Cal-B/C Training Module 6c

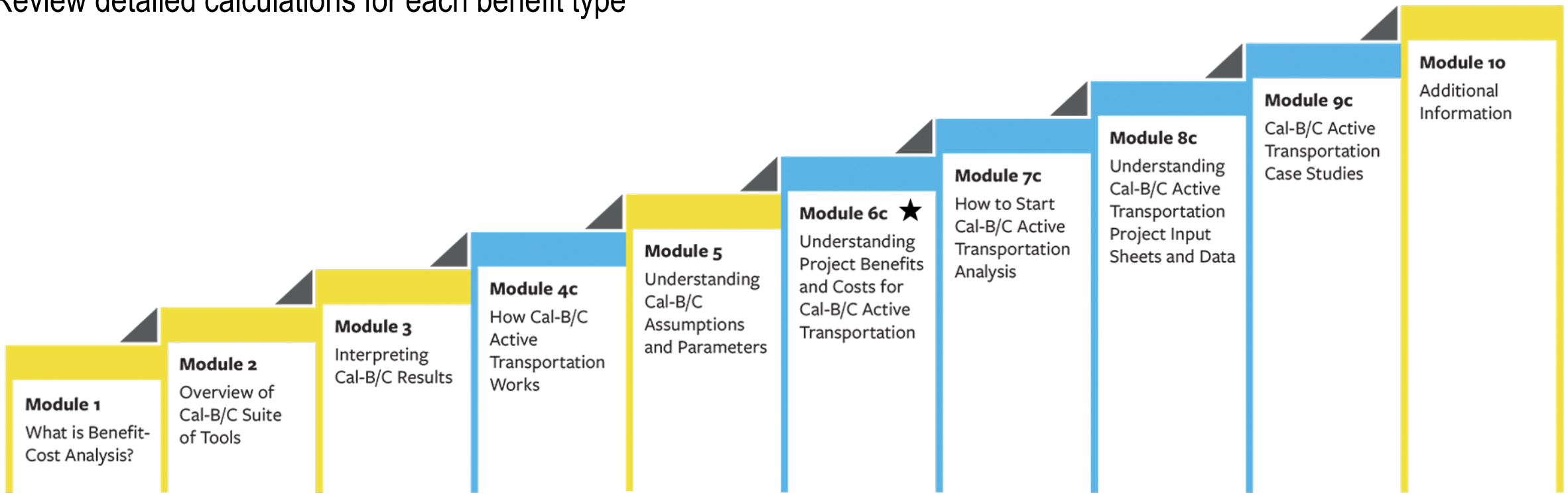
Understanding Project Benefits and Costs for Cal-B/C Active Transportation

01

About This Module

This module will…

- Build on Modules 1 through 5 to provide a detailed understanding of project costs and benefits
- Describes benefit types and calculation methods
- Review detailed calculations for each benefit type



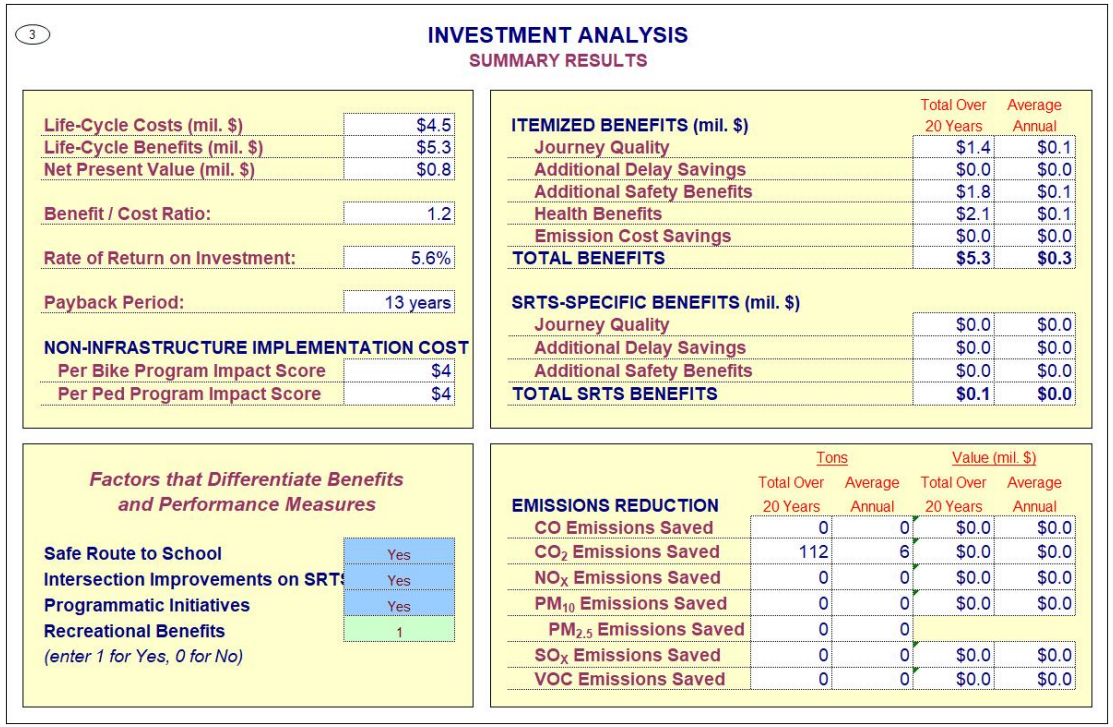
★ *This module is covered in this presentation*

Previous Modules…

- Module 1 provided a basic introduction on benefit-cost analysis (BCA) and a general overview of how to conduct a BCA
- Module 2 described the Cal-B/C suite of tools, discussed the types of projects that can be evaluated, and provided guidance on which tools to use for various project types
- Module 3 presented the Cal-B/C results page, detailed what each output measure means, and explained how they are calculated
- Modules 4c presented an overview of how Cal-B/C Active Transportation works, including a review of all worksheets and inputs
- Module 5 highlighted the information in the Parameters worksheet and discussed key assumptions used by Cal-B/C

Overview of Benefit Categories

Benefit Category	Cal-B/C AT
Travel time savings (as Additional Delay Savings)	✓
Vehicle operating cost savings	
Accident cost savings (as Additional Safety Benefits)	✓
Emission cost savings	✓
Residual value	
Journey quality benefits	✓
Health benefits	✓
Shipper cost savings	



3

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$4.5
Life-Cycle Benefits (mil. $)	$5.3
Net Present Value (mil. $)	$0.8
Benefit / Cost Ratio:	1.2
Rate of Return on Investment:	5.6%
Payback Period:	13 years
NON-INFRASTRUCTURE IMPLEMENTATION COST	
Per Bike Program Impact Score	$4
Per Ped Program Impact Score	$4

ITEMIZED BENEFITS (mil. $)	Total Over 20 Years	Average Annual
Journey Quality	$1.4	$0.1
Additional Delay Savings	$0.0	$0.0
Additional Safety Benefits	$1.8	$0.1
Health Benefits	$2.1	$0.1
Emission Cost Savings	$0.0	$0.0
TOTAL BENEFITS	$5.3	$0.3
SRTS-SPECIFIC BENEFITS (mil. $)		
Journey Quality	$0.0	$0.0
Additional Delay Savings	$0.0	$0.0
Additional Safety Benefits	$0.0	$0.0
TOTAL SRTS BENEFITS	$0.1	$0.0

Factors that Differentiate Benefits and Performance Measures

Safe Route to School	Yes
Intersection Improvements on SRTS	Yes
Programmatic Initiatives	Yes
Recreational Benefits	1

(enter 1 for Yes, 0 for No)

EMISSIONS REDUCTION	Tons: Total Over 20 Years	Tons: Average Annual	Value (mil. $): Total Over 20 Years	Value (mil. $): Average Annual
CO Emissions Saved	0	0	$0.0	$0.0
CO_2 Emissions Saved	112	6	$0.0	$0.0
NO_X Emissions Saved	0	0	$0.0	$0.0
PM_{10} Emissions Saved	0	0	$0.0	$0.0
$PM_{2.5}$ Emissions Saved	0	0		
SO_X Emissions Saved	0	0	$0.0	$0.0
VOC Emissions Saved	0	0	$0.0	$0.0

This Module focuses on the monetized benefits and costs in the Cal-B/C AT tool, it will not review methods in the multi-criteria analysis used for Non-Infrastructure Program Improvements.

Overview of Project Cost Types in Cal-B/C AT

- Cal-B/C Active Transportation can accommodate the following cost types:
  - Project support
  - Right-of-way
  - Construction
  - Maintenance and rehabilitation

Project Costs

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	1		$500.0	$2,000.0	<-- Must enter a cost			$2,500,000	$2,500,000
2	1			$2,000.0				2,000,000	1,923,077
3	0							0	0
4	0							0	0
5	0							0	0
6	0							0	0
7	0							0	0
8	0							0	0
Annual Infrastructure O&M Costs									
1					$5			$5,000	$4,623
2					$5			5,000	4,445
3					$5			5,000	4,274
4					$5			5,000	4,110
5					$5			5,000	3,952
6					$5			5,000	3,800
7					$5			5,000	3,653
8					$5			5,000	3,513
9					$5			5,000	3,378
10					$5			5,000	3,248
11					$5			5,000	3,123
12					$5			5,000	3,003
13					$5			5,000	2,887
14					$5			5,000	2,776
15					$5			5,000	2,670
16					$5			5,000	2,567
17					$5			5,000	2,468
18					$5			5,000	2,373
19					$5			5,000	2,282
20					$5			5,000	2,194
Total		$0	$500	$4,000	$100	$0		$4,600,000	$4,488,415

ATP REQUESTED FUNDS		
Total		

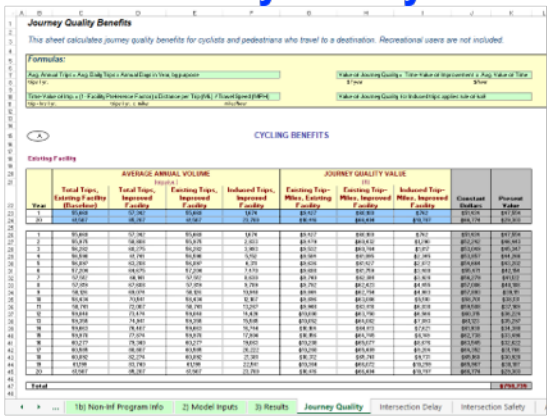
02

Overview of Benefit Calculations in Cal-B/C AT

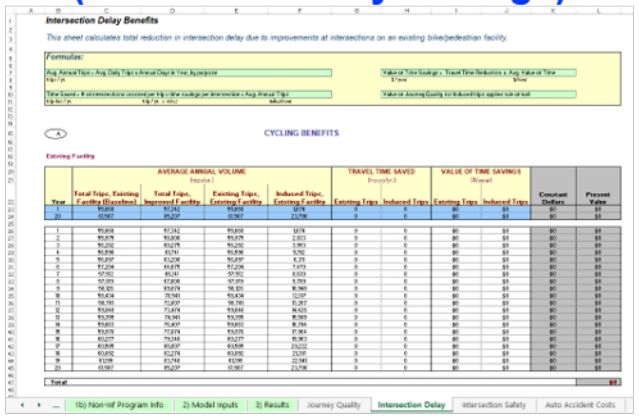
Overview of Benefit Calculations

- Benefit calculation worksheets produce detailed calculations for each benefit category
- They are provided for model transparency, not a "Black Box"
- Benefit estimates are functions of your inputs and assumptions contained in the Parameters worksheet

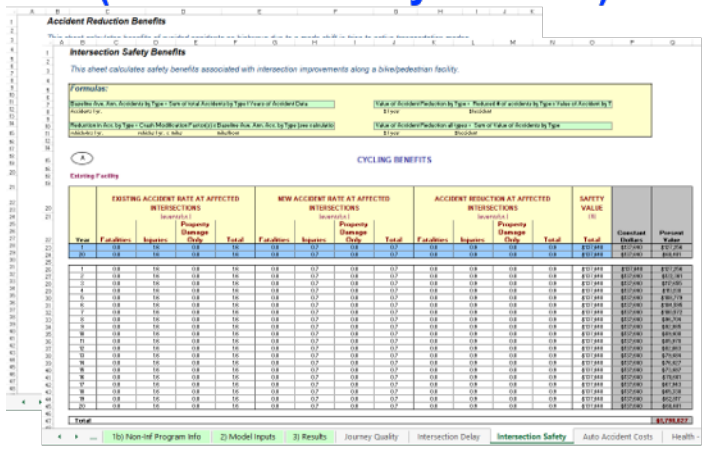
Journey Quality



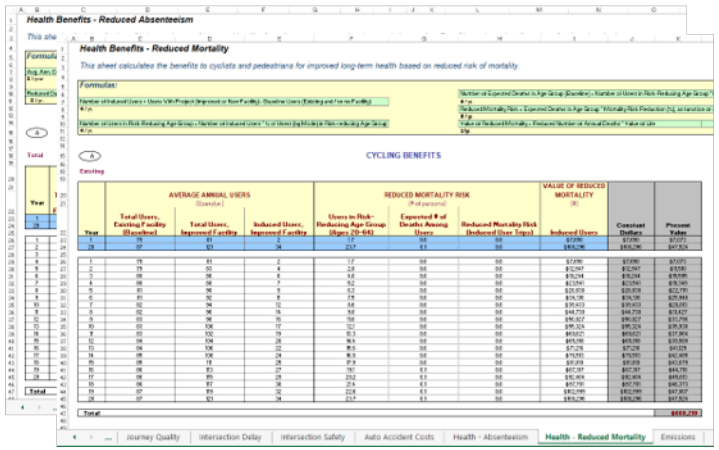
Intersection Delay (Additional Delay Savings)



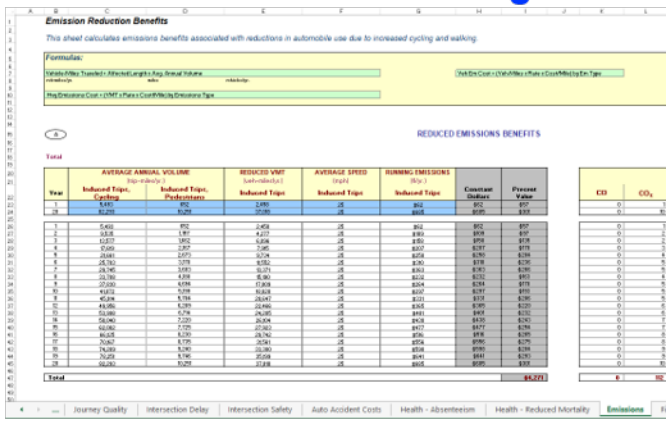
Intersection Safety (Additional Safety Benefits)



