



Caltrans Training Module 7a

How to Start a Cal-B/C Sketch Analysis

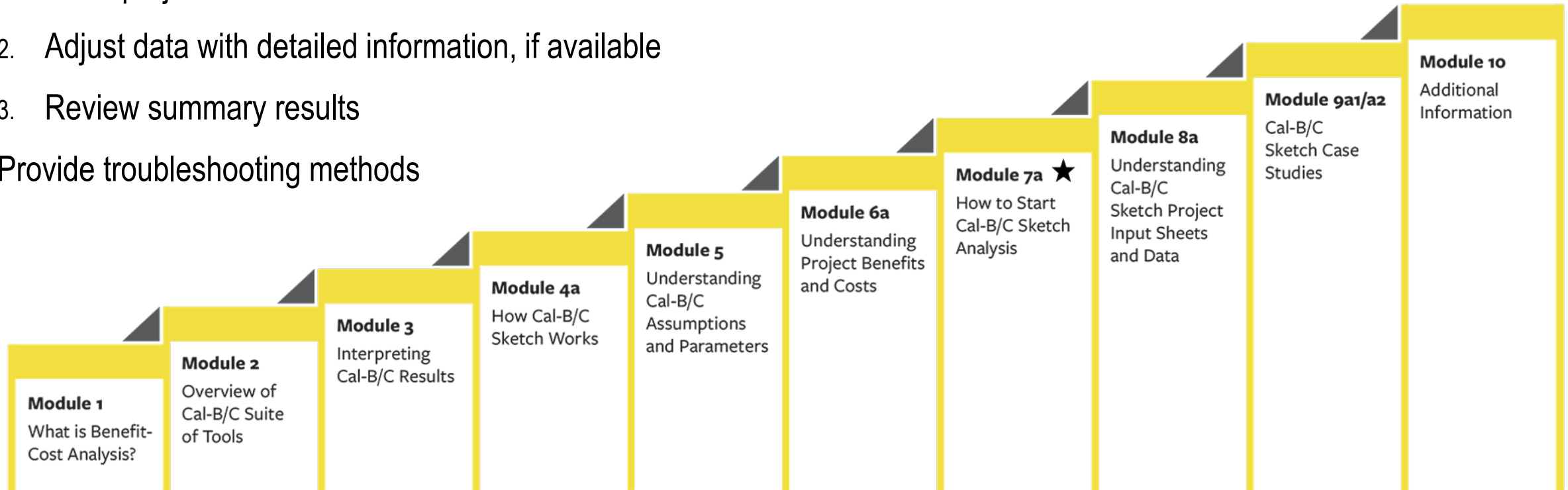


01

About This Module

This module will...

- Present a Quick-Start guide to Cal-B/C tools
- Walk through a three-step process to start an analysis in a Cal-B/C tool
 1. Enter project information
 2. Adjust data with detailed information, if available
 3. Review summary results
- Provide troubleshooting methods



★ *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
- **Module 4a** presented an overview of how Cal-B/C Sketch works including a review of all worksheets and inputs
 - This current module complements Module 4a
- **Module 5** highlighted the information in the Parameters worksheet and discussed key assumptions used by Cal-B/C
- **Module 6a** provided detailed information on how Cal-B/C Sketch calculates benefits

02

Step 1, Enter Project Information

Preview of Project Information Required by Project Type

	Project Type	Section 1A Project Data	Section 1B Highway Design and Traffic Data	Section 1C Highway Accident Data	Section 1D Rail and Transit Data	Section 1E Project Costs
Highway Capacity Expansion	General Highway	X	X	X		X
	HOV Lane Addition	X	X	X		X
	HOT Lane Addition	X	X	X		X
	Passing Lane	X	X	X		X
	Intersection	X	X	X		X
	Truck Only Lane	X	X	X		X
	Bypass	X	X	X		X
	Queuing	X	X	X		X
	Pavement	X	X	X		X

Preview of Project Information Required by Project Type

	Project Type	Section 1A Project Data	Section 1B Highway Design and Traffic Data	Section 1C Highway Accident Data	Section 1D Rail and Transit Data	Section 1E Project Costs
Rail or Transit Capacity Expansion	Passenger Rail	X	X*		X	X
	Light-Rail (LRT)	X	X*		X	X
	Bus	X	X*		X	X
	Hwy-Rail Grade Crossing	X	X*	X	X	X

*Highway Design and Traffic Data are required for transit projects to calculate the No Build conditions and mode shifts in the Build conditions

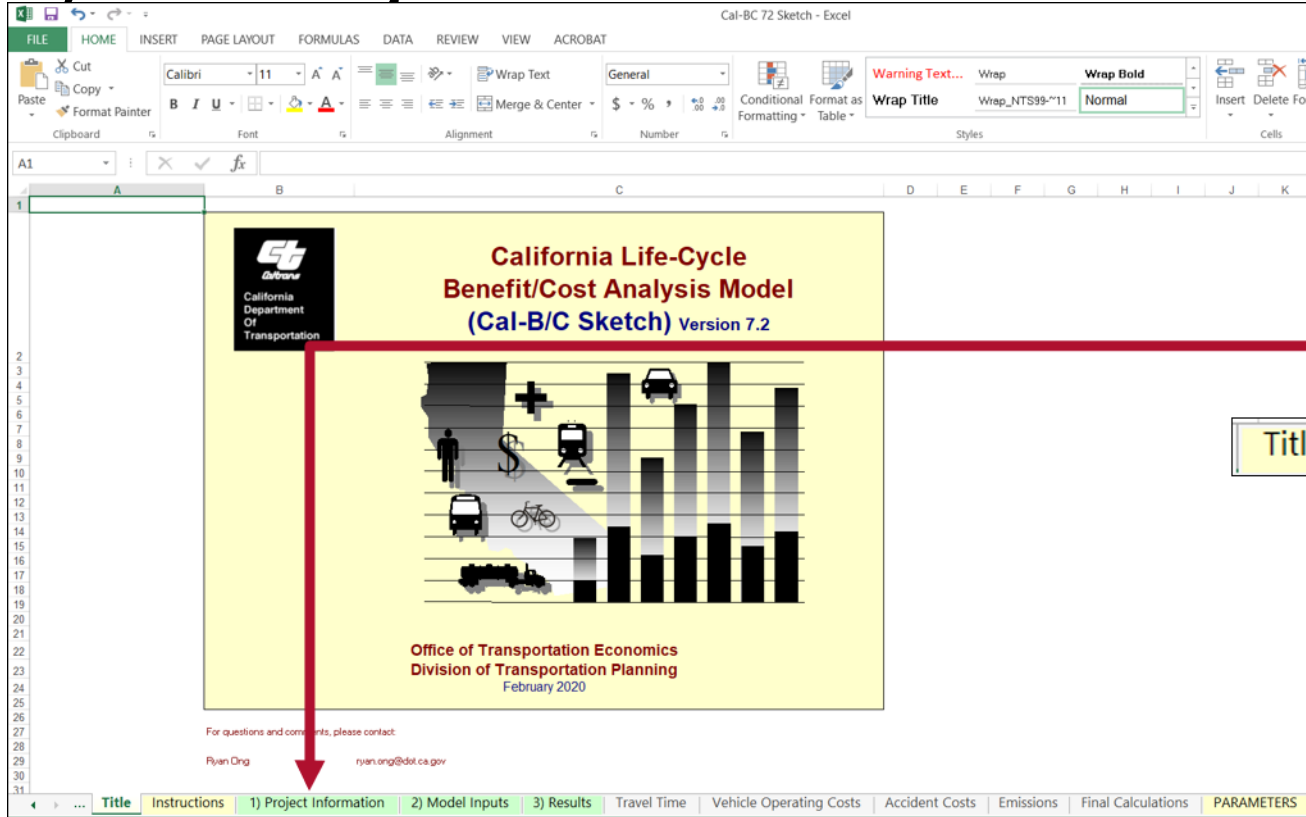
Preview of Project Information Required by Project Type

