

## **APPENDIX C**

### **TRANSIT STATION ACCESS PLANNING TOOL INSTRUCTIONS**

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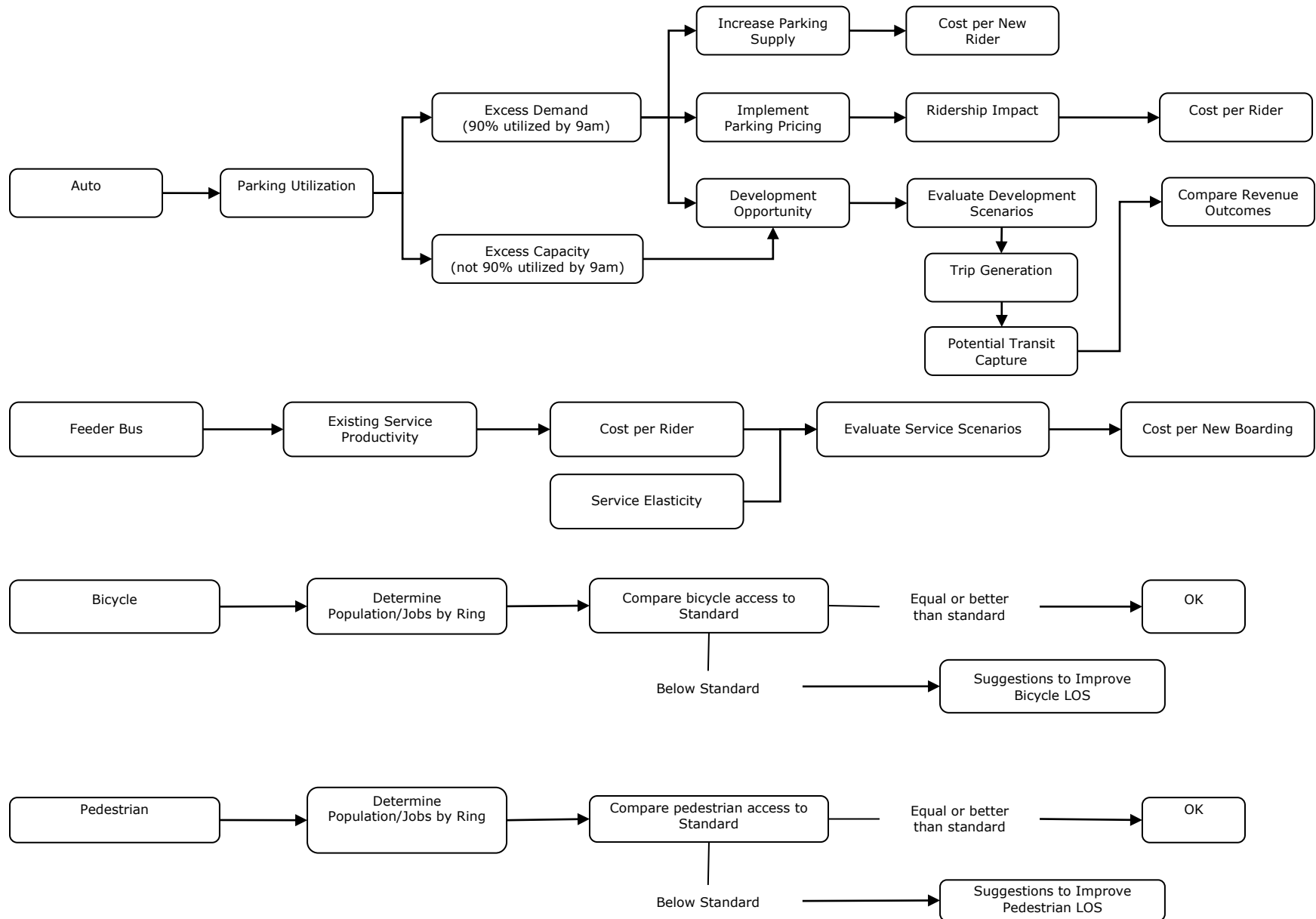
This document provides step-by-step instructions for applying the TCRP B-38 Station Access Planning Tool to assess and evaluate access to high capacity public transit stations. The Station Access Planning Tool is a spreadsheet-based planning tool taking the user through the estimation and evaluation of ridership and access mode splits, the testing of alternatives, and a rough cost-benefit evaluation. It can be accessed on the CD accompanying **TCRP Report XXX: Guidelines for Providing Access to Public Transportation Stations** or downloaded at <http://www.tcrponline.org>. The Tool also illustrates a completed example of a hypothetical transit station to help guide the user through the analysis process.

The user is responsible for collecting and entering data related to the transit agency, the station itself, and data related to the station area (within a ½-mile radius). These instructions identify sources from which users can collect data and input to the Tool. Some data are available from external sources such as the U.S. Census Bureau and the Longitudinal Employment Database. For other data, default values have been developed using data obtained from over 600 high-capacity transit stations throughout the country. Station typologies have been developed to allow the user to select a similar station area based on the surrounding environment and operating characteristics. Figure C-1 illustrates the station access planning model process for each station access mode. The station typologies are described in Chapter 4.

The Station Access Planning Tool is set up to be a step-wise process with each step on a separate tab in the spreadsheet. Although each step is part of the process, there are interim outputs generated throughout the Tool and it does not necessarily provide a clear answer at the end.

