BENEFIT-COST ANALYSIS OF ACTIVE TRANSPORTATION PROJECTS (Cal-B/C AT)

INTRODUCTION

This workbook is a benefit-cost analysis (BCA) tool to perform simple economic analyses of active transportation projects that improve travel options and conditions for cyclists and pedestrians. Users enter data into the tool, which computes lifecycle costs, annual and total benefits in several key categories, net present value, benefit-cost ratio, internal rate of return, and payback period. Benefits are also specifically estimated for children as part of Safe Route to School (SRTS) initiatives.

In addition to the BCA tool, a data entry form is provided for assessing non-infrastructure initiatives. Attributes of these initiatives are used in a multi-criteria scoring system to provide a common basis of comparison. Results of this scoring system are presented alongside, but not added to, the monetized benefits computed in the BCA tool.

The model contains worksheets with the following information, data, and results:

Worksheets	Contents
Instructions	General model description and assumptions
1a) Project Info	Input data for capital projects to improve or construct bike routes
1b) Non-Inf Program Info	Input data and scoring system for non-infrastructure initiatives
2) Model Inputs	Number of trips, users, and miles traveled by trip purpose based on data entered in Project Information worksheet and adjustable by user
3) Results	Summary results of analysis
Journey Quality	Calculation of journey quality impacts for improved travel
Intersection Delay	Calculation of travel time savings where bike and pedestrian facilities cross improved intersections
Intersection Safety	Calculation of changes in user crash risks at improved intersections on existing facilities
Auto Crash Costs	Calculation of changes in auto crash costs from diversions to active transportation
Health - Absenteeism	Calculation of health benefits for employers due to reduced absenteeism based on increased productivity
Health - Reduced Mortality	Calculation of user health benefits associated with reduced risk of mortality
Emissions	Calculation of changes in highway emissions costs from diversions to active transportation
Final Calculations	Calculation of net present value, internal rate of return, and payback period

Parameters   Economic assumptions, lookup tables, and other model parameters
                                   consistent with Cal-B/C

Tool users enter data primarily on the Project Information or Non-Infrastructure Program Information sheets, depending on project type. These worksheets cover information that drives the impacts of infrastructure and non-infrastructure initiatives, respectively. Infrastructure projects are categorized as one of four bike facility classes (i.e., I - Bike Paths, II - Bike Lanes, III - Bike Route, and IV - Separated Bikeways, and Cycle Tracks). Characteristics of facility users (i.e., number of cycling and walking users, trip purpose, and average distance traveled) are influential in estimating facility benefits.

Separate data are required for estimating the benefits of improvements to existing routes and the construction of new bike routes. The model can include projects with elements of both new and improved facilities. Additional data on the number of school-aged children are also collected to estimate benefits from a *Safe Route to School* initiative, if applicable. Benefits are compared with lifecycle costs to determine economic metrics, such as a benefit-cost ratio and net present value.

Non-infrastructure initiatives include a variety of education and outreach programs. Attributes that reflect the programmatic impact of these initiatives include the numbers of people in the target audience, the characteristics of the promotional effort, the type of impact or messaging, and the frequency of outreach effort. Evaluations of these initiatives are performed with a multi-criteria framework that determines overall program scores consistent with the potential for reaching new users through a variety of mechanisms and frequency. The scoring system determines overall program impact scores. The scoring system allows initiatives to be compared by the estimated average lifecycle cost per new potential user.

Cal-B/C AT is designed so that the user generally needs to insert data only in the green boxes on the Project Information and Non-Infrastructure Program Information sheets. Summary results are shown on the Results worksheet. The remaining worksheets are provided for the user to see, but the model performs calculations automatically.

In the process of economic analysis, some generally accepted economic assumptions are necessary. These assumptions include the real and nominal discount rates, unit user costs (e.g., value of time), consumption rates (e.g., fuel consumption and vehicle emissions), and crash 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 FOR INFRASTRUCTURE PROJECTS

The user can analyze most projects by entering limited data on the Project Information sheet. The Model Inputs sheet allows the user to enter more detailed data or adjust estimated annual trips, number of users, and total miles traveled. The analysis results are calculated automatically and displayed on the Results sheet. The section below explains the input data required to analyze infrastructure projects.

PROJECT AND SITE CHARACTERISTICS (Box 1A)

This section provides general information about the project. At the top of the sheet, the user can insert information, such as the project name, Caltrans District, and funding information.

Type of Project

1. Select whether the project is a facility upgrade or a new facility.

Total Project Length

2. Enter total new construction mileage for existing and new bike and pedestrian facilities. If the project type matches the project lengths entered, the data entry indicators will read "OK."

Project Location

3. Insert a 1, 2, or 3 for the appropriate region of California. This information is used to select average bicycle and pedestrian trip data for determining health risk benefits. Characteristics include average travel distance, trip purpose, and ages of users.

