0.01	0.59
	61	5.29	10.98	0.12	0.01	0.59
	62	5.44	11.47	0.12	0.01	0.60
	63	5.59	11.95	0.12	0.01	0.60
	64	5.75	12.44	0.12	0.01	0.60
	65	5.90	12.92	0.12	0.01	0.60

Source: California Air Resources Board EMFAC2002, V2.2 Burden Area Planning

HEALTH COST OF TRANSPORTATION EMISSIONS
(\$/ton)

Area	Proj Loc	CO	NO _x	PM ₁₀	SO _x	VOC
LA/South Coast	1	\$121	\$48,983	\$401,257	\$150,757	\$3,045
CA Urban Area	2	\$63	\$14,339	\$115,859	\$57,867	\$1,002
CA Rural Area	3	\$57	\$10,659	\$82,612	\$41,750	\$787

Source: McCubbin and Delucchi, 1996

PASSENGER TRAIN EMISSIONS FACTORS
(g/train-mile)

Mode	Year	CO	NO _x	PM ₁₀	SO _x	VOC
Passenger Train	2002	45.67	583.58	62.02		19.73
	2022	45.67	250.11	31.01		19.73

LIGHT RAIL EMISSIONS FACTORS
(g/veh-mile)

Mode	Year	CO	NO _x	PM ₁₀	SO _x	VOC
Light Rail	2002	0.14	1.13	0.17		0.06
	2022	0.14	1.14	0.17		0.06

Source: California Air Resources Board

Pavement Adjustments (used only for pavement projects)

PAVEMENT DETERIORATION (IRI in inches/mile)			
Year 0	Year 20, By Loading		
	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

VEHICLE OPERATING SPEED (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	0.89
300	0.98	0.86
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

Source: Botterill, 1996 and 1997

FUEL CONSUMPTION (percent adjustment)		
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

NON-FUEL COSTS (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

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

VEHICLE OPERATING SPEED (percent adjustment)		
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)

PEAK PERIOD SPEED, VOLUME, AND NON-HIGHWAY BENEFITS (percent adjustment)								
TMS Strategy	Without		With		Non-Highway Benefits			Total Benefit
	Speed	Volume	Speed	Volume	TT	VOC	Em	
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

11) Chaudhary and Messer, 2000

TRANSIT TRAVEL TIME AND AGENCY COST SAVINGS (percent savings)			
TMS Strategy	Travel Time	Agency Costs	
		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