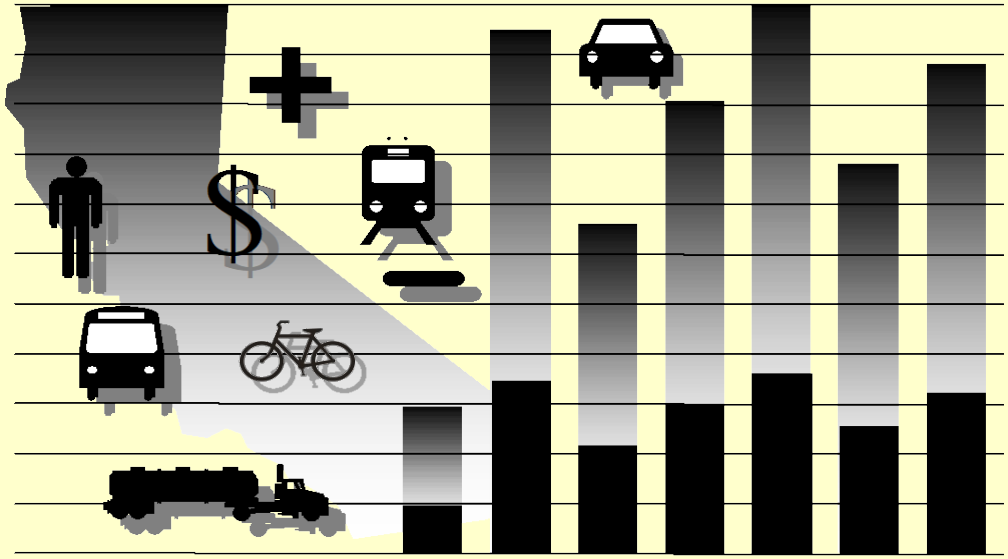
California Department Of Transportation

California Active Transportation Benefit/Cost Analysis Model for 2022 INFRA/RAISE Applications

(Cal-B/C AT) Version 8.1



Office of Transportation Economics
Division of Transportation Planning

March 2022

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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.

	Existing Facility Improvement		New Construction	
Benefit Categories by Facility Type	**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: 4

PROJECT: SFMTA - Howard Street Streetscape Project

EA:

PPNO:

1A

PROJECT AND SITE CHARACTERISTICS

Type of Project

Existing facility upgrade only = 1
New facility only, no existing facility work = 2
Existing facility upgrade and new facility extension = 3

	3	

Total Project Length

		Project Type Data Check
Total Existing Facility Length (miles)	1	OK
Total New Facility Length (miles)	1	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)	0
Programmatic Initiatives? (enter 1 for Yes, 0 for No)	0

Construction

		Constr. Years Data Check
Length of Construction Period (years)	4	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	0	0	OK
Bike Lanes (miles)	II	0	0	
Bike Route (miles)	III	0	0	
Separated Bikeways, Cycle Tracks (miles)	IV	1	1	
Total		1	1	

Pedestrian Improvements	No Build (Yes =1 or No=0)	Build (Yes =1 or No=0)
Street Lighting	0	1
Curb Level	0	1
Crowding	0	1
Pavement Evenness	0	1
Information Panels	0	1
Benches	0	1
Directional Signage	0	1

Trip Data - Adults

Cycling

Daily Trips - Current	1,030	
Projected Annual Growth Rates from Year 1 (%)	4%	4%
Daily Trips - Year 1 (post-construction)	1,205	1,205
Daily Trips - Year 20 (post-construction)	2,640	2,640

Pedestrian

Daily Trips - Current	7,389	
Projected Annual Growth Rates from Year 1 (%)	5%	5%
Daily Trips - Year 1 (post-construction)	8,981	8,981
Daily Trips - Year 20 (post-construction)	23,830	23,830

Trip Data - Children - SRTS

Cycling

Daily Trips - Current	0	
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	0	
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	8
Time Savings per Improved Intersection (min.)	0
Intersection improvements on SRTS? (enter 1 for Yes, 0 for No)	0

Accident Rate - Current Conditions

Cyclists

	Count (No.)	Rate per Year
Number of Years of Data	6.00	
Existing Conditions		
Total Number of Accidents (Tot)	34	5.7
Number of Fatal Accidents (Fat)	2	0.3
Number of Injury Accidents (Inj)	1	0.2
Number of \Property Damage Only (PDO) Accidents	31	5.2
Annual Growth Rate in Accidents (%/year)	2.7%	0.0045

Pedestrians

	Count (No.)	Rate per Year
Number of Years of Data	6.00	
Existing Conditions		
Total Number of Accidents (Tot)	41	6.8
Number of Fatal Accidents (Fat)	1	0.2
Number of Injury Accidents (Inj)	2	0.3
Number of \Property Damage Only (PDO) Accidents	38	6.3
Annual Growth Rate in Accidents (%/year)	5.5%	0.009166667

Safety Countermeasures (improvements to existing facilities only)

	Yes =1
Signalized Intersection	
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)	1
Pedestrian Crossing	1
Other Reduction Factor Countermeasures	1

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
No Facility	0	1		OK
Bike Paths (miles)	I		0	
Bike Lanes (miles)	II		0	
Bike Route (miles)	III		0	
Separated Bikeways, Cycle Tracks (miles)	IV		1	
Total		1	1	

Pedestrian Improvements	Yes =1
Street Lighting	0
Curb Level	0
Crowding	0
Pavement Evenness	0
Information Panels	0
Benches	0
Directional Signage	0

Trip Data - Adults

Cycling	No Build	Build
Daily Trips - Current	0	
Projected Annual Growth Rates from Year 1 (%)	0%	4%
Daily Trips - Year 1 (post-construction)	0	0
Daily Trips - Year 20 (post-construction)	0	0

Pedestrian

Daily Trips - Current	0	
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

	No Build	Build
Daily Trips - Current	0	
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	0	
Projected Annual Growth Rates from Year 1 (%)		
Daily Trips - Year 1 (post-construction)	0	0
Daily Trips - Year 20 (post-construction)	0	0

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)	
		INITIAL COSTS			SUBSEQUENT COSTS				
		Project Support	R / W	Construction	Maint./ Op.	Rehab.		Constant Dollars	Present Value
Infrastructure Program Costs									
1	0	$650.0			<-- Must enter a cost			$650,000	$650,000
2	1	$4,200.0		$25,000.0				29,200,000	28,349,515
3	1			$2,900.0				2,900,000	2,733,528
4	1			$16,000.0				16,000,000	14,642,267
5	1			$1,100.0				1,100,000	977,336
6	0							0	0
7	0							0	0
8	0							0	0
Annual Infrastructure O&M Costs									
1					$168			$167,500	$148,822
2					$168			167,500	144,487
3					$168			167,500	140,279
4					$168			167,500	136,193
5					$168			167,500	132,226
6					$168			167,500	128,375
7					$168			167,500	124,636
8					$168			167,500	121,006
9					$168			167,500	117,481
10					$168			167,500	114,059
11					$168			167,500	110,737
12					$168			167,500	107,512
13					$168			167,500	104,380
14					$168			167,500	101,340
15					$168			167,500	98,389
16					$168			167,500	95,523
17					$168			167,500	92,741
18					$168			167,500	90,040
19					$168			167,500	87,417
20					$168			167,500	84,871
Total		$4,850	$0	$45,000	$3,350	$0		$53,200,000	$49,633,157

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)	
		INITIAL COSTS			SUBSEQUENT COSTS				
		Project Support	R / W	Construction	Maint./ Op.	Rehab.		Constant Dollars	Present Value

Non-Infrastructure Program Costs									
1					<-- Must enter a cost			$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	Pedestrian Daily Trips per
Existing Facility Users	1,030	7,389
New Facility Users	0	0

	Safety Measures - Existing only
Existing Facility Characteristics	OK

District:	**4**		
PROJECT:	**SFMTA - Howard Street Streetscape Project**	EA:	**0**
		PPNO:	**0**

1I

NON-INFRASTRUCTURE PROGRAM CHARACTERISTICS

Programmatic Initiatives? — No

Scale of Initiative

Participants / Beneficiaries

		Data Check on Initiative
Numbers of People Reached per Year		**OK**
Average Percentage of Current Active Bicyclists Reached per Year		
Average Percentage of Current Active Pedestrians Reached per Year		

Scoring Criteria

Total Number of Criteria	4
Total Criteria Weight Sum	100%

1) Target Audience — Criteria Weight: 25%

Indicators	(mark as %; sum must equal 100%)	Indicator Weight
Younger than 10		10%
10-12		20%
13-24		25%
25-55		15%
55+		5%
Indicator-Weighted Score	**Sum must equal 100%**	

2) Characteristics Promotional Effort — Criteria Weight: 25%

Indicators	(enter 1 for Yes on all that apply)	Indicator Weight
Effort Targets 5 E's or 5 P's		5%
Knowledgeable Staff/Educator		5%
Partnership/Volunteers		5%
Creates Community Ownership/Relationship		5%
Part of Bigger Effort (e.g., political support)		5%
Indicator-Weighted Score	**0**	

