Module 4d
How Cal-B/C Park-and-Ride (PnR) Works
About This Module
This module will...

- Build on Modules 1, 2, and 3 to provide an understanding of how Cal-B/C PnR works
- Help you decide if Cal-B/C PnR 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 PnR
- 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 project types.

- Module 3 presented the Cal-B/C results page, detailed what each output measure means, and explained how each measure is calculated.
Cal-B/C PnR Can Evaluate…

- Park and ride lot investments
  - New locations
  - Improved highway, transit, and/or bicycle access to park and ride lots
- Up to four user types
  - Existing and new transit riders
  - Existing and new carpoolers
- Up to nine destinations for park and ride lot users
  - Macro-enabled to enter additional destinations beyond the default 3 destinations
Cal-B/C PnR System, User, and Data Requirements

**System Requirements**
- Designed for a Windows environment, tested on Microsoft Excel 2013 and later versions
- Cal-B/C PnR file is about 600 kilobytes (KB) in size

**User Requirements**
- Working knowledge of spreadsheets, particularly Microsoft Excel
- Understanding of benefit-cost analysis
- Ability to interpret results in a transportation planning context

**Data Requirements**
- Percent of lot users to destinations
- Requires some understanding of origin-destination (OD) relationships at a high level
Cal-B/C PnR Overview
Overview of Cal-B/C PnR

- Updated for the Cal-B/C suite to estimate park and ride lot benefits
- Set up as an interconnected, multi-sheet spreadsheet
  - Project Information worksheet is primary location for data entry
  - BCA results presented in the Results worksheet
- Estimates five categories of user benefits
  - Travel Time Savings
  - Vehicle Operating Cost Savings
  - Accident Cost Savings
  - Emission Cost Savings
  - Residual Value
- Contains default values and lookup tables to standardize analysis
- Calculates benefits for existing and new park and ride users traveling to specific destinations by comparing modal options
Worksheet Layout in Cal-B/C PnR

- **Introduction Worksheets**
  - Title
  - Instructions

- **Project Input & Results Worksheets**
  - 1) Project Information
  - 2) Results

- **Analysis Worksheets**
  - Travel Time
  - Vehicle Operating Costs
  - Accident Costs
  - Emissions
  - Final Calculations
  - Parameters
Module 4d: Cal/B/C PnR Overview

Instructions Page in the model

**BENEFIT-COST ANALYSIS OF PARK & RIDE/INTERMODAL STRATEGIES (Cal/B/C PnR)**

**INTRODUCTION**

This spreadsheet tool provides a method for preparing simple economic analyses for park-and-ride lot projects. Given required input data for a project, the model calculates its lifecycle costs, lifecycle benefits, net present value, benefit/cost ratio, internal rate of return, and payback period. Annual benefits are also calculated.

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

<table>
<thead>
<tr>
<th>Worksheets</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructions</td>
<td>General model description and assumptions</td>
</tr>
<tr>
<td>1) Project</td>
<td>Project input data</td>
</tr>
<tr>
<td>Information</td>
<td>Summary of analysis results</td>
</tr>
<tr>
<td>Travel Time</td>
<td>Calculation of travel time impacts</td>
</tr>
<tr>
<td>Vehicle Operating Costs</td>
<td>Calculation of changes in highway vehicle operating costs and</td>
</tr>
<tr>
<td></td>
<td>out-of-pocket costs</td>
</tr>
<tr>
<td>Accidents</td>
<td>Calculation of changes in highway accident costs</td>
</tr>
<tr>
<td>Emissions</td>
<td>Calculation of changes in highway emissions</td>
</tr>
<tr>
<td>Final Calculations</td>
<td>Calculation of net present value, internal rate of return, and</td>
</tr>
<tr>
<td></td>
<td>payback period</td>
</tr>
<tr>
<td>Parameters</td>
<td>Economic assumptions, lookup tables, and other model parameters consistent</td>
</tr>
</tbody>
</table>

The model is designed so that the user generally needs to insert data only in the **green boxes** on the Project Information worksheet. Summary results are shown in 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 and nominal discount rates, 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 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 most projects simply by inserting limited data on the Project Information sheet and getting results on the Results page.

**PROJECT DATA (Box 1A)**

This section provides general information about the park-and-ride lot project. At the top of the sheet, the user can insert information about the project, such as the project name, Caltrans Districts, and funding information.

**Type of Project**

1. Select the appropriate type of park-and-ride lot project from the pull-down menu. The menu appears if user clicks on the green box next to the project type.

**Project Location**

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

**Length of Construction Period**

3. Insert the number of construction years before benefits begin. This must be a whole number (round to the nearest higher integer).