Health Benefits (Reduced Absenteeism & Mortality)



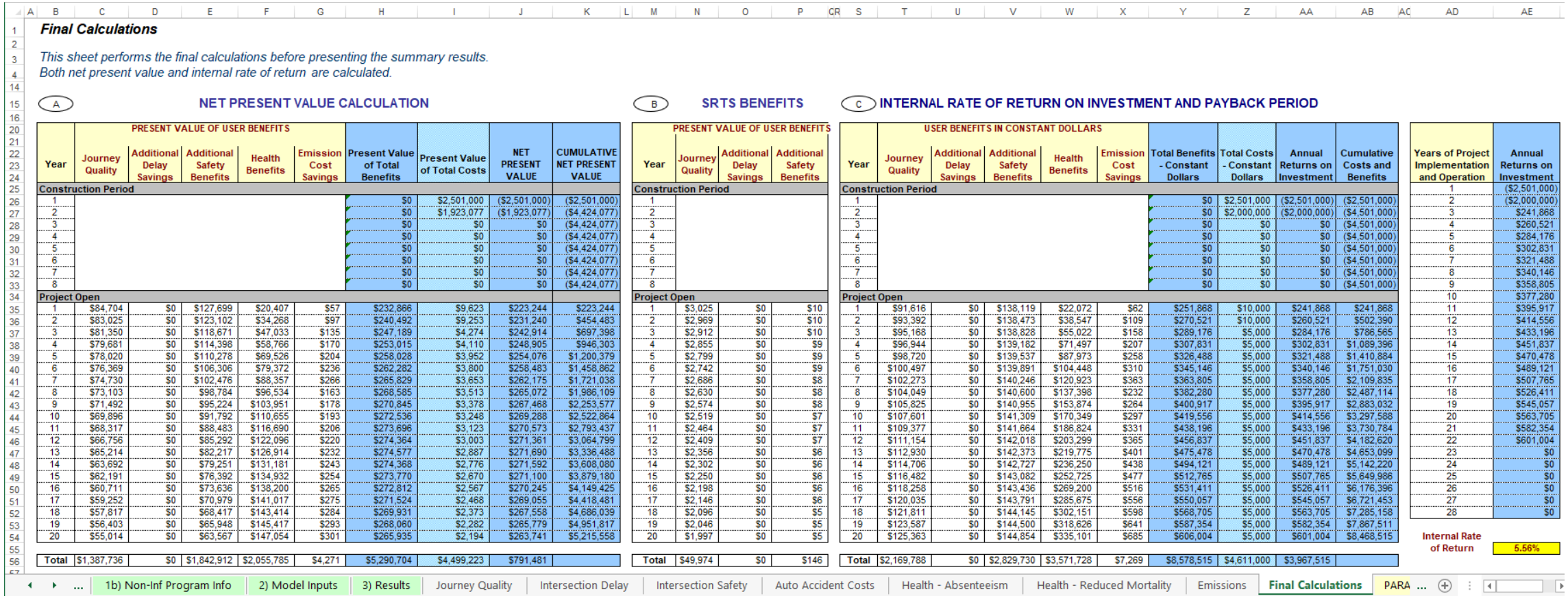
Emission Cost Savings



Overview of Benefit Calculations

The Final Calculations worksheet:

- Tabulates all the benefits and costs by year, in present value and constant dollars, from the benefit estimation worksheets
- Calculates BCA metrics (B/C ratio, IRR, NPV, and payback period)



Final Calculations

This sheet performs the final calculations before presenting the summary results.
Both net present value and internal rate of return are calculated.

A NET PRESENT VALUE CALCULATION

Year	PRESENT VALUE OF USER BENEFITS: Journey Quality	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	$2,501,000	($2,501,000)	($2,501,000)
2						$0	$1,923,077	($1,923,077)	($4,424,077)
3						$0	$0	$0	($4,424,077)
4						$0	$0	$0	($4,424,077)
5						$0	$0	$0	($4,424,077)
6						$0	$0	$0	($4,424,077)
7						$0	$0	$0	($4,424,077)
8						$0	$0	$0	($4,424,077)
Project Open									
1	$84,704	$0	$127,699	$20,407	$57	$232,866	$9,623	$223,244	$223,244
2	$83,025	$0	$123,102	$34,268	$97	$240,492	$9,253	$231,240	$454,483
3	$81,350	$0	$118,671	$47,033	$135	$247,189	$4,274	$242,914	$697,398
4	$79,681	$0	$114,398	$58,766	$170	$253,015	$4,110	$248,905	$946,303
5	$78,020	$0	$110,278	$69,526	$204	$258,028	$3,952	$254,076	$1,200,379
6	$76,369	$0	$106,306	$79,372	$236	$262,282	$3,800	$258,483	$1,458,862
7	$74,730	$0	$102,476	$88,357	$266	$265,829	$3,653	$262,175	$1,721,038
8	$73,103	$0	$98,784	$96,534	$163	$268,585	$3,513	$265,072	$1,986,109
9	$71,492	$0	$95,224	$103,951	$178	$270,845	$3,378	$267,468	$2,253,577
10	$69,896	$0	$91,792	$110,655	$193	$272,536	$3,248	$269,288	$2,522,864
11	$68,317	$0	$88,483	$116,690	$206	$273,696	$3,123	$270,573	$2,793,437
12	$66,756	$0	$85,292	$122,096	$220	$274,364	$3,003	$271,361	$3,064,799
13	$65,214	$0	$82,217	$126,914	$232	$274,577	$2,887	$271,690	$3,336,488
14	$63,692	$0	$79,251	$131,181	$243	$274,368	$2,776	$271,592	$3,608,080
15	$62,191	$0	$76,392	$134,932	$254	$273,770	$2,670	$271,100	$3,879,180
16	$60,711	$0	$73,636	$138,200	$265	$272,812	$2,567	$270,245	$4,149,425
17	$59,252	$0	$70,979	$141,017	$275	$271,524	$2,468	$269,055	$4,418,481
18	$57,817	$0	$68,417	$143,414	$284	$269,931	$2,373	$267,558	$4,686,039
19	$56,403	$0	$65,948	$145,417	$293	$268,060	$2,282	$265,779	$4,951,817
20	$55,014	$0	$63,567	$147,054	$301	$265,935	$2,194	$263,741	$5,215,558
Total	$1,387,736	$0	$1,842,912	$2,055,785	$4,271	$5,290,704	$4,499,223	$791,481	

B 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	$3,025	$0	$10
2	$2,969	$0	$10
3	$2,912	$0	$10
4	$2,855	$0	$9
5	$2,799	$0	$9
6	$2,742	$0	$9
7	$2,686	$0	$8
8	$2,630	$0	$8
9	$2,574	$0	$8
10	$2,519	$0	$7
11	$2,464	$0	$7
12	$2,409	$0	$7
13	$2,356	$0	$6
14	$2,302	$0	$6
15	$2,250	$0	$6
16	$2,198	$0	$6
17	$2,146	$0	$6
18	$2,096	$0	$5
19	$2,046	$0	$5
20	$1,997	$0	$5
Total	$49,974	$0	$146

C INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

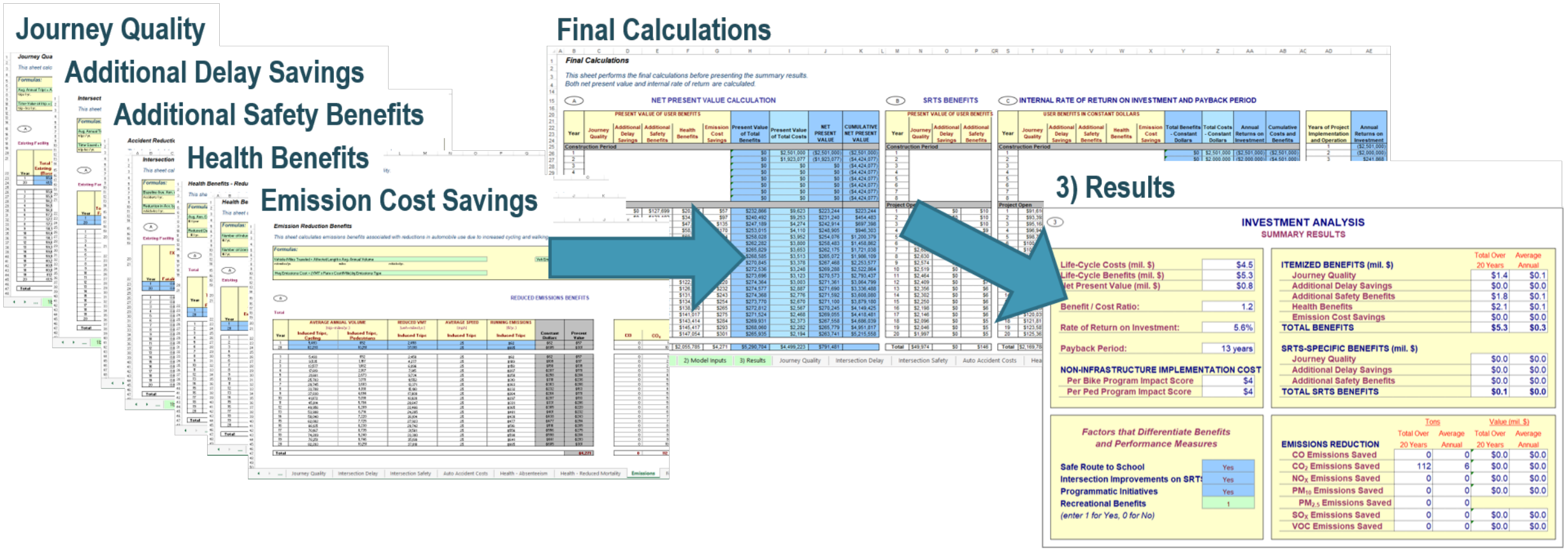
Year	USER BENEFITS IN CONSTANT DOLLARS: Journey Quality	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings	Total Benefits - Constant Dollars	Total Costs - Constant Dollars	Annual Returns on Investment	Cumulative Costs and Benefits
Construction Period									
1						$0	$2,501,000	($2,501,000)	($2,501,000)
2						$0	$2,000,000	($2,000,000)	($4,501,000)
3						$0	$0	$0	($4,501,000)
4						$0	$0	$0	($4,501,000)
5						$0	$0	$0	($4,501,000)
6						$0	$0	$0	($4,501,000)
7						$0	$0	$0	($4,501,000)
8						$0	$0	$0	($4,501,000)
Project Open									
1	$91,616	$0	$138,119	$22,072	$62	$251,868	$10,000	$241,868	$241,868
2	$93,392	$0	$138,473	$38,547	$109	$270,521	$10,000	$260,521	$502,390
3	$95,168	$0	$138,828	$55,022	$158	$289,176	$5,000	$284,176	$786,565
4	$96,944	$0	$139,182	$71,497	$207	$307,831	$5,000	$302,831	$1,089,396
5	$98,720	$0	$139,537	$87,973	$258	$326,488	$5,000	$321,488	$1,410,884
6	$100,497	$0	$139,891	$104,448	$310	$345,146	$5,000	$340,146	$1,751,030
7	$102,273	$0	$140,246	$120,923	$363	$363,805	$5,000	$358,805	$2,109,835
8	$104,049	$0	$140,600	$137,398	$232	$382,280	$5,000	$377,280	$2,487,114
9	$105,825	$0	$140,955	$153,874	$264	$400,917	$5,000	$395,917	$2,883,032
10	$107,601	$0	$141,309	$170,349	$297	$419,556	$5,000	$414,556	$3,297,588
11	$109,377	$0	$141,664	$186,824	$331	$438,196	$5,000	$433,196	$3,730,784
12	$111,154	$0	$142,018	$203,299	$365	$456,837	$5,000	$451,837	$4,182,620
13	$112,930	$0	$142,373	$219,775	$401	$475,478	$5,000	$470,478	$4,653,099
14	$114,706	$0	$142,727	$236,250	$438	$494,121	$5,000	$489,121	$5,142,220
15	$116,482	$0	$143,082	$252,725	$477	$512,765	$5,000	$507,765	$5,649,986
16	$118,258	$0	$143,436	$269,200	$516	$531,411	$5,000	$526,411	$6,176,396
17	$120,035	$0	$143,791	$285,675	$556	$550,057	$5,000	$545,057	$6,721,453
18	$121,811	$0	$144,145	$302,151	$598	$568,705	$5,000	$563,705	$7,285,158
19	$123,587	$0	$144,500	$318,626	$641	$587,354	$5,000	$582,354	$7,867,511
20	$125,363	$0	$144,854	$335,101	$685	$606,004	$5,000	$601,004	$8,468,515
Total	$2,169,788	$0	$2,829,730	$3,571,728	$7,269	$8,578,515	$4,611,000	$3,967,515	

Years of Project Implementation and Operation	Annual Returns on Investment
1	($2,501,000)
2	($2,000,000)
3	$241,868
4	$260,521
5	$284,176
6	$302,831
7	$321,488
8	$340,146
9	$358,805
10	$377,280
11	$395,917
12	$414,556
13	$433,196
14	$451,837
15	$470,478
16	$489,121
17	$507,765
18	$526,411
19	$545,057
20	$563,705
21	$582,354
22	$601,004
23	$0
24	$0
25	$0
26	$0
27	$0
28	$0

Internal Rate of Return: 5.56%

Overview of Monetized Benefit Calculations

- Analysis worksheets estimate monetized benefits from data in 1a) Project Info and 2) Model Inputs
- Benefit estimates are linked to the Final Calculations worksheet
- Life-Cycle Benefits, Life-Cycle Costs, and all other BCA metrics are linked to the Results page.