	Project Type	Section 1A Project Data	Section 1B Highway Design and Traffic Data	Section 1C Highway Accident Data	Section 1D Rail and Transit Data	Section 1E Project Costs
Hwy Operational Improvement	Auxiliary Lane	X	X	X		X
	Freeway Connector	X	X	X		X
	HOV Connector	X	X	X		X
	HOV Drop Ramp	X	X	X		X
	Off-Ramp Widening	X	X	X		X
	On-Ramp Widening	X	X	X		X
	HOV-2 to HOV-3 Conv	X	X	X		X
	HOT Lane Conversion	X	X	X		X

Preview of Project Information Required by Project Type

	Project Type	Section 1A Project Data	Section 1B Highway Design and Traffic Data	Section 1C Highway Accident Data	Section 1D Rail and Transit Data	Section 1E Project Costs
Transportation Management Systems (TMS)	Ramp Metering	X				X
	Ramp Metering Signal Coord	X				X
	Incident Management	X				X
	Traveler Information	X				X
	Arterial Signal Management	X				X
	Transit Vehicle Location (AVL)	X			X	X
	Transit Vehicle Signal Priority	X			X	X
	Bus Rapid Transit (BRT)	X		X		X

1) Enter Project Information



Title	Instructions	1) Project Information	2) Model Inputs	3) Results
	Summary instructions on how to fill out each data item in Cal-B/C	<ul style="list-style-type: none"> Project Description/ Type of Project Highway Geometric and Traffic Data Highway Collision Data Rail and Transit Data Project Costs 	<ul style="list-style-type: none"> Default calculations Additional ramp and arterial inputs Person-trip verification for HOV/HOT projects 	<ul style="list-style-type: none"> BCA results Itemized Benefits (\$) Emission Savings (Tons)

Required Data Input for All Project Types

Cal-B/C Sketch requires few user inputs if the user is willing to accept the built-in default values

The data that must be entered to perform an analysis are the following:

1A Project Data

- The type of project and its location (determines some default parameters)
- Length of the construction/implementation period (number of years)

1E Project Costs

- Project costs for each year in the construction/implementation period
- Post-opening costs for each of 20 years of assumed project life

Overview of Project Information Worksheet

- The primary data entry worksheet for Cal-B/C Sketch

1A Project Data

- Required for all projects

1B Highway Design and Traffic Data

- Roadway geometrics
- Traffic demand and speed data
- Not all sections need to be filled in since some are project-type specific

The screenshot shows a complex spreadsheet interface with several data entry sections. Callouts point to the following areas:

- Section 1A: Project Data:** Includes fields for District, Project Name, Type of Project, Project Location, Length of Construction Period, and Length of Peak Period.
- Section 1B: Highway Design and Traffic Data:** Contains sub-sections for Highway Design (Roadway Type, Number of Lanes, etc.), Average Daily Traffic, Average Hourly HOV/HOT Lane Traffic, Percent Traffic in Waves, Percent Trucks, Truck Speed, On-Ramp Volume, Queue Formation, and Parameter Conditions.
- Section 1C: Highway Accident Data:** Includes Statewide Basic Average Accident Rate, Annual Person-Trips, Percent Trips during Peak Period, Percent New Trips from Parallel Highway, Annual Vehicle Miles, Average Vehicles/Day, Reduction in Transit Accidents, and Average Transit Travel Time.
- Section 1D: Rail and Transit Data:** Includes Annual Person-Trips, Average Vehicles/Day, Reduction in Transit Accidents, and Average Transit Travel Time.
- Section 1E: Project Costs:** A table with columns for Year, Project Support, Initial Project Costs, Direct Project Costs, Subsequent Costs, Transit Agency Cost Savings, and Total Costs (Constant Dollars and Present Value).
- Button to analyze multiple roads for bypass and intersection projects:** A button labeled "Please Model for Bypass" is located at the bottom of the worksheet.

Project Information Worksheet Tab

Overview of Project Information Worksheet

- The primary data entry worksheet for Cal-B/C Sketch

1C Highway Accident (i.e., Collision) Data

- Study area accident rates
- Statewide average accident rates

1D Rail and Transit Data

- Service demand characteristics (e.g., person trips)
- Service supply characteristics

The screenshot shows a complex spreadsheet interface with several data entry sections. Callouts point to the following sections:

- Section 1A: Project Data**: Located at the top left, containing fields for District, Project Name, Type of Project, Project Location, Length of Construction Period, and Length of Peak Period.
- Section 1B: Highway Design and Traffic Data**: Located in the middle left, containing fields for Highway Design (Roadway Type, Number of General Traffic Lanes, etc.), Average Daily Traffic, Average Hourly HOV3+ Lane Traffic, Percent Traffic in Waves, Percent Trucks, Truck Speed, On-Ramp Volume, Queue Formation, and Parameter Conditions.
- Section 1C: Highway Accident Data**: Located in the middle right, containing fields for Statewide Basic Average Accident Rate, Annual Person-Trips, Percent Trips during Peak Period, Percent New Trips from Parallel Highway, Annual Vehicle Miles, Average Vehicles/Day, Reduction in Transit Agency Costs, and Average Transit Travel Time.
- Section 1D: Rail and Transit Data**: Located at the bottom middle, containing fields for Average Vehicle Occupancy (AVOC) and a button to analyze multiple roads for bypass and intersection projects.
- Section 1E: Project Costs**: Located on the right side, containing a table for Project Costs (enter costs in thousands of dollars) with columns for Year, Project Support, Initial Costs, Direct Project Costs, Subsequent Costs, Transit Agency Cost Savings, and Total Costs.

At the bottom of the spreadsheet, 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 C...

Overview of Project Information Worksheet

- The primary data entry worksheet for Cal-B/C Sketch

1E Project Costs

- Direct project costs and subsequent costs
- Mitigation and expected cost savings

Button that resets tool to input data for the intersecting street

Other worksheets should be modified if project specific information is available

The screenshot shows a complex spreadsheet interface with several data entry sections. Callouts point to the following areas:

- Section 1A: Project Data**: Includes fields for District, Project Name, Type of Project, Project Location, Length of Construction Period, and Length of Peak Period.
- Section 1B: Highway Design and Traffic Data**: Includes Highway Design (Roadway Type, Number of General Traffic Lanes, etc.), Average Daily Traffic, Average Hourly HOV3+ Lane Traffic, Percent Traffic in Queue, Percent Traffic in Queue, Percent Traffic in Queue, and Average Vehicle Occupancy (AVOC).
- Section 1C: Highway Accident Data**: Includes Statewide Basic Average Accident Rate, Annual Person-Trips, Percent Trips during Peak Period, Percent New Trips from Parallel Highway, Annual Vehicle Miles, Average Vehicles/Day, Reduction in Transit Accidents, and Average Transit Travel Time.
- Section 1D: Rail and Transit Data**: Includes Annual Person-Trips, Percent Trips during Peak Period, Percent New Trips from Parallel Highway, Annual Vehicle Miles, Average Vehicles/Day, Reduction in Transit Accidents, and Average Transit Travel Time.
- Section 1E: Project Costs**: A table with columns for Year, Project Support, Initial Project Costs, Subsequent Costs, Transit Agency Cost Savings, and Total Costs (Constant Dollars and Present Value).
- Project Information Worksheet Tab**: The active tab in the spreadsheet.

