



## **Module 4b**

### **How Cal-B/C Corridor Works**

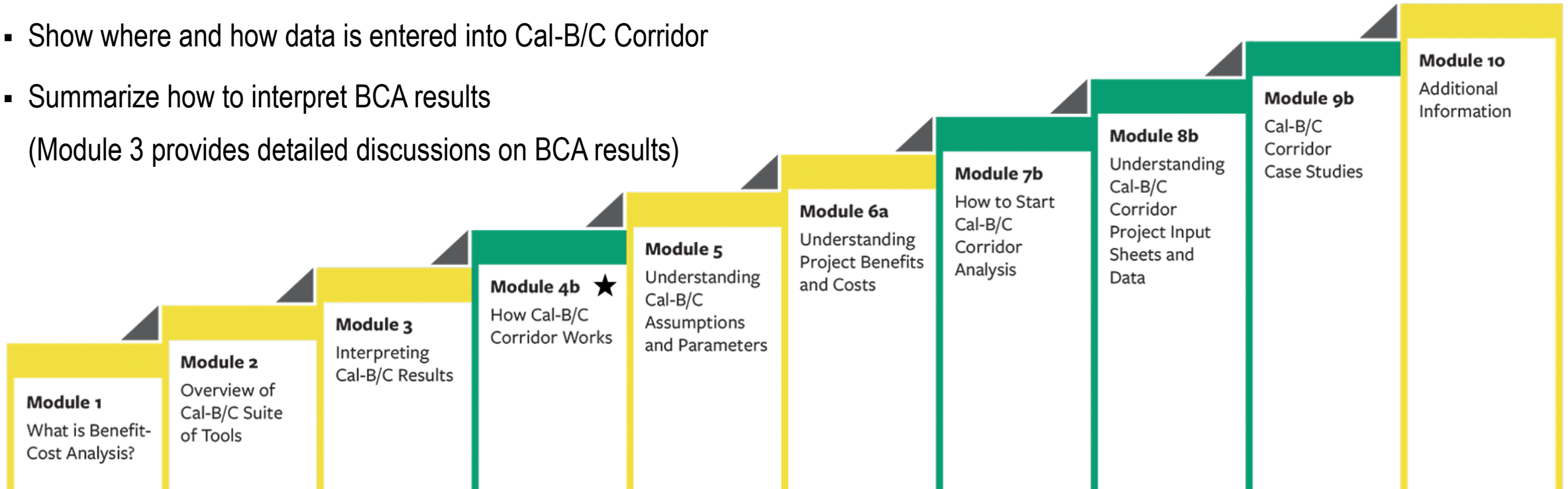


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## **About This Module**

## This module will...

- Build on Modules 1, 2, and 3 to provide a detailed understanding of how Cal-B/C Corridor works
- Help you decide if Cal-B/C Corridor is the appropriate tool for your job
- Review worksheet tabs and summarize key components for performing a benefit-cost analysis (BCA)
- Show where and how data is entered into Cal-B/C Corridor
- Summarize how to interpret BCA results  
(Module 3 provides detailed discussions on BCA results)



★ *This module is covered in this presentation*

## Previous Modules...

- **Module 1** provided a basic introduction to benefit-cost analysis (BCA) and a general overview of how you 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 projects
- **Module 3** presented the Cal-B/C results page, detailed what each output measure means, and explained how each measure is calculated

## Is Cal-B/C Corridor the right tool for you?

- Highway and transit projects with detailed data available:
  - Modeled in a travel demand model
  - Modeled in a micro-simulation model
  - Traffic by segment estimated using Highway Capacity Manual (HCM) methods



## Cal-B/C Corridor System, User, and Data Requirements

### ▪ System Requirements

- Designed for a Windows environment, tested on Microsoft Excel 2013 and later versions
- Cal-B/C Corridor file is about 700 kilobytes (KB) in size
  - File size expands during analysis according to how much data is incorporated in the model

### ▪ User Requirements

- Working knowledge of spreadsheets (i.e., Microsoft Excel)
- Understanding of benefit-cost analysis
- Understanding of how to interpret travel demand/microsimulation results
- Ability to interpret results in a transportation planning context