**PARK-AND-RIDE LOT INFORMATION (Box 1B)**

This section provides project-specific information about the park-and-ride lot. If the project is constructing a new lot, no information should be entered in the no build case.

**Lot Design**

4. Insert the number of marked parking spaces provided for the build and no build cases. If the project is expanding an existing lot, the difference between the build and no build should equal the number of new spaces.

**Park-and-Ride Demand**

5. Insert the typical percent of lot capacity expected to be used for current year (no build) and opening year (build).

6. Insert the estimated number of years until the lot reaches capacity for build and no build cases.

7. If the lot will be located next to residential units that could supply bicycle or walk-up users, insert the estimated number of bicycle/pedestrian users for the build and no build.

8. Insert the average vehicle occupancy (average number of people per vehicle) of vehicles driven to the lot in build and no build cases. Model assumes 1 person per vehicle if no information is entered.
Cell Color-Coding

- Cal-B/C PnR requires some detailed user inputs
  - **Green** cells indicate required data
    - Must input values depending on analysis being performed
    - Cal-B/C descriptions tell you what cells need to be used for a given analysis
    - Example: for a highway project, highway traffic data must be entered in the appropriate green cells. Rail transit data in this case does not need to be entered
  - **Red** cells provide default values that can be changed if needed
    - Examples: default values for percent trucks and average vehicle occupancy (AVO)
  - **Blue** cells contain values calculated by the model for No Build and Build Scenarios

- 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.
Project Information Worksheet
Project Information Worksheet

- The primary data entry worksheet for Cal-B/C Park-and-Ride.

1A Project Data
- Required for all projects.

1B Park-and-Ride Lot Information
- Required data for lot design and Park-and-Ride demand

1C Destination Information
- Required data for destination, travel demand, accident rates, transit and highway travel, and carpool/vanpool travel
1A) Project Data

- Optional, but can include unique project identifiers: Caltrans District, Project Name, Expenditure Authorization (EA) number, Planning and Programming Number (PPNO)
1A) Project Data

Type of Project
- Pull-down menu allows user to select one of 3 project types
  - New Park and Ride Lot
  - Park and Ride Leased Lot
  - Park and Ride Lot Expansion

Project Location
- Used to estimate emission benefits using values appropriate for each region

Length of Construction Period
- Years needed to construct project
- Project opening date assumed to occur at the end of the construction period
1B) Park-and-Ride Lot Information

Lot Design
- Number of Parking Spaces
  - Data is entered for No Build and Build scenarios, as applicable for project type (new lot vs. expansion)

Park-and-Ride Demand
- Typical percent of lot capacity expected to be used in the current year (No Build) and the opening year (Build)
- Number of years until lot reaches capacity
- Number of active transportation users
  - If the lot is located near residential areas that could supply bicycle or walk-up users
- Average Vehicle Occupancy (default value of 1 can be overwritten if better data is available)

The PnR model does not estimate demand for a park-and-ride lot based on increased capacity—this is a user input.
1C) Destination Information – Destination Description

- This section holds information about the final destinations of park-and-ride users
  - The model handles only three destinations at once

Destination Name
- For informational purposes only
- At least one destination is required

Distance from Park-and-Ride Lot (miles)
- Distance from the lot to the destination

Distance to Next Lot (miles)
- Distance from the new/expanded lot to the next closest lot for the destinations
- Used if the park-and-ride lot is proposed near an existing lot and may attract users from the other lot

Parking Cost at Destination (avg $/day)
- Average daily cost for parking at the destination
1C) Destination Information – Demand for Travel to Destination

**Percent of Lot Users to Destination**
- Percent of park-and-ride users (from all modes) that travel to this destination
- Sum of percentages for the three destinations must total 100%

**Distribution for each destination**
- Percent of lot users that are new transit riders
- Percent of users that are existing transit riders
- Percent of users that are new carpoolers
- Percent of users that are existing carpoolers
- Sum of percentages for a given destination must total 100%

### Destination Information

<table>
<thead>
<tr>
<th>Destination Description</th>
<th>Dest 1</th>
<th>Dest 2</th>
<th>Dest 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from Park-and-Ride Lot (miles)</td>
<td>15.0</td>
<td>42.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Distance to Next Lot (miles)</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>Parking Cost at Destination (avg $/day)</td>
<td>$2.00</td>
<td>$5.00</td>
<td>$2.00</td>
</tr>
</tbody>
</table>