- The “Input” tab is where background data about the station and region are entered.
- The “Step 1” tab covers station ridership estimation.
- The “Step 2” tab covers estimating station access mode split.
- The “Step 3” tab covers estimating auto parking demand.
- The “Step 4” tab assesses the impacts of changes in parking.
- The “Step 5” tab assesses the effects of management options: parking pricing, improving feeder bus service, walk access, bicycle access, and transit-oriented development.
- The “Fiscal” tab provides high level operating and cost estimates.
- The “Defaults” tab provides all of the default values that are used in the first six tabs.
- The “Lists” tab documents all of the drop-down menu options found in the first six tabs.
- The “Name Manager” tab indexes the cell references for all of the named cells in the Tool.

The remainder of this document walks the user through the Tool.



**Figure C-1** Station Access Planning Tool Mode Models

The Access Planning Tool has been color-coded to indicate which cells require user input, which are based on calculations, and which represent output values. Please refer to the following key when working through the tool:

### Legend:

User Data Input Required (yellow)
Spreadsheet Calculation (green)
Financial Calculation (purple)
Default Value (red)
Output (blue)

## INPUT BACKGROUND DATA

The Input tab (Figure C-2) is the starting point for any station access analysis. Begin by entering basic data about the station **1**, including the Agency Name, analysis date, and analyst name. You must also choose the Census-designated Metropolitan Statistical Area (see U.S. Census Bureau for details). Next, fill out some details about the station **2**, beginning with the name of the station. Then choose whether the station is existing or if this is a planning effort for a new station. Other data needs include the line haul mode of the transit serving the station, the station type (from the Station Typology developed within the *Guidebook*), the predominant land use, climate, and topography of the area.

**TCRP 8-38 Station Access Planning Tool**  
**Background Data Input**

Provide basic background data about the station, transit agency, station-area demographics, and regional characteristics. Inputs entered on this tab will be used in subsequent steps of the access planning process. For a more detailed explanation of each of the inputs, refer to the Glossary of Inputs included with the Tool Instructions.

Color Key: User Data Input Required

<b>1</b>	<b>Transit Agency:</b> Sample Agency <b>Metro Region:</b> Sample Region		<b>Date:</b> January 5, 2010 <b>Analyst/User:</b> Nick
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**Station Characteristics**

<b>Station Name:</b>	Pearl Street
<b>Existing or Planned:</b>	Existing
<b>Line Haul Mode:</b>	Heavy Rail
<b>Station Type:</b>	Medium-Density Urban Neighborhood
<b>Predominant Land Use:</b>	Mix
<b>Climate:</b>	Hot or humid summer
<b>Topography:</b>	Flat

Enter values for existing station

<b>Daily Parking Spaces:</b>	16
<b>Reserved Parking Spaces:</b>	0
<b>Daily Car Parking Price:</b>	\$0.00
<b>Monthly Parking Price:</b>	\$0.00
<b>Car Parking Utilization (9 am):</b>	0%
<b>Bicycle Parking Spaces:</b>	58
<b>Round Trip Fare:</b>	\$2.00
<b>Connecting Transit Lines:</b>	8
<b>Average Transfer Fee:</b>	\$0.50
<b>Local Bicycle Commute Mode Share<sup>2</sup></b>	0.7%

**Station-Area Demographics (within 1/2-mile radius)<sup>1</sup>**

<b>Population:</b>	8,000
<b>Jobs:</b>	4,500
<b>Workers:</b>	5,000
<b>Workers (walked to work):</b>	300
<b>Median Household Income:</b>	\$65,000
<b>Percent Zero-Car Households:</b>	0.15
<b>Vehicles per Worker:</b>	0.94

**Notes:**

1. Station-area data are available from the Center for Neighborhood Technology's TOD Database (toddata.cnt.org)

2. Bicycle commute mode share for Census Place (from American Community Survey)

Total population in Census Blocks within 1/2-mile of station

Total jobs in Census Blocks within 1/2-mile of station

Total workers (employed residents) in Census Block Groups within 1/2-mile of station

Total workers in Census Block Groups who walked to work within 1/2-mile of station

Average of Median Household Income for Census Block Groups within 1/2-mile of station

Average of Percent Households with zero cars for Census Block Groups within 1/2-mile of station

Total Vehicles in Census Block Groups divided by Total Workers within 1/2-mile of station

**Figure C-2** Input Tab

If the station is existing, the Tool will prompt you to fill out some additional details ③ about provisions for station access modes, such as parking and feeder transit. The final input in this section relates to the bicycle commute mode share for the Census-designated Place where the transit station is located. Mode of transportation to work data are available from the American Community Survey ([www.census.gov/acs](http://www.census.gov/acs)).

Finally, enter station-area ④ characteristic data. Station-area data come from the U.S. Census and other sources, which are easily accessed through the Center for Neighborhood Technology's TOD database ([toddata.cnt.org](http://toddata.cnt.org)). The TOD database compiles station-area statistics for a ½-mile radius of all existing and planned rail transit stations in the country and outputs the data for entry into the spreadsheet. All of the inputs for this section are available from the database. A Glossary of Inputs has been provided at the end of the instructions for convenience.

## STEP 1 – ESTIMATE STATION RIDERSHIP

To attain a total daily ridership at the station, you first must choose a ridership estimation method ① on the Step 1 tab (Figure C-3). There are three methods available to input the station ridership:

- *Actual or External Model Data*: if actual station boarding data are available, or if a model is used to estimate boardings, choose *Actual or External Model Data* and enter the ridership in the cell provided.
- *Spreadsheet Model*: if no actual or estimated data are available, you may use the Station Access Planning Tool to estimate total daily ridership based on station, regional, and line-haul characteristics. Choose *Spreadsheet Model* and the Tool will calculate total ridership using a linear regression model based on observed transit station access data.

