Cal-B/C Training Module 4e
How Cal-B/C Intermodal Freight (IF) Works
About This Module
This module will...

- Build on Modules 1, 2, and 3 to provide an understanding of how Cal-B/C IF works
- Help you decide if Cal-B/C IF 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 IF
- Summarize how to interpret BCA results

(Module 3 provides detailed discussions on BCA results)
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.
Cal-B/C IF Can Evaluate…

- Modal Diversion and Freight Network Improvements
  - Rail and truck corridor capacity improvements
  - Projects enabling dedicated freight movements in unit trains
  - Loop track construction
  - Wye construction/extension
  - Rail infrastructure upgrades and enhancements
  - Other projects that divert freight movements between truck and rail

- Transload Operations and Terminal Efficiency Improvements
  - New terminal construction
  - Port/terminal capacity improvements
  - New port/terminal technology implementation
Cal-B/C IF System, User, and Data Requirements

- **System Requirements**
  - Designed for a Windows environment, tested on Microsoft Excel 2013 and later versions
  - Cal-B/C IF 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**
  - Freight volume inputs
  - Transload operations inputs
  - Terminal efficiency inputs
  - Accident rate inputs
## Terminology

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Bulk</td>
<td>Bulk cargo is loose cargo such as grain, coal, and iron ore. Bulk freight is not unitized or packaged and typically transported in cargo holds via bulk carriers. Bulk volumes are measured in short tons in Cal-B/C IF.</td>
</tr>
<tr>
<td>Break bulk</td>
<td>Break bulk cargo is cargo that is unitized and loaded individually. Break bulk cargo is generally packaged (e.g., bags, boxes, barrels, etc.) and not containerized. Break bulk volumes are measured in short tons in Cal-B/C IF.</td>
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<tr>
<td>Short tons</td>
<td>Short tons/US ton is measurement of weight equal to 2,000 pounds. Used as the unit of measure for bulk/break bulk volumes in Cal-B/C IF.</td>
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<tr>
<td>TEU</td>
<td>Twenty-foot equivalent unit (TEU) refers to container freight equivalent to a 20-footlong intermodal container. For instance, a 40-foot container would be equivalent to 2 TEU's.</td>
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<tr>
<td>Intermodal</td>
<td>Freight transportation that requires multiple modes of transportation without any handling of the freight itself when changing modes.</td>
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<tr>
<td>Intermodal Train</td>
<td>A freight train that carries goods or commodities loaded into domestic or international shipping containers or highway semi-trailers on their own wheels.</td>
</tr>
<tr>
<td>Transload</td>
<td>The process of transferring a shipment from one mode of transportation to another.</td>
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<tr>
<td>Drayage</td>
<td>The transportation of goods over a short distance and usually part of a longer overall move – for instance from a port to a nearby rail yard.</td>
</tr>
<tr>
<td>Empty-haul trip</td>
<td>The movement of empty freight trucks and railcars.</td>
</tr>
<tr>
<td>Modal Diversion</td>
<td>The process of diverting freight volumes from one transportation mode to another. For instance, diverting freight shipments from trucks to rail.</td>
</tr>
</tbody>
</table>
Cal-B/C IF Overview
Overview of Cal-B/C IF

- Updated for the Cal-B/C suite to estimate intermodal freight benefits
- Set up as an interconnected, multi-sheet spreadsheet
  - Project Information and Model Inputs worksheet is primary location for data entry
  - BCA results presented in the Results worksheet
- Estimates three categories of user benefits
  - Shipper Cost Savings
  - Accident Cost Savings
  - Emission Cost Savings
- Contains default values and lookup tables to standardize analysis
- Calculates benefits by project type (i.e., modal diversion, freight transportation network improvements, transload operations and terminal efficiency improvements)
Worksheet Layout in Cal-B/C IF

Introduction Worksheets
- Title
- Instructions

Project Input & Results Worksheets
- 1) Project Information
- 2) Model Inputs
- 3) Results