03

Benefits in Cal-B/C AT, Infrastructure Projects

Active Transportation Benefit Categories

- **Journey Quality:** Value of enhanced trip conditions
- **Travel Time Savings (at Intersections):** Estimated by reduced wait times at intersections
- **Safety Benefits (at Intersections, Sidewalks):** Estimated by crash reduction factors for safety countermeasures
- **Auto Accident Cost Savings:** Modal shift from passenger vehicles to active transportation reduces number of accidents
- **Emissions Cost Savings:** Modal shift from passenger vehicles to active transportation reduces pollution
- **Health Benefits:** Reduced absenteeism (short-term health risk), and avoided pre-mature deaths (long-term health risk)

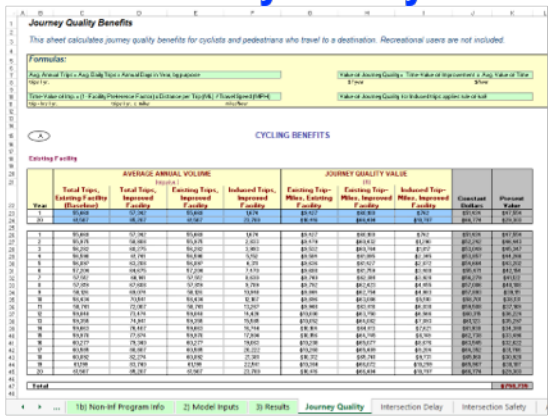
Applicability of Benefits to a Project Depend on Type of Project (Existing & New), Type of Trip (Existing & Induced)

Benefit Categories by Facility Type	Existing Facility Improvement		New Construction	
	Existing Trips	Induced Trips	Existing Trips	Induced Trips
Journey Quality	Yes	Yes	Yes	Yes
Time Savings (at Intersections)	Yes	Yes		
Safety (at Intersections)	Yes	Yes		
Auto Accident Costs and Auto Emissions		Yes		Yes
Health Benefits (Reduced Absenteeism)		Yes (Commuters)		Yes (Commuters)
Health Benefits (Reduced Mortality)		Yes (Age dependent)		Yes (Age dependent)

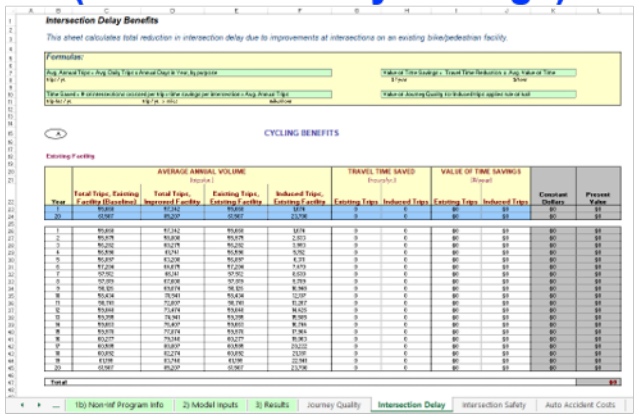
Benefit Calculations in Cal-B/C AT

- In **Cal-B/C AT** estimation worksheets, calculations are provided by:
  - Year
  - Mode (e.g., cyclists and pedestrians)
  - Facility (e.g., existing and new) depending on the benefit category

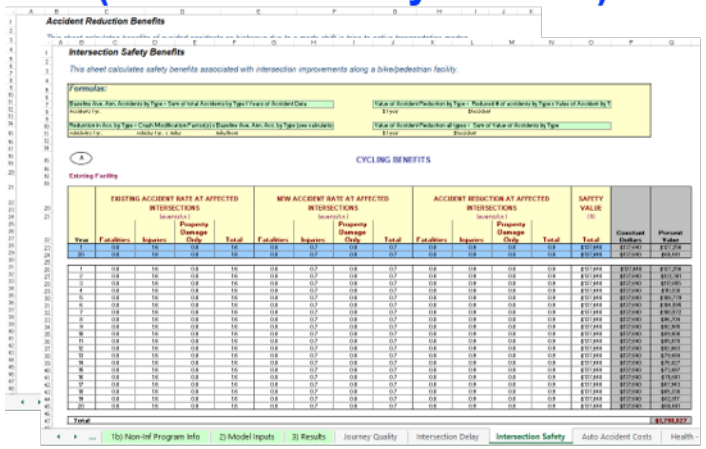
Journey Quality



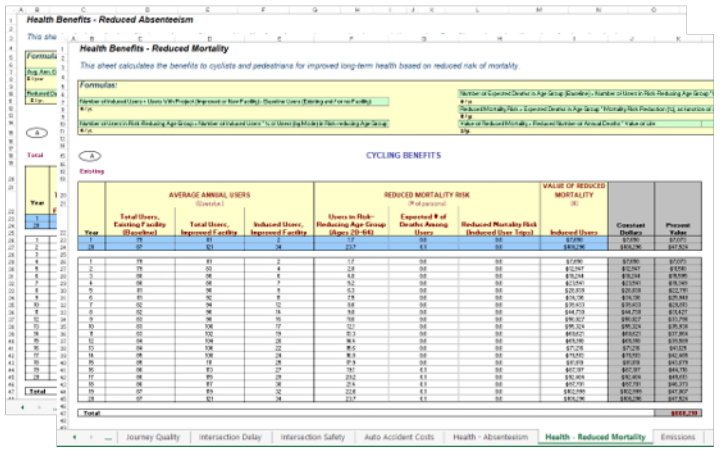
Intersection Delay (Additional Delay Savings)



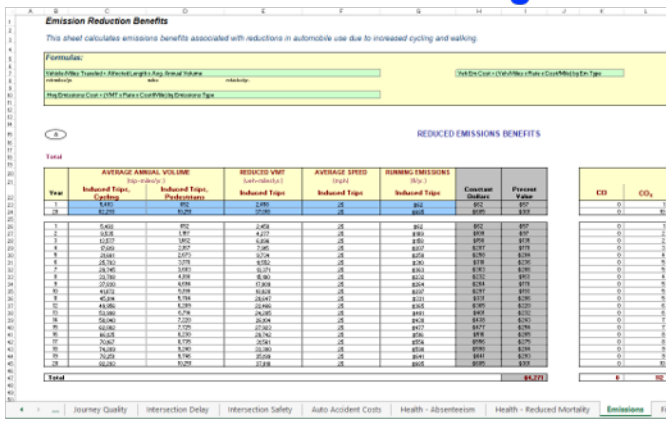
Intersection Safety (Additional Safety Benefits)



Health Benefits (Reduced Absenteeism & Mortality)



Emission Cost Savings



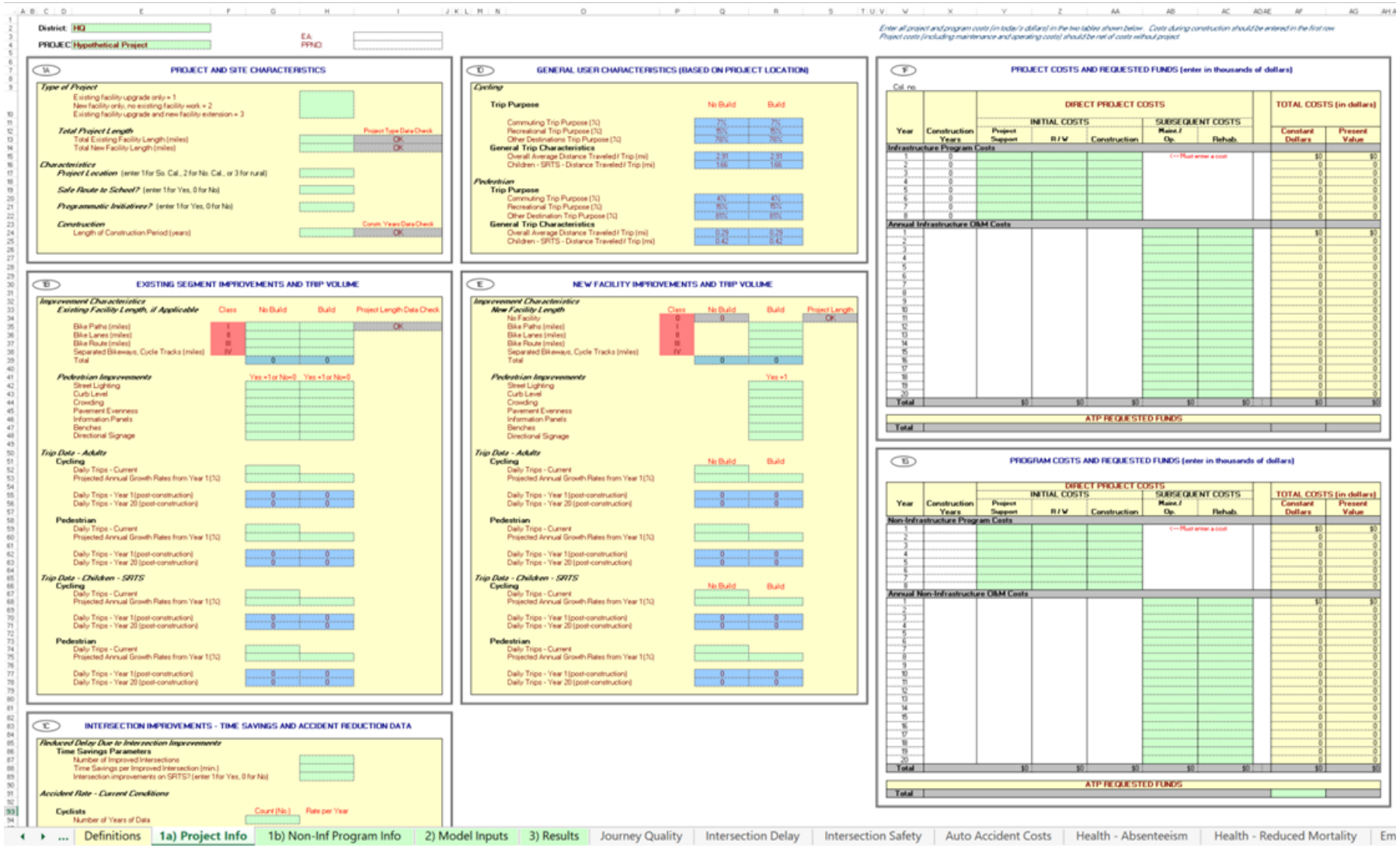
Calculations

Intermediate calculations for several benefit categories based on the data in:

1) Project Information:

- **Avg. Annual (Ann.) Trips** = Avg. Daily Trips x Number of Days per Year, by purpose
- **Avg. Distance per Trip** Set to the project length or an average distance per trip parameter (whichever is less)

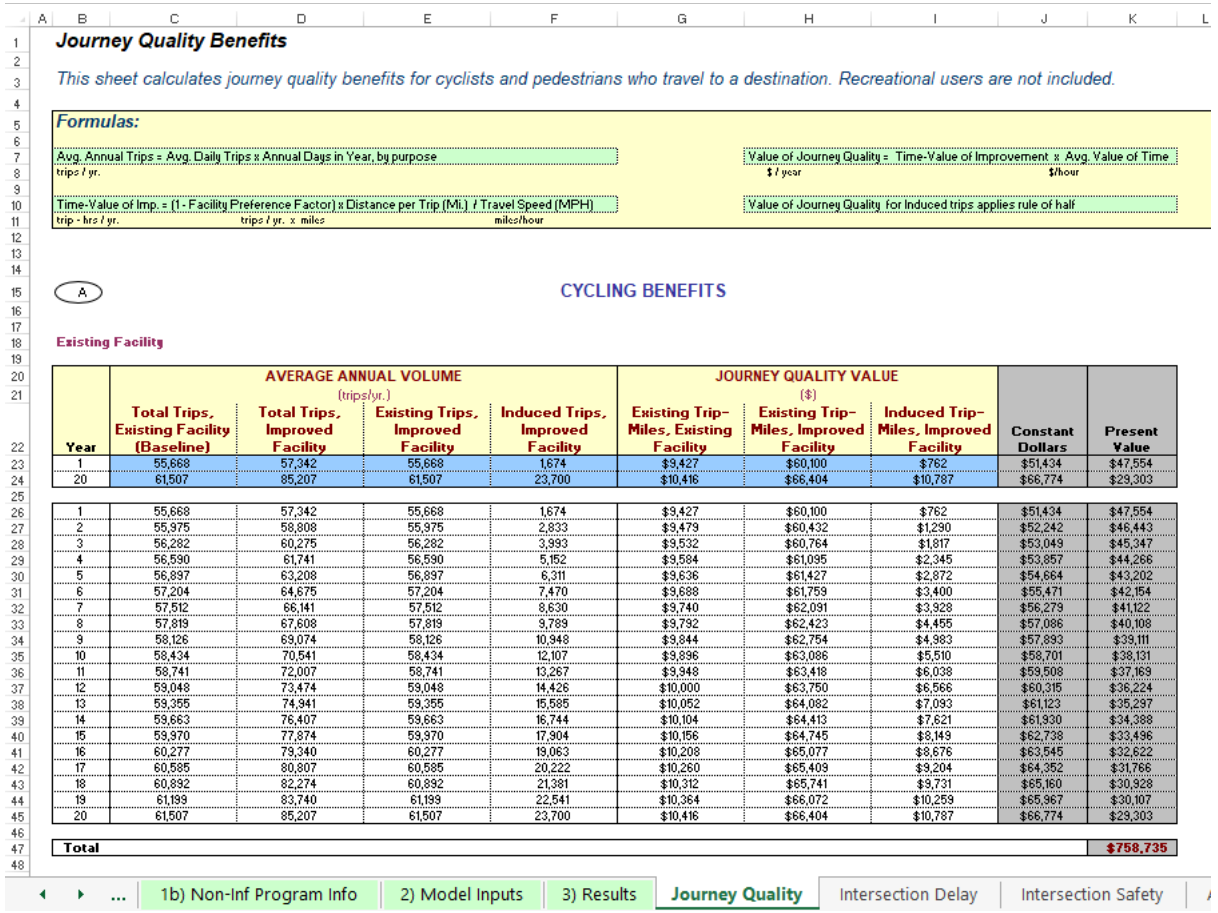
Calculated for Base and Forecast years, for the Existing and New Facility, and in No Build and Build scenarios



Project Benefits in Cal-B/C AT

Journey Quality Benefits

- Function (trips, distance per trip, value of time, journey quality parameters) by mode
  - Value of Improvement for Cycling ($ per mile) = (1- Facility Preference Factor) / Cycle Speed (mph) x Value of Time
  - Value of Improvement for Walking ($ per mile) = Journey Quality Values per Mile (from Parameters sheet, for each improvement)
  - Value of Journey Quality (Existing Users, $ per year) = Annual Trips x Avg. Distance (mi) per Trip x Value of Improvement, by mode
  - Value of Journey Quality (Induced trips) applies rule of half
- Journey Quality Benefits by year are linked to the Final Calculations worksheet



Journey Quality Benefits

This sheet calculates journey quality benefits for cyclists and pedestrians who travel to a destination. Recreational users are not included.

Formulas:

Avg. Annual Trips = Avg. Daily Trips x Annual Days in Year, by purpose (trips / yr.)