### ▪ Data Requirements

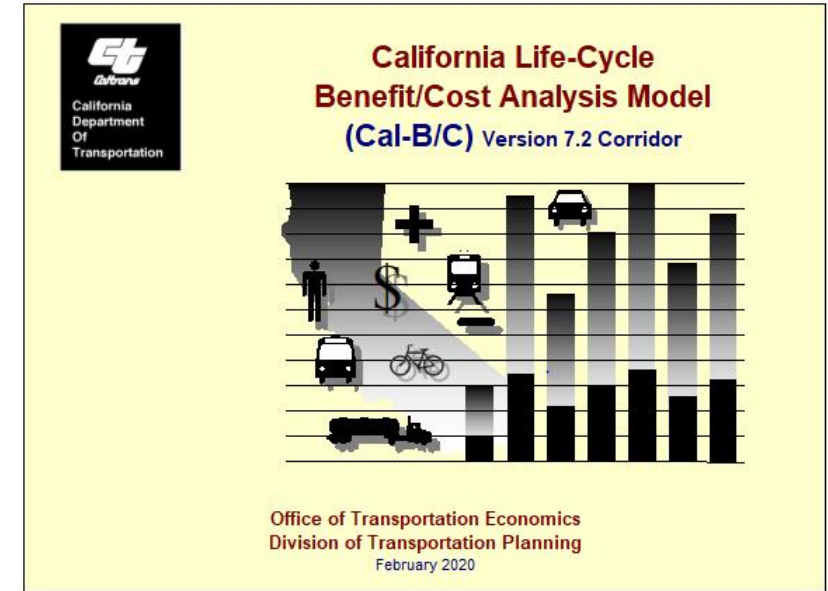
- Travel demand model results or microsimulation results
  - User should be comfortable handling larger datasets
- Think about model groups and data organization
  - Cal-B/C Corridor is limited to 500 model groups (comparable to “rows” in the modeled data)
  - If the modeled data contains more than 500 rows or lines, consider aggregating
- Do the model results make sense?

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## **Cal-B/C Corridor Overview**

