TransValU

TRANSPORTATION VALUE TO YOU

User Guide

Florida Department of Transportation
District Five

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TRANSVALU OVERVIEW

What is TransValU?

TransValU (Transportation Value to You) is a spreadsheet-based tool designed for the economic and financial assessment of proposed transportation investments in Florida (District Five in particular). It focuses on three types of transportation investments: highway, transit, and bicycle/pedestrian, as well as combinations of these modes. In addition, projects focusing on the movement of goods can be assessed by separate freight modules in the tool. Three forms of analyses are available within the tool: Benefit-Cost Analysis, Economic Impact Analysis, and Financial Analysis.

- **Benefit-Cost Analysis (BCA)** is a conceptual framework that monetizes as many of the costs and benefits of a project, program, or policy as possible to generate a single "bottom-line" estimate of value. BCA is primarily concerned with economic efficiency and the use of resources to maximize society's overall well-being ("social welfare"). The approach involves quantifying benefits and costs relative to a Base Case to determine whether the net benefits of a project outweigh its costs. TransValU provides a comprehensive framework to include all capital and Operating & Maintenance (O&M) costs, as well as a wide range of benefits. Users of TransValU are able to identify the alternative or mix of alternatives that maximizes net benefits or social welfare per dollar invested. The tool provides a side-by-side comparison of multiple alternatives by calculating Net Present Value, Benefit/Cost Ratio, Overall Rate of Return, and Discounted Payback Period.
- **Economic Impact Analysis (EIA)** looks at the effects of a project, program, or policy on the economy of a state or region. It is primarily concerned with changes in economic activity. Economic impacts are typically expressed as changes in business sales (output), Gross Regional Product (GRP) or "value added," employment, and earnings. TransValU estimates the short-term economic impacts resulting from spending on transportation projects. Long-term economic impacts are also estimated for freight projects. These are lasting impacts resulting from improvements to a transportation facility.
- **Financial Analysis** focuses on the flows of money to and from a project or organization, typically a firm or government agency. It helps identify the project or alternative that maximizes net inflows (e.g., total revenue minus total expenses). A financial analysis from the perspective of a government agency looks at the impacts of a project on government expenditures and receipt. It is a form of fiscal analysis.

In deciding which type of analysis to run, users should consider the following:

- Run a BCA to determine whether a project creates enough societal benefits (e.g., travel time saving, accident cost saving) to justify its costs.
- Run an EIA to assess the contribution of a project to a local economy, and estimate the number of jobs created or retained by the project.
- Run a Financial Analysis to assess the flow of money (inflows and outflows) to and from a project entity, firm, or government agency.

Which Projects Can be Assessed with TransValU?

TransValU was designed to assess a variety of highway, transit, and bicycle/pedestrian projects, as well as multimodal projects that combine multiple investments in these modes. Projects focused on freight can also be evaluated in TransValU, including highway freight, rail freight, and intermodal logistics center (ILC) projects. All three types of analyses (BCA, EIA, and Financial Analysis) can be performed on all project modes, including freight. However, TransValU includes separate BCA and EIA Modules for evaluating freight projects. Below is an overview of how the three types of analyses are performed in TransValU.

- The **Benefit-Cost Analysis** Module of TransValU can be used to assess capital projects for which any of the following data and projections are available:
    - Changes – under the "project case" (or "with project scenario"), relative to a "base case" (or "without project scenario") – in daily Vehicle Miles Traveled (VMT) and/or Vehicle Hours Traveled (VHT) from highway investments and/or spending in other modes affecting highway travel through modal shifts;
    - Changes in the number of transit riders and/or the average transportation costs borne by transit riders (including in-vehicle travel time, waiting time, and fares);
    - Changes in the number of bicycle users or pedestrians, and/or in their average door-to-door travel times;
    - Changes in the percent breakdown of the transit vehicle fleet (e.g., diesel, hybrid, CNG, or electric buses and trains);
    - Changes in the number of accidents by severity level (e.g., non-incapacitating injury, incapacitating injury, or death) resulting from safety projects that reduce the likelihood of crashes at a specific location, as well as from capital projects that entice travelers to use relatively safer modes;
    - Changes in the extent of roadside aesthetic improvements, expressed as additional acres of vegetated right-of-way;
    - Changes in the number of cyclist or pedestrian trips; and
    - Changes in freight rail movements or volumes of goods handled at an ILC.

  Depending on the type, size and location of the project, the above changes may be estimated with various tools and procedures. For example, a regional travel demand model may be used to estimate the changes in network VMT and VHT resulting from a major highway capacity project; whereas, a micro-simulation model may be used to estimate the changes in VMT and VHT associated with an interchange modification project. Similarly, changes in the number of transit riders may be developed with a regional travel demand model, an econometric model, or a sketch-planning tool, depending on project needs and resources. The BCA Module of TransValU can be used in all these contexts, as long as the resulting transportation data and projections are produced in a format compatible with the module's requirements.

- The **Economic Impact Analysis** Module can be used to assess a broad range of transit projects, including spending on any mode of transit (commuter rail, light rail, bus rapid transit, etc.), any nature of service (existing service, expansion of service, or planned new service), and any type of spending (capital or O&M). The module can also be used to estimate the short-term impacts of construction spending associated with capital projects in other modes of travel (highway, bicycle/pedestrian, or freight-focused), as well as long-term impacts of freight-focused projects due to reduced travel costs or increased long-term employment.
- The **Financial Analysis** Module can be used to assess any transportation projects for which annual projections of future financial flows (e.g., revenue and expenses) are available. These annual projections are entered into the tool as inputs, adjusted with model parameters and project-specific assumptions, and used in the estimation of financial feasibility indicators.

Summary of the Type of Projects that can be Analyzed with TransValU:

Projects Focused on Passenger Travel:

- Highway
- Transit
- Bike/Pedestrian

Projects Focused on Goods Movement:

- Highway Freight
- Rail Freight
- Intermodal Logistics Center (ILC)

Main Characteristics

All three types of analysis (BCA, EIA and Financial) are accessible from the WELCOME screen in the tool. They are organized into separate modules (sets of color-coded tabs) to avoid confusion. For the BCA and EIA, there are separate modules for the analysis of projects focused on passenger movements (e.g., highway, transit, and bicycle/pedestrian) and those focused on goods movements (e.g., highway freight, freight rail, and ILC). The Financial Analysis Module is different—there is only one module for financial analysis; it is the same for all project modes.

- The BCA Modules are consistent with the latest US DOT guidance for BUILD and INFRA grant applications – including methods for the valuation of travel time saving, emission costs and safety impacts, and the estimation of benefits from investments in bicycle/pedestrian facilities.
- The EIA Modules are based partly on the Tool for Assessing the Economic Impacts of Spending on Public Transit developed by the Center for Urban Transportation Research (CUTR) at the University of South Florida.
- The Financial Analysis Module uses a Discounted Cash Flow approach to estimate measures of financial return from the perspective of the Project or FDOT. Forecasts of future money flows (inflows and outflows) must be developed outside the tool.
- All TransValU modules use up-to-date data for District Five that are consistent with recent State or regional studies. Data is also available at the county-level for District Five (including emissions, crash

data, employment, and wages), and for other districts in Florida (including crash data—aggregated by county, emissions, employment, and wages).

- The tool has a user-friendly interface, with navigation buttons, drop-down menus, clearly labeled tabs (or "worksheets") and a number of pre-formatted summary tables. A number of worksheets are hidden to enhance user experience.

Workbook Contents

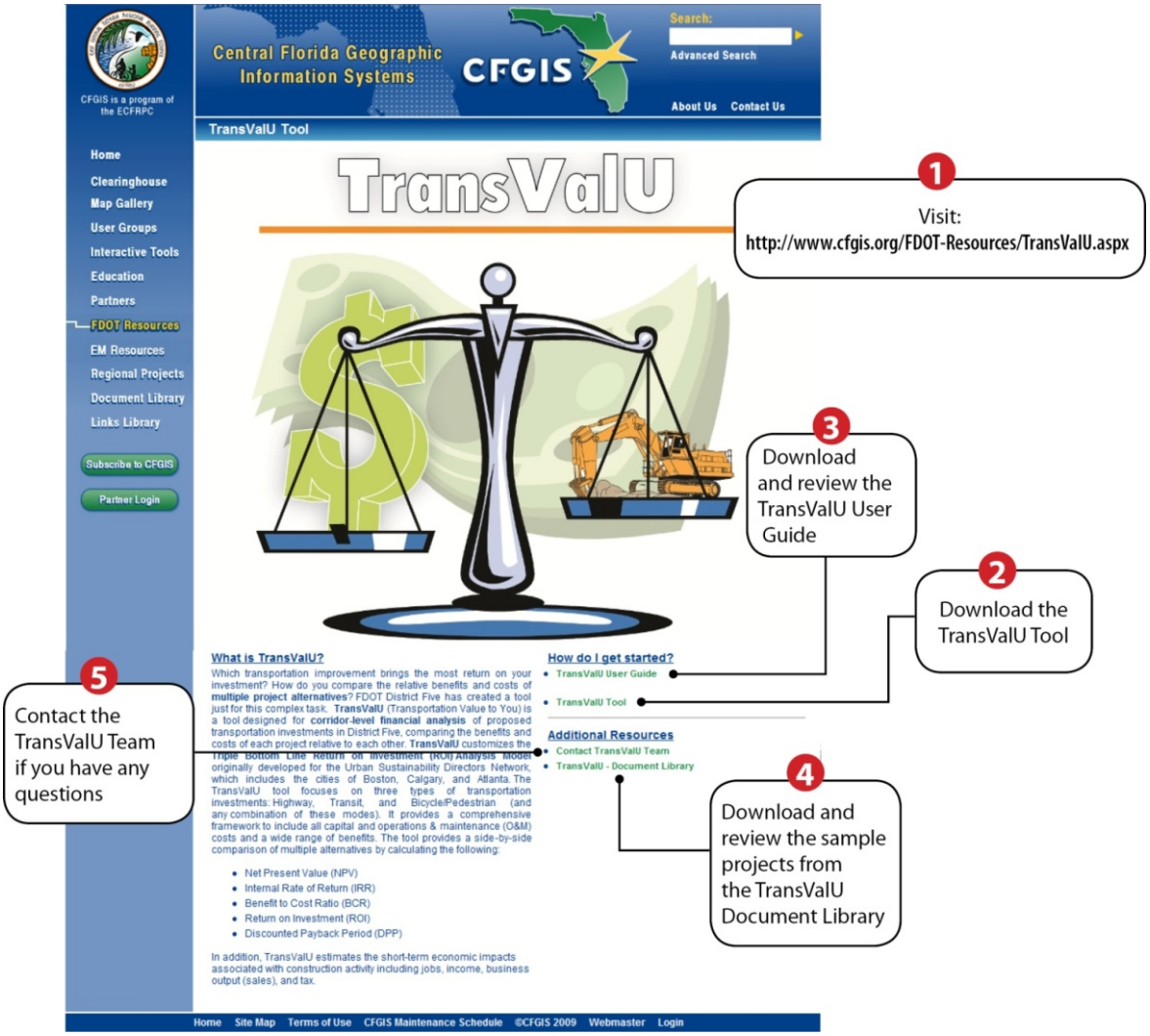
Each of the modules of TransValU (including those modules specifically for freight projects) includes the following worksheets:

- Inputs – for each type of project, the tool provides users with clear directions on the required and optional/advanced inputs;
- Calculations – customized calculations to estimate all relevant metrics, including benefits, costs, economic impacts and financial flows; and
- Results – the tool includes tabular and graphic summaries of outcomes.

In addition, the BCA Modules contain a Multiple Projects Results worksheet allowing side-by-side comparisons of multiple alternatives at an executive level.

GETTING STARTED

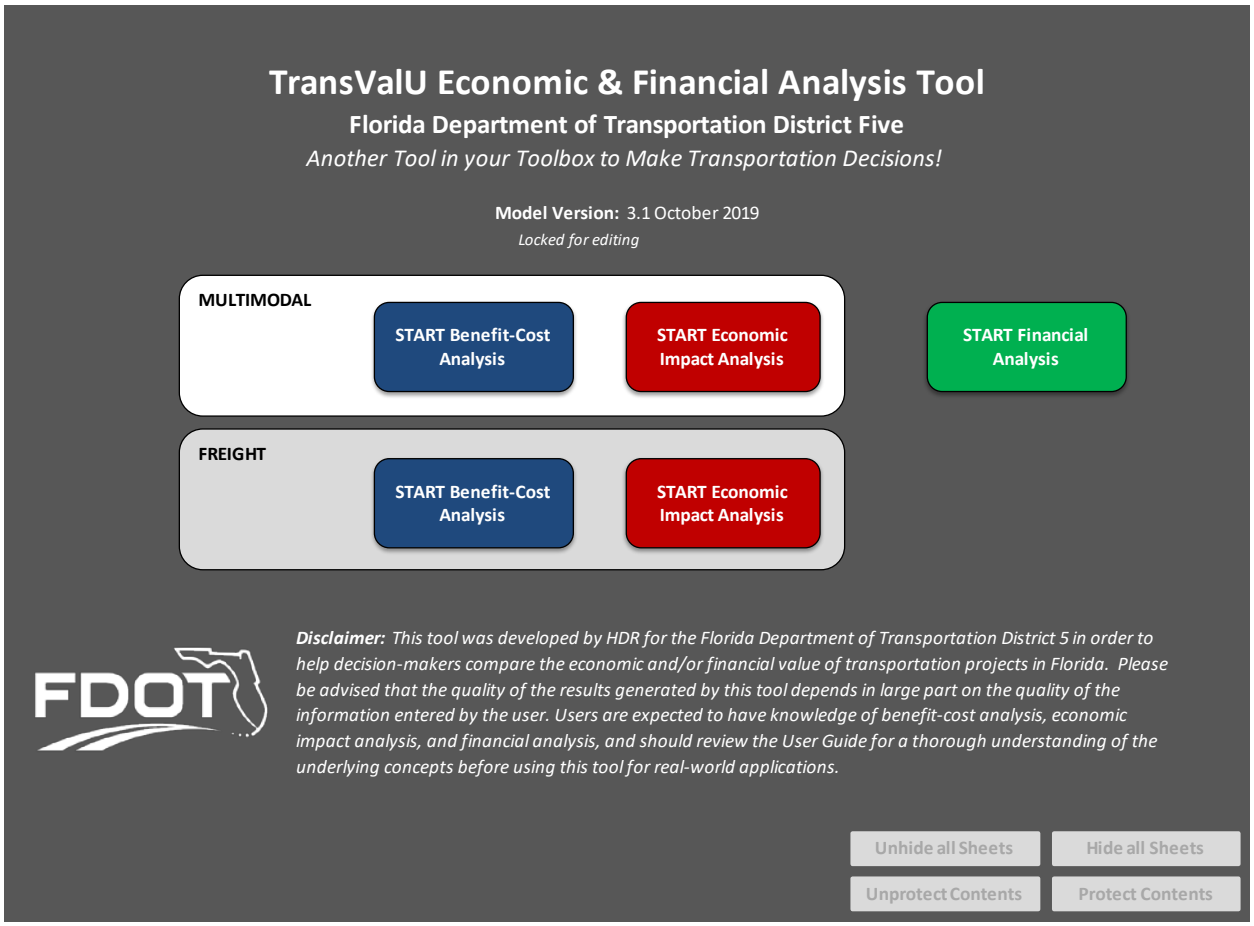
Figure 1: Snapshot from the TransValU Website



The TransValU tool and user guide are available online for download at http://www.cfgis.org/FDOT-Resources/TransValU.aspx. Refer to Figure 1 to understand how to navigate the website.

The WELCOME screen of the TransValU tool is shown in Figure 2 below. It does not require any input from the user. Users should simply click one of the buttons in the center of the screen to start the analysis. Under MULTIMODAL, the user can click on START Benefit-Cost Analysis or START Economic Impact Analysis to analyze a roadway, transit, bicycle/pedestrian, or multi-modal project. If the user wishes to perform the same analysis of a freight project, click on the same buttons under FREIGHT. The START Financial Analysis button is for all project types, including freight.

Figure 2: TransValU Welcome Screen



Purpose and Organization of the TransValU User Guide

The purpose of this User Guide is to provide transportation practitioners with the information necessary to perform a benefit-cost analysis, economic impact analysis, or financial analysis using the TransValU tool. Careful conceptualization of the project and preparation of quality input data are required to quantify the economic and financial implications of any transportation project.

The TransValU User Guide has three major sections: PART A – Benefit-Cost Analysis, PART B – Economic Impact Analysis, and PART C – Financial Analysis. Within each section, an overview of the conceptual framework, a description of the user interface, and step-by-step instructions to perform the analysis are provided. Both PART A and PART B include separate sections to describe the user interface and step-by-step instructions for running the BCA and EIA Modules for freight projects.

PART A. BENEFIT-COST ANALYSIS

This section provides a background on benefit-cost analysis (BCA), including a description of the framework, theory, and output categories to be estimated in TransValU. Next, the section explains how to run the BCA Module in TransValU, including the data requirements, a description of the user interface, and detailed instructions for navigating the tool. Finally, this same explanation is provided for how to run the BCA Module for freight-focused projects, as this analysis is performed in a separate Freight BCA Module.

Section A.1 – Introduction to Benefit-Cost Analysis

BCA is a conceptual framework that monetizes as many of the costs and benefits of a project as possible, to generate a single "bottom-line" estimate of value. The approach involves quantifying benefits and costs of the "project case" (or "with project scenario") relative to a "base case" (or "without project scenario"), to determine whether the net benefits of a project outweigh its costs. The TransValU (Transportation Value to You) model was created for the Florida Department of Transportation's (FDOT) District Five Office, for analyses of transportation investments proposed within the District, or in other Florida districts.