Other Worksheets
- Parameters
Module 4e: Cal-B/C IF Overview

Instructions Page in the model

CALIFORNIA LIFE-CYCLE BENEFIT/COST INTERMODAL FREIGHT ANALYSIS MODEL (CAL-B/C IF)

INTRODUCTION

This spreadsheet model provides a method for preparing a simple economic analysis of Intermodal Freight projects. Given input data for a project, the model calculates its lifecycle costs, lifecycle benefits, 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:

Worksheets

- Project Information
- Model Inputs
- Results
- Shipper Costs
- Accident Costs
- Emissions
- Final Calculations
- Parameters

The model is designed so that the user generally needs to enter data only in the green boxes on the Project Information worksheet. The model estimates detailed shipment information and accident data for the user to review on the Model Inputs worksheet. Shipyard distances are estimated from inputed freight volumes, capacity by mode and average distance to destination. Adjustments are made for the number of empty-trip miles returning to point of origin. Accidents for freight trucks are estimated from statewide averages, while accidents for rail are derived from national-level data. If available, project-specific inputs for truck accidents can be entered to override model default inputs. Summary results are shown in Results worksheet. The remaining worksheets are provided for the user to see, but the model performs the calculations automatically.

After reading the instructions in this worksheet, the user should proceed to the Project Information worksheet and input data as a specific project in the green boxes. The model provides default values in the blue boxes which can be changed by the user if project-specific information is available. The model calculates some values based on relationships or assumptions, with results shown in the blue boxes. These values can all be adjusted by the user.

INSTRUCTIONS

The user can analyze most projects simply by entering relevant data on the Project Information Sheet and getting results on the Results page. The Model Inputs page allows the user to enter more detailed data to adjust shipyard distances, volumes, and accident rates, and check the various costs estimated for the project.

PROJECT DATA (Box 1A)

This section provides general information about the Intermodal Freight project. At the top of the sheet, the user will enter information about the project, such as project name, and Caltrans district.

Project Location

1. Insert 1, 2, or 3 for the appropriate region of California. This information is used to estimate the emission values per short ton.

Current Year

2. Enter the current year. All benefits and costs are discounted to the year entered in this cell.

Year Project Development Begins

3. Enter the first year in which initial project costs are incurred.

Year Project Opens (Year 1)

4. Enter the first year in which benefits are expected to occur.

FREIGHT CAPACITY (Box 1B)

This section allows the user to enter average capacity and distance traveled by mode and type of freight. The user is required to enter information for the type of freight and modes of transportation relevant to the project.

Average Bulk / Break Bulk Shipment (Short Tons)

5. Average Short Tons per Truck: Enter the average short tons hauled by a single freight truck in the no build case. The build case assumes the same capacity, but this may be adjusted by the user.

6. Average Trip Distance (Miles, 3-Ways): Enter the average distance traveled by freight trucks to reach their destination in the no build case. The build case assumes the same one-way distance, but this may be adjusted by the user.

7. Average Short Tons per Railcar: Enter the average capacity of a railcar used to move bulk/break bulk commodities in the no build case. The build case assumes the same capacity, but this may be adjusted by the user.

8. Average Number of Railcars per Train: Enter the average number of railcars hauled by a freight train in the no build case. The build case assumes the same number of railcars, but this may be adjusted by the user.
Cell Color-Coding

- **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: freight shipping cost data must be entered in the appropriate green cells.

