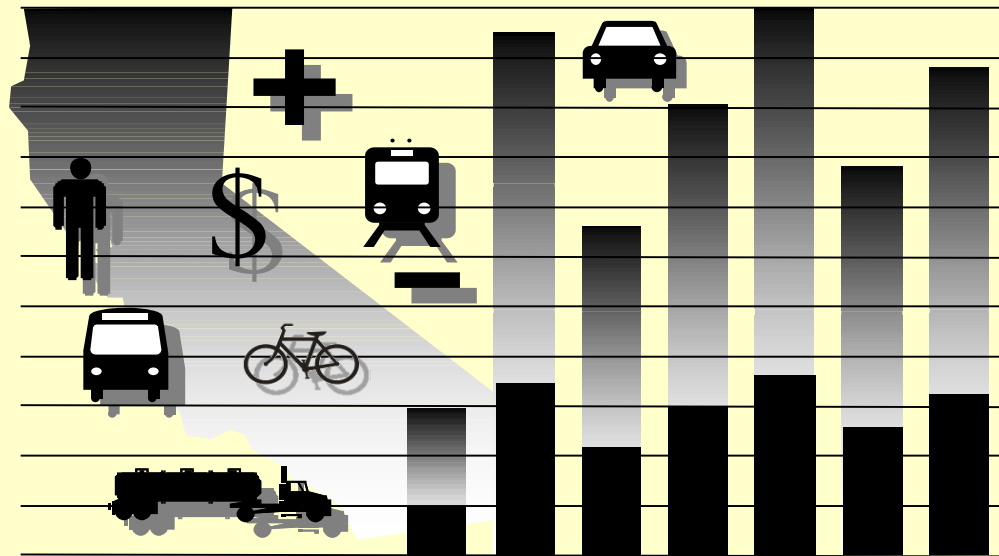




California Active Transportation Benefit/Cost Analysis Model for 2024 INFRA/RAISE Applications (Cal-B/C AT) Version 8.1



Office of State Planning-Transportation Economics Branch
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BENEFIT-COST ANALYSIS OF ACTIVE TRANSPORTATION PROJECTS (Cal-B/C AT)

INTRODUCTION

This workbook is a benefit-cost analysis (BCA) tool to perform simple economic analyses of active transportation projects that improve travel options and conditions for cyclists and pedestrians. Users enter data into the tool, which computes lifecycle costs, annual and total benefits in several key categories, net present value, benefit-cost ratio, internal rate of return, and payback period. Benefits are also specifically estimated for children as part of Safe Route to School (SRTS) initiatives.

In addition to the BCA tool, a data entry form is provided for assessing non-infrastructure initiatives. Attributes of these initiatives are used in a multi-criteria scoring system to provide a common basis of comparison. Results of this scoring system are presented alongside, but not added to, the monetized benefits computed in the BCA tool.

The model contains worksheets with the following information, data, and results:

<u>Worksheets</u>	<u>Contents</u>
Instructions	General model description and assumptions
1a) Project Info	Input data for capital projects to improve or construct bike routes
1b) Non-Inf Program Info	Input data and scoring system for non-infrastructure initiatives
2) Model Inputs	Number of trips, users, and miles traveled by trip purpose based on data entered in Project Information worksheet and adjustable by user
3) Results	Summary results of analysis
Journey Quality	Calculation of journey quality impacts for improved travel
Intersection Delay	Calculation of travel time savings where bike and pedestrian facilities cross improved intersections
Intersection Safety	Calculation of changes in user accident risks at improved intersections on existing facilities
Auto Accident Costs	Calculation of changes in auto accident costs from diversions to active transportation
Health - Absenteeism	Calculation of health benefits for employers due to reduced absenteeism based on increased productivity
Health - Reduced Mortality	Calculation of user health benefits associated with reduced risk of mortality
Emissions	Calculation of changes in highway emissions costs from diversions to active transportation
Final Calculations	Calculation of net present value, internal rate of return, and payback period

Parameters

Economic assumptions, lookup tables, and other model parameters consistent with Cal-B/C

Tool users enter data primarily on the Project Information or Non-Infrastructure Program Information sheets, depending on project type. These worksheets cover information that drives the impacts of infrastructure and non-infrastructure initiatives, respectively. Infrastructure projects are categorized as one of four bike facility classes (i.e., I - Bike Paths, II - Bike Lanes, III - Bike Route, and IV - Separated Bikeways, and Cycle Tracks). Characteristics of facility users (i.e., number of cycling and walking users, trip purpose, and average distance traveled) are influential in estimating facility benefits.

Separate data are required for estimating the benefits of improvements to existing routes and the construction of new bike routes. The model can include projects with elements of both new and improved facilities. Additional data on the number of school-aged children are also collected to estimate benefits from a *Safe Route to School* initiative, if applicable. Benefits are compared with lifecycle costs to determine economic metrics, such as a benefit-cost ratio and net present value.

Non-infrastructure initiatives include a variety of education and outreach programs. Attributes that reflect the programmatic impact of these initiatives include the numbers of people in the target audience, the characteristics of the promotional effort, the type of impact or messaging, and the frequency of outreach effort. Evaluations of these initiatives are performed with a multi-criteria framework that determines overall program scores consistent with the potential for reaching new users through a variety of mechanisms and frequency. The scoring system determines overall program impact scores. The scoring system allows initiatives to be compared by the estimated average lifecycle cost per new potential user.

Cal-B/C AT is designed so that the user generally needs to insert data only in the **green boxes** on the Project Information and Non-Infrastructure Program Information sheets. Summary results are shown on the Results worksheet. The remaining worksheets are provided for the user to see, but the model performs calculations automatically.

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 FOR INFRASTRUCTURE PROJECTS

The user can analyze most projects by entering limited data on the Project Information sheet. The Model Inputs sheet allows the user to enter more detailed data or adjust estimated annual trips, number of users, and total miles traveled. The analysis results are calculated automatically and displayed on the Results sheet. The section below explains the input data required to analyze infrastructure projects.

PROJECT AND SITE CHARACTERISTICS (Box 1A)

This section provides general information about the project. At the top of the sheet, the user can insert information, such as the project name, Caltrans District, and funding information.

Type of Project

- 1 Select whether the project is a facility upgrade or a new facility.

Total Project Length

- 2 Enter total new construction mileage for existing and new bike and pedestrian facilities. If the project type matches the project lengths entered, the data entry indicators will read "OK."

Project Location

- 3 Insert a 1, 2, or 3 for the appropriate region of California. This information is used to select average bicycle and pedestrian trip data for determining health risk benefits. Characteristics include average travel distance, trip purpose, and ages of users.

Safe Route to School

- 4 Indicate if the project involves a Safe Route to School.

Programmatic Initiatives

- 5 Indicate whether the project includes any non-infrastructure, programmatic initiatives.

Construction

- 6 Insert the number of construction years before benefits begin. This must be a whole number (round to the next higher integer). The number of years should correspond with the cost data are entered in Boxes 1F and 1G.

EXISTING SEGMENT IMPROVEMENTS AND TRIP VOLUME (Box 1B)

This section provides specific information about the existing bike facility segment to be improved.

Existing Facility Length

- 7 Enter lengths for each class of existing bike facility (e.g., bike paths (Class I), bike lanes (Class II) bike routes (Class III), and separated bikeways, cycle tracks (Class IV). The sum of the facility lengths for No Build and Build scenarios should equal the total length of existing facility in Box 1A. If the total miles are entered correctly, and match mileage of potentially different facility classes, the data entry indicators will read "OK." Otherwise, the adjacent cell will read "Not OK."

Pedestrian Improvements

- 8 Indicate if the project design includes one or more of the following: street lighting, curb level, crowding, pavement evenness, information panels, benches, and directional signage.

Trip Data

- 9 Indicate the current number of 1-way trips and the annual growth rate in trips in the No Build and Build scenarios. These parameters are used to estimate trips in the first year after construction (depending on the expected number of years until construction is completed) and 20 years after construction. Blue cells can be overwritten if better data are available (e.g., an expectation that demand jumps in the first year of operations).

INTERSECTIONS IMPROVEMENTS – TIME SAVINGS AND ACCIDENT REDUCTION (Box 1C)

Improvements at existing intersections between bike and pedestrian facilities and roadways can generate benefits from time savings by avoiding delays and from reduced crashes. This section allows the user to enter the data required to estimate these benefits.

Reduced Delay Due to Intersection Improvements

These data are used to compute the number of intersections crossed by users (based on average trip lengths) and the reduced delay at intersections. Improvements can include signals for bike facility users as well as bridges for bike and pedestrian facilities over roadways. The average number of intersections crossed is computed from the number of intersections improved and average distance per trip.

- 10 Enter the number of improved intersections.
- 11 Estimate the time savings in minutes at each improved intersection (based on intersection traffic conditions and existing bike facility crossing characteristics).
- 12 Indicate if the intersection improvements occur for children as part of an SRTS initiative.

Accident Rates – Current Conditions

These benefits are already covered for new bike and pedestrian facilities because the improved journey quality captures the value of safety. For existing facilities with explicit safety improvements, enter 5-year average data for accidents involving cyclists or pedestrians. Baseline data should indicate the number of fatality, injury, and property damage only accidents.

If available, data on the annual percent growth in accidents should be provided. Annual accident rates are determined based on the years available, if other than 5 years. Improvements at intersections can take several forms (e.g., signals, lane markings, etc.). Each improvement provides a different crash reduction rate. The three most effective measures are used to estimate reductions in accidents and the associated monetized benefits.

- 13 Provide baseline accident rates for crashes involving cyclists and pedestrians in terms of:
 - a. Number of Years of Data
 - b. Fatal Accidents (Fat) (#)
 - c. Injury Accidents (Inj) (#)
 - d. Property Damage Only (PDO) Accidents (#)
 - e. Annual Growth Rate in Accidents (%)

Safety Countermeasures (improvements to existing facilities only)

- 14 Indicate which countermeasures are included in the facility improvement.

GENERAL USER CHARACTERISTICS (Box 1D)

This section reports on mode-specific trip characteristics for walking and cycling for a new or existing facility. Reported default values on trip purpose by percentage of total and average distance traveled per trip are provided. Separate trip distances are provided for children and can be used as default values for SRTS initiatives. These values can be overwritten by the user. Other default values (e.g., ages of users, diversion of riders from personal vehicles, and traveling speeds) are included in the Parameters worksheet.

Trip Purpose

- 15 Indicate the percent trips taken by trip purpose and mode. If the user changes percentages, the sum of new values must be 100%.

Trip Characteristics

- 16 Provide the average distance traveled per trip in miles for SRTS trips and other trips.

NEW FACILITY IMPROVEMENTS AND TRIP VOLUME (Box 1E)

This section provides specific information about the new segment to be improved in the project. For new segments, riders are assumed to use the road in the No Build condition. The No Build option is assumed to be equal to the length of the new facility. Data need to be filled in for projects that involve construction of new bike and pedestrian facilities or improvements to existing facilities that connect to newly constructed ones.

New Facility Length

- 17 Enter lengths of each class of new bike facility for: Bike Paths (Class I), Bike Lanes (Class II), Bike Routes (Class III), Separated Bikeways, Cycle Tracks (Class IV). If total miles are entered correctly and match the total mileage of different facility classes, the data entry indicators will read "OK." Otherwise, the adjacent cells will read "Not OK."

Pedestrian Improvements

- 18 Indicate with a "1" for Yes, if the project design involves one or more of the following improvements: street lighting, curb level, crowding, pavement evenness, information panels, benches, and directional signage. These features are assumed to be located throughout the bike facility so all users will have the opportunity to use them when on the path.

Trip Data

- 19 Indicate current number of one-way trips and annual growth rate in trips in the No Build and Build contexts. These parameters are used to estimate numbers of trips in first year after construction (depending on expected number of years until construction is completed), and 20 years after construction. Blue cells can be overwritten if better data are available (e.g., if there is an expectation that demand jumps in the first year of operations).

PROJECT COSTS (Box 1F)

This section allows the user to input costs for infrastructure projects. Total project costs should be entered in the years they are expected to occur. Costs should be inserted for construction period and for

a 20-year operating period after construction completion. Construction Year 1 is the first year that costs are incurred. All costs should be in thousands of dollars.

- 20 Insert the project's initial costs in constant dollars for project development, right-of-way, and construction. The number of construction years should equal the length of the construction period
- 21 Insert estimated future incremental maintenance/operating and rehabilitation costs in constant dollars. These figures should be entered for all years after the project opens.
- 22 Insert any other costs not already included.

NON-INFRASTRUCTURE PROGRAM COSTS (Box 1G)

This section allows the user to input costs for non-infrastructure programs. Total program costs should be entered in the years that they are expected to occur. Costs should be inserted for initial capital costs and for a 20-year operating period after the initial years of implementation. Year 1 is the first year that capital costs are incurred. All costs should be in thousands of dollars.

- 23 Insert program's initial costs in constant dollars for any costs related to program development and set-up.
- 24 Insert estimated future program costs in constant dollars for all years.
- 25 Enter any other costs not already included.

DATA CHECKS - PROJECT LENGTH, DAILY TRIPS (Box 1H)

This section contains data checks to make sure that data are entered correctly. The user does not need to enter anything in this table. The data checks evaluate No Build and Build project lengths for each type of relevant project (e.g., new and existing). All of these cells should read "OK." Errors indicate that prior inputs should be modified.

INSTRUCTIONS FOR NON-INFRASTRUCTURE PROGRAMS

Non-infrastructure programs are intended to reach target audiences through a variety of outreach and training mechanisms. The Non-Infrastructure Program Information sheet collects information about the proposed initiative and applies a scoring framework to determine the overall program score per cost.

The impact score is based on the number of people reached who are not currently engaging in active transportation. Four criteria are established to assess the effectiveness of the initiative, each with a different measure of relative value. The criteria have equal weights. The scoring system is designed to provide a maximum potential score of 1.0, with values ranging as percentages from 0% to 100%. The percentage is applied to the number of currently non-active transportation mode users, to develop a total program impact score.

Program costs should be entered into the Project Information sheet (Box 1G). If a proposed program does not include capital investments, the anticipated impact on user demand from the program can be entered in the trip volumes in Box 1B. If the program is combined with an infrastructure project, it is assumed that the demand impact is already captured by the infrastructure project. To avoid overestimating demand, no additional demand from the program alone should be included in the Project Information sheet. Non-infrastructure initiatives are assumed to stimulate demand and safety for 20 years. If this is not the case, adjustments should be made for the appropriate number of years in

each benefit calculation page. In this case, the project type should be set to 1 to reflect the use of only existing facilities.

NON-INFRASTRUCTURE PROGRAM CHARACTERISTICS (Box 1I)

This section allows the user to provide information about the non-infrastructure program.

Scale of Initiative - Participants / Beneficiaries

- 26 Enter the number of people likely to be reached annually by the initiative.
- 27 Enter the % of active cyclists reached each year.
- 28 Enter the % of active pedestrians reached each year.

Scoring System

For each criterion, enter data corresponding to the question:

- 29 Insert the percent of the target audience in each age group.
- 30 Enter 1 as yes for all of the promotional efforts that are part of the initiative.
- 31 Enter 1 as yes for each of the types of impacts and messaging that are part of the initiative.
- 32 Select the most applicable frequency of outreach.

