



Cal-B/C Training Module 6a

Understanding Project Benefits and Costs for
Cal-B/C Sketch, Corridor, and PnR

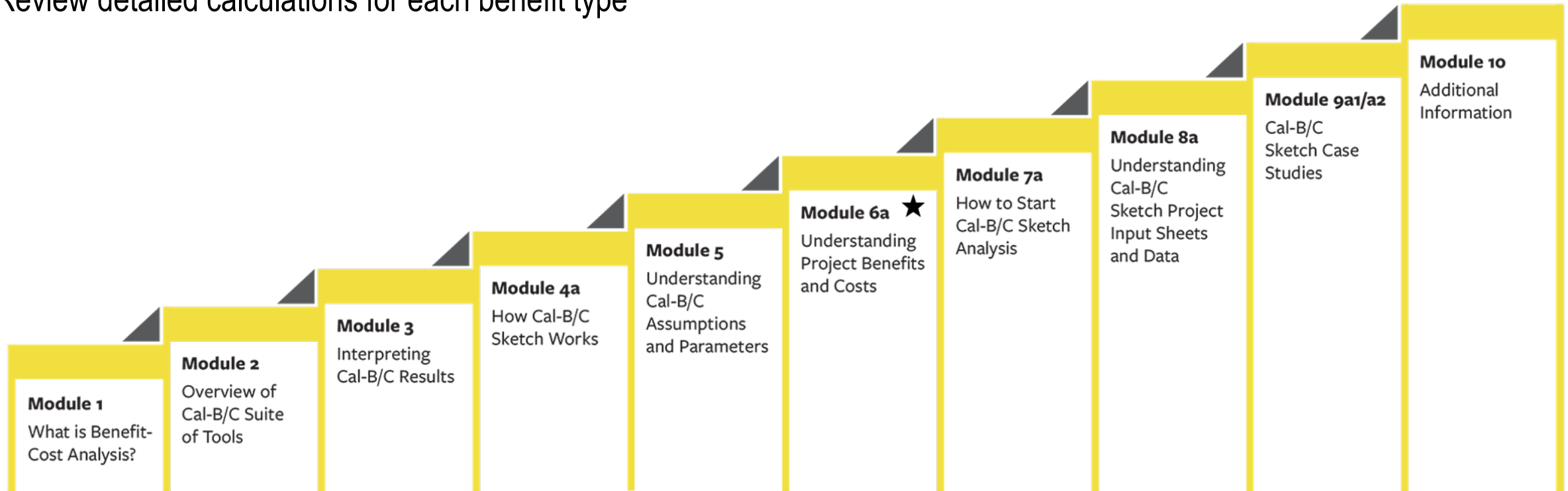


01

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 4a, b, and d** presented an overview of how Cal-B/C Sketch, Corridor, and PnR work including a review of all worksheets and inputs
 - This current module complements Modules 4a, 4b, and 4d
- **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 Sketch	Cal-B/C Corridor	Cal-B/C PnR
Travel time savings (aka user benefits and additional delay savings)	✓	✓	✓
Vehicle operating cost savings	✓	✓	✓
Accident cost savings (aka additional safety benefits)	✓	✓	✓
Emission cost savings	✓	✓	✓
Residual value			✓
Journey quality benefits			
Health benefits			
Shipper cost savings			

Cal-B/C Sketch

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

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

ITEMIZED BENEFITS (mil. \$)	Passenger Benefits	Freight Benefits	Total Over 20 Years	Average Annual
Travel Time Savings	\$0.0	\$0.0	\$0.0	\$0.0
Veh. Op. Cost Savings	\$0.0	\$0.0	\$0.0	\$0.0
Accident Cost Savings	\$0.0	\$0.0	\$0.0	\$0.0
Emission Cost Savings	\$0.0	\$0.0	\$0.0	\$0.0
TOTAL BENEFITS	\$0.0	\$0.0	\$0.0	\$0.0

Person-Hours of Time Saved: 0

Cal-B/C Corridor

3

INVESTMENT ANALYSIS
SUMMARY RESULTS

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

ITEMIZED BENEFITS (mil. \$)	Total Over 50 Years	Average Annual
Travel Time Savings	\$0.0	\$0.0
Veh. Op. Cost Savings	\$0.0	\$0.0
Accident Cost Savings	\$0.0	\$0.0
Emission Cost Savings	\$0.0	\$0.0
TOTAL BENEFITS	\$0.0	\$0.0

Person-Hours of Time Saved: 0

Fatalities Avoided: 0

Injuries Avoided: 0

PDO Avoided: 0

Cal-B/C PnR

2

INVESTMENT ANALYSIS
SUMMARY RESULTS

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

ITEMIZED BENEFITS (mil. \$)	Total Over 20 Years	Average Annual
Travel Time Savings	\$0.0	\$0.0
Veh. Op. Cost Savings	\$0.0	\$0.0
Accident Cost Savings	\$0.0	\$0.0
Emission Cost Savings	\$0.0	\$0.0
Residual Value	\$0.0	\$0.0
TOTAL BENEFITS	\$0.0	\$0.0

Person-Hours of Time Saved: 0

VMT Reduction: 0

02

Overview of Calculations in Cal-B/C Tools

Overview of Benefit Calculations in All Cal-B/C Tools

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 on investment are calculated.