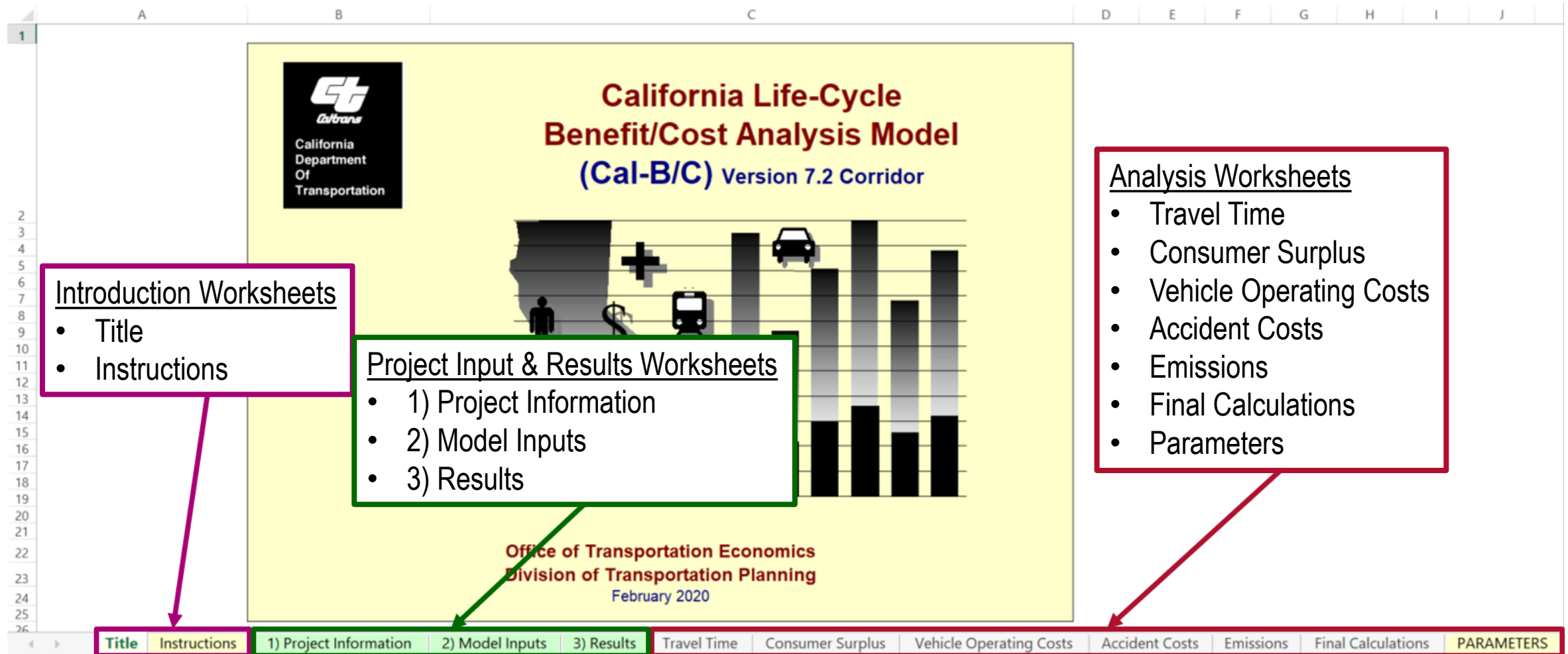
## Overview of Cal-B/C Corridor

- Post-processor, BCA tool for preparing economic analyses of highway and transit projects
- Flexible design that supports a variety of input data
- Set up as an interconnected, multi-sheet spreadsheet
  - 12 worksheets, including title page shown at right
  - Project Information and Model Inputs worksheets are primary locations for data entry
  - BCA results presented in the Results worksheet
  - Macros set up the model for analysis from user-defined number of traffic and safety model groups
- Estimates four categories of user benefits
- Estimates benefits using changes in vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) by mode from travel demand or micro-simulation model data





# Worksheet Layout in Cal-B/C Corridor



# Instructions Page in Model

## CALIFORNIA LIFE-CYCLE BENEFIT/COST ANALYSIS MODEL (Cal-B/C Corridor)

### INTRODUCTION

Cal-B/C Corridor is a post-processor, benefit-cost tool for preparing economic analyses of highway and transit projects. The model conducts benefit-cost analyses using the changes in vehicle-miles traveled (VMT) and vehicle-hours traveled (VHT) or person-miles traveled (PMT) and person-hours traveled (PHT) estimated in traffic and planning models. Cal-B/C Corridor is derived from the Cal-B/C Sketch model, but it has a flexible design to support a variety of inputs, including segment and speed bin data from regional travel demand and micro-simulation models. The Cal-B/C Corridor model uses the same assumptions and parameters and produces results fully comparable with Cal-B/C.

Provided that a project is already modeled in a traffic or planning model, Cal-B/C Corridor is able to calculate lifecycle costs, lifecycle benefits, net present value, benefit/cost ratio, internal rate of return, and payback period using appropriate input data. Four main categories of annual benefits are calculated directly within the model:

- Travel time savings (reduced travel time and new trips)
- Vehicle operating cost savings (reduced fuel and non-fuel operating costs)
- Accident cost savings (reduced cost to society related to safety)
- Emission cost savings (air quality and greenhouse gas benefits).

The model is arranged by worksheets and contains the following information, data, and results:

<u>Worksheets</u>	<u>Contents</u>
Instructions	General model description and assumptions
1) Project Information	Basic project data, model setup, and project costs
2) Model Inputs	Traffic or planning model input data in terms of VMT, VHT, PMT, PHT, out-of-pocket costs, and accident rates
3) Results	Summary results of analysis
Travel Time	Calculation of travel time impacts
Consumer Surplus	Calculation of benefits for new trips that result from project implementation
Vehicle Operating Costs	Calculation of changes in highway vehicle operating costs
Accident Costs	Calculation of benefits resulting from improved safety
Emissions	Calculation of emissions impacts
Final Calculations	Calculation of net present value, internal rate of return, and payback period
Parameters	Economic assumptions, lookup tables, and other model parameters consistent with other Cal-B/C models

Cal-B/C Corridor is designed so that the user generally needs to insert data only in the **green boxes** (light gray when printed) on the Project Information and Model Inputs worksheets. Summary results are shown on the Results worksheet. The remaining worksheets are provided for the user to see, but the model performs calculations automatically.

