# Caltrans Training Module 7b

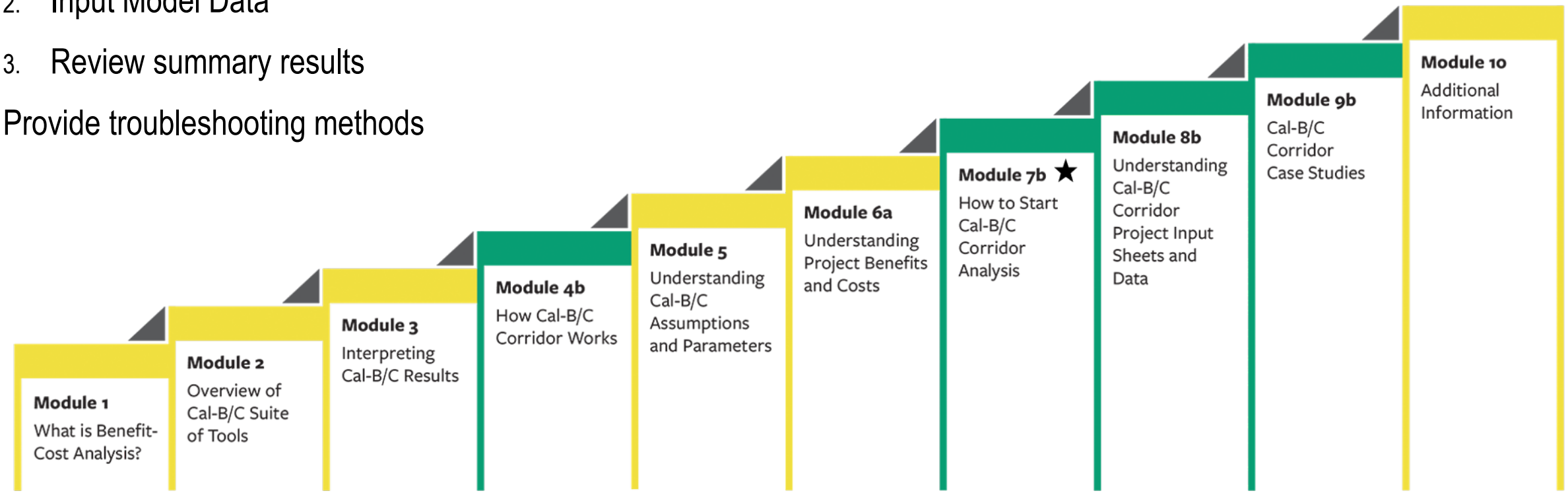
## How to Start a Cal-B/C Corridor Analysis

01

# About This Module

# This module will…

- Walk through a three-step process to start an analysis in Cal-B/C Corridor
  1. Enter project information
  2. Input Model Data
  3. Review summary results
- Provide troubleshooting methods




★ *This module is covered in this presentation*

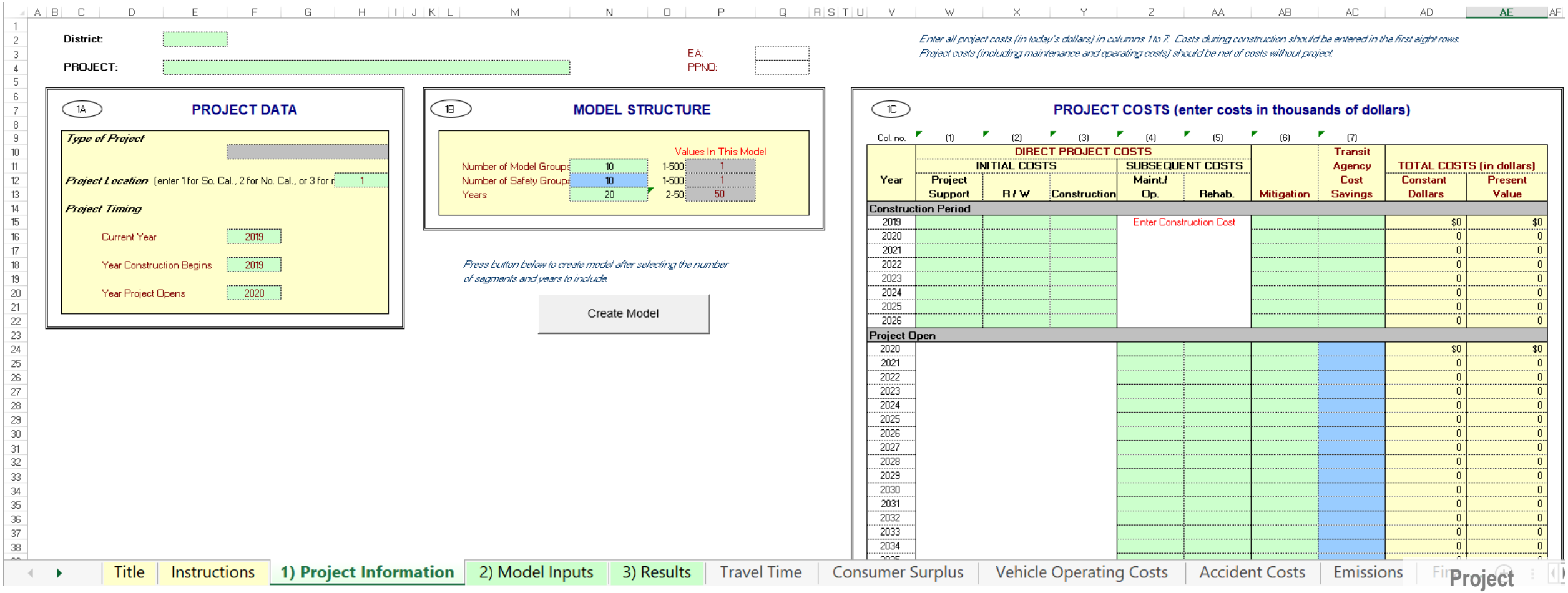
# Previous Modules…

- 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 4b presented an overview of how Cal-B/C Corridor works including a review of all worksheets and inputs
  - **It is strongly recommended to review Module 4b before starting Module 7b**
- Module 5 highlighted the information in the Parameters worksheet and discussed key assumptions used by all Cal-B/C tools
- Module 6a provided detailed information on how Cal-B/C Sketch and Corridor calculate benefits

02

# Step 1, Enter Project Information

# Project Information Worksheet



District:

PROJECT:

EA:
PPNO:

*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.*

**1A PROJECT DATA**

*Type of Project*

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

*Project Timing*

| | |
|---|---|
| Current Year | 2019 |
| Year Construction Begins | 2019 |
| Year Project Opens | 2020 |

**1B MODEL STRUCTURE**

| | | Values In This Model | |
|---|---|---|---|
| Number of Model Groups | 10 | 1-500 | 1 |
| Number of Safety Groups | 10 | 1-500 | 1 |
| Years | 20 | 2-50 | 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)**

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

Title | Instructions | 1) Project Information | 2) Model Inputs | 3) Results | Travel Time | Consumer Surplus | Vehicle Operating Costs | Accident Costs | Emissions

- Three Primary Data Entry Areas:
  - Project Data, Model Structure, Project Costs

Project Information

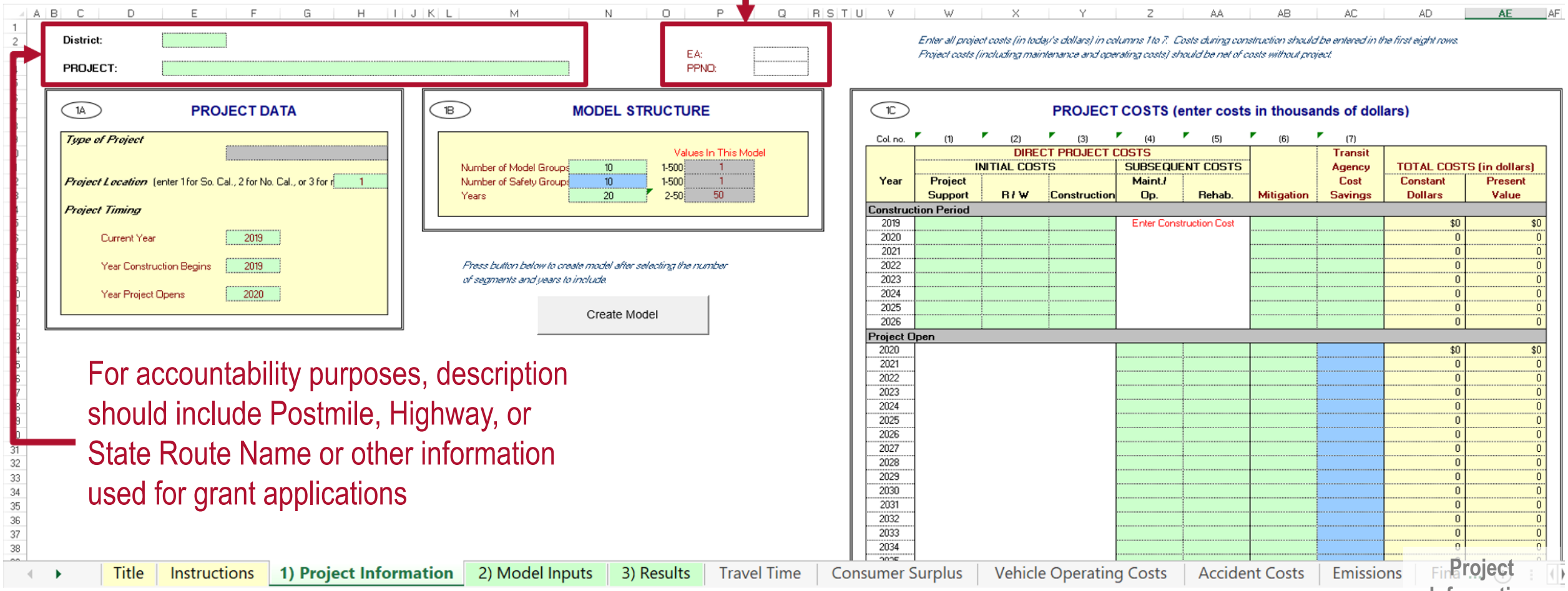
1

# Project Information – Data Requirements

- Project Data – Location, construction start date, project opening year
- Model Structure – Number of model groups, safety groups, and number of years of analysis
- Project Costs – Capital and on-going operating expenses for the project