A NET PRESENT VALUE CALCULATION

Year	PRESENT VALUE OF USER BENEFITS				Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions			
Construction Period							
1					\$0	\$89,334,000	(\$89,334,000)
2					\$0	\$55,608,654	(\$55,608,654)
3					\$0	\$53,469,859	(\$53,469,859)
4					\$0	\$0	\$0
5					\$0	\$0	\$0
6					\$0	\$0	\$0
7					\$0	\$0	\$0
8					\$0	\$0	\$0
Project Open							
1	\$12,981,719	(\$8,530,522)	\$8,681,688	(\$714,706)	\$12,419,180	\$0	\$12,419,180
2	\$13,506,140	(\$7,996,857)	\$8,468,429	(\$646,149)	\$13,341,563	\$0	\$13,341,563
3	\$14,087,248	(\$7,488,320)	\$8,258,732	(\$548,881)	\$14,308,778	\$0	\$14,308,778
4	\$14,734,236	(\$6,864,370)	\$8,052,638	(\$444,568)	\$15,477,936	\$0	\$15,477,936
5	\$15,458,756	(\$6,254,752)	\$7,850,191	(\$365,707)	\$16,698,377	\$0	\$16,698,377
19	\$59,124,232	(\$3,273,242)	\$5,400,435	(\$959,031)	\$68,756,940	\$0	\$68,756,940
20	\$72,573,396	(\$4,365,088)	\$5,252,283	(\$1,169,608)	\$83,360,366	\$0	\$83,360,366
Total	\$559,467,270	(\$57,695,757)	\$137,265,319	\$2,220,164	\$641,256,996	\$198,412,513	\$442,844,483

B INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	USER BENEFITS IN CONSTANT DOLLARS				Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions				
Construction Period								
1					\$0	\$89,334,000	(\$89,334,000)	
2					\$0	\$57,833,000	(\$57,833,000)	
3					\$0	\$57,833,000	(\$57,833,000)	
4					\$0	\$0	\$0	
5					\$0	\$0	\$0	
6					\$0	\$0	\$0	
7					\$0	\$0	\$0	
8					\$0	\$0	\$0	
Project Open								
1	\$14,602,669	(\$9,595,677)	\$9,765,719	(\$803,947)	\$13,968,764	\$0	\$13,968,764	\$13,968,764
2	\$15,800,274	(\$9,343,493)	\$9,906,864	(\$755,903)	\$15,607,742	\$0	\$15,607,742	\$29,576,506
3	\$17,139,291	(\$9,110,687)	\$10,048,010	(\$667,797)	\$17,408,817	\$0	\$17,408,817	\$46,985,323
4	\$18,643,509	(\$8,685,618)	\$10,189,156	(\$562,520)	\$19,584,527	\$0	\$19,584,527	\$66,569,850
5	\$20,342,010	(\$8,230,821)	\$10,330,301	(\$490,720)	\$21,960,765	\$0	\$21,960,765	\$88,530,615
19	\$134,730,411	(\$7,458,959)	\$12,306,339	(\$2,185,409)	\$156,681,118	\$0	\$156,681,118	\$1,014,424,442
20	\$171,993,031	(\$10,344,905)	\$12,447,485	(\$2,771,877)	\$197,557,298	\$0	\$197,557,298	\$1,211,981,740
Total	\$1,050,437,725	(\$68,264,292)	\$222,132,038	\$7,676,269	\$1,211,981,740	\$205,000,000	\$1,006,981,740	

Navigation: 3) Results | Travel Time | Vehicle Operating Costs | Accident Costs | Emissions | **Final Calculations** | PARAMETERS

Overview of Benefit Calculations in All Cal-B/C Tools

- Analysis worksheets estimate benefits from data in 1) Project Information 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.

Travel Time Savings

Vehicle Operating Cost Savings

Accident Cost Savings

Emission Cost Savings

This sheet calculates accident benefits for highway and transit.

Accident Reduction Benefits

This sheet calculates accident benefits for highway and transit.