In the process of economic analysis, some generally accepted economic assumptions are necessary. These assumptions include the real discount rate, unit user costs (e.g., value of time), consumption rates (e.g., fuel consumption and vehicle emissions), and accident rates. These assumptions are given in the Parameters worksheet and should not be changed by the user.

After reading the instructions in this worksheet, the user should proceed to the Project Information worksheet and Model Inputs worksheet and input data for the specific project in the green boxes (light gray when printed). The model provides default values in the **red boxes** (medium gray when printed). These values can be changed by the user, if information specific to the project is available. The model calculates some values based on relationships or assumptions, with results shown in the **blue boxes** (dark gray when printed). These values can be changed by the user.

### INSTRUCTIONS

The user can analyze projects by entering data primarily in the Project Information and Model Inputs worksheets. These worksheets cover information regarding project characteristics, analysis inputs, traffic model data that drives the costs and benefits of infrastructure investments. The results are calculated automatically and displayed on the Results page. The section below explains the input data required to analyze projects.

#### PROJECT DATA (Box 1A)

*This section provides general information about the highway or transit improvements. At the top of the Project Information sheet, the user can insert information about the improvements, such as the project name, Caltrans District, and funding information.*

#### Project Location

- 1 Insert a 1, 2, or 3 for the appropriate region of California. This information is used to estimate the emissions benefits.

#### Project Timing

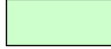
- 2 Enter the current year. All benefits and costs are discounted to the year entered in this cell.
- 3 Enter the year in which construction begins. This should represent the first year of construction expenditures.
- 4 Enter the project opening year. This should represent the first year in which economic benefits will begin accruing in the analysis.


#### MODEL STRUCTURE (Box 1B)

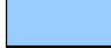
*This section allows the user to customize Cal-B/C Corridor and specify the number of model groups, safety groups, and years to be included in the analysis. Once these have been selected, press "Create Model" button to save the model with the selected numbers of structure elements. If the user wishes to change the model structure (i.e., number of model groups or years), the user will need to start again*

## Cell Color-Coding

- Cal-B/C Corridor requires several user inputs, but allows flexibility in the use of model groups depending on the detail of available data
- **Green** cells indicate required data
  - Must input these values regardless of the type of project
  - Some cells will turn from green to gray if they are not required, based on the VMT and VHT data input by mode
- **Red** cells provide default values that you can change if needed
  - Examples of this in Cal-B/C Corridor include base and forecast years under your model inputs
- **Blue** cells contain values calculated by the model for No Build and Build Scenarios
  - Can be overridden if better data is available

 - User must enter data for Cal-B/C to work correctly.

 - Cal-B/C provides default values that can be overridden by the user if better data is available.

 - Cal-B/C calculates cell value, but user can override result if better data is available.

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## **Project Information Worksheet**

# Project Information 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.

**District:**

**PROJECT:**

**EA:**

**PPNO:**

**1A PROJECT DATA**

*Type of Project*

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

*Project Timing*

Current Year

Year Construction Begins

Year Project Opens

**1B MODEL STRUCTURE**

Values In This Model

Number of Model Groups	<input type="text" value="10"/>	1-500	<input type="text" value="1"/>
Number of Safety Groups	<input type="text" value="10"/>	1-500	<input type="text" value="1"/>
Years	<input type="text" value="20"/>	2-50	<input type="text" value="50"/>

Press button below to create model after selecting the number of segments and years to include.

Create Model

**1C PROJECT COSTS (enter costs in thousands of dollars)**

Year	DIRECT PROJECT COSTS					Transit Agency Cost Savings	TOTAL COSTS (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.		Constant Dollars	Present Value
<b>Construction Period</b>								
2019				Enter Construction Cost			\$0	\$0
2020							0	0
2021							0	0
2022							0	0
2023							0	0
2024							0	0
2025							0	0
2026							0	0
<b>Project Open</b>								
2020							\$0	\$0
2021							0	0
2022							0	0
2023							0	0
2024							0	0
2025							0	0
2026							0	0
2027							0	0
2028							0	0
2029							0	0
2030							0	0
2031							0	0
2032							0	0
2033							0	0
2034							0	0
2035							0	0