TransValU enables users to conduct BCA of transportation infrastructure investments in Florida. The model was developed to help evaluate the benefits and costs of roadway, transit, bicycle and pedestrian, multi-modal, or freight projects. Users of TransValU are able to identify the alternative, or mix of alternatives, that maximizes net benefits or "social welfare" per dollar invested. TransValU enables users to compare multiple alternatives side-by-side. Results of the BCA using TransValU are expressed as a Net Present Value (NPV), a Benefit/Cost Ratio (BCR), an Overall Rate of Return (ORR), and Discounted Payback Period.

Framework

A sound BCA framework relies on a solid understanding of what is likely to happen if an improvement is not made versus what is expected to occur if the infrastructure is improved. As a result, a critical step in the BCA process is defining the future year conditions for a base case forecast as well as project case alternative(s). It is the difference in benefits and costs between the baseline forecast and the alternative(s) that help determine whether a project is justifiable on benefit-cost grounds.

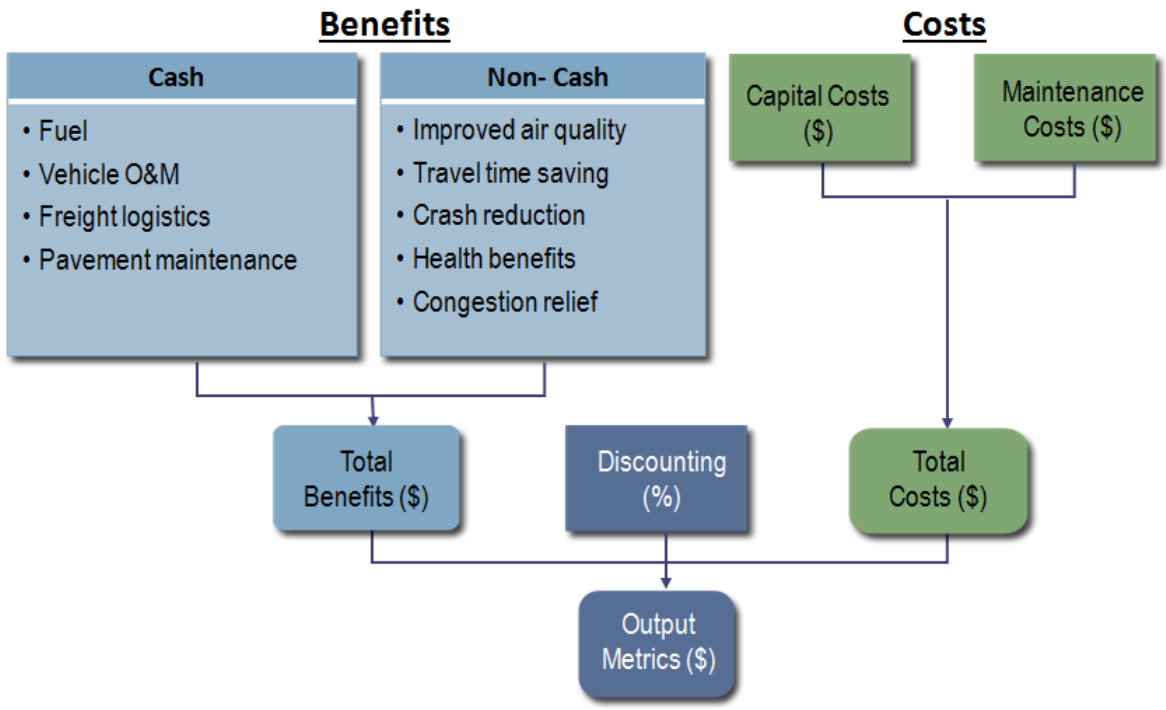
For transportation improvements, the base case defines the transportation facilities affected, as well as any changes in trips expected to occur over time. Alternative, or project case, scenarios include the configuration of the transportation project and reflect the potential changes in distance traveled, travel time, or travel patterns.

Timelines or project schedules should coincide with the project case and base case in order to estimate project benefits and costs. Within TransValU, all future costs and benefits are discounted into a common year, expressing future outcomes in present value1. An illustrative flow diagram in Figure 3 shows the

[1] See glossary in APPENDIX IV for definition.

BCA framework and how various transportation benefits and costs are addressed in TransValU. The "cash" benefits represent out-of-pocket cost savings to individuals and businesses, while the "non-cash" benefits represent societal benefits that are monetized within TransValU.

Figure 3: Transportation Benefit-Cost Analysis Diagram



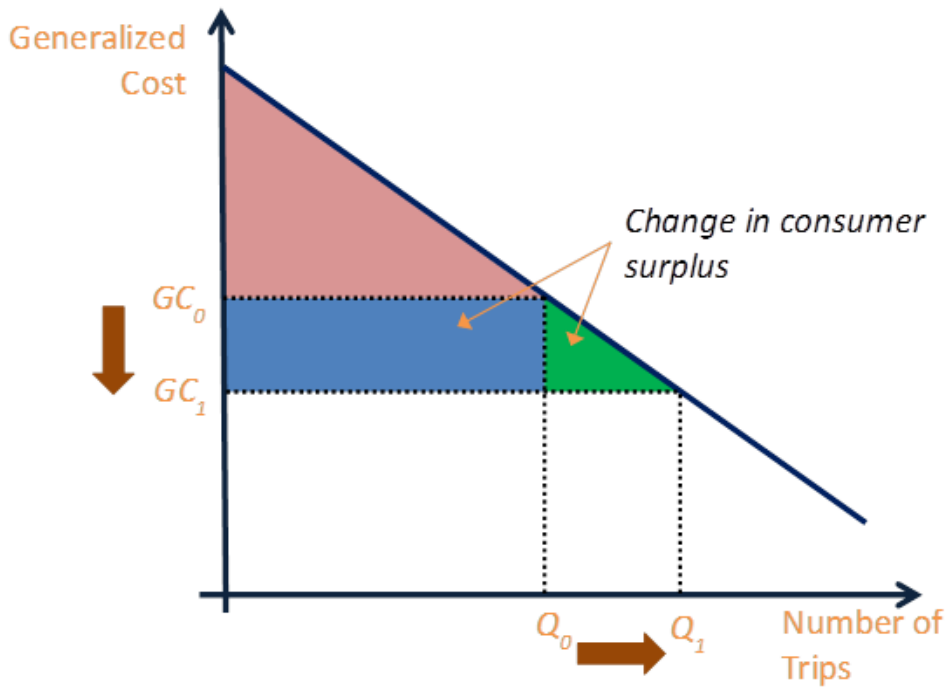
Benefit-Cost Analysis Theory

When a transportation facility is improved, travelers adjust their behavior in response to changes in travel costs. A decrease in travel costs induces travelers to use the facility. To account for this induced demand, benefits to both existing and new users of the facility must be calculated. This is accomplished by using the elasticity of demand for travel and the concept of consumer surplus. The difference between what a group of users is willing to pay in terms of their generalized cost of a trip (travel time, vehicle operating costs, transit fares, and other charges) and what they actually pay is called consumer surplus. Consumer surplus theory assumes that induced travelers must be benefiting from using the facility, or they would not have chosen to change their behavior.

In a BCA, we are concerned with the change in consumer surplus attributable to a transportation improvement. There are two aspects to the change in consumer surplus that results from the transportation improvement. First, there is the benefit to existing users from the decrease in the generalized cost of travel. This is represented by the blue rectangle in Figure 4 below. Second, some people who were not taking advantage of the transportation option previously are doing so now. They have been induced to use the new or improved facility. This benefit to new users is measured by the green triangle in Figure 4.

The sum of the blue rectangle and green triangle represents total user benefits, or the change in consumer surplus.

Figure 4: Change in Consumer Surplus



Assuming a linear demand curve (like the one in Figure 4), the "rule of half" can be used to approximate the change in consumer surplus **for new users**, as seen in the following equation:

$$\Delta CS_{new\ users} = \frac{1}{2}(GC_0 - GC_1)(Q_1 - Q_0).$$

Benefits and Costs Estimated in TransValU

For any project or program to be evaluated through BCA, there must be some measure of transportation performance impact, such as changes in travel time, costs, modal shifts, or total volume. Depending on the investment, these changes can be positive or negative (such as temporary delays during construction or environmental impacts). In many cases, a project yields several categories of benefits (for example, travel time, safety, and environmental benefits), which are reflected in a number of measures (such as travel time savings, lower accident rates, and reduced emissions). While projects and the modes affected may vary, the benefit concepts generally are uniform and consistent.

Using a series of inputs required for each mode, TransValU estimates the benefits of transportation infrastructure projects or programs. These inputs and benefit categories are outlined below. Note that some benefit categories will not apply to all project modes.

Capital Costs and Operating & Maintenance Costs

Annual capital and operating & maintenance (O&M) costs for any given project are required as inputs to TransValU. Capital and O&M costs for the infrastructure project should be in constant dollars and include

all costs over the analysis period. Incorporating long-term O&M costs allows TransValU to capture the life-cycle cost impacts of a transportation investment.

Travel Time by Trip Purpose

The change in travel time by trip purpose measures aggregate time savings due to the project. Change in travel time is often the largest benefit of transportation improvements. It is typically based on changes in vehicle hours of travel (VHT) for highways (an output from travel demand models). Time savings are generated when an improvement reduces overall congestion, increases average speeds, improves reliability and reduces delays, or otherwise improves traffic flows. Aggregate time savings for transit, bicycle, and pedestrian modes are estimated on a per-user basis.

Every transportation facility has a different mix of travel purposes, and there are accepted dollar values of time that vary for each type of trip (business versus personal). Values of time are county-specific within TransValU, based on average wage rates and can be adjusted to reflect trip purpose for a corridor or transportation facility.

User / Travel Costs

Infrastructure improvements often generate changes in "out-of-pocket" user costs other than travel time. These changes occur for both passenger and freight investments through effects such as induced highway travel, reduced mileage due to more direct routes (change in vehicle miles traveled - VMT), or diversion to less expensive modes. For example, if more frequent bus service is implemented, diverting passengers from auto to bus, the diverted passengers reduce their vehicle O&M expenditures, as well as fuel consumption, by driving fewer miles. Even the transfer of a small percentage of traffic from auto to bus has the potential to yield benefits in the millions of dollars.

Safety

Safety benefits are measured as changes in vehicle crashes[2] and monetized using cost estimates in dollars per crash, by crash type.[3] Methods for estimating safety benefits for highway improvements as well as those that divert users from highways to safer modes are well established. Safety improvements are measured using the estimated change in the number and/or severity of accidents anticipated to occur with the infrastructure improvement. The change is often based on the change in VMT. If safety estimates from a more detailed analysis are available, they can be entered into TransValU.

Environmental

Environmental benefits are most commonly measured as changes in air pollutants and greenhouse gases. These changes can be either positive or negative, depending on the project's impact on overall VMT and the number of trips by mode.

The TransValU model uses different methods to evaluate emission rates depending on the type of project analyzed. One method estimates emission rates based on the EPA Motor Vehicle Emission Simulator (MOVES). These rates are specific to each county in Florida, as well as fuel and vehicle type. The second

[2] County and district-specific crash rates retrieved from Florida's Integrated Report Exchange System (FIRES).
[3] Crash costs per vehicle type follow US DOT BCA Guidance for Discretionary Grant Programs.

method estimates emission rates for transit vehicles, but not by region. This method uses FTA New Start data. Emissions are monetized using estimates of dollars per ton of emission based on US DOT guidance. Emissions measured include volatile organic compounds (VOC), carbon dioxide (CO_2), nitrogen oxide (NO_X), sulfur dioxide (SO_2), and particulate matter (PM).

Energy

Energy benefits reflect changes in fuel consumption. They may be generated from reduced trip length, modal shifts to less energy-intensive modes, or shifts to sustainable fuel sources. Energy benefits, when determined to be relevant and appropriate, are monetized using fuel efficiency estimates[4] for truck, auto, and bus; and costs per gallon of gasoline, diesel fuel, and diesel gallon equivalent of natural gas[5].

Economic Development

Economic development benefits can be an important factor for transportation investment due to cost savings, reliability and access improvements[6]. Caution, however, must be used when including them in BCA. The challenge to capturing economic development benefits in a BCA is that the benefits must: a) reflect net benefits for the project county/district selected, making sure not to count benefits that would replace economic activity in other areas of Florida; and b) reflect additional benefits that would not occur anyway and are not already "captured" with other transportation impacts. The specifics of economic development benefits vary by mode and are carefully classified to avoid double counting. Economic development in TransValU is captured for transit investments only, through changes in property value within a quarter-mile surrounding a new/enhanced transit station or new fixed-guideway hub.

Health Benefits from Increased Physical Activity

There are health benefits associated with cycling and walking given the physical exertion of the activities. A bicycle/pedestrian project that increases the level of cycling/walking will thus achieve an increase in health benefits. The value of cycling and walking is estimated on a per mile basis. [7]

Aesthetics and Trip Quality

In transportation, aesthetics and trip quality benefits are generally associated with two broad categories of projects or programs: (i) streetscaping and (ii) highway landscaping and beautification. Streetscaping refers specifically to improvements to urban roadway design and conditions, that may include changes to the roadway cross section, signage, sidewalk, landscaping (e.g., tree cover), street furniture, or building fronts. Benefits from streetscaping include improved walking and cycling experience, improved community cohesion and interactions, increased retail activity, and property values [8]. Highway landscaping and beautification refers to programs or projects aimed at restoring, preserving, or enhancing scenic beauty adjacent to highways. These programs include design approaches that provide for the

[4] Bureau of Transportation Statistics, "National Highway Transportation Statistics" 2011.
[5] Energy Information Administration, "Annual Energy Outlook."
[6] "Best Practice Methodology for Calculating Return on Investment for Transportation Programs and Projects," Prepared for the National Cooperative Highway Research Program: 8-36 Research for the AASHTO Standing Committee on Planning by Cambridge Systematics, Inc. in association with Economic Development Research Group, September 2008.
[7] New Zealand Transport Agency, "Economic Evaluation Manual (EEM)," January 1, 2016.
[8] VTPI "Streetscape Improvements, Enhancing Urban Roadway Design," September 10, 2014.

"appropriate aesthetics," as well as landscape design or plant materials around the facilities. Benefits from landscaping and beautification, in addition to aesthetic value, include prevention of roadside erosion, improved air quality, improved water quality (through the containment of storm-water runoffs), pollination, and conservation of scenery. Highway beautification may also increase the appeal and attractiveness of a community, and contribute to increased visitation and retail activity.

Aesthetics and trip quality benefits in TransValU can be estimated with empirical findings from a 2014 University of Florida study[9] focusing on the impacts of roadside vegetation. Additionally, for bicycle projects, improvements in aesthetics and trip quality can be monetized using the willingness-to-pay value for each type of bicycle facility.[10] For pedestrian projects, aesthetics and trip quality are captured by a willingness-to-pay value for improvements to street lighting, curb level, information panel, pavement evenness, directional signage, and benches.[11]

Reduction in External Costs of Travel

Bicycle and pedestrian projects that divert people from vehicles will help reduce some of the external costs associated with vehicle travel. Specifically, TransValU monetizes the reduction of the following external costs: pavement maintenance costs, congestion, vehicle crashes, noise pollution, and air pollution.

Additional Benefits for Freight Projects

In addition to the benefits described above, there are other benefits estimated in TransValU specifically for freight projects. These include reduced shipping, handling, and/or storage costs of goods due to congestion/improvement of an ILC, and reduced noise pollution from diverting truck trips to rail.

Section A.2 – Using TransValU for Benefit-Cost Analysis

The BCA Module for projects focused on passenger movements can be used to assess roadway, transit, bicycle and pedestrian, and multimodal. Roadway transportation projects focus on capacity enhancement projects (e.g., widening or adding lanes) and require travel demand model output data to develop the base case and project case scenarios. Travel demand results should include estimates for a base year, a future base case, and one or more future project case alternatives. Transit projects focus on new, improved, or extensions of bus and fixed guideway transit routes. Improvements at stations and transportation hubs that improve travel time can also be modeled. Bicycle and pedestrian projects focus on new or improved bicycle lanes and bike/pedestrian paths that will either improve travel time or divert travelers from other modes.

[9] Harrison, George L., "Economic Impact of Ecosystem Services Provided by Ecologically Sustainable Roadside Right of Way Vegetation Management Practices," University of Florida/IFAS, March 2014.

[10] Values come from various studies: Wardman, M., Tight, M. and Page, M., Factors influencing the propensity to cycle to work, Transportation Research Part A. Vol. 41, 2007, pp. 339-350; and Hopkinson, P and Wardman, M, Evaluating the demand for cycling facilities, Transport Policy Vol. 3 No. 4, 1996, pp. 241-249.

[11] Heuman D., P. Buchanan, M. Wedderburn, and R. Sheldon, Valuing Walking, Evaluating Improvements to the Public Realm, Association for European Transport and Contributors, August 2005.

It is recommended that users download and review OMB Circular A-94[12] and the US DOT BCA Guidance for Discretionary Grant Programs.[13] Both documents provide background information and resources for BCA.

Data Requirements

The minimum data requirements for BCA, by mode, are provided in Table 1 and in the BCA Data Needs tab within the Excel file. The table lists data requirements by project type. The inputs for "all modes" focus on project short-term and long-term costs (capital and O&M costs), as well as the project schedule. Roadway inputs focus on the required travel demand model outputs, including VMT and VHT. For roadway projects, the same geographic coverage should be used for estimation of VMT and VHT in the future base case and project case alternatives. The geographic extent depends on the travel shed of the project. For regionally significant projects, the Central Florida Regional Planning Model (CFRPM) coverage is recommended. Transit requirements focus on ridership, possible diversions, trip length, and time savings. Similarly, bicycle and pedestrian analyses require data on utilization (number of bicyclists or pedestrians), possible diversions, trip length, and time savings.