The output of the method chosen will produce a ridership estimate ② to be used throughout the rest of the process.

**TCRP B-38 Station Access Planning Tool**  
**Step 1: Estimate Station Ridership**

Step 1 develops an estimate of total station ridership. If counts or external model data are available, station ridership can be entered directly. Otherwise, use the Analogy method to estimate total station ridership.

Color Key: User Data Input Required  
Spreadsheet Calculation  
Output

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Transit Agency: Sample Agency  
 City/Region: Sample Region

Date: January 5, 2010  
 Analyst/User: Nick

Station Name: Pearl Street  
 New or Existing: Existing  
 Line Haul Mode: Heavy Rail  
 Station Type: Medium-Density Urban Neighborhood

**1** Choose Ridership Estimation Method: Analogy

Analogy

Station Type: Medium-Density Urban Neighborhood  
 Predominant Land Use: Mix  
 Climate: Hot or humid summer  
 Topography: Flat

Station-Area Demographics (within 1/2-mile)

Population:	8,000
Jobs:	4,500
Workers:	5,000
Workers (walked to work):	300
Median Household Income:	\$65,000
Percent Zero-Car Households:	0.15
Vehicles per Worker:	0.94
Connecting Transit Lines:	8
Parking Spaces:	16
Ridership Estimate:	5,997

**2** Ridership 5,997

**Figure C-3** Step 1 Tab

## STEP 2 – ESTIMATE STATION ACCESS MODE SPLIT

There are several methods available to estimate boardings by transit station access mode. Moving to the Step 2 tab (Figure C-4), choose **1** one of the following methods to estimate access boardings by mode:

- *Actual or Estimated Mode Split*: if station access data are available by mode, or if they are estimated by an external travel demand model, choose *Actual or Estimated Mode Split*. Enter the total boardings for auto (park-and-ride), auto (drop-off), feeder transit, bicycle, and pedestrian in the space provided. The Tool will calculate percent mode share for each access mode.
- *Station Type*: if access and model data are not available, choose *Station Type* and the Station Access Planning Tool will assign mode splits according to the Station Type chosen in the Inputs. The Tool will then assign access mode boardings based on the mode split and the ridership estimation from Step 1.

The resulting access mode volumes **2** will be used in the next steps of the process.

**TCRP B-38 Station Access Planning Tool**  
**Step 2: Estimate Station Access Mode Split**

Once an estimate of total station ridership is produced, Step 2 helps to estimate the station access mode split by each of the five primary access modes. If counts or an external model are available, they can be entered directly below. Otherwise, use the Analogy method to develop estimates for station access mode split.

Color Key: User Data Input Required  
Spreadsheet Calculation  
Output

---

Transit Agency: Sample Agency  
City/Region: Sample Region

Date: January 5, 2010  
Analyst/User: Nick

Station Name: Pearl Street  
New or Existing: Existing  
Line Haul Mode: Heavy Rail  
Station Type: Medium-Density Urban Neighborhood

Station Ridership: 5,997

**1** Choose Mode Split Estimation Method: Actual/External Model

Actual/External Model	Boardings	Percent
Auto (Park & Ride)	580	10%
Auto (Drop-off)	160	3%
Feeder Transit	960	16%
Bicycle	80	1%
Walk	2620	44%

**2** Mode Split:

	Boardings	Percent
Auto (Park & Ride)	580	10%
Auto (Drop-off)	160	3%
Feeder Transit	960	16%
Bicycle	80	1%
Walk	2620	44%

**Figure C-4** Step 2 Tab

### STEP 3 – ESTIMATE AUTO PARKING DEMAND

Step 3 (Figure C-5) estimates the station's demand for auto parking. If the station is existing, the Tool will first **1** assess the level of parking utilization experienced at the station. If the station is planned or its parking supply is over 90 percent utilized, the Tool will estimate additional demand for parking. If no parking is planned for the station, proceed directly to Step 4.

**TCRP B-38 Station Access Planning Tool**  
**Step 3: Estimate Auto Parking Demand**

Step 3 helps to estimate auto parking demand at the station and provides a comparison to similar station types. If parking demand exceeds supply, this step will help calculate the number of additional spaces needed and the cost to build them.

Color Key:

User Data Input Required
Spreadsheet Calculation
Default Value
Output

---

Transit Agency: Sample Agency  
City/Region: Sample Region

Date: January 5, 2010  
Analyst/User: Nick

Station Name: Pearl Street  
New or Existing: Existing  
Line Haul Mode: Heavy Rail  
Station Type: Medium-Density Urban Neighborhood

**1** Existing or Planned: Existing  
Parking Utilization 90% or higher?: No  
Excess parking supply exists.

**2**

Station Ridership:	5,997
Auto Boardings:	580
Percent Auto Access:	9.7%

**Station Type Data**

Average Auto Percent Mode Split:	6.7%
Low Range:	0.0%
High Range:	15.3%
Average Parking Spaces:	23
Low Range:	0
High Range:	116

Average auto access mode split  
One standard deviation below average auto mode split  
One standard deviation above average auto mode split  
Average number of parking spaces  
One standard deviation below average number of spaces  
One standard deviation above average number of spaces

**3**

Auto Mode Split:	Above Average
Parking Supply:	Below Average
Number of New Spaces to be Added:	80