NEXT STEPS

Once the required values are entered into the Project Information and Non-Infrastructure Program sheets, as applicable, the aggregate results of the analysis are automatically compiled on the Results sheet. This sheet also includes a toggle to select whether benefits for recreational users are included in the analysis. A more detailed breakdown of the results by year and benefit type is available on the Final Calculations sheet.

There is also a Parameters page, identical to the one found in Cal-B/C. Since Cal-B/C requires additional parameters for highway projects, several of the values found on the Cal-B/C AT parameters page are not used. This design is intentional, so the same parameters page can be used in both models. A few cells (e.g., project type) are left blank to avoid Excel error messages.

Definitions

Several definitions require clarification in evaluating facility use, either improved existing or new facilities. This section provides definitions for terms that are used in this tool with respect to “trip types” and “user types). In addition, not all users benefit from projects in the same way. Definitions about benefit categories are elaborated upon below. Relevance of benefit categories depends on trip purpose and type of project (i.e., existing facility upgrade and new construction).

Trip Types	Definitions
Trips	One-way travel to a destination for commuting, or other purposes and is assumed to counted for both directions of travel (and subsequently modeled) for a specific location.
Roundtrips	Most trips have a return journey using the same mode and some can include other unlinked side trips. This "roundtrip" measure divides Trips by the average number of unlinked trips to determine the is used to identify the number of users that take trips.
Existing Trips	Baseline trips, either on an existing facility or unmarked street, where the project will create a new facility with specific improvements
Induced Trips	Additional trips above the baseline that arise because of the improvements to existing or new facilities
Trip Forecasts	Forecasts are developed for existing facilities and new locations (if applicable), model users determine numbers of current and induced trips, and other characteristics (e.g., roundtrip probability, purpose, distance, etc.)

Trip Purposes	Definitions
Commute to Work	Users who are taking the facility to or from work. These users are primarily adult or young-adult aged. Use by college students would be classified under "other destinations"
Safe Route to School	Users who are school-aged, i.e. 18 or under years old, and taking the facility to or from school.
Other Destinations	Users who are taking the facility to reach a variety of other destinations besides work, such as shopping, meeting friends, college classes, etc. These are trips that would be otherwise taken by some type of motor vehicle
Recreational	Users who are taking the facility purely as a loop-trip for exercise purposes. These trips would not be otherwise taken by motor vehicle since the purpose is for fitness and recreation.

Benefit Categories	Definitions
Journey Quality	Improvements in the quality of the trip for pedestrians and cyclists that arise from a greater feeling of safety, comfort, aesthetics, and other types of improvements. Improvements to existing and new facilities can generate benefits for current trips and induced trips. Benefits to induced users are estimated using "rule of half" approximation. Journey quality is assumed to have a zero value for existing users along routes where there is no existing facility. The value of journey quality includes the perception of safety improvement and thus, to avoid double counting, additional accident reduction value along the routes is excluded. However, safety improvements at intersections along existing facilities generate additional benefits that are discussed below.
Intersection Delay (Time Savings from Improved Intersections on Existing Facilities)	Improvements to existing intersections (e.g. lights, bridges, etc.) can lead to time savings for trips by reducing waiting time at intersections, for say a break in vehicular traffic. Time savings benefits can arise for existing and induced pedestrians and cyclists at each intersection that they cross. The number of intersections crossed by users of a facility on each trip is determined by the total length of the existing facility the average distance traveled per user type, and the number of intersections with improvements. Benefits to induced users are estimated using "rule of half" approximation.
Intersection Safety (Accident Reduction at Improved Intersections of Existing Facilities)	Improvements to existing intersections (e.g. lights, bridges, etc.) can lead to reduced accidents at intersections. Benefits can arise for existing and induced pedestrians and cyclists at each intersection crossed. The number of intersections crossed per trip is determined by the total length of the existing facility, the average distance traveled per user type, and the number of intersections with improvements. The magnitude of impacts is determined by the percent reduction in existing accidents due to specific safety measures. Induced trips benefits apply "rule of half" approximation.
Auto Accident Costs and Auto Emissions	Some of the induced pedestrian and cycling trips entail diversions from auto use. Benefits from reduced auto use include reduced frequency of accidents and level of auto emissions. Benefits are estimated for each diverted auto trip by using standard methods and data for estimating the value of auto use externalities.
Health Benefits - Reduced Absenteeism of Commuters	Health benefits related to reduced absenteeism are generated by induced walking and cycling commuters. The benefits are monetized by higher productivity due to fewer sick days. Benefits to these induced users are not estimated using "rule of half" approximation since the value is observed by the employer.
Health Benefits - Reduced Mortality Risk	Health benefits related to improved long-term health and reduced risk of disease and early death. These benefits are derived from parameters established by the World Health Organization (WHO) and formalized in their online HEAT tool and documentation. Benefits are derived from reduced mortality risk in populations that range from 20-64 for cyclists and 20-74 for pedestrians. Reduced mortality risk depends on the amount of cycling (average distance) undertaken over a one year period.

Benefit Categories by Facility Type

The matrix below indicates the applicability of benefits by to different types of trips and projects. Projects include existing facility improvements and new construction. Trips differ between current trips already being taken and new, induced trips that arise because of improvements.

Benefit Categories by Facility Type	Existing Facility Improvement		New Construction	
	Existing Trips	Induced Trips	Existing Trips	Induced Trips
Journey Quality	Yes	Yes	Yes	Yes
Intersection Delay (Time Savings from Improved Intersections on Existing Facilities)	Yes	Yes		
Intersection Safety (Accident Reduction at Improved Intersections of Existing Facilities)	Yes	Yes		
Auto Accident Costs and Auto Emissions		Yes		Yes
Health Benefits - Reduced Absenteeism of Commuters		Yes (Commuters, only)		Yes (Commuters, only)
Health Benefits - Reduced Mortality Risk		Yes (Age dependent)		Yes (Age dependent)

District:

PROJECT: **SouthEast Connector Segment D2 Class 1 Trail and 2 Lane Roadway**

EA:
PPNO:

1A

PROJECT AND SITE CHARACTERISTICS

Type of Project		
Existing facility upgrade only = 1		
New facility only, no existing facility work = 2	2	
Existing facility upgrade and new facility extension = 3		
Total Project Length		
Total Existing Facility Length (miles)	0	Project Type Data Check OK
Total New Facility Length (miles)	3.6	OK
Characteristics		
Project Location (enter 1 for So. Cal., 2 for No. Cal., or 3 for rural)	2	
Safe Route to School? (enter 1 for Yes, 0 for No)	1	
Programmatic Initiatives? (enter 1 for Yes, 0 for No)	0	
Construction		
Length of Construction Period (years)	5	Constr. Years Data Check OK

1B

EXISTING SEGMENT IMPROVEMENTS AND TRIP VOLUME

Improvement Characteristics				
Existing Facility Length, if Applicable	Class	No Build	Build	Project Length Data Check
Bike Paths (miles)	I			OK
Bike Lanes (miles)	II			
Bike Route (miles)	III			
Separated Bikeways, Cycle Tracks (miles)	IV			
Total		0	0	
Pedestrian Improvements				
Street Lighting				Yes =1 or No=0
Curb Level				Yes =1 or No=0
Crowding				
Pavement Evenness				
Information Panels				
Benches				
Directional Signage				
Trip Data - Adults				
Cycling				
Daily Trips - Current				
Projected Annual Growth Rates from Year 1 (%)				
Daily Trips - Year 1 (post-construction)		0	0	
Daily Trips - Year 20 (post-construction)		0	0	
Pedestrian				

Daily Trips - Current		
Projected Annual Growth Rates from Year 1 (%)		
Daily Trips - Year 1 (post-construction)	0	0
Daily Trips - Year 20 (post-construction)	0	0
Trip Data - Children - SRTS		
Cycling		
Daily Trips - Current		
Projected Annual Growth Rates from Year 1 (%)		
Daily Trips - Year 1 (post-construction)	0	0
Daily Trips - Year 20 (post-construction)	0	0
Pedestrian		
Daily Trips - Current		
Projected Annual Growth Rates from Year 1 (%)		
Daily Trips - Year 1 (post-construction)	0	0
Daily Trips - Year 20 (post-construction)	0	0

1C

INTERSECTION IMPROVEMENTS - TIME SAVINGS AND ACCIDENT REDUCTION DATA

Reduced Delay Due to Intersection Improvements

Time Savings Parameters

Number of Improved Intersections	3
Time Savings per Improved Intersection (min.)	2
Intersection improvements on SRTS? (enter 1 for Yes, 0 for No)	1

Accident Rate - Current Conditions

Cyclists

	Count (No.)	Rate per Year
Number of Years of Data	10.00	
Existing Conditions		
Total Number of Accidents (Tot)	2	0.2
Number of Fatal Accidents (Fat)	0	0.0
Number of Injury Accidents (Inj)	2	0.2
Number of Property Damage Only (PDO) Accidents	0	0.0
Annual Growth Rate in Accidents (%/year)	1.0%	0.001

Pedestrians

	Count (No.)	Rate per Year
Number of Years of Data	10.00	
Existing Conditions		
Total Number of Accidents (Tot)	2	0.2
Number of Fatal Accidents (Fat)	1	0.1
Number of Injury Accidents (Inj)	1	0.1
Number of Property Damage Only (PDO) Accidents	0	0.0
Annual Growth Rate in Accidents (%/year)	1.0%	0.001

Safety Countermeasures (improvements to existing facilities only)

Signalized Intersection

	Yes =1
Pedestrian Countdown Signal Heads	1
Pedestrian Crossing	1
Advance Stop Bar before Crosswalk	1

Install Overpass/Underpass	0
Unsignalized Intersection	
Raised Medians/Refuge Islands	0
Pedestrian Crossing (new signs and markings only)	1
Pedestrian Crossing (safety features/curb extensions)	1
Pedestrian Signals	0
Roadways - relevant for pedestrian improvements, such as sidewalks	
Sidewalk/Pathway (to avoid walking along roadway)	1
Pedestrian Crossing (with enhanced safety features)	0
Pedestrian Crossing	1
Other Reduction Factor Countermeasures	0

1D

GENERAL USER CHARACTERISTICS (BASED ON PROJECT LOCATION)

Cycling**Trip Purpose**

No Build

Build

Commuting Trip Purpose (%)

19%

19%

Recreational Trip Purpose (%)

46%

46%

Other Destinations Trip Purpose (%)

35%

35%

General Trip Characteristics

Overall Average Distance Traveled / Trip (mi)

2.29

2.29

Children - SRTS - Distance Traveled / Trip (mi)

0.99

0.99

Pedestrian**Trip Purpose**

Commuting Trip Purpose (%)

5%

5%

Recreational Trip Purpose (%)

55%

55%

Other Destination Trip Purpose (%)

40%

40%

General Trip Characteristics

Overall Average Distance Traveled / Trip (mi)

0.68

0.68

Children - SRTS - Distance Traveled / Trip (mi)

0.63

0.63

1E

NEW FACILITY IMPROVEMENTS AND TRIP VOLUME

Improvement Characteristics**New Facility Length**

Class

No Build

Build

Project Length
Data Check

No Facility

0

3.6

OK

Bike Paths (miles)

I

0

Bike Lanes (miles)

II

Bike Route (miles)

III

Separated Bikeways, Cycle Tracks (miles)

IV

3.6

Total

4

4

Pedestrian Improvements

Yes =1

Street Lighting

0

Curb Level

1

Crowding

0

Pavement Evenness

1

Information Panels

1

Benches

1

Directional Signage

1

Trip Data - Adults**Cycling**

No Build

Build

Daily Trips - Current

2

Projected Annual Growth Rates from Year 1 (%)

2%

5%

Daily Trips - Year 1 (post-construction)

2

3

Daily Trips - Year 20 (post-construction)

3

7

Pedestrian

Daily Trips - Current	1	
Projected Annual Growth Rates from Year 1 (%)	2%	5%
Daily Trips - Year 1 (post-construction)	1	1
Daily Trips - Year 20 (post-construction)	2	3
Trip Data - Children - SRTS		
Cycling		
	No Build	Build
Daily Trips - Current	1	
Projected Annual Growth Rates from Year 1 (%)	0%	5%
Daily Trips - Year 1 (post-construction)	1	1
Daily Trips - Year 20 (post-construction)	1	3
Pedestrian		
Daily Trips - Current	1	
Projected Annual Growth Rates from Year 1 (%)	0%	5%
Daily Trips - Year 1 (post-construction)	1	1
Daily Trips - Year 20 (post-construction)	1	3

Enter all project and program costs (in today's dollars) in the two tables shown below. Costs during construction should be entered in the first row.
Project costs (including maintenance and operating costs) should be net of costs without project.

1F

PROJECT COSTS AND REQUESTED FUNDS (enter in thousands of dollars)

Col. no.

Year	Construction Years	DIRECT PROJECT COSTS						TOTAL COSTS (in dollars)	
		Project Support	INITIAL COSTS		SUBSEQUENT COSTS			Constant Dollars	Present Value
			R / W	Construction	Maint./ Op.	Rehab.			
Infrastructure Program Costs									
1	1	\$5,000.0			<-- Must enter a cost		\$5,000,000	\$5,000,000	
2	1		\$5,000.0				5,000,000	4,849,661	
3	1			\$20,000.0			20,000,000	18,815,366	
4	1			\$15,000.0			15,000,000	13,687,220	
5	1			\$10,500.0			10,500,000	9,292,972	
6	0						0	0	
7	0						0	0	
8	0						0	0	
Annual Infrastructure O&M Costs									
1						\$9	\$9,000	\$7,726	
2						\$9	9,000	7,494	
3						\$9	9,000	7,268	
4						\$10	10,000	7,833	
5						\$10	10,000	7,598	
6						\$10	10,000	7,369	
7						\$11	11,000	7,862	
8						\$11	11,000	7,626	
9						\$11	11,000	7,397	
10						\$11	11,000	7,174	
11						\$25	25,000	15,815	
12						\$9	9,000	5,522	
13						\$9	9,000	5,356	
14						\$9	9,000	5,195	
15						\$10	10,000	5,599	
16						\$10	10,000	5,430	
17						\$10	10,000	5,267	
18						\$11	11,000	5,620	
19						\$11	11,000	5,451	
20						\$11	11,000	5,287	
Total		\$5,000	\$5,000	\$45,500	\$0	\$216		\$55,716,000	\$51,785,106
ATP REQUESTED FUNDS									
Total									

1G

PROGRAM COSTS AND REQUESTED FUNDS (enter in thousands of dollars)

Year	Construction Years	DIRECT PROJECT COSTS						TOTAL COSTS (in dollars)	
		Project Support	INITIAL COSTS		SUBSEQUENT COSTS			Constant Dollars	Present Value
			R / W	Construction	Maint./ Op.	Rehab.			
Non-Infrastructure Program Costs									

1									\$0	\$0
2									0	0
3									0	0
4									0	0
5									0	0
6									0	0
7									0	0
8									0	0
Annual Non-Infrastructure O&M Costs										
1									\$0	\$0
2									0	0
3									0	0
4									0	0
5									0	0
6									0	0
7									0	0
8									0	0
9									0	0
10									0	0
11									0	0
12									0	0
13									0	0
14									0	0
15									0	0
16									0	0
17									0	0
18									0	0
19									0	0
20									0	0
Total		\$0	\$0	\$0	\$0	\$0			\$0	\$0
ATP REQUESTED FUNDS										
Total										

1H

DATA CHECKS - PROJECT LENGTH, DAILY TRIPS

	No Build Project Length	Build Project Length
Existing Facility Length Check	OK	OK
New Facility Length Check	OK	OK
	Cycling Daily Trips per Mile	Revenue Daily Trips per Mile
Existing Facility Users	NA	NA
New Facility Users	1	0
	Safety Measures - Existing only	
Existing Facility Characteristics	Not OK	

District:

PROJECT: **SouthEast Connector Segment D2 Class 1 Trail and 2 Lane Roadway**

EA:
PPNO:

11

NON-INFRASTRUCTURE PROGRAM CHARACTERISTICS

Programmatic Initiatives?