Criteria Weight

3) Type of Impact and Messaging — 25%

Indicators	(enter 1 for Yes on all that apply)	Indicator Weight
Outreach is Hands-on (self-efficacy)		5%
Overcome Barriers (e.g., dist., time, etc.)		5%
Eliminates Hazards/Threats (speed, crime, etc.)		5%
Connected or Addresses Connectivity Challenges		5%
Creating Value in Using Active Transportation		5%
Indicator-Weighted Score	0	

4) Frequency of Outreach Effort — Criteria Weight: 25%

Indicators	(enter 1 for Yes for only one option)	Indicator Weight
One Day		5%
One Month		10%
One Year		15%
Multiple Years		20%
Continuous Effort		25%
Indicator-Weighted Score	0	

Projected New Active Transportation Cyclists

Number of Potential New Facility Users	0
Weighted Impact Score of Outreach	
Program Impact Score	
Years of Outreach	0.0
Multi-year Program Impact Score	

Cost Effectiveness

Total Discounted Cost	$0
Cost per Program Impact Score	

Projected New Active Transportation Pedestrians

Number of Potential New Facility Users	0
Weighted Impact Score of Outreach	
Program Impact Score	
Years of Outreach	0.0
Multi-year Program Impact Score	

Cost Effectiveness

Total Discounted Cost	$0
Cost per Program Impact Score	

2A ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - CYCLING - Existing Facility Segment

	Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
No Build - Cycling				
Year 1				
Annual Trips - Commuting	81,804		81,804	
Annual Trips - Other Destinations	155,252		155,252	
Annual Trips - Recreational	202,752		0	Recreational Users not Included in Benefits
Users - Commuting	101		101	
Users - Other Destinations	191		191	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	182,424		182,424	
Total Miles - Other Destinations	346,213		346,213	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Trips - Commuting	179,243		179,243	
Trips - Other Destinations	340,177		340,177	
Trips - Recreational	444,254		0	Recreational Users not Included in Benefits
Users - Commuting	220		220	
Users - Other Destinations	418		418	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	399,713		399,713	
Total Miles - Other Destinations	758,595		758,595	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Build - Cycling				
Year 1				
Annual Trips - Commuting	81,804		81,804	
Annual Trips - Other Destinations	155,252		155,252	
Annual Trips - Recreational	202,752		0	Recreational Users not Included in Benefits
Users - Commuting	101		101	
Users - Other Destinations	191		191	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	182,424		182,424	
Total Miles - Other Destinations	346,213		346,213	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Annual Trips - Commuting	179,243		179,243	
Annual Trips - Other Destinations	340,177		340,177	
Annual Trips - Recreational	444,254		0	Recreational Users not Included in Benefits
Users - Commuting	220		220	
Users - Other Destinations	418		418	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	399,713		399,713	
Total Miles - Other Destinations	758,595		758,595	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits

2E ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - PEDESTRIAN - Existing Facility Segment

	Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
No Build - Pedestrian				
Year 1				
Annual Trips - Commuting	170,467		170,467	
Annual Trips - Other Destinations	1,304,724		1,304,724	
Annual Trips - Recreational	1,803,011		0	Recreational Users not Included in Benefits
Users - Commuting	222		222	
Users - Other Destinations	1,702		1,702	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	243,426		243,426	
Total Miles - Other Destinations	1,863,147		1,863,147	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Annual Trips - Commuting	452,298		452,298	
Annual Trips - Other Destinations	3,461,822		3,461,822	
Annual Trips - Recreational	4,783,925		0	Recreational Users not Included in Benefits
Users - Commuting	590		590	
Users - Other Destinations	4,516		4,516	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	645,882		645,882	
Total Miles - Other Destinations	4,943,482		4,943,482	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Build - Pedestrian				
Year 1				
Annual Trips - Commuting	170,467		170,467	
Annual Trips - Other Destinations	1,304,724		1,304,724	
Annual Trips - Recreational	1,803,011		0	Recreational Users not Included in Benefits
Users - Commuting	222		222	
Users - Other Destinations	1,702		1,702	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	243,426		243,426	
Total Miles - Other Destinations	1,863,147		1,863,147	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Annual Trips - Commuting	452,298		452,298	
Annual Trips - Other Destinations	3,461,822		3,461,822	
Annual Trips - Recreational	4,783,925		0	Recreational Users not Included in Benefits
Users - Commuting	590		590	
Users - Other Destinations	4,516		4,516	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	645,882		645,882	
Total Miles - Other Destinations	4,943,482		4,943,482	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits

2B ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - CYCLING - New Facility Segment

	Calculated by Model		Used for Proj. Eval.	Reason for Change
No Build - Cycling				
Year 1				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Trips - Commuting	0		0	
Trips - Other Destinations	0		0	
Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Build - Cycling				
Year 1				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits

2F ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - PEDESTRIAN - New Facility Segment

	Calculated by Model		Used for Proj. Eval.	Reason for Change
No Build - Pedestrian				
Year 1				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Build - Pedestrian				
Year 1				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits
Year 20				
Annual Trips - Commuting	0		0	
Annual Trips - Other Destinations	0		0	
Annual Trips - Recreational	0		0	Recreational Users not Included in Benefits
Users - Commuting	0		0	
Users - Other Destinations	0		0	
Users - Recreational	0		0	Recreational Users not Included in Benefits
Total Miles - Commuting	0		0	
Total Miles - Other Destinations	0		0	
Total Miles - Recreational	0		0	Recreational Users not Included in Benefits

2C ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - CYCLING - New Safe Routes To School

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

2G ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - PEDESTRIAN - New Safe Routes To School

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

2D ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - CYCLING - Existing Safe Routes To School

	Calculated by Model		Used for Proj. Eval.	Reason for Change
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	0.00%		0.00%	

2H ACTIVE TRANSPORTATION DAILY VOLUME INPUTS - PEDESTRIAN - Existing Safe Routes To School

	Calculated by Model		Used for Proj. Eval.	Reason for Change
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	0.00%		0.00%	

District: 4

PROJECT: SFMTA - Howard Street Streetscape Project

EA:
PPNO:

3

INVESTMENT ANALYSIS

SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$49.6
Life-Cycle Benefits (mil. $)	$88.1
Net Present Value (mil. $)	$38.5
Benefit / Cost Ratio:	1.8
Rate of Return on Investment:	8.8%
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	$7.8	$0.4
Additional Delay Savings	$0.0	$0.0
Additional Safety Benefits	$80.3	$4.0
Health Benefits	$0.0	$0.0
Emission Cost Savings	$0.0	$0.0
TOTAL BENEFITS	**$88.1**	**$4.4**
SRTS-SPECIFIC BENEFITS (mil. $)		
Journey Quality	N/A	N/A
Additional Delay Savings	N/A	N/A
Additional Safety Benefits	N/A	N/A
TOTAL SRTS BENEFITS	**N/A**	**N/A**

Factors that Differentiate Benefits and Performance Measures

Safe Route to School	No
Intersection Improvements on SRTS	No
Programmatic Initiatives	No
Recreational Benefits	0

(enter 1 for Yes, 0 for No)

	Tons		Value (mil. $)	
EMISSIONS REDUCTION	Total Over 20 Years	Average Annual	Total Over 20 Years	Average Annual
CO Emissions Saved	0	0	$0.0	$0.0
CO_2 Emissions Saved	0	0	$0.0	$0.0
NO_X Emissions Saved	0	0	$0.0	$0.0
$PM_{2.5}$ Emissions Saved	0	0	$0.0	$0.0
SO_X Emissions Saved	0	0	$0.0	$0.0
VOC Emissions Saved	0	0	$0.0	$0.0

C

TOTAL

Existing Facility

Year	Constant Dollars	Present Value
1	$330,030	$293,227
20	$875,667	$443,693

1	$330,030	$293,227
2	$358,747	$309,459
3	$387,465	$324,496
4	$416,183	$338,395
5	$444,901	$351,209
6	$473,619	$362,989
7	$502,336	$373,785
8	$531,054	$383,645
9	$559,772	$392,613
10	$588,490	$400,733
11	$617,207	$408,047
12	$645,925	$414,595
13	$674,643	$420,415
14	$703,361	$425,545
15	$732,078	$430,019
16	$760,796	$433,871
17	$789,514	$437,135
18	$818,232	$439,840
19	$846,949	$442,017
20	$875,667	$443,693

Total	**$7,825,726**

New 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 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**

C

TOTAL

New 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**

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	$4,207,016	$3,737,880
20	$8,581,644	$4,348,248

1	$4,207,016	$3,737,880
2	$4,361,146	$3,761,963
3	$4,521,668	$3,786,825
4	$4,688,875	$3,812,485
5	$4,863,079	$3,838,960
6	$5,044,605	$3,866,270
7	$5,233,794	$3,894,434
8	$5,431,006	$3,923,474
9	$5,636,616	$3,953,409
10	$5,851,022	$3,984,261
11	$6,074,639	$4,016,052
12	$6,307,903	$4,048,803
13	$6,551,274	$4,082,537
14	$6,805,234	$4,117,279
15	$7,070,291	$4,153,051
16	$7,346,976	$4,189,878
17	$7,635,850	$4,227,785
18	$7,937,502	$4,266,798
19	$8,252,550	$4,306,944
20	$8,581,644	$4,348,248