[12] OMB Circular A-94 Revised, http://www.whitehouse.gov/omb/circulars_a094/, October 29, 1992.

[13] US DOT BCA Guidance for Discretionary Grant Programs, https://cms.dot.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance , June 2018.

Table 1: Minimum BCA Data Requirements

Project Type	Input Data Requirements	Data Description
All modes	Capital costs	Annual estimates in constant 2017 dollars
	Incremental O&M costs	Annual estimates in constant 2017 dollars
	Project schedule	Beginning and end of investment period and year benefits begin accruing
	Useful life of investment	Number of years benefits will accrue due to investment
Roadway	Travel demand model output data	
	Vehicle Miles Traveled	Auto and truck VMT in the base and future years, with and without the project
	Vehicle Hours Traveled	Auto and truck VHT in the base and future years, with and without the project
	Crash analysis (optional override)	
	Expected change in number of crashes	Annual crash reduction by severity (KABCO scale)
	Safety analysis year	Year for which safety analysis was conducted
	Growth in number of avoided crashes	Annual growth in number of avoided crashes, in percent
Transit	Transit modes	Up to six transit modes to select from, with and without the project
	Daily ridership by mode	Number of trips per day, with and without the project
	Average trip length	Average length of a transit trip, in miles
	Percent trips during peak period	Percent of daily transit trips occurring during peak hours
	Daily transit Vehicle Miles Traveled	Daily transit VMT by mode, with and without the project, in miles
	Average in-vehicle transit time	Average time spent in a transit vehicle, in minutes per trip
	Average out-of-vehicle transit time	Average time spent accessing or waiting for transit, in minutes per trip
	Average fare	Average fare, in dollars per trip
Bicycle	Number of cyclists	Average number of (existing and new) cyclists per day
	Cyclists diverted from auto	Percent of new cyclists diverted from auto
	Annual growth in cyclists	Annual growth in number of cyclists, in percent
	Average trip length	Average length of a bicycle trip, in miles
	Change in travel time	Average time saving per trip for existing cyclists, in minutes
	Trip quality	Facility type with and without the project
Pedestrian	Number of pedestrians	Average number of (existing and new) pedestrians per day
	Pedestrians diverted from auto	Percent of new pedestrians diverted from auto
	Annual growth in pedestrians	Annual growth in number of pedestrians, in percent
	Average trip length	Average length of a walking trip, in miles
	Change in travel time	Average time saving per trip for existing pedestrians, in minutes
	Trip quality	Amenities available to pedestrians with the project
Beautification	Roadside vegetation	Additional acres of roadside vegetation, or
	Annual benefits	Estimate of average annual benefits developed outside TransValU

User Interface

The BCA Module of the TransValU workbook has eight user-enabled tabs, each devoted to specific tasks or functions. The following describes each tab of the module.

Parameters

The Parameters tab displays critical assumptions and data sources used by TransValU to estimate various benefits (see Figure 5 below). This tab includes units and source information for each parameter.

The following values can be directly adjusted by the user in this tab: the discount rate, various annualization factors, the average vehicle occupancy, and the share of personal and business travel.

Figure 5: Parameters Tab (screenshot)

Model Parameter Values Used in Analyses

All Monetized Estimates are in Constant Dollars of 2017

PARAMETER NAME	VALUE USED IN CALCULATIONS	RECOMMENDED VALUE	UNIT OF MEASUREMENT	REFERENCES & COMMENTS
OPTIONS FOR ANALYSIS				
First Year of Analysis	2018	2018	year	n/a
Base Year for all Monetization Assumptions	2017	2017	year	n/a
Real Discount Rate	4.0%	4.0%	% per year	US DOT BCA Guidance for Discretionary Grant Programs, December 2018
Real Discount Rate implicit in Social Cost of Carbon	7.0%	7.0%	% per year	US DOT BCA Guidance for Discretionary Grant Programs, December 2018
Annualization Factor	300	300	days	n/a
Annualization Factor for Bike/Ped Projects	300	300	days	n/a
Annualization Factor for Freight Projects	300	300	days	n/a
UNIT CONVERSIONS				
Kilograms per Short U.S. Ton	907.19	907.19	kg	n/a
Kilograms per Metric Ton	1,000	1,000	kg	n/a
VALUATION OF TRAVEL TIME SAVING				
Value of Time Estimates				
Personal Travel, all modes except Bike/Ped	$14.8	$14.8	$ per person-hour	US DOT BCA Guidance for Discretionary Grant Programs, December 2018
Business Travel, all modes except Bike/Ped	$26.5	$26.5	$ per person-hour	ibid
All Travel except by Bike/Ped Mode	$16.1	$16.1	$ per person-hour	Assumed equal to value for personal travel
		16.2		
Personal vs. Business Travel				
Share of Personal Travel in Total Travel	88.2%	88.2%	percent of total	US DOT BCA Guidance for Discretionary Grant Programs, December 2018
Share of Business Travel in Total Travel	11.8%	11.8%	percent of total	ibid
Hourly Earnings of Vehicle Operators				
Truck Drivers	$28.6	$28.6	$ per person-hour	US DOT BCA Guidance for Discretionary Grant Programs, December 2018
Bus Drivers	$30.0	$30.0	$ per person-hour	ibid
Locomotive Engineers	$44.9	$44.9	$ per person-hour	ibid
Year of Value of Time Estimates	2017	2017	year	n/a
Annual Growth in Real Value of Time	0.00%	0.00%	% per year	US DOT Guidance, September 2017
Average Daily Vehicle Occupancy				
Auto	1.68	1.68	persons per vehicle	US DOT BCA Guidance for Discretionary Grant Programs, December 2018
Trucks	1.00	1.00	persons per vehicle	ibid
Locomotives	2.00	2.00	engineers per train	Assumption

BCA Data Needs

This tab provides the input requirements for TransValU by mode and is identical to Table 1 above. The table is formatted for printing and can be used to collect data.

BCA Inputs

The BCA Inputs tab contains the input tables users are required to fill in before running a BCA. Users are not required to fill in every table. Rather, inputs in Table A (of BCA Inputs tab) will determine which of the remaining input tables must be completed for a particular project type. If a user is not required to complete an input table, the table's content will be hidden. The legend table in the top right corner displays the formatting conventions for input tables and results formats within TransValU, as shown in Figure 6 below.

The following describes each of the input tables a user may be required to complete when evaluating a particular project:

- **Table A – Project Information:** Table A focuses on project schedule information and adjusts parameters in TransValU based upon the user selections. Table A also determines other modal input tables into which the users must enter data.
- **Table B – Cost Information: Fill-In Cost Estimates for All Years:** Table B requires annual capital and O&M costs for all project types.
- **Table C1 – Roadway Transportation Data:** Roadway projects require travel demand model output data for Table C1.
- **Table C2 – Bicycle and Pedestrian Transportation Data:** Users enter data for bicycle and pedestrian projects into Table C2.
- **Table C3 – Public Transportation Data:** Table C3 requires transit-related transportation data for bus or fixed guideway transit projects.
- **Table D – Optional Crash Reduction Estimates, Override Parameters:** Table D is for roadway projects only, and enables users to enter crash estimates from supplemental analysis, if available, into TransValU.
- **Table E – Aesthetics & Other Ecosystem Services Provided by Roadside Improvements:** Table E is for highway beautification and/or streetscaping projects.
- **Table F – (Optional) Daily Vehicle Miles Traveled, by Speed Bin**: Table F is for roadway projects and is optional. If the user has VMT data by speed bin (obtained from a travel demand model), then the tool can perform a more detailed vehicle operating cost calculation. This table can be left blank if the data is not available.

Additionally, detailed pop-up messages and table labels were created to direct users through the input process. Optional and override data tables are included to allow users to override some of the model's direct estimates, like crash rates, when more information is available. See Table 1 in the previous section for specific minimum input requirements by mode.

A portion of the BCA Inputs tab with sample data is shown below in Figure 6.

Figure 6: BCA Inputs Tab (screenshot)

Transportation Inputs for BCA of Multimodal Corridor Improvements

Review BCA Calculations

A - PROJECT INFORMATION

Project / alternative name	Highway Example
Construction start year	2015
Construction end year	2022
Investment useful life	30 years
Base model year	2010
Forecast model year	2035
Project opening year	2020
Scenario #	1
Select county or district	District 5
Select area type	Urban
Select roadway access type	Restricted
Project type	Roadway

LEGEND	
Drop-Down Box	
User Input Field	
Sum or Total Value	*Number*

B - COST INFORMATION: FILL-IN COST ESTIMATES FOR ALL YEARS	1	2	3	4	5	6
	2015	2016	2017	2018	2019	2020
Capital costs	$70,646,571	$209,111,720	$237,112,181	$288,446,430	$423,651,031	$259,781,703
Incremental Operating & Maintenance costs				$1,515,912	$6,316,299	$7,444,449
Total capital costs, $	***$1,646,875,611***					
Total incremental O&M costs, $	***$204,638,185***					

C1 - ROADWAY TRANSPORTATION DATA

	Base Year 2010	WITHOUT PROJECT Forecast Year 2035	WITH PROJECT Forecast Year 2035
Automobiles			
Daily Vehicle Miles Traveled	46,256,898	87,594,429	87,973,524
Daily Vehicle Hours Traveled	1,672,871	6,503,309	6,467,248
Trucks			
Daily Vehicle Miles Traveled	5,139,655	9,732,714	9,774,836
Daily Vehicle Hours Traveled	185,875	722,590	718,583
Additional Roadway Parameters			
Roadway type	Freeway		
Free-flow speed, mph	55.0		
Do O&M costs (Row 22) include pavement maintenance?	Yes		

BCA Calculations for Bike & Pedestrian

The BCA Calculations for Bike & Pedestrian tab includes the benefit calculations for projects with bicycle and/or pedestrian elements. Blue horizontal lines separate calculations for bicycle and pedestrian projects. Benefits are calculated over the analysis period of the project. Bike and pedestrian benefits are used on the BCA Calculations tab to aggregate total project benefits and compare these with total project capital and O&M costs for all project elements.

BCA Calculations for Transit

The BCA Calculations for Transit tab estimates the benefits of a bus, express bus, BRT, heavy rail, light rail/streetcar, or commuter rail projects. Benefits are calculated by year and aggregated over the analysis period. Dark blue horizontal lines separate the categories of benefits estimated. For each benefit category, calculations are made for the without project (indicated by horizontal light blue lines) and the with project (indicated by horizontal purple lines) scenarios. The relative benefits of the project are estimated for each benefit category, and used on the BCA Calculations tab to aggregate total project benefits and compare these with total project capital and O&M costs for all project elements.

BCA Calculations

The BCA Calculations tab calculates annual and aggregate values for all cost and benefit categories estimated by TransValU based upon the input data. The tab also links to the Benefits from the BCA Calculations for Bike & Pedestrian tab to include benefits for these projects. Each set of benefits and costs are separated by blue horizontal lines. In some cases, intermediate calculations (non-monetized) are also

included—for example, the change in tons of emissions or the change in VMT and VHT. The tab, as shown below in Figure 7, includes the total benefits and costs in present value (PV), benefit/cost ratio (BCR), and internal rate of return. Please note that while some benefits may be calculated in the BCA Calculations tab, they might not be used in the final BCA calculations to avoid double counting.[14]

Figure 7: BCA Calculations Tab (sample screenshot)

Benefit-Cost Analysis Calculations

View BCA Results

			Year	2015	2016	2017	2018
			Year Index	1	2	3	4
		30	Operations Index	0	0	0	0
		Discount Rate:	4.0%	1.000	0.962	0.925	0.889
		Discount Rate for SCC:	3.0%	1.000	0.971	0.943	0.915
KEY ASSUMPTIONS FROM DASHBOARD							
Project name	Example for Testing						
County or district average	District 1						
Region type	Urban						
Roadway type	Unrestricted						
Average vehicle occupancy	1.60						
INVESTMENT COSTS							
Project Cost Estimates							
Total capital costs			$ 1,488,749,634	$ 70,646,571	$ 209,111,720	$ 237,112,181	$ 288,446,430
Total incremental O&M costs			$ 285,793,124	$ -	$ -	$ -	$ 1,515,912
TRANSPORTATION DATA BY MODE							
Roadway Users							
Changes in Vehicle Miles Traveled							
Automobiles			3,881,649,198	-	-	-	-
Trucks			431,294,355	-	-	-	-
Changes in Vehicle Hours Traveled							
Automobiles			(436,631,772)	-	-	-	-
Trucks			(48,514,641)	-	-	-	-
ESTIMATION OF BENEFITS							
BENEFIT-COST ANALYSIS RESULTS							
Total Project Costs							
Capital costs			$ 970,000,000	$ 70,000,000	$ 200,000,000	$ 300,000,000	$ 200,000,000
O&M costs			$ 300,000,000	$ -	$ -	$ -	$ -
Total project costs			$ 1,270,000,000	$ 70,000,000	$ 200,000,000	$ 300,000,000	$ 200,000,000
Total project costs in PV			$ 1,027,274,867	$ 70,000,000	$ 192,307,692	$ 277,366,864	$ 177,799,272
Total Project Benefits							
** Travel time savings	$ 1,375,176,916		$ 1,375,176,916	$ -	$ -	$ -	$ -
Fuel cost savings	$ 393,929,445		$ 393,929,445	$ -	$ -	$ -	$ -
Other vehicle O&M cost savings	$ 172,471,136		$ 172,471,136	$ -	$ -	$ -	$ -
Fare cost savings	$ 10,540,440		$ 10,540,440	$ -	$ -	$ -	$ -
Parking cost savings	$ 5,536,769		$ 5,536,769	$ -	$ -	$ -	$ -
*** Additional cost savings to new transit users	$ -		$ -	$ -	$ -	$ -	$ -
Emission cost savings, Carbon Dioxide	$ 5,908,132		$ 5,908,132	$ -	$ -	$ -	$ -
** Emission cost savings, Other Pollutants	$ (1,741,497)		$ (1,741,497)	$ -	$ -	$ -	$ -
** Safety benefits	$ 465,493,626		$ 465,493,626	$ -	$ -	$ -	$ -
** Pavement maintenance cost savings	$ (12,239,014)		$ (12,239,014)	$ -	$ -	$ -	$ -
Economic development benefits	$ -		$ -	$ -	$ -	$ -	$ -
Health benefits of increased physical activity	$ 51,156,755		$ 51,156,755	$ -	$ -	$ -	$ -
Improvements to trip quality	$ 9,947,298		$ 9,947,298	$ -	$ -	$ -	$ -
Aesthetics & other roadside improvements	$ 16,176,000		$ 16,176,000	$ -	$ -	$ -	$ -
Total project benefits	$ 2,492,356,006		$ 2,492,356,006	$ -	$ -	$ -	$ -
Total project benefits in PV			$ 2,042,623,846	$ -	$ -	$ -	$ -
*** inc. reduction in external costs of auto use from diversion to bike/ped or transit*							
**** in situations where there is NO transit service in the project area without the project*							
Comparison of Benefits and Costs							
Benefit-Cost Ratio			1.99				
Net monetized benefits and costs			$ 1,222,356,006	$ (70,000,000)	$ (200,000,000)	$ (300,000,000)	$ (200,000,000)
Net monetized benefits and costs in PV			$ 1,015,348,979	$ (70,000,000)	$ (192,307,692)	$ (277,366,864)	$ (177,799,272)
Cumulative net monetized benefits and costs in PV			$ (2,510,714,566)	$ (70,000,000)	$ (262,307,692)	$ (539,674,556)	$ (717,473,828)
Breakeven year, based on discounted values			2036				
Internal Rate of Return			4.0%				

[14] TransValU has a series of conditional equations that determine which benefits and costs are used in the final estimation in order to avoid double counting and to provide consistent results.

BCA Results

The BCA Results tab contains summary-level report tables. The primary table focuses on the BCA results, displaying total benefits and costs by category over the useful life of the project, as shown in Figure 8. All tables and figures can be copied to external spreadsheets.

The following provides a brief description of each table:

- **BCA Results Table:** This table contains benefit and cost estimates by category, aggregate costs and benefits in present value, and the Benefit/Cost Ratio.
- **Key Model Parameters & Assumptions:** This table shows different user selected inputs and parameters from the BCA Inputs tab. These are reported to users to show the input differences across multiple scenarios.