# Project Information Worksheet

EA or PPNO used for Caltrans internal budgeting and programming, but not for preliminary project planning




For accountability purposes, description should include Postmile, Highway, or State Route Name or other information used for grant applications

- Optional: input unique project identifiers including Caltrans District, Project Name (with route number and postmiles), Expenditure Authorization (EA) number, Planning and Programming Number (PPNO)

# 1A) Project Data

## Type of Project

- For documentation purposes only

## Project Location

- Used to estimate emission benefits, accident costs and accident severity using values appropriate for each region

### *Current Year*

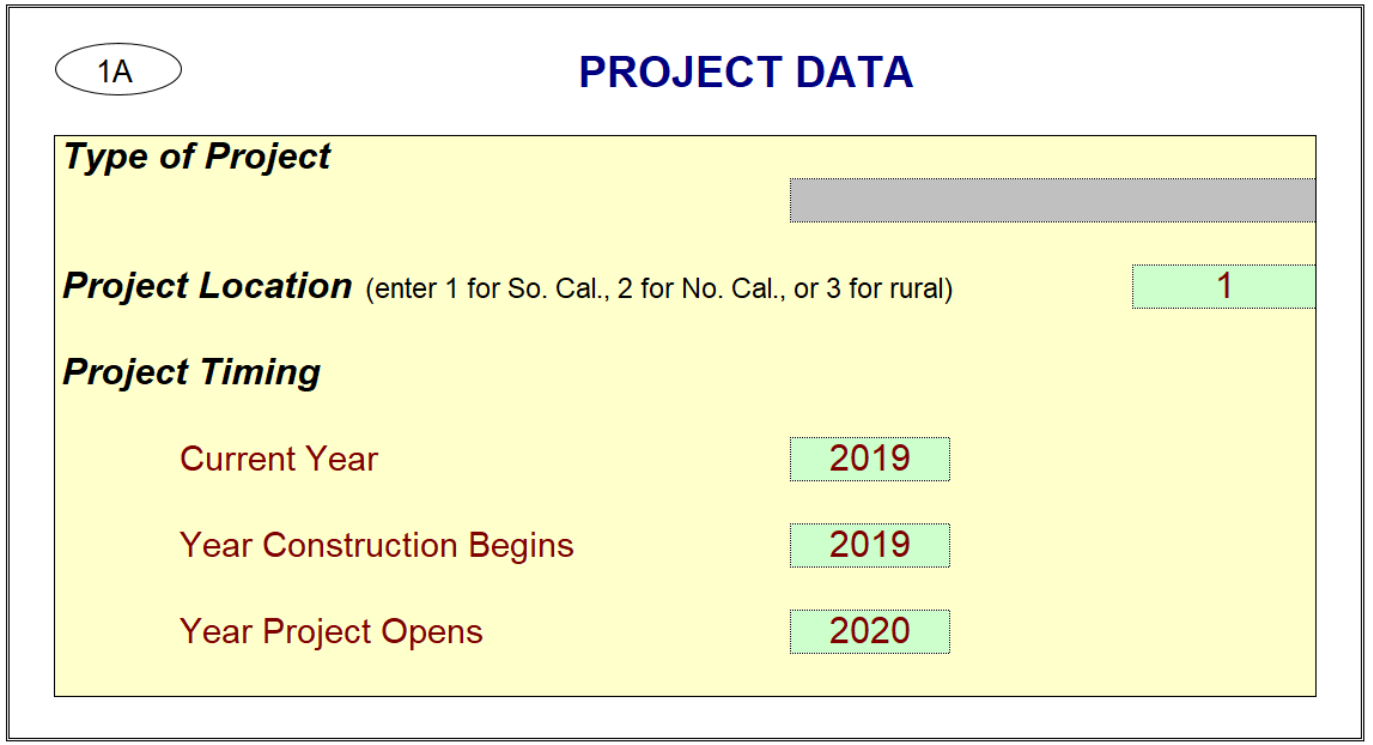
- Monetized benefits and costs are discounted to this year (i.e. this is the year used to calculate present value)

### *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 34 months (November 2025), then 2026 should be entered as the Year Project Opens.



# 1B) Model Structure

## Number of Model Groups

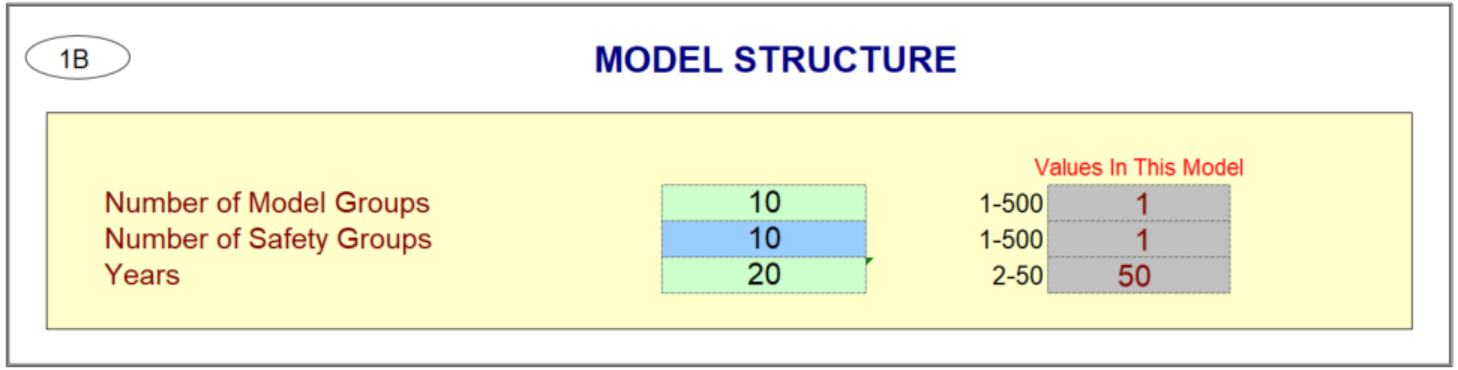
- Used to expand the tool to hold up to 500 Model Groups to hold traffic data
- Model Groups can hold speed bins, roadway segments, modes, or any other segmentation of the modeled data

## Number of Safety Groups

- Used to expand the tool to hold up to 500 Safety Groups
- Number of Safety Groups default is equal 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

## Years (of analysis)

- The period of analysis or project operating period



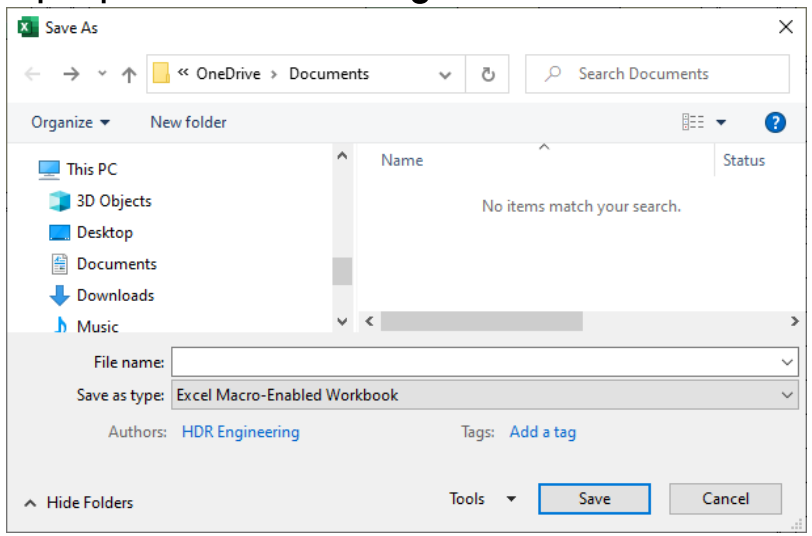

*Press button below to create model after selecting the number of segments and years to include.*