Total	$80,317,336

D

SRTS Benefits Share

Existing Facility

Year	Share of Cycling Benefits	Share of Ped Benefits	Sum of Benefits
	0.00%	0.00%	
	SRTS Cycling Benefits - Present Value	SRTS Ped Benefits - Present Value	
1	$0.0	$0.0	$0.0
20	$0.0	$0.0	$0.0
1	$0.0	$0.0	$0.0
2	$0.0	$0.0	$0.0
3	$0.0	$0.0	$0.0
4	$0.0	$0.0	$0.0
5	$0.0	$0.0	$0.0
6	$0.0	$0.0	$0.0
7	$0.0	$0.0	$0.0
8	$0.0	$0.0	$0.0
9	$0.0	$0.0	$0.0
10	$0.0	$0.0	$0.0
11	$0.0	$0.0	$0.0
12	$0.0	$0.0	$0.0
13	$0.0	$0.0	$0.0
14	$0.0	$0.0	$0.0
15	$0.0	$0.0	$0.0
16	$0.0	$0.0	$0.0
17	$0.0	$0.0	$0.0
18	$0.0	$0.0	$0.0
19	$0.0	$0.0	$0.0
20	$0.0	$0.0	$0.0

Total	$0	$0	$0

A

REDUCED ACCIDENT BENEFITS - HIGHWAY USERS

Total

Year	AVERAGE ANNUAL VOLUME (trip-miles/yr.) Induced Trips, Cycling	AVERAGE ANNUAL VOLUME (trip-miles/yr.) Induced Trips, Pedestrians	REDUCED VMT (veh-miles/yr.) Induced Trips, Cyclists, Pedestrians	ACCIDENT BENEFITS ($/yr.) Induced Trips	Constant Dollars	Present Value
1	0	0	0	$0	$0	$0
20	0	0	0	$0	$0	$0

1	0	0	0	$0	$0	$0
2	0	0	0	$0	$0	$0
3	0	0	0	$0	$0	$0
4	0	0	0	$0	$0	$0
5	0	0	0	$0	$0	$0
6	0	0	0	$0	$0	$0
7	0	0	0	$0	$0	$0
8	0	0	0	$0	$0	$0
9	0	0	0	$0	$0	$0
10	0	0	0	$0	$0	$0
11	0	0	0	$0	$0	$0
12	0	0	0	$0	$0	$0
13	0	0	0	$0	$0	$0
14	0	0	0	$0	$0	$0
15	0	0	0	$0	$0	$0
16	0	0	0	$0	$0	$0
17	0	0	0	$0	$0	$0
18	0	0	0	$0	$0	$0
19	0	0	0	$0	$0	$0
20	0	0	0	$0	$0	$0

Total	**$0**

C

TOTAL

Total

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

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

New

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**

A

REDUCED EMISSIONS BENEFITS

Total

Year	AVERAGE ANNUAL VOLUME (trip-miles/yr.) Induced Trips, Cycling	Induced Trips, Pedestrians	REDUCED VMT (veh-miles/yr.) Induced Trips	AVERAGE SPEED (mph) Induced Trips	RUNNING EMISSIONS ($/yr.) Induced Trips	Constant Dollars	Present Value	CO	CO_2
1	0	0	0	25	$0	$0	$0	0	0
20	0	0	0	25	$0	$0	$0	0	0
1	0	0	0	25	$0	$0	$0	0	0
2	0	0	0	25	$0	$0	$0	0	0
3	0	0	0	25	$0	$0	$0	0	0
4	0	0	0	25	$0	$0	$0	0	0
5	0	0	0	25	$0	$0	$0	0	0
6	0	0	0	25	$0	$0	$0	0	0
7	0	0	0	25	$0	$0	$0	0	0
8	0	0	0	25	$0	$0	$0	0	0
9	0	0	0	25	$0	$0	$0	0	0
10	0	0	0	25	$0	$0	$0	0	0
11	0	0	0	25	$0	$0	$0	0	0
12	0	0	0	25	$0	$0	$0	0	0
13	0	0	0	25	$0	$0	$0	0	0
14	0	0	0	25	$0	$0	$0	0	0
15	0	0	0	25	$0	$0	$0	0	0
16	0	0	0	25	$0	$0	$0	0	0
17	0	0	0	25	$0	$0	$0	0	0
18	0	0	0	25	$0	$0	$0	0	0
19	0	0	0	25	$0	$0	$0	0	0
20	0	0	0	25	$0	$0	$0	0	0
Total							$0	0	0

A NET PRESENT VALUE CALCULATION

Year	Journey Quality (PRESENT VALUE OF USER BENEFITS)	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings	Present Value of Total Benefits	Present Value of Total Costs	NET PRESENT VALUE	CUMULATIVE NET PRESENT VALUE
Construction Period									
1						$0	$650,000	($650,000)	($650,000)
2						$0	$28,349,515	($28,349,515)	($28,999,515)
3						$0	$2,733,528	($2,733,528)	($31,733,043)
4						$0	$14,642,267	($14,642,267)	($46,375,309)
5						$0	$977,336	($977,336)	($47,352,645)
6						$0	$0	$0	($47,352,645)
7						$0	$0	$0	($47,352,645)
8						$0	$0	$0	($47,352,645)
Project Open									
1	$293,227	$0	$3,737,880	$0	$0	$4,031,107	$148,822	$3,882,285	$3,882,285
2	$309,459	$0	$3,761,963	$0	$0	$4,071,422	$144,487	$3,926,935	$7,809,220
3	$324,496	$0	$3,786,825	$0	$0	$4,111,321	$140,279	$3,971,043	$11,780,263
4	$338,395	$0	$3,812,485	$0	$0	$4,150,880	$136,193	$4,014,687	$15,794,950
5	$351,209	$0	$3,838,960	$0	$0	$4,190,168	$132,226	$4,057,942	$19,852,892
6	$362,989	$0	$3,866,270	$0	$0	$4,229,259	$128,375	$4,100,884	$23,953,776
7	$373,785	$0	$3,894,434	$0	$0	$4,268,220	$124,636	$4,143,584	$28,097,360
8	$383,645	$0	$3,923,474	$0	$0	$4,307,119	$121,006	$4,186,113	$32,283,473
9	$392,613	$0	$3,953,409	$0	$0	$4,346,022	$117,481	$4,228,541	$36,512,014
10	$400,733	$0	$3,984,261	$0	$0	$4,384,994	$114,059	$4,270,935	$40,782,949
11	$408,047	$0	$4,016,052	$0	$0	$4,424,098	$110,737	$4,313,361	$45,096,310
12	$414,595	$0	$4,048,803	$0	$0	$4,463,398	$107,512	$4,355,886	$49,452,196
13	$420,415	$0	$4,082,537	$0	$0	$4,502,952	$104,380	$4,398,572	$53,850,768
14	$425,545	$0	$4,117,279	$0	$0	$4,542,823	$101,340	$4,441,483	$58,292,251
15	$430,019	$0	$4,153,051	$0	$0	$4,583,070	$98,389	$4,484,681	$62,776,932
16	$433,871	$0	$4,189,878	$0	$0	$4,623,749	$95,523	$4,528,226	$67,305,158
17	$437,135	$0	$4,227,785	$0	$0	$4,664,920	$92,741	$4,572,179	$71,877,337
18	$439,840	$0	$4,266,798	$0	$0	$4,706,638	$90,040	$4,616,599	$76,493,936
19	$442,017	$0	$4,306,944	$0	$0	$4,748,960	$87,417	$4,661,543	$81,155,480
20	$443,693	$0	$4,348,248	$0	$0	$4,791,942	$84,871	$4,707,071	$85,862,550
Total	$7,825,726	$0	$80,317,336	$0	$0	$88,143,062	$49,633,157	$38,509,905	

tons	$ PV	
0	$0	CO Saved

Total Construction Costs: $47,352,645

B SRTS BENEFITS

Year	Journey Quality (PRESENT VALUE OF USER BENEFITS)	Additional Delay Savings	Additional Safety Benefits
Construction Period			
1			
2			
3			
4			
5			
6			
7			
8			
Project Open			
1	$0	$0	$0
2	$0	$0	$0
3	$0	$0	$0
4	$0	$0	$0
5	$0	$0	$0
6	$0	$0	$0
7	$0	$0	$0
8	$0	$0	$0
9	$0	$0	$0
10	$0	$0	$0
11	$0	$0	$0
12	$0	$0	$0
13	$0	$0	$0
14	$0	$0	$0
15	$0	$0	$0
16	$0	$0	$0
17	$0	$0	$0
18	$0	$0	$0
19	$0	$0	$0
20	$0	$0	$0
Total	$0	$0	$0

C INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	Journey Quality (USER BENEFITS IN CONSTANT DOLLARS)	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings	Total Benefits - Constant Dollars	Total Costs - Constant Dollars	Annual Returns on Investment	Cumulative Costs and Benefits
Construction Period									
1						$0	$650,000	($650,000)	($650,000)
2						$0	$29,200,000	($29,200,000)	($29,850,000)
3						$0	$2,900,000	($2,900,000)	($32,750,000)
4						$0	$16,000,000	($16,000,000)	($48,750,000)
5						$0	$1,100,000	($1,100,000)	($49,850,000)
6						$0	$0	$0	($49,850,000)
7						$0	$0	$0	($49,850,000)
8						$0	$0	$0	($49,850,000)
Project Open									
1	$330,030	$0	$4,207,016	$0	$0	$4,537,046	$167,500	$4,369,546	$4,369,546
2	$358,747	$0	$4,361,146	$0	$0	$4,719,894	$167,500	$4,552,394	$8,921,940
3	$387,465	$0	$4,521,668	$0	$0	$4,909,133	$167,500	$4,741,633	$13,663,573
4	$416,183	$0	$4,688,875	$0	$0	$5,105,058	$167,500	$4,937,558	$18,601,131
5	$444,901	$0	$4,863,079	$0	$0	$5,307,980	$167,500	$5,140,480	$23,741,611
6	$473,619	$0	$5,044,605	$0	$0	$5,518,224	$167,500	$5,350,724	$29,092,335
7	$502,336	$0	$5,233,794	$0	$0	$5,736,130	$167,500	$5,568,630	$34,660,965
8	$531,054	$0	$5,431,006	$0	$0	$5,962,060	$167,500	$5,794,560	$40,455,525
9	$559,772	$0	$5,636,616	$0	$0	$6,196,388	$167,500	$6,028,888	$46,484,413
10	$588,490	$0	$5,851,022	$0	$0	$6,439,512	$167,500	$6,272,012	$52,756,424
11	$617,207	$0	$6,074,639	$0	$0	$6,691,846	$167,500	$6,524,346	$59,280,770
12	$645,925	$0	$6,307,903	$0	$0	$6,953,828	$167,500	$6,786,328	$66,067,098
13	$674,643	$0	$6,551,274	$0	$0	$7,225,917	$167,500	$7,058,417	$73,125,515
14	$703,361	$0	$6,805,234	$0	$0	$7,508,595	$167,500	$7,341,095	$80,466,610
15	$732,078	$0	$7,070,291	$0	$0	$7,802,369	$167,500	$7,634,869	$88,101,479
16	$760,796	$0	$7,346,976	$0	$0	$8,107,772	$167,500	$7,940,272	$96,041,752
17	$789,514	$0	$7,635,850	$0	$0	$8,425,364	$167,500	$8,257,864	$104,299,616
18	$818,232	$0	$7,937,502	$0	$0	$8,755,734	$167,500	$8,588,234	$112,887,849
19	$846,949	$0	$8,252,550	$0	$0	$9,099,499	$167,500	$8,931,999	$121,819,848
20	$875,667	$0	$8,581,644	$0	$0	$9,457,311	$167,500	$9,289,811	$131,109,660
Total	$12,056,968	$0	$122,402,692	$0	$0	$134,459,660	$53,200,000	$81,259,660	

Total Construction Costs: $49,850,000

Years of Project Implementation and Operation	Annual Returns on Investment
1	($650,000)
2	($29,200,000)
3	($2,900,000)
4	($16,000,000)
5	$4,369,546
6	$4,552,394
7	$4,741,633
8	$4,937,558
9	$5,140,480
10	$5,350,724
11	$5,568,630
12	$5,794,560
13	$6,028,888
14	$6,272,012
15	$6,524,346
16	$6,786,328
17	$7,058,417
18	$7,341,095
19	$7,634,869
20	$7,940,272
21	$8,257,864
22	$8,588,234
23	$8,931,999
24	$9,289,811
25	$0
26	$0
27	$0
28	$0

Internal Rate of Return: 8.78%

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.

Payback Period: 10 years

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

	Value	Ref.
Year of Current Dollars for Model	2020	
Economic Update Factor (Using GDP Deflator)	1.00	1
Real Discount Rate	3.0%	2

Mode Types

- Bus
- Pass Train
- Light Rail
- Highway

Travel Time Parameters

	Value	Units	Ref.
Statewide Average Hourly Wage	$ 32.44	$/hr	3
Heavy and Light Truck Drivers			
Average Hourly Wage	$ 23.96	$/hr	3
Benefits and Costs	$ 11.92	$/hr	4
Value of Time			
Automobile	$ 17.80	$/hr/per	5
Truck	$ 32.00	$/hr/veh	5
Auto & Truck Composite	$ 23.95	$/hr/veh	6
Transit	$ 17.80	$/hr/per	5
Out-of-Vehicle Travel	1.82	times	5
Incident-Related Travel	3	times	7
Travel Time Uprater	0.0%	annual incr	

Vehicle Operating Cost Parameters

	Value	Units	Ref.
Average Fuel Price			
Automobile (regular unleaded)	$ 3.81	$/gal	8
Truck (diesel)	$ 3.87	$/gal	8
Sales and Fuel Taxes			
State Sales Tax (gasoline)	2.25%	%	9
State Sales Tax (diesel)	13.00%	%	10
Average Local Sales Tax	0.50%	%	9
Federal Fuel Excise Tax (gasoline)	$ 0.183	$/gal	9
Federal Fuel Excise Tax (diesel)	$ 0.243	$/gal	9
State Fuel Excise Tax (gasoline)	$ 0.511	$/gal	9
State Fuel Excise Tax (diesel)	$ 0.389	$/gal	9
Fuel Cost Per Gallon (Exclude Taxes)			
Automobile	$ 3.00	$/gal	
Truck	$ 2.80	$/gal	
Non-Fuel Cost Per Mile			
Automobile	$ 0.356	$/mi	11
Truck	$ 0.440	$/mi	12
Idling Speed for Op. Costs and Emissions	5	mph	

Accident Cost Parameters

	Value	Units	Ref.
Cost of a Fatality	$11,600,000	$/event	13
Cost of an Injury			
Level A (Severe)	$ 554,800	$/event	13
Level B (Moderate)	$ 151,100	$/event	13
Level C (Minor)	$ 77,200	$/event	13
Cost of Property Damage	$ 4,600	$/event	14
Cost of Highway Crash			
Fatal Crash	$ 12,700,000	$/crash	
Injury Crash	$ 181,700	$/crash	
PDO Crash	$ 16,600	$/crash	
Average Cost	$ 126,400	$/crash	
Statewide Highway Crash Rates			
Fatal Crash	0.005	per mil veh-mi	15
Injury Crash	0.28	per mil veh-mi	15
PDO Crash	0.61	per mil veh-mi	15
Non-Freeway	1.04	per mil veh-mi	15

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 [illegible]

Highway Operations Parameters

	Value	Units	Ref.
Maximum V/C Ratio	1.56	-	16
Percent ADT in Peak Period		%	
Percent ADT in Average Peak Hour		%	
Annualization Factor	365	days/yr	

	Alpha	Beta	Capacity (vphpl)	Dep. Rate (vphpl)	Ref.
Freeway	0.20	10	2,000	1,800	16, 17
Expressway	0.20	10	2,000	1,800	16, 17
Conventional Highway	0.05	10	800	1,400	17
HOV Lanes	0.55	8	1,600		18

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

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

Active Transportation Parameters

	Value	Units	Ref.
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	$ 32.40	$/hr/per	
Children	$ 32.40	$/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
Morality Rate - All Causes (Aged 20-64)	252	#/100,000 people	25
Morality 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

Project Types

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

Travel Demand Tables

DEMAND FOR TRAVEL IN PEAK PERIOD
(percent of total daily travel)

Number of Hours in Peak Period	Urban: So. California Fwy/Exp	Urban: So. California Other	Urban: No. California Fwy/Exp	Urban: No. California Other	Rural Fwy/Exp	Rural 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	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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 South	Urban North	Rural
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 South	Urban North	Rural
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 South	Urban North	Rural
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, [illegible]

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

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	Ref.
Fatal Crash	0.45%	0.73%	2.04%	0.73%	26
Injury Crash	31.95%	33.13%	36.01%	32.77%	26
PDO Crash	67.60%	66.14%	61.96%	66.50%	26

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

COST OF HIGHWAY CRASHES
($/crash)

Crash Type	Urban	Suburban	Rural	Average
Fatal Crash	#########	#########	#########	#########
Injury Crash	$181,700	$181,700	$187,800	$182,400
PDO Crash	$16,600	$18,700	$14,600	$18,000
All Types	$126,400	$164,500	$350,000	$166,600

Source: Combination of above four tables

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

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

Event	Pass Train	Light Rail	Bus	Freight Rail
Fatality	$11,600,000	$11,600,000	$11,600,000	$11,600,000
Injury	$219,000	$219,000	$219,000	$219,000
Prop Damage	$90,000	$14,200	$4,300	$156,700

Sources: FTA, 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	$1,023,300	$3,501,000	$1,218,400	$15,704,600