Button to analyze multiple roads for bypass and intersection projects

1A) Project Data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2			District:		HQ													
3																		
4			PROJECT:		Hypothetical Project													
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		

EA:
PPND:

1A PROJECT DATA

Type of Project Check AVOs & trips in sections 1B & 2D
Select project type from list

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

Length of Construction Period years
One- or Two-Way Data enter 1 or 2

Length of Peak Period(s) (up to 24 hrs) hours

Required Project Inputs

Type of Project (pull-down menu of 29 project types)

- Once the project type is selected, text may appear above pull-down menu listing which data entry sections must be completed

Project Location (1, 2, or 3)

- Used to estimate emission benefits using values appropriate for each region
- Used to look up the percentage of travel during the peak period

Length of Construction Period

- Years needed to construct project
- Project opening date assumed to occur at the end of the construction period

1A) Project Data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2			District:		HQ													
3																EA:		
4			PROJECT:		Hypothetical Project											PPNO:		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		
16																		
17																		
18																		

1A PROJECT DATA

Type of Project Check AVOs & trips in sections 1B & 2D
Select project type from list

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

Length of Construction Period years
One- or Two-Way Data enter 1 or 2

Length of Peak Period(s) (up to 24 hrs) hours
Current

Required Project Inputs

One- or Two-Way Data

- Indicates if Section 1B data is for travel in one direction or two directions.

Length of Peak Period(s)

- The total number of daily hours considered peak hours for travel
- Helps determine peak/non-peak volumes and speeds

Additional inputs in this section (optional):

- Unique project identifiers
 - Caltrans District
 - Project Name
 - Expenditure Authorization (EA) number
 - Planning and Programming Number (PPNO)

1E) Project Costs – Direct Project Costs

Required Project Inputs

Project costs are entered in seven costing columns, by year, in incremental costs in thousands of constant dollars

Initial Project Costs

- Must be entered for each year of construction in at least one of the three columns (project support, right-of-way, and/or construction)
- Up to eight (8) years of initial project costs, consistent with the length of construction entered in Section 1A

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 – Direct Project Costs

Additional project cost inputs in this section:

Project costs are entered in seven costing columns, by year, in incremental costs in thousands of constant dollars

Subsequent Costs (if applicable)

- Subsequent project costs (maintenance and operating costs and rehabilitation costs) can be entered by year for the 20-year project operating period

Mitigation (if applicable)

- Can be entered for construction or project operation period years

Transit Agency Cost Savings (for TMS projects)

- Can be entered for construction period years
- Calculated automatically after project opening. These estimates can be overwritten with more specific cost information

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)	DIRECT PROJECT COSTS			(6)	(7)	TOTAL COSTS (in dollars)	
			INITIAL COSTS		SUBSEQUENT COSTS			Constant Dollars	Present Value
Year	Project Support	R / W	Construction	Maint./ Op.	Rehab.	Mitigation	Transit Agency Cost Savings		
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

Required Data Input for Highway Improvement Projects

If the proposed project involves a highway improvement, the following are required:

1B Highway Design and Traffic Data

- Number of highway lanes (existing and proposed)
- Free-flow highway speed
- Length of the highway section
- Current Annual Average Daily Traffic (AADT)
- Expected AADT in the 20th year after the project would open (with & without the project)

1C Highway Accident Data

- Current (3-year) counts of fatal, injury, and property damage only (PDO) collisions
- Expected accident rates for the type of facility in question (with & without the project)
- Expected percentages of fatal and injury collisions (with & without the project)

Module 9b walks through a case study in which a HOV project is analyzed using Cal-B/C Sketch, which illustrates the data input shown in the following slides

1B) Highway Design and Traffic Data – Highway Design

Required for Highway Capacity Expansion and Operational Improvement Projects

Number of General Traffic Lanes

- Mainline traffic lanes along the roadway section

Highway Free-Flow Speed

- Design speed for the highway section

Length (miles)

		No Build	Build
Highway Design			
Roadway Type (Fwy, Exp, Conv Hwy)		F	F
Number of General Traffic Lanes			
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)		N	
Highway Free-Flow Speed			0
Ramp Design Speed (if aux. lane/off-ramp proj.)		35	35
Length (in miles)	Highway Segment		0.0
	Impacted Length	0.0	0.0
Average Daily Traffic			
Current			
		No Build	Build
Base (Year 1)		0	0
Forecast (Year 20)			0
Average Hourly HOV/HOT Lane Traffic			
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)			100%
Percent Traffic in Weave			
			0.0%
Percent Trucks (include RVs, if applicable)			
		9%	9%
Truck Speed			
On-Ramp Volume			
		Peak	Non-Peak
Hourly Ramp Volume (if aux. lane/on-ramp proj.)		0	0
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)			
Queue Formation (if queuing or grade crossing project)			
		Year 1	Year 20
Arrival Rate (in vehicles per hour)		0	0
Departure Rate (in vehicles per hour)		0	0
Pavement Condition (if pavement project)			
		No Build	Build
IRI (inches/mile)	Base (Year 1)		
	Forecast (Year 20)		
Average Vehicle Occupancy (AVO)			
		No Build	Build
General Traffic	Non-Peak	1.30	1.30
	Peak	1.15	1.15
High Occupancy Vehicle (if HOV/HOT lanes)			

Project Information

1B) Highway Design and Traffic Data – Highway Design

Additional inputs in this section:

Roadway Type (F, E, or C)

- “F” (freeway), “E” (expressway), or “C” (conventional highway), case sensitive

Number of HOV/HOT Lanes (required for HOV/HOT-related projects)

HOV Restriction (2 or 3, required for HOV-related projects)

- Cal-B/C allows a “2” for a two-person or a “3” for a three-or more person carpool restriction

Exclusive ROW (Right-of-Way) for Buses (Y or N)

- Input used if the highway contains an exclusive busway or bus lanes

Ramp Design Speed (required input for auxiliary lane/off-ramp projects)

- For auxiliary lanes, speed is the average speed during acceleration (for on-ramps), merging, or decelerating (for off-ramps)

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design			
Roadway Type (Fwy, Exp, Conv Hwy)	No Build	Build	
Number of General Traffic Lanes	F	F	
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)	N		
Highway Free-Flow Speed		0	
Ramp Design Speed (if aux. lane/off-ramp proj.)	35	35	
Length (in miles)	Highway Segment	0.0	
	Impacted Length	0.0	
Average Daily Traffic			
Current			
	No Build	Build	
Base (Year 1)	0	0	
Forecast (Year 20)		0	
Average Hourly HOV/HOT Lane Traffic			
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)		100%	
Percent Traffic in Weave			
		0.0%	
Percent Trucks (include RVs, if applicable)			
	9%	9%	
Truck Speed			
On-Ramp Volume			
	Peak	Non-Peak	
Hourly Ramp Volume (if aux. lane/on-ramp proj.)	0	0	
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)			
Queue Formation (if queuing or grade crossing project)			
	Year 1	Year 20	
Arrival Rate (in vehicles per hour)	0	0	
Departure Rate (in vehicles per hour)	0	0	
Pavement Condition (if pavement project)			
	No Build	Build	
IRI (inches/mile)			
Base (Year 1)			
Forecast (Year 20)			
Average Vehicle Occupancy (AVO)			
	No Build	Build	
General Traffic			
Non-Peak	1.30	1.30	
Peak	1.15	1.15	
High Occupancy Vehicle (if HOV/HOT lanes)			