Highway Benefits

Transit Benefits

AVI

Final Calculations

Final Calculations

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

A) NET PRESENT VALUE CALCULATION

Year	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
1	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
2	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
3	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
4	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
5	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
6	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
7	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
8	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
9	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
10	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
11	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
12	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
13	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
14	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
15	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
16	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
17	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
18	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
19	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
20	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
Total	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000

B) INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
1	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
2	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
3	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
4	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
5	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
6	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
7	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
8	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
9	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
10	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
11	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
12	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
13	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
14	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
15	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
16	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
17	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
18	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
19	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
20	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000	\$1,300,000
Total	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000	\$26,000,000

3) Results

3) Results

INVESTMENT ANALYSIS SUMMARY RESULTS

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

ITEMIZED BENEFITS (mil. \$)	Passenger Benefits	Freight Benefits	Total Over 20 Years	Average Annual
Travel Time Savings	\$0.0	\$0.0	\$0.0	\$0.0
Veh. Op. Cost Savings	\$0.0	\$0.0	\$0.0	\$0.0
Accident Cost Savings	\$0.0	\$0.0	\$0.0	\$0.0
Emission Cost Savings	\$0.0	\$0.0	\$0.0	\$0.0
TOTAL BENEFITS	\$0.0	\$0.0	\$0.0	\$0.0

Person-Hours of Time Saved: 0

03

Benefits in Cal-B/C Sketch

Calculations

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

1) Project Information:

- **Avg. Annual Volume** = Avg. Daily Traffic x Number of Days in Model Year
- **Vehicle-Miles Traveled (VMT)** = Impacted Length x Avg. Annual Volume

Calculated for Base and Forecast years, in No Build and Build scenarios

The screenshot displays a spreadsheet interface with several data entry sections:

- PROJECT DATA (1A):** Includes fields for District (HQ), Project (Hypothetical Project), Type of Project, Project Location, Length of Construction Period (2 years), and Length of Peak Period(s) (5 hours).
- HIGHWAY ACCIDENT DATA (1C):** Shows Actual 3-Year Accident Data (Total Accidents: 0.85, Fatal: 0.006, Injury: 0.29, Property Damage Only: 0.55) and Statewide Basic Average Accident Rate.
- HIGHWAY DESIGN AND TRAFFIC DATA (1B):** Contains Highway Design (Roadway Type, Lanes, etc.), Average Daily Traffic, Average Hourly HOV/HOT Lane Traffic, Percent Traffic in Weave, Percent Trucks, Truck Speed, On-Ramp Volume, Queue Formation, Pavement Condition, and Average Vehicle Occupancy (AVO).
- RAIL AND TRANSIT DATA (1D):** Includes Annual Person-Trips, Annual Vehicle-Miles, Average Vehicles/Train, Reduction in Transit Accidents, Average Transit Travel Time, Highway Grade Crossing, and Transit Agency Costs.
- PROJECT COSTS (1E):** A detailed cost table with columns for Year, Project Support, R/W, Construction, Subsequent Costs (Maint/Op, Rehab, Mitigation), Transit Agency Cost Savings, and Total Costs (Constant Dollars, Present Value).

At the bottom, a navigation bar shows tabs for Title, Instructions, 1) Project Information, 2) Model Inputs, 3) Results, Travel Time, Vehicle Operating Costs, Accident Costs, Emissions, Final Calculations, and PARAMETERS.

Project Benefits in Cal-B/C Sketch

Travel Time (TT) Savings

- Function (volume, speed, value of time)
 - Ann. Person-Trips = AVO x Avg. Annual Volume
 - Ann. Travel Time (TT) = Person-Trips x Impacted Length / Speed
 - TT Reduction = No Build Travel Time – Build Travel Time
 - TT Savings (Existing Users) = TT Reduction x Value of Time (by veh. type)
 - TT Savings (Induced) = Change in Trips (No Build to Build) x TT Reduction * 0.5
- Travel Time Savings by year are linked to the Final Calculations worksheet

Travel Time Benefits

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

Formulas:

Avg. Annual Volume = Avg. Daily Traffic x Number of Days in Model Year
vehicles / yr

Travel Time = AVO x Avg. Annual Volume x Affected Length / Speed
vehicle-hrs / yr vehicles / yr x miles mileshour

TT Savings = Travel Time Reduction x Avg. Value of Time
\$/year \$/hour

Avg. Value of Time (varies by vehicle type)

Induced = Change in Trips x Change in Travel Time * 0.5

HIGHWAY BENEFITS

Peak Period HDV

Year	AVERAGE VOLUME <small>(vehicles/yr)</small>		AVERAGE SPEED <small>(mph)</small>		ANNUAL PERSON-TRIPS <small>(trips/yr)</small>		AVERAGE TRAVEL TIME <small>(hours)</small>		TIME BENEFIT <small>(person-hours/yr)</small>		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	Existing Users	New (Induced)		
1	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
20	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
2	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
3	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
4	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
5	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
6	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
7	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
8	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
9	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
10	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
11	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
12	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
13	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
14	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
15	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
16	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
17	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
18	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
19	0	0	55.0	55.0	0	0	0.00	0.00	0	0	\$0	\$0
Total												\$0

Title Instructions 1) Project Information 2) Model Inputs 3) Results **Travel Time** Vehicle Operating Co ...