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		$11,600,000	$219,000

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

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	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
	9	1.2807	491.4703	0.0857	0.0047	0.0049	0.0617	0.0047
	10	1.2613	476.6647	0.0833	0.0043	0.0047	0.0567	0.0043
	11	1.2223	452.5800	0.0804	0.0039	0.0045	0.0518	0.0039
	12	1.1846	429.7124	0.0775	0.0036	0.0042	0.0473	0.0036
	13	1.1480	408.0001	0.0748	0.0033	0.0040	0.0433	0.0033
	14	1.1126	387.3849	0.0721	0.0030	0.0038	0.0396	0.0030
	15	1.0783	367.8114	0.0696	0.0027	0.0036	0.0361	0.0027
	16	1.0942	366.7610	0.0702	0.0026	0.0036	0.0348	0.0026
	17	1.1103	365.7136	0.0708	0.0025	0.0036	0.0335	0.0025
	18	1.1267	364.6693	0.0714	0.0024	0.0036	0.0323	0.0024
	19	1.1433	363.6278	0.0720	0.0024	0.0036	0.0311	0.0024
	20	1.1601	362.5894	0.0726	0.0023	0.0036	0.0300	0.0023
	21	1.1563	356.2510	0.0724	0.0022	0.0035	0.0287	0.0022
	22	1.1524	350.0234	0.0723	0.0021	0.0035	0.0275	0.0021
	23	1.1486	343.9046	0.0721	0.0020	0.0034	0.0263	0.0020
	24	1.1448	337.8928	0.0719	0.0019	0.0033	0.0252	0.0019
	25	1.1410	331.9861	0.0718	0.0018	0.0033	0.0242	0.0018
	26	1.1286	327.2741	0.0711	0.0017	0.0032	0.0232	0.0017
	27	1.1164	322.6289	0.0703	0.0017	0.0032	0.0222	0.0017
	28	1.1042	318.0497	0.0696	0.0016	0.0031	0.0213	0.0016
	29	1.0922	313.5355	0.0689	0.0015	0.0031	0.0204	0.0015
	30	1.0804	309.0854	0.0682	0.0015	0.0031	0.0196	0.0015
	31	1.0681	304.8313	0.0679	0.0014	0.0030	0.0190	0.0014
	32	1.0561	300.6357	0.0675	0.0014	0.0030	0.0184	0.0014
	33	1.0441	296.4979	0.0671	0.0013	0.0029	0.0178	0.0013
	34	1.0323	292.4171	0.0667	0.0013	0.0029	0.0172	0.0013
	35	1.0206	288.3924	0.0663	0.0012	0.0029	0.0167	0.0012
	36	1.0098	287.1873	0.0661	0.0012	0.0028	0.0163	0.0012
	37	0.9991	285.9872	0.0658	0.0012	0.0028	0.0159	0.0012
	38	0.9885	284.7922	0.0656	0.0011	0.0028	0.0155	0.0011
	39	0.9780	283.6021	0.0653	0.0011	0.0028	0.0152	0.0011
	40	0.9677	282.4170	0.0651	0.0011	0.0028	0.0148	0.0011
	41	0.9542	282.6316	0.0649	0.0011	0.0028	0.0146	0.0011
	42	0.9408	282.8464	0.0647	0.0010	0.0028	0.0144	0.0010
	43	0.9277	283.0613	0.0645	0.0010	0.0028	0.0142	0.0010
	44	0.9147	283.2764	0.0643	0.0010	0.0028	0.0140	0.0010
	45	0.9020	283.4917	0.0641	0.0010	0.0028	0.0138	0.0010
	46	0.8950	286.1470	0.0643	0.0010	0.0028	0.0138	0.0010
	47	0.8882	288.8273	0.0645	0.0010	0.0029	0.0138	0.0010
	48	0.8814	291.5326	0.0647	0.0010	0.0029	0.0137	0.0010
	49	0.8746	294.2633	0.0649	0.0010	0.0029	0.0137	0.0010
	50	0.8679	297.0195	0.0652	0.0010	0.0029	0.0137	0.0010
	51	0.8608	300.5677	0.0655	0.0010	0.0030	0.0138	0.0010
	52	0.8537	304.1583	0.0659	0.0010	0.0030	0.0139	0.0010
	53	0.8467	307.7918	0.0663	0.0010	0.0030	0.0140	0.0010
	54	0.8398	311.4687	0.0667	0.0010	0.0031	0.0141	0.0010
	55	0.8329	315.1895	0.0671	0.0010	0.0031	0.0142	0.0010
	56	0.8167	317.3875	0.0668	0.0010	0.0031	0.0143	0.0010
	57	0.8008	319.6009	0.0666	0.0010	0.0032	0.0144	0.0010
	58	0.7852	321.8297	0.0664	0.0011	0.0032	0.0144	0.0011
	59	0.7699	324.0740	0.0662	0.0011	0.0032	0.0145	0.0011
	60	0.7549	326.3340	0.0660	0.0011	0.0032	0.0146	0.0011
	61	0.7519	328.7321	0.0672	0.0011	0.0032	0.0151	0.0011
	62	0.7490	331.1477	0.0684	0.0011	0.0033	0.0156	0.0011
	63	0.7460	333.5812	0.0697	0.0012	0.0033	0.0160	0.0012
	64	0.7430	336.0325	0.0710	0.0012	0.0033	0.0165	0.0012
	65	0.7401	338.5018	0.0723	0.0012	0.0033	0.0171	0.0012
	66	0.7380	339.0778	0.0728	0.0012	0.0034	0.0172	0.0012
	67	0.7359	339.6547	0.0732	0.0013	0.0034	0.0173	0.0013
	68	0.7338	340.2326	0.0737	0.0013	0.0034	0.0175	0.0013
	69	0.7318	340.8115	0.0742	0.0013	0.0034	0.0176	0.0013
	70	0.7297	341.3914	0.0746	0.0013	0.0034	0.0178	0.0013
Truck	0	1.3150	11.0294	1.0065	0.0001	0.0001	0.0703	0.0001
	5	2.3136	########	2.1959	0.0460	0.0164	0.3065	0.0460
	6	2.2436	########	2.2233	0.0443	0.0161	0.2881	0.0443
	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	2.1098	########	2.2792	0.0410	0.0154	0.2546	0.0410
	9	2.0460	########	2.3076	0.0395	0.0151	0.2393	0.0395
	10	1.9841	########	2.3365	0.0380	0.0148	0.2249	0.0380
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	13	1.6578	########	1.9080	0.0323	0.0129	0.1860	0.0323
	14	1.5615	########	1.7834	0.0306	0.0124	0.1746	0.0306
	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	1.2890	########	1.6286	0.0251	0.0116	0.1404	0.0251
	18	1.2067	########	1.6097	0.0233	0.0115	0.1300	0.0233
	19	1.1297	########	1.5910	0.0217	0.0113	0.1204	0.0217
	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	21	1.0154	########	1.5314	0.0199	0.0108	0.1089	0.0199
	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	23	0.9361	########	1.4522	0.0195	0.0101	0.1041	0.0195
	24	0.8988	########	1.4141	0.0192	0.0097	0.1017	0.0192
	25	0.8629	984.4475	1.3771	0.0190	0.0093	0.0995	0.0190
	26	0.8297	974.5904	1.3491	0.0180	0.0092	0.0935	0.0180
	27	0.7977	964.8319	1.3216	0.0170	0.0091	0.0879	0.0170
	28	0.7670	955.1712	1.2948	0.0161	0.0090	0.0827	0.0161
	29	0.7374	945.6072	1.2684	0.0152	0.0089	0.0777	0.0152
	30	0.7090	936.1389	1.2426	0.0144	0.0088	0.0731	0.0144
	31	0.6779	941.2716	1.2298	0.0137	0.0089	0.0682	0.0137
	32	0.6482	946.4323	1.2171	0.0131	0.0089	0.0636	0.0131
	33	0.6198	951.6214	1.2046	0.0126	0.0089	0.0593	0.0126
	34	0.5926	956.8389	1.1921	0.0120	0.0090	0.0553	0.0120
	35	0.5666	962.0850	1.1798	0.0115	0.0090	0.0516	0.0115
	36	0.5505	967.4195	1.1663	0.0113	0.0091	0.0488	0.0113
	37	0.5349	972.7836	1.1529	0.0110	0.0091	0.0462	0.0110
	38	0.5197	978.1775	1.1396	0.0108	0.0091	0.0437	0.0108
	39	0.5050	983.6013	1.1266	0.0106	0.0092	0.0413	0.0106
	40	0.4906	989.0551	1.1136	0.0104	0.0092	0.0391	0.0104
	41	0.4868	984.5077	1.0994	0.0105	0.0092	0.0382	0.0105
	42	0.4829	979.9812	1.0854	0.0106	0.0091	0.0374	0.0106
	43	0.4791	975.4754	1.0715	0.0106	0.0091	0.0366	0.0106
	44	0.4753	970.9904	1.0579	0.0107	0.0091	0.0359	0.0107
	45	0.4716	966.5261	1.0444	0.0108	0.0090	0.0351	0.0108
	46	0.4762	930.2224	1.0417	0.0110	0.0087	0.0368	0.0110
	47	0.4809	895.2823	1.0391	0.0112	0.0084	0.0386	0.0112
	48	0.4857	861.6546	1.0364	0.0115	0.0081	0.0405	0.0115
	49	0.4905	829.2899	1.0338	0.0117	0.0078	0.0425	0.0117
	50	0.4953	798.1410	1.0311	0.0120	0.0075	0.0445	0.0120
	51	0.4801	830.7086	1.0417	0.0125	0.0078	0.0425	0.0125
	52	0.4653	864.6052	1.0523	0.0130	0.0081	0.0405	0.0130
	53	0.4510	899.8848	1.0631	0.0136	0.0085	0.0386	0.0136
	54	0.4371	936.6040	1.0739	0.0142	0.0088	0.0369	0.0142
	55	0.4236	974.8216	1.0849	0.0148	0.0091	0.0352	0.0148
	56	0.4100	########	1.0832	0.0157	0.0096	0.0315	0.0157
	57	0.3969	########	1.0815	0.0165	0.0101	0.0282	0.0165
	58	0.3841	########	1.0797	0.0175	0.0105	0.0252	0.0175
	59	0.3718	########	1.0780	0.0184	0.0111	0.0226	0.0184
	60	0.3599	########	1.0763	0.0195	0.0116	0.0202	0.0195
	61	0.3501	########	1.1266	0.0206	0.0118	0.0202	0.0206
	62	0.3406	########	1.1792	0.0219	0.0121	0.0201	0.0219
	63	0.3313	########	1.2343	0.0232	0.0123	0.0201	0.0232
	64	0.3223	########	1.2920	0.0247	0.0126	0.0201	0.0247
	65	0.3135	########	1.3524	0.0262	0.0128	0.0200	0.0262
	66	0.3131	########	1.3589	0.0264	0.0127	0.0209	0.0264
	67	0.3127	########	1.3655	0.0266	0.0125	0.0218	0.0266
	68	0.3124	########	1.3722	0.0269	0.0124	0.0228	0.0269
	69	0.3120	########	1.3788	0.0271	0.0123	0.0238	0.0271
	70	0.3116	########	1.3855	0.0273	0.0122	0.0248	0.0273
Bus	0	1.7524	13.2318	0.5397	0.0001	0.0001	0.0815	0.0001
	5	31.9638	########	4.1913	0.0368	0.0162	0.3550	0.0368
	6	29.9626	########	3.8723	0.0346	0.0157	0.3264	0.0346
	7	28.0868	########	3.5776	0.0325	0.0153	0.3000	0.0325
	8	26.3284	########	3.3053	0.0306	0.0149	0.2758	0.0306
	9	24.6801	########	3.0537	0.0287	0.0145	0.2536	0.0287
	10	23.1349	########	2.8213	0.0270	0.0141	0.2331	0.0270
	11	21.8499	########	2.5833	0.0241	0.0133	0.2059	0.0241
	12	20.6362	########	2.3655	0.0216	0.0127	0.1819	0.0216
	13	19.4899	########	2.1660	0.0193	0.0120	0.1606	0.0193
	14	18.4073	########	1.9833	0.0172	0.0114	0.1419	0.0172
	15	17.3848	########	1.8160	0.0154	0.0108	0.1253	0.0154
	16	19.1133	########	1.5686	0.0120	0.0092	0.1068	0.0120
	17	21.0138	########	1.3549	0.0093	0.0078	0.0910	0.0093
	18	23.1031	########	1.1703	0.0073	0.0066	0.0776	0.0073
	19	25.4002	########	1.0108	0.0057	0.0056	0.0661	0.0057
	20	27.9257	########	0.8731	0.0044	0.0047	0.0563	0.0044
	21	21.3276	########	0.9662	0.0053	0.0055	0.0589	0.0053
	22	16.2884	########	1.0692	0.0063	0.0064	0.0616	0.0063
	23	12.4399	########	1.1832	0.0076	0.0075	0.0644	0.0076
	24	9.5006	########	1.3094	0.0091	0.0087	0.0673	0.0091
	25	7.2559	########	1.4490	0.0109	0.0101	0.0704	0.0109
	26	7.1789	########	1.4072	0.0106	0.0099	0.0677	0.0106
	27	7.1028	########	1.3666	0.0103	0.0097	0.0651	0.0103
	28	7.0275	########	1.3272	0.0100	0.0095	0.0626	0.0100
	29	6.9529	########	1.2890	0.0097	0.0094	0.0602	0.0097
	30	6.8792	########	1.2518	0.0095	0.0092	0.0579	0.0095
	31	6.6944	########	1.2340	0.0095	0.0091	0.0564	0.0095
	32	6.5146	########	1.2165	0.0096	0.0090	0.0550	0.0096
	33	6.3396	########	1.1992	0.0096	0.0089	0.0536	0.0096
	34	6.1693	########	1.1822	0.0097	0.0088	0.0523	0.0097
	35	6.0035	########	1.1654	0.0097	0.0087	0.0510	0.0097
	36	5.7912	########	1.1584	0.0099	0.0087	0.0498	0.0099
	37	5.5864	########	1.1514	0.0100	0.0087	0.0487	0.0100
	38	5.3889	########	1.1445	0.0101	0.0087	0.0476	0.0101
	39	5.1983	########	1.1376	0.0102	0.0087	0.0466	0.0102
	40	5.0145	########	1.1308	0.0103	0.0087	0.0455	0.0103
	41	4.8804	########	1.1354	0.0104	0.0087	0.0446	0.0104
	42	4.7499	########	1.1399	0.0105	0.0087	0.0436	0.0105
	43	4.6229	########	1.1446	0.0105	0.0087	0.0427	0.0105
	44	4.4993	########	1.1492	0.0106	0.0087	0.0418	0.0106
	45	4.3791	########	1.1538	0.0106	0.0088	0.0409	0.0106
	46	4.3262	########	1.1440	0.0105	0.0088	0.0401	0.0105
	47	4.2740	########	1.1342	0.0104	0.0089	0.0392	0.0104
	48	4.2223	########	1.1245	0.0103	0.0089	0.0384	0.0103
	49	4.1714	########	1.1148	0.0101	0.0090	0.0377	0.0101
	50	4.1210	########	1.1053	0.0100	0.0090	0.0369	0.0100
	51	4.0545	########	1.1102	0.0102	0.0092	0.0371	0.0102
	52	3.9891	########	1.1150	0.0104	0.0094	0.0373	0.0104
	53	3.9248	########	1.1199	0.0105	0.0096	0.0374	0.0105
	54	3.8615	########	1.1249	0.0107	0.0098	0.0376	0.0107
	55	3.7992	########	1.1298	0.0109	0.0101	0.0378	0.0109
	56	3.6830	########	1.1319	0.0113	0.0103	0.0380	0.0113
	57	3.5703	########	1.1339	0.0117	0.0106	0.0382	0.0117
	58	3.4611	########	1.1360	0.0121	0.0109	0.0384	0.0121
	59	3.3552	########	1.1380	0.0125	0.0113	0.0386	0.0125
	60	3.2525	########	1.1401	0.0130	0.0116	0.0388	0.0130
	61	3.1682	########	1.1445	0.0135	0.0119	0.0393	0.0135
	62	3.0860	########	1.1490	0.0139	0.0122	0.0397	0.0139
	63	3.0060	########	1.1535	0.0144	0.0125	0.0402	0.0144
	64	2.9280	########	1.1580	0.0149	0.0128	0.0407	0.0149
	65	2.8521	########	1.1625	0.0154	0.0131	0.0412	0.0154
	66	2.7293	########	1.1936	0.0165	0.0130	0.0378	0.0165
	67	2.6119	########	1.2256	0.0176	0.0129	0.0348	0.0176
	68	2.4994	########	1.2584	0.0188	0.0128	0.0320	0.0188
	69	2.3919	########	1.2922	0.0201	0.0127	0.0294	0.0201
	70	2.2889	########	1.3268	0.0215	0.0126	0.0270	0.0215