### Demand for Travel to Destination

<table>
<thead>
<tr>
<th>Percent of Lot Users to Destination</th>
<th>Dest 1</th>
<th>Dest 2</th>
<th>Dest 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution (percent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Transit Riders</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Existing Transit Riders</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>New Carpoolers</td>
<td>50%</td>
<td>75%</td>
<td>100%</td>
</tr>
<tr>
<td>Existing Carpoolers</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Highway Travel to Destination

<table>
<thead>
<tr>
<th></th>
<th>Dest 1</th>
<th>Dest 2</th>
<th>Dest 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOV Travel Time (in min)</td>
<td>25.0</td>
<td>55.0</td>
<td>28.0</td>
</tr>
<tr>
<td>Non-HOV Travel Time (in min)</td>
<td>35.0</td>
<td>73.0</td>
<td>32.0</td>
</tr>
<tr>
<td>Accident Rate (per million vehicle-miles)</td>
<td>0.89</td>
<td>0.99</td>
<td>0.77</td>
</tr>
<tr>
<td>Percent Fatal Accidents (Pct Fat)</td>
<td>0.4%</td>
<td>0.4%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Percent Injury Accidents (Pct Inj)</td>
<td>26.5%</td>
<td>28.3%</td>
<td>33.5%</td>
</tr>
</tbody>
</table>

### Transit Travel to Destination

<table>
<thead>
<tr>
<th></th>
<th>Dest 1</th>
<th>Dest 2</th>
<th>Dest 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Express Bus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel Time (in min)</td>
<td>45.0</td>
<td>0.0</td>
<td>80.0</td>
</tr>
<tr>
<td>Average Fare</td>
<td>$6.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
<tr>
<td>Headway (in min)</td>
<td>10.0</td>
<td>0.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Local Bus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel Time (in min)</td>
<td>50.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Average Fare</td>
<td>$4.00</td>
<td>$0.00</td>
<td>$0.00</td>
</tr>
</tbody>
</table>

### Carpool/Vanpool Travel to Destination

<table>
<thead>
<tr>
<th></th>
<th>Dest 1</th>
<th>Dest 2</th>
<th>Dest 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Carpool Size (people/vehicle)</td>
<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Average Carpool Wait Time (in min)</td>
<td>5.0</td>
<td>7.5</td>
<td>7.5</td>
</tr>
</tbody>
</table>
1C) Destination Information – Highway Travel to Destination

**HOV Travel Time (min) for each destination**
- Travel time for HOVs to each destination
  - Should include travel on non-HOV lanes where HOV lanes are not available

**Non-HOV Travel Time (min) for each destination**
- Travel time using non-HOV lanes to each destination

**Accident Rate (per MVM) for each destination**
- Accident rates for highway travel from the park-and-ride lot to each destination
- Percent fatal and injury accidents
1C) Destination Information – Transit Travel to Destination

**Express Bus Travel Time, Fare, & Headway** for each destination
- Average transit travel time (minutes) for express bus riders
- Average (daily) fare paid by express bus riders
  - Assume 21 workdays per month to convert from a monthly pass
- Express bus headway (time between buses, minutes)
  - The model estimates that riders wait on average one half of the headway time, and no more than 10 minutes

**Local Bus Travel Time & Fare** for each destination
- Average transit travel time (minutes) for local bus riders
- Average (daily) fare paid by local bus riders
  - Assume 21 workdays per month to convert from a monthly pass
1C) Destination Information – Carpool/Vanpool Travel to Destination

**Average Carpool Size** for each destination
- Average size (people per vehicle) of carpools to each destination

**Average Carpool Wait Time** for each destination
- Average time (minutes) that people wait for carpools
1D) Project Costs – Overview

- All project costs entered in seven cost columns
- Project costs should be entered as incremental rather than total costs
  - Incremental costs are the difference between the No Build and the Build scenarios
- Project costs must be entered in constant dollars, in the same year as the economic parameters used for benefit calculations
  - Current year in Cal-B/C models is 2016
  - Modules 5 and 6a will go into more details about year for current dollars
- Costs must be entered in thousands of dollars ($1,000)
1D) Project Costs – Overview

- Up to eight (8) years of initial project costs allowed
- Costs must be entered for each year of construction
  - Should be consistent with “Length of Construction Period” entered in Section 1A
- Following construction, project opens and the 20-year project operating period begins
1D) 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
- Module 8d discusses project cost sources, including O&M costs
Module 4d: Project Information Worksheet

1D) 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
  - Example: signal prioritization projects speed up buses, which may reduce operating hours, resulting in lower labor and other costs
  - Costs should be entered as negative numbers

Total Costs

- Calculated automatically
- Includes project cost in constant dollars and present value for each year
- Values are in total dollars and not in thousands of dollars like other columns
1D) Project Costs – Residual Value