Figure 8: BCA Results Tab (sample screenshot)

Benefit-Cost Analysis Results

Multi-Project Results

Select Unit for Display: Millions of $2015

Scenario 1: Example for Testing

Real Discount Rate: 4.0%

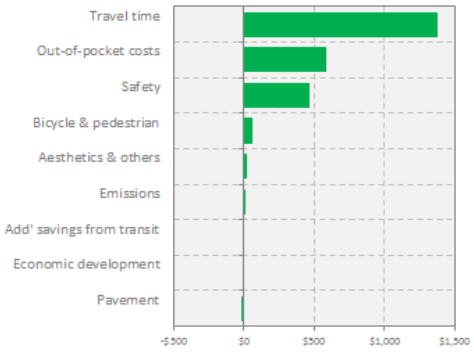
PROJECT BENEFITS	Millions of $2015	Value	Units
Travel time savings	**$1,375.2**		
Automobiles	$1,178.9	51.7	Millions of Vehicle-Hours
Trucks	$140.3	5.2	Millions of Vehicle-Hours
Transit Users	$50.3	3.6	Millions of Person-Hours
Cyclists & Pedestrians	$5.6	0.4	Millions of Person-Hours
Out-of-pocket cost savings	**$582.5**		
Fuel cost savings	**$393.9**		
Gasoline	$404.7	(123.0)	Millions of Gallons
Diesel	($10.8)	2.6	Millions of Gallons
Other vehicle operating cost savings	**$172.5**		
Automobiles	$206.9		
Trucks	($34.5)		
Bicycles	$0.0		
Reductions in fare payments	**$10.5**		
Parking cost savings	**$5.5**		
Additional savings to new transit users	$0.0		
Emission cost savings	**$4.2**		
NOX	($0.6)	170.2	Tons
CO2	$5.9	(96,360.0)	Tons
VOC	$0.0	(22.9)	Tons
PM	($1.2)	8.2	Tons
SO2	$0.0	(0.7)	Tons
Safety benefits	**$465.5**	480	Crashes
Pavement maintenance cost savings	**($12.2)**		
Economic development around transit stations	$0.0		
Health benefits of increased physical activity	**$51.2**	145,265	New Bike/Ped Trips per Year
Improvements to trip quality	**$9.9**		
Aesthetics & other roadside improvements	**$16.2**	100.0	Acres of Vegetation
TOTAL PROJECT BENEFITS	**$2,492.4**		
Present Value of Total Benefits	**$2,042.6**		

PROJECT COSTS	
Incremental O&M costs	$300.0
Capital costs	$970.0
TOTAL PROJECT COSTS	**$1,270.0**
Present Value of Total Costs	**$1,027.3**

SUMMARY RESULTS	
Net Present Value	**$1,015.3**
Benefit-Cost Ratio	**1.99**
First Year Project Breaks Even*	**2036**
Overall Rate of Return	**4.0%**

** Discounted Payback Period = 21 years*

SOCIAL BENEFITS OF PUBLIC TRANSPORTATION	
Avoided Expenditures on Public Assistance	$0.0



BCA Multi-Project Results

The BCA Multi-Project Results tab includes the same information provided in the BCA Results tab, as shown in Figure 9 below. To compare multiple projects or alternatives, once a scenario is complete, users should press the "Save Results" button in cell C1. TransValU will then save the current results to the right of any other saved results.

Please note that users may need to enable macros for this feature to work properly. A maximum of 10 scenarios can be saved. Users can delete saved results by highlighting any column (except Columns A through F) and pressing the delete button.

Figure 9: BCA Multi-Project Results Tab (sample screenshot)

DELETE All Saved Results | Save ACTIVE Results

	Scenario 1: Example for Testing			Scenario 1: Example for Testing		
Real Discount Rate: 4.0%				4.0%		
BENEFIT ESTIMATES	**Millions of $2015**	**Value**	**Units**	Millions of $2015	Value	Units
Travel time savings	$1,375.2			$1,375.2		
Automobiles	$1,178.9	51.7	Millions of Vehicle-Hours	$1,178.9	51.7	Millions of Vehicle-Hours
Trucks	$140.3	5.2	Millions of Vehicle-Hours	$140.3	5.2	Millions of Vehicle-Hours
Transit Users	$50.3	3.6	Millions of Person-Hours	$50.3	3.6	Millions of Person-Hours
Cyclists & Pedestrians	$5.6	0.4	Millions of Person-Hours	$5.6	0.4	Millions of Person-Hours
Out-of-pocket cost savings						
Fuel cost savings	$393.9			$393.9		
Gasoline	$404.7	(123.0)	Millions of Gallons	$404.7	(123.0)	Millions of Gallons
Diesel	($10.8)	2.6	Millions of Gallons	($10.8)	2.6	Millions of Gallons
Other vehicle operating cost savings	$172.5			$172.5		
Automobiles	$206.9			$206.9		
Trucks	($34.5)			($34.5)		
Bicycles	$0.0			$0.0		
Transit fare payments	$10.5			$10.5		
Parking cost savings	$5.5			$5.5		
Additional savings to new transit users	$0.0			$0.0		
Emission cost savings	$4.2			$4.2		
NOX	($0.6)	170.2	Tons	($0.6)	170.2	Tons
CO2	$5.9	(96,360.0)	Tons	$5.9	(96,360.0)	Tons
VOC	$0.0	(22.9)	Tons	$0.0	(22.9)	Tons
PM	($1.2)	8.2	Tons	($1.2)	8.2	Tons
SO2	$0.0	(0.7)	Tons	$0.0	(0.7)	Tons
Safety benefits	$465.5	480.0	Crashes	$465.5	480.0	Crashes
Pavement maintenance cost savings	($12.2)			($12.2)		
Economic development around transit stations	$0.0			$0.0		
Health benefits of increased physical activity	$51.2	145,265	New Bike/Ped Trips per Year	$51.2	145,265.5	New Bike/Ped Trips per Year
Improvements to trip quality	$9.9			$9.9		
Aesthetics & other roadside improvements	$16.2	100.0	Acres of Vegetation	$16.2	100.0	Acres of Vegetation
TOTAL BENEFITS	$2,492.4			$2,492.4		
Present Value of Total Benefits	$2,042.6			$2,042.6		
COST ESTIMATES						
Incremental O&M costs	$300.0			$300.0		
Capital costs	$970.0			$970.0		
TOTAL COSTS	$1,270.0			$1,270.0		
Present Value of Total Costs	$1,027.3			$1,027.3		
SUMMARY RESULTS						
Net Present Value	$1,015.3			$1,015.3		
Benefit-Cost Ratio	1.99			1.99		
First Year Project Breaks Even*	2036			2036		
Overall Rate of Return	4.0%			4.0%		

** Discounted Payback Period = 21 years*

Navigating the Tool

All equations, databases, and critical aspects of the TransValU model are locked or hidden to avoid unintended modifications. This will provide continuity between model runs and various users. Users should always maintain at least one clean copy of the model in a separate folder(s). Every time a new project is initiated, the user should take a clean copy of the model, save to a separate folder and rename the file – preferably including the date and project name.[15] The following sections provide a detailed description and walk through of the BCA tabs.

Parameters Tab

The Parameters tab allows users to view key assumptions and model parameters that are used in the BCA. All transportation, emission, value of time, crash, bicycle/pedestrian, and freight parameters have units and sources listed in fields in Columns D, and E. The model's default values are located in Column C, whereas the values used by the model are in Column B. The values in Column B may differ from the default values based on user selections in the BCA Inputs tab, which automatically adjusts various parameters.

The parameters in Column B can be modified by the user. These are currently set to industry standards, and should only be adjusted if the user has better information available. The parameters the user can directly adjust in the Parameters tab[16] are:

1. **Discount Rate:** FDOT recommends using a real discount rate of 4 percent to evaluate projects in the state.[17] The default value is set to 4 percent.
2. **Annualization Factor/ Annualization Factor for Freight Projects:** This factor is used to convert daily VMT and VHT to annual estimates. It should be in the neighborhood of 300 days. The annualization factor should only be adjusted to match the factor used in producing the daily estimates and/or assumed in the travel demand model.
3. **Annualization Factor for Bike/Ped Projects:** This factor is used to convert daily bike and/or pedestrian trips to annual estimates. It should be in the neighborhood of 300 days. This can be adjusted based on seasonality of cycling/walking.
4. **Average Vehicle Occupancy:** The default vehicle occupancy rate in TransValU is 1.39 persons per auto, 1.0 person per truck, and 2.0 engineers per train. These estimates are based on a 2016 Highway Statistics report prepared by the Federal Highway Administration, and recommended in the 2018 US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs. This value should only be adjusted if regional vehicle occupancy data are available.
5. **Share of Personal versus Business Travel:** The default percentage of personal and business travel is taken from the USDOT Revised Departmental Guidance on Valuation of Travel Time in Economic

[15] Consistent folder and file naming conventions should help avoid confusing different TransValU project analyses and preserve the clean copy.

[16] Other parameters are calibrated through choices in the BCA Inputs tab, for example, area choices will calibrate wages and emissions.

[17] FDOT, "Macroeconomic Analysis of Florida's Transportation Investments". January 2015. Appendix B-6. Accessed on 12/29/2016 at: http://www.fdot.gov/planning/policy/economic/macroimpacts0115.pdf.

Analysis. However, if the user has data on the personal and business trips specific to the region then these values may be updated in the tool.

As a precaution, these values are identified in the output tables so that users can compare input data and assumptions across various analyses. Users can then determine if these assumptions are consistent or if the parameter adjustments are responsible for the differences in the results.

BCA Data Needs Tab

The BCA Data Needs tab shows a table of the data required to run the BCA Module in TransValU. No action is required from the user on this tab. A copy of the data needs table is provided in the User Guide in Table 1.

BCA Inputs Tab

The BCA Inputs tab is where users will enter all relevant schedule, cost, and transportation data. The tab contains eight tables for the user to fill out, some of which are optional. Each table is either devoted to cost data, specific mode information, or optional override parameters. The step-by-step instructions below will enable users to perform a BCA of a roadway, transit, bicycle or pedestrian transportation project. Additionally, the legend table in the top right corner (cells F6 through G9) displays the formatting conventions for input tables and results formats within TransValU. Similar to a map legend, this tab will provide the user with an understanding of what the different colors in TransValU denote. These formatting conventions within the remaining TransValU tabs will prompt users to enter data, select parameters from a drop-down box, or tell the user if values represent an aggregate estimate over the project period versus an annual estimate. Additionally, the button in the top left corner is a hyperlink shortcut to the BCA Calculations tab.

Table A (in BCA Inputs tab) provides the TransValU model with critical schedule and project timeline information and adjusts parameters in the BCA Module. All scheduling information must be entered to ensure that the model calculations are consistent throughout.

Table A – Part 1 (light blue cells): Project Information

1. **Project / alternative name:** Enter the project and/or alternative name (cell B6). This name will be used in the results tabs to identify the alternative by name.
2. **Construction start year:** Enter the start of the construction or investment period. This information is required for all modes.
3. **Construction end year:** Enter the end of the construction or investment period. This information is required for all modes.
4. **Investment useful life:** The useful life of the investment represents the number of years the investment will provide benefits to users; most transportation investments should have a useful life of at least 20 years.

5. **Base model year:** The validated base model year is only required for roadway projects (and transit projects with bus VMT and VHT estimates). Enter the year in a four-digit year format that corresponds to the baseline year of the travel demand model output data.
6. **Forecast model year:** This is only required for roadway projects (and transit projects with bus VMT and VHT estimates). This year is the same as the future baseline and future alternative model years in the travel demand model output data.
7. **Project opening year:** Benefits can begin accruing before the end of the investment period or completion of construction. This year must be entered in cell B12; otherwise, the model will not calculate any benefits.

Table A – Part 2 (dark blue cells): Project Information

1. **Scenario #:** Select a scenario number from the drop-down list in cell B13. Like the project name, this scenario number is a user-identified parameter that will be used in the results tabs to identify projects.
2. **Select county or district:** Select a county in District Five, or one of the seven Florida districts (cell B14). The model uses this information to tailor inputs by geography, such as emission factors, and crash rates. If the project overlaps multiple counties within District Five, it is recommended to use the District Five average.
3. **Select area type:** Select whether the region type is urban or rural (cell B15). The region type must be filled in for any project that is expected to result in the diversion of travelers from automobiles. This designation is used by the model to select project specific vehicle emissions rates.
4. **Select roadway access type:** Select roadway access type (restricted or unrestricted) in cell B16. The roadway access type works in concert with the region type and must be filled out for roadway projects or any project where travelers are diverted from automobiles. This input is also used by the model to select project-specific vehicle emission rates.
5. **Project type:** The selection of the project type determines the input data required for the BCA.
    a. "Bicycle & Pedestrian" projects require Table C2 be completed.
    b. "Transit" projects require Table C3 be completed.
    c. "Roadway" projects require that portions of Table C1 be completed.
    d. "Multi-modal" will enable all project type tables.

A completed sample of Table A is shown below in Figure 10. Once the fields are entered in Table A, for the specific mode being evaluated, proceed to Table B, Cost Information.

Figure 10: Sample Table A Project Investment Period for BCA

A - PROJECT INFORMATION	
Project / alternative name	Highway Example
Construction start year	2019
Construction end year	2022
Investment useful life	30 years
Base model year	2010
Forecast model year	2035
Project opening year	2023
Scenario #	1
Select county or district	District 5
Select area type	Urban
Select roadway access type	Restricted
Project type	Roadway

Table B – Cost Information

1. **Capital costs:** Enter the capital expenditures for each year into the cells in row 21. Once all capital cost information is entered in row 21, proceed to the O&M costs. Dollars should be entered in real terms. The total investment costs will be displayed in cell B23.
2. **O&M costs:** Enter the net operating and maintenance costs in row 22. Specifically, the annual amount entered for O&M should be the difference in O&M costs between the project case and base case for each year of the study period. Typically, infrastructure investments have an O&M schedule with costs occurring in intervals ranging from annually to every fifth or tenth year. Accurate depictions of O&M costs will improve the precision of the BCA. Dollars should be entered in real terms.

A completed sample of Table B is shown below in Figure 11. Once the cost information is entered in Table B, proceed to the appropriate modal tables depending upon the analysis you are performing. Input labels will only appear in the tables if a user is required to provide that specific information. Otherwise, the table or table cells will remain blank.

Figure 11: Sample Table B Cost Information for BCA

B - COST INFORMATION: FILL-IN COST ESTIMATES FOR ALL YEARS	1	2	3	4	5
	2015	2016	2017	2018	2019
Capital costs	$70,646,571	$209,111,720	$237,112,181	$288,446,430	$423,651,031
Incremental Operating & Maintenance costs				$1,515,912	$6,316,299
Total capital costs, $	***$1,646,875,611***				
Total incremental O&M costs, $	***$204,638,185***				

As discussed in the Table A description (Part 2, step 5), the project type (e.g., "Roadway" "Bicycle & Pedestrian," "Transit," or "Multi-modal") must be selected in the project type field (cell B17). Before inputting travel data in Table C1, ensure that the table displays the correct years for the base year, without project forecast year, and with project forecast year data in the table header. If the years do not coincide with the travel demand model output years, return to Table A Part 1 and repeat steps 5 and 6 by entering the correct values for the "Base Model Year" and the "Forecast Model Year." Additionally, make sure that the traffic data entered is for the selected years and that the base case and project case data is for the same geographic area.

Table C1 – Roadway Data

The roadway data table requires network level VMT and VHT for auto and truck, which can be obtained from the travel demand analysis. In certain instances, the analysis may show that changes in VMT and VHT may not be produced by the investment (for example operational improvements) and supplemental analysis may be required.

1. Automobiles
    a. **Daily Vehicle Miles Traveled:** Daily estimates for auto VMT must be entered for the base case, without project forecast year, and with project forecast year (cells B30, C30, and D30).
    b. **Daily Vehicle Hours Traveled:** Daily estimates for auto VHT must be entered for the base case, without project forecast year, and with project forecast year (cells B31, C31, and D31).
2. Trucks
    a. **Daily Truck Miles Traveled:** Daily estimates for truck VMT must be entered for the base case, without project forecast year, and with project forecast year (cells B33, C33, and D33).
    b. **Daily Truck Hours Traveled:** Daily estimates for truck VHT must be entered for the base case, without project forecast year, and with project forecast year (cells B34, C34, and D34).
3. Additional roadway parameters
    a. **Roadway type:** Select from a dropdown list of roadway types, including freeway or arterial. This information is used to calculate the volume-to-capacity ratio in the base case and project case.
    b. **Free flow speed, mph:** Enter the average network free flow speed. This will also calibrate the volume-to-capacity ratio used in the estimation of travel time reliability.
    c. **Do O&M costs (Row 22) include pavement maintenance?** If the O&M costs entered into Table B include pavement maintenance cost, select yes. TransValU will then exclude the pavement maintenance benefits.

A completed sample of Table C1 is shown below in Figure 12.

Figure 12: Sample Table C1 Roadway Transportation Data for BCA

C1 - ROADWAY TRANSPORTATION DATA			
	Base Year 2010	WITHOUT PROJECT Forecast Year 2035	WITH PROJECT Forecast Year 2035
Automobiles			
Daily Vehicle Miles Traveled	46,256,898	87,594,429	87,973,524
Daily Vehicle Hours Traveled	1,672,871	6,503,309	6,467,248
Trucks			
Daily Vehicle Miles Traveled	5,139,655	9,732,714	9,774,836
Daily Vehicle Hours Traveled	185,875	722,590	718,583
Additional Roadway Parameters			
Roadway type	Freeway		
Free-flow speed, mph	55.0		
Do O&M costs (Row 22) include pavement maintenance?	Yes		

Table C2 – Bicycle & Pedestrian Transportation Data

Selecting "Bicycle and Pedestrian" or "Multi-modal" in Table A (Part 2, step 5) will display the input fields for Table C2. Table C2 is devoted to estimating benefits for bicycle and pedestrian projects. Since these modes have similar data requirements, the steps below apply to modeling both bicycle and pedestrian projects. Benefits will be estimated for existing and new users.

Additional Project Information

1. **Bike/Ped Project Component Opening Year**: Enter the opening year of the bike/pedestrian improvement portion of the project (cell B42).
2. Are Bike/Ped-induced changes in VMT reflected in roadway data? Select "Yes" or "No" (cell B43).

Bicycle Trips

3. Daily Usage in Project Opening Year
    a. **Number of bicycle trips, # per day**: Enter the daily number of trips without the project (cell B47) and with the project (cell C47).
    b. **Number of NEW trips (calculated), # per day**: Tool automatically calculates the number of new trips with project (cell C48).
    c. **Percent of two-way trips in total trips, %**: Enter the percentage of total trips that are round-trips (cell C49).
    d. **Number of NEW users (calculated), #**: Tool automatically calculates the number of new cyclists with project (cell C50).
    e. **Percent of NEW trips for recreation purpose, %**: Enter the percentage of new trips taken for recreation (cell C51).
4. **Annual Growth in Number of Trips, % per year**: Enter the percent growth rate of trips per year without project (cell B52) and with project (cell C52).
5. **Average Trip Length, miles**: Enter the average trip length, in miles, without the project (cell B53) and with the project (cell C53).
6. **Portion of Trip Length on Improved Facility, %**: Enter the percentage of the average trip length that will occur on the new bike facility (cell C54).
7. Sources of New Trips (non-recreation trips only):
    a. **Percent of trips diverted from auto, %**: Enter the portion of bike trips in the with project scenario that will be diverted from auto (cell C56).
    b. **Percent of trips diverted from other modes, %**: Enter the portion of bike trips in the with project scenario that will be diverted from other modes (cell C57).
8. **Time Savings to Existing Users, minutes per trip**: Enter the average number of minutes saved per trip due to the new bike facility (cell C58).