Create Model

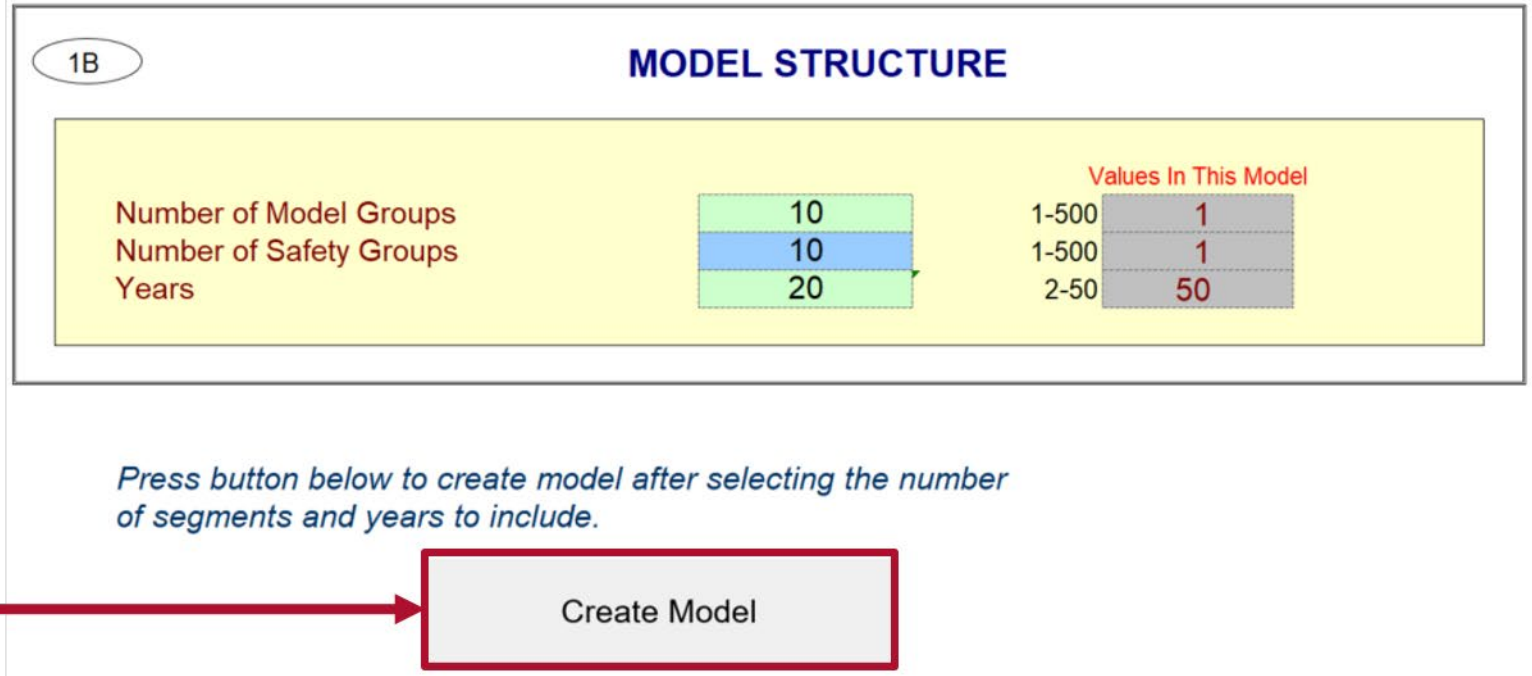
# 1B) Model Structure (cont.)

**Create Model** button

- Creates a new copy of the Corridor workbook
- Pop-up **Save As** dialog window




- Expands/contracts the contents of the analysis sheets to correspond to the number of model and safety groups and the period of analysis




- Once you click on the “Create Model” macro button, Cal-B/C will create the appropriate number of rows in the Model Inputs worksheet.
- Once the model is created, the number of model or safety groups cannot be changed.
- Cannot undo!

# Creation of Model Groups

Enter number of groups

1B

## MODEL STRUCTURE

| | | Values In This Model | |
|---|---|---|---|
| Number of Model Groups | 10 | 1-500 | 1 |
| Number of Safety Groups | 10 | 1-500 | 1 |
| Years | 20 | 2-50 | 50 |

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

Create Model button

Create Model

2A

## DEFINITIONS OF MODEL GROUPS AND YEARS

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

| | |
|---|---|
| Base Year | 2020 |
| Forecast Year | 2040 |

# Creation of Model Groups (cont.)

1B

**MODEL STRUCTURE**

| | | Values In This Model | |
|---|---|---|---|
| Number of Model Groups | 10 | 1-500 | 1 |
| Number of Safety Groups | 10 | 1-500 | 1 |
| Years | 20 | 2-50 | 50 |

Adds model groups in all sections in the 2) Model Input worksheet

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

Create Model

2A

**DEFINITIONS OF MODEL GROUPS AND YI**

| | Select Mode | Name | Description | Avg. Vehicle Occupancy (AVO) | Percent Trucks |
|---|---|---|---|---|---|
| Model Group 1 | Highway | Model Group 1 | | | |
| Model Group 2 | Highway | Model Group 2 | | | |
| Model Group 3 | Highway | Model Group 3 | | | |
| Model Group 4 | Highway | Model Group 4 | | | |
| Model Group 5 | Highway | Model Group 5 | | | |
| Model Group 6 | Highway | Model Group 6 | | | |
| Model Group 7 | Highway | Model Group 7 | | | |
| Model Group 8 | Highway | Model Group 8 | | | |
| Model Group 9 | Highway | Model Group 9 | | | |
| Model Group 10 | Highway | Model Group 10 | | | |

| | |
|---|---|
| Base Year | 2020 |
| Forecast Year | 2040 |

- In Step 2, we will cover naming and describing your model groups

# 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 (current year in Cal-B/C is 2016)
- Costs must be entered in thousands of dollars ($1,000)
- The level of detail for cost estimates depends on where the project is in the development process

1C

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

| Col. no. | (1) | (2) | (3) | (4) | (5) | (6) | (7) | | |
|---|---|---|---|---|---|---|---|---|---|
| | DIRECT PROJECT COSTS | | | | | | | TOTAL COSTS (in dollars) | |
| | INITIAL COSTS | | | SUBSEQUENT COSTS | | | | | |
| Year | Project Support | R / W | Construction | Maint./ Op. | Rehab. | Mitigation | Transit Agency Cost Savings | Constant Dollars | Present Value |
| **Construction Period** | | | | | | | | | |
| 2023 | | | | Enter Construction Cost | | | | $0 | $0 |
| 2024 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2025 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2026 | | | | | | | | 0 | 0 |
| 2027 | | | | | | | | 0 | 0 |
| 2028 | | | | | | | | 0 | 0 |
| 2029 | | | | | | | | 0 | 0 |
| 2030 | | | | | | | | 0 | 0 |
| **Project Open** | | | | | | | | | |
| 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 |
| 2036 | | | | | | | | 0 | 0 |
| 2037 | | | | | | | | 0 | 0 |
| 2038 | | | | | | | | 0 | 0 |
| 2039 | | | | | | | | 0 | 0 |
| 2040 | | | | | | | | 0 | 0 |
| 2041 | | | | | | | | 0 | 0 |
| 2042 | | | | | | | | 0 | 0 |
| 2043 | | | | | | | | 0 | 0 |

# 1C) Project Costs (cont.)

- 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

1C

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

| Col. no. | (1) | (2) | (3) | (4) | (5) | (6) | (7) | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | DIRECT PROJECT COSTS | | | | | Mitigation | Transit Agency Cost Savings | TOTAL COSTS (in dollars) | |
| | INITIAL COSTS | | | SUBSEQUENT COSTS | | | | | |
| | Project Support | R / W | Construction | Maint./ Op. | Rehab. | | | Constant Dollars | Present Value |
| **Construction Period** | | | | | | | | | |
| 2023 | | | | Enter Construction Cost | | | | $0 | $0 |
| 2024 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2025 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2026 | | | | | | | | 0 | 0 |
| 2027 | | | | | | | | 0 | 0 |
| 2028 | | | | | | | | 0 | 0 |
| 2029 | | | | | | | | 0 | 0 |
| 2030 | | | | | | | | 0 | 0 |
| **Project Open** | | | | | | | | | |
| 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 |
| 2036 | | | | | | | | 0 | 0 |
| 2037 | | | | | | | | 0 | 0 |
| 2038 | | | | | | | | 0 | 0 |
| 2039 | | | | | | | | 0 | 0 |
| 2040 | | | | | | | | 0 | 0 |
| 2041 | | | | | | | | 0 | 0 |
| 2042 | | | | | | | | 0 | 0 |
| 2043 | | | | | | | | 0 | 0 |

# 1C) Project Costs – Direct Project Costs

## Initial Costs

- Project support - engineering design and management
- Right-of-Way acquisition costs
- Construction costs (including contingency)
- 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 data sources, including O&M costs

1C

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

| Col. no. | (1) | (2) | (3) | (4) | (5) | (6) | (7) | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | DIRECT PROJECT COSTS | | | | | | Transit Agency Cost Savings | TOTAL COSTS (in dollars) | |
| | INITIAL COSTS | | | SUBSEQUENT COSTS | | Mitigation | | Constant Dollars | Present Value |
| | Project Support | R / W | Construction | Maint./ Op. | Rehab. | | | | |
| Construction Period | | | | | | | | | |
| 2023 | | | | Enter Construction Cost | | | | $0 | $0 |
| 2024 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2025 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2026 | | | | | | | | 0 | 0 |
| 2027 | | | | | | | | 0 | 0 |
| 2028 | | | | | | | | 0 | 0 |
| 2029 | | | | | | | | 0 | 0 |
| 2030 | | | | | | | | 0 | 0 |
| Project Open | | | | | | | | | |
| 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 |
| 2036 | | | | | | | | 0 | 0 |
| 2037 | | | | | | | | 0 | 0 |
| 2038 | | | | | | | | 0 | 0 |
| 2039 | | | | | | | | 0 | 0 |
| 2040 | | | | | | | | 0 | 0 |
| 2041 | | | | | | | | 0 | 0 |
| 2042 | | | | | | | | 0 | 0 |
| 2043 | | | | | | | | 0 | 0 |