Value of Journey Quality = Time-Value of Improvement x Avg. Value of Time ($ / year; $/hour)

Time-Value of Imp. = (1 - Facility Preference Factor) x Distance per Trip (Mi.) / Travel Speed (MPH) (trip - hrs / yr.; trips / yr. x miles; miles/hour)

Value of Journey Quality for Induced trips applies rule of half

A

CYCLING BENEFITS

Existing Facility

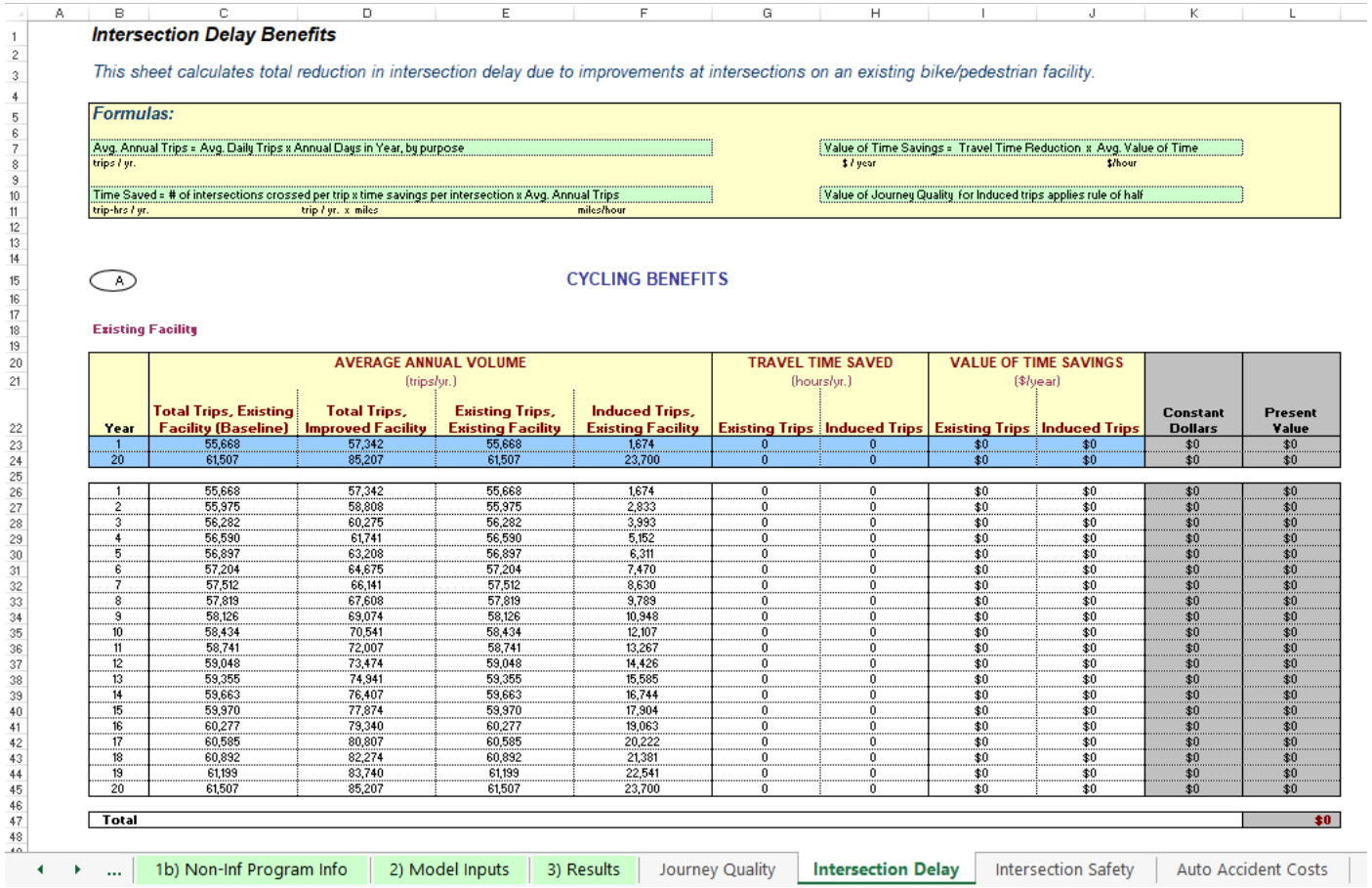
Year	AVERAGE ANNUAL VOLUME (trips/yr.) Total Trips, Existing Facility (Baseline)	Total Trips, Improved Facility	Existing Trips, Improved Facility	Induced Trips, Improved Facility	JOURNEY QUALITY VALUE ($) Existing Trip-Miles, Existing Facility	Existing Trip-Miles, Improved Facility	Induced Trip-Miles, Improved Facility	Constant Dollars	Present Value
1	55,668	57,342	55,668	1,674	$9,427	$60,100	$762	$51,434	$47,554
20	61,507	85,207	61,507	23,700	$10,416	$66,404	$10,787	$66,774	$29,303
1	55,668	57,342	55,668	1,674	$9,427	$60,100	$762	$51,434	$47,554
2	55,975	58,808	55,975	2,833	$9,479	$60,432	$1,290	$52,242	$46,443
3	56,282	60,275	56,282	3,993	$9,532	$60,764	$1,817	$53,049	$45,347
4	56,590	61,741	56,590	5,152	$9,584	$61,095	$2,345	$53,857	$44,266
5	56,897	63,208	56,897	6,311	$9,636	$61,427	$2,872	$54,664	$43,202
6	57,204	64,675	57,204	7,470	$9,688	$61,759	$3,400	$55,471	$42,154
7	57,512	66,141	57,512	8,630	$9,740	$62,091	$3,928	$56,279	$41,122
8	57,819	67,608	57,819	9,789	$9,792	$62,423	$4,455	$57,086	$40,108
9	58,126	69,074	58,126	10,948	$9,844	$62,754	$4,983	$57,893	$39,111
10	58,434	70,541	58,434	12,107	$9,896	$63,086	$5,510	$58,701	$38,131
11	58,741	72,007	58,741	13,267	$9,948	$63,418	$6,038	$59,508	$37,169
12	59,048	73,474	59,048	14,426	$10,000	$63,750	$6,566	$60,315	$36,224
13	59,355	74,941	59,355	15,585	$10,052	$64,082	$7,093	$61,123	$35,297
14	59,663	76,407	59,663	16,744	$10,104	$64,413	$7,621	$61,930	$34,388
15	59,970	77,874	59,970	17,904	$10,156	$64,745	$8,149	$62,738	$33,496
16	60,277	79,340	60,277	19,063	$10,208	$65,077	$8,676	$63,545	$32,622
17	60,585	80,807	60,585	20,222	$10,260	$65,409	$9,204	$64,352	$31,766
18	60,892	82,274	60,892	21,381	$10,312	$65,741	$9,731	$65,160	$30,928
19	61,199	83,740	61,199	22,541	$10,364	$66,072	$10,259	$65,967	$30,107
20	61,507	85,207	61,507	23,700	$10,416	$66,404	$10,787	$66,774	$29,303
Total									$758,735

1b) Non-Inf Program Info | 2) Model Inputs | 3) Results | Journey Quality | Intersection Delay | Intersection Safety

Project Benefits in Cal-B/C AT

Intersection Delay (Additional Time Savings)

- Function (trips, intersection time savings, value of time) by mode
  - Travel Time (TT) Reduction = Avg. Ann. Trips x Avg. Intersections Crossed per Trip x Time Savings per Improved Intersection
  - TT Savings (Existing Users) = TT Reduction x Value of Time
  - TT Savings (Induced) applies the rule of half
- Intersection Delay Savings by year are linked to the Final Calculations worksheet



Intersection Delay Benefits

This sheet calculates total reduction in intersection delay due to improvements at intersections on an existing bike/pedestrian facility.

Formulas:

Avg. Annual Trips = Avg. Daily Trips x Annual Days in Year, by purpose (trips / yr.)

Value of Time Savings = Travel Time Reduction x Avg. Value of Time ($ / year; $/hour)

Time Saved = # of intersections crossed per trip x time savings per intersection x Avg. Annual Trips (trip-hrs / yr.; trip / yr. x miles; miles/hour)

Value of Journey Quality for Induced trips applies rule of half

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CYCLING BENEFITS

Existing Facility

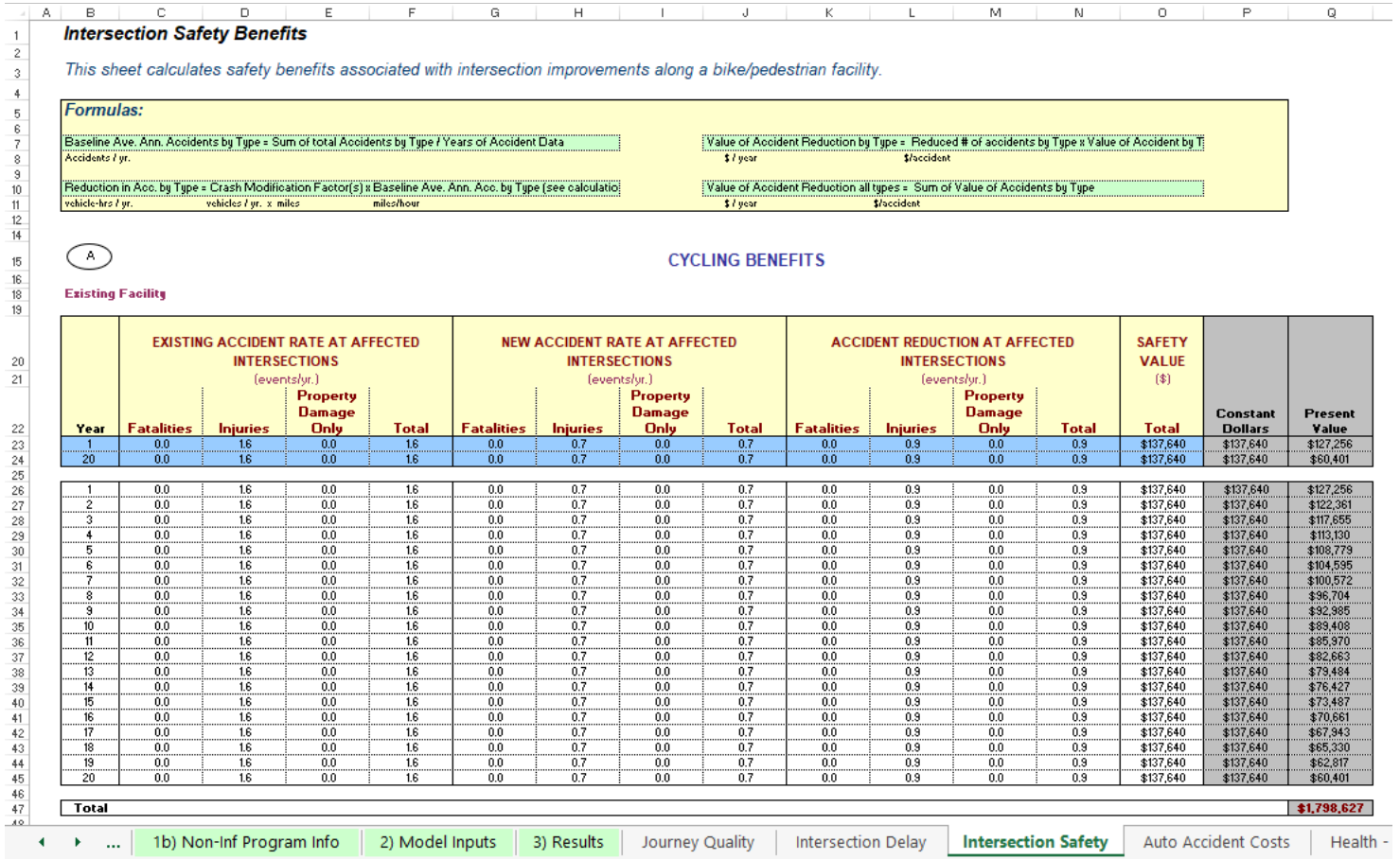
Year	AVERAGE ANNUAL VOLUME (trips/yr.) Total Trips, Existing Facility (Baseline)	Total Trips, Improved Facility	Existing Trips, Existing Facility	Induced Trips, Existing Facility	TRAVEL TIME SAVED (hours/yr.) Existing Trips	Induced Trips	VALUE OF TIME SAVINGS ($/year) Existing Trips	Induced Trips	Constant Dollars	Present Value
1	55,668	57,342	55,668	1,674	0	0	$0	$0	$0	$0
20	61,507	85,207	61,507	23,700	0	0	$0	$0	$0	$0
1	55,668	57,342	55,668	1,674	0	0	$0	$0	$0	$0
2	55,975	58,808	55,975	2,833	0	0	$0	$0	$0	$0
3	56,282	60,275	56,282	3,993	0	0	$0	$0	$0	$0
4	56,590	61,741	56,590	5,152	0	0	$0	$0	$0	$0
5	56,897	63,208	56,897	6,311	0	0	$0	$0	$0	$0
6	57,204	64,675	57,204	7,470	0	0	$0	$0	$0	$0
7	57,512	66,141	57,512	8,630	0	0	$0	$0	$0	$0
8	57,819	67,608	57,819	9,789	0	0	$0	$0	$0	$0
9	58,126	69,074	58,126	10,948	0	0	$0	$0	$0	$0
10	58,434	70,541	58,434	12,107	0	0	$0	$0	$0	$0
11	58,741	72,007	58,741	13,267	0	0	$0	$0	$0	$0
12	59,048	73,474	59,048	14,426	0	0	$0	$0	$0	$0
13	59,355	74,941	59,355	15,585	0	0	$0	$0	$0	$0
14	59,663	76,407	59,663	16,744	0	0	$0	$0	$0	$0
15	59,970	77,874	59,970	17,904	0	0	$0	$0	$0	$0
16	60,277	79,340	60,277	19,063	0	0	$0	$0	$0	$0
17	60,585	80,807	60,585	20,222	0	0	$0	$0	$0	$0
18	60,892	82,274	60,892	21,381	0	0	$0	$0	$0	$0
19	61,199	83,740	61,199	22,541	0	0	$0	$0	$0	$0
20	61,507	85,207	61,507	23,700	0	0	$0	$0	$0	$0
Total										$0

1b) Non-Inf Program Info | 2) Model Inputs | 3) Results | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs

Project Benefits in Cal-B/C AT

Intersection Safety

- Function (accident rate, expected accident reduction, cost per accident) by accident type, by mode
  - Avg. Ann. Accidents (No Build) = Total Accidents (by type) / Years of Accident Data
  - Reduction in Accidents = Avg. Ann. Accidents (No Build, by type) x Combined Crash Modification Factor (CMF)
  - Accident Cost Savings = Reduction in Accidents (by type) x Value of Avoided Accident (by type)
  - CMFs and Cost/Accident from Parameters sheet
- Intersection Safety Benefits by year are linked to the Final Calculations worksheet in "**Additional Safety Benefits**"



Intersection Safety Benefits

This sheet calculates safety benefits associated with intersection improvements along a bike/pedestrian facility.