No

Scale of Initiative

Participants / Beneficiaries

Numbers of People Reached per Year
Average Percentage of Current Active Bicyclists Reached per Year
Average Percentage of Current Active Pedestrians Reached per Year

Data Check on Initiative

OK

Scoring Criteria

Total Number of Criteria

4

Total Criteria Weight Sum

100%

1) Target Audience

Criteria Weight

25%

Indicators

Younger than 10
10-12
13-24
25-55
55+

(mark as %; sum must equal 100%)

Indicator Weight

10%

20%

25%

15%

5%

Indicator-Weighted Score

Sum must equal 100%

2) Characteristics Promotional Effort

Criteria Weight

25%

Indicators

Effort Targets 5 E's or 5 P's
Knowledgeable Staff/Educator
Partnership/Volunteers
Creates Community Ownership/Relationship
Part of Bigger Effort (e.g., political support)

(enter 1 for Yes on all that apply)

Indicator Weight

5%

5%

5%

5%

5%

Indicator-Weighted Score

0

3) Type of Impact and Messaging

Criteria Weight

25%

Indicators

Outreach is Hands-on (self-efficacy)
Overcome Barriers (e.g., dist., time, etc.)
Eliminates Hazards/Threats (speed, crime, etc.)
Connected or Addresses Connectivity Challenges
Creating Value in Using Active Transportation

(enter 1 for Yes on all that apply)

Indicator Weight

5%

5%

5%

5%

5%

Indicator-Weighted Score

0

4) Frequency of Outreach Effort

Criteria Weight

25%

Indicators

One Day
One Month
One Year
Multiple Years
Continuous Effort

(enter 1 for Yes for only one option)

Indicator Weight

5%

10%

15%

20%

25%

Indicator-Weighted Score

0

Projected New Active Transportation Cyclists

Number of Potential New Facility Users
Weighted Impact Score of Outreach
Program Impact Score
Years of Outreach
Multi-year Program Impact Score

0

0.0

Cost Effectiveness

Total Discounted Cost
Cost per Program Impact Score

\$0

Projected New Active Transportation Pedestrians

Number of Potential New Facility Users
Weighted Impact Score of Outreach
Program Impact Score
Years of Outreach
Multi-year Program Impact Score

0

0.0

Cost Effectiveness

Total Discounted Cost
Cost per Program Impact Score

\$0

2A

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS

	Calculated by Model	Changed by User	Used for Proj. Eval.
No Build - Cycling			
Year 1			
Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0
Year 20			
Trips - Commuting	0		0
Trips - Other Destinations	0		0
Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0

Build - Cycling			
Year 1			
Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0
Year 20			
Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS

	Calculated by Model		Used for Proj. Eval.
No Build - Cycling			
Year 1			
Annual Trips - Commuting	150		150
Annual Trips - Other Destinations	285		285
Annual Trips - Recreational	372		372
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	766		766
Total Miles - Other Destinations	1,453		1,453
Total Miles - Recreational	1,897		1,897
Year 20			
Trips - Commuting	223		223
Trips - Other Destinations	423		423
Trips - Recreational	552		552
Users - Commuting	0		0
Users - Other Destinations	1		1
Users - Recreational	1		1
Total Miles - Commuting	1,138		1,138
Total Miles - Other Destinations	2,159		2,159
Total Miles - Recreational	2,819		2,819
Build - Cycling			
Year 1			
Annual Trips - Commuting	173	67,890	67,890
Annual Trips - Other Destinations	329	128,845	128,845
Annual Trips - Recreational	430	168,265	168,265
Users - Commuting	83	83	83
Users - Other Destinations	158	158	158
Users - Recreational	207	207	207
Total Miles - Commuting	346,694	346,694	346,694
Total Miles - Other Destinations	657,973	657,973	657,973
Total Miles - Recreational	859,279	859,279	859,279
Year 20			
Annual Trips - Commuting	460	180,132	180,132
Annual Trips - Other Destinations	873	341,864	341,864
Annual Trips - Recreational	1,140	446,457	446,457
Users - Commuting	221	221	221
Users - Other Destinations	420	420	420
Users - Recreational	549	549	549
Total Miles - Commuting	919,882	919,882	919,882
Total Miles - Other Destinations	1,745,798	1,745,798	1,745,798
Total Miles - Recreational	2,279,923	2,279,923	2,279,923

2C

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - C

	Calculated by Model	Changed by User	Used for Proj. Eval.
No Build - Cycling			
Year 1			
Annual Trips - SRTS	180		180
SRTS Users	0		0
Total Miles - SRTS	1		1
Year 20			
Annual Trips - SRTS	180		180
SRTS Users	0		0
Total Miles - SRTS	1		1
Build - Cycling			
Year 1			
Annual Trips - SRTS	230	10,800	10,800
SRTS Users	1	27	27
Total Miles - SRTS	59	59	59
Year 20			
Annual Trips - SRTS	610	28,656	28,656
SRTS Users	2	71	71
Total Miles - SRTS	158	158	158

2D

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - C

	Calculated by Model	Changed by User	Used for Proj. Eval.
No Build - Cycling			
Year 1			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
Year 20			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
Build - Cycling			
Year 1			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
Year 20			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
PROPORTIONS OF SRTS IN TOTAL BENEFITS			
SRTS Trip-Mile / Total Trip-Mile	100.00%		100.00%

- CYCLING - Existing Facility Segment

Reason for Change

S - CYCLING - New Facility Segment

Reason for Change

Number adjusted to account for 1000 trips after year one of construction
Number adjusted to account for 1000 trips after year one of construction
Number adjusted to account for 1000 trips after year one of construction.
Number adjusted to account for 1000 trips after year one of construction
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Number adjusted to account for 1000 trips after year one of construction
Number adjusted to account for 1000 trips after year one of construction.
Number adjusted to account for 1000 trips after year one of construction
Number adjusted to account for 1000 trips after year one of construction
Number adjusted to account for 1000 trips after year one of construction.

Reason for Change

Number adjusted to account for 60 trips after 1 year of construction
Number adjusted to account for 60 trips after 1 year of construction
Number adjusted to account for 60 trips after 1 year of construction

Number adjusted to account for 60 trips after 1 year of construction
Number adjusted to account for 60 trips after 1 year of construction
Number adjusted to account for 60 trips after 1 year of construction

Reason for Change

[illegible]

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - F

Calculated
by Model

Changed
by User

Used for
Proj. Eval.

No Build - Pedestrian**Year 1**

Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0

Year 20

Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0

Build - Pedestrian**Year 1**

Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0

Year 20

Annual Trips - Commuting	0		0
Annual Trips - Other Destinations	0		0
Annual Trips - Recreational	0		0
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	0		0
Total Miles - Other Destinations	0		0
Total Miles - Recreational	0		0

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS

	Calculated by Model		Used for Proj. Eval.
No Build - Pedestrian			
Year 1			
Annual Trips - Commuting	21		21
Annual Trips - Other Destinations	160		160
Annual Trips - Recreational	222		222
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	30		30
Total Miles - Other Destinations	229		229
Total Miles - Recreational	317		317
Year 20			
Annual Trips - Commuting	31		31
Annual Trips - Other Destinations	238		238
Annual Trips - Recreational	329		329
Users - Commuting	0		0
Users - Other Destinations	0		0
Users - Recreational	0		0
Total Miles - Commuting	44		44
Total Miles - Other Destinations	340		340
Total Miles - Recreational	470		470
Build - Pedestrian			
Year 1			
Annual Trips - Commuting	24	6,643	6,643
Annual Trips - Other Destinations	185	50,845	50,845
Annual Trips - Recreational	256	70,263	70,263
Users - Commuting	9	9	9
Users - Other Destinations	66	66	66
Users - Recreational	96	96	96
Total Miles - Commuting	9,486	9,486	9,486
Total Miles - Other Destinations	72,606	72,606	72,606
Total Miles - Recreational	100,335	100,335	100,335
Year 20			
Annual Trips - Commuting	64	17,626	17,626
Annual Trips - Other Destinations	492	134,906	134,906
Annual Trips - Recreational	680	186,427	186,427
Users - Commuting	23	23	23
Users - Other Destinations	176	176	176
Users - Recreational	255	255	255
Total Miles - Commuting	25,170	25,170	25,170
Total Miles - Other Destinations	192,645	192,645	192,645
Total Miles - Recreational	266,218	266,218	266,218

2G

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - PE

	Calculated by Model	Changed by User	Used for Proj. Eval.
No Build - Pedestrian			
Year 1			
Annual Trips - SRTS	180		180
SRTS Users	0		0
Total Miles - SRTS	1		1
Year 20			
Annual Trips - SRTS	180		180
SRTS Users	0		0
Total Miles - SRTS	1		1
Build - Pedestrian			
Year 1			
Annual Trips - SRTS	230	3,600	3,600
SRTS Users	1	10	10
Total Miles - SRTS	13	13	13
Year 20			
Annual Trips - SRTS	610	9,552	9,552
SRTS Users	2	25	25
Total Miles - SRTS	33	33	33

2H

ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - PED

	Calculated by Model	Changed by User	Used for Proj. Eval.
No Build - Pedestrian			
Year 1			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
Year 20			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
Build - Pedestrian			
Year 1			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
Year 20			
Annual Trips - SRTS	0		0
SRTS Users	0		0
Total Miles - SRTS	0		0
PROPORTIONS OF SRTS IN TOTAL BENEFITS			
SRTS Trip-Mile / Total Trip-Mile	100.00%		100.00%

PEDESTRIAN - Existing Facility Segment

Reason for Change

- PEDESTRIAN - New Facility Segment

Reason for Change

Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction.
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction.
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction.

Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction.
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction.
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction
Number adjusted to account for 350 trips after year one of construction.

DESTRIAN - New Safe Routes To School

Reason for Change

Number adjusted to account for 20 trips after 1 year of construction
Number adjusted to account for 20 trips after 1 year of construction
Number adjusted to account for 20 trips after 1 year of construction

Number adjusted to account for 20 trips after 1 year of construction
Number adjusted to account for 20 trips after 1 year of construction
Number adjusted to account for 20 trips after 1 year of construction

[illegible]

District: 3

PROJECT: SouthEast Connector Segment D2 Class 1 Trail and 2 Lane Roadway

EA:
PPNO:

3

INVESTMENT ANALYSIS

SUMMARY RESULTS

Life-Cycle Costs (mil. \$)	\$51.8	
Life-Cycle Benefits (mil. \$)	\$91.7	
Net Present Value (mil. \$)	\$39.9	
Benefit / Cost Ratio:		1.8
Rate of Return on Investment:		8.2%
Payback Period:		10 years
NON-INFRASTRUCTURE IMPLEMENTATION COST		
Per Bike Program Impact Score	N/A	
Per Ped Program Impact Score	N/A	

ITEMIZED BENEFITS (mil. \$)	Total Over 20 Years	Average Annual
Journey Quality	\$11.2	\$0.6
Additional Delay Savings	\$0.0	\$0.0
Additional Safety Benefits	\$13.9	\$0.7
Health Benefits	\$66.3	\$3.3
Emission Cost Savings	\$0.3	\$0.0
TOTAL BENEFITS	\$91.7	\$4.6
SRTS-SPECIFIC BENEFITS (mil. \$)		
Journey Quality	\$0.1	\$0.0
Additional Delay Savings	\$0.0	\$0.0
Additional Safety Benefits	\$13.2	\$0.7
TOTAL SRTS BENEFITS	\$13.4	\$0.7

Factors that Differentiate Benefits and Performance Measures

Safe Route to School	Yes
Intersection Improvements on SRTS	Yes
Programmatic Initiatives	No
Recreational Benefits	1

(enter 1 for Yes, 0 for No)

	<u>Tons</u>	<u>Value (mil. \$)</u>
EMISSIONS REDUCTION	Total Over 20 Years	Average Annual
CO Emissions Saved	5	0
CO ₂ Emissions Saved	1,751	88
NO _x Emissions Saved	0	0
PM _{2.5} Emissions Saved	0	0
SO _x Emissions Saved	0	0
VOC Emissions Saved	0	0

C

TOTAL**Existing Facility**

Year	Constant Dollars	Present Value
1	\$0	\$0
20	\$0	\$0

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
--------------	------------

New Facility

Year	Constant Dollars	Present Value
1	\$488,388	\$419,248
20	\$1,294,574	\$622,184

1	\$488,388	\$419,248
2	\$530,818	\$441,971
3	\$573,249	\$462,949
4	\$615,680	\$482,265
5	\$658,111	\$500,001
6	\$700,542	\$516,235
7	\$742,973	\$531,040
8	\$785,403	\$544,489
9	\$827,834	\$556,648
10	\$870,265	\$567,584
11	\$912,696	\$577,359
12	\$955,127	\$586,033
13	\$997,558	\$593,664
14	\$1,039,988	\$600,306
15	\$1,082,419	\$606,012
16	\$1,124,850	\$610,831
17	\$1,167,281	\$614,814
18	\$1,209,712	\$618,004
19	\$1,252,143	\$620,447
20	\$1,294,574	\$622,184

Total	\$11,072,084
--------------	---------------------

F

TOTAL**Existing SRTS Facility**

Year	Constant Dollars	Present Value
1	\$0	\$0
20	\$0	\$0

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
--------------	------------

New SRTS Facility

Year	Constant Dollars	Present Value
1	\$6,440	\$5,528
20	\$16,903	\$8,124

1	\$6,440	\$5,528
2	\$6,991	\$5,821
3	\$7,541	\$6,090
4	\$8,092	\$6,339
5	\$8,643	\$6,566
6	\$9,193	\$6,775
7	\$9,744	\$6,965
8	\$10,295	\$7,137
9	\$10,845	\$7,293
10	\$11,396	\$7,432
11	\$11,947	\$7,557
12	\$12,497	\$7,668
13	\$13,048	\$7,765
14	\$13,599	\$7,849
15	\$14,149	\$7,922
16	\$14,700	\$7,983
17	\$15,251	\$8,033
18	\$15,801	\$8,072
19	\$16,352	\$8,103
20	\$16,903	\$8,124

Total	\$145,020
--------------	------------------

C

TOTAL**Existing Facility**

Year	Constant Dollars	Present Value
1	\$0	\$0
20	\$0	\$0

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
--------------	------------

F

TOTAL**Existing Facility**

Year	Constant Dollars	Present Value
1	\$0	\$0
20	\$0	\$0

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
--------------	------------