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	#######	0.0223	0.0018	0.0033	0.0249	0.0018
	6	0.5576	#######	0.0221	0.0016	0.0032	0.0233	0.0016
	7	0.5594	#######	0.0219	0.0015	0.0031	0.0217	0.0015
	8	0.5612	#######	0.0218	0.0014	0.0031	0.0203	0.0014
	9	0.5630	#######	0.0216	0.0013	0.0030	0.0189	0.0013
	10	0.5647	#######	0.0214	0.0012	0.0030	0.0177	0.0012
	11	0.5479	#######	0.0206	0.0011	0.0028	0.0161	0.0011
	12	0.5315	#######	0.0199	0.0010	0.0027	0.0147	0.0010
	13	0.5156	#######	0.0192	0.0009	0.0026	0.0134	0.0009
	14	0.5002	#######	0.0185	0.0009	0.0024	0.0122	0.0009
	15	0.4853	#######	0.0178	0.0008	0.0023	0.0111	0.0008
	16	0.5039	#######	0.0184	0.0008	0.0023	0.0109	0.0008
	17	0.5232	#######	0.0190	0.0008	0.0024	0.0107	0.0008
	18	0.5433	#######	0.0197	0.0007	0.0024	0.0105	0.0007
	19	0.5641	#######	0.0203	0.0007	0.0025	0.0103	0.0007
	20	0.5858	#######	0.0210	0.0007	0.0025	0.0101	0.0007
	21	0.5910	#######	0.0211	0.0007	0.0025	0.0098	0.0007
	22	0.5964	#######	0.0213	0.0007	0.0025	0.0094	0.0007
	23	0.6018	#######	0.0215	0.0006	0.0025	0.0091	0.0006
	24	0.6072	#######	0.0217	0.0006	0.0025	0.0088	0.0006
	25	0.6127	#######	0.0218	0.0006	0.0025	0.0085	0.0006
	26	0.6144	#######	0.0220	0.0006	0.0024	0.0083	0.0006
	27	0.6161	#######	0.0221	0.0006	0.0024	0.0080	0.0006
	28	0.6178	#######	0.0222	0.0006	0.0024	0.0078	0.0006
	29	0.6195	#######	0.0224	0.0005	0.0024	0.0076	0.0005
	30	0.6212	#######	0.0225	0.0005	0.0024	0.0074	0.0005
	31	0.6126	#######	0.0222	0.0005	0.0024	0.0071	0.0005
	32	0.6042	#######	0.0220	0.0005	0.0024	0.0068	0.0005
	33	0.5959	#######	0.0217	0.0005	0.0023	0.0065	0.0005
	34	0.5877	#######	0.0215	0.0005	0.0023	0.0063	0.0005
	35	0.5796	#######	0.0212	0.0004	0.0022	0.0060	0.0004
	36	0.5729	#######	0.0211	0.0004	0.0022	0.0058	0.0004
	37	0.5664	#######	0.0210	0.0004	0.0022	0.0057	0.0004
	38	0.5599	#######	0.0208	0.0004	0.0022	0.0055	0.0004
	39	0.5535	#######	0.0207	0.0004	0.0022	0.0053	0.0004
	40	0.5471	#######	0.0206	0.0004	0.0022	0.0052	0.0004
	41	0.5398	#######	0.0205	0.0004	0.0022	0.0051	0.0004
	42	0.5325	#######	0.0205	0.0004	0.0022	0.0050	0.0004
	43	0.5253	#######	0.0204	0.0004	0.0022	0.0050	0.0004
	44	0.5182	#######	0.0203	0.0004	0.0022	0.0049	0.0004
	45	0.5112	#######	0.0203	0.0004	0.0022	0.0048	0.0004
	46	0.5081	#######	0.0203	0.0004	0.0023	0.0048	0.0004
	47	0.5051	#######	0.0204	0.0004	0.0023	0.0048	0.0004
	48	0.5021	#######	0.0205	0.0004	0.0023	0.0048	0.0004
	49	0.4991	#######	0.0206	0.0004	0.0023	0.0048	0.0004
	50	0.4961	#######	0.0207	0.0004	0.0024	0.0048	0.0004
	51	0.4937	#######	0.0209	0.0004	0.0024	0.0049	0.0004
	52	0.4913	#######	0.0211	0.0004	0.0024	0.0049	0.0004
	53	0.4889	#######	0.0213	0.0004	0.0025	0.0050	0.0004
	54	0.4866	#######	0.0215	0.0004	0.0025	0.0051	0.0004
	55	0.4842	#######	0.0217	0.0004	0.0026	0.0051	0.0004
	56	0.4772	#######	0.0218	0.0004	0.0026	0.0052	0.0004
	57	0.4703	#######	0.0220	0.0004	0.0026	0.0053	0.0004
	58	0.4635	#######	0.0222	0.0004	0.0026	0.0054	0.0004
	59	0.4568	#######	0.0223	0.0004	0.0027	0.0055	0.0004
	60	0.4502	#######	0.0225	0.0004	0.0027	0.0057	0.0004
	61	0.4455	#######	0.0227	0.0004	0.0027	0.0058	0.0004
	62	0.4408	#######	0.0229	0.0004	0.0027	0.0059	0.0004
	63	0.4362	#######	0.0231	0.0004	0.0028	0.0061	0.0004
	64	0.4316	#######	0.0233	0.0005	0.0028	0.0062	0.0005
	65	0.4271	#######	0.0235	0.0005	0.0028	0.0064	0.0005
	66	0.4250	#######	0.0236	0.0005	0.0028	0.0065	0.0005
	67	0.4229	#######	0.0237	0.0005	0.0028	0.0066	0.0005
	68	0.4208	#######	0.0238	0.0005	0.0028	0.0067	0.0005
	69	0.4187	#######	0.0239	0.0005	0.0028	0.0068	0.0005
	70	0.4166	#######	0.0241	0.0005	0.0028	0.0069	0.0005
Truck	0	0.6659	5.1023	0.7656	0.0000	0.0001	0.0203	0.0000
	5	0.6516	#######	0.4277	0.0095	0.0083	0.0478	0.0095
	6	0.6625	#######	0.5016	0.0092	0.0083	0.0465	0.0092
	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	8	0.6850	#######	0.6897	0.0087	0.0082	0.0441	0.0087
	9	0.6966	#######	0.8088	0.0084	0.0082	0.0430	0.0084
	10	0.7083	#######	0.9484	0.0082	0.0081	0.0419	0.0082
	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	13	0.5731	#######	0.7710	0.0074	0.0073	0.0359	0.0074
	14	0.5340	#######	0.7196	0.0072	0.0070	0.0341	0.0072
	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	17	0.4222	#######	0.6709	0.0062	0.0066	0.0283	0.0062
	18	0.3890	#######	0.6706	0.0058	0.0065	0.0265	0.0058
	19	0.3583	#######	0.6703	0.0055	0.0064	0.0247	0.0055
	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	21	0.3157	#######	0.6323	0.0051	0.0062	0.0230	0.0051
	22	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	23	0.2890	#######	0.5632	0.0050	0.0058	0.0227	0.0050
	24	0.2765	#######	0.5316	0.0050	0.0057	0.0226	0.0050
	25	0.2645	#######	0.5017	0.0049	0.0055	0.0225	0.0049
	26	0.2525	#######	0.4836	0.0047	0.0054	0.0213	0.0047
	27	0.2410	#######	0.4662	0.0045	0.0054	0.0202	0.0045
	28	0.2300	#######	0.4493	0.0043	0.0053	0.0191	0.0043
	29	0.2196	#######	0.4331	0.0041	0.0053	0.0181	0.0041
	30	0.2096	#######	0.4175	0.0039	0.0052	0.0172	0.0039
	31	0.2018	#######	0.4131	0.0038	0.0052	0.0162	0.0038
	32	0.1942	#######	0.4088	0.0038	0.0053	0.0153	0.0038
	33	0.1870	#######	0.4045	0.0037	0.0053	0.0144	0.0037
	34	0.1800	#######	0.4003	0.0036	0.0053	0.0136	0.0036
	35	0.1733	#######	0.3961	0.0035	0.0054	0.0128	0.0035
	36	0.1688	#######	0.3883	0.0036	0.0054	0.0122	0.0036
	37	0.1645	#######	0.3806	0.0037	0.0055	0.0116	0.0037
	38	0.1603	#######	0.3731	0.0038	0.0055	0.0111	0.0038