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

## Mitigation

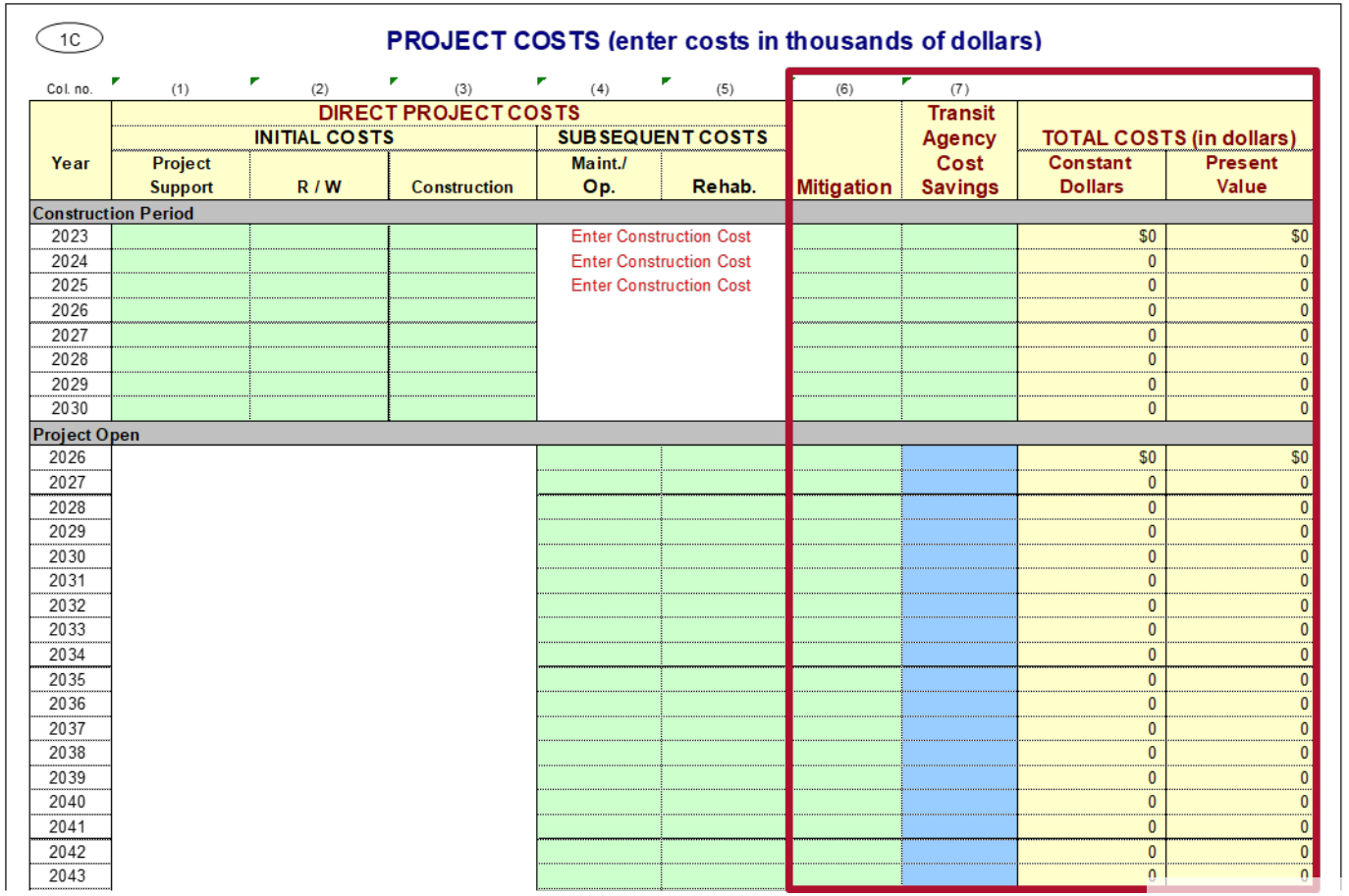
- Costs to mitigate community and environmental impacts

## 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



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

| Col. no. | (1) | (2) | (3) | (4) | (5) | (6) | (7) | | |
|---|---|---|---|---|---|---|---|---|---|
| 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. | | | | |
| Construction Period | | | | | | | | | |
| 2023 | | | | Enter Construction Cost | | | | $0 | $0 |
| 2024 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2025 | | | | Enter Construction Cost | | | | 0 | 0 |
| 2026 | | | | | | | | 0 | 0 |
| 2027 | | | | | | | | 0 | 0 |
| 2028 | | | | | | | | 0 | 0 |
| 2029 | | | | | | | | 0 | 0 |
| 2030 | | | | | | | | 0 | 0 |
| Project Open | | | | | | | | | |
| 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 |
| 2036 | | | | | | | | 0 | 0 |
| 2037 | | | | | | | | 0 | 0 |
| 2038 | | | | | | | | 0 | 0 |
| 2039 | | | | | | | | 0 | 0 |
| 2040 | | | | | | | | 0 | 0 |
| 2041 | | | | | | | | 0 | 0 |
| 2042 | | | | | | | | 0 | 0 |
| 2043 | | | | | | | | 0 | 0 |

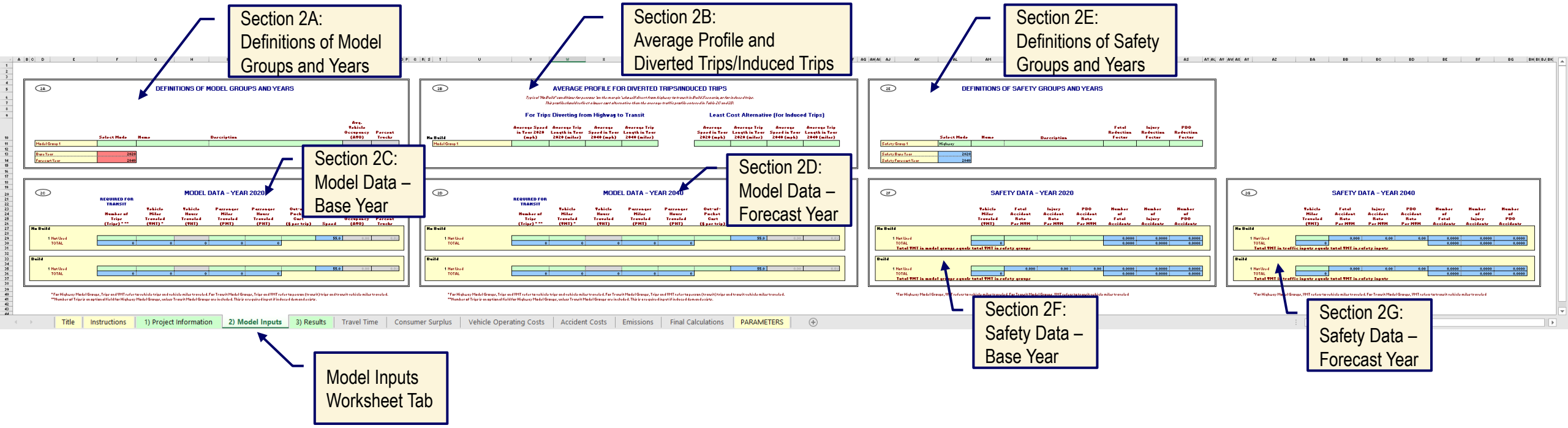
03

# Step 2, Input Model Data

# Model Inputs – Data Requirements

- Travel Demand/Microsimulation Data – Individual model link-level data needs to be aggregated into the "model groups" defined in Step 1
- Safety (Collision) Data – Collision data for each safety group setup in Step 1 needs to be defined, crash reduction factor
- Diverted Trips/Induced Demand – Required only when there is a new transit model group (i.e., bus, passenger train, light rail) defined in section 2A that does not already exist in the No Build scenario
- Miscellaneous Data – Data such as future and/or build AVO and truck percent data if needed

# Model Inputs Worksheet Overview



# 2A) Definitions of Model Groups & Years

2A

**DEFINITIONS OF MODEL GROUPS AND YEARS**

| | Select Mode | Name | Description | Avg. Vehicle Occupancy (AVO) | Percent Trucks |
|---|---|---|---|---|---|
| Model Group 1 | Highway | 57N00:00 | SR-57 NB 00:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 2 | Highway | 57N01:00 | SR-57 NB 01:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 3 | Highway | 57N02:00 | SR-57 NB 02:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 4 | Highway | 57N03:00 | SR-57 NB 03:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 5 | Highway | 57N04:00 | SR-57 NB 04:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 6 | Highway | 57N05:00 | SR-57 NB 05:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 7 | Highway | 57N06:00 | SR-57 NB 06:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 8 | Highway | 57N07:00 | SR-57 NB 07:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 9 | Highway | 57N08:00 | SR-57 NB 08:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 10 | Highway | 57N09:00 | SR-57 NB 09:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |

| | |
|---|---|
| Base Year | 2020 |
| Forecast Year | 2040 |

## Required input: Mode

- Drop down menu for Bus, Passenger Train, Light Rail, Highway
- Used to determine benefit estimation method for each model group

## Name

- Succinct but meaningful to identify the traffic data

## Description

- Description for the traffic data in the model group
- Be as detailed as possible to assist other reviewers now and in the future