- **Red** cells provide default values that can be changed if needed
  - Examples: default values for annual increase in shipping cost (net of inflation)

- **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.
03

Project Information Worksheet
Project Information Worksheet Overview

- The primary data entry worksheet for Cal-B/C IF
- Other worksheets should be modified if project specific information is available

1A Project Data
- Required for all projects

1B Freight Capacity
- Average capacity and distance traveled by mode and type of freight

1C Freight Volumes by Mode
- Volumes of bulk / break bulk and containers shipped by mode relevant to project
Project Information Worksheet Overview

1D Freight Shipments by Mode
- Calculated values for total number of trucks and trains
- Number of empty-haul returns
- Average truck speeds
  (for emissions benefits)

1E Highway Accident Data
- Project-specific highway accident data

1F Freight Shipping Costs
- Shipping cost information (to calculate benefits for projects that involve modal diversion)
Module 4e: Project Information Worksheet

Project Information Worksheet Overview

1G Transload Operations Data
- Required data for freight projects that include changes in transloading operations or drayage

1H Changes in Terminal Efficiency
- Required data for freight projects that impact terminal efficiencies
- Captured through reduced delay or dwell time

1I Project Costs
- Required to fill in each year of construction period
- Recommended to estimate O&M costs based on existing relevant transload terminal projects
- O&M costs should be the difference between the No Build and Build Scenarios
1A) Project Data

**Project Location**
- Used to determine the appropriate accident costs and health costs of transportation emissions parameters by region

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

**Year Project Development Begins**
- The year that project development 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 2018 and will last 38 months, 2021 should be entered as the Year Project Opens
1B) Freight Capacity

**Average Shipments**

- Contains information on capacity and distance shipped by both truck and rail for bulk/break bulk and containers
- User must enter the input average capacity by mode and the average one-way trip distance in miles
1C) Freight Volumes by Mode

**Current Year**
- Enter current annual volumes of freight shipped for both bulk/break bulk and container shipments by mode

**Forecast Year**
- Provide forecasted volumes of freight shipped for both bulk/break bulk and container shipments by mode

**Base Year**
- Volumes correspond to the volumes in the project opening year
- Values are calculated using the forecasted volumes and the current volumes along with the annual increases in freight volumes
1C) Freight Volumes by Mode

Annual Increases in Freight Volumes

- Automatically calculated by the model using the current and forecasted year volumes
- Presented as a percentage
- User may adjust these values, however changes to the annual increase in freight volumes requires expert knowledge
Module 4e: Project Information Worksheet

1D) Freight Shipments by Mode

**Number of Loaded Shipments per Year**
- Number of trucks and trains per year calculated by Cal-B/C IF
  - Used in determining shipper cost savings
  - Combined with average distance traveled, it provides vehicle-miles to calculate accident costs and emissions

**Number of Empty-Haul Return Trips for Every Full Truck/Carload**
- User may adjust the number of empty-haul return trips per full truck/carload
  - Value is an adjustment factor used to calculate accident costs and emissions

**Average Truck Speed**
- User needs to provide only the average truck speeds for freight trucks in the current year
1E) Highway Accident Data

**Actual Historical Accident Data**

- Enter project specific data relating to accident counts under the “Count” column if available
  - State highway default accident rates from Traffic Accident Surveillance and Analysis System (TASAS) used if project specific data are not available
  - Accident rates are for freight only
- Enter vehicle-miles traveled (VMT)
  - VMT is used to calculate project-specific accident rates
1F) Freight Shipping Costs

Shipper Costs

- Split between bulk/break bulk and containers by mode
  - Bulk/break bulk shipping costs require data on the shipping costs per truckload and per carload
  - Containers require shipping rates per TEU moved by rail and truck
- Shipping costs used by the model also consider the annual increase in shipper costs (net of inflation)
1G) Transload Operations Data

**Transload Operations**
- Input data on the cost per unit if transload operations are relevant to the project
- Adjust proportion of overall volume that is transloaded and the expected annual increase in costs, net of inflation, for both bulk/break bulk and containers

**Freight Drayage**
- Provide data regarding one-way distance drayed, the cost per truck, and the average truck speed for drayage if the project includes freight drayage
1H) Changes in Terminal Efficiency

**Average Delay/Dwell Time per Vehicle and Operator Cost per Hour of Delay**

- Enter data on the average delay/dwell time in minutes and the cost of the delays for both modes.
- User can change the annual increase in delay/dwell time and cost of delays.
  - Enter negative percentage for the annual increase in average delay/dwell time if the project is expected to decrease delay/dwell time.
- Leave this section blank if there are no expected changes to terminal efficiency.
11) Project Costs