Estimate number of new spaces needed based on Station Type

**4** **Parking Construction Cost Estimates**

Parking Type (number of levels): Surface

Land cost per square foot:	\$10.00
Land cost per space:	\$3,500
Construction cost per parking space:	\$5,250
Annual maintenance cost per parking space:	\$350
Financing charge:	0.15
Capital Recovery Factor:	0.071
Passengers arriving by automobile:	580
Average occupancy per vehicle:	1.2

If unknown, assume \$10 per square foot  
Land cost per square foot \* 350 square feet (average parking space)

Annual cost per parking space:	\$443.13
Annual cost per parking space per person:	\$369.27

**5**

New Parking Spaces:	80
Annual Cost of New Parking:	\$35,450.01
Daily cost per new parking space:	\$1.77

**Figure C-5** Step 3 Tab

The next section **2** provides average parking data for stations of the same Station Type. It provides a low, average, and high range of auto (park-and-ride) access mode split as well as low, average, and high parking supply for similar stations. If station access mode split is known, use this information to **3** estimate how many new parking spaces to construct for this



station. If the auto access mode split was estimated in Step 2, the Tool will estimate the parking over- or under-supply and will allow the user to input the number of spaces to be built.

This step also includes parking construction cost estimates <sup>4</sup>. Enter the type of parking facility (surface, structure, or underground garage), the land cost per square foot, and the estimated financing charge for construction. The cost calculations are based on several default assumptions, including maintenance costs, capital recovery, and average vehicle occupancy. These default values can all be adjusted in the master Defaults tab.

The output <sup>5</sup> of Step 3 consists of the number of new parking spaces to be built, the annual cost of those spaces (including financing), and the daily cost.

## STEP 4 – ASSESS IMPACTS OF PARKING CHANGE

Step 4 (Figure C-6) calculates the impact of parking supply changes on ridership. If parking utilization is high <sup>1</sup> (90 percent or higher), then additional parking supply is anticipated to increase ridership. If utilization is low, then increasing parking is not expected increase ridership. Likewise, removing unused parking would not reduce ridership.

**TCRP B-38 Station Access Planning Tool**  
**Step 4: Assess Impacts of Parking Change**

Step 4 tests the impacts of changing the supply of parking at the station.

Color Key: User Data Input Required Spreadsheet Calculation Default Value Output

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**Transit Agency:** Sample Agency  
**City/Region:** Sample Region

**Date:** January 5, 2010  
**Analyst/User:** Nick

**Station Name:** Pearl Street  
**New or Existing:** Existing  
**Line Haul Mode:** Heavy Rail  
**Station Type:** Medium-Density Urban Neighborhood

<sup>1</sup> **Existing or Planned:** Existing  
**Parking Utilization 90% or higher?:** No  
 Excess parking supply exists; no additional ridership expected. Adding parking spaces is not recommended.

<sup>2</sup> **Additional Parking Demand:** 80

**Number of spaces added/removed:** 80

**Space turnover (cars parked per day):** 1.0

**Number of people per car:** 1.2

**Number of auto access boardings added/lost:** 96

**Percent that switch to/from other mode:** 0.34

**Boardings maintained:** 33

**Net boardings gain/loss:** 63

<sup>3</sup> **Ridership gain/loss:** 127

From Step 3 (for reference)  
 Choose parking change or enter from Step 3 (use positive or negative values)

Space Turnover \* Vehicle occupancy \* Number spaces added/removed  
 Percent of riders who will switch to or from auto access mode  
 Auto access boardings added/lost \* switched access mode  
 Auto access boardings added/lost - boardings maintained  
 Based on 2 trips per station boarding

**Figure C-6** Step 4 Tab

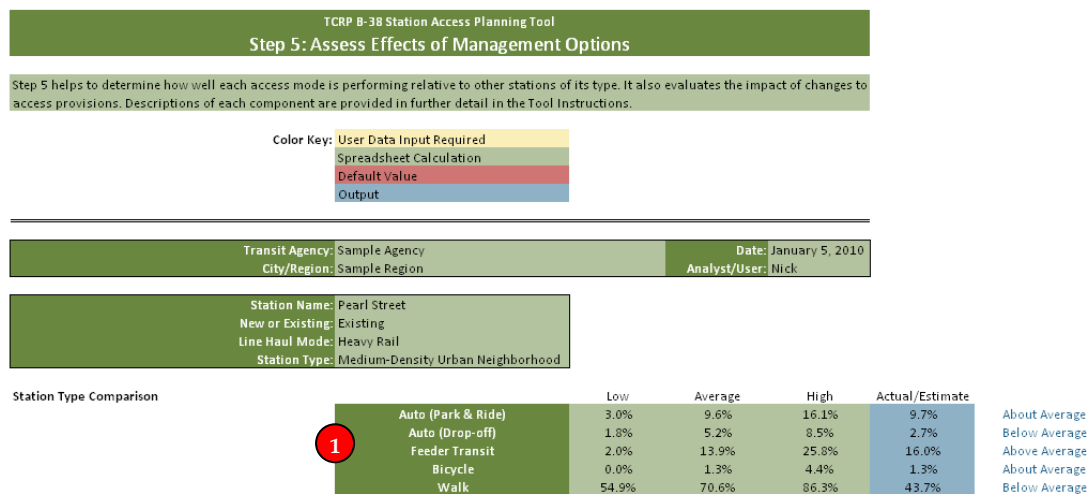
To estimate the impact of a change in parking, choose the number of spaces to be added or removed <sup>2</sup> based on the Additional Parking Demand and parking utilization judgment. The Tool will output <sup>3</sup> a net ridership impact of the change in vehicular parking supply. Since

latent demand cannot be estimated, ridership growth from added parking supply is capped at 25%.