Safe Route to School

4. Indicate if the project involves a Safe Route to School.

Programmatic Initiatives

5. Indicate whether the project includes any non-infrastructure, programmatic initiatives.

Construction

6. Insert the number of construction years before benefits begin. This must be a whole number (round to the next higher integer). The number of years should correspond with the cost data are entered in Boxes 1F and 1G.

EXISTING SEGMENT IMPROVEMENTS AND TRIP VOLUME (Box 1B)

This section provides specific information about the existing bike facility segment to be improved.

Existing Facility Length

7. Enter lengths for each class of existing bike facility (e.g., bike paths (Class I), bike lanes (Class II) bike routes (Class III), and separated bikeways, cycle tracks (Class IV). The sum of the facility lengths for No Build and Build scenarios should equal the total length of existing facility in Box 1A. If the total miles are entered correctly, and match mileage of potentially different facility classes, the data entry indicators will read "OK." Otherwise, the adjacent cell will read "Not OK."

Pedestrian Improvements

8. Indicate if the project design includes one or more of the following: street lighting, curb level, crowding, pavement evenness, information panels, benches, and directional signage.

Trip Data

9   Indicate the current number of 1-way trips and the annual growth rate in trips in the No Build and Build scenarios. These parameters are used to estimate trips in the first year after construction (depending on the expected number of years until construction is completed) and 20 years after construction. Blue cells can be overwritten if better data are available (e.g., an expectation that demand jumps in the first year of operations).

INTERSECTIONS IMPROVEMENTS – TIME SAVINGS AND CRASH REDUCTION (Box 1C)

Improvements at existing intersections between bike and pedestrian facilities and roadways can generate benefits from time savings by avoiding delays and from reduced crashes. This section allows the user to enter the data required to estimate these benefits.

Reduced Delay Due to Intersection Improvements

These data are used to compute the number of intersections crossed by users (based on average trip lengths) and the reduced delay at intersections. Improvements can include signals for bike facility users as well as bridges for bike and pedestrian facilities over roadways. The average number of intersections crossed is computed from the number of intersections improved and average distance per trip.

10   Enter the number of improved intersections.
11   Estimate the time savings in minutes at each improved intersection (based on intersection traffic conditions and existing bike facility crossing characteristics).
12   Indicate if the intersection improvements occur for children as part of an SRTS initiative.

Crash Rates – Current Conditions

These benefits are already covered for new bike and pedestrian facilities because the improved journey quality captures the value of safety. For existing facilities with explicit safety improvements, enter 5-year average data for crashes involving cyclists or pedestrians. Baseline data should indicate the number of fatality, injury, and property damage only crashes.

If available, data on the annual percent growth in crashes should be provided. Annual crash rates are determined based on the years available, if other than 5 years. Improvements at intersections can take several forms (e.g., signals, lane markings, etc.). Each improvement provides a different crash reduction rate. The three most effective measures are used to estimate reductions in crashes and the associated monetized benefits.

13   Provide baseline crash rates for crashes involving cyclists and pedestrians in terms of:
      a.   Number of Years of Data
      b.   Fatal Crashes (Fat) (#)
      c.   Injury Crashes (Inj) (#)
      d.   Property Damage Only (PDO) Crashes (#)
      e.   Annual Growth Rate in Crashes (%).

Safety Countermeasures (improvements to existing facilities only)

14   Indicate which countermeasures are included in the facility improvement.

GENERAL USER CHARACTERISTICS (Box 1D)

This section reports on mode-specific trip characteristics for walking and cycling for a new or existing facility. Reported default values on trip purpose by percentage of total and average distance traveled per trip are provided. Separate trip distances are provided for children and can be used as default values for SRTS initiatives. These values can be overwritten by the user. Other default values (e.g., ages of users, diversion of riders from personal vehicles, and traveling speeds) are included in the Parameters worksheet.

Trip Purpose

15 Indicate the percent trips taken by trip purpose and mode. If the user changes percentages, the sum of new values must be 100%.

Trip Characteristics

16 Provide the average distance traveled per trip in miles for SRTS trips and other trips.

NEW FACILITY IMPROVEMENTS AND TRIP VOLUME (Box 1E)

This section provides specific information about the new segment to be improved in the project. For new segments, riders are assumed to use the road in the No Build condition. The No Build option is assumed to be equal to the length of the new facility. Data need to be filled in for projects that involve construction of new bike and pedestrian facilities or improvements to existing facilities that connect to newly constructed ones.

New Facility Length

17 Enter lengths of each class of new bike facility for: Bike Paths (Class I), Bike Lanes (Class II), Bike Routes (Class III), Separated Bikeways, Cycle Tracks (Class IV). If total miles are entered correctly and match the total mileage of different facility classes, the data entry indicators will read "OK." Otherwise, the adjacent cells will read "Not OK."