9. **Trip Quality - Change in Facility Type (select one facility type in each case)**: Select "Yes" or "No" to indicate the change in each facility type. Cell text will grey out for each element where "No" is selected.
    a. **No bicycle facility**: Select "Yes" or "No" for the scenario with project (cell B60) and without project (cell C60).
    b. **Off-road segregated bicycle track**: Select "Yes" or "No" for the scenario with project (cell B61) and without project (cell C61).
    c. **On-road segregated bicycle lane**: Select "Yes" or "No" for the scenario with project (cell B62) and without project (cell C62).
    d. **On-road non-segregated bicycle lane**: Select "Yes" or "No" for the scenario with project (cell B63) and without project (cell C63).
    e. **Wider lane**: Select "Yes" or "No" for the scenario with project (cell B64) and without project (cell C64).
    f. **Shared bus lane**: Select "Yes" or "No" for the scenario with project (cell B65) and without project (cell C65).
    g. **Other**: Select "Yes" or "No" for the scenario with project (cell B66) and without project (cell C66).

Pedestrian Trips

10. Daily Usage in Project Opening Year
    a. **Number of pedestrian trips, # per day**: Enter the daily number of pedestrian trips without the project (cell B70) and with the project (cell C70).
    b. **Number of NEW trips (calculated), # per day**: Tool automatically calculates the number of new trips with project (cell C71).
    c. **Percent of two-way trips in total trips, %**: Enter the percentage of total trips that are round-trips (cell C72).
    d. **Number of NEW users (calculated), #**: Tool automatically calculates the number of new pedestrians with project (cell C73).
    e. **Percent of NEW trips for recreation purpose, %**: Enter the percentage of new trips taken for recreation (cell C74).
11. **Annual Growth in Number of Trips, % per year**: Enter the percent growth rate of trips per year without project (cell B75) and with project (cell C75).
12. **Average Trip Length, miles**: Enter the average trip length, in miles, without the project (cell B76) and with the project (cell C76).
13. **Portion of Trip Length on Improved Facility, %**: Enter the percentage of the average trip length that will occur on the new pedestrian facility (cell C77).

14. Sources of New Trips (non-recreation trips only):
    a. **Percent of trips diverted from auto, %:** Enter the portion of pedestrian trips in the with project scenario that will be diverted from auto (cell C79).
    b. **Percent of trips diverted from other modes, %**: Enter the portion of pedestrian trips in the with project scenario that will be diverted from other modes (cell C80).
15. **Time Savings to Existing Users, minutes per trip**: Enter the average number of minutes saved per trip due to the new pedestrian facility (cell C81).
16. **Trip Quality - Pedestrian Amenities ADDED by Project (select all that apply)**: Select "Yes" or "No" to indicate the change in each facility type. Cell text will grey out for each element where "No" is selected.
    a. **Street lighting**: Select "Yes" or "No" depending on whether or not project will add/improve this amenity (cell C83).
    b. **Curb level**: Select "Yes" or "No" depending on whether or not project will add/improve this amenity (cell C84).
    c. **Information panel**: Select "Yes" or "No" depending on whether or not project will add/improve this amenity (cell C85).
    d. **Pavement evenness**: Select "Yes" or "No" depending on whether or not project will add/improve this amenity (cell C86).
    e. **Directional signage**: Select "Yes" or "No" depending on whether or not project will add/improve this amenity (cell C87).
    f. **Benches**: Select "Yes" or "No" depending on whether or not project will add/improve this amenity (cell C88).

A portion of Table C2 is shown below in Figure 13 with sample data provided for illustration purposes. Once the fields in Table C2 are filled in for bicycle, pedestrian, or both, proceed to Table C3 to enter required data for public transportation projects (if applicable).

Figure 13: Sample Table C2 Bicycle and Pedestrian Data for BCA

C2 - BICYCLE & PEDESTRIAN TRANSPORTATION DATA		
PROJECT INFORMATION		
Bike/Ped project component opening year	2020	
Are bike/ped-induced changes in VMT reflected in roadway data?	No	
BICYCLE TRIPS	**WITHOUT PROJECT**	**WITH PROJECT**
Daily Usage in Project Opening Year		
Number of bicycle trips, # per day	1,000	1,200
Number of NEW trips (calculated), # per day		200
Percent of two-way trips in total trips, %		90.0%
Number of NEW users (calculated), #		110
Percent of NEW Trips for Recreation Purpose, %		40.0%
Annual Growth in Number of Trips, % per year	1.0%	1.0%
Average Trip Length, miles	5.00	5.00
Portion of Trip Length on Improved Facility, %		60.0%
Sources of New Trips (non-recreation trips only)		
Percent of trips diverted from auto, %		50.0%
Percent of trips diverted from other modes, %		0.0%
Time Saving to Existing Users, minutes per trip		2.5
Trip Quality - Change in Facility Type	***Select one facility type in each case***	
No bicycle facility	Yes	No
Off-road segregated bicycle track	No	No
On-road segregated bicycle lane	No	Yes
On-road non-segregated bicycle lane	No	Yes
Wider lane	No	No
Shared bus lane	No	No
Other	No	No
PEDESTRIAN TRIPS	**WITHOUT PROJECT**	**WITH PROJECT**
Daily Usage in Project Opening Year		
Number of pedestrian trips, # per day	50	70
Number of NEW trips (calculated), # per day		20
Percent of two-way trips in total trips, %		50.0%
Number of NEW users (calculated), #		15
Percent of NEW Trips for Recreation Purpose, %		70.0%
Annual Growth in Number of Trips, % per year	0.0%	0.0%
Average Trip Length, miles	1.00	1.00
Portion of Trip Length on Improved Facility, %		60.0%
Sources of New Trips (non-recreation trips only)		
Percent of trips diverted from auto, %		10.0%
Percent of trips diverted from other modes, %		0.0%
Time Saving to Existing Users, minutes per trip		3.0

Table C3 – Public Transportation Data

Selecting "Transit" in Table A (Part 2, step 5) will display the input fields for Table C3. Table C3 is devoted to estimating benefits for new and existing users of transit due to improvements to the transit system. Benefits will be estimated for existing and new users.

Existing riders will only receive travel time savings while new or diverted users may also benefit from reduced fuel costs, reduced vehicle operating and maintenance costs, and safety benefits.

1. Project information:

a. **Transit investment type**: Select from a dropdown menu whether the project is an "Improvement to an existing mode," an "Investment in a new mode," or an "Investment in a new service."

b. **EXISTING transit mode**: If the user selected either "Improvement to an existing mode," or "Investment in a new mode" in Table C3 Part 1 step a, the user should then select the existing mode type from a dropdown menu of mode type options. If the user selected "Investment in a new service" in Table C3 Part 1 step a, he or she will need to select "None" for the existing transit mode.

c. **NEW transit mode or service**: If the user selected either "Investment in a new mode" or "Investment in a new service" in Table C3 Part 1 step a, he or she must select what the new mode or service is from a dropdown menu of options. If the user selected "Improvement to an existing mode" in Table C3 Part 1 step a, then he or she will need to select "None" for the new transit mode/service.

d. **Transit project opening year**: Enter the expected first year of operations for the transit project.

e. **Transit data forecast year**: Enter the year of the forecast transit data to be entered below.

f. **Are transit-induced changes in VMT reflected in roadway data?** Select "Yes" or "No" from a dropdown menu depending on whether or not the VMT data entered in Table C1 already reflects the expected trip diversion from auto to transit, due to the transit project.

2. **Existing Mode:** If the user selected "Improvement to an existing mode," or "Investment in a new mode" in Table C3 Part 1 step a, the user will need to fill out the questions below for the existing mode selected. If the user is not required to fill this table, the table will be greyed out in the tool.

   a. **Average daily ridership, trips per day:**[18] For the existing transit mode specified in the table, enter the average daily ridership in the opening year, forecast year without project, and forecast year with project.

   b. **Average trip length, miles per trip**: For the existing transit mode specified in the table, enter the average trip length in the opening year.

   c. **Percent trips occurring in the peak period, %**: For the existing transit mode specified in the table, enter the percent of trips taken during peak period in the opening year.

   d. **Percent trips for business purposes, %**: For the existing transit mode specified in the table, enter the percent business trips in the opening year.

   e. **Percent of NEW trips diverted from autos, %**: For the existing transit mode specified in the table, enter the percent of new trips expected to be diverted from autos in the opening year.

   f. **Percent of NEW trips in opening year, %**: For the existing transit mode specified in the table, enter the percent of new trips out of total daily trips expected for the opening year.

[18] Note: all trips are defined as one-way trips.

g. **Percent of service improvements in opening year, %**: For the existing transit mode specified in the table, enter the ramp-up factor for the forecasted data (e.g., forecasted ridership, vehicle miles traveled, travel time, fare, and parking fees).

h. **Daily transit vehicle miles traveled, miles**: For the existing transit mode specified in the table, enter the average daily vehicle miles traveled by transit in the opening year, forecast year without project, and forecast year with project.

i. **Average in-vehicle transit time, peak period, minutes per trip**: For the existing transit mode specified in the table, enter the average trip-time spent in-vehicle during peak period hours for the opening year, forecast year without project, and forecast year with project.

j. **Average out-of-vehicle transit time, peak period, minutes per trip**: For the existing transit mode specified in the table, enter the average trip-time spent out-of-vehicle during peak period hours for the opening year, forecast year without project, and forecast year with project.

k. **Average in-vehicle transit time, off-peak, minutes per trip:** For the existing transit mode specified in the table, enter the average trip-time spent in-vehicle during off-peak hours for the opening year, forecast year without project, and forecast year with project.

l. **Average out-of-vehicle transit time, off-peak, minutes per trip**: For the existing transit mode specified in the table, enter the average trip-time spent out-of-vehicle during off-peak hours for the opening year, forecast year without project, and forecast year with project.

m. **Average fare, $ per trip**: For the existing transit mode specified in the table, enter the expected average fare price per trip during opening year, forecast year without project, and forecast year with project.

n. **Average parking fee at park & ride lots, $ per day**: For the existing transit mode specified in the table, enter the average daily parking fees for the park & ride lots during the opening year, forecast year without project, and forecast year with project.

o. **Percent of riders paying for parking at the park & ride lots, %**: For the existing transit mode specified in the table, enter percent of transit riders who use the park & ride lots in the opening year.

3. **New Mode or Service:** If the user selected "Investment in a new mode," or "Investment in a new service" in Table C3 Part 1 step a, the user will need to fill out the questions below for the new mode/service selected. If the user is not required to fill this table, the table will be greyed out in the tool.

   a. **Average daily ridership, trips per day**: For the new transit mode/service specified in the table, enter the average daily ridership in the opening year and forecast year with project.

   b. **Average trip length, miles per trip**: For the new transit mode/service specified in the table, enter the average trip length in the opening year.

c. **Percent trips occurring in the peak period, %**: For the new transit mode/service specified in the table, enter the percent of trips taken during peak period in the opening year.

d. **Percent trips for business purposes, %**: For the new transit mode/service specified in the table, enter the percent business trips in the opening year.

e. **Percent of NEW trips in opening year, %**: For the new transit mode/service specified in the table, enter the percent of new trips out of total daily trips expected for the opening year.

f. **Percent of NEW trips diverted from autos, %**: For the new transit mode/service specified in the table, enter the percent of new trips expected to be diverted from autos in the opening year.

g. **Percent of service improvements in opening year, %**: For the new transit mode/service specified in the table, enter the ramp-up factor for the forecasted data (e.g., forecasted ridership, vehicle miles traveled, travel time, fare, and parking fees).

h. **Daily transit vehicle miles traveled, miles**: For the new transit mode/service specified in the table, enter the average daily vehicle miles traveled by transit in the opening year and forecast year with project.

i. **Average in-vehicle transit time, peak period, minutes per trip**: For the new transit mode/service specified in the table, enter the average trip-time spent in-vehicle during peak period hours for the opening year and forecast year with project.

j. **Average out-of-vehicle transit time, peak period, minutes per trip**: For new transit mode/service specified in the table, enter the average trip-time spent out-of-vehicle during peak period hours for the opening year and forecast year with project.

k. **Average in-vehicle transit time, off-peak, minutes per trip:** For the new transit mode/service specified in the table, enter the average trip-time spent in-vehicle during off-peak hours for the opening year and forecast year with project.

l. **Average out-of-vehicle transit time, off-peak, minutes per trip**: For the new transit mode/service specified in the table, enter the average trip-time spent out-of-vehicle during off-peak hours for the opening year and forecast year with project.

m. **Average fare, $ per trip**: For the new transit mode/service specified in the table, enter the expected fare per trip during the opening year and forecast year with project.

n. **Average parking fee at destination, $ per day**: Enter the average daily parking fee that would be incurred by transit riders in the base case (e.g., when traveling by auto). Enter estimates for the opening year and forecast year with project.

o. **Average parking fee at park & ride lots, $ per day**: For the new transit mode/service specified in the table, enter the average daily parking fees for the park & ride lots during the opening year and forecast year with project.

p. **Percent of NEW riders paying for parking at destination WITHOUT project, %**: Enter the percentage of new transit riders who would be paying for parking in the base case (e.g., when traveling by auto). Enter estimates for the opening year.

q. **Percent of riders paying for parking at the park & ride lots, %**: For the new transit mode/service specified in the table, enter percent of transit riders who use the park & ride lots in the opening year.

4. **Additional information for new mode or service**: If the user selected "Investment in a new mode," or "Investment in a new service" in Table C3 Part 1 step a, the user will need to fill out the questions below for the new mode/service selected. If the user is not required to fill this table, the table will be greyed out in the tool.

   a. Distribution of NEW transit trips diverted from non-auto modes or induced, %:

      i. **Percent diverted from taxis**: For the new transit mode/service specified in the table, enter the percent of new transit trips that were diverted from taxis in the base case. Enter estimate for the opening year.

      ii. **Percent diverted from other modes**: For the new transit mode/service specified in the table, enter the percent of new transit trips that were diverted from other non-auto modes in the base case. Enter estimate for the opening year.

      iii. **Percent induced (calculated)**: Based on the information provided by the user, the tool calculates the percent of new transit trips that are induced in the opening year.

   b. Average vehicle speed prior to diversion, miles per hour:

      i. **Automobiles & taxis**: Enter the average speed of autos and taxis without considering effects of the project. Enter speed for the opening year and forecast year.

      ii. **Other modes**: Enter the average speed of other vehicle modes without considering effects of the project. Enter speed for the opening year and forecast year.

   c. Average out of pocket costs, $ per mile:

      i. **Taxis**: Enter the average dollar-per-mile cost of riding in a taxi in the project area. Enter information for the project opening year.

      ii. **Other modes**: Enter the average dollar-per-mile cost of taking other non-auto modes of transportation (not including the new mode/service) in the project study area. Enter information for the project opening year.

   d. Distribution of NEW transit trips by trip purpose, %:

      i. **Work/job search**: Enter the percentage of new transit trips that are taken for the purpose of traveling to work or searching for a job. Enter estimate for the project opening year.

ii. **Health care/medical**: Enter the percentage of new transit trips that are taken for the purpose of seeking health care or medical services. Enter estimate for the project opening year.

iii. **Other purposes (calculated)**: Given the information entered by the user, the tool automatically calculates the percentage of new transit trips taken for purposes other than those named above. An estimate is calculated for the project opening year.

5. **Transit vehicle fleet:** For the without project case and the with project case, enter the breakdown of the type of buses and trains used in the project area.

   Buses

   a. **Diesel bus**: Enter the percent of diesel buses out of the entire bus fleet in the project area for the without project and with project scenarios.

   b. **Hybrid bus**: Enter the percent of hybrid buses out of the entire bus fleet in the project area for the without project and with project scenarios.

   c. **CNG bus**: Enter the percent of compressed natural gas (CNG) buses out of the entire bus fleet in the project area for the without project and with project scenarios.

   d. **Electric bus**: Enter the percent of electric buses out of the entire bus fleet in the project area for the without project and with project scenarios.

   Commuter trains

   a. **New diesel locomotive or DMU**: Enter the percent of diesel multiple unit (DMU) or other new diesel or locomotives out of the entire commuter train fleet in the project area for the without project and with project scenarios.

   b. **Used diesel locomotive**: Enter the percent of used diesel locomotives out of the entire commuter train fleet in the project area for the without project and with project scenarios.

   c. **Electric or EMU**: Enter the percent of electric multiple unit (EMU) or other electric trains out of the entire commuter train fleet in the project area for the without project and with project scenarios.

6. **Real estate property data - rail transit only:** The following information is used estimate the economic development associated with new rail development. The information is only required if the user wishes to analyze a rail expansion project expected to attract economic development.

   a. **Total cumulative RESIDENTIAL property value, $ million**: Enter the aggregate property value of all residential property within ¼ mile of the new rail station(s). Value should be in millions of Base Year dollars.

   b. **Total cumulative COMMERCIAL property value, $ million**: Enter the aggregate property value of all commercial property within ¼ mile of the new rail station(s). Value should be in millions of Base Year dollars.

c. **RESIDENTIAL property value premium**: Select from dropdown list to indicate whether the residential property value premium is considered "low," "medium," or "high."

d. **COMMERCIAL property value premium**: Select from dropdown list to indicate whether the commercial property value premium is considered "low," "medium," or "high."

A screenshot of Table C3 with sample data is shown below in Figure 14.