	39	0.1561	#######	0.3658	0.0038	0.0056	0.0105	0.0038
	40	0.1521	#######	0.3586	0.0039	0.0056	0.0100	0.0039
	41	0.1479	#######	0.3530	0.0042	0.0057	0.0098	0.0042
	42	0.1438	#######	0.3474	0.0044	0.0057	0.0096	0.0044
	43	0.1399	#######	0.3420	0.0047	0.0058	0.0094	0.0047
	44	0.1360	#######	0.3366	0.0050	0.0058	0.0093	0.0050
	45	0.1323	#######	0.3314	0.0053	0.0059	0.0091	0.0053
	46	0.1300	#######	0.3103	0.0054	0.0057	0.0093	0.0054
	47	0.1278	#######	0.2906	0.0055	0.0055	0.0096	0.0055
	48	0.1256	#######	0.2722	0.0056	0.0053	0.0099	0.0056
	49	0.1234	#######	0.2549	0.0057	0.0051	0.0102	0.0057
	50	0.1213	#######	0.2387	0.0058	0.0049	0.0105	0.0058
	51	0.1184	#######	0.2548	0.0064	0.0051	0.0101	0.0064
	52	0.1156	#######	0.2719	0.0070	0.0053	0.0098	0.0070
	53	0.1129	#######	0.2902	0.0076	0.0056	0.0094	0.0076
	54	0.1102	#######	0.3097	0.0083	0.0058	0.0091	0.0083
	55	0.1076	#######	0.3306	0.0091	0.0061	0.0088	0.0091
	56	0.1045	#######	0.3648	0.0100	0.0064	0.0085	0.0100
	57	0.1015	#######	0.4025	0.0111	0.0067	0.0083	0.0111
	58	0.0986	#######	0.4442	0.0123	0.0071	0.0080	0.0123
	59	0.0957	#######	0.4902	0.0137	0.0074	0.0078	0.0137
	60	0.0930	#######	0.5409	0.0151	0.0078	0.0076	0.0151
	61	0.0918	#######	0.5861	0.0162	0.0080	0.0078	0.0162
	62	0.0907	#######	0.6351	0.0173	0.0082	0.0081	0.0173
	63	0.0896	#######	0.6882	0.0185	0.0083	0.0084	0.0185
	64	0.0885	#######	0.7457	0.0197	0.0085	0.0086	0.0197
	65	0.0874	#######	0.8081	0.0211	0.0087	0.0089	0.0211
	66	0.0866	#######	0.8155	0.0213	0.0087	0.0091	0.0213
	67	0.0858	#######	0.8230	0.0216	0.0087	0.0092	0.0216
	68	0.0850	#######	0.8306	0.0218	0.0087	0.0094	0.0218
	69	0.0842	#######	0.8383	0.0220	0.0088	0.0095	0.0220
	70	0.0834	#######	0.8460	0.0223	0.0088	0.0097	0.0223
Bus	0	0.7539	6.0009	0.3925	0.0001	0.0001	0.0363	0.0001
	5	4.4133	#######	0.8621	0.0053	0.0083	0.0694	0.0053
	6	3.5422	#######	0.7928	0.0049	0.0079	0.0610	0.0049
	7	2.8431	#######	0.7290	0.0046	0.0075	0.0537	0.0046
	8	2.2820	#######	0.6704	0.0042	0.0071	0.0472	0.0042
	9	1.8316	#######	0.6165	0.0039	0.0067	0.0415	0.0039
	10	1.4701	#######	0.5669	0.0037	0.0063	0.0365	0.0037
	11	1.2749	#######	0.5047	0.0033	0.0059	0.0308	0.0033
	12	1.1056	#######	0.4493	0.0029	0.0055	0.0259	0.0029
	13	0.9588	#######	0.4000	0.0026	0.0052	0.0219	0.0026
	14	0.8315	#######	0.3561	0.0024	0.0048	0.0184	0.0024
	15	0.7211	#######	0.3171	0.0021	0.0045	0.0155	0.0021
	16	0.5336	#######	0.2446	0.0016	0.0035	0.0113	0.0016
	17	0.3949	#######	0.1888	0.0012	0.0027	0.0082	0.0012
	18	0.2922	#######	0.1456	0.0009	0.0021	0.0060	0.0009
	19	0.2162	#######	0.1124	0.0007	0.0017	0.0044	0.0007
	20	0.1600	#######	0.0867	0.0005	0.0013	0.0032	0.0005
	21	0.1995	#######	0.1100	0.0007	0.0016	0.0039	0.0007
	22	0.2487	#######	0.1395	0.0009	0.0021	0.0049	0.0009
	23	0.3100	#######	0.1770	0.0011	0.0027	0.0061	0.0011
	24	0.3864	#######	0.2246	0.0014	0.0034	0.0076	0.0014
	25	0.4817	#######	0.2850	0.0018	0.0044	0.0094	0.0018
	26	0.4524	#######	0.2716	0.0017	0.0043	0.0089	0.0017
	27	0.4249	#######	0.2589	0.0017	0.0042	0.0085	0.0017
	28	0.3991	#######	0.2468	0.0017	0.0040	0.0081	0.0017
	29	0.3748	#######	0.2352	0.0016	0.0039	0.0077	0.0016
	30	0.3520	#######	0.2242	0.0016	0.0038	0.0073	0.0016
	31	0.3357	#######	0.2180	0.0016	0.0038	0.0071	0.0016
	32	0.3202	#######	0.2121	0.0016	0.0038	0.0070	0.0016
	33	0.3054	#######	0.2062	0.0017	0.0038	0.0068	0.0017
	34	0.2913	#######	0.2006	0.0017	0.0038	0.0066	0.0017
	35	0.2779	#######	0.1951	0.0017	0.0037	0.0065	0.0017
	36	0.2673	#######	0.1926	0.0018	0.0038	0.0064	0.0018
	37	0.2571	#######	0.1902	0.0019	0.0039	0.0064	0.0019
	38	0.2473	#######	0.1877	0.0020	0.0039	0.0063	0.0020
	39	0.2378	#######	0.1854	0.0021	0.0040	0.0063	0.0021
	40	0.2288	#######	0.1830	0.0022	0.0041	0.0062	0.0022
	41	0.2233	#######	0.1794	0.0022	0.0041	0.0061	0.0022
	42	0.2179	#######	0.1759	0.0023	0.0042	0.0060	0.0023
	43	0.2127	#######	0.1724	0.0024	0.0042	0.0059	0.0024
	44	0.2076	#######	0.1691	0.0025	0.0043	0.0059	0.0025
	45	0.2026	#######	0.1657	0.0026	0.0044	0.0058	0.0026
	46	0.2012	#######	0.1615	0.0026	0.0044	0.0057	0.0026
	47	0.1997	#######	0.1573	0.0027	0.0044	0.0056	0.0027
	48	0.1983	#######	0.1532	0.0028	0.0045	0.0055	0.0028
	49	0.1969	#######	0.1493	0.0028	0.0045	0.0054	0.0028
	50	0.1955	#######	0.1454	0.0029	0.0045	0.0054	0.0029
	51	0.1974	#######	0.1497	0.0031	0.0047	0.0054	0.0031
	52	0.1995	#######	0.1540	0.0033	0.0048	0.0055	0.0033
	53	0.2015	#######	0.1585	0.0035	0.0049	0.0056	0.0035
	54	0.2036	#######	0.1632	0.0037	0.0050	0.0057	0.0037
	55	0.2056	#######	0.1680	0.0039	0.0052	0.0058	0.0039
	56	0.1997	#######	0.1821	0.0044	0.0054	0.0060	0.0044
	57	0.1940	#######	0.1975	0.0048	0.0057	0.0062	0.0048
	58	0.1885	#######	0.2141	0.0053	0.0059	0.0065	0.0053
	59	0.1831	#######	0.2321	0.0059	0.0062	0.0067	0.0059
	60	0.1778	#######	0.2517	0.0065	0.0065	0.0070	0.0065
	61	0.1746	#######	0.2735	0.0071	0.0068	0.0072	0.0071
	62	0.1715	#######	0.2971	0.0077	0.0070	0.0075	0.0077
	63	0.1684	#######	0.3228	0.0084	0.0072	0.0078	0.0084
	64	0.1654	#######	0.3508	0.0091	0.0075	0.0081	0.0091
	65	0.1624	#######	0.3811	0.0099	0.0078	0.0084	0.0099
	66	0.1669	#######	0.4042	0.0107	0.0080	0.0083	0.0107
	67	0.1715	#######	0.4288	0.0115	0.0083	0.0082	0.0115
	68	0.1762	#######	0.4548	0.0125	0.0085	0.0081	0.0125
	69	0.1811	#######	0.4824	0.0135	0.0088	0.0081	0.0135
	70	0.1861	#######	0.5116	0.0146	0.0091	0.0080	0.0146