## STEP 5 – ASSESS EFFECTS OF MANAGEMENT OPTIONS

Step 5 predicts how well each access mode may perform based on the station type, and evaluates the impact of changes to access provisions. This step is broken into several different sub-steps, which are described below.

The first objective is to understand how the access mode split for passengers at your station compares to the typical station of that type. The Station Type Comparison section (Figure C-7) provides details on the low, average, and high access mode splits <sup>1</sup> to be expected for each mode, and compares them to the output from Step 2. Examine these results to assess which are significantly above or below average to help determine where to focus station access planning efforts.



**Figure C-7** Step 5 Tab: Station Type Comparison

The next step evaluates the impact of parking pricing on ridership (Figure C-8). Enter a proposed parking charge <sup>2</sup> in the sheet. If the parking supply is greater than 90 percent utilized, the Tool assumes latent demand will supplement any lost riders and there is no net loss in ridership. It cannot estimate parking demand elasticity for specific locations, so the amount of latent demand is unknown. Agencies are encouraged to test the impact of parking pricing in the field using reasonable pricing increments (e.g. \$2 to \$5 at first). If utilization is less than 90-percent, you can calculate the impact of pricing on ridership here. Indicate how many of the spaces <sup>3</sup> would be subject to the new pricing and the Tool will calculate the net ridership loss.

<b>Parking Pricing</b>		
2	Existing Parking Charge:	\$0.00 per day
	Proposed Parking Charge:	\$2.00 per day
	Parking Utilization 90% or higher?:	No
<b>Calculate Ridership Loss</b>		
3	Number of spaces affected:	16
	Boardings per space:	1.2
	Station boardings affected by parking charges:	19
	Combined elasticity:	-0.33
	Current average round trip parking/fare:	\$2.00
	Proposed parking/fare:	\$4.00
	Percent total cost due to Parking:	0.500
	Elasticity effect:	-0.165
	Number of auto access boardings potentially lost:	3
	Percent boardings that find another access mode:	0.34
	Boardings retained:	1
	Net boarding loss:	2
	Ridership loss (at 2 trips per station boarding):	4
		Choose new daily parking fare (\$2 - \$5 intervals recommended)
		How many existing parking spaces will be affected?
		Space Turnover * Vehicle Occupancy
		Complete round trip expense (including existing parking pricing)
		Round trip fare + Proposed parking charge
		Proposed Parking Fee / Total (Fare plus Parking)
		Parking share of total cost * Elasticity
		Park & Ride boardings * Elasticity effect
		Potentially lost boardings * percent boardings that find another access mode
		Potentially lost boardings - Retained boardings

**Figure C-8** Step 5 Tab: Parking Pricing

Note that several default assumptions are used to perform the ridership impact calculations. The percent boardings that will switch to another access mode is an estimate based on previous rapid transit station experience. If local data are available, this value can be modified in the Defaults tab. Other default assumptions include boardings per space and elasticity. Boardings per space is calculated by multiplying the default average vehicle occupancy and the default daily space turnover.

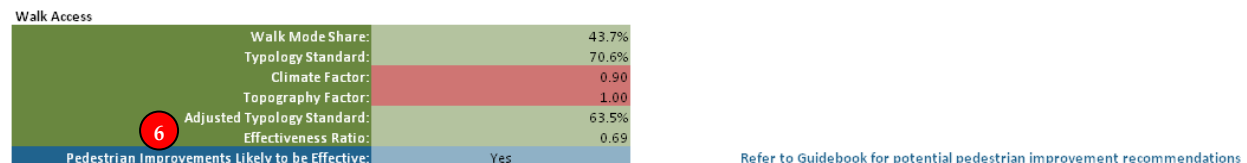
Feeder transit service impacts are calculated in the following section (Figure C-9). The Tool will import the existing feeder service data from the Input tab, but you will need to enter 4 the daily total revenue hours for feeder transit service and the cost per revenue hour. The Tool will then calculate the average cost per access boarding rider.

<b>Feeder Transit Service</b>		
	Connecting Transit Lines:	8
	Average Transfer Fee:	\$0.50
	Passengers arriving by feeder transit:	960
4	Feeder Service Revenue Hours:	60
	Cost per Revenue Hour:	\$100.00
	Productivity:	16.0
	Elasticity:	0.6
	Daily Operating Cost:	\$6,000
	Cost per Rider:	\$6.25
		Enter daily total revenue hours for feeder transit service
		Enter cost per revenue hour for feeder transit service
5	New Service Hours:	12
	Percent shift from Auto access:	0.2
	Additional daily operating cost:	\$1,200
	Percent new service:	0.2
	Elasticity effect:	0.12
	Additional feeder bus ridership:	115
	Total feeder bus passengers:	1,075
	New Productivity:	14.9
		Choose increase in feeder transit service hours
		Percent new service hours of total service hours
		Percent new service * Elasticity
		Elasticity effect * Existing feeder bus ridership
		Total ridership / Total service hours
	New Passengers:	92
	Reduced parking space demand:	19
	Cost per rider:	\$6.70
	Cost per new rider:	\$13.02

**Figure C-9** Step 5 Tab: Feeder Transit Service

The effect of increasing feeder transit service 5 can be tested by entering an increase in transit service hours. The Tool will calculate the estimated increase in daily ridership and the associated costs. The calculations assume a percentage shift from Auto access from the Default tab, which the user can modify.