Figure 14: Sample Table C3 Public Transportation Data for BCA

C3 - PUBLIC TRANSPORTATION DATA

PROJECT INFORMATION		
Transit investment type	Investment in new mode	*Select an EXISTING mode and a NEW mode.*
EXISTING transit mode	Bus	
NEW transit mode or service	Light Rail / Streetcar	
Transit project opening year or base year	2020	
Transit data forecast year	2030	
Are transit-induced changes in auto VMT reflected in roadway data?	No	

EXISTING MODE *BUS*	Base Year 2020	WITHOUT PROJECT Forecast Year 2030	WITH PROJECT Forecast Year 2030
Average Daily Ridership, trips per day	1,000	2,000	3,000
Average Trip Length, miles per trip	15.0		
Percent of Trips Occurring in Peak Period, %	80%		
Percent of Trips for Business Purposes, %	2%		
Percent of NEW Trips Diverted from Autos, %	80%		
Percent of NEW Trips in Opening Year, %	50%		
Percent of Service Improvements* in Opening Year, %	100%		
Daily Transit Vehicle Miles Traveled, miles	2,000	2,000	2,500
Average In-Vehicle Transit Time, Peak Period, minutes per trip	45.0	45.0	40.0
Average Out-of-Vehicle Transit Time, Peak Period, minutes per trip	10.0	10.0	8.0
Average In-Vehicle Transit Time, Off-Peak, minutes per trip	35.0	35.0	30.0
Average Out-of-Vehicle Transit Time, Off-Peak, minutes per trip	10.0	10.0	8.0
Average Fare, $ per trip	$5.00	$5.00	$5.00
Average Parking Fee at Park&Ride Lots, $ per day	$2.00	$2.00	$1.00
Percent of Riders Paying for Parking at Park&Ride Lots, %	50%		

*Notes: all trips defined as ONE-WAY trips; * including changes in transit VMT, time, fare and parking fees*

NEW MODE OR SERVICE *LIGHT RAIL / STREETCAR*	Opening Year 2020	WITH PROJECT Forecast Year 2030
Average Daily Ridership, trips per day	500	500
Average Trip Length, miles per trip	20.0	
Percent of Trips Occurring in Peak Period, %	80%	
Percent of Trips for Business Purposes, %	2%	
Percent of NEW Trips in Opening Year, %	100%	
Percent of NEW Trips Diverted from Autos, %	90%	
Daily Transit Vehicle Miles Traveled, miles	1,000	1,000
Average In-Vehicle Transit Time, Peak Period, minutes per trip	30.0	30.0
Average Out-of-Vehicle Transit Time, Peak Period, minutes per trip	10.0	10.0
Average In-Vehicle Transit Time, Off-Peak, minutes per trip	30.0	30.0
Average Out-of-Vehicle Transit Time, Off-Peak, minutes per trip	10.0	10.0
Average Fare, $ per trip	$2.00	$2.00
Average Parking Fee at Destination, $ per day	$5.00	$5.00
Average Parking Fee at Park&Ride Lots, $ per day	$2.00	$2.00
Percent of NEW Riders Paying for Parking at Destination WITHOUT Project, %	50%	
Percent of Riders Paying for Parking at Park&Ride Lots, %	30%	

Table D – Optional Crash Reduction Estimates, Override Parameters

TransValU's safety benefits are calculated one of two ways:

1) Default crash reduction benefits are estimated using 2011 through 2015 VMT-based average crash rates, by county from the FDOT Crash Analysis Reporting System; or

2) Customized crash calculations are used by the model if the user enters crash severity level information obtained from supplemental crash analysis, into Table D.

If a user enters any data in Table D, the default crash rates will be overridden. If a detailed crash analysis is not available, the user should leave the table blank, and the model's default values will be used instead. Leaving the tables empty will not exclude benefits from the analysis. The model's default parameter values are available in the Parameters tab. Additional information on data sources is provided in APPENDIX I: Data Sources.

Users choosing to override the default crash parameters using supplemental crash analysis should enter the inputs into Table D. Users should note that custom crash data for Table D must be provided in KABCO format (K = killed, A = incapacitating, B = non-incapacitating, C = possible injury, O = no injury). Reductions in crash incidence must be entered as negative numbers, and increases in crash incidence must be entered as positive numbers, in cells B173 through B180. Table D is formatted like FDOT's crash data output tables.

Users should also specify the year for which the supplemental safety analysis was conducted, and an estimate of the annual growth rate in the number of accidents.

A completed sample of Table D is shown below in Figure 15. Once values are entered in Table D, proceed to Table E (aesthetics benefits), or to the BCA Calculations or BCA Results tabs.

Figure 15: Sample Table D Crash Reduction Estimates (Optional Override) for BCA

D - OPTIONAL CRASH REDUCTION ESTIMATES, OVERRIDE PARAMETERS	
FDOT CRASH SEVERITY LEVELS	Annual Change in Number of Crashes WITH PROJECT
1 = No Injury	-50.0
2 = Possible Injury	-30.0
3 = Non-Incapacitating Injury	-20.0
4 = Incapacitating Injury	-10.0
5 = Fatality	-2.0
6 = Non-Traffic Fatality	-1.0
Year for which safety analysis was conducted	2020
Annual growth in number of avoided crashes, % per year	0.0%

Table E – Aesthetics & Other Ecosystem Services Provided by Roadside Improvements

Two options are available to include aesthetics benefits in TransValU:

1) Benefits associated with roadside vegetation can be estimated with the number of additional acres of roadside vegetation in the project case relative to the base case (to be specified by users in cell B185), and estimates of the annual benefits of roadside vegetation in dollars per acre from the economic literature, or

2) An estimate of average annual aesthetics benefits developed outside TransValU can be entered directly into the tool, as an input (in cell B191).

In Option 1, a number of additional benefits (other than aesthetics) can be considered in the analysis. These benefits include pollination, carbon sequestration, storm-water runoff reduction, and air quality. To add or remove these effects, users should use the "Yes/No" drop-down menus provided in Table E (cells B186 to B190).

A completed sample of Table E is shown below in Figure 16. Once values are entered in Table E, proceed to the BCA Calculations or BCA Results tabs.

Figure 16: Sample Table E Aesthetics & Other Ecosystem Services for BCA

E - AESTHETICS & OTHER ECOSYSTEM SERVICES PROVIDED BY ROADSIDE IMPROVEMENTS	
	Estimates WITH PROJECT
Additional acres of roadside vegetation	300.0
Include benefits associated with Aesthetics?	Yes
Pollination?	No
Carbon Sequestration?	No
Stormwater Runoff Reduction?	No
Air Quality?	No
--- OR --- Enter estimate of average annual benefits in dollars, $2015	$0.0

Table F – (Optional) Daily Vehicle Miles Traveled, by Speed Bin

Table F will appear if the user selects either a Roadway or Multimodal project type in Table A. This table is optional. If the user has detailed data on vehicle miles traveled by speed bin, enter this information in Table F. Data should be entered separately for autos and trucks. This information will be used in the tool to estimate change in vehicle operating costs. If this data is not available, leave Table F blank and the tool will use the average daily VMT data to estimate change in vehicle operating costs.

Table F is divided into three parts. The first part is for the user to enter VMT in the Base Year. The second is for VMT in the forecast year without the project. The third part is for VMT in the forecast year with the project. The table is divided into 16 speed bins, ranging from less than 2.5 mph to over 72.5 mph. Each speed bin includes a range of 5 mph.

Figure 17 Figure 17: Sample Table F Optional Daily Vehicle Miles Traveled, by Speed Binincludes a screenshot of the first part of Table F, which includes VMT for the Base Year. No sample data is included in this example.

Figure 17: Sample Table F Optional Daily Vehicle Miles Traveled, by Speed Bin

F - (OPTIONAL) DAILY VEHICLE MILES TRAVELED, BY SPEED BIN

Base Year 2015	Auto	Truck
<= 2.5 mph		
02.5-7.5 mph		
07.5-12.5 mph		
12.5-17.5 mph		
17.5-22.5 mph		
22.5-27.5 mph		
27.5-32.5 mph		
32.5-37.5 mph		
37.5-42.5 mph		
42.5-47.5 mph		
47.5-52.5 mph		
52.5-57.5 mph		
57.5-62.5 mph		
62.5-67.5 mph		
67.5-72.5 mph		
>72.5 mph		
Total	0	0

BCA Calculations for Bike & Pedestrian Tab

The BCA Calculations for Bike & Pedestrian tab is where benefits are calculated for projects with bicycle and/or pedestrian facility improvements. Calculations are shown for each year in the period of analysis, and aggregate totals are shown in Column C in ***italicized green***. The top of the sheet shows bicycle and pedestrian trips over time with and without the project, as calculated on a separate calculations tab. Next, benefits are calculated for existing and new bicycle/pedestrian trips. Benefit results are used on the BCA Calculations tab to aggregate total project benefits and compare with project capital and O&M costs.

BCA Calculations for Transit Tab

The BCA Calculations for Transit tab is where benefits are calculated for transit projects, including bus, express bus, BRT, heavy rail, light rail/streetcar, or commuter rail. Estimates are calculated annually and then aggregated in Column J. Aggregate totals are shown in ***italicized green.*** For each benefit category, calculations are performed for the without project scenario and the with project scenario, and then the difference is calculated. Benefit results are used on the BCA Calculations tab to aggregate total project benefits and compare with project capital and O&M costs.

BCA Calculations Tab

The BCA Calculations tab is where users are able to view and copy (to external spreadsheets) annual estimates of transportation, costs, and benefits data. A "Dashboard" table in rows 7 though 13 provides parameter information for the active scenario, including the project name, county/district, region type, roadway type, and average vehicle occupancy.

Column C of the BCA Calculations tab contains the undiscounted aggregate results for each category in ***italicized green***. The cost categories are limited to capital and O&M costs (rows 14 through 18). Estimated annual travel information (by mode) is displayed in rows 19 through 27. Individual benefits categories are calculated in rows 28 through 205.

The benefit categories estimated in TransValU are listed below. The tab includes the benefit estimates calculated on the BCA Calculations tab, BCA Calculations for Bike & Pedestrian tab, and the BCA Calculations for Transit tab.

- Travel time savings;
- Fuel cost savings;
- Other vehicle O&M cost savings;
- Fare cost savings;
- Parking cost savings;
- Additional savings to new transit users;
- Emission cost savings for carbon dioxide (CO2) and other pollutants;
- Safety benefits;
- Pavement maintenance cost savings;
- Economic development benefits (changes in property values);
- Health benefits of increased physical activity (for bike & pedestrian projects);
- Improved trip quality (for bike & pedestrian projects); and
- Aesthetics & other roadside improvements.

The BCA results begin on row 225 and show the total annual costs and benefits by category in real terms, as well as the summation of total benefits and costs over the period of analysis. The benefits and costs in present value (PV) represent the benefits and costs discounted back to the base year, using the discount rate shown in the Parameters tab. The benefit/cost ratio, payback period, and internal rate of return[19] are displayed in this section.

The button located in the top left corner of the worksheet will take users to the BCA Results tab.

BCA Results Tab

The BCA Results tab contains summary results that can be copied and pasted into external worksheets. The button in the top left corner of the sheet will take users to the BCA Multi-Project Results tab.

The BCA results table provides summary estimates by benefit and cost category, as well as costs and benefits in present value, the net present value, benefit-cost ratio, discounted payback period, and internal rate of return (see Figure 18). Values in red are negative.

[19] Internal Rate of Return may display a value of "N/A" if net benefits (i.e., benefits minus costs) alternate multiple times between negative and positive values.

Figure 18: Sample BCA Results Table

Benefit-Cost Analysis Results

Multi-Project Results

Select Unit for Display: Millions of $2015

Scenario 1: Example for Testing

Real Discount Rate: 4.0%

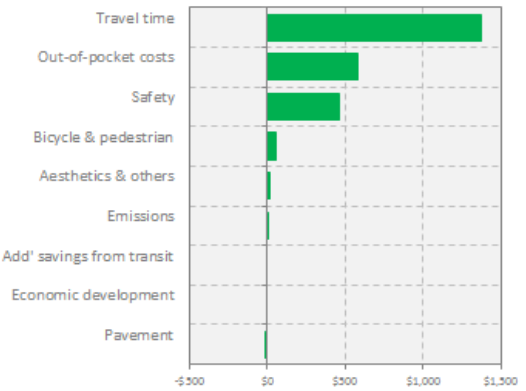
PROJECT BENEFITS	Millions of $2015	Value	Units
Travel time savings	**$1,375.2**		
Automobiles	$1,178.9	51.7	Millions of Vehicle-Hours
Trucks	$140.3	5.2	Millions of Vehicle-Hours
Transit Users	$50.3	3.6	Millions of Person-Hours
Cyclists & Pedestrians	$5.6	0.4	Millions of Person-Hours
Out-of-pocket cost savings	**$582.5**		
Fuel cost savings	**$393.9**		
Gasoline	$404.7	(123.0)	Millions of Gallons
Diesel	($10.8)	2.6	Millions of Gallons
Other vehicle operating cost savings	**$172.5**		
Automobiles	$206.9		
Trucks	($34.5)		
Bicycles	$0.0		
Reductions in fare payments	**$10.5**		
Parking cost savings	**$5.5**		
Additional savings to new transit users	$0.0		
Emission cost savings	**$4.2**		
NOX	($0.6)	170.2	Tons
CO2	$5.9	(96,360.0)	Tons
VOC	$0.0	(22.9)	Tons
PM	($1.2)	8.2	Tons
SO2	$0.0	(0.7)	Tons
Safety benefits	**$465.5**	480	Crashes
Pavement maintenance cost savings	**($12.2)**		
Economic development around transit stations	$0.0		
Health benefits of increased physical activity	**$51.2**	145,265	New Bike/Ped Trips per Year
Improvements to trip quality	**$9.9**		
Aesthetics & other roadside improvements	**$16.2**	100.0	Acres of Vegetation
TOTAL PROJECT BENEFITS	**$2,492.4**		
Present Value of Total Benefits	**$2,042.6**		

PROJECT COSTS	
Incremental O&M costs	$300.0
Capital costs	$970.0
TOTAL PROJECT COSTS	**$1,270.0**
Present Value of Total Costs	**$1,027.3**

SUMMARY RESULTS	
Net Present Value	**$1,015.3**
Benefit-Cost Ratio	**1.99**
First Year Project Breaks Even*	**2036**
Overall Rate of Return	**4.0%**

** Discounted Payback Period = 21 years*

SOCIAL BENEFITS OF PUBLIC TRANSPORTATION	
Avoided Expenditures on Public Assistance	$0.0



The Model Parameters table provides information on the model's input specifications and selected parameters (see Figure 19). This table will allow users to compare results across multiple scenarios and review the impact of various parameter selections on the results. This table identifies the parameter selections for region, investment periods, transportation data, optional overrides, and value of time.

Figure 19: Sample BCA Model Parameters Table

KEY MODEL PARAMETERS & ASSUMPTIONS	
Regional and Investment Parameters	
Selected region	District 5
Region type	Urban
Roadway access	Restricted
Construction start year	0
Construction end year	0
Investment useful life in years	0
Benefits begin accruing	0
Real discount rate	4.0%
Optional Override Data	
Crash data	Calculated with historical crash rates
Average vehicle occupancy	1.68
Value of Time	
Personal time ($ per hour)	$14.8
Business time ($ per hour)	$26.5

BCA Multi-Project Results Tab

The BCA Multi-Project Results tab was created to enable users to save multiple iterations of the project analyses. The summary results are carried over from the BCA Results tab into the BCA Multi-Project Results tab. These results can be saved by pressing the "Save ACTIVE Results" button in cell C1. TransValU will then save the current results in the columns to the right of any other saved results.

Please note that users may need to enable macros for this feature to work properly; and that a maximum of 10 scenarios can be saved. Users can delete saved results by highlighting any column (except Columns A through F) and pressing the delete button. The tables should look like those in Figure 20 and Figure 21 below, covering the BCA results and parameters.