Formulas:

Baseline Ave. Ann. Accidents by Type = Sum of total Accidents by Type / Years of Accident Data
Accidents / yr.

Value of Accident Reduction by Type = Reduced # of accidents by Type x Value of Accident by T
$ / year $/accident

Reduction in Acc. by Type = Crash Modification Factor(s) x Baseline Ave. Ann. Acc. by Type (see calculatio
vehicle-hrs / yr. vehicles / yr. x miles miles/hour

Value of Accident Reduction all types = Sum of Value of Accidents by Type
$ / year $/accident

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CYCLING BENEFITS

Existing Facility

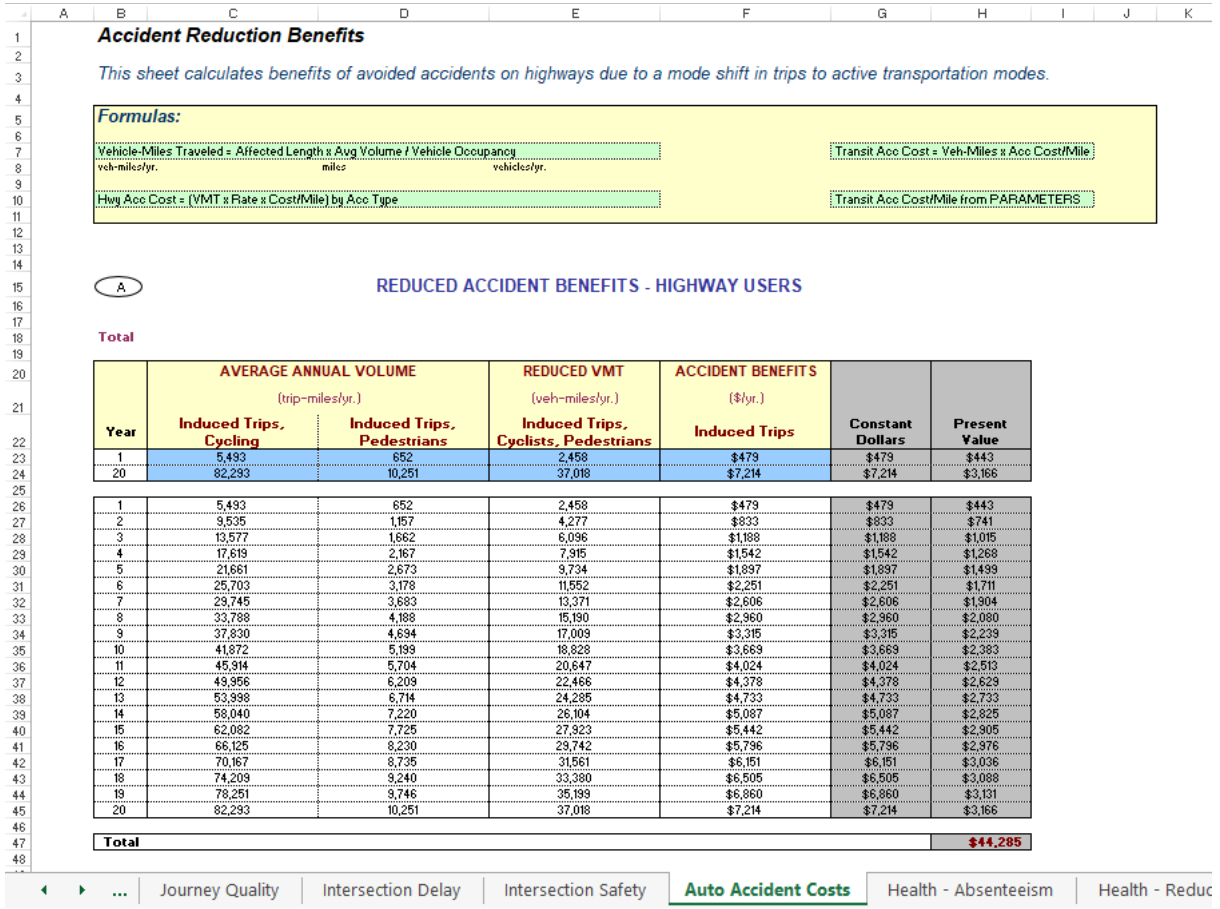
Year	EXISTING ACCIDENT RATE AT AFFECTED INTERSECTIONS (events/yr.) Fatalities	Injuries	Property Damage Only	Total	NEW ACCIDENT RATE AT AFFECTED INTERSECTIONS (events/yr.) Fatalities	Injuries	Property Damage Only	Total	ACCIDENT REDUCTION AT AFFECTED INTERSECTIONS (events/yr.) Fatalities	Injuries	Property Damage Only	Total	SAFETY VALUE ($) Total	Constant Dollars	Present Value
1	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$127,256
20	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$60,401
1	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$127,256
2	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$122,361
3	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$117,655
4	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$113,130
5	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$108,779
6	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$104,595
7	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$100,572
8	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$96,704
9	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$92,985
10	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$89,408
11	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$85,970
12	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$82,663
13	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$79,484
14	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$76,427
15	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$73,487
16	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$70,661
17	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$67,943
18	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$65,330
19	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$62,817
20	0.0	1.6	0.0	1.6	0.0	0.7	0.0	0.7	0.0	0.9	0.0	0.9	$137,640	$137,640	$60,401
Total															$1,798,627

1b) Non-Inf Program Info | 2) Model Inputs | 3) Results | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health -

Project Benefits in Cal-B/C AT

Auto Accident Costs

- Function (trips, distance per trip, accident rate, cost per accident)
  - Induced Ann. Trip-Miles = Change in Ann. Trips (No Build to Build) x Avg. Distance (mi) per Trip, by mode
  - Reduced Vehicle-Miles Traveled (VMT) = Induced Ann. Trip-Miles (by mode) x Diversion from Personal Vehicles (%, by mode) / Vehicle Occupancy
  - Accident Cost Savings = Reduced VMT x Non-Freeway Accident Rate per MVM x Avg. Cost per Accident
  - Accident Rate and Avg. Accident Cost from Parameters sheet
- Accident Reduction Benefits by year are linked to the Final Calculations worksheet in "**Additional Safety Benefits**"



Accident Reduction Benefits

This sheet calculates benefits of avoided accidents on highways due to a mode shift in trips to active transportation modes.

Formulas:

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

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

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

Transit Acc Cost/Mile from PARAMETERS

(A) REDUCED ACCIDENT BENEFITS - HIGHWAY USERS

Total

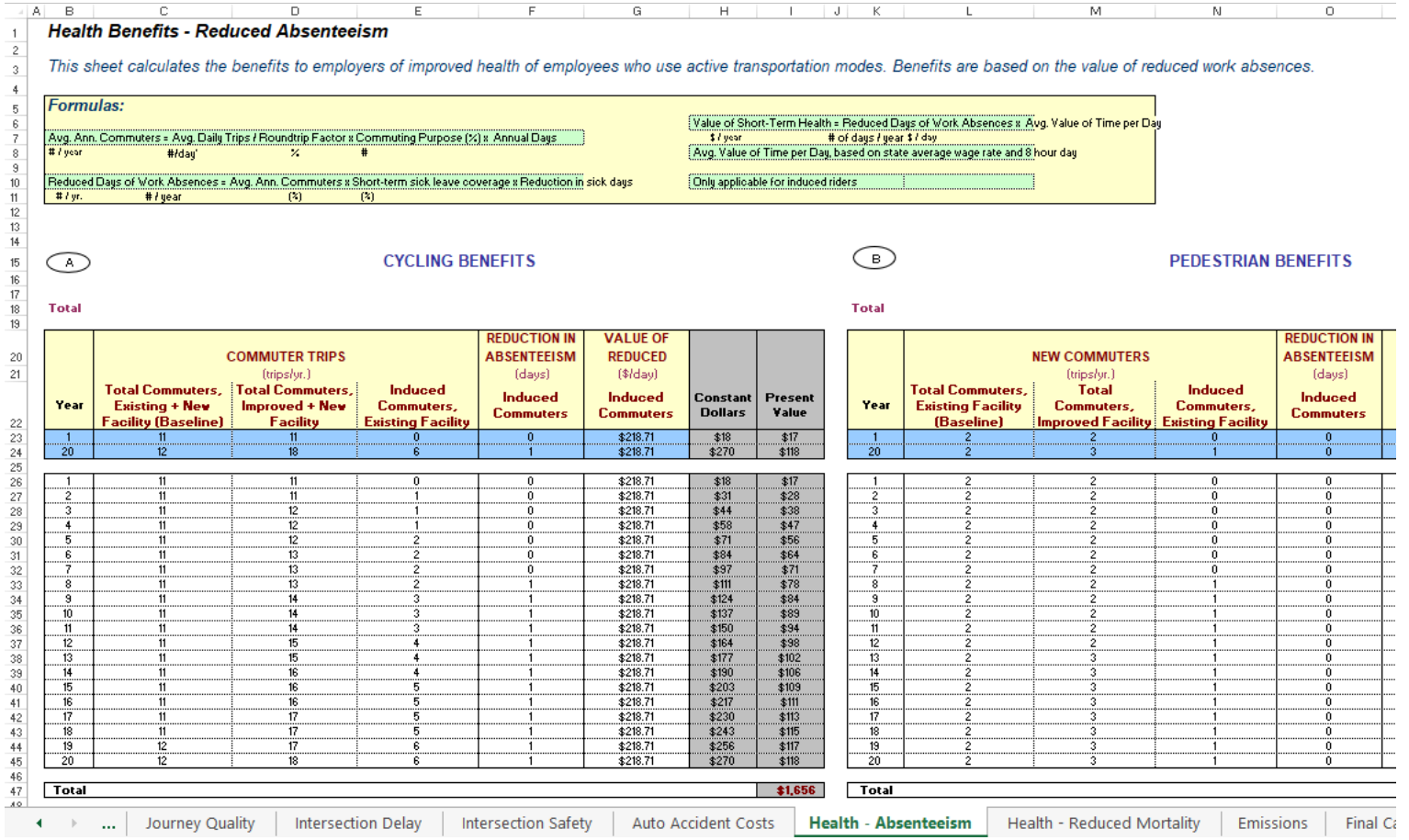
Year	AVERAGE ANNUAL VOLUME (trip-miles/yr.) Induced Trips, Cycling	Induced Trips, Pedestrians	REDUCED VMT (veh-miles/yr.) Induced Trips, Cyclists, Pedestrians	ACCIDENT BENEFITS ($/yr.) Induced Trips	Constant Dollars	Present Value
1	5,493	652	2,458	$479	$479	$443
20	82,293	10,251	37,018	$7,214	$7,214	$3,166
1	5,493	652	2,458	$479	$479	$443
2	9,535	1,157	4,277	$833	$833	$741
3	13,577	1,662	6,096	$1,188	$1,188	$1,015
4	17,619	2,167	7,915	$1,542	$1,542	$1,268
5	21,661	2,673	9,734	$1,897	$1,897	$1,499
6	25,703	3,178	11,552	$2,251	$2,251	$1,711
7	29,745	3,683	13,371	$2,606	$2,606	$1,904
8	33,788	4,188	15,190	$2,960	$2,960	$2,080
9	37,830	4,694	17,009	$3,315	$3,315	$2,239
10	41,872	5,199	18,828	$3,669	$3,669	$2,383
11	45,914	5,704	20,647	$4,024	$4,024	$2,513
12	49,956	6,209	22,466	$4,378	$4,378	$2,629
13	53,998	6,714	24,285	$4,733	$4,733	$2,733
14	58,040	7,220	26,104	$5,087	$5,087	$2,825
15	62,082	7,725	27,923	$5,442	$5,442	$2,905
16	66,125	8,230	29,742	$5,796	$5,796	$2,976
17	70,167	8,735	31,561	$6,151	$6,151	$3,036
18	74,209	9,240	33,380	$6,505	$6,505	$3,088
19	78,251	9,746	35,199	$6,860	$6,860	$3,131
20	82,293	10,251	37,018	$7,214	$7,214	$3,166
Total						$44,285

Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health - Absenteeism | Health - Reduc

Project Benefits in Cal-B/C AT

Health Benefits – Reduced Absenteeism

- Function (trips, value of time, absenteeism parameters) by mode
  - Ann. AT Commuters = Avg. Daily Trips x Commuting Trips (%) x Days per Year / Roundtrip Factor (trips per user)
  - Induced Ann. AT Commuters = Change in Ann. AT Commuters (No Build to Build)
  - Reduced Work Absences (days) = Induced Ann. Commuters x Ann. Sick Days x Short-term Sick Leave Coverage (%) x Reduction in Sick Days with Increased Daily Activity (%)
  - Value of Reduced Absenteeism = Reduced Work Absences x Avg. Value of Time per Day
  - Avg. Value of Time per Day based on state average wage rate and 8-hour day
- Health Benefits from Reduced Absenteeism by year are linked to the Final Calculations worksheet in "**Health Benefits**"



Health Benefits - Reduced Absenteeism

This sheet calculates the benefits to employers of improved health of employees who use active transportation modes. Benefits are based on the value of reduced work absences.