# 2A) Definitions of Model Groups & Years (cont.)

2A

**DEFINITIONS OF MODEL GROUPS AND YEARS**

| | Select Mode | Name | Description | Avg. Vehicle Occupancy (AVO) | Percent Trucks |
|---|---|---|---|---|---|
| Model Group 1 | Highway | 57N00:00 | SR-57 NB 00:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 2 | Highway | 57N01:00 | SR-57 NB 01:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 3 | Highway | 57N02:00 | SR-57 NB 02:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 4 | Highway | 57N03:00 | SR-57 NB 03:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 5 | Highway | 57N04:00 | SR-57 NB 04:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 6 | Highway | 57N05:00 | SR-57 NB 05:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 7 | Highway | 57N06:00 | SR-57 NB 06:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 8 | Highway | 57N07:00 | SR-57 NB 07:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 9 | Highway | 57N08:00 | SR-57 NB 08:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 10 | Highway | 57N09:00 | SR-57 NB 09:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |

| | |
|---|---|
| Base Year | 2020 |
| Forecast Year | 2040 |

## Required Inputs: Avg. Vehicle Occupancy (AVO)

- Enter the AVO that applies to the traffic in that model group
- Enter weighted average if the group contains mixed highway traffic (passenger cars and trucks)

## Percent Trucks

- Enter truck percentage that applies to the traffic in the model group

AVO and Percent Trucks are often available from model outputs, but can be obtained from other sources (e.g. Caltrans Traffic Census, Managed Lanes Annual Report)

# 2A) Definitions of Model Groups & Years (cont.)

2A

**DEFINITIONS OF MODEL GROUPS AND YEARS**

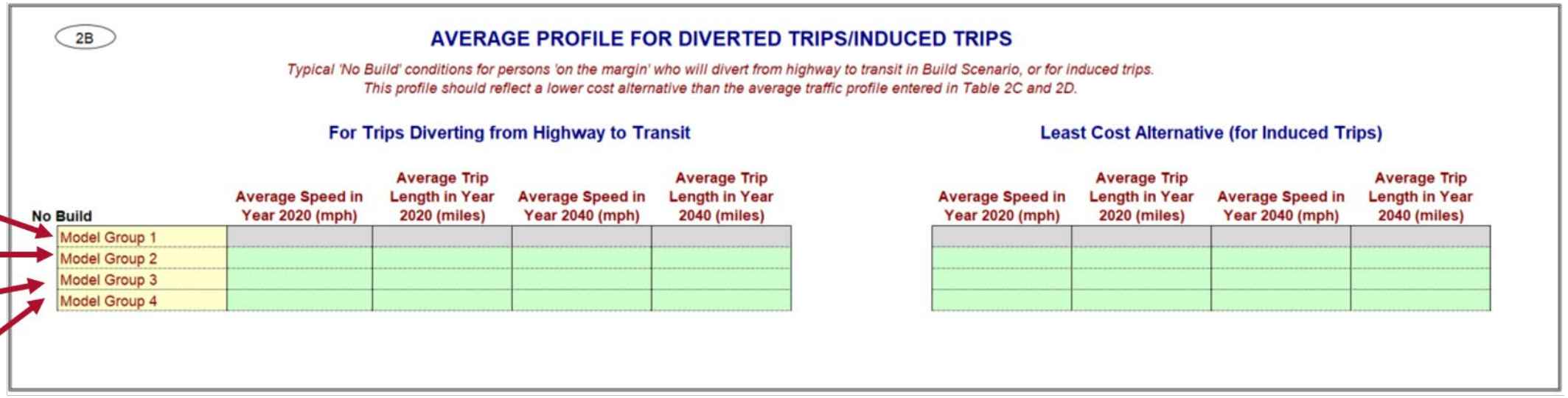
| | Select Mode | Name | Description | Avg. Vehicle Occupancy (AVO) | Percent Trucks |
|---|---|---|---|---|---|
| Model Group 1 | Highway | 57N00:00 | SR-57 NB 00:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 2 | Highway | 57N01:00 | SR-57 NB 01:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 3 | Highway | 57N02:00 | SR-57 NB 02:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 4 | Highway | 57N03:00 | SR-57 NB 03:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 5 | Highway | 57N04:00 | SR-57 NB 04:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 6 | Highway | 57N05:00 | SR-57 NB 05:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 7 | Highway | 57N06:00 | SR-57 NB 06:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 8 | Highway | 57N07:00 | SR-57 NB 07:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 9 | Highway | 57N08:00 | SR-57 NB 08:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |
| Model Group 10 | Highway | 57N09:00 | SR-57 NB 09:00 Fall 2018 Weekday Hourly Summary | 1.09 | 6.1% |

| | |
|---|---|
| Base Year | 2020 |
| Forecast Year | 2040 |

## Base and Forecast Year

- Default values are 2020 and 2040
- Overwrite with the base and forecast year associated with the modeled traffic data available
- These years may or may not correspond to the project opening year or operation period

# 2B) Average Profile for Diverted Trips/Induced Trips



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.*

**For Trips Diverting from Highway to Transit**

| No Build | 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 | | | | |
| Model Group 2 | | | | |
| Model Group 3 | | | | |
| Model Group 4 | | | | |

**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) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

Highway group

Bus group

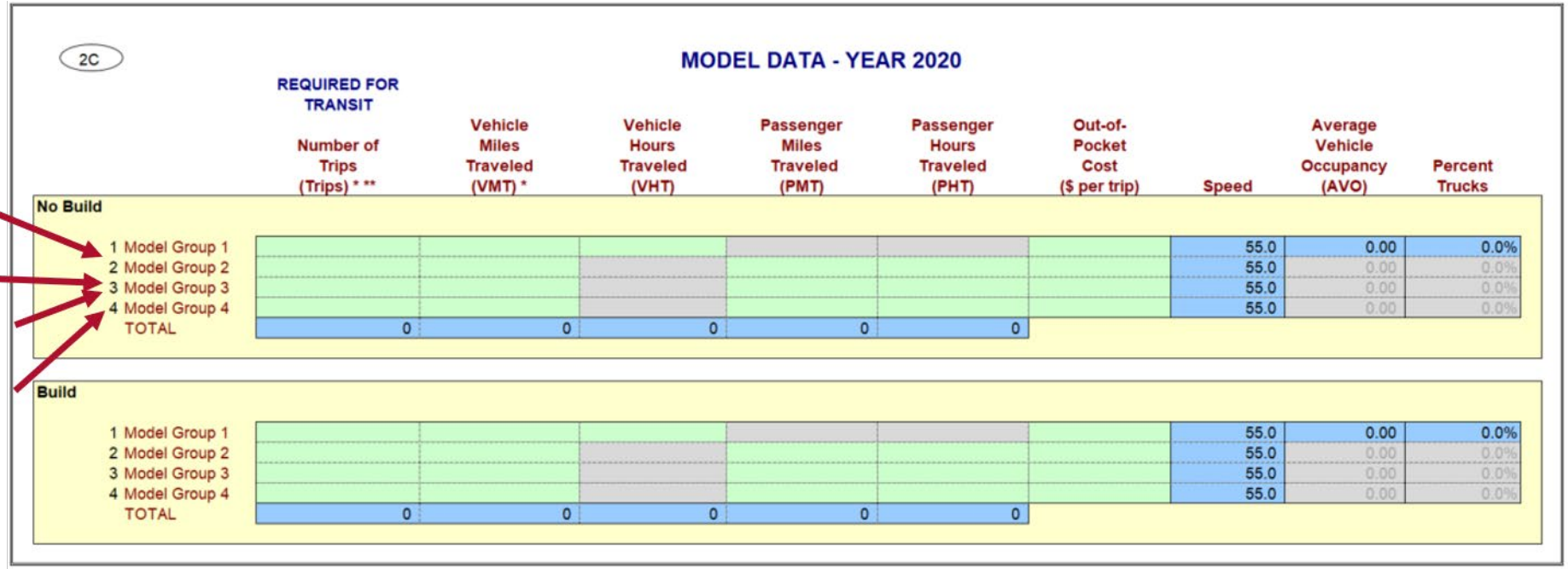
Pass Train group

Light Rail group

Only required for transit model groups defined in Section 2A for new transit projects (e.g., a new light rail line is proposed to be constructed, not an expansion of an existing service)

- Used to calculate travel time benefits for persons "on the margin" who divert from highway to transit or are induced trips in the Build Scenario
- This data typically comes from an analysis of TDM origin-destination matrices

# 2C) Model Data – Base Year, No Build and Build



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 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |
| **Build** | | | | | | | | | |
| 1 Model Group 1 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |

Highway group

Bus group

Pass Train group

Light Rail group

- Data entry in Section 2C (and 2D) depends on mode selected in Section 2a, regardless of the project type
- Cells that do not require any data entry are colored in gray

*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.