Figure 20: Sample BCA Multi-Project Results Table

DELETE All Saved Results | Save ACTIVE Results

Real Discount Rate: 4.0%

BENEFIT ESTIMATES	Scenario 1: Example for Testing Millions of $2015	Value	Units	Scenario 1: Example for Testing 4.0% Millions of $2015	Value	Units
Travel time savings	$1,375.2			$1,375.2		
Automobiles	$1,178.9	51.7	Millions of Vehicle-Hours	$1,178.9	51.7	Millions of Vehicle-Hours
Trucks	$140.3	5.2	Millions of Vehicle-Hours	$140.3	5.2	Millions of Vehicle-Hours
Transit Users	$50.3	3.6	Millions of Person-Hours	$50.3	3.6	Millions of Person-Hours
Cyclists & Pedestrians	$5.6	0.4	Millions of Person-Hours	$5.6	0.4	Millions of Person-Hours
Out-of-pocket cost savings						
Fuel cost savings	$393.9			$393.9		
Gasoline	$404.7	(123.0)	Millions of Gallons	$404.7	(123.0)	Millions of Gallons
Diesel	($10.8)	2.6	Millions of Gallons	($10.8)	2.6	Millions of Gallons
Other vehicle operating cost savings	$172.5			$172.5		
Automobiles	$206.9			$206.9		
Trucks	($34.5)			($34.5)		
Bicycles	$0.0			$0.0		
Transit fare payments	$10.5			$10.5		
Parking cost savings	$5.5			$5.5		
Additional savings to new transit users	$0.0			$0.0		
Emission cost savings	$4.2			$4.2		
NOX	($0.6)	170.2	Tons	($0.6)	170.2	Tons
CO2	$5.9	(96,360.0)	Tons	$5.9	(96,360.0)	Tons
VOC	$0.0	(22.9)	Tons	$0.0	(22.9)	Tons
PM	($1.2)	8.2	Tons	($1.2)	8.2	Tons
SO2	$0.0	(0.7)	Tons	$0.0	(0.7)	Tons
Safety benefits	$465.5	480.0	Crashes	$465.5	480.0	Crashes
Pavement maintenance cost savings	($12.2)			($12.2)		
Economic development around transit stations	$0.0			$0.0		
Health benefits of increased physical activity	$51.2	145,265	New Bike/Ped Trips per Year	$51.2	145,265.5	New Bike/Ped Trips per Year
Improvements to trip quality	$9.9			$9.9		
Aesthetics & other roadside improvements	$16.2	100.0	Acres of Vegetation	$16.2	100.0	Acres of Vegetation
TOTAL BENEFITS	$2,492.4			$2,492.4		
Present Value of Total Benefits	$2,042.6			$2,042.6		
COST ESTIMATES						
Incremental O&M costs	$300.0			$300.0		
Capital costs	$970.0			$970.0		
TOTAL COSTS	$1,270.0			$1,270.0		
Present Value of Total Costs	$1,027.3			$1,027.3		
SUMMARY RESULTS						
Net Present Value	$1,015.3			$1,015.3		
Benefit-Cost Ratio	1.99			1.99		
First Year Project Breaks Even*	2036			2036		
Overall Rate of Return	4.0%			4.0%		

** Discounted Payback Period = 21 years*

Figure 21: Sample BCA Multi-Project Model Parameters Table

KEY MODEL PARAMETERS		
Regional and Investment Parameters		
Selected region	District 1	District 1
Region type	Urban	Urban
Roadway access	Unrestricted	Unrestricted
Construction start year	2015	2015
Construction end year	2020	2020
Investment useful life in years	30	30
Benefits begin accruing	2021	2021
Real discount rate	4.0%	4.0%
Optional Override Data		
Crash data	User-defined	User-defined
Average vehicle occupancy	1.60	1.60
Value of Time		
Personal time ($ per hour)	$13.6	$13.6
Business time ($ per hour)	$25.4	$25.4

Section A.3 – Using TransValU for Benefit-Cost Analysis of Freight Projects

A separate BCA Module exists within TransValU for evaluating freight-focused projects, including highway freight, freight rail, and ILC projects. The highway freight analysis requires travel demand model outputs to develop the without project and with project scenarios. Travel demand results should include estimates for a base year, a future base case, and future project case alternatives.

Users can find additional guidance and resources for BCAs in the OMB Circular A-94[20], and the US DOT Guidance for Discretionary Grant Programs.[21]

Data Requirements

The minimum data requirements to run the Freight BCA Module are listed in Table 2 and are included in the Freight BCA Data Needs tab within the Excel file. The table provides a list of input data requirements plus a brief description of the data. As shown in Table 2, input data on project cost, schedule, and useful life are required for any type of freight project. Freight projects involving roadway enhancements will additionally require travel demand model outputs, such as VMT, and VHT. Rail projects will require shipping data (volumes, distance, train speeds, handling time, and others). ILC projects will require similar input data but specific to freight handled at the ILC and in the catchment area.

[20] OMB Circular A-94 Revised, http://www.whitehouse.gov/omb/circulars_a094/, October 29, 1992.

[21] USDOT BCA Guidance for Discretionary Grant Programs, https://cms.dot.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance , June 2018.

Table 2: Minimum BCA Data Requirements for Freight Projects

Project Type	Input Data Requirements	Data Description
All Freight Modes	Capital costs	Annual estimates in constant 2017 dollars
	Incremental O&M costs	Annual estimates in constant 2017dollars
	Project schedule	Beginning and end of investment period and year benefits begin accruing
	Useful life of investment	Number of years benefits will accrue due to investment
Roadway Projects	Travel demand model data output	
	Vehicle Miles Traveled (VMT)	Truck and auto VMT in the base year, and in future year with and without the project
	Vehicle Hours Traveled (VHT)	Truck and auto VHT in the base year, and in future year with and without the project
	Crash analysis (optional override)	
	Changes in number of accidents	Annual crash reduction by severity (KABCO scale)
	Safety analysis year	Year for which safety analysis was conducted
	Growth in number of accidents	Annual growth in number of accidents, in percent
Freight Rail Projects	Freight rail volumes	Number of freight trains per day
	Shipping distance	Average distance traveled by freight trains in miles
	Growth in freight volumes	Average annual growth rate in train miles
	Freight train speeds	Average effective speed of freight trains in miles per hour
	Drayage and handling time	Additional shipping time for drayage and handling/transloading
	Capacity of freight trains	Number of carloads per unit-train and average carload size
	Sources of additional rail ton-miles	Diversion from trucks and other modes, in percent
Intermodal Logistics Center (ILC) Projects	Freight volumes handled at ILC	Number of TEUs or truckloads handled at ILC per year
	Growth in freight volumes	Average annual growth rate in TEUs or truckloads
	Diversion from truck to rail	Percent of total TEUs or truckloads handled at ILC that are transported by truck and rail
	Terminal dwell time	Average terminal dwell time, in hours
	Terminal storage cost	Average storage cost, in dollars per TEU or truckload per day
	Terminal handling cost	Average terminal handling cost, in dollars per TEU or truckload

User Interface

The following sections describe the function of each of the eight user-enabled tabs in the Freight BCA Module.

Parameters

The Parameters tab displays critical assumptions and data sources used by TransValU for both BCA Modules. The tab includes the value, units, and source for each parameter. A screenshot of the tab is provided in the previous section on multi-modal analysis (see Figure 5).

The user can choose to adjust the following values on this tab: the discount rate, various annualization factors, the average vehicle occupancy, and the share of personal and business travel.

Freight BCA Data Needs

This tab lists the required inputs to run the Freight BCA, as shown in Table 2 above.

Freight BCA Inputs

This tab contains all of the input tables that users must fill in before running the Freight BCA Module. The tab also contains a legend explaining the formatting conventions for input tables and results formats within TransValU (see screenshot in Figure 22).

Below is a list of all the input tables on the Freight BCA Inputs tab:

- **Table A – Project Information:** Table A requires data on the project information, including the construction start and end year, useful life, project location (county within District Five, or District-level), and other similar information.
- **Table B – Cost Information (Fill-In Cost Estimates for Each Year):** Table B requires annual capital and O&M costs for the duration of the analysis.
- **Table C – Roadway Transportation Data:** Requires travel demand model output data, such as daily VMT and VHT in the base and forecast year (with and without project).
- **Table D – Optional Crash Reduction Estimates, Override Parameters:** Table D provides users the option to enter data on reduced crashes due to the project. These estimates would come from supplemental analysis if available. If no information is provided, the tool will default to calculating safety benefits based on reduced VMT caused by the project.
- **Table E – Method for Estimating Changes in Vehicle O&M Costs:** Table E allows the user to select which data the tool will use to estimate the change in vehicle O&M costs. Options include data from the American Transportation Research Institute (ATRI) or Highway Economic Requirements System (HERS). Unit operating cost data from HERS varies by vehicle speed, while ATRI data does not. Therefore, using ATRI data will capture O&M cost savings for a project that reduces VMT, but would not capture a change in O&M costs due to a change in vehicle speed.
- **Table F – Freight Rail Data and Assumptions:** Table F requires data on train movements in the project catchment area, vehicle speeds and shipping times for train and truck, train cargo capacity, and traffic diverted from truck and waterways to rail. All data must be entered for both the without project and with project cases.
- **Table G – Data and Assumptions for Intermodal Logistics Centers- New Builds or Improvements:** If the user wishes to analyze an ILC project, Table G must be filled. Table G requires data on freight volumes transported in the catchment area, costs and volumes of goods handled at the ILC, and information on truck-only versus combination truck and rail freight transportation in the catchment area.

Figure 22 includes a partial screenshot of the Freight BCA Inputs tab, including sample data.

Figure 22: Freight BCA Inputs Tab (sample screenshot)

Transportation Inputs for BCA of Freight Projects

Review BCA Calculations

A - PROJECT INFORMATION

Project / alternative name	Highway Example
Construction start year	2015
Construction end year	2019
Investment useful life	20 years
Base model year	2010
Forecast model year	2035
Project opening year	2020
Scenario #	1
Select county or district average	District 5
Select area type	Urban
Select roadway access type	Restricted
Project type	Freight Rail

LEGEND	
Drop-Down Box	
User Input Field	
Sum or Total Value	*Number*

B - COST INFORMATION (FILL-IN COST ESTIMATES FOR EACH YEAR)	1	2	3	4	5	6
	2015	2016	2017	2018	2019	2020
Capital costs	$ 50,000,000	$ 150,000,000	$ 350,000,000	$ 200,000,000	$ 50,000,000	
Incremental Operating & Maintenance costs					$ 5,000,000	$
Total capital costs	***$ 800,000,000***					
Total incremental O&M costs	***$ 100,000,000***					

C - ROADWAY TRANSPORTATION DATA

	Base Year 2010	WITHOUT PROJECT Forecast Year 2035	WITH PROJECT Forecast Year 2035	
Trucks / Commercial Vehicles				
Daily Vehicle Miles Traveled	5,000,000	9,000,000	9,100,000	*Increase w. Project*
Daily Vehicle Hours Traveled	100,000	225,000	215,000	*Decrease w. Project*
Automobiles				
Daily Vehicle Miles Traveled	20,000,000	36,000,000	37,000,000	*Increase w. Project*
Daily Vehicle Hours Traveled	400,000	900,000	860,000	*Decrease w. Project*
Additional Roadway Parameters				
Roadway type	Freeway			
Free flow speed, mph	55.0			
Do O&M costs (Row 22) include pavement maintenance?	No			

Freight BCA Rail Calculations

The Freight BCA Rail Calculations tab contains calculations of annual freight volumes transported by rail with and without the project, and resulting annual benefits of the rail project. These benefits are also shown on the Freight BCA Calculations tab. All project benefits are aggregated and compared with overall project capital and O&M costs.

Freight BCA ILC Calculations

The Freight BCA ILC Calculations tab contains calculations of annual freight volumes transported in the ILC catchment area with and without the project, and the change in costs and benefits with the ILC project. These benefits are shown on the Freight BCA Calculations tab. All project benefits are aggregated and compared with overall project capital and O&M costs.

Freight BCA Calculations

The Freight BCA Calculations tab contains the annual and aggregate calculations of benefits and costs for freight truck projects. A summary of benefits from the Freight BCA Rail Calculations tab and the Freight BCA ILC Calculations tab are also linked to this sheet to calculate the overall project benefits compared to project costs. Total benefits and costs are compared to estimate the benefit/cost ratio (BCR) and internal rate of return. A blue horizontal line separates the different benefit and cost categories considered in the tool. While all benefits and costs are monetized, some intermediate calculates display other key project information, such change in VMT and VHT. Note that this tab includes some calculations not used in the

final BCR estimate. These additional calculations are available for trying different methodologies.[22] Figure 23 below includes a screenshot of part of the Freight BCA Calculations tab.

Figure 23: Freight BCA Calculations Tab (sample screenshot)

Benefit-Cost Analysis Calculations for Freight Projects					
View Freight BCA Results		Year	2015	2016	2017
		Year Index	1	2	3
	30	Operations Index	0	0	0
	Discount Rate:	4.0%	1.000	0.962	0.925
	Discount Rate for SCC:	3.0%	1.000	0.971	0.943
KEY ASSUMPTIONS FROM DASHBOARD					
Project name	Example for Testing				
County or district average	District 1				
Region type	Urban				
Roadway type	Restricted				
Average vehicle occupancy	1.60				
INVESTMENT COSTS					
Project Cost Data					
Capital cost		$ 800,000,000	$ 50,000,000	$ 150,000,000	$ 350,000,000
O&M costs		$ 150,000,000	$ -	$ -	$ -
TRANSPORTATION DATA BY MODE					
Change in Vehicle Miles Traveled					
Auto		953,517,896	-	-	-
Truck		(952,449,579)	-	-	-
Change in Vehicle Hours Traveled					
Auto		-	-	-	-
Truck		(49,426,822)	-	-	-
ESTIMATION OF BENEFITS					
Select Method for Estimating Roadway Travel Time Savings:					
Method 2 - Change in Total Vehicle Hours Traveled					
Travel Time Savings					
Travel Time Savings in Hours					
Method 1 - Change in Average Speed & Consumer Surplus					
Existing auto (hours)		24,688,793	-	-	-
New auto (hours)		81,085	-	-	-
Existing truck (hours)		24,688,277	-	-	-
New truck (hours)		-	-	-	-

Freight BCA Results

The Freight BCA Results tab includes summary report tables and charts that can be copied into an external spreadsheet. The following describe the summary tables and charts:

- **BCA Results Table and Chart:** Table lists the aggregate benefit and cost estimates by category for all freight project components entered on the Freight BCA Inputs tab. Benefits and costs are shown in present value. The table also includes the BCR and wider economic benefits by category. The benefit categories are also shown in a chart.
- **Model Parameters and Assumptions:** This table displays input and parameter values from the BCA Inputs tab. This table shows differences in input values across multiple scenarios.

[22] TransValU has a series of conditional equations that determine which benefits and costs will be used in the final estimation in order to avoid double counting and to provide consistent results.

Figure 24 and Figure 25 below show screenshot of the two tables on the Freight BCA Results tab.

Figure 24: Freight BCA Results Tab- Results Table and Chart (sample screenshot)

Freight Benefit-Cost Analysis Results

Multi-Project Results

Select Unit for Display: Millions of $2015

Scenario 1: Example for Testing

Real Discount Rate: 4.0%

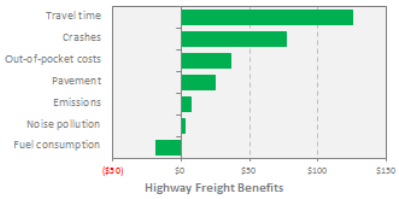
PROJECT BENEFITS	Millions of $2015	Value	Units
HIGHWAY FREIGHT			
Travel time savings	$125.3		
Automobiles	$56.0	2.5	Millions of Vehicle-Hours
Trucks	$69.3	2.5	Millions of Vehicle-Hours
Out-of-pocket cost savings	$18.7	(6.6)	Millions of Gallons
Fuel cost savings	($17.9)		
Other vehicle operating cost savings	$36.6		
Emission cost savings	$7.0		
CO2	$6.2	103,191.9	Tons
Other pollutants	$0.8	119.0	Tons
Safety benefits	$76.9	7.5	Crashes
Pavement maintenance cost savings	$25.3		
Noise pollution cost savings	$3.4		
RAIL FREIGHT and/or INTERMODAL LOGISTICS CENTER			
Generalized shipping cost savings	$814.7		
Economic value of induced rail shipments	$65.1	1,485.0	Millions of Rail Ton-Miles
ILC handling & storage cost savings	($1.2)		
Emission cost savings	$520.7		
CO2	$95.9	1,717,083.7	Tons
Other pollutants	$424.8	20,075.9	Tons
Safety benefits	$243.6	472.6	Injuries (Fatal and Non-Fatal)
Reduction in traffic congestion	$111.6		
Pavement maintenance cost savings	$136.7	3,290,843.5	Millions of Truck VMT Avoided
Noise pollution cost savings	$10.0		
TOTAL PROJECT BENEFITS	**$2,157.8**		
Present Value of Total Benefits	**$1,052.5**		

PROJECT COSTS	
Incremental O&M costs	$150.0
Capital costs	$700.0
TOTAL PROJECT COSTS	**$850.0**
Present Value of Total Costs	**$718.0**

SUMMARY RESULTS	
Net Present Value	**$334.5**
Benefit-Cost Ratio	**1.47**
First Year Project Breaks Even*	**2036**
Overall Rate of Return	**7.1%**

** Discounted Payback Period = 21 years*

WIDER ECONOMIC BENEFITS	
Logistics Reorganization	**$1.2**
Truck Travel Time Reliability	**$0.0**
Buyer-Supplier Market Access	**$0.0**
Freight Connectivity	**$0.0**
BCR with Wider Economic Benefits	**1.47**



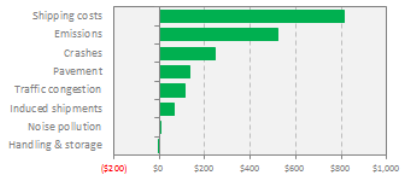


Figure 25: Freight BCA Results Tab- Model Parameters and Assumptions (sample screenshot)

KEY MODEL PARAMETERS & ASSUMPTIONS

Regional and Investment Parameters	
Selected region	District 5
Region type	Urban
Roadway access	Restricted
Construction start year	0
Construction end year	0
Investment useful life in years	0
Benefits begin accruing	0
Real discount rate	4.0%

Optional Override Data	
Crash data	Calculated with historical crash rates
Average vehicle occupancy	1.68

Value of Time	
Personal time ($ per hour)	$14.8
Business time ($ per hour)	$26.5

Freight BCA Multi-Project Results

The Freight BCA Multi-Project Results tab allows the user to compare results of several different projects or alternatives side-by-side. Once the tool is run for one project alternative, click the "Save BCA Results" button located in the top left of the tab. The tool will then save the current results to the right of any other saved results. A screenshot of this tab is located in Figure 26.

Note that users should check that macros are enabled for this feature to work properly. Up to 10 scenario results can be saved at once. Apart from the active results (Columns A through G), users can directly delete results by highlighting the column and pressing the delete button.