Project Benefits in Cal-B/C Sketch

Vehicle Operating Cost (VOC) Savings

- Function (volume, speed, fuel consumption, wear factors)
 - Fuel Cost = VMT x Fuel Consumption (by speed) x Fuel Price
 - Non-Fuel Cost = VMT x Cost Per Mile
 - VOC Savings = No Build Cost – Build Cost, for both Fuel and Non-Fuel costs
- VOC Savings by year are linked to the Final Calculations worksheet

Vehicle Operating Cost Benefits

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

Formulas:

Vehicle-Miles Traveled = Affected Length x Avg. Annual Volume
 veh-miles/yr miles vehicles/yr Non-Fuel Cost = VMT x Cost Per Mile
 dollars \$/miles

Fuel Cost = VMT x Fuel Consumption x Fuel Price Benefit = Existing Cost - New Cost
 dollars gallons/mile \$/gallon

HIGHWAY BENEFITS

Peak Period HDV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		BENEFITS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	Fuel Costs	Non-Fuel Costs		
1	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
20	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
2	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
3	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
4	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
5	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
6	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
7	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
8	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
9	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
10	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
11	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
12	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
13	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
14	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
15	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
16	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
17	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
18	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
19	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0
Total							\$0	\$0		\$0

Navigation: ... Travel Time **Vehicle Operating Costs** Accident Costs Emissions Final Calculator ...

Project Benefits in Cal-B/C Sketch

Accident Cost Savings

- Function (volume, facility type, accident rate, cost per accident) by accident type
 - Hwy Acc Cost = $VMT \times Rate \text{ (accidents/MVM)} \times Cost/Accident$
 - Hwy-Rail Transit Acc. Cost = $Rate \text{ (accidents/year)} \times Cost/Accident$
 - Non-Hwy Transit Acc. Cost = $VMT \times Rate \text{ (accidents/MVM)} \times Cost/Accident$
 - Cost/Accident from Parameters sheet
 - Acc. Cost Savings = No Build Cost – Build Cost
- Accident Cost Savings by year are linked to the Final Calculations worksheet

Accident Reduction Benefits
 This sheet calculates accident benefits for highway and transit.

Formulas:

Vehicle-Miles Traveled = Affected Length x Avg Volume
 veh-miles/yr miles vehicles/yr $Transit\ Acc\ Cost = Veh\ Miles \times Acc\ Cost/Mile$

Hwy Acc Cost = (VMT x Rate x Cost/Mile) by Acc. Type $Transit\ Acc\ Cost/Mile\ from\ PARAMETERS$

HIGHWAY BENEFITS

Peak Period HDV

Year	AVERAGE VOLUME (vehicles/yr)		TOTAL VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build		
1	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	\$0	\$0	\$0	\$0
Total								\$0

Travel Time Vehicle Operating Costs **Accident Costs** Emi ...

Project Benefits in Cal-B/C Sketch

Emission Cost Savings

- Function (volume, speed, emission rate) by emissions type
 - Hwy Emissions Cost = VMT x Em. Rate x Cost/Mile
 - Transit Em. Cost = VMT x Em. Rate x Cost/Mile
 - Emissions Cost Savings = No Build Cost – Build Cost
- Emissions Cost Savings by year are linked to the Final Calculations worksheet

Emission Reduction Benefits

This sheet calculates emissions benefits for highway and transit.

Formulas:

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

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

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

Peak Period HOV

Year	AVERAGE VOLUME (vehicles/yr)		AVERAGE SPEED (mph)		TOTAL VMT (veh-miles/yr)		RUNNING EMISSIONS (\$/yr)		STARTING EMISSIONS (\$/yr)		Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	No Build	Build		
1	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
20	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
2	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
3	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
4	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
5	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
6	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
7	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
8	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
9	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
10	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
11	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
12	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
13	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
14	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
15	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
16	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
17	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
18	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
19	0	0	55.0	55.0	0	0	\$0	\$0	\$0	\$0	\$0	\$0
Total												\$0

Navigation: ... Travel Time Vehicle Operating Costs Accident Costs **Emissions** Final Calculations PAR/ ...

04

Benefits in Cal-B/C Corridor

Calculations

Intermediate calculations for several benefit categories based on the data in 2) Model Inputs:

- Speed = Vehicle-Miles Traveled (VMT) / Vehicle-Hours Traveled (VHT)
- VMT, VHT, and Person- or Vehicle-Trips are provided as model input

Calculated for Base and Forecast years, in No Build and Build scenarios

2A DEFINITIONS OF MODEL GROUPS AND YEARS

Select Mode	Name	Description	Avg. Vehicle Occupancy (AVO)	Percent Trucks
Model Group 1	Highway	Model Group 1		

Base Year	2020
Forecast Year	2040

2B AVERAGE PROFILE FOR DIVERTED TRIPS/INDUCED TRIPS

Typical 'No Build' conditions for persons 'on the margin' who will divert from highway to transit in Build Scenario, or for induced trips. This profile should reflect a lower cost alternative than the average traffic profile entered in Table 2C and 2D.