# 2C) Model Data – Base Year, No Build and Build (cont.)

Highway group

2C

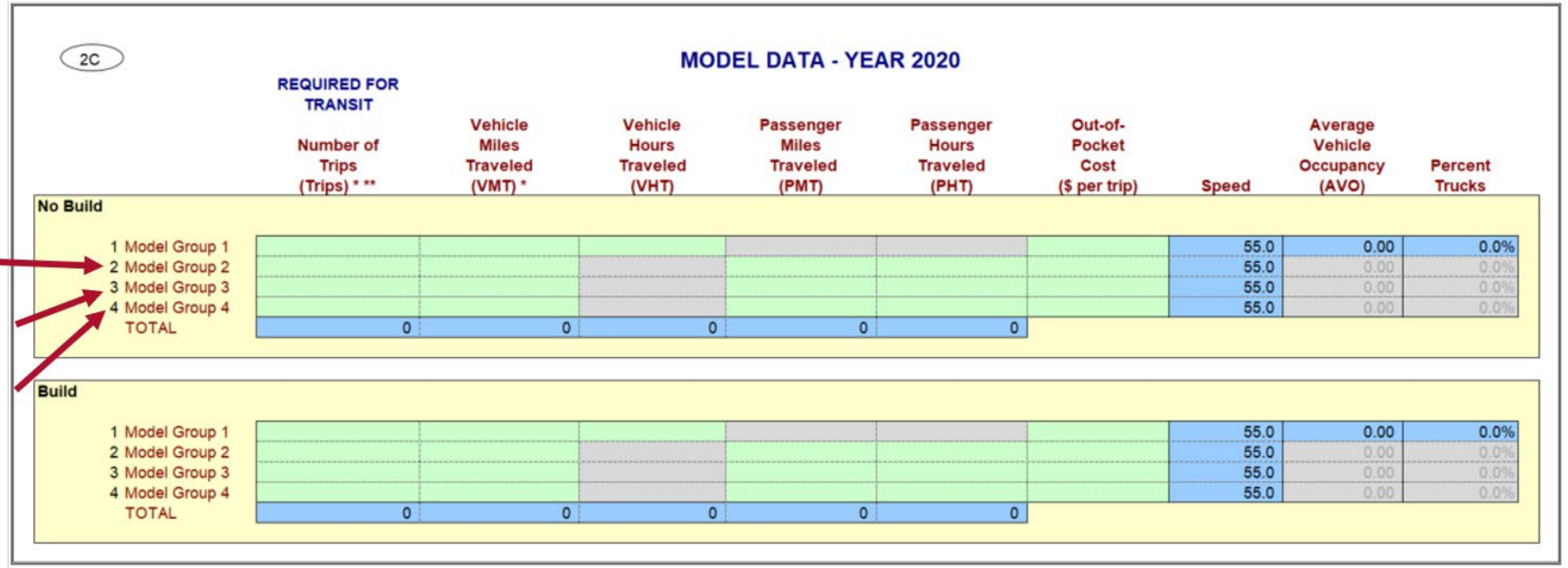
MODEL DATA - YEAR 2020

| | 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 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |
| **Build** | | | | | | | | | |
| 1 Model Group 1 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |

## Required for Highway Groups (see Group 1)

- Number of Trips: **vehicle** trips
  - If no Transit Model Groups are included and no induced demand exists, then *optional*
- Vehicle Miles Traveled (VMT)
- Vehicle Hours Traveled (VHT)

# 2C) Model Data – Base Year, No Build and Build (cont.)




## **Required for Transit Groups** (see Groups 2-4)

- Number of Trips: **person** transit trips
- Vehicle Miles Traveled (VMT): **transit vehicle** miles traveled
- Passenger Miles Traveled (PMT)
- Passenger Hours Traveled (VHT)

# 2C) Model Data – Base Year, No Build and Build (cont.)

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 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |
| **Build** | | | | | | | | | |
| 1 Model Group 1 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |

## Optional for All Model Groups

- Out-of-Pocket Cost ($ per trip)
  - For example: Parking costs, if available

## Calculated for All Model Groups

- Speed (VMT / VHT or PMT / PHT)
- AVO (from Section 2A by model group)

# 2D) Model Data – Forecast Year, No Build and Build

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 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |
| **Build** | | | | | | | | | |
| 1 Model Group 1 | | | | | | | 55.0 | 0.00 | 0.0% |
| 2 Model Group 2 | | | | | | | 55.0 | 0.00 | 0.0% |
| 3 Model Group 3 | | | | | | | 55.0 | 0.00 | 0.0% |
| 4 Model Group 4 | | | | | | | 55.0 | 0.00 | 0.0% |
| TOTAL | 0 | 0 | 0 | 0 | 0 | | | | |

Inputs for Section 2D (traffic in the Forecast Year) are essentially the same as Section 2C (traffic in the Base Year).

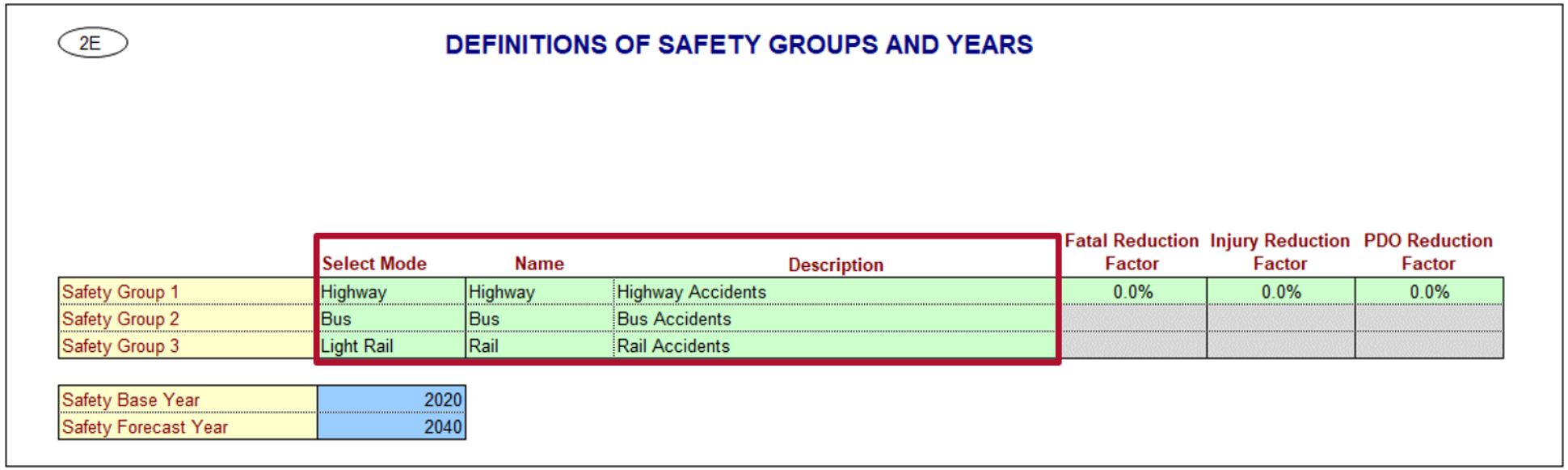
# VMT Adjustment

- May have higher VMT and/or VHT in Build than No Build, but... **no induced demand**
- Why?
  - Travel demand model data does not include entire network (misses traffic shifting from other routes)
  - Increased capacity allows micro-simulation model to handle more traffic
- How to handle?
  - Adjust Build data so the number of trips is constant
  - Often trip data is not available
  - Alternative – assume that average trip distance is same in Build and No Build, so adjustment can be made by VMT
  - Formula:

$$Adjustment = \frac{VMT_{NB}}{VMT_{B}}$$

  - Complications:
    - May need to account for change in trip distance if configuration changes
    - May need to account for average vehicle occupancy (AVO) if project involves HOV or HOT lanes

# 2E) Definitions of Safety Groups and Years



2E

DEFINITIONS OF SAFETY GROUPS AND YEARS

| | Select Mode | Name | Description | Fatal Reduction Factor | Injury Reduction Factor | PDO Reduction Factor |
|---|---|---|---|---|---|---|
| Safety Group 1 | Highway | Highway | Highway Accidents | 0.0% | 0.0% | 0.0% |
| Safety Group 2 | Bus | Bus | Bus Accidents | | | |
| Safety Group 3 | Light Rail | Rail | Rail Accidents | | | |

| | |
|---|---|
| Safety Base Year | 2020 |
| Safety Forecast Year | 2040 |

## Required input: Mode

- Drop down menu for Bus, Passenger Train, Light Rail, Highway
- Used to determine accident cost savings

## Name

- Short label to identify the crash data

## Description

- Description for the crash data in the model group

# 2E) Definitions of Safety Groups and Years (cont.)

2E

**DEFINITIONS OF SAFETY GROUPS AND YEARS**

| | Select Mode | Name | Description | Fatal Reduction Factor | Injury Reduction Factor | PDO Reduction Factor |
|---|---|---|---|---|---|---|
| Safety Group 1 | Highway | Highway | Highway Accidents | 0.0% | 0.0% | 0.0% |
| Safety Group 2 | Bus | Bus | Bus Accidents | | | |
| Safety Group 3 | Light Rail | Rail | Rail Accidents | | | |

| | |
|---|---|
| Safety Base Year | 2020 |
| Safety Forecast Year | 2040 |

## Required input: Reduction Factors (%)

- Fatal Reduction Factor
- Injury Reduction Factor
- PDO Reduction Factor
- Used to calculate the reduction in accidents (by type) in the base and forecast year

# 2E) Definitions of Safety Groups and Years (cont.)

2E

**DEFINITIONS OF SAFETY GROUPS AND YEARS**

| | Select Mode | Name | Description | Fatal Reduction Factor | Injury Reduction Factor | PDO Reduction Factor |
|---|---|---|---|---|---|---|
| Safety Group 1 | Highway | Highway | Highway Accidents | 0.0% | 0.0% | 0.0% |
| Safety Group 2 | Bus | Bus | Bus Accidents | | | |
| Safety Group 3 | Light Rail | Rail | Rail Accidents | | | |

| | |
|---|---|
| Safety Base Year | 2020 |
| Safety Forecast Year | 2040 |

## Base and Forecast Year

- Default values are 2020 and 2040 (based on traffic model group defaults)
- Overwrite with the base and forecast year associated with the data to be entered in Section 2F and 2G
  - These years may or may not correspond to the project opening year or operation period