Formulas:

Avg. Ann. Commuters = Avg. Daily Trips / Roundtrip Factor x Commuting Purpose (%) x Annual Days
/ year #/day' %

Reduced Days of Work Absences = Avg. Ann. Commuters x Short-term sick leave coverage x Reduction in sick days
/ yr. # / year (%) (%)

Value of Short-Term Health = Reduced Days of Work Absences x Avg. Value of Time per Day
$ / year # of days / year $ / day

Avg. Value of Time per Day, based on state average wage rate and 8 hour day

Only applicable for induced riders

(A) CYCLING BENEFITS

Total

Year	COMMUTER TRIPS (trips/yr.) Total Commuters, Existing + New Facility (Baseline)	Total Commuters, Improved + New Facility	Induced Commuters, Existing Facility	REDUCTION IN ABSENTEEISM (days) Induced Commuters	VALUE OF REDUCED ($/day) Induced Commuters	Constant Dollars	Present Value
1	11	11	0	0	$218.71	$18	$17
20	12	18	6	1	$218.71	$270	$118
1	11	11	0	0	$218.71	$18	$17
2	11	11	1	0	$218.71	$31	$28
3	11	12	1	0	$218.71	$44	$38
4	11	12	1	0	$218.71	$58	$47
5	11	12	2	0	$218.71	$71	$56
6	11	13	2	0	$218.71	$84	$64
7	11	13	2	0	$218.71	$97	$71
8	11	13	2	1	$218.71	$111	$78
9	11	14	3	1	$218.71	$124	$84
10	11	14	3	1	$218.71	$137	$89
11	11	14	3	1	$218.71	$150	$94
12	11	15	4	1	$218.71	$164	$98
13	11	15	4	1	$218.71	$177	$102
14	11	16	4	1	$218.71	$190	$106
15	11	16	5	1	$218.71	$203	$109
16	11	16	5	1	$218.71	$217	$111
17	11	17	5	1	$218.71	$230	$113
18	11	17	5	1	$218.71	$243	$115
19	12	17	6	1	$218.71	$256	$117
20	12	18	6	1	$218.71	$270	$118
Total							$1,656

(B) PEDESTRIAN BENEFITS

Total

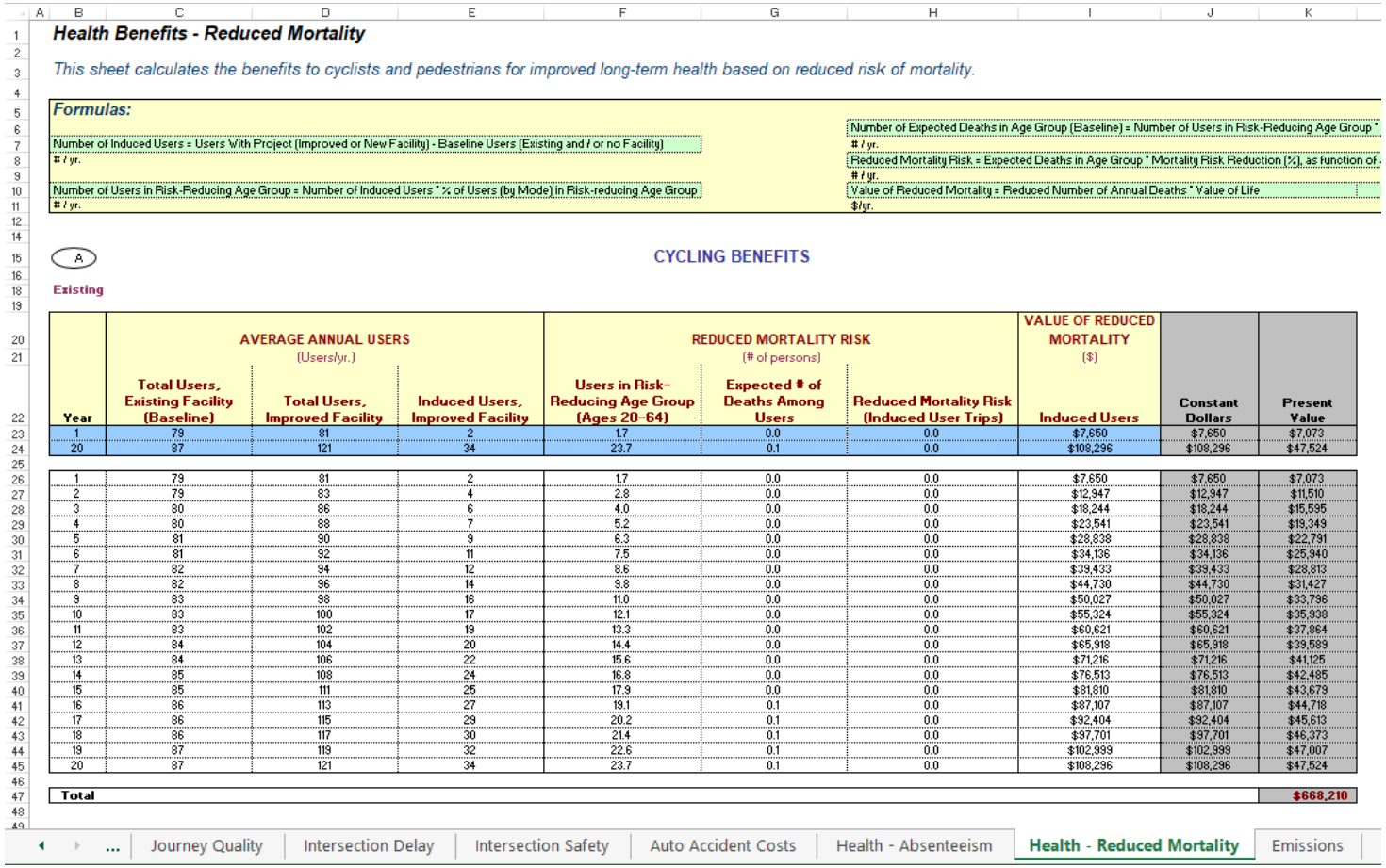
Year	NEW COMMUTERS (trips/yr.) Total Commuters, Existing Facility (Baseline)	Total Commuters, Improved Facility	Induced Commuters, Existing Facility	REDUCTION IN ABSENTEEISM (days) Induced Commuters
1	2	2	0	0
20	2	3	1	0
1	2	2	0	0
2	2	2	0	0
3	2	2	0	0
4	2	2	0	0
5	2	2	0	0
6	2	2	0	0
7	2	2	0	0
8	2	2	1	0
9	2	2	1	0
10	2	2	1	0
11	2	2	1	0
12	2	2	1	0
13	2	3	1	0
14	2	3	1	0
15	2	3	1	0
16	2	3	1	0
17	2	3	1	0
18	2	3	1	0
19	2	3	1	0
20	2	3	1	0
Total				

... | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health - Absenteeism | Health - Reduced Mortality | Emissions | Final Ca

Project Benefits in Cal-B/C AT

Health Benefits – Reduced Mortality

- Function (trips, value of life, mortality parameters)
  - Ann. AT Users = Avg. Daily Trips (by purpose) x Days per Year / Roundtrip Factor (trips per user)
  - Induced AT Users = Change in Users (No Build to Build)
  - Users in Risk-Reducing Age Group = Induced AT Users x Users in Risk-Reducing Age Group (%)
  - Expected Deaths in Age Group = Users in Risk-Reducing Age Group x Mortality Rate
  - Reduced Mortality Risk (Ann. Deaths) = Expected Deaths in Age Group x Reduction in Mortality Risk (%)
  - Value of Reduced Mortality Risk = Reduced Ann. Deaths x Value of Statistical Life
- Health Benefits from Reduced Mortality by year are linked to the Final Calculations worksheet in "**Health Benefits**"



Health Benefits - Reduced Mortality

This sheet calculates the benefits to cyclists and pedestrians for improved long-term health based on reduced risk of mortality.

Formulas:

Number of Induced Users = Users With Project (Improved or New Facility) - Baseline Users (Existing and / or no Facility)
/ yr.

Number of Users in Risk-Reducing Age Group = Number of Induced Users * % of Users (by Mode) in Risk-reducing Age Group
/ yr.

Number of Expected Deaths in Age Group (Baseline) = Number of Users in Risk-Reducing Age Group *
/ yr.

Reduced Mortality Risk = Expected Deaths in Age Group * Mortality Risk Reduction (%), as function of
/ yr.

Value of Reduced Mortality = Reduced Number of Annual Deaths * Value of Life
$/yr.

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CYCLING BENEFITS

Existing

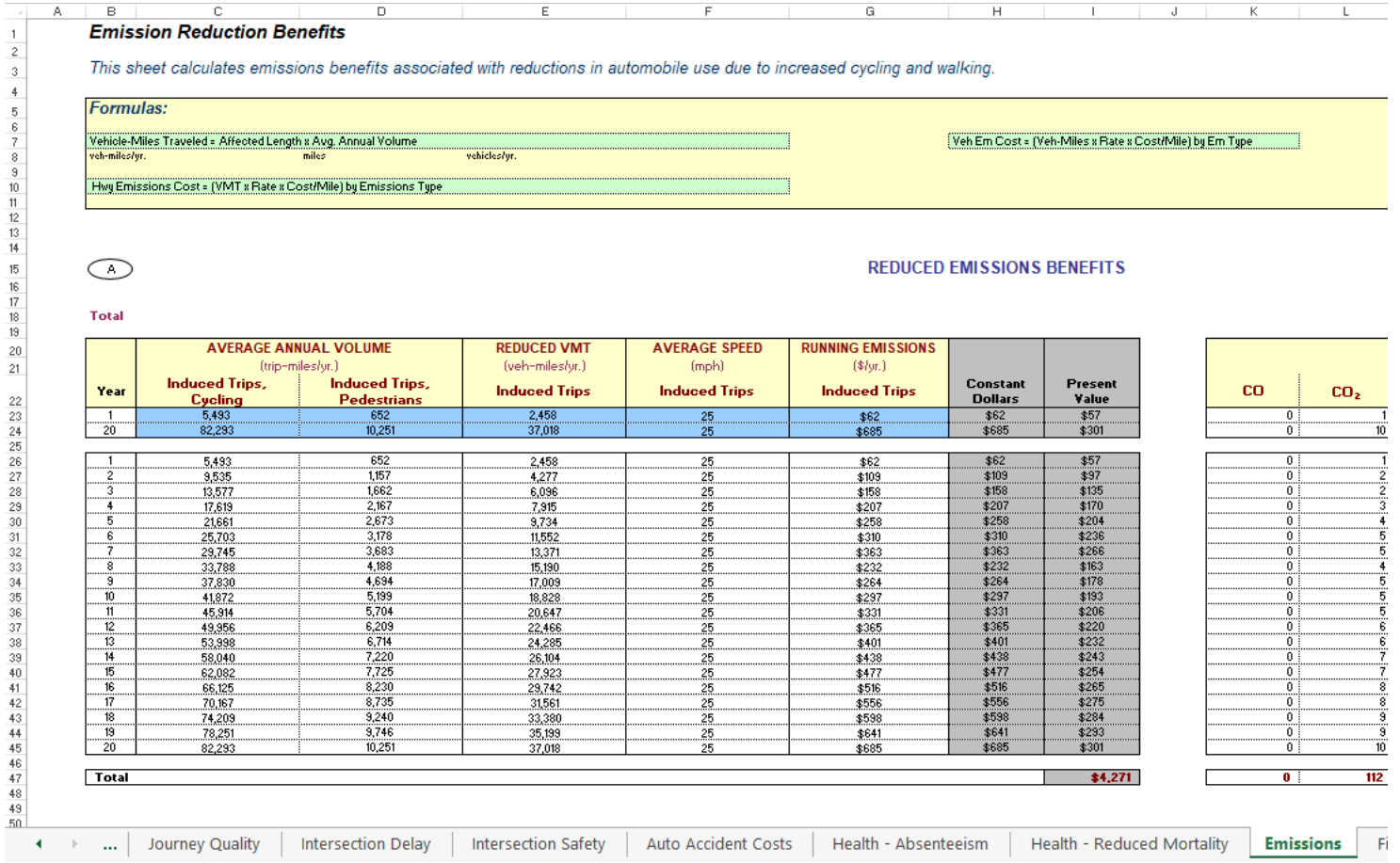
Year	AVERAGE ANNUAL USERS (Users/yr.) Total Users, Existing Facility (Baseline)	Total Users, Improved Facility	Induced Users, Improved Facility	REDUCED MORTALITY RISK (# of persons) Users in Risk-Reducing Age Group (Ages 20–64)	Expected # of Deaths Among Users	Reduced Mortality Risk (Induced User Trips)	VALUE OF REDUCED MORTALITY ($) Induced Users	Constant Dollars	Present Value
1	79	81	2	1.7	0.0	0.0	$7,650	$7,650	$7,073
20	87	121	34	23.7	0.1	0.0	$108,296	$108,296	$47,524
1	79	81	2	1.7	0.0	0.0	$7,650	$7,650	$7,073
2	79	83	4	2.8	0.0	0.0	$12,947	$12,947	$11,510
3	80	86	6	4.0	0.0	0.0	$18,244	$18,244	$15,595
4	80	88	7	5.2	0.0	0.0	$23,541	$23,541	$19,349
5	81	90	9	6.3	0.0	0.0	$28,838	$28,838	$22,791
6	81	92	11	7.5	0.0	0.0	$34,136	$34,136	$25,940
7	82	94	12	8.6	0.0	0.0	$39,433	$39,433	$28,813
8	82	96	14	9.8	0.0	0.0	$44,730	$44,730	$31,427
9	83	98	16	11.0	0.0	0.0	$50,027	$50,027	$33,796
10	83	100	17	12.1	0.0	0.0	$55,324	$55,324	$35,938
11	83	102	19	13.3	0.0	0.0	$60,621	$60,621	$37,864
12	84	104	20	14.4	0.0	0.0	$65,918	$65,918	$39,589
13	84	106	22	15.6	0.0	0.0	$71,216	$71,216	$41,125
14	85	108	24	16.8	0.0	0.0	$76,513	$76,513	$42,485
15	85	111	25	17.9	0.0	0.0	$81,810	$81,810	$43,679
16	86	113	27	19.1	0.1	0.0	$87,107	$87,107	$44,718
17	86	115	29	20.2	0.1	0.0	$92,404	$92,404	$45,613
18	86	117	30	21.4	0.1	0.0	$97,701	$97,701	$46,373
19	87	119	32	22.6	0.1	0.0	$102,999	$102,999	$47,007
20	87	121	34	23.7	0.1	0.0	$108,296	$108,296	$47,524
Total									$668,210

... | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health - Absenteeism | Health - Reduced Mortality | Emissions

Project Benefits in Cal-B/C AT

Emission Cost Savings

- Function (trips, distance per trip, emission rate) by emissions type
  - Induced Ann. AT Trip-Miles = Change in Trips (No Build to Build) x Avg. Distance (mi) per Trip, by mode
  - Reduced Vehicle-Miles Traveled (VMT) = Induced Trip-Miles (by mode) x Diversion from Personal Vehicles (%, by mode) / Vehicle Occupancy
  - Emissions Cost Savings = Reduced VMT x Emission Rate x Cost/Mile (by emissions type)
- Emissions Cost Savings by year are linked to the Final Calculations worksheet



Emission Reduction Benefits

This sheet calculates emissions benefits associated with reductions in automobile use due to increased cycling and walking.