No Build	For Trips Diverting from Highway to Transit				Least Cost Alternative (for Induced Trips)			
	Average Speed in Year 2020 (mph)	Average Trip Length in Year 2020 (miles)	Average Speed in Year 2040 (mph)	Average Trip Length in Year 2040 (miles)	Average Speed in Year 2020 (mph)	Average Trip Length in Year 2020 (miles)	Average Speed in Year 2040 (mph)	Average Trip Length in Year 2040 (miles)
Model Group 1								

2C MODEL DATA - YEAR 2020

REQUIRED FOR TRANSIT									
	Number of Trips (Trips) * **	Vehicle Miles Traveled (VMT) *	Vehicle Hours Traveled (VHT)	Passenger Miles Traveled (PMT)	Passenger Hours Traveled (PHT)	Out-of-Pocket Cost (\$ per trip)	Speed	Average Vehicle Occupancy (AVO)	Percent Trucks
No Build									
1 Model Group 1 TOTAL	0	0	0	0	0		55.0	0.00	0.0%
Build									
1 Model Group 1 TOTAL	0	0	0	0	0		55.0	0.00	0.0%

2D MODEL DATA - YEAR 2040

REQUIRED FOR TRANSIT									
	Number of Trips (Trips) * **	Vehicle Miles Traveled (VMT) *	Vehicle Hours Traveled (VHT)	Passenger Miles Traveled (PMT)	Passenger Hours Traveled (PHT)	Out-of-Pocket Cost (\$ per trip)	Speed	Average Vehicle Occupancy (AVO)	Percent Trucks
No Build									
1 Model Group 1 TOTAL	0	0	0	0	0		55.0	0.00	0.0%
Build									
1 Model Group 1 TOTAL	0	0	0	0	0		55.0	0.00	0.0%

* For Highway Model Groups, Trips and VMT refer to vehicle trips and vehicle miles traveled. For Transit Model Groups, Trips and VMT refer to person (transit) trips and transit vehicle miles traveled.
 **Number of Trips is an optional field for Highway Model Groups, unless Transit Model Groups are included. This is a required input if induced demand exists.

* For Highway Model Groups, Trips and VMT refer to vehicle trips and vehicle miles traveled. For Transit Model Groups, Trips and VMT refer to person (transit) trips and transit vehicle miles traveled.
 **Number of Trips is an optional field for Highway Model Groups, unless Transit Model Groups are included. This is a required input if induced demand exists.

Project Benefits in Cal-B/C Corridor

Accident Cost Savings

- Function (VMT, accident rate, events per acc., cost per event)
 - Events = VMT x Accident Rate x Events per Accident
 - Events Avoided = No Build Events – Build Events (by event)
 - Accident Cost Savings = Events Avoided * Cost/Event (by event)
 - Total Accident Cost Savings = Fatal + Injury + PDO Cost Savings

Accident Cost Savings by year are linked to the Final Calculations worksheet

Accident Cost Benefits

This sheet calculates accident cost benefits on highway and transit

Formulas:

Vehicle-Miles Traveled = Affected Length x Avg. Annual Volume veh-miles/yr miles vehicles/yr	Fatalities = (Vehicle-Miles Traveled * Fatal Accident Rate / 10 ⁵) * Conversion Factor event/yr veh-miles/yr accident/mvmt event/accident
Injuries = (Vehicle-Miles Traveled * Injury Accident Rate / 10 ⁵) * Conversion Factor event/yr veh-miles/yr accident/mvmt event/accident	PDOs = (Vehicle-Miles Traveled * PDO Accident Rate / 10 ⁵) * Conversion Factor event/yr veh-miles/yr accident/mvmt event/accident
Fatal Cost Savings = (Existing Fatalities - New Fatalities) * Fatality Cost dollar/yr event/yr dollar/event	Injury Cost Savings = (Existing Injuries - New Injuries) * Injury Cost dollar/yr event/yr dollar/event
PDO Cost Savings = (Existing PDO - New PDO) * PDO Cost dollar/yr event/yr dollar/event	Accident Cost Savings = Fatal Cost Savings + Injury Cost Savings + PDO Cost Savings dollar/yr dollar/yr dollar/yr dollar/yr

A

MODEL BENEFITS

1 Model Group 1

Year	TOTAL VMT (veh-miles/yr)		TOTAL FATALITIES (event/yr)		TOTAL INJURIES (event/yr)		TOTAL VEHICLES DAMAGED (event/yr)		ACCIDENT BENEFITS (\$/yr)			Constant Dollars	Present Value
	No Build	Build	No Build	Build	No Build	Build	No Build	Build	Fatality Cost Savings	Injury Cost Savings	Property Damage Cost Savings		
2020	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2040	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2020	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2021	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2022	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2023	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2024	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2025	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2026	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2027	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2028	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
2029	0	0	0.0	0.0	0.0	0.0	0.0	0.0	\$0	\$0	\$0	\$0	\$0
Total									\$0	\$0	\$0	\$0	\$0