1B) Highway Design and Traffic Data – Travel Demand, Weaving, and Trucks

Required for Highway Capacity Expansion and Operational Improvement projects

Current Average Daily Traffic

- Enter the general purpose highway traffic for current year

Expected Average Daily Traffic

- Enter the general purpose highway traffic for the forecast year (Year 20) without the project (No Build)
- If data is available, overwrite estimate of traffic in Year 20 with the project (Build)

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design		No Build	Build
Roadway Type (Fwy, Exp, Conv Hwy)		F	F
Number of General Traffic Lanes			
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)		N	
Highway Free-Flow Speed			0
Ramp Design Speed (if aux. lane/off-ramp proj.)		35	35
Length (in miles)	Highway Segment		0.0
	Impacted Length	0.0	0.0
Average Daily Traffic			
Current			
		No Build	Build
Base (Year 1)		0	0
Forecast (Year 20)			0
Average Hourly HOV/HOT Lane Traffic			0
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)			100%
Percent Traffic in Weave			0.0%
Percent Trucks (include RVs, if applicable)		9%	9%
Truck Speed			
On-Ramp Volume		Peak	Non-Peak
Hourly Ramp Volume (if aux. lane/on-ramp proj.)		0	0
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)			
Queue Formation (if queuing or grade crossing project)		Year 1	Year 20
Arrival Rate (in vehicles per hour)		0	0
Departure Rate (in vehicles per hour)		0	0
Pavement Condition (if pavement project)		No Build	Build
IRI (inches/mile)	Base (Year 1)		
	Forecast (Year 20)		
Average Vehicle Occupancy (AVO)		No Build	Build
General Traffic	Non-Peak	1.30	1.30
	Peak	1.15	1.15
High Occupancy Vehicle (if HOV/HOT lanes)			

1B) Highway Design and Traffic Data – Travel Demand, Weaving, and Trucks

Additional inputs in this section:

Average Hourly HOV/HOT Lane Traffic (required for HOV/HOT-related projects)

- If segment has existing HOV/HOT lane, enter current year average hourly HOV/HOT volumes

Percent of Induced Trips in HOV (for HOT or a 2-3 conversion)

- Indicate how much of the forecast ADT occurs in the HOV/HOT lane by entering a percentage

Percent Traffic in Weave (for operational improvement projects)

Percent Trucks (required for highway projects)

Truck Speed (required input for passing lane projects)

- Enter trucks/RV average speed on a grade with no passing lanes

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design		No Build	Build
Roadway Type (Fwy, Exp, Conv Hwy)		F	F
Number of General Traffic Lanes			
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)		N	
Highway Free-Flow Speed			0
Ramp Design Speed (if aux. lane/off-ramp proj.)		35	35
Length (in miles)	Highway Segment		0.0
	Impacted Length	0.0	0.0
Average Daily Traffic			
Current			
		No Build	Build
Base (Year 1)		0	0
Forecast (Year 20)			0
Average Hourly HOV/HOT Lane Traffic			0
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)			100%
Percent Traffic in Weave			0.0%
Percent Trucks (include RVs, if applicable)		9%	9%
Truck Speed			
On-Ramp Volume		Peak	Non-Peak
Hourly Ramp Volume (if aux. lane/on-ramp proj.)		0	0
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)			
Queue Formation (if queuing or grade crossing project)		Year 1	Year 20
Arrival Rate (in vehicles per hour)		0	0
Departure Rate (in vehicles per hour)		0	0
Pavement Condition (if pavement project)		No Build	Build
IRI (inches/mile)	Base (Year 1)		
	Forecast (Year 20)		
Average Vehicle Occupancy (AVO)		No Build	Build
General Traffic	Non-Peak	1.30	1.30
	Peak	1.15	1.15
High Occupancy Vehicle (if HOV/HOT lanes)			

Project Information

1C) Highway Accident Data – Actual 3-Year Accident Data

Required for Highway Capacity Expansion and Operational Improvement projects

3-Year Accident Counts by Type

- Enter current (3-year) counts of fatal, injury, and property damage only (PDO) of collisions along the analysis corridor
- Cal-B/C automatically calculates the collision rates by using the ADT values entered in Section 1B)
 - Collision Rate = $\text{Accidents} / (\text{ADT} \times \text{segment length} \times 365 \text{ days} / 1,000,000)$
- You can override the calculated rates if better collision rate data is available
 - Module 8a will discuss how to obtain collision data and use it for analysis in more detail, including the use of TASAS, SWITRS, FRA or other collision data sources

1C HIGHWAY ACCIDENT DATA		
Actual 3-Year Accident Data (from Table B)		
	Count (No.)	Rate
Total Accidents (Tot)		0.85
Fatal Accidents (Fat)		0.006
Injury Accidents (Inj)		0.29
Property Damage Only (PDO) Accidents		0.55
Statewide Basic Average Accident Rate		
	No Build	Build
Rate Group		
Accident Rate (per million vehicle-miles)		
Percent Fatal Accidents (Pct Fat)		
Percent Injury Accidents (Pct Inj)		

1C) Highway Accident Data – Statewide Basic Average Accident Rate

Required for Highway Capacity Expansion and Operational Improvement projects

Expected accident rates for the type of facility in question (with & without the project)

Expected percentages of fatal and injury collisions (with & without the project)

- Cal-B/C Sketch uses the change in accident rate group to estimate the safety benefits of roadway projects
- Rate group entry for the No Build and Build scenarios is for record-keeping purposes only
- Cal-B/C relies on average accident rates and percentages by accident type for analysis
 - Module 8a will present more detailed information on where to source data for this section

1C HIGHWAY ACCIDENT DATA		
Actual 3-Year Accident Data (from Table B)		
	Count (No.)	Rate
Total Accidents (Tot)		0.85
Fatal Accidents (Fat)		0.006
Injury Accidents (Inj)		0.29
Property Damage Only (PDO) Accidents		0.55
Statewide Basic Average Accident Rate		
	No Build	Build
Rate Group		
Accident Rate (per million vehicle-miles)		
Percent Fatal Accidents (Pct Fat)		
Percent Injury Accidents (Pct Inj)		

1B) Highway Design and Traffic Data – On Ramp Volumes

Required for Auxiliary Lane and On-Ramp Widening projects

Hourly Ramp Volume

- Input required for average peak hour and non-peak hour
- Cal-B/C assumes a peak period volume of 1,350 vehicles per hour for auxiliary lanes and 800 vehicles per hour for on-ramps

Metering Strategy (1, 2, 3, or D)

- Required for on-ramp widening projects with ramp metering
- Cal-B/C requires a “1”, “2”, or “3” to indicate the number of vehicles allowed per green signal
- Enter a “D” to indicate dual metering

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design		No Build	Build
Roadway Type (Fwy, Exp, Conv Hwy)		F	F
Number of General Traffic Lanes			
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (yln)		N	
Highway Free-Flow Speed			0
Ramp Design Speed (if aux. lane/off-ramp proj.)		35	35
Length (in miles)	Highway Segment		0.0
	Impacted Length	0.0	0.0
Average Daily Traffic			
Current			
		No Build	Build
Base (Year 1)		0	0
Forecast (Year 20)			0
Average Hourly HOV/HOT Lane Traffic			0
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)			100%
Percent Traffic in Weave			0.0%
Percent Trucks (include RVs, if applicable)		9%	9%
Truck Speed			
On-Ramp Volume		Peak	Non-Peak
Hourly Ramp Volume (if aux. lane/on-ramp proj.)		0	0
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)			
Queue Formation (if queuing or grade crossing project)		Year 1	Year 20
Arrival Rate (in vehicles per hour)		0	0
Departure Rate (in vehicles per hour)		0	0
Pavement Condition (if pavement project)		No Build	Build
IRI (inches/mile)	Base (Year 1)		
	Forecast (Year 20)		
Average Vehicle Occupancy (AVO)		No Build	Build
General Traffic	Non-Peak	1.30	1.30
	Peak	1.15	1.15
High Occupancy Vehicle (if HOV/HOT lanes)			