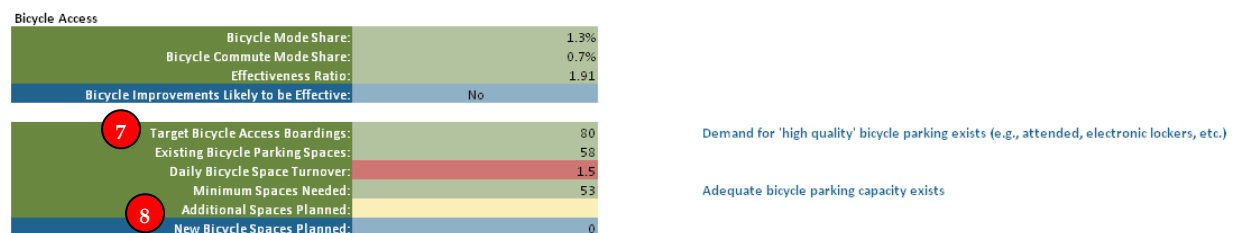
The Walk Access section (Figure C-10) evaluates the current walk access performance against an adjusted typology standard. The average walk access percentage is factored according to climate and topography to produce an adjusted average. Then, an effectiveness ratio **6** is calculated to assess how close your subject station's walk mode share is to the adjusted average. If the ratio is less than 0.95, you may realize a benefit by performing access improvements. If the station is already realizing walk access mode shares similar or higher than the average, pedestrian improvements are less likely to be helpful in further increasing pedestrian share.



**Figure C-10** Step 5 Tab: Walk Access

The Bicycle Access element (Figure C-11) evaluates the performance of bicycle station access compared with the average bicycle commute mode share for the station's location. If the station's bicycle access mode share is less than that of its Census Place, then bicycle improvements may result in increased bicycle access boardings.

Next, the Tool calculates the bicycle parking needs of the station **7** by evaluating existing parking provision and bicycle access boardings. This assumes a bicycle parking space turns over 1.5 times per day, on average. This can vary by station and location, so the default setting should be modified where appropriate under the Defaults tab. Based on the information calculated here, enter the additional parking spaces planned **8** for financial calculations in the next section.



**Figure C-11** Step 5 Tab: Bicycle Access

The final access management option relates to transit-oriented development (Figure C-12). The Tool assumes that sufficient demand exists for development, so the user should first understand the market context of the station area.

Transit-Oriented Development		
Proposed Development Characteristics		
9	Total development size:	50,000 sf
	Residential (units):	400 units
	Office (square feet):	15,000 sf
	Retail (square feet):	8,000 sf

Enter total parcel size in square feet  
Enter number of residential units planned  
Enter square footage of office planned  
Enter square footage of retail planned

Trip Generation Details <sup>1</sup>		
	Residential Daily Trip Generation Rate (per unit):	6.65
	Residential Trip Split (Work):	0.25
	Residential Trip Split (Non-Work):	0.75
	Office Daily Trip Generation Rate (per 1,000 sf):	11.01
	Retail Daily Trip Generation Rate (per 1,000 sf):	42.94

	Residential (Work) Trips:	665
	Residential (Non-Work) Trips:	1,995
	Office Trips:	165
	Retail Trips:	344

Transit Capture Details		
	Percent Transit Capture - Residential (Work):	40.5%
	Percent Transit Capture - Residential (Non-Work):	8.6%
	Percent Transit Capture - Office:	10.0%
	Percent Transit Capture - Retail:	11.7%

	Residential (Work) Transit Trips:	269
	Residential (Non-Work) Transit Trips:	171
	Office Transit Trips:	17
	Retail Transit Trips:	40

10	Total (Walk) Trips:	497
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**Figure C-12** Step 5 Tab: Transit-Oriented Development

Begin by entering basic details about the development 9, including total development size and the breakdown of residential, office, and retail. The Tool then works through a number of trip generation and mode split calculations to identify the total impact on transit trips (walk access). The trip generation assumptions are based on the ITE *Trip Generation Manual*, 8<sup>th</sup> Edition. Transit capture defaults are based on California data and can be modified for local conditions.

The total walk trips 10 from the proposed development will be used to calculate impacts and trade-offs in the next section. Note: if TOD replaces parking, make sure to calculate the impact in Step 4.

## FISCAL IMPACTS

The final step in the Station Access Planning Tool evaluates the fiscal impacts of the access options selected in the previous steps.

The Tool first calculates the impacts to various sources of revenue related to the transit station (Figure C-13). Fare revenue 1 is calculated based on net change in daily ridership from the previous steps in the process. Parking revenue 2 is calculated according to the total number of reserved and daily parking spaces planned for the station. Enter the change in reserved parking spaces, if any, in the first cell of this section. Finally, any ground rent 3 associated with TOD is calculated in the last section under Revenue. Enter the land value per square foot, the cost of replacement parking per space, and then number of spaces to be replaced. The change in total annual revenue 4 is calculated at the end of the section.