05

Benefits in Cal-B/C Park & Ride

Project Benefits in Cal-B/C Park & Ride

Travel Time Savings

- Function (users, travel time, wait time, value of time) by user group
 - Users Benefited = New Lot Users – Existing Lot Users
 - Travel Time is user provided
 - Wait Time = Transit Headway x 0.5 or Carpool Wait Time
 - Travel Time Savings = Travel Time Reduction x Avg. Value of Time
- Travel Time Savings by year are linked to the Final Calculations worksheet

Travel Time Benefits
This sheet calculates total travel time benefits by user group.

Formulas:

Users Benefited = New Lot Users - Existing Lot Users people / yr	Wait Time = Transit Headway x 0.5 or Carpool Wait Time
Travel Time = User Provided minutes/user	Time Benefit = Travel Time Reduction x Avg. Value of Time \$/year
	Same Value of Time Used for All Users

DESTINATION 1

New Transit Riders (switch from automobile to express bus)

Year	ANNUAL NUMBER OF USERS (people/yr)			AVG TRAVEL TIME (minutes)		AVERAGE WAIT TIME (minutes)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Lot	New Lot	Users Benefited	No Build	Build	No Build	Build	Travel Time	Wait Time		
1	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
2	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
3	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
4	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
5	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
6	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
7	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
8	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
9	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
10	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
11	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
12	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
13	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
14	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
15	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
16	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
17	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
18	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
19	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
20	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
Total											\$0

Existing Transit Riders (switch from local bus to express bus)

Year	ANNUAL NUMBER OF USERS (people/yr)			AVG TRAVEL TIME (minutes)		AVERAGE WAIT TIME (minutes)		TIME BENEFIT (person-hours/yr)		Constant Dollars	Present Value
	Existing Lot	New Lot	Users Benefited	No Build	Build	No Build	Build	Travel Time	Wait Time		
1	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
2	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
3	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
4	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
5	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
6	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
7	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
8	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
9	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
10	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
11	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
12	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
13	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
14	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
15	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
16	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
17	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
18	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
19	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
20	0	0	0	0.0	0.0	0.0	0.0	0	0	\$0	\$0
Total											\$0

Project Benefits in Cal-B/C Park & Ride

Accident Cost Savings

- Function (volume, distance, accident rate, cost per accident)
 - Users Benefited = New Lost Users - Existing Lot Users
 - Change in Vehicle-Miles Traveled (VMT) = Distance x Users Benefited / Avg Veh Occupancy
 - Accident Cost Savings = (Change in VMT x Accident Rate x Cost/Mile) by Accident Type
- Accident Cost Savings by year are linked to the Final Calculations worksheet

Accident Reduction Benefits

This sheet calculates changes in highway accident costs.

Formulas:

Users Benefited = New Lost Users - Existing Lot Users people / yr	Acc Cost = (VMT x Rate x Cost/Mile) by Acc Type
Vehicle-Miles Traveled = Distance x Users / AVD veh-miles/yr miles vehicles/yr	

DESTINATION 1

New Transit Riders (switch from automobile to express bus)

Year	ANNUAL NUMBER OF USERS (people/yr)			TOTAL AUTO VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Lot	New Lot	Users Benefited	No Build	Build	No Build	Build		
1	0	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	0	\$0	\$0	\$0	\$0
Total									\$0

Existing Transit Riders (switch from local bus to express bus)

Year	ANNUAL NUMBER OF USERS (people/yr)			TOTAL AUTO VMT (veh-miles/yr)		ACCIDENT COSTS (\$/yr)		Constant Dollars	Present Value
	Existing Lot	New Lot	Users Benefited	No Build	Build	No Build	Build		
1	0	0	0	0	0	\$0	\$0	\$0	\$0
2	0	0	0	0	0	\$0	\$0	\$0	\$0
3	0	0	0	0	0	\$0	\$0	\$0	\$0
4	0	0	0	0	0	\$0	\$0	\$0	\$0
5	0	0	0	0	0	\$0	\$0	\$0	\$0
6	0	0	0	0	0	\$0	\$0	\$0	\$0
7	0	0	0	0	0	\$0	\$0	\$0	\$0
8	0	0	0	0	0	\$0	\$0	\$0	\$0
9	0	0	0	0	0	\$0	\$0	\$0	\$0
10	0	0	0	0	0	\$0	\$0	\$0	\$0
11	0	0	0	0	0	\$0	\$0	\$0	\$0
12	0	0	0	0	0	\$0	\$0	\$0	\$0
13	0	0	0	0	0	\$0	\$0	\$0	\$0
14	0	0	0	0	0	\$0	\$0	\$0	\$0
15	0	0	0	0	0	\$0	\$0	\$0	\$0
16	0	0	0	0	0	\$0	\$0	\$0	\$0
17	0	0	0	0	0	\$0	\$0	\$0	\$0
18	0	0	0	0	0	\$0	\$0	\$0	\$0
19	0	0	0	0	0	\$0	\$0	\$0	\$0
20	0	0	0	0	0	\$0	\$0	\$0	\$0
Total									\$0