Project Information

1B) Highway Design and Traffic Data – Queue Formation

Required for Highway Queuing and Rail Grade Separation projects

Arrival Rate

- Enter VPH contributing to the queue
- Should be estimated only for the time that the queue grows
- Cal-B/C estimates queue dissipation automatically

Departure Rate

- Enter VPH leaving the queue

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design			
Roadway Type (Fwy, Exp, Conv Hwy)	No Build	Build	
Number of General Traffic Lanes	F	F	
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (yln)	N		
Highway Free-Flow Speed		0	
Ramp Design Speed (if aux. lane/off-ramp proj.)	35	35	
Length (in miles)	Highway Segment	0.0	
Impacted Length		0.0	
Average Daily Traffic			
Current			
Base (Year 1)	No Build	Build	
Forecast (Year 20)	0	0	
Average Hourly HOV/HOT Lane Traffic			
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)		0	
Percent Traffic in Weave		100%	
Percent Trucks (include RVs, if applicable)	9%	9%	
Truck Speed			
On-Ramp Volume			
Hourly Ramp Volume (if aux. lane/on-ramp proj.)	Peak	Non-Peak	
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)	0	0	
Queue Formation (if queuing or grade crossing project)			
Arrival Rate (in vehicles per hour)	Year 1	Year 20	
Departure Rate (in vehicles per hour)	0	0	
	0	0	
Pavement Condition (if pavement project)			
IRI (inches/mile)	No Build	Build	
Base (Year 1)			
Forecast (Year 20)			
Average Vehicle Occupancy (AVO)			
General Traffic	No Build	Build	
Non-Peak	1.30	1.30	
Peak	1.15	1.15	
High Occupancy Vehicle (if HOV/HOT lanes)			

Project Information

1B) Highway Design and Traffic Data – Pavement Condition

Required for Pavement Rehabilitation projects

International Roughness Index (IRI)

- Enter the IRI in the No Build and Build scenarios
- Cal-B/C Sketch will calculate Year 20 values using standard parameters (Module 5 presented these parameters in detail)
- You can override forecast year (Year 20) IRI values
- The IRI of a roadway is a standard measure used by the Federal Highway Administration (FHWA) for pavement condition
- Measured in California by vehicles driving down a road and capturing deviations from a smooth pavement condition

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design		No Build	Build
Roadway Type (Fwy, Exp, Conv Hwy)		F	F
Number of General Traffic Lanes			
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)		N	
Highway Free-Flow Speed			0
Ramp Design Speed (if aux. lane/off-ramp proj.)		35	35
Length (in miles)	Highway Segment		0.0
	Impacted Length	0.0	0.0
Average Daily Traffic			
Current			
		No Build	Build
Base (Year 1)		0	0
Forecast (Year 20)			0
Average Hourly HOV/HOT Lane Traffic			
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)			100%
Percent Traffic in Weave			
Percent Trucks (include RVs, if applicable)		9%	9%
Truck Speed			
		Peak	Non-Peak
Hourly Ramp Volume (if aux. lane/on-ramp proj.)		0	0
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)			
Queue Formation (if queuing or grade crossing project)			
		Year 1	Year 20
Arrival Rate (in vehicles per hour)		0	0
Departure Rate (in vehicles per hour)		0	0
Pavement Condition (if pavement project)			
		No Build	Build
IRI (inches/mile)	Base (Year 1)		
	Forecast (Year 20)		
Average Vehicle Occupancy (AVO)			
		No Build	Build
General Traffic	Non-Peak	1.30	1.30
	Peak	1.15	1.15
High Occupancy Vehicle (if HOV/HOT lanes)			

Project Information

1B) Highway Design and Traffic Data – Average Vehicle Occupancy (AVO)

Optional input to overwrite Cal-B/C model defaults for any project

General Traffic AVO

- Cal-B/C uses standard AVO estimates based on the most recent California Statewide Travel Survey data
- Many regional and local agencies have more updated No Build and Build AVO data available (e.g., data from regional TDMs)

High Occupancy Vehicle (HOV) Occupancy

- Data entry is required if the analysis roadway has an HOV or HOT lane
- This estimate can vary widely from freeway to freeway, so you must enter the appropriate values in this section
- Each Caltrans District produces a Managed Lanes Annual Report that reports AVOs for both general purpose and HOV/HOT lanes at select locations
- Module 8a will have more details on data sources for AVO data

1B) HIGHWAY DESIGN AND TRAFFIC DATA			
Highway Design			
Roadway Type (Fwy, Exp, Conv Hwy)	No Build	Build	
Number of General Traffic Lanes	F	F	
Number of HOV/HOT Lanes			
HOV Restriction (2 or 3)			
Exclusive ROW for Buses (y/n)	N		
Highway Free-Flow Speed		0	
Ramp Design Speed (if aux. lane/off-ramp proj.)	35	35	
Length (in miles)		0.0	
Highway Segment Impacted Length		0.0	
Average Daily Traffic			
Current			
Base (Year 1)	No Build	Build	
Forecast (Year 20)	0	0	
Average Hourly HOV/HOT Lane Traffic			
Percent of Induced Trips in HOV (if HOT or 2-to-3 conv.)		100%	
Percent Traffic in Weave			
Percent Trucks (include RVs, if applicable)	9%	9%	
Truck Speed			
On-Ramp Volume			
Hourly Ramp Volume (if aux. lane/on-ramp proj.)	Peak	Non-Peak	
Metering Strategy (1, 2, 3, or D, if on-ramp proj.)	0	0	
Queue Formation (if queuing or grade crossing project)			
Arrival Rate (in vehicles per hour)	Year 1	Year 20	
Departure Rate (in vehicles per hour)	0	0	
Pavement Condition (if pavement project)			
IRI (inches/mile)	No Build	Build	
Base (Year 1)			
Forecast (Year 20)			
Average Vehicle Occupancy (AVO)			
General Traffic	No Build	Build	
Non-Peak	1.30	1.30	
Peak	1.15	1.15	
High Occupancy Vehicle (if HOV/HOT lanes)			

Project information

Required Data Input for transit improvement projects

If the proposed project involves a transit improvement, the following are required:

- **1D) Rail and Transit Data:**

- Annual person-trips in Year 1 and Year 20 of project operations (with & without project)
- Annual vehicle-miles in Year 1 and Year 20 of project operations (with & without project)
- Average transit trip time in the peak and off-peak under existing conditions

Module 9a walks through a light rail transit case study using Cal-B/C Sketch that illustrates the data input shown in the following slides.