Residual Value

- Residual value is counted as a project benefit
- Cal-B/C calculates this value as the sum of the right-of-way costs
- Can be overridden by user if better information is available
- Include any lot improvements that remain after the 20-year lifecycle
Module 4d: Project Information Worksheet

Entering Additional Destinations

- The model contains a macro that allows the user to enter additional destination data

- To enter data for the next set of three destinations:
  - Enter all the information through Section 1D
  - Save an interim version of the model manually
  - Click button “Prepare Model for Next Set of Destinations”
    - Model will prompt to “save as”; enter the file name for the model with the next set of destinations
  - Enter data for 2nd set of destinations in Section 1C

- The model has the capacity for nine destinations
  - The user can enter the additional destination data by running the macro and entering data for two additional sets of destinations
Results Worksheet
2) Model Results

- Life-Cycle Costs
- Life-Cycle Benefits
- Net Present Value
- Benefit/Cost Ratio
- Rate of Return on Investment
- Payback Period
- Itemized Benefits
- Person-Hours of Time Saved
- VMT Reduction
- Emissions Reduction

Model results and how to interpret them were discussed in more detail in Module 3.

### INVESTMENT ANALYSIS
#### SUMMARY RESULTS

<table>
<thead>
<tr>
<th>ITEMIZED BENEFITS (mil. $)</th>
<th>Total Over 20 Years</th>
<th>Average Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel Time Savings</td>
<td>$0.5</td>
<td>$0.0</td>
</tr>
<tr>
<td>Veh. Op. Cost Savings</td>
<td>$4.9</td>
<td>$0.2</td>
</tr>
<tr>
<td>Accident Cost Savings</td>
<td>$1.4</td>
<td>$0.1</td>
</tr>
<tr>
<td>Emission Cost Savings</td>
<td>$0.3</td>
<td>$0.0</td>
</tr>
<tr>
<td>Residual Value</td>
<td>$0.0</td>
<td>$0.0</td>
</tr>
<tr>
<td><strong>TOTAL BENEFITS</strong></td>
<td><strong>$7.1</strong></td>
<td></td>
</tr>
</tbody>
</table>

| Person-Hours of Time Saved | 55,897              | 2,795          |
| VMT Reduction              | 22,408,719          | 1,120,436      |

### Should benefit-cost results include:

1) Induced Travel is not considered
2) Vehicle Operating Costs? (y/n) | Y | Default = Y
3) Accident Costs? (y/n) | Y | Default = Y
4) Vehicle Emissions? (y/n) | Y | includes value for CO$_2$e, Default = Y

### EMISSIONS REDUCTION

<table>
<thead>
<tr>
<th>Tons</th>
<th>Total Over 20 Years</th>
<th>Average Annual</th>
<th>Value (mil. $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO Emissions Saved</td>
<td>21</td>
<td>1</td>
<td>$0.0</td>
</tr>
<tr>
<td>CO$_2$ Emissions Saved</td>
<td>6,274</td>
<td>314</td>
<td>$0.2</td>
</tr>
<tr>
<td>NO$_x$ Emissions Saved</td>
<td>1</td>
<td>0</td>
<td>$0.1</td>
</tr>
<tr>
<td>PM$_{10}$ Emissions Saved</td>
<td>0</td>
<td>0</td>
<td>$0.0</td>
</tr>
<tr>
<td>PM$_{2.5}$ Emissions Saved</td>
<td>0</td>
<td>0</td>
<td>$0.0</td>
</tr>
<tr>
<td>SO$_x$ Emissions Saved</td>
<td>0</td>
<td>0</td>
<td>$0.0</td>
</tr>
<tr>
<td>VOC Emissions Saved</td>
<td>1</td>
<td>0</td>
<td>$0.0</td>
</tr>
</tbody>
</table>
05

Additional Information
Detailed Calculations

- Discussed in more detail in Module 6a
- Produces detailed calculations for each benefit category
- Final Calculations Worksheet tabulates all the benefits and calculates the results
- Calculations provided by year, by destination, and by type of rider (e.g., new and existing, transit and carpool)
- Describes economic values and parameters for all Cal-B/C tools

User's Guide

Parameter Guide
In this module, you learned…

- What Cal-B/C PnR is and were provided an overview of the tool
- How to determine if Cal-B/C PnR 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 PnR
What’s Next?

- Get more information on how another Cal-B/C tool works
  - Module 4a (Cal-B/C Sketch)
  - Module 4b (Cal-B/C Corridor)
  - Module 4c (Cal-B/C Active Transportation)
  - 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)