- Optional, input unique project identifiers include Caltrans District, Project Name (w/ route number and postmile project limits), Expenditure Authorization (EA) number, Planning and Programming Number (PPNO)

# Project Information Worksheet

The screenshot displays a spreadsheet interface with three main sections highlighted by callouts:

- Section 1A: Project Data**: Contains fields for District, Project, EA, and PPNO. It includes sub-sections for Project Data (Type of Project, Project Location, Project Timing) and Model Structure (Number of Model Groups, Number of Safety Groups, Years).
- Section 1B: Model Structure**: A sub-section of 1A containing a 'Create Model' button and a note: 'Press button below to create model after selecting the number of segments and years to include.'
- Section 1C: Project Costs**: A large table for entering costs in thousands of dollars. The table has columns for Year, Project Support, R/W, Construction, Maint./Op., Rehab., Mitigation, Transit Agency Cost Savings, and TOTAL COSTS (Constant Dollars and Present Value). The table is divided into 'Construction Period' (2019-2026) and 'Project Open' (2021-2069).

At the bottom of the spreadsheet, a navigation bar shows tabs: Title, Instructions, 1) Project Information (selected), 2) Model Inputs, 3) Results, Travel Time, Consumer Surplus, Vehicle Operating Costs, Accident Costs, Emis ...

# 1A) Project Data

## Project Location

- Used to select accident parameters by region
- Used to select emission rates by region

## Current Year

- Monetized benefits and costs are discounted to this year (i.e., this is the “present year”)

## Year Construction Begins

- The year that construction is expected to begin, or the year that project dollars will first be spent

## Year Project Opens

- The first full year that the project is open to the public
- Example: if construction begins in February of 2023 and will last 30 months, 2026 should be entered as the Year Project Opens

1A	<b>PROJECT DATA</b>
<b>Type of Project</b>	
	[Grey bar]
<b>Project Location</b> (enter 1 for So. Cal., 2 for No. Cal., or 3 for rural)	1
<b>Project Timing</b>	
Current Year	2019
Year Construction Begins	2019
Year Project Opens	2020

## 1B) Model Structure

### Number of Model Groups

- Used to expand the tool to hold up to 500 Model Groups to hold traffic data
- Model Groups can hold speed bins, roadway segments, modes, and any other segmentation of the modeled data

### Number of Safety Groups

- Used to expand the tool to hold up to 500 Safety Groups
- Number of Safety Groups defaults to the number of Model Groups entered
- If crash data is segmented differently than the traffic data, the user can overwrite the Safety Groups default to match the data available

1B

### MODEL STRUCTURE

Number of Model Groups	10	1-500	1
Number of Safety Groups	10	1-500	1
Years	20	2-50	50

Values In This Model

Press button below to create model after selecting the number of segments and years to include.

Create Model



## 1B) Model Structure

### Years (of analysis)

- The period of analysis or project operating period

### Create Model macro

- Creates a new copy of the Corridor workbook
- Expands the contents of the analysis sheets to correspond to the number of Model and Safety Groups and the period of analysis

\*Note that once the model is created, the number of model or safety groups cannot be changed

1B

### MODEL STRUCTURE

Number of Model Groups	10	1-500	1
Number of Safety Groups	10	1-500	1
Years	20	2-50	50

Values In This Model

*Press button below to create model after selecting the number of segments and years to include.*

Create Model

# 1C) Project Costs

- All project costs entered into seven costing columns
- Incremental project costs should be entered
  - 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 (currently 2016 in Cal-B/C models)
  - Modules 5 and 6a will go into more details about year for current dollars
- 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.

1C) PROJECT COSTS (enter costs in thousands of dollars)									
Col. no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
Year	INITIAL COSTS			SUBSEQUENT COSTS		Transit Agency Cost Savings	TOTAL COSTS (in dollars)		
	Project Support	R / W	Construction	Maint./ Op.	Rehab.		Mitigation	Constant Dollars	Present Value
<b>Construction Period</b>									
2019				Enter Construction Cost				\$0	\$0
2020								0	0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
2026								0	0
<b>Project Open</b>									
2020								\$0	\$0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
2026								0	0
2027								0	0
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2029								0	0
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2031								0	0
2032								0	0
2033								0	0
2034								0	0
2035								0	0
2036								0	0
2037								0	0
2038								0	0
2039								0	0

Project Information

# 1C) Project Costs

- Up to eight (8) years of initial project costs allowed
- Costs must be entered for each year of construction
  - Defined by entry in Section 1A, from “Year Construction Begins” to one year before “Year Project Opens”
  - Example: if Section 1A has 2023 as the start of construction and 2026 as the opening year, then years 2023 through 2025 in Section 1C must have a direct project cost
- Following construction, the project opens, and project operating period begins
  - Length of operating period defined by the “Years” entry in Section 1B

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.