1D) Rail and Transit Data – Person Trip Data

Required for Transit Improvement projects

Annual Person Trips

- Enter passenger trips on transit for both Base (Year 1) during the first year after the project is built and the Forecast (Year 20) for both the No Build and Build scenarios

Additional inputs in this section:

Percent Trips during Peak Period

- Enter an estimate of the ratio of peak period to daily ridership
- The hours in the peak period should be the same number of hours as entered in the Section 1A

Percent New Trips from Parallel Highway

- Default value is set at 100%, meaning all new transit users were people who drove or carpoled prior to the implementation of the transit project

RAIL AND TRANSIT DATA				
Annual Person-Trips		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Percent Trips during Peak Period		40%		
Percent New Trips from Parallel Highway			100%	
Annual Vehicle-Miles		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Average Vehicles/Train (if rail project)				
Reduction in Transit Accidents				
Percent Reduction (if safety project)				
Average Transit Travel Time		No Build	Build	
In-Vehicle	Non-Peak (in minutes)		0.0	
	Peak (in minutes)		0.0	
Out-of-Vehicle	Non-Peak (in minutes)	0.0	0.0	
	Peak (in minutes)	0.0	0.0	
Highway Grade Crossing		Current	Year 1	Year 20
Annual Number of Trains			0	
Avg. Gate Down Time (in min.)			0.0	
Transit Agency Costs (if TMS project)		No Build	Build	
Annual Capital Expenditure			\$0	
Annual Ops. and Maintenance Expenditure			\$0	

1D) Rail and Transit Data – Transit Service and Collision Data

Required for Transit Improvement projects

Annual Vehicle-Miles

- Enter number of vehicle-miles of transit or rail service operated on the line each year
- Estimates needed for Base (Year 1) and Forecast (Year 20) after the opening date for both No Build and Build scenarios
- For passenger rail projects, the number of vehicle-miles is total number of train car miles (i.e., multiply train miles x average number of cars per train)

ID		RAIL AND TRANSIT DATA		
Annual Person-Trips		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Percent Trips during Peak Period		40%		
Percent New Trips from Parallel Highway			100%	
Annual Vehicle-Miles		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Average Vehicles/Train (if rail project)				
Reduction in Transit Accidents				
Percent Reduction (if safety project)				
Average Transit Travel Time		No Build	Build	
In-Vehicle	Non-Peak (in minutes)		0.0	
	Peak (in minutes)		0.0	
Out-of-Vehicle	Non-Peak (in minutes)	0.0	0.0	
	Peak (in minutes)	0.0	0.0	
Highway Grade Crossing		Current	Year 1	Year 20
Annual Number of Trains			0	
Avg. Gate Down Time (in min.)			0.0	
Transit Agency Costs (if TMS project)		No Build	Build	
Annual Capital Expenditure			\$0	
Annual Ops. and Maintenance Expenditure			\$0	

1D) Rail and Transit Data – Transit Service and Collision Data

Additional inputs in this section:

Average Vehicles per Train

- Enter number of train cars used in an average train consist
- Can be used above to calculate vehicle-miles
- Vehicle-Miles and vehicles/train used by Cal-B/C to estimate annual emissions caused by transit

Reduction in Transit Accidents (collisions)

- If the project improvement specifically addresses safety, enter the percentage change in collisions expected to occur due to the project

RAIL AND TRANSIT DATA				
Annual Person-Trips		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Percent Trips during Peak Period		40%		
Percent New Trips from Parallel Highway			100%	
Annual Vehicle-Miles		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Average Vehicles/Train (if rail project)				
Reduction in Transit Accidents				
Percent Reduction (if safety project)				
Average Transit Travel Time		No Build	Build	
In-Vehicle	Non-Peak (in minutes)		0.0	
	Peak (in minutes)		0.0	
Out-of-Vehicle	Non-Peak (in minutes)	0.0	0.0	
	Peak (in minutes)	0.0	0.0	
Highway Grade Crossing		Current	Year 1	Year 20
Annual Number of Trains			0	
Avg. Gate Down Time (in min.)			0.0	
Transit Agency Costs (if TMS project)		No Build	Build	
Annual Capital Expenditure			\$0	
Annual Ops. and Maintenance Expenditure			\$0	

1D) Rail and Transit Data – Transit Travel Times

Required for Transit Improvement projects

In-Vehicle Travel Time

- Enter in the average travel time spent in the transit vehicle for both the No Build non-Peak and Peak periods
 - In-vehicle time is the time spent in the bus or train traveling to the rider’s destination
 - Cal-B/C estimates travel time with the project, which you can override if better data is available
 - If project is a TMS project, enter average travel time for all routes impacted by project

Out-Of-Vehicle Time

- Cal-B/C automatically estimates out of vehicle time impacts for Automatic Vehicle Location (AVL) TMS projects using assumptions
- You can override out-of-vehicle savings for other types of projects (e.g., more frequent service resulting in shorter transit wait times)

RAIL AND TRANSIT DATA				
Annual Person-Trips		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Percent Trips during Peak Period		40%		
Percent New Trips from Parallel Highway			100%	
Annual Vehicle-Miles		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Average Vehicles/Train (if rail project)				
Reduction in Transit Accidents				
Percent Reduction (if safety project)				
Average Transit Travel Time		No Build	Build	
In-Vehicle	Non-Peak (in minutes)		0.0	
	Peak (in minutes)		0.0	
Out-of-Vehicle	Non-Peak (in minutes)	0.0	0.0	
	Peak (in minutes)	0.0	0.0	
Highway Grade Crossing		Current	Year 1	Year 20
Annual Number of Trains			0	
Avg. Gate Down Time (in min.)			0.0	
Transit Agency Costs (if TMS project)		No Build	Build	
Annual Capital Expenditure			\$0	
Annual Ops. and Maintenance Expenditure			\$0	

1D) Rail and Transit Data – Highway Grade Crossing

Required for Highway/Rail Grade Crossing projects

Annual Number of Trains

- Annual number of trains is total number of freight and passenger trains
- Enter total number of annual trains passing by grade crossing in current year
- Enter number of annual trains forecast to pass in Year 20 following grade crossing construction
- Year 1 estimates are often unavailable, so Cal-B/C estimates year based on current and Year 20 inputs

Average Gate Down Time (minutes)

- Average time (minutes) crossing gate is closed for train
- Can vary by train type: longer, slower moving freight trains and shorter, faster moving passenger trains
- Enter an average estimated gate down time that combines impact of both freight and passenger trains

1D RAIL AND TRANSIT DATA				
Annual Person-Trips		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Percent Trips during Peak Period		40%		
Percent New Trips from Parallel Highway			100%	
Annual Vehicle-Miles		No Build	Build	
Base (Year 1)				
Forecast (Year 20)				
Average Vehicles/Train (if rail project)				
Reduction in Transit Accidents				
Percent Reduction (if safety project)				
Average Transit Travel Time		No Build	Build	
In-Vehicle	Non-Peak (in minutes)		0.0	
	Peak (in minutes)		0.0	
Out-of-Vehicle	Non-Peak (in minutes)	0.0	0.0	
	Peak (in minutes)	0.0	0.0	
Highway Grade Crossing		Current	Year 1	Year 20
Annual Number of Trains			0	
Avg. Gate Down Time (in min.)			0.0	
Transit Agency Costs (if TMS project)		No Build	Build	
Annual Capital Expenditure			\$0	
Annual Ops. and Maintenance Expenditure			\$0	

1D) Rail and Transit Data – Transit Agency Costs (TMS Projects Only)

Required for Transportation Management Systems (TMS) projects

Transit Agency Costs

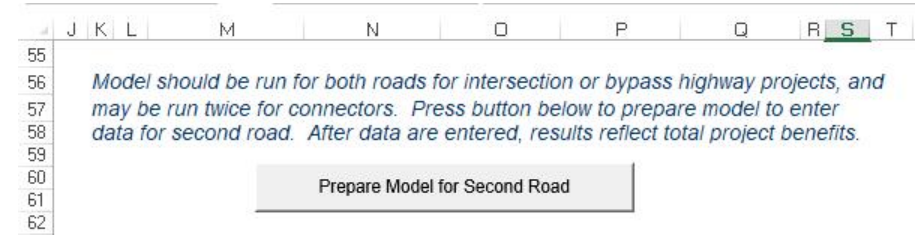
- Enter total annual capital, operating, and maintenance expenditures for routes impacted by project
 - Cal-B/C calculates cost reductions due to transit TMS
 - Agency cost savings are estimated in Section 1E, where they are listed as negative costs