# 2F) Safety Data – Base Year

2F

**SAFETY DATA - YEAR 2020**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 487,404,540 | 0.006 | 0.28 | 0.55 | 2.7965 | 134.3506 | 266.6337 |
| 2 Bus | 482,500 | | | | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 36,540 | | | | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 487,923,580 | | | | 2.7965 | 134.3506 | 266.6337 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 479,492,760 | 0.006 | 0.28 | 0.55 | 2.7512 | 132.1698 | 262.3056 |
| 2 Bus | 534,910 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 57,790 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 480,085,460 | | | | 2.7512 | 132.1698 | 262.3056 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |

## VMT Data in Base Year

- VMT for each safety model group, No Build and Build scenarios
  - For Highway Model Groups, VMT refers to **vehicle** miles traveled
  - For Transit Model Groups, VMT refers to **transit vehicle** miles traveled

# 2F) Safety Data – Base Year (cont.)

2F

**SAFETY DATA - YEAR 2020**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 487,404,540 | 0.006 | 0.28 | 0.55 | 2.7965 | 134.3506 | 266.6337 |
| 2 Bus | 482,500 | | | | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 36,540 | | | | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 487,923,580 | | | | 2.7965 | 134.3506 | 266.6337 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 479,492,760 | 0.006 | 0.28 | 0.55 | 2.7512 | 132.1698 | 262.3056 |
| 2 Bus | 534,910 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 57,790 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 480,085,460 | | | | 2.7512 | 132.1698 | 262.3056 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |

## Crash Data in Base Year, No Build Scenario

For each safety group

- Enter accident rates only for Highway Mode
- For other modes, override the rates in PARAMETERS worksheet (BH12:BJ14), if project specific data is available
- Fatal Accident Rate per MVM
- Injury Accident Rate per MVM
- PDO Accident Rate per MVM

# 2F) Safety Data – Base Year (cont.)

2F

**SAFETY DATA - YEAR 2020**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 487,404,540 | 0.006 | 0.28 | 0.55 | 2.7965 | 134.3506 | 266.6337 |
| 2 Bus | 482,500 | | | | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 36,540 | | | | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 487,923,580 | | | | 2.7965 | 134.3506 | 266.6337 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 479,492,760 | 0.006 | 0.28 | 0.55 | 2.7512 | 132.1698 | 262.3056 |
| 2 Bus | 534,910 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 57,790 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 480,085,460 | | | | 2.7512 | 132.1698 | 262.3056 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |

The "0.00" here means that the rate is calculated elsewhere, not that the rate is zero

## Crash Data in Base Year, Build Scenario

- Rates per MVM are calculated from rates in the No Build and reduction factors in Section 2E
- User can overwrite calculated values if data is available

# 2F) Safety Data – Base Year (cont.)

2F

**SAFETY DATA - YEAR 2020**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 487,404,540 | 0.006 | 0.28 | 0.55 | 2.7965 | 134.3506 | 266.6337 |
| 2 Bus | 482,500 | | | | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 36,540 | | | | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 487,923,580 | | | | 2.7965 | 134.3506 | 266.6337 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 479,492,760 | 0.006 | 0.28 | 0.55 | 2.7512 | 132.1698 | 262.3056 |
| 2 Bus | 534,910 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 57,790 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 480,085,460 | | | | 2.7512 | 132.1698 | 262.3056 |
| Total VMT in model groups equals total VMT in safety groups | | | | | | | |

If necessary, edit numbers of accidents only for Highway mode.

For other modes, override the rates in PARAMETERS worksheet (BH12:BJ14), if project specific data is available

## Crashes in Base Year, No Build and Build Scenarios

- Number of Fatal Accidents, Injury Accidents, and PDO Accidents
  - Calculated from Rates per MVM and VMT
  - Module 6a provides more detail on intermediate calculations for safety benefits in the Corridor tool
- User can overwrite calculated values if data is available

# 2G) Safety Data – Forecast Year

2G

**SAFETY DATA - YEAR 2040**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 523,560,090 | 0.006 | 0.28 | 0.55 | 3.0040 | 144.3167 | 286.4125 |
| 2 Bus | 575,680 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 44,550 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 524,180,320 | | | | 3.0040 | 144.3167 | 286.4125 |
| Total VMT in traffic inputs equals total VMT in safety inputs | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 503,801,750 | 0.006 | 0.28 | 0.55 | 2.8906 | 138.8705 | 275.6037 |
| 2 Bus | 741,890 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 99,120 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 504,642,760 | | | | 2.8906 | 138.8705 | 275.6037 |
| Total VMT in traffic inputs equals total VMT in safety inputs | | | | | | | |

## VMT Data in Forecast Year

- VMT for each safety model group, No Build and Build scenarios

# 2G) Safety Data – Forecast Year (cont.)

2G

**SAFETY DATA - YEAR 2040**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 523,560,090 | 0.006 | 0.28 | 0.55 | 3.0040 | 144.3167 | 286.4125 |
| 2 Bus | 575,680 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 44,550 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 524,180,320 | | | | 3.0040 | 144.3167 | 286.4125 |
| Total VMT in traffic inputs equals total VMT in safety inputs | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 503,801,750 | 0.006 | 0.28 | 0.55 | 2.8906 | 138.8705 | 275.6037 |
| 2 Bus | 741,890 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 99,120 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 504,642,760 | | | | 2.8906 | 138.8705 | 275.6037 |
| Total VMT in traffic inputs equals total VMT in safety inputs | | | | | | | |

## Crash Data in Forecast Year, No Build and Build Scenarios

- Future accident rates per MVM in the No Build are assumed equal to No Build rates in the Base Year
- Rates per MVM in the Build are calculated from No Build rates and reduction factors in Section 2E

# 2G) Safety Data – Forecast Year (cont.)

2G

**SAFETY DATA - YEAR 2040**

| | Vehicle Miles Traveled (VMT) | Fatal Accident Rate Per MVM | Injury Accident Rate Per MVM | PDO Accident Rate Per MVM | Number of Fatal Accidents | Number of Injury Accidents | Number of PDO Accidents |
|---|---|---|---|---|---|---|---|
| **No Build** | | | | | | | |
| 1 Highway | 523,560,090 | 0.006 | 0.28 | 0.55 | 3.0040 | 144.3167 | 286.4125 |
| 2 Bus | 575,680 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 44,550 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 524,180,320 | | | | 3.0040 | 144.3167 | 286.4125 |
| Total VMT in traffic inputs equals total VMT in safety inputs | | | | | | | |
| **Build** | | | | | | | |
| 1 Highway | 503,801,750 | 0.006 | 0.28 | 0.55 | 2.8906 | 138.8705 | 275.6037 |
| 2 Bus | 741,890 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| 3 Rail | 99,120 | 0.000 | 0.00 | 0.00 | 0.0000 | 0.0000 | 0.0000 |
| TOTAL | 504,642,760 | | | | 2.8906 | 138.8705 | 275.6037 |
| Total VMT in traffic inputs equals total VMT in safety inputs | | | | | | | |

## Crashes in Forecast Year, No Build and Build Scenarios

- Number of crashes are calculated from rates per MVM and VMT
- User can overwrite any calculated values if data is available