C

TOTAL**Existing Facility**

	Dollars	Value
1	\$931,351	\$799,503
20	\$1,125,174	\$540,769

1	\$931,351	\$799,503
2	\$940,665	\$783,218
3	\$950,071	\$767,265
4	\$959,572	\$751,637
5	\$969,168	\$736,328
6	\$978,860	\$721,330
7	\$988,648	\$706,637
8	\$998,535	\$692,244
9	\$1,008,520	\$678,144
10	\$1,018,605	\$664,331
11	\$1,028,791	\$650,800
12	\$1,039,079	\$637,544
13	\$1,049,470	\$624,558
14	\$1,059,965	\$611,837
15	\$1,070,564	\$599,374
16	\$1,081,270	\$587,166
17	\$1,092,083	\$575,206
18	\$1,103,003	\$563,490
19	\$1,114,034	\$552,013
20	\$1,125,174	\$540,769

Total	\$13,243,393
--------------	---------------------

D

SRTS Benefits Share**Existing Facility**

Year	Share of Cycling Benefits	Share of Ped Benefits	Sum of Benefits
	100.00%	100.00%	
	SRTS Cycling Benefits - Present Value	SRTS Ped Benefits - Present Value	
1	\$31,998.9	\$767,504.3	\$799,503.2
20	\$21,643.4	\$519,125.4	\$540,768.8

1	\$31,998.9	\$767,504.3	\$799,503.2
2	\$31,347.1	\$751,871.4	\$783,218.5
3	\$30,708.6	\$736,556.8	\$767,265.4
4	\$30,083.1	\$721,554.2	\$751,637.3
5	\$29,470.4	\$706,857.2	\$736,327.5
6	\$28,870.1	\$692,459.5	\$721,329.6
7	\$28,282.0	\$678,355.1	\$706,637.1
8	\$27,706.0	\$664,538.0	\$692,243.9
9	\$27,141.6	\$651,002.3	\$678,143.9
10	\$26,588.8	\$637,742.3	\$664,331.1
11	\$26,047.2	\$624,752.4	\$650,799.6
12	\$25,516.7	\$612,027.1	\$637,543.8
13	\$24,997.0	\$599,561.0	\$624,557.9
14	\$24,487.8	\$587,348.7	\$611,836.5
15	\$23,989.0	\$575,385.3	\$599,374.3
16	\$23,500.4	\$563,665.5	\$587,165.9
17	\$23,021.7	\$552,184.5	\$575,206.2
18	\$22,552.8	\$540,937.2	\$563,490.0
19	\$22,093.4	\$529,919.1	\$552,012.6
20	\$21,643.4	\$519,125.4	\$540,768.8

Total	\$530,046	\$12,713,347	\$13,243,393
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REDUCED ACCIDENT BENEFITS - HIGHWAY USERS

Total

Year	AVERAGE ANNUAL VOLUME (trip-miles/yr.)		REDUCED VMT (veh-miles/yr.)	ACCIDENT BENEFITS (\$/yr.)	Constant Dollars	Present Value
	Induced Trips, Cycling	Induced Trips, Pedestrians	Induced Trips, Cyclists, Pedestrians	Induced Trips		
1	449,528	38,968	161,754	\$27,269	\$27,269	\$23,409
20	1,193,894	103,538	429,613	\$72,426	\$72,426	\$34,809

1	449,528	38,968	161,754	\$27,269	\$27,269	\$23,409
2	488,705	42,367	175,852	\$29,646	\$29,646	\$24,684
3	527,883	45,765	189,950	\$32,022	\$32,022	\$25,861
4	567,060	49,163	204,047	\$34,399	\$34,399	\$26,945
5	606,237	52,562	218,145	\$36,776	\$36,776	\$27,940
6	645,414	55,960	232,243	\$39,152	\$39,152	\$28,852
7	684,591	59,359	246,341	\$41,529	\$41,529	\$29,683
8	723,768	62,757	260,439	\$43,906	\$43,906	\$30,438
9	762,945	66,156	274,537	\$46,282	\$46,282	\$31,121
10	802,122	69,554	288,635	\$48,659	\$48,659	\$31,735
11	841,300	72,952	302,732	\$51,036	\$51,036	\$32,285
12	880,477	76,351	316,830	\$53,413	\$53,413	\$32,772
13	919,654	79,749	330,928	\$55,789	\$55,789	\$33,201
14	958,831	83,148	345,026	\$58,166	\$58,166	\$33,575
15	998,008	86,546	359,124	\$60,543	\$60,543	\$33,896
16	1,037,185	89,944	373,222	\$62,919	\$62,919	\$34,167
17	1,076,362	93,343	387,320	\$65,296	\$65,296	\$34,392
18	1,115,540	96,741	401,417	\$67,673	\$67,673	\$34,572
19	1,154,717	100,140	415,515	\$70,049	\$70,049	\$34,710
20	1,193,894	103,538	429,613	\$72,426	\$72,426	\$34,809

Total					\$619,046	
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C

TOTAL**Total**

Year	Constant Dollars	Present Value
1	\$3,588	\$3,080
20	\$9,529	\$4,580

1	\$3,588	\$3,080
2	\$3,900	\$3,248
3	\$4,213	\$3,402
4	\$4,526	\$3,545
5	\$4,838	\$3,676
6	\$5,151	\$3,796
7	\$5,464	\$3,905
8	\$5,777	\$4,005
9	\$6,089	\$4,094
10	\$6,402	\$4,175
11	\$6,715	\$4,248
12	\$7,027	\$4,312
13	\$7,340	\$4,368
14	\$7,653	\$4,417
15	\$7,965	\$4,460
16	\$8,278	\$4,495
17	\$8,591	\$4,525
18	\$8,903	\$4,548
19	\$9,216	\$4,567
20	\$9,529	\$4,580

Total	\$81,445
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TOTAL**Existing**

Year	Constant Dollars	Present Value
1	\$0	\$0
20	\$0	\$0

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
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F

TOTAL**New**

Year	Constant Dollars	Present Value
1	\$2,918,500	\$2,505,338
20	\$7,752,249	\$3,725,802

1	\$2,918,500	\$2,505,338
2	\$3,172,907	\$2,641,833
3	\$3,427,315	\$2,767,855
4	\$3,681,723	\$2,883,911
5	\$3,936,131	\$2,990,484
6	\$4,190,539	\$3,088,042
7	\$4,444,947	\$3,177,029
8	\$4,699,355	\$3,257,874
9	\$4,953,762	\$3,330,984
10	\$5,208,170	\$3,396,752
11	\$5,462,578	\$3,455,554
12	\$5,716,986	\$3,507,749
13	\$5,971,394	\$3,553,681
14	\$6,225,802	\$3,593,679
15	\$6,480,210	\$3,628,060
16	\$6,734,617	\$3,657,124
17	\$6,989,025	\$3,681,160
18	\$7,243,433	\$3,700,444
19	\$7,497,841	\$3,715,240
20	\$7,752,249	\$3,725,802

Total	\$66,258,594
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REDUCED EMISSIONS BENEFITS

Total

Year	AVERAGE ANNUAL VOLUME (trip-miles/yr.)		REDUCED VMT (veh-miles/yr.)	AVERAGE SPEED (mph)	RUNNING EMISSIONS (\$/yr.)	Constant Dollars	Present Value
	Induced Trips, Cycling	Induced Trips, Pedestrians	Induced Trips	Induced Trips	Induced Trips		
1	449,528	38,968	161,754	25	\$14,157	\$14,157	\$12,153
20	1,193,894	103,538	429,613	25	\$37,743	\$37,743	\$18,139

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1	449,528	38,968	161,754	25	\$14,157	\$14,157	\$12,153
2	488,705	42,367	175,852	25	\$15,642	\$15,642	\$13,024
3	527,883	45,765	189,950	25	\$17,172	\$17,172	\$13,868
4	567,060	49,163	204,047	25	\$18,748	\$18,748	\$14,685
5	606,237	52,562	218,145	25	\$20,370	\$20,370	\$15,477
6	645,414	55,960	232,243	25	\$22,042	\$22,042	\$16,243
7	684,591	59,359	246,341	25	\$23,762	\$23,762	\$16,984
8	723,768	62,757	260,439	25	\$18,749	\$18,749	\$12,998
9	762,945	66,156	274,537	25	\$20,094	\$20,094	\$13,511
10	802,122	69,554	288,635	25	\$21,479	\$21,479	\$14,008
11	841,300	72,952	302,732	25	\$22,904	\$22,904	\$14,489
12	880,477	76,351	316,830	25	\$24,372	\$24,372	\$14,954
13	919,654	79,749	330,928	25	\$25,882	\$25,882	\$15,403
14	958,831	83,148	345,026	25	\$27,436	\$27,436	\$15,837
15	998,008	86,546	359,124	25	\$29,035	\$29,035	\$16,256
16	1,037,185	89,944	373,222	25	\$30,680	\$30,680	\$16,660
17	1,076,362	93,343	387,320	25	\$32,372	\$32,372	\$17,051
18	1,115,540	96,741	401,417	25	\$34,113	\$34,113	\$17,427
19	1,154,717	100,140	415,515	25	\$35,902	\$35,902	\$17,790
20	1,193,894	103,538	429,613	25	\$37,743	\$37,743	\$18,139

[illegible]

Total	\$306,956
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NET PRESENT VALUE CALCULATION

Year	PRESENT VALUE OF USER BENEFITS					Present Value of Total Benefits	Present Value of Total Costs	NET PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
	Journey Quality	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings				
Construction Period									
1						\$0	\$5,000,000	(\$5,000,000)	(\$5,000,000)
2						\$0	\$4,849,661	(\$4,849,661)	(\$9,849,661)
3						\$0	\$18,815,366	(\$18,815,366)	(\$28,665,026)
4						\$0	\$13,687,220	(\$13,687,220)	(\$42,352,247)
5						\$0	\$9,292,972	(\$9,292,972)	(\$51,645,219)
6						\$0	\$0	\$0	(\$51,645,219)
7						\$0	\$0	\$0	(\$51,645,219)
8						\$0	\$0	\$0	(\$51,645,219)
Project Open									
1	\$424,777	\$0	\$822,912	\$2,508,418	\$12,153	\$3,768,259	\$7,726	\$3,760,533	\$3,760,533
2	\$447,792	\$0	\$807,902	\$2,645,081	\$13,024	\$3,913,798	\$7,494	\$3,906,305	\$7,666,838
3	\$469,039	\$0	\$793,126	\$2,771,258	\$13,868	\$4,047,291	\$7,268	\$4,040,022	\$11,706,860
4	\$488,604	\$0	\$778,582	\$2,887,456	\$14,685	\$4,169,327	\$7,833	\$4,161,494	\$15,868,354
5	\$506,568	\$0	\$764,268	\$2,994,161	\$15,477	\$4,280,473	\$7,598	\$4,272,875	\$20,141,229
6	\$523,010	\$0	\$750,181	\$3,091,838	\$16,243	\$4,381,272	\$7,369	\$4,373,903	\$24,515,131
7	\$538,005	\$0	\$736,320	\$3,180,935	\$16,984	\$4,472,244	\$7,862	\$4,464,382	\$28,979,513
8	\$551,626	\$0	\$722,682	\$3,261,878	\$12,998	\$4,549,183	\$7,626	\$4,541,558	\$33,521,071
9	\$563,941	\$0	\$709,265	\$3,335,078	\$13,511	\$4,621,795	\$7,397	\$4,614,399	\$38,135,469
10	\$575,017	\$0	\$696,066	\$3,400,927	\$14,008	\$4,686,019	\$7,174	\$4,678,845	\$42,814,314
11	\$584,917	\$0	\$683,084	\$3,459,802	\$14,489	\$4,742,291	\$15,815	\$4,726,477	\$47,540,791
12	\$593,701	\$0	\$670,316	\$3,512,061	\$14,954	\$4,791,032	\$5,522	\$4,785,509	\$52,326,300
13	\$601,429	\$0	\$657,759	\$3,558,049	\$15,403	\$4,832,640	\$5,356	\$4,827,284	\$57,153,584
14	\$608,155	\$0	\$645,411	\$3,598,097	\$15,837	\$4,867,500	\$5,195	\$4,862,305	\$62,015,889
15	\$613,933	\$0	\$633,270	\$3,632,519	\$16,256	\$4,895,979	\$5,599	\$4,890,380	\$66,906,269
16	\$618,814	\$0	\$621,333	\$3,661,619	\$16,660	\$4,918,426	\$5,430	\$4,912,996	\$71,819,265
17	\$622,846	\$0	\$609,598	\$3,685,684	\$17,051	\$4,935,179	\$5,267	\$4,929,912	\$76,749,177
18	\$626,076	\$0	\$598,062	\$3,704,992	\$17,427	\$4,946,558	\$5,620	\$4,940,938	\$81,690,115
19	\$628,549	\$0	\$586,723	\$3,719,807	\$17,790	\$4,952,869	\$5,451	\$4,947,418	\$86,637,534
20	\$630,307	\$0	\$575,577	\$3,730,381	\$18,139	\$4,954,406	\$5,287	\$4,949,119	\$91,586,653
Total	\$11,217,105	\$0	\$13,862,439	\$66,340,040	\$306,956	\$91,726,540	\$51,785,106	\$39,941,434	

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Total Construction Costs **\$51,645,219**

SRTS BENEFITS

Year	PRESENT VALUE OF USER BENEFITS		
	Journey Quality	Additional Delay Savings	Additional Safety Benefits
Construction Period			
1			
2			
3			
4			
5			
6			
7			
8			
Project Open			
1	\$5,528	\$0	\$799,503
2	\$5,821	\$0	\$783,218
3	\$6,090	\$0	\$767,265
4	\$6,339	\$0	\$751,637
5	\$6,566	\$0	\$736,328
6	\$6,775	\$0	\$721,330
7	\$6,965	\$0	\$706,637
8	\$7,137	\$0	\$692,244
9	\$7,293	\$0	\$678,144
10	\$7,432	\$0	\$664,331
11	\$7,557	\$0	\$650,800
12	\$7,668	\$0	\$637,544
13	\$7,765	\$0	\$624,558
14	\$7,849	\$0	\$611,837
15	\$7,922	\$0	\$599,374
16	\$7,983	\$0	\$587,166
17	\$8,033	\$0	\$575,206
18	\$8,072	\$0	\$563,490
19	\$8,103	\$0	\$552,013
20	\$8,124	\$0	\$540,769
Total	\$145,020	\$0	\$13,243,393

C INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	USER BENEFITS IN CONSTANT DOLLARS					Total Benefits - Constant Dollars	Total Costs - Constant Dollars	Annual Returns on Investment	Cumulative Costs and Benefits
	Journey Quality	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings				
Construction Period									
1						\$0	\$5,000,000	(\$5,000,000)	(\$5,000,000)
2						\$0	\$5,000,000	(\$5,000,000)	(\$10,000,000)
3						\$0	\$20,000,000	(\$20,000,000)	(\$30,000,000)
4						\$0	\$15,000,000	(\$15,000,000)	(\$45,000,000)
5						\$0	\$10,500,000	(\$10,500,000)	(\$55,500,000)
6						\$0	\$0	\$0	(\$55,500,000)
7						\$0	\$0	\$0	(\$55,500,000)
8						\$0	\$0	\$0	(\$55,500,000)
Project Open									
1	\$494,828	\$0	\$958,620	\$2,922,087	\$14,157	\$4,389,692	\$9,000	\$4,380,692	\$4,380,692
2	\$537,809	\$0	\$970,311	\$3,176,808	\$15,642	\$4,700,569	\$9,000	\$4,691,569	\$9,072,261
3	\$580,791	\$0	\$982,094	\$3,431,528	\$17,172	\$5,011,584	\$9,000	\$5,002,584	\$14,074,846
4	\$623,772	\$0	\$993,971	\$3,686,249	\$18,748	\$5,322,740	\$10,000	\$5,312,740	\$19,387,585
5	\$666,754	\$0	\$1,005,944	\$3,940,969	\$20,370	\$5,634,037	\$10,000	\$5,624,037	\$25,011,623
6	\$709,735	\$0	\$1,018,012	\$4,195,690	\$22,042	\$5,945,479	\$10,000	\$5,935,479	\$30,947,102
7	\$752,717	\$0	\$1,030,177	\$4,450,411	\$23,762	\$6,257,067	\$11,000	\$6,246,067	\$37,193,169
8	\$795,698	\$0	\$1,042,440	\$4,705,131	\$18,749	\$6,562,018	\$11,000	\$6,551,018	\$43,744,187
9	\$838,680	\$0	\$1,054,803	\$4,959,852	\$20,094	\$6,873,427	\$11,000	\$6,862,427	\$50,606,614
10	\$881,661	\$0	\$1,067,264	\$5,214,572	\$21,479	\$7,184,976	\$11,000	\$7,173,976	\$57,780,591
11	\$924,643	\$0	\$1,079,827	\$5,469,293	\$22,904	\$7,496,667	\$25,000	\$7,471,667	\$65,252,257
12	\$967,624	\$0	\$1,092,492	\$5,724,013	\$24,372	\$7,808,501	\$9,000	\$7,799,501	\$73,051,758
13	\$1,010,606	\$0	\$1,105,259	\$5,978,734	\$25,882	\$8,120,481	\$9,000	\$8,111,481	\$81,163,239
14	\$1,053,587	\$0	\$1,118,131	\$6,233,454	\$27,436	\$8,432,608	\$9,000	\$8,423,608	\$89,586,848
15	\$1,096,569	\$0	\$1,131,107	\$6,488,175	\$29,035	\$8,744,886	\$10,000	\$8,734,886	\$98,321,734
16	\$1,139,550	\$0	\$1,144,189	\$6,742,896	\$30,680	\$9,057,315	\$10,000	\$9,047,315	\$107,369,049
17	\$1,182,532	\$0	\$1,157,379	\$6,997,616	\$32,372	\$9,369,899	\$10,000	\$9,359,899	\$116,728,948
18	\$1,225,513	\$0	\$1,170,676	\$7,252,337	\$34,113	\$9,682,639	\$11,000	\$9,671,639	\$126,400,586
19	\$1,268,495	\$0	\$1,184,083	\$7,507,057	\$35,902	\$9,995,537	\$11,000	\$9,984,537	\$136,385,123
20	\$1,311,476	\$0	\$1,197,600	\$7,761,778	\$37,743	\$10,308,596	\$11,000	\$10,297,596	\$146,682,720
Total	\$18,063,038	\$0	\$21,504,378	\$106,838,649	\$492,654	\$146,898,720	\$55,716,000	\$91,182,720	

Total Construction Costs **\$55,500,000**

Years of Project Implementation and Operation	Annual Returns on Investment
1	(\$5,000,000)
2	(\$5,000,000)
3	(\$20,000,000)
4	(\$15,000,000)
5	(\$10,500,000)
6	\$4,380,692
7	\$4,691,569
8	\$5,002,584
9	\$5,312,740
10	\$5,624,037
11	\$5,935,479
12	\$6,246,067
13	\$6,551,018
14	\$6,862,427
15	\$7,173,976
16	\$7,471,667
17	\$7,799,501
18	\$8,111,481
19	\$8,423,608
20	\$8,734,886
21	\$9,047,315
22	\$9,359,899
23	\$9,671,639
24	\$9,984,537
25	\$10,297,596
26	\$0
27	\$0
28	\$0

Internal Rate of Return **8.21%**

Payback Period **10 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	2022
Economic Update Factor (Using GDP Deflator)	1.07
Real Discount Rate	3.1%

Mode Types

Bus
Pass Train
Light Rail
Highway

Travel Time Parameters

	Value	Units
Statewide Average Hourly Wage	\$ 35.22	\$/hr
Heavy and Light Truck Drivers		
Average Hourly Wage	\$ 26.80	\$/hr
Benefits and Costs	\$ 14.25	\$/hr
Value of Time		
Automobile	\$ 19.60	\$/hr/per
Truck	\$ 33.50	\$/hr/veh
Auto & Truck Composite	\$ 26.20	\$/hr/veh
Transit	\$ 19.60	\$/hr/per
Out-of-Vehicle Travel	1.82	times
Incident-Related Travel	3	times
Travel Time Uprater	0.0%	annual incr

Vehicle Operating Cost Parameters

Average Fuel Price		
Automobile (regular unleaded)	\$ 4.07	\$/gal
Truck (diesel)	\$ 4.14	\$/gal
Sales and Fuel Taxes		
State Sales Tax (gasoline)	2.25%	%
State Sales Tax (diesel)	13.00%	%
Average Local Sales Tax	0.50%	%
Federal Fuel Excise Tax (gasoline)	\$ 0.183	\$/gal
Federal Fuel Excise Tax (diesel)	\$ 0.243	\$/gal
State Fuel Excise Tax (gasoline)	\$ 0.539	\$/gal
State Fuel Excise Tax (diesel)	\$ 0.410	\$/gal
Fuel Cost Per Gallon (Exclude Taxes)		
Automobile	\$ 3.25	\$/gal
Truck	\$ 3.00	\$/gal
Non-Fuel Cost Per Mile		
Automobile	\$ 0.380	\$/mi
Truck	\$ 0.471	\$/mi
Idling Speed for Op. Costs and Emissions	5	mph

Accident Cost Parameters

Cost of a Fatality	\$ 12,500,000	\$/event
Cost of an Injury		
Level A (Severe)	\$ 1,188,200	\$/event
Level B (Moderate)	\$ 233,800	\$/event
Level C (Minor)	\$ 111,700	\$/event
Cost of Property Damage	\$ 5,000	\$/event
Cost of Highway Crash		
Fatal Crash	\$ 13,800,000	\$/crash
Injury Crash	\$ 293,800	\$/crash
PDO Crash	\$ 9,000	\$/crash
Average Cost	\$ 162,100	\$/crash
Statewide Highway Crash Rates		
Fatal Crash	0.005	per mil veh-mi
Injury Crash	0.28	per mil veh-mi
PDO Crash	0.61	per mil veh-mi
Non-Freeway	1.04	per mil veh-mi

Highway Operations Parameters

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

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

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

Sources: 16) Highway Capacity Manual, 17) NCHRP 387, 18) PeMS data

Sources: 1) Office of Management and Budget (OMB), 2) Review of OMB and State Treasurer's Office data, 3) Bureau of Labor Statistics (BLS) OES 2020, 4) BLS Employment Cost Index, 5) USDOT Department Guidance 2021, 6) California Department of Transportation TSI and Traffic Operations, 7) IDAS model, 8) AAA Daily Fuel Gauge Report 2021, 9) California Board of Equalization, 10) Caltrans Transportation Funding in California 2020, 11) AAA Your Driving Costs 2021, 12) American Transportation Research Institute 2021, 13) USDOT VSL,

Active Transportation Parameters			
General Travel Activity Characteristics Parameters			
Cycling Days per Year	365	days	
Walking Days per Year	365	days	
School Days per Year	180	days	
Vehicle Statistics			
Average Vehicle Speed	25	mph	
Average Vehicle Occupancy	1.51	persons / veh	19
Active Transportation User Characteristics			
Average Cycling Speed	8.70	mph	20
Average Walking Speed	3.30	mph	20
Number of Unlinked Cycling Trips per Day	2.23	trips	19
Number of Unlinked Pedestrian Trips per Day	2.10	trips	19
Diversion of Cyclists from Personal Vehicles	50%	assumption	
Diversion of Pedestrians from Personal Vehicles	50%	assumption	
Value of Travel Time			
Adults	\$ 19.60	\$/hr/per	
Children	\$ 19.60	\$/hr/per	
Cycling Journey Quality - Facility Preference Factors as Function of Distance by Facility Class			
Class I	0.57	-	21
Class II	0.49	-	21
Class III	0.92	-	21
Class IV	0.49	-	21
Note: Class IV assumed to be the same as Class II			
Walking Journey Quality Values per Mile by Amenity			
Street Lighting	\$0.110	\$/mi	22
Curb Level	\$0.078	\$/mi	22
Crowding	\$0.055	\$/mi	22
Pavement Evenness	\$0.026	\$/mi	22
Information Panels	\$0.026	\$/mi	22
Benches	\$0.017	\$/mi	22
Directional Signage	\$0.017	\$/mi	22
Health (Absenteeism Reduction)			
Average Absence of Employees	3.50	days/yr	23
Percentage Covered by Short-Term Sick Leave	66%	%	23
Percentage of Sick Days Reduced When Active at Least 30 Minutes per Day	6%	%	24
Health (Mortality Reduction)			
Percentage of Cyclists Aged 16-64	54.9%	%	
Percentage of Pedestrians Aged 16-74	80.5%	%	
Percentage Reduction in Mortality per 365 Annual Cycling Miles	4.5%	%	20
Percentage Reduction in Mortality per 365 Annual Walking Miles	9.0%	%	20
Mortality Rate - All Causes (Aged 20-64)	252	#/100,000 people	25
Mortality Rate - All Causes (Aged 20-74)	392	#/100,000 people	25

Sources: 19) 2017 National Household Travel Survey, 20) 2017 WHO HEAT Model Documentation, 21) Hood et al., 2011, 22) Heuman et al., 2005, 23) Maestas et al., 2018, 24) World Health Organization, 2003, 25) California Health and Human Services Agency, 2019 Final Deaths

Travel Demand Tables

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

DEMAND FOR TRAVEL IN PEAK PERIOD (percent of total daily travel)						
Number of Hours in Peak Period	Urban				Rural	
	So. California		No. California		Fwy/Exp	Other
	Fwy/Exp	Other	Fwy/Exp	Other		
1	8.5%	8.5%	8.5%	8.5%	8.5%	8.5%
2	16.8%	16.8%	16.8%	16.8%	16.8%	16.8%
3	25.0%	25.0%	25.0%	25.0%	25.0%	25.0%
4	32.8%	32.8%	32.8%	32.8%	32.8%	32.8%
5	40.3%	40.3%	40.3%	40.3%	40.3%	40.3%
6	47.4%	47.4%	47.4%	47.4%	47.4%	47.4%
7	54.2%	54.2%	54.2%	54.2%	54.2%	54.2%
8	60.8%	60.8%	60.8%	60.8%	60.8%	60.8%
9	67.1%	67.1%	67.1%	67.1%	67.1%	67.1%
10	73.4%	73.4%	73.4%	73.4%	73.4%	73.4%
11	79.0%	79.0%	79.0%	79.0%	79.0%	79.0%
12	84.3%	84.3%	84.3%	84.3%	84.3%	84.3%
13	88.6%	88.6%	88.6%	88.6%	88.6%	88.6%
14	91.6%	91.6%	91.6%	91.6%	91.6%	91.6%
15	94.3%	94.3%	94.3%	94.3%	94.3%	94.3%
16	96.4%	96.4%	96.4%	96.4%	96.4%	96.4%
17	97.6%	97.6%	97.6%	97.6%	97.6%	97.6%
18	98.5%	98.5%	98.5%	98.5%	98.5%	98.5%
19	99.1%	99.1%	99.1%	99.1%	99.1%	99.1%
20	99.4%	99.4%	99.4%	99.4%	99.4%	99.4%
21	99.7%	99.7%	99.7%	99.7%	99.7%	99.7%
22	99.8%	99.8%	99.8%	99.8%	99.8%	99.8%
23	99.9%	99.9%	99.9%	99.9%	99.9%	99.9%
24	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: California Department of Transportation, 2010-2012 California Household Travel Survey, Final Report Appendix, June 2013

AGE COHORTS FOR MORTALITY RISK REDUCTION (percent of population)				
Mode	Age Cohort	Urban		Rural
		South	North	
Cycling	Age 16-64	54.9%	54.9%	44.6%
Walking	Age 16-74	80.5%	80.5%	79.9%

AVERAGE DISTANCE PER ACTIVE TRANSPORTATION TRIP (miles/trip)				
Mode	Age Cohort	Urban		Rural
		South	North	
Cycling	Adults	2.29	2.29	7.89
	Children <16	0.99	0.99	0.78
Walking	Adults	0.68	0.68	0.60
	Children <16	0.63	0.63	1.08

TRIP PURPOSE FOR ACTIVE TRANSPORTATION TRIPS (percent of trips)				
Mode	Trip Purpose	Urban		Rural
		South	North	
Cycling	Commuting	18.6%	18.6%	9.9%
	Recreation	46.1%	46.1%	62.2%
	Other Destination	35.3%	35.3%	27.9%
Walking	Commuting	5.2%	5.2%	6.2%
	Recreation	55.0%	55.0%	63.5%
	Other Destination	39.8%	39.8%	30.3%

Source: 2017 National Household Travel Survey, California Sample

Operating Cost Tables

FUEL CONSUMPTION RATES (gal/veh-mi)		
Speed	Auto*	Truck
5	0.0515	0.1400
6	0.0501	0.1377
7	0.0488	0.1355
8	0.0476	0.1333
9	0.0464	0.1312
10	0.0452	0.1291
11	0.0429	0.1238
12	0.0407	0.1186
13	0.0387	0.1137
14	0.0367	0.1090
15	0.0349	0.1044
16	0.0351	0.1029
17	0.0352	0.1015
18	0.0354	0.1000
19	0.0356	0.0986
20	0.0358	0.0972
21	0.0354	0.0940
22	0.0350	0.0909
23	0.0345	0.0879
24	0.0341	0.0850
25	0.0337	0.0822
26	0.0334	0.0813
27	0.0331	0.0803
28	0.0328	0.0794
29	0.0325	0.0785
30	0.0322	0.0776
31	0.0317	0.0778
32	0.0313	0.0781
33	0.0308	0.0784
34	0.0304	0.0787
35	0.0300	0.0790
36	0.0298	0.0794
37	0.0297	0.0799
38	0.0296	0.0803
39	0.0295	0.0808
40	0.0293	0.0812
41	0.0294	0.0813
42	0.0294	0.0813
43	0.0295	0.0814
44	0.0295	0.0814
45	0.0295	0.0814
46	0.0299	0.0786
47	0.0302	0.0758
48	0.0305	0.0731
49	0.0309	0.0705
50	0.0312	0.0680
51	0.0316	0.0707
52	0.0321	0.0735
53	0.0325	0.0764
54	0.0330	0.0794
55	0.0334	0.0826
56	0.0337	0.0865
57	0.0340	0.0907
58	0.0343	0.0950
59	0.0345	0.0995
60	0.0348	0.1043
61	0.0351	0.1062
62	0.0353	0.1083
63	0.0356	0.1104
64	0.0358	0.1125
65	0.0361	0.1146
66	0.0361	0.1138
67	0.0362	0.1130
68	0.0363	0.1123
69	0.0364	0.1115
70	0.0365	0.1107

* Includes motorcycles & medium duty vehicles
Note: Five mph is best estimate for idling

Source: California Air Resources Board,
EMFAC2021, 2024 & 2044 average

Accident Tables

HIGHWAY INJURY SEVERITY FREQUENCY
(percent of injuries)