TCRP B-38 Station Access Planning Tool			
Impacts on Costs and Revenues			
The final step is to evaluate the fiscal impacts of the access management options calculated in Steps 1 through 5. This sheet calculates the impacts of various sources of revenue (fare, parking, rent, etc.) related to the transit station. Then, various costs (operations and capital) are subtracted to produce the Net Annual Impact of the access planning strategies contained in the analysis.			
Color Key: <span style="background-color: yellow; border: 1px solid black; padding: 2px;">User Data Input Required</span> <span style="background-color: #e67e22; border: 1px solid black; padding: 2px;">Default Value</span> <span style="background-color: #2980b9; border: 1px solid black; padding: 2px;">Output</span>			
Transit Agency: Sample Agency City/Region: Sample Region		Date: January 5, 2010 Analyst/User: Nick	
Station Name: Pearl Street New or Existing: Existing Line Haul Mode: Heavy Rail Station Type: Medium-Density Urban Neighborhood			
<b>Revenue Factors</b>			
<b>Fare Revenue</b>			
1	Ridership impact of joint development	497	
	Ridership impact of change in parking supply	127	
	Ridership impact of parking charge programs	4	
	Ridership impact of feeder bus access programs	92	
	Net change in daily ridership	719	
	Average fare	\$2.00	
	Annual fare revenue	\$383,341	
<b>Parking Revenue</b>			
2	Change in number of spaces under reserved parking	0	Addition/Reduction of reserved parking spaces <sup>2</sup>
	Monthly cost of reserved parking	\$0.00	
	Cost of collection	10%	
	Net revenue from reserved parking	\$0	
	Number of spaces under paid parking	96	
	Daily parking price	\$2.00	
	Cost of collection (per space)	\$0.30	
	Net revenue from parking charges	\$7,488	
	Combined parking revenue	\$7,488	
<b>Ground Rent after replacement parking</b>			
3	Fair market land value	\$20.00	Land value per square foot
	Parcel size	50000	Parcel size in square feet
	Land value	\$1,000,000	
	Replacement Capital Cost per Space	\$15,000	Cost of replacement parking per space
	Number of Spaces Replaced	0	
	Cost of replacement parking	\$0	
	Residual	\$1,000,000	
	Annualization factor	0.1	
	Ground rent after parking costs	\$100,000	
4	Total Annual Revenue	\$490,829	

**Figure C-13** Fiscal Tab: Revenue Impacts

Next, costs are calculated based on changes in management options (Figure C-14). Parking and feeder bus operating costs are calculated automatically based on data entered in the previous sections. The user must enter any costs associated with agency participation in other access operations 5 and capital costs.

Capital bicycle construction costs are also calculated automatically. Bicycle parking is classified into three tiers according to the type and quantity of parking to be built:

- Tier 1 (less than 30 parking spaces): all spaces can be provided as covered racks.
- Tier 2 (between 30 and 60 parking spaces): split space provision between regular and covered racks.

- Tier 3 (more than 60 parking spaces): provide racks, covered racks, and lockers.

The Tool then calculates the total annual costs and subtracts them from total revenue to yield the net annual impact of the access management options **6**.

<b>Cost Factors</b>			
Change in Parking Operating Costs			
Parking Operating Costs			\$35,450
<b>Operating Costs</b>			
New Feeder Bus Service			\$300,000
<b>Agency participation in other access operating costs</b>			
<b>5</b>	Amount		
<b>Agency participation in other access capital costs</b>			
One-time capital cost			
Annualization factor			0.1
Annualized Capital Cost			\$0
<b>Bicycle Parking Costs</b>			
Additional spaces planned			0
Tier			2
Covered Racks			0
Racks			0
Lockers			0
One-time capital cost			\$0
Annualization factor			0.1
Annualized Bike Parking Cost			\$0
Total Annual Cost			\$335,450
<b>6</b>	Net Annual Impact		\$155,379

Bicycle parking quantity tier (see Guidebook)

**Figure C-14** Fiscal Tab: Cost Impacts

## DEFAULT VALUES

The default values in the Tool were obtained from a variety of different sources obtained through the literature review, stakeholder interviews, and case studies. The values are provided as rough estimates on which a generic analysis can be based. However, the user should modify the values if better local data are available (Figure C-15).

The parking cost default values **1** are based on a combination of land cost estimates and general construction costs. Land costs are pro-rated based on the number of levels, and a 15-percent engineering design cost is added to the construction cost per space. Total development costs of land and design are increased another 15-percent to reflect financing costs.

The annual development costs are based on the anticipated life of the facility (e.g., 25 years) and the likely interest rate (5%). Calculations include a 0.07 capital recovery factor. Annual operating costs are suggested in ITE's *Transportation Planning Handbook*.

TCRP B-38 Station Access Planning Tool		
Default Values		
All Default values used in the Tool are contained on this worksheet. These values are generalized estimates and should be modified where local data are available.		
<b>Parking Costs</b>		
1	Annual Operating Cost per Surface Space	\$350
	Capital Cost per Surface Space	\$5,250
	Annual Operating Cost per Structured Space	\$538
	2 Levels	\$14,000
	3-7 Levels	\$17,500
	Underground	\$35,000
	Reserved parking collection cost	10%
	Daily parking collection cost (per space)	\$0.30
	Capital Recover Factor (25 yrs @ 5%)	0.070952457
	Average occupancy per vehicle	1.2
	Percent of Auto Access who Park and Ride	0.8
<b>Parking Impacts</b>		
2	Percent switch from Other to Auto	0.34
	Percent switch from Auto to Other	0.34
	Cars parked per day	1.0
	Parking Elasticity	-0.33
<b>Feeder Bus</b>		
3	Elasticity with respect to service hours	0.6
	Percentage shift from other auto access	20%
	Daily to annual conversion factor	296
	Fare discount factor	0.9
	Annualization Factor	0.1
	Capacity per Bus	50
	Bus Cost	\$350,000
	Capital Recovery Factor (12 yrs @ 6%)	0.112960105
	Annual Bus Cost	\$40,000
	Layover time per bus trip	6
	Number of operating days per year	250
	Operating cost per bus per mile	\$10

**Figure C-15** Defaults Tab: Parking and Feeder Bus Defaults

Access mode shift and parking elasticities ② were obtained from BART's Access Policy Spreadsheets, which are based on empirical data at their heavy rail stations.