- All project costs must be entered into seven cost columns (e.g., project support, right-of-way, construction, etc.)
- Project costs must be entered in constant dollars, in the same year as economic parameters used for benefit calculations
- 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
11) Project Costs

- Up to eight (8) years of initial project costs allowed
  - Costs must be entered for each year of construction
- Following construction, the project opens, and project operating period begins
11) 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
- Module 8e discusses project cost data sources, including O&M costs
1I) Project Costs – Mitigation, Agency, and Total Costs

**Mitigation**
- Costs to mitigate community and environmental impacts

**Other Agency Cost Savings**
- Savings to agency due to efficiency improvements

**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
Model Inputs Worksheet
Model Inputs Worksheet Overview

- Review this worksheet to make sure that your freight volume and transload operations input make sense.
- This worksheet also lists the accident rates calculated for the project in the No Build and Build scenarios. Review to ensure that the rates make sense.
- You should not adjust the blue cells directly if alternative values are to be used:
  - Identify which inputs need adjustments and use the green cells located next to the blue cells for making any changes.
- Specify “Reason for Change” for any values overridden by user:
  - Example: Federal Highway Administration (FHWA) grant reviewers examine these cells closely and users should have citing documents ready if values are overridden.
Model Inputs Worksheet Contents

- For Sections 2A to 2C, values are calculated for both the No Build and Build cases, the first year the project opens and the final year of the project lifecycle

2A Freight Volume Inputs
- Calculated values for laden and empty miles traveled, laden ton-miles, and shipping cost per truck and per railcar

2B Transload Operations Input
- Calculated values for transload cost per short ton and per TEU, truck miles drayed for bulk/break bulk and containers, trucks per day, and dray cost per truck

2C Terminal Efficiency Inputs
- Calculated values by mode for freight operating cost per hour and idle/dwell hours per year

2D Accident Rates Input
- Calculated accident rates for freight trucks and accident reduction factor for each type of accident
**Freight Volume Inputs**

- Allows user to review the detailed trips, volumes, and shipping costs by mode and shipment type, estimated by the model.
## Transload Operations Inputs

- Allows user to review detailed transload costs, distance drayed by shipment type, number of trucks used for drayage, and dray costs

### Model Inputs Worksheet

<table>
<thead>
<tr>
<th>Year</th>
<th>No Build</th>
<th>Base Year (0)</th>
<th>Forecast Year (5)</th>
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<td>Transload Cost per TUS</td>
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<td>Direct Brokered (Short Term)</td>
<td>Direct Brokered (Short Term)</td>
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<td>Truck Miles Drayed</td>
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<td>Container (TEU)</td>
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<td>Drayage Cost per Truck</td>
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### Build

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</table>
Terminal Efficiency Inputs

- Allows user to review detailed annual idle/dwell time estimates and operating cost per hour by mode
Accident Rate Inputs

- Allows user to adjust accident rates used by the model for freight trucks
Results Worksheet
Module 4e: Results Worksheet

Model Results

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

- Model results and how to interpret them were discussed in more detail in Module 3.
Additional Information
Detailed Calculations

- Discussed in more detail in Module 6c
- Produces detailed calculations for each benefit category
- Final Calculations Worksheet tabulates all the benefits and calculates the results
- Calculations provided by year and for modal diversion, drayage, terminal efficiency, and transload operations where applicable

Safety Benefits

Emissions Benefits
Cal-B/C IF User’s Guide
- User-focused model overview with step-by-step instructions and project example
- Describes model framework, project types, and updated parameters

Parameter Guide
- Describes economic values and parameters for all Cal-B/C tools
Conclusion
In this module, you learned…

- What Cal-B/C IF is and were provided an overview of the tool
- How to determine if Cal-B/C IF 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 IF
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 4d (Cal-B/C Park-and-Ride)

- 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)