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

HEALTH COST OF TRANSPORTATION EMISSIONS

($/ton)

Area	Proj. Loc	CO	CO_2e	NO_X	PM_{10}	SO_X	VOC
LA/South Coast	1	$170	$48	$14,344	#######	$38,402	$4,300
CA Urban Area	2	$90	$48	$14,344	#######	$38,402	$1,415
CA Rural Area	3	$80	$48	$14,344	#######	$38,402	$1,110

CO_2e Updater: 2.0% 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_{10}	SO_X	VOC	$PM_{2.5}$
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_{10}	SO_X	VOC	$PM_{2.5}$
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_{10}	SO_X	VOC	$PM_{2.5}$
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: 480 ton-miles/gal
Fuel Burned at Idle: 4 gal/hr

Sources: Argonne National Laboratory, Energy Systems, GREET Model, 2021
FTA, National Transit Database, Fuel and Energy, 2019
Energy Information Administration, Electricty 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 20, By Loading		
Year 0	Light	Medium	Heavy
0	125	150	350
25	150	200	500
50	175	250	675
[illegible]	[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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	0.789	0.879
0.022	0.747	0.867
0.024	0.706	0.855
0.026	0.664	0.842
[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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
[illegible]	[illegible]	[illegible]
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	Without		With		Non-Highway Benefits			Total	
Strategy	Speed	Volume	Speed	Volume	TT	VOC	Em	Benefit	
AMoth	1.02	0.95	1.02	0.95	-5.05	12.81	1.37	0.74	
AMsev	1.53	0.94	1.53	0.94	1.21	1.38	-0.37	1.00	
IMoth	0.88	1.18	0.98	0.96	0.51	0.15	0.06	0.74	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
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		27
ORsev	0.95	1.03	1.00	1.00	0.00	0.00	5.67		27
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

TRANSIT TRAVEL TIME AND AGENCY COST SAVINGS

(percent savings)

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

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

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.