Formulas:

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

Veh Em Cost = (Veh-Miles x Rate x Cost/Mile) by Em Type

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

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	5,493	652	2,458	25	$62	$62	$57	0	1
20	82,293	10,251	37,018	25	$685	$685	$301	0	10
1	5,493	652	2,458	25	$62	$62	$57	0	1
2	9,535	1,157	4,277	25	$109	$109	$97	0	2
3	13,577	1,662	6,096	25	$158	$158	$135	0	2
4	17,619	2,167	7,915	25	$207	$207	$170	0	3
5	21,661	2,673	9,734	25	$258	$258	$204	0	4
6	25,703	3,178	11,552	25	$310	$310	$236	0	5
7	29,745	3,683	13,371	25	$363	$363	$266	0	5
8	33,788	4,188	15,190	25	$232	$232	$163	0	4
9	37,830	4,694	17,009	25	$264	$264	$178	0	5
10	41,872	5,199	18,828	25	$297	$297	$193	0	5
11	45,914	5,704	20,647	25	$331	$331	$206	0	5
12	49,956	6,209	22,466	25	$365	$365	$220	0	6
13	53,998	6,714	24,285	25	$401	$401	$232	0	6
14	58,040	7,220	26,104	25	$438	$438	$243	0	7
15	62,082	7,725	27,923	25	$477	$477	$254	0	7
16	66,125	8,230	29,742	25	$516	$516	$265	0	8
17	70,167	8,735	31,561	25	$556	$556	$275	0	8
18	74,209	9,240	33,380	25	$598	$598	$284	0	9
19	78,251	9,746	35,199	25	$641	$641	$293	0	9
20	82,293	10,251	37,018	25	$685	$685	$301	0	10
Total							$4,271	0	112

... | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health - Absenteeism | Health - Reduced Mortality | Emissions | Fi

04

Project Costs in Cal-B/C AT

Project Cost Inputs

- All project costs are entered in Section 1F in the Project Information worksheet, in five cost columns
- Project costs should be entered as incremental costs
  - Incremental costs are difference between No Build and Build scenarios
- Project costs must be entered in constant dollars, in same year as economic parameters used for benefit calculations (current year in Cal-B/C is 2016)
- Project costs must be entered in thousands of dollars ($1,000)

1F

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

Col. no.

Year	Construction Years	DIRECT PROJECT COSTS: INITIAL COSTS: Project Support	INITIAL COSTS: R / W	INITIAL COSTS: Construction	SUBSEQUENT COSTS: Maint./ Op.	SUBSEQUENT COSTS: Rehab.	TOTAL COSTS (in dollars): Constant Dollars	TOTAL COSTS (in dollars): Present Value
Infrastructure Program Costs								
1	1		$500.0	$2,000.0	<-- Must enter a cost		$2,500,000	$2,500,000
2	1			$2,000.0			2,000,000	1,923,077
3	0						0	0
4	0						0	0
5	0						0	0
6	0						0	0
7	0						0	0
8	0						0	0
Annual Infrastructure O&M Costs								
1					$5		$5,000	$4,623
2					$5		5,000	4,445
3					$5		5,000	4,274
4					$5		5,000	4,110
5					$5		5,000	3,952
6					$5		5,000	3,800
7					$5		5,000	3,653
8					$5		5,000	3,513
9					$5		5,000	3,378
10					$5		5,000	3,248
11					$5		5,000	3,123
12					$5		5,000	3,003
13					$5		5,000	2,887
14					$5		5,000	2,776
15					$5		5,000	2,670
16					$5		5,000	2,567
17					$5		5,000	2,468
18					$5		5,000	2,373
19					$5		5,000	2,282
20					$5		5,000	2,194
Total		$0	$500	$4,000	$100	$0	$4,600,000	$4,488,415

ATP REQUESTED FUNDS			
Total			

Project Cost Inputs

- Year 1 (current year) is represented by the "1" under the "Construction Period" header
- Cal-B/C allows up to eight (8) years of initial project costs
- Costs must be entered for each year to be consistent with "Length of Construction Period"
  - Example: If the Length of Construction Period (entered in Project Information, Section 1A) is 5 years, then years 1 through 5 in Section 1E must have a direct project cost entered
- Following construction, project opens and O&M & rehabilitation costs may be input for the duration of the project operating period
- Year 1 (Base Year) is represented by the "1" under the "Project Open" header

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	1		$500.0	$2,000.0	<-- Must enter a cost			$2,500,000	$2,500,000
2	1			$2,000.0				2,000,000	1,923,077
3	0							0	0
4	0							0	0
5	0							0	0
6	0							0	0
7	0							0	0
8	0							0	0
Annual Infrastructure O&M Costs									
1					$5			$5,000	$4,623
2					$5			5,000	4,445
3					$5			5,000	4,274
4					$5			5,000	4,110
5					$5			5,000	3,952
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11					$5			5,000	3,123
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13					$5			5,000	2,887
14					$5			5,000	2,776
15					$5			5,000	2,670
16					$5			5,000	2,567
17					$5			5,000	2,468
18					$5			5,000	2,373
19					$5			5,000	2,282
20					$5			5,000	2,194
Total		$0	$500	$4,000	$100	$0		$4,600,000	$4,488,415

ATP REQUESTED FUNDS									
Total									

Project Costs – Direct Project Costs

Initial Costs

- Project support (e.g., preliminary engineering, design, management costs)
- Right-of-way acquisition costs
- Construction costs

No initial project costs should be incurred after the project opens

Cal-B/C assumes all construction funding is expended by opening day

1F

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

Col. no.

Year	Construction Years	DIRECT PROJECT COSTS: INITIAL COSTS: Project Support	DIRECT PROJECT COSTS: INITIAL COSTS: R / W	DIRECT PROJECT COSTS: INITIAL COSTS: Construction	DIRECT PROJECT COSTS: SUBSEQUENT COSTS: Maint./ Op.	DIRECT PROJECT COSTS: SUBSEQUENT COSTS: Rehab.	TOTAL COSTS (in dollars): Constant Dollars	TOTAL COSTS (in dollars): Present Value
Infrastructure Program Costs								
1	1		$500.0	$2,000.0	<-- Must enter a cost		$2,500,000	$2,500,000
2	1			$2,000.0			2,000,000	1,923,077
3	0						0	0
4	0						0	0
5	0						0	0
6	0						0	0
7	0						0	0
8	0						0	0
Annual Infrastructure O&M Costs								
1					$5		$5,000	$4,623
2					$5		5,000	4,445
3					$5		5,000	4,274
4					$5		5,000	4,110
5					$5		5,000	3,952
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17					$5		5,000	2,468
18					$5		5,000	2,373
19					$5		5,000	2,282
20					$5		5,000	2,194
Total		$0	$500	$4,000	$100	$0	$4,600,000	$4,488,415

ATP REQUESTED FUNDS	
Total	

Project Costs – Direct Project Costs

Subsequent Costs

- Maintenance and operating costs
- Rehabilitation costs (e.g., pavement overlay, vehicle, track, or station refurbishment)

These costs are incurred after the project is constructed and open for service

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	1		$500.0	$2,000.0	<-- Must enter a cost		$2,500,000	$2,500,000
2	1			$2,000.0			2,000,000	1,923,077
3	0						0	0
4	0						0	0
5	0						0	0
6	0						0	0
7	0						0	0
8	0						0	0
Annual Infrastructure O&M Costs								
1					$5		$5,000	$4,623
2					$5		5,000	4,445
3					$5		5,000	4,274
4					$5		5,000	4,110
5					$5		5,000	3,952
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10					$5		5,000	3,248
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15					$5		5,000	2,670
16					$5		5,000	2,567
17					$5		5,000	2,468
18					$5		5,000	2,373
19					$5		5,000	2,282
20					$5		5,000	2,194
Total		$0	$500	$4,000	$100	$0	$4,600,000	$4,488,415

ATP REQUESTED FUNDS		
Total		

Project Costs – Total Costs

Total Costs

- Calculated automatically based on entry in previous seven columns of cost data
  - Constant Dollars column sums all costs spent in each year
  - Present Value column discounts costs spent in each year using the Real Discount Rate (Parameters sheet)
- Values are in total dollars (not in thousands of dollars)

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	1		$500.0	$2,000.0	<-- Must enter a cost			$2,500,000	$2,500,000
2	1			$2,000.0				2,000,000	1,923,077
3	0							0	0
4	0							0	0
5	0							0	0
6	0							0	0
7	0							0	0
8	0							0	0
Annual Infrastructure O&M Costs									
1					$5			$5,000	$4,623
2					$5			5,000	4,445
3					$5			5,000	4,274
4					$5			5,000	4,110
5					$5			5,000	3,952
6					$5			5,000	3,800
7					$5			5,000	3,653
8					$5			5,000	3,513
9					$5			5,000	3,378
10					$5			5,000	3,248
11					$5			5,000	3,123
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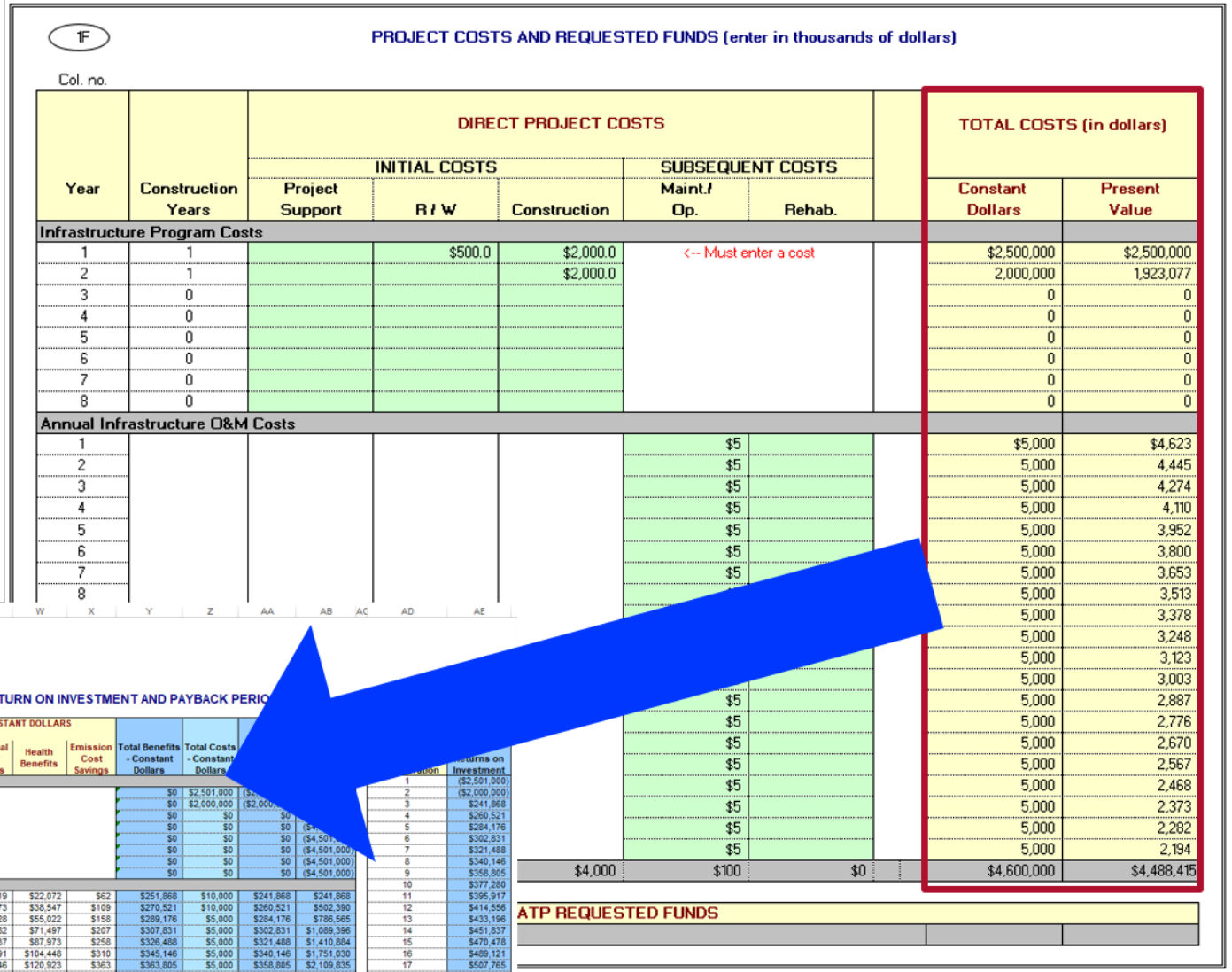
16					$5			5,000	2,567
17					$5			5,000	2,468
18					$5			5,000	2,373
19					$5			5,000	2,282
20					$5			5,000	2,194
Total		$0	$500	$4,000	$100	$0		$4,600,000	$4,488,415

ATP REQUESTED FUNDS			
Total			

Project Costs – Total Costs

Total Costs

- Calculated automatically based on entry in previous seven columns of cost data
- Values are in total dollars (not in thousands)
- Project costs (in constant dollars and present value) for each year are linked to the Final Calculations worksheet



1F

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

Col. no.

Year	Construction Years	DIRECT PROJECT COSTS: INITIAL COSTS: Project Support	INITIAL COSTS: R / W	INITIAL COSTS: Construction	SUBSEQUENT COSTS: Maint./ Op.	SUBSEQUENT COSTS: Rehab.	TOTAL COSTS (in dollars): Constant Dollars	TOTAL COSTS (in dollars): Present Value
Infrastructure Program Costs								
1	1		$500.0	$2,000.0	<-- Must enter a cost		$2,500,000	$2,500,000
2	1			$2,000.0			2,000,000	1,923,077
3	0						0	0
4	0						0	0
5	0						0	0
6	0						0	0
7	0						0	0
8	0						0	0
Annual Infrastructure O&M Costs								
1					$5		$5,000	$4,623
2					$5		5,000	4,445
3					$5		5,000	4,274
4					$5		5,000	4,110
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							5,000	3,378
							5,000	3,248
							5,000	3,123
							5,000	3,003
					$5		5,000	2,887
					$5		5,000	2,776
					$5		5,000	2,670
					$5		5,000	2,567
					$5		5,000	2,468
					$5		5,000	2,373
					$5		5,000	2,282
					$5		5,000	2,194
		$4,000	$100	$0			$4,600,000	$4,488,415

ATP REQUESTED FUNDS

Final Calculations

This sheet performs the final calculations before presenting the summary results.
Both net present value and internal rate of return are calculated.