		J	K	L	M	N	O	P	Q	R	S
23											
24											
25	1D	RAIL AND TRANSIT DATA									
26											
27		Annual Person-Trips		No Build		Build					
28		Base (Year 1)									
29		Forecast (Year 20)									
30		Percent Trips during Peak Period		40%							
31		Percent New Trips from Parallel Highway				100%					
32											
33		Annual Vehicle-Miles		No Build		Build					
34		Base (Year 1)									
35		Forecast (Year 20)									
36		Average Vehicles/Train (if rail project)									
37											
38		Reduction in Transit Accidents									
39		Percent Reduction (if safety project)									
40											
41		Average Transit Travel Time		No Build		Build					
42		In-Vehicle	Non-Peak (in minutes)				0.0				
43	Peak (in minutes)				0.0						
44		Out-of-Vehicle	Non-Peak (in minutes)		0.0		0.0				
45	Peak (in minutes)		0.0		0.0						
46											
47		Highway Grade Crossing		Current		Year 1		Year 20			
48		Annual Number of Trains				0					
49		Avg. Gate Down Time (in min.)				0.0					
50											
51		Transit Agency Costs (if TMS project)		No Build		Build					
52		Annual Capital Expenditure				\$0					
53		Annual Ops. and Maintenance Expenditure				\$0					
54											
55											

Project Information

1) Bypass, Intersection, and Truck Only Lane Projects Macro

- If two roads are involved in an analysis, Cal-B/C Sketch requires data for both roads.
- The “Prepare Model for Second Road” Button in the 1) Project Information worksheet runs a macro that clears data in the Project Information worksheet to be ready for data entry for the second road
 - **Note: detailed calculations for the first road are lost**
 - It is good practice to save a copy of the analysis before clearing project data for the first road entering information for second road



03

Step 2, Adjust Model Data

Overview of Model Inputs worksheet

Review and replace Cal-B/C estimated values if more detailed data are available (e.g., travel demand model data)

2A Highway Speed and Volume Inputs

- Peak and non-peak periods
- HOV, non-HOV, weaving, and truck volumes and speeds

2B Highway Accident Rates and Adjustment Factors

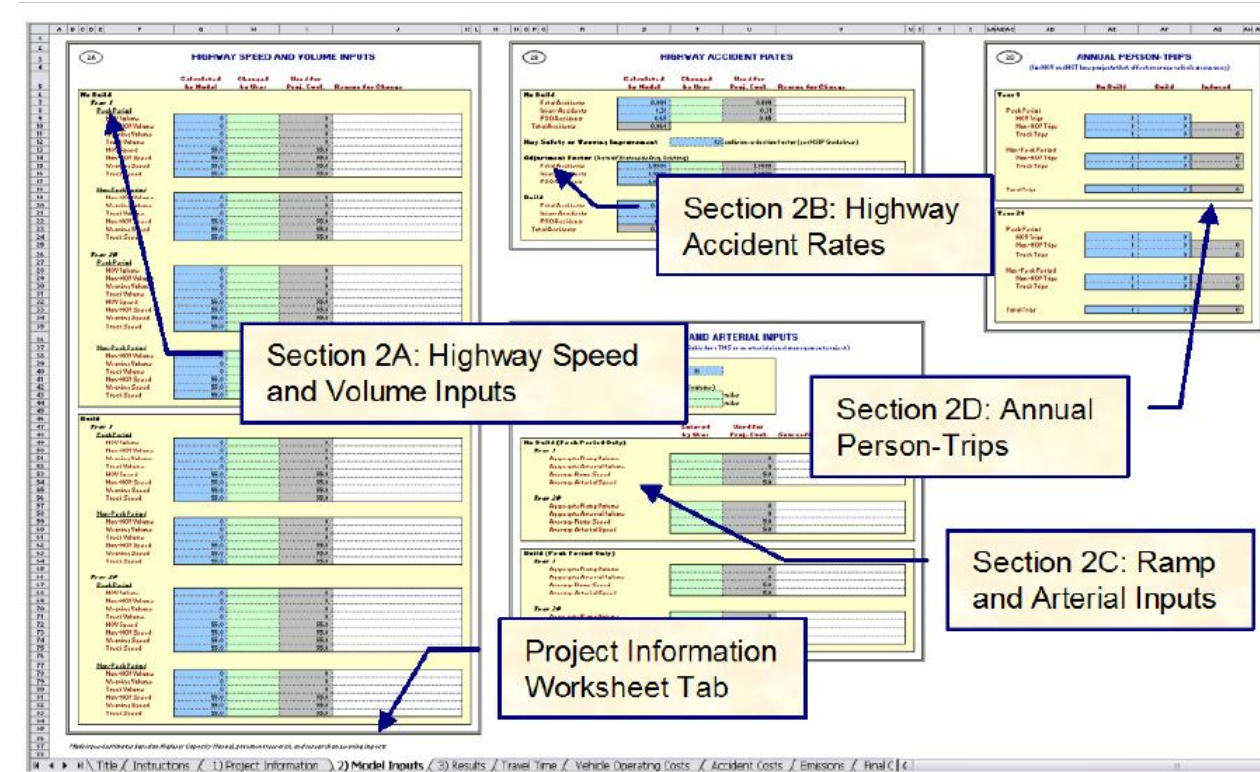
- Fatal accidents
- Injury accidents
- Property damage only (PDO) accidents

2C Ramp and Arterial Inputs

- Aggregate ramp and arterial volumes and speeds

2D Annual Person Trips

- Displays annual person-trip estimates for HOV conversion and HOT lane projects for review purposes only
- If needed, ADT and AVO inputs can be adjusted



2A) Model Inputs – Highway Speed and Volume Adjustments

- Review the calculated speeds and volumes to ensure they are realistic and correspond with user expectations
- Volumes and speeds are listed for
 - Year 1 and Year 20
 - Peak and Non-Peak
 - No Build and Build
 - HOV, Non-HOV (General Purpose), and Trucks
- If detailed data is available, change volumes and speeds in the green columns and note source or reason for change in white column

		Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
2A					
HIGHWAY SPEED AND VOLUME INPUTS					
Without Project					
Year 1					
<u>Peak Period</u>					
HOV Volume		0		0	
Non-HOV Volume		0		0	
Weaving Volume		0		0	
Truck Volume		0		0	
HOV Speed		55.0		55.0	
Non-HOV Speed		55.0		55.0	
Weaving Speed		55.0		55.0	
Truck Speed		55.0		55.0	
<u>Non-Peak Period</u>					
Non-HOV Volume		0		0	
Weaving Volume		0		0	
Truck Volume		0		0	
Non-HOV Speed		55.0		55.0	
Weaving Speed		55.0		55.0	
Truck Speed		55.0		55.0	
Year 20					
<u>Peak Period</u>					
HOV Volume		0		0	
Non-HOV Volume		0		0	
Weaving Volume		0		0	
Truck Volume		0		0	
HOV Speed		55.0		55.0	
Non-HOV Speed		55.0		55.0	
Weaving Speed		55.0		55.0	
Truck Speed		55.0		55.0	
<u>Non-Peak Period</u>					
Non-HOV Volume		0		0	
Weaving Volume		0		0	
Truck Volume		0		0	
Non-HOV Speed		55.0		55.0	
Weaving Speed		55.0		55.0	
Truck Speed		55.0		55.0	

2B) Model Inputs – Highway Accident Rate Adjustments

- Review the calculated accident rates to ensure they are realistic and correspond with user expectations
- If detailed data is available, change accident rates and adjustment factors
 - For No Build and Build scenarios
 - For rates and adjustments for Fatal, Injury, and PDO accidents