Year	INITIAL COSTS			SUBSEQUENT COSTS		Mitigation	Transit Agency Cost Savings	TOTAL COSTS (in dollars)	
	Project Support	R / W	Construction	Maint./ Op.	Rehab.			Constant Dollars	Present Value
<b>Construction Period</b>									
2019				Enter Construction Cost				\$0	\$0
2020								0	0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
2026								0	0
<b>Project Open</b>									
2020								\$0	\$0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
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2034								0	0
2035								0	0
2036								0	0
2037								0	0
2038								0	0
2039								0	0

Project Information

# 1C) Project Costs – Direct Project Costs

## Initial Costs

- Project support - engineering design and management
- Right-of-way acquisition costs
- Construction costs
- Project should incur no initial project costs in or after the project opening year

## Subsequent Costs

- Any costs incurred after the project is constructed and open
  - Operating and Maintenance (O&M) costs
  - Rehabilitation costs - pavement overlay, vehicle, track, or station refurbishment
- Module 8b discusses project cost sources, including O&M costs

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.

Year	DIRECT PROJECT COSTS					Mitigation	Transit Agency Cost Savings	TOTAL COSTS (in dollars)	
	INITIAL COSTS			SUBSEQUENT COSTS				Constant Dollars	Present Value
Col. no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)		
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
<b>Construction Period</b>									
2019				Enter Construction Cost				\$0	\$0
2020								0	0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
2026								0	0
<b>Project Open</b>									
2020								\$0	\$0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
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2037								0	0
2038								0	0
2039								0	0

# 1C) Project Costs – Mitigation, Transit Agency, and Total Costs

## Mitigation

- Costs to mitigate community and environmental impacts

## Transit Agency Cost Savings

- Savings to transit agency due to efficiency improvements
  - Usually not used in Cal-B/C Corridor

## Total Costs

- Calculated automatically
- Include project cost in constant dollars and net present value for each year
- Values are in total dollars and not in thousands of dollars like other columns

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.

Year	DIRECT PROJECT COSTS					Mitigation	Transit Agency Cost Savings	TOTAL COSTS (in dollars)	
	INITIAL COSTS		SUBSEQUENT COSTS					Constant Dollars	Present Value
	Project Support	R / W	Construction	Maint./ Op.	Rehab.				
<b>Construction Period</b>									
2019				Enter Construction Cost				\$0	\$0
2020								0	0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
2026								0	0
<b>Project Open</b>									
2020								\$0	\$0
2021								0	0
2022								0	0
2023								0	0
2024								0	0
2025								0	0
2026								0	0
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2037								0	0
2038								0	0
2039								0	0

07

## **Conclusion**

## **In this module, you learned...**

- What Cal-B/C Corridor is and were provided with an overview of the tool
- How to determine if Cal-B/C Corridor is the right tool for your project evaluation
- Cal-B/C color-coding and worksheet layout
- Where and how data is entered into Cal-B/C Corridor

## What's Next?

- Get more information on how another Cal-B/C tool works
  - **Module 4a** (Cal-B/C Sketch)
  - **Module 4c** (Cal-B/C Active Transportation)
  - **Module 4d** (Cal-B/C Park & Ride)
  - **Module 4e** (Cal-B/C Intermodal Freight)
- Find out more about Cal-B/C assumptions and parameters
  - **Module 5: Understanding Cal-B/C Assumptions and Parameters**
- Start an analysis!
  - **Module 7a** (Cal-B/C Sketch)
  - **Module 7b** (Cal-B/C Corridor)
  - **Module 7c** (Cal-B/C Active Transportation)
  - **Module 7d** (Cal-B/C Park & Ride)
  - **Module 7e** (Cal-B/C Intermodal Freight)