06

Project Costs in All Cal-B/C tools

Project Cost Inputs

- All project costs are entered in Section 1E in the Project Information worksheet, in seven 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)

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

1E PROJECT COSTS (enter costs in thousands of dollars)									
Col.no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	INITIAL COSTS			SUBSEQUENT COSTS			Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.	Mitigation			
Construction Period									
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
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	\$0	\$0	\$0	\$0	\$0	\$0

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

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

1E PROJECT COSTS (enter costs in thousands of dollars)

Col.no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	INITIAL COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
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
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	\$0	\$0	\$0	\$0	\$0	\$0

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

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

1E PROJECT COSTS (enter costs in thousands of dollars)

Col.no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
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
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	\$0	\$0	\$0	\$0	\$0	\$0

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

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

1E PROJECT COSTS (enter costs in thousands of dollars)

Col.no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
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
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	\$0	\$0	\$0	\$0	\$0	\$0

1E) Project Costs – Mitigation, Transit Agency, and Total Costs

Mitigation

- Costs to protect communities and the environment from negative impacts
- May include wetland and community preservation, sound walls to reduced highway or rail transit noise

Transit Agency Cost Savings

- In Cal-B/C Sketch, calculated automatically for TMS projects based on user data input (blue cells)
 - Represents savings to transit agency due to efficiency improvements
 - For example, signal prioritization projects speed up buses, which may reduce operating hours, resulting in lower labor and other costs
- Not included in Cal-B/C AT
- Blank for user data entry in all other Cal-B/C tools

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

1E PROJECT COSTS (enter costs in thousands of dollars)

Col. no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	INITIAL COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
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
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	\$0	\$0	\$0	\$0	\$0	\$0

1E) Project Costs – Mitigation, Transit Agency, and Total Costs

Total Costs

- Calculated automatically based on entry in previous seven columns of cost data
- Values are in total dollars (not in thousands of dollars)

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

1E PROJECT COSTS (enter costs in thousands of dollars)

Col.no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
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
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	\$0	\$0	\$0	\$0	\$0	\$0

1E) Project Costs – Mitigation, Transit Agency, and 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

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

1E PROJECT COSTS (enter costs in thousands of dollars)									
Col.no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	TOTAL COSTS (in dollars)	
Year	DIRECT PROJECT COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
Construction Period									
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
Project Open									
1								\$0	\$0
2								0	0
3								0	0
4								0	0
5								0	0
6								0	0
7								0	0
8								0	0

Final Calculations

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

A NET PRESENT VALUE CALCULATION

Year	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
Construction Period							
1					\$0	\$89,334,000	(\$89,334,000)
2					\$0	\$95,608,654	(\$95,608,654)
3					\$0	\$53,469,859	(\$53,469,859)
4					\$0	\$0	\$0
5					\$0	\$0	\$0
6					\$0	\$0	\$0
7					\$0	\$0	\$0
8					\$0	\$0	\$0
Project Open							
1	\$12,981,719	(\$8,530,522)	\$8,681,688	(\$714,706)	\$12,418,180	\$0	\$12,418,180
2	\$13,506,140	(\$7,986,857)	\$8,468,429	(\$646,149)	\$13,341,563	\$0	\$13,341,563
3	\$14,087,248	(\$7,488,320)	\$8,258,732	(\$548,881)	\$14,308,778	\$0	\$14,308,778
4	\$14,734,236	(\$6,864,370)	\$8,052,638	(\$444,568)	\$15,477,936	\$0	\$15,477,936
18	\$49,564,895	\$1,942,947	\$5,552,036	\$726,931	\$57,786,768	\$0	\$57,786,768
19	\$59,124,232	\$3,273,242	\$5,400,435	\$959,031	\$68,756,940	\$0	\$68,756,940
20	\$72,573,386	\$4,365,088	\$5,252,283	\$1,169,608	\$83,360,366	\$0	\$83,360,366
Total	\$959,467,270	(\$57,695,757)	\$137,265,319	\$2,220,164	\$641,256,996	\$198,412,513	\$442,844,483

B INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions	Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJ OPENS
Construction Period								
1					\$0	\$89,334,000	(\$89,334,000)	
2					\$0	\$57,833,000	(\$57,833,000)	
3					\$0	\$57,833,000	(\$57,833,000)	
4					\$0	\$0	\$0	
5					\$0	\$0	\$0	
6					\$0	\$0	\$0	
7					\$0	\$0	\$0	
8					\$0	\$0	\$0	
Project Open								
1	\$14,602,669	(\$9,595,677)	\$9,765,719	(\$803,947)	\$13,968,764	\$0	\$13,968,764	\$13,968,764
2	\$15,800,274	(\$9,343,493)	\$9,906,864	(\$755,903)	\$15,607,742	\$0	\$15,607,742	\$29,576,506
3	\$17,139,291	(\$9,110,687)	\$10,048,070	(\$667,797)	\$17,408,617	\$0	\$17,408,617	\$46,985,323
4	\$18,643,509	(\$8,685,618)	\$10,389,156	(\$562,520)	\$19,584,527	\$0	\$19,584,527	\$66,569,850
18	\$108,602,701	\$4,257,235	\$12,465,194	\$1,592,795	\$126,617,926	\$0	\$126,617,926	\$697,743,323
19	\$134,730,411	\$7,458,959	\$12,306,339	\$2,185,409	\$156,681,118	\$0	\$156,681,118	\$1,014,424,442
20	\$171,993,031	\$10,344,905	\$12,447,485	\$2,771,877	\$197,557,299	\$0	\$197,557,298	\$1,211,981,740
Total	\$1,050,437,725	(\$68,264,292)	\$222,132,038	\$7,676,269	\$1,211,981,740	\$205,000,000	\$1,006,981,740	

Final Calculations summary table with columns A through X.

Project Costs



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 on investment are calculated.

A NET PRESENT VALUE CALCULATION

Year	PRESENT VALUE OF USER BENEFITS				Present Value of Total User Benefits	Present Value of Total Project Costs	NET PRESENT VALUE
	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions			
1	\$0	\$0	\$0	\$0	\$89,334,000	(\$89,334,000)	
2	\$0	\$0	\$0	\$0	\$55,608,654	(\$55,608,654)	
3	\$0	\$0	\$0	\$0	\$53,463,959	(\$53,463,959)	
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	
10	\$49,164,895	\$1,942,347	\$5,592,036	\$7,267,931	\$78,767,209	\$78,767,209	
19	\$59,124,232	\$3,273,242	\$5,400,435	\$959,031	\$68,756,940	\$68,756,940	
20	\$72,573,366	\$4,365,088	\$5,252,203	\$1,103,608	\$83,300,366	\$83,300,366	
Total	\$99,467,270	(\$57,695,797)	\$17,265,319	\$2,220,84	\$641,256,396	(\$199,412,513)	\$442,844,493

B INTERNAL RATE OF RETURN ON INVESTMENT AND PAYBACK PERIOD

Year	USER BENEFITS IN CONSTANT DOLLARS				Total User Benefits in Constant Dollars	Total Project Costs in Constant Dollars	ANNUAL RETURNS ON INVESTMENT	CUMULATIVE RETURNS AFTER PROJECT OPENS
	Travel Time Savings	Vehicle Op. Cost Savings	Accident Reductions	Vehicle Emission Reductions				
1	\$0	\$0	\$0	\$0	\$89,334,000	(\$89,334,000)		
2	\$0	\$0	\$0	\$0	\$57,833,000	(\$57,833,000)		
3	\$0	\$0	\$0	\$0	\$57,833,000	(\$57,833,000)		
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		
10	\$18,602,689	(\$3,595,677)	\$5,765,719	(\$803,347)	\$10,969,794	\$0	\$13,369,764	
19	\$134,730,417	\$7,498,969	\$12,306,339	\$2,185,409	\$156,601,100	\$0	\$156,601,100	
20	\$171,993,031	\$10,344,905	\$12,447,485	\$2,771,877	\$197,557,298	\$0	\$197,557,298	
Total	\$1,050,437,725	(\$68,264,252)	\$222,132,838	\$7,676,269	\$1,211,981,740	\$295,000,000	\$1,006,981,740	

3) Results

INVESTMENT ANALYSIS SUMMARY RESULTS

	Passenger Benefits	Freight Benefits	Total Over 20 Years	Average Annual
Life-Cycle Costs (mil. \$)	\$0.0	\$0.0	\$0.0	\$0.0
Life-Cycle Benefits (mil. \$)	\$0.0	\$0.0	\$0.0	\$0.0
Net Present Value (mil. \$)	\$0.0	\$0.0	\$0.0	\$0.0
Benefit / Cost Ratio:	N/A			
Rate of Return on Investment:	N/A			
Payback Period:	N/A			
Person-Hours of Time Saved			0	0

07

Conclusion

In this module, you learned...

- What project costs are included in Cal-B/C tools
- What benefit categories are automatically estimated in the Cal-B/C Sketch, Corridor, and Park & Ride tools
- How each benefit category is estimated in these tools 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 7: How to Start a Cal-B/C Analysis**
- There are other versions of this module for the other Cal-B/C tools:
 - **Module 6b: Understanding Project Benefits and Costs in Cal-B/C Active Transportation**
 - **Module 6c: Understanding Project Benefits and Costs in Cal-B/C Intermodal Freight**