Pedestrian Improvements

18 Indicate with a "1" for Yes, if the project design involves one or more of the following improvements: street lighting, curb level, crowding, pavement evenness, information panels, benches, and directional signage. These features are assumed to be located throughout the bike facility so all users will have the opportunity to use them when on the path.

Trip Data

19 Indicate current number of one-way trips and annual growth rate in trips in the No Build and Build contexts. These parameters are used to estimate numbers of trips in first year after construction (depending on expected number of years until construction is completed), and 20 years after construction. Blue cells can be overwritten if better data are available (e.g., if there is an expectation that demand jumps in the first year of operations).

PROJECT COSTS (Box 1F)

This section allows the user to input costs for infrastructure projects. Total project costs should be entered in the years they are expected to occur. Costs should be inserted for construction period and for

a 20-year operating period after construction completion. Construction Year 1 is the first year that costs are incurred. All costs should be in thousands of dollars.

20   Insert the project's initial costs in constant dollars for project development, right-of-way, and construction. The number of construction years should equal the length of the construction period

21   Insert estimated future incremental maintenance/operating and rehabilitation costs in constant dollars. These figures should be entered for all years after the project opens.

22   Insert any other costs not already included.

NON-INFRASTRUCTURE PROGRAM COSTS (Box 1G)

This section allows the user to input costs for non-infrastructure programs. Total program costs should be entered in the years that they are expected to occur. Costs should be inserted for initial capital costs and for a 20-year operating period after the initial years of implementation. Year 1 is the first year that capital costs are incurred. All costs should be in thousands of dollars.

23   Insert program's initial costs in constant dollars for any costs related to program development and set-up.

24   Insert estimated future program costs in constant dollars for all years.

25   Enter any other costs not already included.

DATA CHECKS - PROJECT LENGTH, DAILY TRIPS (Box 1H)

This section contains data checks to make sure that data are entered correctly. The user does not need to enter anything in this table. The data checks evaluate No Build and Build project lengths for each type of relevant project (e.g., new and existing). All of these cells should read "OK." Errors indicate that prior inputs should be modified.

INSTRUCTIONS FOR NON-INFRASTRUCTURE PROGRAMS

Non-infrastructure programs are intended to reach target audiences through a variety of outreach and training mechanisms. The Non-Infrastructure Program Information sheet collects information about the proposed initiative and applies a scoring framework to determine the overall program score per cost.

The impact score is based on the number of people reached who are not currently engaging in active transportation. Four criteria are established to assess the effectiveness of the initiative, each with a different measure of relative value. The criteria have equal weights. The scoring system is designed to provide a maximum potential score of 1.0, with values ranging as percentages from 0% to 100%. The percentage is applied to the number of currently non-active transportation mode users, to develop a total program impact score.

Program costs should be entered into the Project Information sheet (Box 1G). If a proposed program does not include capital investments, the anticipated impact on user demand from the program can be entered in the trip volumes in Box 1B. If the program is combined with an infrastructure project, it is assumed that the demand impact is already captured by the infrastructure project. To avoid overestimating demand, no additional demand from the program alone should be included in the Project Information sheet. Non-infrastructure initiatives are assumed to stimulate demand and safety for 20 years. If this is not the case, adjustments should be made for the appropriate number of years in

each benefit calculation page. In this case, the project type should be set to 1 to reflect the use of only existing facilities.

NON-INFRASTRUCTURE PROGRAM CHARACTERISTICS (Box 1I)

This section allows the user to provide information about the non-infrastructure program.

Scale of Initiative - Participants / Beneficiaries

26 Enter the number of people likely to be reached annually by the initiative.
27 Enter the % of active cyclists reached each year.
28 Enter the % of active pedestrians reached each year.

Scoring System
For each criterion, enter data corresponding to the question:

29 Insert the percent of the target audience in each age group.
30 Enter 1 as yes for all of the promotional efforts that are part of the initiative.
31 Enter 1 as yes for each of the types of impacts and messaging that are part of the initiative.
32 Select the most applicable frequency of outreach.

NEXT STEPS

Once the required values are entered into the Project Information and Non-Infrastructure Program sheets, as applicable, the aggregate results of the analysis are automatically compiled on the Results sheet. This sheet also includes a toggle to select whether benefits for recreational users are included in the analysis. A more detailed breakdown of the results by year and benefit type is available on the Final Calculations sheet.

There is also a Parameters page, identical to the one found in Cal-B/C. Since Cal-B/C requires additional parameters for highway projects, several of the values found on the Cal-B/C AT parameters page are not used. This design is intentional, so the same parameters page can be used in both models. A few cells (e.g., project type) are left blank to avoid Excel error messages.