	Calculated by Model	Changed by User	Used for Proj. Eval.	Reason for Change
2B) HIGHWAY ACCIDENT RATES				
No Build				
Fatal Accidents	0.006		0.006	
Injury Accidents	0.29		0.29	
PDO Accidents	0.55		0.55	
Total Accidents	0.846			
Hwy Safety or Weaving Improvement <input type="text" value="0%"/> collision reduction factor (per HSIP Guidelines)				
Adjustment Factor (Actual/Statewide Avg. Existing)				
Fatal Accidents	1.0000		1.0000	
Injury Accidents	1.0000		1.0000	
PDO Accidents	1.0000		1.0000	
Build				
Fatal Accidents	0.006		0.006	
Injury Accidents	0.29		0.29	
PDO Accidents	0.55		0.55	
Total Accidents	0.846			

2C) Model Inputs - Ramp and Arterial Inputs

For TMS projects:

- Input arterial and ramp volumes and speeds if available
- Without data input, Cal-B/C will estimate the impacts on ramps and arterial using the standard relationships developed in the modeling for the TMS Master Plan
 - Included in the TMS table in the Parameters sheet
- Refer to Module 5 for more information on the TMS adjustment factors in the Parameters sheet

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2C

RAMP AND ARTERIAL INPUTS

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

Detailed Information Available? (y/n)

Aggregate Segment Length (estimate as VMT/total volume)

All Ramps miles

Arterials miles

	Entered by User	Used for Proj. Eval.	Source/Notes
No Build (Peak Period Only)			
<i>Year 1</i>			
Aggregate Ramp Volume	0		
Aggregate Arterial Volume	0		
Average Ramp Speed	5.0		
Average Arterial Speed	5.0		
<i>Year 20</i>			
Aggregate Ramp Volume	0		
Aggregate Arterial Volume	0		
Average Ramp Speed	5.0		
Average Arterial Speed	5.0		
Build (Peak Period Only)			
<i>Year 1</i>			
Aggregate Ramp Volume	0		
Aggregate Arterial Volume	0		
Average Ramp Speed	5.0		
Average Arterial Speed	5.0		
<i>Year 20</i>			
Aggregate Ramp Volume	0		
Aggregate Arterial Volume	0		
Average Ramp Speed	5.0		
Average Arterial Speed	5.0		

2D) Model Inputs – Annual Person-Trips Validation

For HOV and HOT lane projects:

- Review and validate the annual person-trip data
 - Calculated based on inputs in the Project Information worksheet for HOV conversion and HOT lane projects
- Compare total trips estimated in Cal-B/C to other sources for the project area to validate
 - Travel demand model outputs for the project area
 - Caltrans Mainline Annual Report Counts for the corridor
- If estimated trips do not match findings from other sources, consider adjusting the ADT and AVO data in project information worksheet.

	AA	AB	AC	AD	AE	AF	AG	AH	AI
1									
2									
3				2D					
4					ANNUAL PERSON-TRIPS (for HOV and HOT lane projects that affect average vehicle occupancy)				
5					No Build	Build	Induced		
6				Year 1					
7									
8				Peak Period					
9				HOV Trips	#VALUE!	#VALUE!			
10				Non-HOV Trips	0	0	0		
11				Truck Trips	0	0	0		
12									
13				Non-Peak Period					
14				Non-HOV Trips	0	0	0		
15				Truck Trips	0	0	0		
16									
17				Total Trips	#VALUE!	#VALUE!	#VALUE!		
18									
19									
20									
21				Year 20					
22									
23				Peak Period					
24				HOV Trips	#VALUE!	#VALUE!			
25				Non-HOV Trips	0	0	0		
26				Truck Trips	0	0	0		
27									
28				Non-Peak Period					
29				Non-HOV Trips	0	0	0		
30				Truck Trips	0	0	0		
31									
32									
33				Total Trips	#VALUE!	#VALUE!	#VALUE!		
34									
35									

04

Step 3, Review Summary Results

Review Model Results

Review BCA metrics

- Life-Cycle Costs: present values of all net project costs
- Life-Cycle Benefits: sum of the monetized benefits for the project in present value
- Net Present Value = Life-Cycle Benefits – Life-Cycle Costs
- Benefit/Cost Ratio = Life-Cycle Benefits/Life-Cycle Costs
- Rate of Return on Investment: Discount rate at which benefits and costs are equal
- Payback Period: number of years it takes for the net benefits to equal the initial construction costs

Adjust which benefits are included in the analysis based on the purpose

District: HQ

PROJECT: Hypothetical Project

EA:
PPMO:

INVESTMENT ANALYSIS
SUMMARY RESULTS

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EMISSIONS REDUCTION	Tons		Value (mil. \$)	
	Total Over 20Years	Average Annual	Total Over 20Years	Average Annual
CO Emissions Saved	0	0	#N/A	#N/A
CO ₂ Emissions Saved	0	0	#N/A	#N/A
NO _x Emissions Saved	0	0	#N/A	#N/A
PM ₁₀ Emissions Saved	0	0	#N/A	#N/A
PM _{2.5} Emissions Saved	0	0	#N/A	#N/A
SO _x Emissions Saved	0	0	#N/A	#N/A
VOC Emissions Saved	0	0	#N/A	#N/A

Review Model Results

Review quantified benefits

- Person-hours of time saved
- Emission reductions: A positive value implies a reduction in emissions

Do the results correspond with your expectation?

Do the monetized benefits correspond with the project components and expected impacts?

Module 3 provided more details on how to interpret Cal-B/C results

District: **HQ**

PROJECT: **Hypothetical Project**

EA:
PPMD:

3

INVESTMENT ANALYSIS

SUMMARY RESULTS

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Troubleshooting Issues with Cal-B/C Results

Issue	Potential Reason
My B/C ratio is way too low/high?	Project Costs not entered in thousands of dollars. If actual project costs entered, then B/C ratios will be close to 0.001; If costs entered in millions of dollars, then B/C ratios will be on the order of 1000/1
I'm getting negative emissions benefits?	Emissions and fuel consumption are more similar to a "U" shape. For projects on corridors operating at higher speeds in the No Build case (e.g., around 45mph or higher), then improvements in speeds may generate higher emissions.
Some benefits improve, but others show negative benefits?	Similar to previous question, some benefits are linear (i.e., the faster you go, the more travel time savings you achieve), while others are "U" shaped. In other words, if base year speeds are very congested, the faster you go in the build scenario, the less you pollute and the less fuel you consume. However, if base year speeds are not extremely congested, then the faster you go in the build scenario the more you pollute and the more fuel you consume (thus increasing your vehicle operating costs).
Accident cost savings are too low/high?	Ensure that accident counts correspond to three-year counts for the Cal-B/C Sketch tool.
Travel time savings or other benefit categories are too low/high?	Ensure that VMT and/or trips are entered in the correct units (daily vs. annual).

05

Conclusion

In this module, you learned...

- A three-step process to start an analysis in the Cal-B/C Sketch tool
- Troubleshooting methods

What's Next?

- Review where to find data for your project, and more detail on input sheets
 - **Module 8a** (Cal-B/C Sketch)
 - **Module 8b** (Cal-B/C Corridor)
 - **Module 8c** (Cal-B/C Active Transportation)
 - **Module 8d** (Cal-B/C Park & Ride)
 - **Module 8e** (Cal-B/C Intermodal Freight)
- Example of an analysis in the Cal-B/C Sketch tool
 - **Module 9a: Cal-B/C Sketch LRT Case Study**
 - **Module 9b: Cal-B/C Sketch HOV Case Study**