Event	Urban	Suburban	Rural	Average
Severe Injury (A)	5.12%	5.12%	5.12%	5.12%
Other Visible Injury (B)	25.30%	25.30%	25.30%	25.30%
Complaint of Pain (C)	69.57%	69.57%	69.57%	69.57%

Source: 2017 SWITRS Annual Report, Table 8C

RATES FOR NON-HIGHWAY ACCIDENT EVENTS
(events/million veh-mi)

Event	Pass Train	Light Rail	Bus	Freight Rail
Fatality	0.0804	0.2416	0.0372	1.0368
Injury	0.2855	2.9209	3.5526	7.3121
All Accidents	0.3128	4.1374	2.0523	13.2505

Sources: USDOT, Transportation Statistics Annual Report, Table 2-33, 2010 to 2019 average
FRA, Office of Safety Analysis, Table 1.13, 2011 to 2020 CY average

NUMBER OF FATALITIES
(events/crash)

Crash Type	Urban	Suburban	Rural	Average
Fatal Crash	1.09	1.08	1.14	1.11

NUMBER OF INJURIES
(events/crash)

Crash Type	Urban	Suburban	Rural	Average
Fatal Crash	0.81	0.82	1.12	0.95
Injury Crash	1.44	1.43	1.50	1.44

NUMBER OF VEHICLES INVOLVED
(events/crash)

Crash Type	Urban	Suburban	Rural	Average
Fatal Crash	1.51	1.69	1.58	1.63
Injury Crash	1.82	2.10	1.59	1.99
PDO Crash	1.80	2.03	1.59	1.96

DISTRIBUTION OF CRASH TYPES
(percent of crashes)

Crash Type	Urban	Suburban	Rural	Average
Fatal Crash	0.45%	0.73%	2.04%	0.73%
Injury Crash	31.95%	33.13%	36.01%	32.77%
PDO Crash	67.60%	66.14%	61.96%	66.50%

Source: California Department of Transportation, TASAS Unit, 2010 to 2013 average
26) Crash Data on California State Highways 2018

COST OF NON-HIGHWAY ACCIDENT EVENTS
(\$/event)

Event	Pass Train	Light Rail	Bus	Freight Rail
Fatality	\$12,500,000	\$12,500,000	\$12,500,000	\$12,500,000
Injury	\$394,400	\$394,400	\$394,400	\$394,400
Prop Damage	\$90,000	\$14,200	\$4,300	\$156,700

Sources: FRA, Transit Safety & Security Statistics, 2002 to 2011 average
FRA, Office of Safety Analysis, Table 3.16, 2018 to 2020 average

COSTS OF NON-HIGHWAY ACCIDENTS
(\$/million veh-mi)

Value	Pass Train	Light Rail	Bus	Freight Rail
Cost	\$1,145,800	\$4,230,800	\$1,875,000	\$17,920,200

Source: Combination of above two tables

HIGHWAY-RAIL GRADE CROSSING INCIDENTS
(units in table)

Value	Incident	Fatality	Injury
Total Events	847	80	462
Avg per Incident		0.0945	0.5455
Cost per Event		\$12,500,000	\$394,400

Source: FRA, Office of Safety Analysis, 5.10 - Hwy/Rail Incidents Summary
Table, California, Motor Vehicles, Public Crossings, Jan 2011 to Dec 2020

COST OF HIGHWAY CRASHES
(\$/crash)

Crash Type	Urban	Suburban	Rural	Average
Fatal Crash	\$13,800,000	\$13,700,000	\$14,500,000	\$14,100,000
Injury Crash	\$293,800	\$293,200	\$304,500	\$294,600
PDO Crash	\$9,000	\$10,200	\$8,000	\$9,800
All Types	\$162,100	\$203,900	\$410,400	\$206,000

Source: Combination of above four tables

PASSING LANE CRASH 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 2024							
Mode	Speed	CO	CO2	NOX	PM2.5	SOX	VOC
Auto	0	3.5182	78.9185	0.3056	0.0020	0.0008	0.3900
	5	1.3616	555.4365	0.0959	0.0065	0.0055	0.0868
	6	1.3409	538.7039	0.0933	0.0060	0.0053	0.0797
	7	1.3206	522.4754	0.0907	0.0055	0.0052	0.0732
	8	1.3005	506.7358	0.0881	0.0051	0.0050	0.0672
	9	1.2807	491.4703	0.0857	0.0047	0.0049	0.0617
	10	1.2613	476.6647	0.0833	0.0043	0.0047	0.0567
	11	1.2223	452.5800	0.0804	0.0039	0.0045	0.0518
	12	1.1846	429.7124	0.0775	0.0036	0.0042	0.0473
	13	1.1480	408.0001	0.0748	0.0033	0.0040	0.0433
	14	1.1126	387.3849	0.0721	0.0030	0.0038	0.0396
	15	1.0783	367.8114	0.0696	0.0027	0.0036	0.0361
	16	1.0942	366.7610	0.0702	0.0026	0.0036	0.0348
	17	1.1103	365.7136	0.0708	0.0025	0.0036	0.0335
	18	1.1267	364.6693	0.0714	0.0024	0.0036	0.0323
	19	1.1433	363.6278	0.0720	0.0024	0.0036	0.0311
	20	1.1601	362.5894	0.0726	0.0023	0.0036	0.0300
	21	1.1563	356.2510	0.0724	0.0022	0.0035	0.0287
	22	1.1524	350.0234	0.0723	0.0021	0.0035	0.0275
	23	1.1486	343.9046	0.0721	0.0020	0.0034	0.0263
	24	1.1448	337.8928	0.0719	0.0019	0.0033	0.0252
	25	1.1410	331.9861	0.0718	0.0018	0.0033	0.0242
	26	1.1286	327.2741	0.0711	0.0017	0.0032	0.0232
	27	1.1164	322.6289	0.0703	0.0017	0.0032	0.0222
	28	1.1042	318.0497	0.0696	0.0016	0.0031	0.0213
	29	1.0922	313.5355	0.0689	0.0015	0.0031	0.0204
	30	1.0804	309.0854	0.0682	0.0015	0.0031	0.0196
	31	1.0681	304.8313	0.0679	0.0014	0.0030	0.0190
	32	1.0561	300.6357	0.0675	0.0014	0.0030	0.0184
	33	1.0441	296.4979	0.0671	0.0013	0.0029	0.0178
	34	1.0323	292.4171	0.0667	0.0013	0.0029	0.0172
	35	1.0206	288.3924	0.0663	0.0012	0.0029	0.0167
	36	1.0098	287.1873	0.0661	0.0012	0.0028	0.0163
	37	0.9991	285.9872	0.0658	0.0012	0.0028	0.0159
	38	0.9885	284.7922	0.0656	0.0011	0.0028	0.0155
	39	0.9780	283.6021	0.0653	0.0011	0.0028	0.0152
	40	0.9677	282.4170	0.0651	0.0011	0.0028	0.0148
	41	0.9542	282.6316	0.0649	0.0011	0.0028	0.0146
	42	0.9408	282.8464	0.0647	0.0010	0.0028	0.0144
	43	0.9277	283.0613	0.0645	0.0010	0.0028	0.0142
	44	0.9147	283.2764	0.0643	0.0010	0.0028	0.0140
	45	0.9020	283.4917	0.0641	0.0010	0.0028	0.0138
	46	0.8895	286.1470	0.0643	0.0010	0.0028	0.0138
	47	0.8882	288.8273	0.0645	0.0010	0.0029	0.0138
	48	0.8814	291.5326	0.0647	0.0010	0.0029	0.0137
	49	0.8746	294.2633	0.0649	0.0010	0.0029	0.0137
	50	0.8679	297.0195	0.0652	0.0010	0.0029	0.0137
	51	0.8608	300.5677	0.0655	0.0010	0.0030	0.0138
	52	0.8537	304.1583	0.0659	0.0010	0.0030	0.0139
	53	0.8467	307.7918	0.0663	0.0010	0.0030	0.0140
	54	0.8398	311.4687	0.0667	0.0010	0.0031	0.0141
	55	0.8329	315.1895	0.0671	0.0010	0.0031	0.0142
	56	0.8167	317.3875	0.0668	0.0010	0.0031	0.0143
	57	0.8008	319.6009	0.0666	0.0010	0.0032	0.0144
	58	0.7852	321.8297	0.0664	0.0011	0.0032	0.0144
	59	0.7699	324.0740	0.0662	0.0011	0.0032	0.0145
	60	0.7549	326.3340	0.0660	0.0011	0.0032	0.0146
	61	0.7519	328.7321	0.0672	0.0011	0.0032	0.0151
	62	0.7490	331.1477	0.0684	0.0011	0.0033	0.0156
	63	0.7460	333.5812	0.0697	0.0012	0.0033	0.0160
	64	0.7430	336.0325	0.0710	0.0012	0.0033	0.0165
	65	0.7401	338.5018	0.0723	0.0012	0.0033	0.0171
	66	0.7380	339.0778	0.0728	0.0012	0.0034	0.0172
	67	0.7359	339.6547	0.0732	0.0013	0.0034	0.0173
	68	0.7338	340.2326	0.0737	0.0013	0.0034	0.0175
	69	0.7318	340.8115	0.0742	0.0013	0.0034	0.0176
	70	0.7297	341.3914	0.0746	0.0013	0.0034	0.0178

HIGHWAY EMISSIONS FACTORS (g/mi)								
Model Year 2044								
Mode	Speed	CO	CO2	NOX	PM2.5	SOX	VOC	PM2.5
Auto	0	1.7535	60.2289	0.1686	0.0008	0.0006	0.1451	0.0008
	5	0.5559	330.9034	0.0223	0.0018	0.0033	0.0249	0.0018
	6	0.5576	324.7042	0.0221	0.0016	0.0032	0.0233	0.0016
	7	0.5594	318.6210	0.0219	0.0015	0.0031	0.0217	0.0015
	8	0.5612	312.6518	0.0218	0.0014	0.0031	0.0203	0.0014
	9	0.5630	306.7945	0.0216	0.0013	0.0030	0.0189	0.0013
	10	0.5647	301.0469	0.0214	0.0012	0.0030	0.0177	0.0012
	11	0.5479	285.9535	0.0206	0.0011	0.0028	0.0161	0.0011
	12	0.5315	271.6169	0.0199	0.0010	0.0027	0.0147	0.0010
	13	0.5156	257.9991	0.0192	0.0009	0.0026	0.0134	0.0009
	14	0.5002	245.0640	0.0185	0.0009	0.0024	0.0122	0.0009
	15	0.4853	232.7774	0.0178	0.0008	0.0023	0.0111	0.0008
	16	0.5039	236.9560	0.0184	0.0008	0.0023	0.0109	0.0008
	17	0.5232	241.2096	0.0190	0.0008	0.0024	0.0107	0.0008
	18	0.5433	245.5396	0.0197	0.0007	0.0024	0.0105	0.0007
	19	0.5641	249.9473	0.0203	0.0007	0.0025	0.0103	0.0007
	20	0.5858	254.4341	0.0210	0.0007	0.0025	0.0101	0.0007
	21	0.5910	253.2384	0.0211	0.0007	0.0025	0.0098	0.0007
	22	0.5964	252.0482	0.0213	0.0007	0.0025	0.0094	0.0007
	23	0.6018	250.8636	0.0215	0.0006	0.0025	0.0091	0.0006
	24	0.6072	249.6847	0.0217	0.0006	0.0025	0.0088	0.0006
	25	0.6127	248.5112	0.0218	0.0006	0.0025	0.0085	0.0006
	26	0.6144	247.7900	0.0220	0.0006	0.0024	0.0083	0.0006
	27	0.6161	247.0709	0.0221	0.0006	0.0024	0.0080	0.0006
	28	0.6178	246.3539	0.0222	0.0006	0.0024	0.0078	0.0006
	29	0.6195	245.6389	0.0224	0.0005	0.0024	0.0076	0.0005
	30	0.6212	244.9261	0.0225	0.0005	0.0024	0.0074	0.0005
	31	0.6126	241.3366	0.0222	0.0005	0.0024	0.0071	0.0005
	32	0.6042	237.7997	0.0220	0.0005	0.0024	0.0068	0.0005
	33	0.5959	234.3147	0.0217	0.0005	0.0023	0.0065	0.0005
	34	0.5877	230.8807	0.0215	0.0005	0.0023	0.0063	0.0005
	35	0.5796	227.4970	0.0212	0.0004	0.0022	0.0060	0.0004
	36	0.5729	226.5716	0.0211	0.0004	0.0022	0.0058	0.0004
	37	0.5664	225.6499	0.0210	0.0004	0.0022	0.0057	0.0004
	38	0.5599	224.7319	0.0208	0.0004	0.0022	0.0055	0.0004
	39	0.5535	223.8177	0.0207	0.0004	0.0022	0.0053	0.0004
	40	0.5471	222.9072	0.0206	0.0004	0.0022	0.0052	0.0004
	41	0.5398	223.3585	0.0205	0.0004	0.0022	0.0051	0.0004
	42	0.5325	223.8107	0.0205	0.0004	0.0022	0.0050	0.0004
	43	0.5253	224.2638	0.0204	0.0004	0.0022	0.0050	0.0004
	44	0.5182	224.7179	0.0203	0.0004	0.0022	0.0049	0.0004
	45	0.5112	225.1728	0.0203	0.0004	0.0022	0.0048	0.0004
	46	0.5081	228.0582	0.0203	0.0004	0.0023	0.0048	0.0004
	47	0.5051	230.9745	0.0204	0.0004	0.0023	0.0048	0.0004
	48	0.5021	233.9312	0.0205	0.0004	0.0023	0.0048	0.0004
	49	0.4991	236.9257	0.0206	0.0004	0.0023	0.0048	0.0004
	50	0.4961	239.9586	0.0207	0.0004	0.0024	0.0048	0.0004
	51	0.4937	243.8377	0.0209	0.0004	0.0024	0.0049	0.0004
	52	0.4913	247.7794	0.0211	0.0004	0.0024	0.0049	0.0004
	53	0.4889	251.7849	0.0213	0.0004	0.0025	0.0050	0.0004
	54	0.4866	255.8552	0.0215	0.0004	0.0025	0.0051	0.0004
	55	0.4842	259.9912	0.0217	0.0004	0.0026	0.0051	0.0004
	56	0.4772	262.6460	0.0218	0.0004	0.0026	0.0052	0.0004
	57	0.4703	265.3279	0.0220	0.0004	0.0026	0.0053	0.0004
	58	0.4635	268.0372	0.0222	0.0004	0.0026	0.0054	0.0004
	59	0.4568	270.7741	0.0223	0.0004	0.0027	0.0055	0.0004
	60	0.4502	273.5390	0.0225	0.0004	0.0027	0.0057	0.0004
	61	0.4455	275.3018	0.0227	0.0004	0.0027	0.0058	0.0004
	62	0.4408	277.0760	0.0229	0.0004	0.0027	0.0059	0.0004
	63	0.4362	278.8616	0.0231	0.0004	0.0028	0.0061	0.0004
	64	0.4316	280.6587	0.0233	0.0005	0.0028	0.0062	0.0005
	65	0.4271	282.4673	0.0235	0.0005	0.0028	0.0064	0.0005
	66	0.4250	283.2451	0.0236	0.0005	0.0028	0.0065	0.0005
	67	0.4229	284.0250	0.0237	0.0005	0.0028	0.0066	0.0005
	68	0.4208	284.8070	0.0238	0.0005	0.0028	0.0067	0.0005
	69	0.4187	285.5912	0.0239	0.0005	0.0028	0.0068	0.0005
	70	0.4166	286.3775	0.0241	0.0005	0.0028	0.0069	0.0005