04

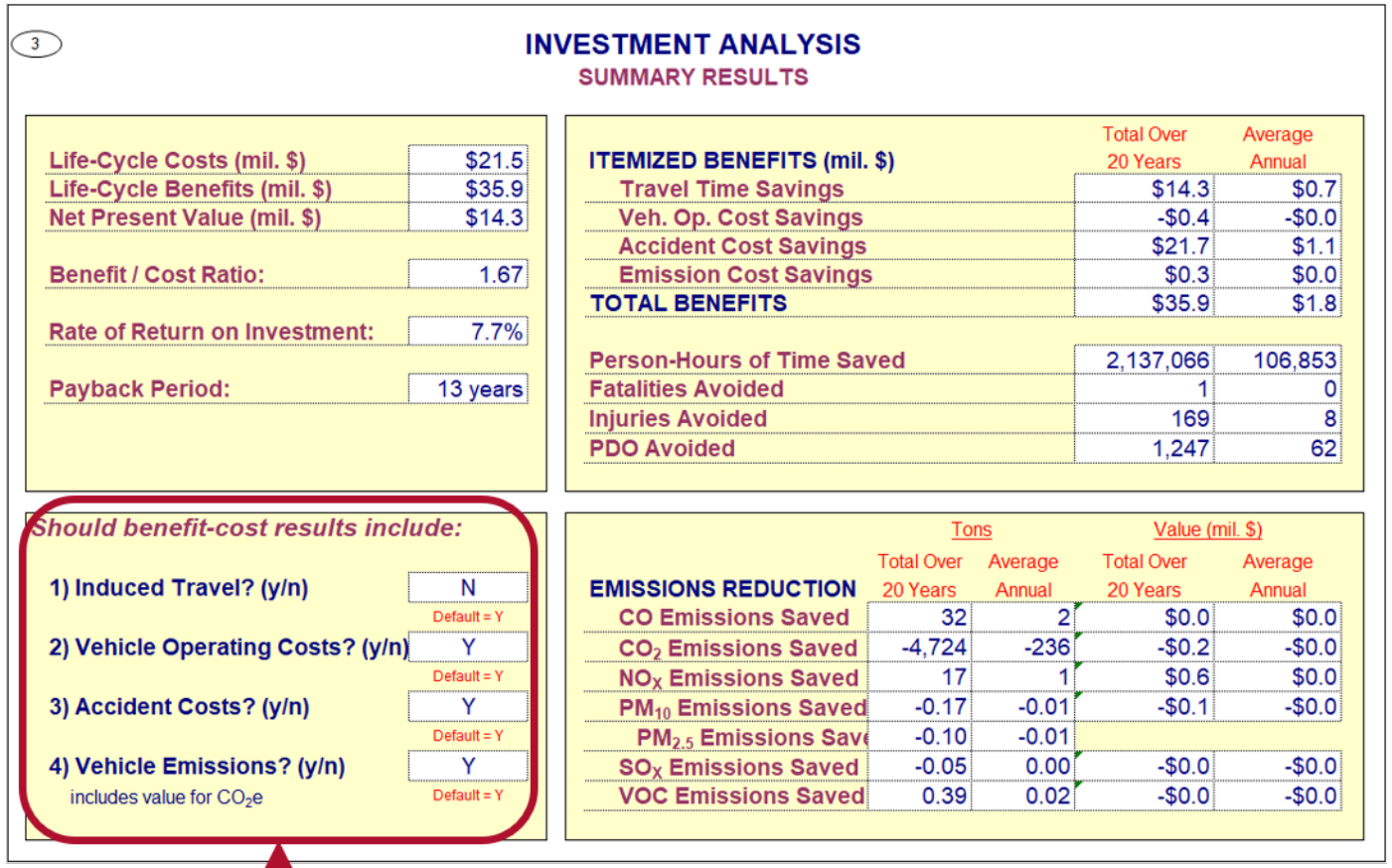
# Step 3, Review Summary Results

# Review Model Results

Review BCA metrics

- Life-Cycle Costs: present values of all incremental 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 costs

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



3

**INVESTMENT ANALYSIS**
**SUMMARY RESULTS**

| | |
|---|---|
| Life-Cycle Costs (mil. $) | $21.5 |
| Life-Cycle Benefits (mil. $) | $35.9 |
| Net Present Value (mil. $) | $14.3 |
| Benefit / Cost Ratio: | 1.67 |
| Rate of Return on Investment: | 7.7% |
| Payback Period: | 13 years |

| ITEMIZED BENEFITS (mil. $) | Total Over 20 Years | Average Annual |
|---|---|---|
| Travel Time Savings | $14.3 | $0.7 |
| Veh. Op. Cost Savings | -$0.4 | -$0.0 |
| Accident Cost Savings | $21.7 | $1.1 |
| Emission Cost Savings | $0.3 | $0.0 |
| TOTAL BENEFITS | $35.9 | $1.8 |
| Person-Hours of Time Saved | 2,137,066 | 106,853 |
| Fatalities Avoided | 1 | 0 |
| Injuries Avoided | 169 | 8 |
| PDO Avoided | 1,247 | 62 |

*Should benefit-cost results include:*

| | | |
|---|---|---|
| 1) Induced Travel? (y/n) | N | Default = Y |
| 2) Vehicle Operating Costs? (y/n) | Y | Default = Y |
| 3) Accident Costs? (y/n) | Y | Default = Y |
| 4) Vehicle Emissions? (y/n) includes value for $CO_2e$ | Y | Default = Y |

| EMISSIONS REDUCTION | Tons: Total Over 20 Years | Tons: Average Annual | Value (mil. $): Total Over 20 Years | Value (mil. $): Average Annual |
|---|---|---|---|---|
| CO Emissions Saved | 32 | 2 | $0.0 | $0.0 |
| $CO_2$ Emissions Saved | -4,724 | -236 | -$0.2 | -$0.0 |
| $NO_X$ Emissions Saved | 17 | 1 | $0.6 | $0.0 |
| $PM_{10}$ Emissions Saved | -0.17 | -0.01 | -$0.1 | -$0.0 |
| $PM_{2.5}$ Emissions Save | -0.10 | -0.01 | | |
| $SO_X$ Emissions Saved | -0.05 | 0.00 | -$0.0 | -$0.0 |
| VOC Emissions Saved | 0.39 | 0.02 | -$0.0 | -$0.0 |

# Review Model Results (cont.)

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?

- The B/C ratio is 1.67, which is >1. Is this reasonable?

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

- Can have a positive B/C ratio, but dis-benefits in vehicle operating costs and emissions and as shown in example to right

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

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**INVESTMENT ANALYSIS**
**SUMMARY RESULTS**

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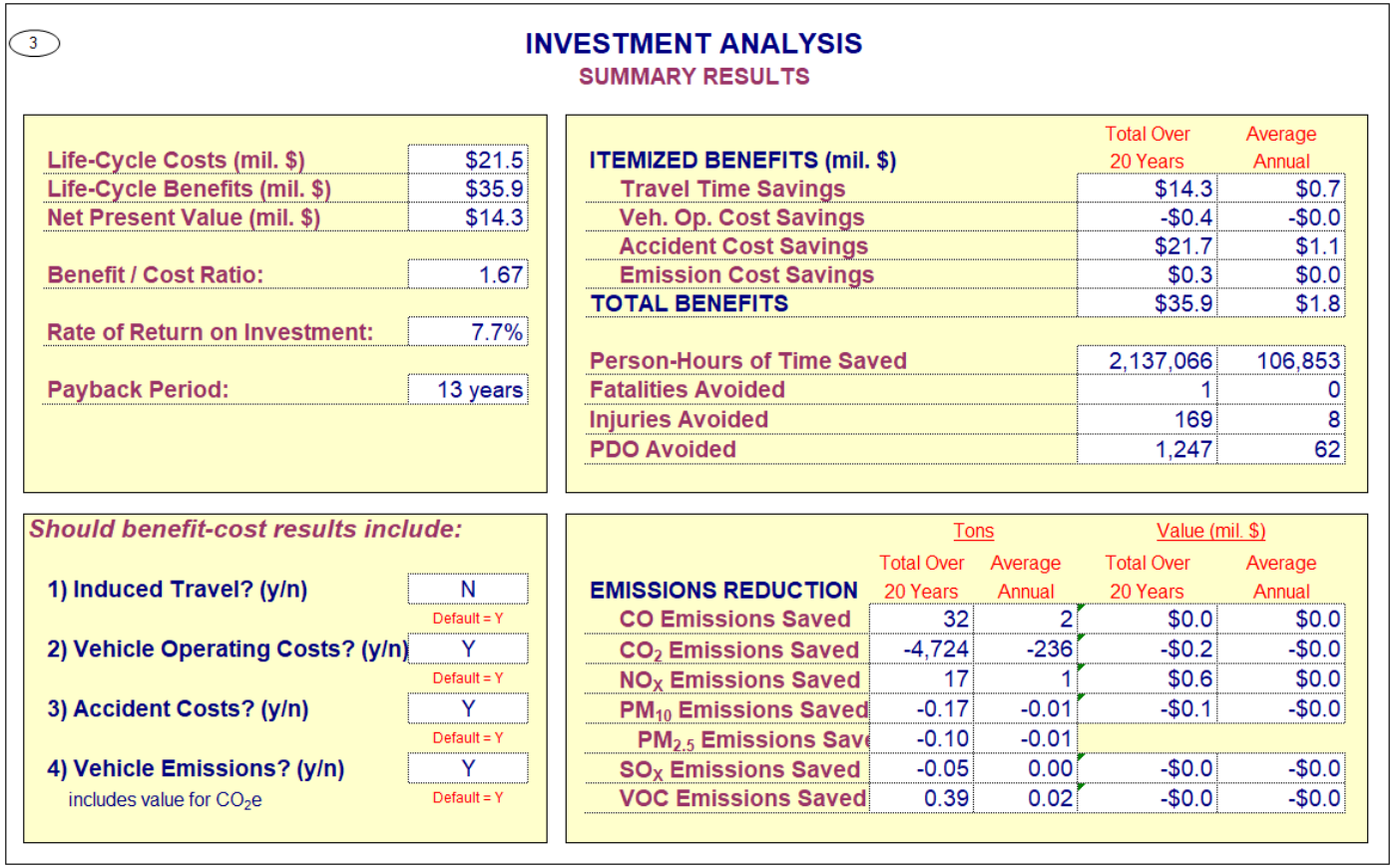
| VOC Emissions Saved | 0.39 | 0.02 | -$0.0 | -$0.0 |

# Miscellaneous

- Benefits may need to be estimated outside Cal-B/C Corridor
  - Intersection Delay Reduction
  - Noise Reduction
  - Emissions, if tons have been estimated in environmental documents



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| | Tons | | Value (mil. $) | |
|---|---|---|---|---|
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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. If projects corridors operate at higher speeds in the No Build case (e.g., around 45mph or higher), then improvements in speeds may generate higher emissions.<br>Rail expansion projects may cause additional PM10 emissions due to steel wheel on steel rail generating “rail dust” or other particulate matter. |
| 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). |
| 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). |

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# Conclusion

# In this module, you have learned…

- A three-step process to start an analysis in the Cal-B/C Corridor tool
- Where to obtain the data needed for:
  - Project Costs
  - Model Data
- How to interpret results
- How to troubleshoot problems
- Identified other modules to review

# What's Next?

- **Module 8b**
  - Where to find data for your project
- **Module 9b**
  - Example of an analysis in the Cal-B/C Corridor
- **Module 10**
  - Provides additional information and data sources for BCA