The feeder bus default values ③ for elasticity and mode shift were based on *TCRP Report 95*, Chapter 14: Transit Scheduling and Frequency. Feeder bus cost estimates are derived from Appendix B of *NCHRP Report 155: Bus Use of Highways, Planning and Design Guidelines*.

The spreadsheet tab continues with bicycle and pedestrian adjustment factors ④ that represent the estimated impact of climate and topography on bicycle and pedestrian access to public transit stations. Bicycle parking usage and cost estimates were obtained from the TriMet Portland–Milwaukie Light Rail Project's bicycle parking spreadsheet.

Trip generation estimates ⑤ were obtained from the *ITE Trip Generation Manual*, 8<sup>th</sup> Edition. The percent transit capture rates and the residential work/non-work trip splits come from the California Statewide TOD Study.

Transit capture ⑥ estimates the percent of trips – by trip purpose – travelers will make by transit. This can vary greatly by region and should be calibrated to approximate local conditions.



Finally, the fiscal default values 7 were obtained from BART's Access Policy Spreadsheets.

Bike/Ped Climate		Ped. Adj. Factor	Bike Adj. Factor
4	Moderate	1.0	1.0
	Hot or humid summer	0.9	0.9
	Cold or icy winter	0.9	0.75
	Seasonal rain	0.95	0.8
Bicycle Parking Turnover (times per day)		1.5	
Covered Rack Cost		\$1,000	
Rack Cost		\$100	
Locker Cost		\$3,000	
Topography		Ped. Adj. Factor	Bike Adj. Factor
	Flat	1.0	1.0
	Rolling hills	1.0	0.9
	Flat center, hills/mountains in periphery	1.0	0.9
	Very hilly/mountainous	0.9	0.7
Trip Generation			
5	Residential (per unit)	6.72	Residential trip generation from ITE 7th Edition rate for apartment
	Office (per ksf)	11.01	Office trip generation from ITE 7th Edition rate for general office
	Retail (per ksf)	42.94	Retail trip generation from ITE 7th Edition rate for 80% specialty retail center and 20% high turnover sit down restaurant
	Residential Trip Split (Work)	0.25	
	Residential Trip Split (Non-Work)	0.75	
Transit Capture			
6	Res. Work	0.405	
	Res. Non-Work	0.0855	
	Office	0.1	
	Retail	0.117	
Fiscal			
7	Daily to annual conversion factor	296	
	Fare discount factor	0.9	
	Annualization Factor	0.1	

**Figure C-16** Defaults Tab: Other Default Values

## GLOSSARY OF INPUTS

**Analyst/User** — name or initials of the individual performing the analysis

**Average Transfer Fee** — average fee to transfer from the line-haul to a feeder transit line

**Bicycle Commute Mode Share** — percent of commuters who travel by bicycle for the Census Designated Place from the American Communities Survey

**Bicycle Parking Spaces** — number of dedicated bicycle parking spaces at the station

**Car Parking Utilization** — percent occupancy of the parking spaces at 9am on a weekday, if available. Otherwise, provide an estimate based on local knowledge of parking patterns.

**Climate** — prevailing climate type in the region

**Connecting Transit Lines** — number of connecting feeder transit lines, including bus, ferry, shuttle, etc.

**Daily Car Parking Price** — cost of daily parking at the station

**Daily Parking Spaces** — number of parking spaces available for daily parking at the station (off-street)

**Date** — date of analysis

**Existing or Planned** — identify whether the station being analyzed is already or existing or planned.

**Jobs** — total jobs within ½-mile of the station (from Census)

**Line Haul Mode** — type of line haul serving the station

**Median Household Income** — average median household income of the Census Tracts within ½-mile of the station

**Metro Region** — Census-designated metropolitan region in which the station falls.

**Monthly Parking Price** — cost of a monthly parking pass at the station, if available

**Percent Zero-Car Households** — percent of households within ½ mile of the station with zero car ownership (from Census)

**Population** — total population within ½ mile of the station (from Census)

**Predominant Land Use** — predominant land use within the ½ mile station area

**Reserved Parking Spaces** — number of reserved parking spaces at the station (off-street)

**Round Trip Fare** — cost of a round trip fare between the station and central business district

**Station Name** — name of the existing or planned station being analyzed

**Station Type** — station type from the Station Typology (see Chapter 4 of the Guidebook)

**Topography** — prevailing topography in the region

**Transit Agency** — name of the agency that operates the line-haul mode serving the study station.

**Vehicles per Worker** — total number of vehicles divided by total number of workers within ½ mile of the station. The number of vehicles is calculated by multiplying the number of households with one vehicle by 1, the number of two-vehicle households by 2, etc.

**Workers** — total number of workers (or employed residents) within ½-mile of the station (from Census)

**Workers (walked to work)** — total number of workers who identified “walk” as their means of transportation to work for Census Block Groups within ½ mile of station.