Emissions Tables

HIGHWAY EMISSIONS FACTORS (g/mi)							
Model Year 2024							
Mode	Speed	CO	CO2	NOX	PM2.5	SOX	VOC
Auto	0	3.5182	78.9185	0.3056	0.0020	0.0008	0.3900
	5	1.3616	555.4365	0.0959	0.0065	0.0055	0.0868
	6	1.3409	538.7039	0.0933	0.0060	0.0053	0.0797
	7	1.3206	522.4754	0.0907	0.0055	0.0052	0.0732
	8	1.3005	506.7358	0.0881	0.0051	0.0050	0.0672
	0	1.3150	11.0294	1.0065	0.0001	0.0001	0.0703
	5	2.3136	1696.8926	2.1959	0.0460	0.0164	0.3065
	6	2.2436	1668.3322	2.2233	0.0443	0.0161	0.2881
	7	2.1757	1640.2524	2.2511	0.0426	0.0157	0.2708
	8	2.1098	1612.6453	2.2792	0.0410	0.0154	0.2546
Truck	9	2.0460	1585.5029	2.3076	0.0395	0.0151	0.2393
	10	1.9841	1558.8172	2.3365	0.0380	0.0148	0.2249
	11	1.8688	1490.2476	2.1839	0.0360	0.0141	0.2111
	12	1.7601	1424.6943	2.0413	0.0341	0.0135	0.1961
	13	1.6578	1362.0246	1.9080	0.0323	0.0129	0.1860
	14	1.5615	1302.1116	1.7834	0.0306	0.0124	0.1746
	15	1.4707	1244.8340	1.6670	0.0290	0.0118	0.1639
	16	1.3769	1231.6228	1.6477	0.0269	0.0117	0.1517
	17	1.2890	1218.5517	1.6286	0.0251	0.0116	0.1404
	18	1.2067	1205.6194	1.6097	0.0233	0.0115	0.1300
	19	1.1297	1192.8244	1.5910	0.0217	0.0113	0.1204
	20	1.0576	1180.1651	1.5726	0.0201	0.0112	0.1114
	21	1.0154	1138.1322	1.5314	0.0199	0.0108	0.1089
	22	0.9749	1097.5964	1.4913	0.0197	0.0104	0.1065
	23	0.9361	1058.5043	1.4522	0.0195	0.0101	0.1041
	24	0.8988	1020.8046	1.4141	0.0192	0.0097	0.1017
	25	0.8629	984.4475	1.3771	0.0190	0.0093	0.0995
	26	0.8297	974.5904	1.3491	0.0180	0.0092	0.0935
	27	0.7977	964.8319	1.3216	0.0170	0.0091	0.0879
	28	0.7670	955.1712	1.2948	0.0161	0.0090	0.0827
	29	0.7374	945.6072	1.2684	0.0152	0.0089	0.0777
	30	0.7090	936.1389	1.2426	0.0144	0.0088	0.0731
	31	0.6779	941.2716	1.2298	0.0137	0.0089	0.0682
	32	0.6482	946.4323	1.2171	0.0131	0.0089	0.0636
	33	0.6198	951.6214	1.2046	0.0126	0.0089	0.0593
	34	0.5926	956.8389	1.1921	0.0120	0.0090	0.0553
	35	0.5666	962.0850	1.1798	0.0115	0.0090	0.0516
	36	0.5505	967.4195	1.1663	0.0113	0.0091	0.0488
	37	0.5349	972.7836	1.1529	0.0110	0.0091	0.0462
	38	0.5197	978.1775	1.1396	0.0108	0.0091	0.0437
	39	0.5050	983.6013	1.1266	0.0106	0.0092	0.0413
	40	0.4906	989.0551	1.1136	0.0104	0.0092	0.0391
	41	0.4868	984.5077	1.0994	0.0105	0.0092	0.0382
	42	0.4829	979.9812	1.0854	0.0106	0.0091	0.0374
	43	0.4791	975.4754	1.0715	0.0106	0.0091	0.0366
	44	0.4753	970.9904	1.0579	0.0107	0.0091	0.0359
	45	0.4716	966.5261	1.0444	0.0108	0.0090	0.0351
	46	0.4762	930.2224	1.0417	0.0110	0.0087	0.0368
	47	0.4809	895.2623	1.0391	0.0112	0.0084	0.0386
	48	0.4857	861.6546	1.0364	0.0115	0.0081	0.0405
	49	0.4905	829.2899	1.0338	0.0117	0.0078	0.0425
	50	0.4953	798.1410	1.0311	0.0120	0.0075	0.0445
	51	0.4801	830.7086	1.0417	0.0125	0.0078	0.0425
	52	0.4653	864.6052	1.0523	0.0130	0.0081	0.0405
	53	0.4510	899.8848	1.0631	0.0136	0.0085	0.0386
	54	0.4371	936.6040	1.0739	0.0142	0.0088	0.0369
	55	0.4236	974.8216	1.0849	0.0148	0.0091	0.0352
	56	0.4100	1022.8646	1.0832	0.0157	0.0096	0.0315
	57	0.3969	1073.2754	1.0815	0.0165	0.0101	0.0282
	58	0.3841	1126.1707	1.0797	0.0175	0.0105	0.0252
	59	0.3718	1181.6728	1.0780	0.0184	0.0111	0.0226
	60	0.3599	1239.9103	1.0763	0.0195	0.0116	0.0202
	61	0.3501	1264.0964	1.1266	0.0206	0.0118	0.0202
	62	0.3406	1288.7544	1.1792	0.0219	0.0121	0.0201
	63	0.3313	1313.8933	1.2343	0.0232	0.0123	0.0201
	64	0.3223	1339.5226	1.2920	0.0247	0.0126	0.0201
	65	0.3135	1365.6518	1.3524	0.0262	0.0128	0.0200
	66	0.3131	1350.2912	1.3589	0.0264	0.0127	0.0209
	67	0.3127	1335.1033	1.3655	0.0266	0.0125	0.0218
	68	0.3124	1320.0862	1.3722	0.0269	0.0124	0.0228
	69	0.3120	1305.2381	1.3788	0.0271	0.0123	0.0238
	70	0.3116	1290.5569	1.3855	0.0273	0.0122	0.0248

HIGHWAY EMISSIONS FACTORS (g/mi)								
Model Year 2044								
Mode	Speed	CO	CO2	NOX	PM2.5	SOX	VOC	PM2.5
Auto	0	1.7535	60.2289	0.1686	0.0008	0.0006	0.1451	0.0008
	5	0.5559	330.9034	0.0223	0.0018	0.0033	0.0249	0.0018
	6	0.5576	324.7042	0.0221	0.0016	0.0032	0.0233	0.0016
	7	0.5594	318.6210	0.0219	0.0015	0.0031	0.0217	0.0015
	8	0.5612	312.6518	0.0218	0.0014	0.0031	0.0203	0.0014
	0	0.6659	5.1023	0.7656	0.0000	0.0001	0.0203	0.0000
	5	0.6516	865.1623	0.4277	0.0095	0.0083	0.0478	0.0095
	6	0.6625	866.0485	0.5016	0.0092	0.0083	0.0465	0.0092
	7	0.6737	866.9357	0.5882	0.0090	0.0082	0.0453	0.0090
	8	0.6850	867.8238	0.6897	0.0087	0.0082	0.0441	0.0087
Truck	9	0.6966	868.7128	0.8088	0.0084	0.0082	0.0430	0.0084
	10	0.7083	869.6027	0.9484	0.0082	0.0081	0.0419	0.0082
	11	0.6600	836.5388	0.8852	0.0079	0.0078	0.0398	0.0079
	12	0.6150	804.7321	0.8261	0.0077	0.0075	0.0378	0.0077
	13	0.5731	774.1348	0.7710	0.0074	0.0073	0.0359	0.0074
	14	0.5340	744.7008	0.7196	0.0072	0.0070	0.0341	0.0072
	15	0.4976	716.3860	0.6716	0.0070	0.0067	0.0324	0.0070
	16	0.4584	707.5670	0.6712	0.0066	0.0067	0.0303	0.0066
	17	0.4222	698.8566	0.6709	0.0062	0.0066	0.0283	0.0062
	18	0.3890	690.2534	0.6706	0.0058	0.0065	0.0265	0.0058
	19	0.3583	681.7562	0.6703	0.0055	0.0064	0.0247	0.0055
	20	0.3300	673.3635	0.6699	0.0052	0.0063	0.0231	0.0052
	21	0.3157	654.8921	0.6323	0.0051	0.0062	0.0230	0.0051
	22	0.3021	636.9274	0.5968	0.0051	0.0060	0.0229	0.0051
	23	0.2890	619.4555	0.5632	0.0050	0.0058	0.0227	0.0050
	24	0.2765	602.4629	0.5316	0.0050	0.0057	0.0226	0.0050
	25	0.2645	585.9364	0.5017	0.0049	0.0055	0.0225	0.0049
	26	0.2525	579.6648	0.4836	0.0047	0.0054	0.0213	0.0047
	27	0.2410	573.4603	0.4662	0.0045	0.0054	0.0202	0.0045
	28	0.2300	567.3222	0.4493	0.0043	0.0053	0.0191	0.0043
29	0.2196	561.2498	0.4331	0.0041	0.0053	0.0181	0.0041	
30	0.2096	555.2424	0.4175	0.0039	0.0052	0.0172	0.0039	
31	0.2018	559.8303	0.4131	0.0038	0.0052	0.0162	0.0038	
32	0.1942	564.4561	0.4088	0.0038	0.0053	0.0153	0.0038	
33	0.1870	569.1201	0.4045	0.0037	0.0053	0.0144	0.0037	
34	0.1800	573.8226	0.4003	0.0036	0.0053	0.0136	0.0036	
35	0.1733	578.5640	0.3961	0.0035	0.0054	0.0128	0.0035	
36	0.1688	584.0671	0.3883	0.0036	0.0054	0.0122	0.0036	
37	0.1645	589.6225	0.3806	0.0037	0.0055	0.0116	0.0037	
38	0.1603	595.2308	0.3731	0.0038	0.0055	0.0111	0.0038	
39	0.1561	600.8924	0.3658	0.0038	0.0056	0.0105	0.0038	
40	0.1521	606.6079	0.3586	0.0039	0.0056	0.0100	0.0039	
41	0.1479	611.8629	0.3530	0.0042	0.0057	0.0098	0.0042	
42	0.1438	617.1633	0.3474	0.0044	0.0057	0.0096	0.0044	
43	0.1399	622.5096	0.3420	0.0047	0.0058	0.0094	0.0047	
44	0.1360	627.9023	0.3366	0.0050	0.0058	0.0093	0.0050	
45	0.1323	633.3417	0.3314	0.0053	0.0059	0.0091	0.0053	
46	0.1300	609.3532	0.3103	0.0054	0.0057	0.0093	0.0054	
47	0.1278	586.2732	0.2906	0.0055	0.0055	0.0096	0.0055	
48	0.1256	564.0674	0.2722	0.0056	0.0053	0.0099	0.0056	
49	0.1234	542.7027	0.2549	0.0057	0.0051	0.0102	0.0057	
50	0.1213	522.1472	0.2387	0.0058	0.0049	0.0105	0.0058	
51	0.1184	546.1226	0.2548	0.0064	0.0051	0.0101	0.0064	
52	0.1156	571.1989	0.2719	0.0070	0.0053	0.0098	0.0070	
53	0.1129	597.4266	0.2902	0.0076	0.0056	0.0094	0.0076	
54	0.1102	624.5585	0.3097	0.0083	0.0058	0.0091	0.0083	
55	0.1076	653.5501	0.3306	0.0091	0.0061	0.0088	0.0091	
56	0.1045	686.2747	0.3648	0.0100	0.0064	0.0085	0.0100	
57	0.1015	720.5379	0.4025	0.0111	0.0067	0.0083	0.0111	
58	0.0986	756.7217	0.4442	0.0123	0.0071	0.0080	0.0123	
59	0.0957	794.6123	0.4902	0.0137	0.0074	0.0078	0.0137	
60	0.0930	834.4002	0.5409	0.0151	0.0078	0.0076	0.0151	
61	0.0918	852.4879	0.5861	0.0162	0.0080	0.0078	0.0162	
62	0.0907	870.9677	0.6351	0.0173	0.0082	0.0081	0.0173	
63	0.0896	889.8481	0.6882	0.0185	0.0083	0.0084	0.0185	
64	0.0885	909.1377	0.7457	0.0197	0.0085	0.0086	0.0197	
65	0.0874	928.8456	0.8081	0.0211	0.0087	0.0089	0.0211	
66	0.0866	929.4837	0.8155	0.0213	0.0087	0.0091	0.0213	
67	0.0858	930.1224	0.8230	0.0216	0.0087	0.0092	0.0216	
68	0.0850	930.7614	0.8306	0.0218	0.0087	0.0094	0.0218	
69	0.0842	931.4009	0.8383	0.0220	0.0088	0.0095	0.0220	
70	0.0834	932.0408	0.8460	0.0223	0.0088	0.0097	0.0223	