A NET PRESENT VALUE CALCULATION

Year	Journey Quality	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	$2,501,000	($2,501,000)	($2,501,000)
2						$0	$1,923,077	($1,923,077)	($4,424,077)
3						$0	$0	$0	($4,424,077)
4						$0	$0	$0	($4,424,077)
5						$0	$0	$0	($4,424,077)
6						$0	$0	$0	($4,424,077)
7						$0	$0	$0	($4,424,077)
8						$0	$0	$0	($4,424,077)
Project Open									
1	$84,704	$0	$127,699	$20,407	$57	$232,866	$9,623	$223,244	$223,244
2	$83,025	$0	$123,102	$34,268	$97	$240,492	$9,253	$231,240	$454,483
3	$81,350	$0	$118,671	$47,033	$135	$247,189	$4,274	$242,914	$697,398
4	$79,681	$0	$114,398	$58,766	$170	$253,015	$4,110	$248,905	$946,303
5	$78,020	$0	$110,278	$69,526	$204	$258,028	$3,952	$254,076	$1,200,379
6	$76,369	$0	$106,306	$79,372	$236	$262,282	$3,800	$258,483	$1,458,862
7	$74,730	$0	$102,476	$88,357	$266	$265,829	$3,653	$262,175	$1,721,038
8	$73,103	$0	$98,784	$96,534	$163	$268,585	$3,513	$265,072	$1,986,109
9	$71,492	$0	$95,224	$103,951	$178	$270,845	$3,378	$267,468	$2,253,577
10	$69,896	$0	$91,792	$110,655	$193	$272,536	$3,248	$269,288	$2,522,864
11	$68,317	$0	$88,483	$116,690	$206	$273,696	$3,123	$270,573	$2,793,437
12	$66,756	$0	$85,292	$122,096	$220	$274,364	$3,003	$271,361	$3,064,799
13	$65,214	$0	$82,217	$126,914	$232	$274,577	$2,887	$271,690	$3,336,488
14	$63,692	$0	$79,251	$131,181	$243	$274,368	$2,776	$271,592	$3,608,080
15	$62,191	$0	$76,392	$134,932	$254	$273,770	$2,670	$271,100	$3,879,180
16	$60,711	$0	$73,636	$138,200	$265	$272,812	$2,567	$270,245	$4,149,425
17	$59,252	$0	$70,979	$141,017	$275	$271,524	$2,468	$269,055	$4,418,481
18	$57,817	$0	$68,417	$143,414	$284	$269,931	$2,373	$267,558	$4,686,039
19	$56,403	$0	$65,948	$145,417	$293	$268,060	$2,282	$265,779	$4,951,817
20	$55,014	$0	$63,567	$147,054	$301	$265,935	$2,194	$263,741	$5,215,558
Total	$1,387,736	$0	$1,842,912	$2,055,785	$4,271	$5,290,704	$4,499,223	$791,481	

B SRTS BENEFITS

Year	Journey Quality	Additional Delay Savings	Additional Safety Benefits
Construction Period			
1			
2			
3			
4			
5			
6			
7			
8			
Project Open			
1	$3,025	$0	$10
2	$2,969	$0	$10
3	$2,912	$0	$10
4	$2,855	$0	$9
5	$2,799	$0	$9
6	$2,742	$0	$9
7	$2,686	$0	$8
8	$2,630	$0	$8
9	$2,574	$0	$8
10	$2,519	$0	$7
11	$2,464	$0	$7
12	$2,409	$0	$7
13	$2,356	$0	$6
14	$2,302	$0	$6
15	$2,250	$0	$6
16	$2,198	$0	$6
17	$2,146	$0	$6
18	$2,096	$0	$5
19	$2,046	$0	$5
20	$1,997	$0	$5
Total	$49,974	$0	$146

C INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIO

Year	Journey Quality	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings	Total Benefits - Constant Dollars	Total Costs - Constant Dollars	Returns on Investment
Construction Period								
1						$0	$2,501,000	($2,501,000)
2						$0	$2,000,000	($2,000,000)
3						$0	$0	$241,868
4						$0	$0	$260,521
5						$0	$0	$284,176
6						$0	$0	$302,831
7						$0	$0	$321,488
8						$0	$0	$340,146
Project Open								
1	$91,616	$0	$138,119	$22,072	$62	$251,868	$10,000	$241,868
2	$93,392	$0	$138,473	$38,547	$109	$270,521	$10,000	$260,521
3	$95,168	$0	$138,828	$55,022	$158	$289,176	$5,000	$284,176
4	$96,944	$0	$139,182	$71,497	$207	$307,831	$5,000	$302,831
5	$98,720	$0	$139,537	$87,973	$258	$326,488	$5,000	$321,488
6	$100,497	$0	$139,891	$104,448	$310	$345,146	$5,000	$340,146
7	$102,273	$0	$140,246	$120,923	$363	$363,805	$5,000	$358,805
8	$104,049	$0	$140,600	$137,398	$232	$382,280	$5,000	$377,280
9	$105,825	$0	$140,955	$153,874	$264	$400,917	$5,000	$395,917
10	$107,601	$0	$141,309	$170,349	$297	$419,556	$5,000	$414,556
11	$109,377	$0	$141,664	$186,824	$331	$438,196	$5,000	$433,196
12	$111,154	$0	$142,018	$203,299	$365	$456,837	$5,000	$451,837
13	$112,930	$0	$142,373	$219,775	$401	$475,478	$5,000	$470,478
14	$114,706	$0	$142,727	$236,250	$438	$494,121	$5,000	$489,121
15	$116,482	$0	$143,082	$252,725	$477	$512,765	$5,000	$507,765
16	$118,258	$0	$143,436	$269,200	$516	$531,411	$5,000	$526,411
17	$120,035	$0	$143,791	$285,675	$556	$550,057	$5,000	$545,057
18	$121,811	$0	$144,145	$302,151	$598	$568,705	$5,000	$563,705
19	$123,587	$0	$144,500	$318,626	$641	$587,354	$5,000	$582,354
20	$125,363	$0	$144,854	$335,101	$685	$606,004	$5,000	$601,004
Total	$2,169,788	$0	$2,829,730	$3,571,728	$7,269	$8,578,515	$4,611,000	$3,967,515

Internal Rate of Return 5.56%

1b) Non-Inf Program Info | 2) Model Inputs | 3) Results | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health - Absenteeism | Health - Reduced Mortality | Emissions | Final Calculations | PARA ...

Project Costs in Final Calculations

- Project Costs are combined with Project Benefits estimates (in constant dollars and present value) in the Final Calculations worksheet to calculate all BCA metrics
- BCA metrics are linked to the Results page

Final Calculations

Final Calculations

This sheet performs the final calculations before presenting the summary results.
Both net present value and internal rate of return are calculated.

A NET PRESENT VALUE CALCULATION

Year	PRESENT VALUE OF USER BENEFITS: Journey Quality	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	$2,501,000	($2,501,000)	($2,501,000)
2						$0	$1,923,077	($1,923,077)	($4,424,077)
3						$0	$0	$0	($4,424,077)
4						$0	$0	$0	($4,424,077)
5						$0	$0	$0	($4,424,077)
6						$0	$0	$0	($4,424,077)
7						$0	$0	$0	($4,424,077)
8						$0	$0	$0	($4,424,077)
Project Open									
1	$84,704	$0	$127,699	$20,407	$57	$232,866	$9,623	$223,244	$223,244
2	$83,025	$0	$123,102	$34,268	$97	$240,492	$9,253	$231,240	$454,483
3	$81,350	$0	$118,671	$47,033	$135	$247,189	$4,274	$242,914	$697,398
4	$79,681	$0	$114,398	$58,766	$170	$253,015	$4,110	$248,905	$946,303
5	$78,020	$0	$110,278	$69,526	$204	$258,028	$3,952	$254,076	$1,200,379
6	$76,369	$0	$106,306	$79,372	$236	$262,282	$3,800	$258,483	$1,458,862
7	$74,730	$0	$102,476	$88,357	$266	$265,829	$3,653	$262,175	$1,721,038
8	$73,103	$0	$98,784	$96,534	$163	$268,585	$3,513	$265,072	$1,986,109
9	$71,492	$0	$95,224	$103,951	$178	$270,845	$3,378	$267,468	$2,253,577
10	$69,896	$0	$91,792	$110,655	$193	$272,536	$3,248	$269,288	$2,522,864
11	$68,317	$0	$88,483	$116,690	$206	$273,696	$3,123	$270,573	$2,793,437
12	$66,756	$0	$85,292	$122,096	$220	$274,364	$3,003	$271,361	$3,064,799
13	$65,214	$0	$82,217	$126,914	$232	$274,577	$2,887	$271,690	$3,336,488
14	$63,692	$0	$79,251	$131,181	$243	$274,368	$2,776	$271,592	$3,608,080
15	$62,191	$0	$76,392	$134,932	$254	$273,770	$2,670	$271,100	$3,879,180
16	$60,711	$0	$73,636	$138,200	$265	$272,812	$2,567	$270,245	$4,149,425
17	$59,252	$0	$70,979	$141,017	$275	$271,524	$2,468	$269,055	$4,418,481
18	$57,817	$0	$68,417	$143,414	$284	$269,931	$2,373	$267,558	$4,686,039
19	$56,403	$0	$65,948	$145,417	$293	$268,060	$2,282	$265,779	$4,951,817
20	$55,014	$0	$63,567	$147,054	$301	$265,935	$2,194	$263,741	$5,215,558
Total	$1,387,736	$0	$1,842,912	$2,055,785	$4,271	$5,290,704	$4,499,223	$791,481	

B 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	$3,025	$0	$10
2	$2,969	$0	$10
3	$2,912	$0	$10
4	$2,855	$0	$9
5	$2,799	$0	$9
6	$2,742	$0	$9
7	$2,686	$0	$8
8	$2,630	$0	$8
9	$2,574	$0	$8
10	$2,519	$0	$7
11	$2,464	$0	$7
12	$2,409	$0	$7
13	$2,356	$0	$6
14	$2,302	$0	$6
15	$2,250	$0	$6
16	$2,198	$0	$6
17	$2,146	$0	$6
18	$2,096	$0	$5
19	$2,046	$0	$5
20	$1,997	$0	$5
Total	$49,974	$0	$146

C INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	USER BENEFITS IN CONSTANT DOLLARS: Journey Quality	Additional Delay Savings	Additional Safety Benefits	Health Benefits	Emission Cost Savings	Total Benefits - Constant Dollars	Total Costs - Constant Dollars	Annual Returns on
Construction Period								
1						$0	$2,50	
2						$0	$2,00	
3						$0		
4						$0	$0	$0
5						$0	$0	$0
6						$0	$0	$0
7						$0	$0	$0
8						$0	$0	$0
Project Open								
1	$91,616	$0	$138,119	$22,072	$62	$251,868	$10,000	$241,868
2	$93,392	$0	$138,473	$38,547	$109	$270,521	$10,000	$260,521
3	$95,168	$0	$138,828	$55,022	$158	$289,176	$5,000	$284,176
4	$96,944	$0	$139,182	$71,497	$207	$307,831	$5,000	$302,831
5	$98,720	$0	$139,537	$87,973	$258	$326,488	$5,000	$321,488
6	$100,497	$0	$139,891	$104,448	$310	$345,146	$5,000	$340,146
7	$102,273	$0	$140,246	$120,923	$363	$363,805	$5,000	$358,805
8	$104,049	$0	$140,600	$137,398	$232	$382,280	$5,000	$377,280
9	$105,825	$0	$140,955	$153,874	$264	$400,917	$5,000	$395,917
10	$107,601	$0	$141,309	$170,349	$297	$419,556	$5,000	$414,556
11	$109,377	$0	$141,664	$186,824	$331	$438,196	$5,000	$433,196
12	$111,154	$0	$142,018	$203,299	$365	$456,837	$5,000	$451,837
13	$112,930	$0	$142,373	$219,775	$401	$475,478	$5,000	$470,478
14	$114,706	$0	$142,727	$236,250	$438	$494,121	$5,000	$489,121
15	$116,482	$0	$143,082	$252,725	$477	$512,765	$5,000	$507,765
16	$118,258	$0	$143,436	$269,200	$516	$531,411	$5,000	$526,411
17	$120,035	$0	$143,791	$285,675	$556	$550,057	$5,000	$545,057
18	$121,811	$0	$144,145	$302,151	$598	$568,705	$5,000	$563,705
19	$123,587	$0	$144,500	$318,626	$641	$587,354	$5,000	$582,354
20	$125,363	$0	$144,854	$335,101	$685	$606,004	$5,000	$601,004
Total	$2,169,788	$0	$2,829,730	$3,571,728	$7,269	$8,578,515	$4,611,000	$3,967,515

Internal Rate of Return 5.56%

Sheet tabs: 1b) Non-Inf Program Info | 2) Model Inputs | 3) Results | Journey Quality | Intersection Delay | Intersection Safety | Auto Accident Costs | Health - Absenteeism | Health - Reduced Mortality | Emissions | Final Calculations | PARA ...

3) Results

INVESTMENT ANALYSIS
SUMMARY RESULTS

Life-Cycle Costs (mil. $)	$4.5
Life-Cycle Benefits (mil. $)	$5.3
Net Present Value (mil. $)	$0.8
Benefit / Cost Ratio:	1.2
Rate of Return on Investment:	5.6%
Payback Period:	13 years
NON-INFRASTRUCTURE IMPLEMENTATION COST	
Per Bike Program Impact Score	$4
Per Ped Program Impact Score	$4

ITEMIZED BENEFITS (mil. $)	Total Over 20 Years	Average Annual
Journey Quality	$1.4	$0.1
Additional Delay Savings	$0.0	$0.0
Additional Safety Benefits	$1.8	$0.1
Health Benefits	$2.1	$0.1
Emission Cost Savings	$0.0	$0.0
TOTAL BENEFITS	$5.3	$0.3
SRTS-SPECIFIC BENEFITS (mil. $)		
Journey Quality	$0.0	$0.0
Additional Delay Savings	$0.0	$0.0
Additional Safety Benefits	$0.0	$0.0
TOTAL SRTS BENEFITS	$0.1	$0.0

Factors that Differentiate Benefits and Performance Measures

Safe Route to School	Yes
Intersection Improvements on SRTS	Yes
Programmatic Initiatives	Yes
Recreational Benefits	1
(enter 1 for Yes, 0 for No)	

EMISSIONS REDUCTION	Tons: Total Over 20 Years	Tons: Average Annual	Value (mil. $): Total Over 20 Years	Value (mil. $): Average Annual
CO Emissions Saved	0	0	$0.0	$0.0
CO_2 Emissions Saved	112	6	$0.0	$0.0
NO_X Emissions Saved	0	0	$0.0	$0.0
PM_{10} Emissions Saved	0	0	$0.0	$0.0
$PM_{2.5}$ Emissions Saved	0	0		
SO_X Emissions Saved	0	0	$0.0	$0.0
VOC Emissions Saved	0	0	$0.0	$0.0

05

Conclusion

In this module, you learned…

- What project costs are included in Cal-B/C AT
- What benefit categories are automatically estimated in the Cal-B/C AT
- How each benefit category is estimated and monetized based on the data input
- How benefit estimates connect from the analysis sheets, through the Final Calculation sheet, to the Results sheet

What's Next?

- Start an analysis!
  - **Module 7c: How to Start a Cal-B/C Analysis**
- There are other versions of this module for the other Cal-B/C tools:
  - **Module 6a: Understanding Project Benefits and Costs in Cal-B/C Sketch, Corridor, and Park and Ride (PnR)**
  - **Module 6e: Understanding Project Benefits and Costs in Cal-B/C Intermodal Freight**