Emissions Tables

HIGHWAY EMISSIONS FACTORS (g/mi)								
Model Year 2024								
Mode	Speed	CO	CO2	NOX	PM2.5	SOX	VOC	PM2.5
Auto	0	3.5182	78.9185	0.3056	0.0020	0.0008	0.3900	0.0020
	5	1.3616	555.4365	0.0959	0.0065	0.0055	0.0868	0.0065
	6	1.3409	538.7039	0.0933	0.0060	0.0053	0.0797	0.0060
	7	1.3206	522.4754	0.0907	0.0055	0.0052	0.0732	0.0055
	8	1.3005	506.7358	0.0881	0.0051	0.0050	0.0672	0.0051
Bus	0	1.7524	13.2318	0.5397	0.0001	0.0001	0.0815	0.0001
	5	31.9638	5318.2891	4.1913	0.0368	0.0162	0.3550	0.0368
	6	29.9626	4954.2773	3.8723	0.0346	0.0157	0.3264	0.0346
	7	28.0868	4615.1803	3.5776	0.0325	0.0153	0.3000	0.0325
	8	26.3284	4299.2929	3.3053	0.0306	0.0149	0.2758	0.0306
	9	24.6801	4005.0265	3.0537	0.0287	0.0145	0.2536	0.0287
	10	23.1349	3730.9013	2.8213	0.0270	0.0141	0.2331	0.0270
	11	21.8499	3416.1438	2.5833	0.0241	0.0133	0.2059	0.0241
	12	20.6362	3127.9409	2.3655	0.0216	0.0127	0.1819	0.0216
	13	19.4899	2864.0522	2.1660	0.0193	0.0120	0.1606	0.0193
	14	18.4073	2622.4265	1.9833	0.0172	0.0114	0.1419	0.0172
	15	17.3848	2401.1855	1.8160	0.0154	0.0108	0.1253	0.0154
	16	16.1133	2243.2861	1.5686	0.0120	0.0092	0.1068	0.0120
	17	21.0138	2286.7867	1.3549	0.0093	0.0076	0.0910	0.0093
	18	23.1031	2231.6477	1.1703	0.0073	0.0066	0.0776	0.0073
	19	25.4002	2177.8382	1.0108	0.0057	0.0056	0.0661	0.0057
	20	27.9257	2125.3262	0.8731	0.0044	0.0047	0.0563	0.0044
	21	21.3276	1958.9478	0.9662	0.0053	0.0055	0.0589	0.0053
	22	16.2884	1805.5941	1.0692	0.0063	0.0064	0.0616	0.0063
	23	12.4399	1664.2455	1.1832	0.0076	0.0075	0.0644	0.0076
	24	9.5006	1533.9621	1.3094	0.0091	0.0087	0.0673	0.0091
	25	7.2559	1413.8779	1.4490	0.0109	0.0101	0.0704	0.0109
	26	7.1789	1378.7891	1.4072	0.0106	0.0099	0.0677	0.0106
	27	7.1028	1344.5710	1.3666	0.0103	0.0097	0.0651	0.0103
	28	7.0275	1311.2022	1.3272	0.0100	0.0095	0.0626	0.0100
	29	6.9529	1278.6915	1.2890	0.0097	0.0094	0.0602	0.0097
	30	6.8792	1246.9284	1.2518	0.0095	0.0092	0.0579	0.0095
	31	6.8044	1222.2643	1.2340	0.0095	0.0091	0.0564	0.0095
	32	6.5146	1198.0880	1.2165	0.0096	0.0090	0.0550	0.0096
	33	6.3396	1174.3900	1.1992	0.0096	0.0089	0.0536	0.0096
	34	6.1693	1151.1607	1.1822	0.0097	0.0088	0.0523	0.0097
	35	6.0035	1128.3909	1.1654	0.0097	0.0087	0.0510	0.0097
	36	5.7912	1115.9714	1.1584	0.0099	0.0087	0.0498	0.0099
	37	5.5864	1103.6886	1.1514	0.0100	0.0087	0.0487	0.0100
	38	5.3889	1091.5410	1.1445	0.0101	0.0087	0.0476	0.0101
	39	5.1983	1079.5271	1.1376	0.0102	0.0087	0.0466	0.0102
	40	5.0145	1067.6455	1.1308	0.0103	0.0087	0.0455	0.0103
	41	4.8804	1062.5905	1.1354	0.0104	0.0087	0.0446	0.0104
	42	4.7499	1057.4997	1.1399	0.0105	0.0087	0.0436	0.0105
	43	4.6229	1052.4630	1.1446	0.0105	0.0087	0.0427	0.0105
	44	4.4993	1047.4503	1.1492	0.0106	0.0087	0.0418	0.0106
	45	4.3791	1042.4615	1.1538	0.0106	0.0088	0.0409	0.0106
	46	4.3262	1046.1259	1.1440	0.0105	0.0088	0.0401	0.0105
	47	4.2740	1049.8033	1.1342	0.0104	0.0089	0.0392	0.0104
	48	4.2223	1053.4936	1.1245	0.0103	0.0089	0.0384	0.0103
	49	4.1714	1057.1969	1.1148	0.0101	0.0090	0.0377	0.0101
	50	4.1210	1060.9131	1.1053	0.0100	0.0090	0.0369	0.0100
	51	4.0545	1079.6318	1.1102	0.0102	0.0092	0.0371	0.0102
	52	3.9891	1098.6808	1.1150	0.0104	0.0094	0.0373	0.0104
	53	3.9248	1118.0659	1.1199	0.0105	0.0096	0.0374	0.0105
	54	3.8615	1137.7929	1.1249	0.0107	0.0098	0.0376	0.0107
	55	3.7992	1157.8681	1.1298	0.0109	0.0101	0.0378	0.0109
	56	3.6830	1184.1948	1.1319	0.0113	0.0103	0.0380	0.0113
	57	3.5703	1211.1202	1.1339	0.0117	0.0106	0.0382	0.0117
	58	3.4611	1238.6578	1.1360	0.0121	0.0109	0.0384	0.0121
	59	3.3552	1266.8214	1.1380	0.0125	0.0113	0.0386	0.0125
	60	3.2525	1295.6255	1.1401	0.0130	0.0116	0.0388	0.0130
	61	3.1682	1321.8235	1.1445	0.0135	0.0119	0.0393	0.0135
	62	3.0860	1348.5512	1.1490	0.0139	0.0122	0.0397	0.0139
	63	3.0060	1375.8194	1.1535	0.0144	0.0125	0.0402	0.0144
	64	2.9280	1403.6389	1.1580	0.0149	0.0128	0.0407	0.0149
	65	2.8521	1432.0209	1.1625	0.0154	0.0131	0.0412	0.0154
	66	2.7293	1425.6298	1.1936	0.0165	0.0130	0.0376	0.0165
	67	2.6119	1419.2653	1.2256	0.0176	0.0129	0.0348	0.0176
	68	2.4994	1412.9301	1.2584	0.0188	0.0128	0.0320	0.0188
	69	2.3919	1406.6232	1.2922	0.0201	0.0127	0.0294	0.0201
	70	2.2889	1400.3445	1.3268	0.0215	0.0126	0.0270	0.0215

Source: California Air Resources Board, EMFAC 2021

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

HIGHWAY EMISSIONS FACTORS (g/mi)								
Model Year 2044								
Mode	Speed	CO	CO2	NOX	PM2.5	SOX	VOC	PM2.5
Auto	0	1.7535	60.2289	0.1686	0.0008	0.0006	0.1451	0.0008
	5	0.5559	330.9034	0.0223	0.0018	0.0033	0.0249	0.0018
	6	0.5576	324.7042	0.0221	0.0016	0.0032	0.0233	0.0016
	7	0.5594	318.6210	0.0219	0.0015	0.0031	0.0217	0.0015
	8	0.5612	312.6518	0.0218	0.0014	0.0031	0.0203	0.0014
Bus	0	0.7539	6.0009	0.3925	0.0001	0.0001	0.0363	0.0001
	5	4.4133	1358.9040	0.8621	0.0053	0.0083	0.0694	0.0053
	6	3.5422	1229.3096	0.7928	0.0049	0.0079	0.0610	0.0049
	7	2.8431	1112.0741	0.7290	0.0046	0.0075	0.0537	0.0046
	8	2.2820	1006.0191	0.6704	0.0042	0.0071	0.0472	0.0042
	9	1.8316	910.0782	0.6165	0.0039	0.0067	0.0415	0.0039
	10	1.4701	823.2868	0.5669	0.0037	0.0063	0.0365	0.0037
	11	1.2749	759.9968	0.5047	0.0033	0.0059	0.0308	0.0033
	12	1.1056	701.5721	0.4493	0.0029	0.0055	0.0259	0.0029
	13	0.9588	647.6388	0.4000	0.0026	0.0052	0.0219	0.0026
	14	0.8315	597.8517	0.3561	0.0024	0.0048	0.0184	0.0024
	15	0.7211	551.8919	0.3171	0.0021	0.0045	0.0155	0.0021
	16	0.5336	427.0975	0.2446	0.0016	0.0035	0.0113	0.0016
	17	0.3949	330.5218	0.1888	0.0012	0.0027	0.0082	0.0012
	18	0.2922	255.7839	0.1456	0.0009	0.0021	0.0060	0.0009
	19	0.2162	197.9458	0.1124	0.0007	0.0017	0.0044	0.0007
	20	0.1600	153.1861	0.0867	0.0005	0.0013	0.0032	0.0005
	21	0.1995	195.5079	0.1100	0.0007	0.0016	0.0039	0.0007
	22	0.2487	249.5223	0.1395	0.0009	0.0021	0.0049	0.0009
	23	0.3100	318.4596	0.1770	0.0011	0.0027	0.0061	0.0011
	24	0.3864	406.4427	0.2246	0.0014	0.0034	0.0076	0.0014
	25	0.4817	518.7335	0.2850	0.0018	0.0044	0.0094	0.0018
	26	0.4524	503.8763	0.2716	0.0017	0.0043	0.0089	0.0017
	27	0.4249	489.4446	0.2589	0.0017	0.0042	0.0085	0.0017
	28	0.3991	475.4262	0.2468	0.0017	0.0041	0.0081	0.0017
	29	0.3748	461.8094	0.2352	0.0016	0.0039	0.0077	0.0016
	30	0.3520	448.5826	0.2242	0.0016	0.0038	0.0073	0.0016
	31	0.3357	444.9934	0.2180	0.0016	0.0038	0.0071	0.0016
	32	0.3202	441.4329	0.2121	0.0016	0.0038	0.0070	0.0016
	33	0.3054	437.9009	0.2062	0.0017	0.0038	0.0068	0.0017
	34	0.2913	434.3972	0.2006	0.0017	0.0038	0.0066	0.0017
	35	0.2779	430.9215	0.1951	0.0017	0.0037	0.0065	0.0017
	36	0.2673	436.4497	0.1926	0.0018	0.0038	0.0064	0.0018
	37	0.2571	442.0488	0.1902	0.0019	0.0039	0.0064	0.0019
	38	0.2473	447.7198	0.1877	0.0020	0.0039	0.0063	0.0020
	39	0.2378	453.4634	0.1854	0.0021	0.0040	0.0063	0.0021
	40	0.2288	459.2808	0.1830	0.0022	0.0041	0.0062	0.0022
	41	0.2233	464.4658	0.1794	0.0022	0.0041	0.0061	0.0022
	42	0.2179	469.70					

HEALTH COST OF TRANSPORTATION EMISSIONS							
(\$/ton)							
Area	Proj Loc	CO	CO ₂ e	NO _x	PM _{2.5}	SO _x	VOC
LA/South Coast	1	\$185	\$211	\$18,235	\$873,809	\$48,807	\$4,600
CA Urban Area	2	\$95	\$211	\$18,235	\$873,809	\$48,807	\$1,515
CA Rural Area	3	\$85	\$211	\$18,235	\$873,809	\$48,807	\$1,190

CO₂e Updater Increase in value per year

Sources: McCubbin and Delucchi, 1996 for emissions other than CO₂e
Interagency Working Group on Social Cost of Carbon, United States Government, 2021 for CO₂e

PASSENGER TRAIN EMISSIONS FACTORS								
(g/train-mile)								
Mode	Year	CO	CO ₂	NO _x	PM _{2.5}	SO _x	VOC	PM ₁₀
Passenger Train	2010	8.11	5150.45	96.11	2.03			2.03
	2040	0.41	359.31	4.87	0.00			0.00

LIGHT RAIL EMISSIONS FACTORS								
(g/veh-mile)								
Mode	Year	CO	CO ₂	NO _x	PM _{2.5}	SO _x	VOC	PM ₁₀
Light Rail	2021	0.31	1241.73	0.39	0.06	0.09	0.03	0.06
	2022	0.31	1241.73	0.39	0.06	0.09	0.03	0.06

FREIGHT LOCOMOTIVE EMISSIONS FACTORS								
(g/gal)								
Mode	Year	CO	CO ₂	NO _x	PM _{2.5}	SO _x	VOC	PM ₁₀
Freight Rail	2020	26.62	10,217	107.38	3.11			3.11
	2030	26.62	10,217	70.92	1.83			1.83

Freight Rail Fuel Efficiency ton-miles/gal
Fuel Burned at Idle gal/hr

Sources: Argonne National Laboratory, Energy Systems, GREET Model, 2021
FTA, National Transit Database, Fuel and Energy, 2019
Energy Information Administration, Electricity Retail Sales, 2019
Association of American Railroads, Freight Rail & Preserving the Environment, April 2021
California Environmental Protection Agency / Air Resources Board, Technology Assessment:
Freight Locomotives, November 2016

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	1.000	1.025
25	1.000	1.025
50	1.000	1.025
75	1.000	1.025
100	1.000	1.025
125	1.000	1.025
150	1.000	1.013
175	1.000	1.000
200	1.000	0.980
225	1.000	0.949
250	1.000	0.919
275	0.991	0.890
300	0.981	0.862
325	0.971	0.834
350	0.961	0.808
375	0.952	0.782
400	0.942	0.758
425	0.932	0.734
450	0.923	0.709

Source: Botterill, 1996 and 1997

FUEL CONSUMPTION (percent adjustment)		
IRI	Auto	Truck
0	0.971	0.961
25	0.977	0.965
50	0.980	0.970
75	0.982	0.975
100	0.985	0.980
125	0.990	0.986
150	0.995	0.993
175	1.000	1.000
200	1.005	1.007
225	1.012	1.017
250	1.019	1.026
275	1.027	1.036
300	1.034	1.047
325	1.041	1.058
350	1.050	1.070
375	1.061	1.085
400	1.072	1.100
425	1.082	1.114
450	1.093	1.129

Source: Texas Transportation Institute, 1994

NON-FUEL COSTS (percent adjustment)		
IRI	Auto	Truck
0	1.000	1.000
25	1.000	1.000
50	1.000	1.000
75	1.000	1.000
100	1.000	1.000
125	1.000	1.000
150	1.017	1.018
175	1.034	1.038
200	1.052	1.058
225	1.070	1.078
250	1.088	1.097
275	1.105	1.117
300	1.123	1.137
325	1.141	1.156
350	1.159	1.176
375	1.176	1.196
400	1.194	1.216
425	1.212	1.235
450	1.230	1.255

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	1.000	1.000
0.002	0.982	0.988
0.004	0.964	0.976
0.006	0.945	0.964
0.008	0.927	0.952
0.010	0.909	0.939
0.012	0.891	0.927
0.014	0.873	0.915
0.016	0.855	0.903
0.018	0.836	0.891
0.020	0.799	0.879
0.022	0.747	0.867
0.024	0.706	0.855
0.026	0.664	0.842
0.028	0.623	0.817
0.030	0.581	0.789
0.032	0.540	0.761
0.034	0.498	0.734
0.036	0.476	0.706
0.038	0.473	0.678
0.040	0.471	0.650
0.042	0.468	0.623
0.044	0.466	0.595
0.046	0.463	0.567
0.048	0.460	0.540
0.050	0.458	0.512
0.052	0.455	0.484
0.054	0.453	0.476
0.056	0.453	0.474
0.058	0.453	0.473
0.060	0.453	0.471
0.062	0.453	0.469
0.064	0.453	0.467
0.066	0.453	0.466
0.068	0.453	0.464
0.070	0.453	0.462
0.072	0.453	0.460
0.074	0.453	0.459
0.076	0.453	0.457
0.078	0.453	0.455
0.080	0.453	0.453

Source: Fitzpatrick, Brewer, and Venglar, 2003

TMS Adjustments (used only for ramp metering, ramp metering signal coordination, incident management, traveler information projects, AVL, 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	1.00
ORsev	0.95	1.03	1.00	1.00	0.00	0.00	5.67	1.00
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
27) 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

Reliability Tables (used for calculating travel time reliability impacts if included)

C11 RELIABILITY PARAMETERS (coefficients for standard deviation calculations)			
AlphaTTI	BetaTTI	AlphaSTD	BetaSTD
1.0274	1.2204	0.71	0.56

Source: Pricing and Travel Time Reliability Enhancements in the SANDAG Activity-Based Travel Model: Final Report, 2016.

RELIABILITY RATIO (value of reliability relative to value of time)	
Mode	Value
Auto	0.8
Truck	1.1

Source: SHRP2 Project C11: Reliability Analysis Tool: User's Guide, January 2013.