Figure 26: Freight BCA Multi-Project Results Tab (sample screenshot)

DELETE All Saved Results | Save ACTIVE Results

	Scenario 1: Highway Example			Scenario 1: Highway Example		
Real Discount Rate: 4.0%				4.0%		
BENEFIT ESTIMATES	**Millions of $2015**	**Value**	**Units**	Millions of $2015	Value	Units
HIGHWAY FREIGHT						
Travel time savings	$1,542.5			$1,542.5		
Auto	$951.7	42.1	Millions of Vehicle-Hours	$951.7	42.1	Millions of Vehicle-Hours
Truck	$590.8	21.0	Millions of Vehicle-Hours	$590.8	21.0	Millions of Vehicle-Hours
Out-of-pocket cost savings	($1,939.9)	(555.8)	Millions of Gallons	($1,939.9)	(555.8)	Millions of Gallons
Fuel cost savings	($1,700.6)			($1,700.6)		
Other vehicle operating cost savings	($239.3)			($239.3)		
Emission cost savings	($91.6)			($91.6)		
CO2	($86.0)	(1,617,880.6)	Tons	($86.0)	(1,617,880.6)	Tons
Other pollutants	($5.6)	(1,001.2)	Tons	($5.6)	(1,001.2)	Tons
Safety benefits	$354.1	520.0	Crashes	$354.1	520.0	Crashes
Pavement maintenance cost savings	($121.0)			($121.0)		
Noise pollution cost savings	($22.2)			($22.2)		
RAIL FREIGHT and/or INTERMODAL LOGISTICS CENTER						
Generalized shipment cost savings	$14.8			$14.8		
Economic value of induced rail shipments	$0.0	-	Millions of Rail Ton-Miles	$0.0	-	Millions of Rail Ton-Miles
ILC handling & storage cost savings	($0.7)			($0.7)		
Emission cost savings	$4.1			$4.1		
CO2	$0.7	13,766.8	Tons	$0.7	13,766.8	Tons
Other pollutants	$3.4	162.3	Tons	$3.4	162.3	Tons
Safety benefits	$2.0	3.8	Injuries (Fatal and Non-Fatal)	$2.0	3.8	Injuries (Fatal and Non-Fatal)
Reduction in traffic congestion	$0.5			$0.5		
Pavement maintenance cost savings	$0.6	2,082,797.5	Millions of Truck VMT Avoided	$0.6	2,082,797.5	Millions of Truck VMT Avoided
Noise pollution cost savings	$0.0			$0.0		
TOTAL BENEFITS	**($256.9)**			**($256.9)**		
Present Value of Total Benefits	**($102.2)**			**($102.2)**		
COST ESTIMATES						
Incremental O&M costs	$100.0			$100.0		
Capital costs	$800.0			$800.0		
TOTAL COSTS	**$900.0**			$900.0		
Present Value of Total Costs	**$796.5**			$796.5		
SUMMARY RESULTS						
Net Present Value	**($898.7)**			**($898.7)**		
Benefit-Cost Ratio	**(0.13)**			**(0.13)**		
First Year Project Breaks Even*	Doesn't Payback			Doesn't Payback		
Overall Rate of Return	N/A			N/A		
KEY MODEL PARAMETERS						
Regional and Investment Parameters						
Selected Region	District 5			District 5		
Region Type	Urban			Urban		
Roadway Access	Restricted			Restricted		
Construction start year	2015			2015		

Navigating the Tool

This section provides a detailed description and walk through of each tab in the Freight BCA Module and the required user inputs. Note that all critical equations and data tabs are used in the background but locked or hidden to the user to avoid unintended modifications and allow for continuity between model runs. A new copy of the tool should be saved each time a new project is evaluated. Each copy of the tool should include the name of the project evaluated.[23]

Parameters Tab

Model users can view key assumptions and parameters on the Parameters tab. The tab includes the variable name, value, unit, and source. The same Parameters tab is used for both BCA Modules. The tab includes a column on the right indicating whether or not the parameter value is used in the Freight BCA Module.

The user can review these assumptions but should not change the values used in the tool. However, there are three values on the Parameters tab that the user can adjust if desired:

1. **Discount Rate:** FDOT recommends using a real discount rate of 4 percent to evaluate projects in the state.[24] The default value is set to 4 percent.
2. **Annualization Factor/ Annualization Factor for Freight Projects:** This factor is used to convert daily VMT and VHT to annual estimates. It should be in the neighborhood of 300 days. The annualization factor should only be adjusted to match the factor used in producing the daily estimates and/or assumed in the travel demand model.
3. **Annualization Factor for Bike/Ped Projects:** This factor is used to convert daily bike and/or pedestrian trips to annual estimates. It should be around 300 days. This can be adjusted based on seasonality of cycling/walking.
4. **Average Vehicle Occupancy:** The default vehicle occupancy rate in TransValU is 1.39 persons per auto, 1.0 person per truck, and 2.0 engineers per train. These estimates are based on a 2016 Highway Statistics report prepared by the Federal Highway Administration, and recommended in the 2017 US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs. This value should only be adjusted if regional vehicle occupancy data are available.
5. **Share of Personal versus Business Travel:** The default percentage of personal and business travel is taken from the US DOT Revised Departmental Guidance on Valuation of Travel Time in Economic Analysis. However, if the user has data on the personal and business trips specific to the region then these values may be updated in the tool.

[23] Consistent folder and file naming conventions should help avoid confusing different TransValU project analyses and preserve the clean copy.

[24] FDOT, "Macroeconomic Analysis of Florida's Transportation Investments". January 2015. Appendix B-6. Accessed on 12/29/2016 at: http://www.fdot.gov/planning/policy/economic/macroimpacts0115.pdf.

The user must be careful to be consistent across projects. Thus, if one or all of these parameter values are changed for evaluating one project, the same parameter values should be used to evaluate all other projects for consistency.

Freight BCA Data Needs Tab

This tab includes a table of the data requirements for the Freight BCA Module. No action is required by the user on this tab. A copy of the table can be found in Table 2.

Freight BCA Inputs Tab

Users will need to fill out Tables A and B regardless of the type of project analyzed. The remaining tables should be filled based on the type of project selected. These tables provide TransValU with the required information on project schedule, cost, transportation data, crash reductions, and changes in vehicle O&M costs. For certain cells, the user will be promoted by pop-up messages on how to fill out the information. Step-by-step instructions are included below for filling out the tables located on this tab.

Table A – Part 1 (light blue cells): Project Investment Period

1. **Project / alternative name:** Enter the name of the project and/or alternative to be evaluated (cell B6). This name will be used in the results tabs to identify the alternative.
2. **Construction start year:** Enter the start of the construction or investment period.
3. **Construction end year:** Enter the end of the construction or investment period.
4. **Investment useful life (years):** Enter the useful life of the investment, or in other words, the number of years the investment will provide benefits to users. Most transportation investments should have a useful life of at least 20 years.
5. **Base model year:** This is the base year for roadway transportation data estimates. Enter the year in a four-digit year format.
6. **Forecast model year:** This is the forecast year roadway transportation data estimates (both with and without the project). Enter the year in a four-digit year format.
7. **Project opening year:** Enter the first year benefits will be realized. This may be during or after the construction period. Enter the year in a four-digit year format.

Table A – Part 2 (dark blue cells): Project Investment Period

1. **Scenario #:** Select a scenario number from the drop-down list in cell B13. Like the project name, this scenario number is a user-identified parameter that will be used in the results tabs to identify projects.
2. **Select County or District:** Select project location, choosing between one of the seven Florida districts, or one of the nine counties within District Five. This information is used in the tool to look up region-specific data for emission factors, crash ratios, and value of time. If the project is located in overlapping counties, it is recommended to use the entirety of District Five.

3. **Select area type:** Select either urban or rural. This information is used in the tool to look up the most accurate pavement maintenance cost.
4. **Select roadway access type:** Select roadway access type (restricted or unrestricted) in cell B16. The roadway access type is used to select project-specific vehicle emission rates.
5. **Project type:** Select the type of freight project to be analyzed. Options include roadway, rail, or ILC.

A completed sample of Table A is shown below in Figure 27. Once the fields are entered in Table A, for the specific mode being evaluated, proceed to Table B, Cost Information.

Figure 27: Sample Table A Project Information for BCA of Freight Projects

A - PROJECT INFORMATION	
Project / alternative name	Highway Example
Construction start year	2015
Construction end year	2019
Investment useful life	20 years
Base model year	2010
Forecast model year	2035
Project opening year	2020
Scenario #	1
Select county or district average	District 5
Select area type	Urban
Select roadway access type	Restricted
Project type	Freight Rail

Table B – Cost Information

1. **Capital costs:** Enter the capital expenditures by year into row 21. Enter dollars in real terms, excluding inflation over time.
2. **O&M costs:** Enter the net operating and maintenance costs by year in row 22. This is the incremental O&M cost between the project case and base case. Enter dollars in real terms, excluding inflation over time.

A partial screenshot of a completed sample of Table B is shown in Figure 28.

Figure 28: Sample Table B Cost Information for BCA of Freight Projects

B - COST INFORMATION (FILL-IN COST ESTIMATES FOR EACH YEAR)	1	2	3	4	5	6
	2015	2016	2017	2018	2019	2020
Capital costs	$ 50,000,000	$ 150,000,000	$ 350,000,000	$ 200,000,000	$ 50,000,000	
Incremental Operating & Maintenance costs						$ 5,000,000
Total capital costs	***$ 800,000,000***					
Total incremental O&M costs	***$ 100,000,000***					

Table C – Roadway Transportation Data

Table C requires network-level traffic data from a travel demand analysis. The user must make sure that the traffic data is for the same geographic area, and for the same base and future years as selected in Table A. The traffic data required is listed below:

1. Commercial Vehicles / Trucks

    a. **Daily truck VMT:** The user must enter network-level daily truck vehicle miles traveled for the "Base Year," "Future Year without Project," and "Future Year with Project" (cells B30, C30, and D30).

    b. **Daily truck VHT:** The user must enter network-level daily truck vehicle hours traveled for the "Base Year," "Future Year without Project," and "Future Year with Project" (cells B31, C31, and D31).

2. Auto

    a. **Daily auto VMT:** The user must enter network-level daily auto vehicle miles traveled for the "Base Year," "Future Year without Project," and "Future Year with Project" (cells B33, C33, and D33).

    b. **Daily auto VHT:** The user must enter network-level daily auto vehicle hours traveled for the "Base Year," "Future Year without Project," and "Future Year with Project" (cells B34, C34, and D34).

3. Additional roadway parameters

    a. **Roadway type:** Select from a dropdown list of roadway types, including freeway or arterial. This information is used to calculate the volume-to-capacity ratio in the base case and project case.

    b. **Free flow speed, mph:** Enter the average network free flow speed. This also will calibrate the volume-to-capacity ratio used in the estimation of travel time reliability.

    c. **O&M costs (Row 22) include pavement maintenance?** User selects from the "Yes/No" dropdown list. If the O&M costs entered into Table B include pavement maintenance cost, select yes. This information will be used to calculate pavement maintenance benefits.

A completed sample of Table C is shown below in Figure 29.

Figure 29: Sample Table C Detailed Roadway Data for BCA of Freight Projects

C - ROADWAY TRANSPORTATION DATA			
	Base Year 2010	WITHOUT PROJECT Forecast Year 2035	WITH PROJECT Forecast Year 2035
Trucks / Commercial Vehicles			
Daily Vehicle Miles Traveled	5,000,000	9,000,000	9,100,000
Daily Vehicle Hours Traveled	100,000	225,000	215,000
Automobiles			
Daily Vehicle Miles Traveled	20,000,000	36,000,000	37,000,000
Daily Vehicle Hours Traveled	400,000	900,000	860,000
Additional Roadway Parameters			
Roadway type	Freeway		
Free flow speed, mph	55.0		
Do O&M costs (Row 22) include pavement maintenance?	No		

Table D – Optional Crash Reduction Estimates, Override Parameters

To calculate safety benefits, the user can chose between the automated safety calculations in the tool, or entering crash reduction data directly. For the first method, the tool calculates the reduction in VMT caused by the project and looks up the average crash rates specific to the county where the project is located. For the second method, the tool again calculates the VMT reduction, but instead applies customized crash reduction data specific to the project. The user enters this crash reduction data directly into Table D.

The tool automatically defaults to using the first method to calculate safety benefits from the project. However, if the user enters crash data into Table D, the crash data from method 1 will be overridden. The user will be able to employ the second method for calculating safety benefits only if a detailed external analysis is available. If this information is not available, the user should leave Table D blank, thus allowing the tool to use the safety benefit calculations for method 1.

Any crash data entered into Table D must be in KABCO format (K = killed, A = incapacitating, B = non-incapacitating, C = possible injury, O = no injury). A reduction in crash incidence should be entered as a negative number. Users must also enter the year of the crash data and an estimated annual growth rate in accidents.

A completed sample of Table D is shown below in Figure 30.

Figure 30: Sample Table D Crash Reduction Estimates (Optional Override) for BCA of Freight Projects

D - OPTIONAL CRASH REDUCTION ESTIMATES, OVERRIDE PARAMETERS	
FDOT Crash Severity Levels	Change in Annual Number of Crashes WITH PROJECT
1 = No Injury	0.0
2 = Possible Injury	0.0
3 = Non-Incapacitating Injury	-20.0
4 = Incapacitating Injury	-5.0
5 = Fatality	-1.0
6 = Non-Traffic Fatality	0.0
Year for which safety analysis was conducted	2020
Annual growth in number of avoided crashes, % per year	0.0%

Table E – Method for Estimating Changes in Vehicle O&M Costs

In Table E, users must select which data source the tool should use to calculate the change in vehicle O&M costs for passenger cars and trucks in the freight network. Users choose from a dropdown list of options.

For passenger cars, users can choose either HERS or AAA data. HERS data allows the tool to account for different O&M unit costs depending on vehicle speed, while AAA using a constant dollar-per-mile unit cost.

Similarly, for trucks users must select either HERS or ATRI data. While HERS unit cost data varies by vehicle speed, ATRI data does not. If ATRI data is selected, the user must also chose between a VMT-based or VHT-based methodology.

The methodologies used for calculating the change in vehicle O&M costs for passenger cars and trucks are independent. For instance, the user can choose HERS data for passenger cars and ATRI data for trucks. However, the same rationale for selecting a speed-dependent methodology (e.g., HERS) for passenger cars would also apply for trucks. Thus, the same type of methodology will generally be selected for both passenger cars and trucks.

Figure 31 shows a screenshot of Table E.

Figure 31: Sample Table E Changes in Vehicle O&M Costs for BCA of Freight Projects

E - METHOD FOR ESTIMATING CHANGES IN VEHICLE O&M COSTS	
Passenger Cars	HERS
Commercial Vehicles / Trucks	ATRI (VHT-based)

Table F – Freight Rail Data and Assumptions

If the user wishes to analyze a freight rail project, input information on the train movements, speeds, and capacity are required:

1. Train Movements & Distance Traveled in Project Opening Year
    a. **Number of freight trains per day, #:** The user enters the number of daily freight trains scheduled to pass through the project study area in both the without project and with project scenarios.
    b. **Average distance traveled, miles:** Enter the average trip length of the trains in the project study area in the without project and with project scenarios.
    c. **Annual train miles traveled, calculated:** Here the tool calculates the total train miles traveled in the without project and with project scenarios, based on the two former inputs.
    d. **Annual growth in train miles, % per year:** Enter the expected growth in train miles traveled in the without project and with project scenarios.
2. Vehicle Speeds & Shipping Times
    a. **Average effective speed of freight trains, mph:** The user enters the average speed of freight trains in the without project and with project scenarios.
    b. **Additional time for drayage and dwelling, % of in-vehicle time:** Enter the additional time with and without the project to account for drayage and dwelling. Enter additional time as a percentage of in-vehicle time by rail for the without project and with project scenarios.
    c. **Average effective speed of shipments by truck, mph:** Enter the typical speed of freight trucks in the study area for the without project and with project scenarios.

3. Average Train Capacity for all Freight Trains & Commodities

    a. **Number of carloads per unit-train, #:** Enter the average number of carloads carried per train in the without project and with project scenarios.

    b. **Average carload size, tons:** Enter the average number of tons per train carload in the without project and with project scenarios.

    c. **Annual volumes transported by rail (calculated), tons**: Based on the two prior inputs, the tool calculates the number of tons per year transported by rail in the without project and with project scenarios.

4. Sources of Additional Train Tonnage with Project

    a. **Diverted from trucks, % of total:** Enter the percentage of freight that would be transported by truck in the without project scenario but will now be transported by rail in the with project scenario.

    b. **Diverted from waterways, % of total:** Enter the percentage of freight that would be transported by waterway in the without project scenario but will now be transported by rail in the with project scenario.

    c. **Newly generated goods movement, % of total:** Based on the percentage of freight diverted from trucks and waterways, the tool calculates the percentage of freight that is new; that is, the additional freight that will now be transported in the with project scenario.

Figure 32 includes a screenshot of Table F with sample data.

Figure 32: Sample Table F Freight Rail Data and Assumptions for BCA of Freight Projects

F - FREIGHT RAIL DATA AND ASSUMPTIONS		
	WITHOUT PROJECT	WITH PROJECT
Train Movements & Distance Traveled in Project Opening Year		
Number of freight trains per day, #	2	3
Average distance traveled, miles	500	500
Annual train miles traveled, calculated	300,000	450,000
Annual growth in train miles, % per year	1.0%	1.0%
Vehicle Speeds & Shipping Times		
Average effective speed of freight trains, mph	50.0 mph	60.0 mph
Additional time for drayage and dwelling, % of in-vehicle time	50.0%	50.0%
Average effective speed of shipments by truck, mph	35.0 mph	35.0 mph
Average Train Capacity for all Freight Trains & Commodities		
Number of carloads per unit-train, #	100	100
Average carload size, tons	110	110
Annual volumes transported by rail (calculated), tons	6,600,000	9,900,000
Sources of Additional Train Tonnage with Project		
Diverted from trucks, % of total		60.0%
Diverted from waterways, % of total		30.0%
Newly generated goods movements, % of total		10.0%

Table G – Data and Assumptions for Intermodal Logistics Centers- New Builds or Improvements

Table G allows the user to enter data for an ILC project. Note that the inputs entered in Table F do not apply to the ILC benefit-cost analysis, even for the rail component. The inputs required to analyze an ILC projects are listed below:

1. **Freight Volumes best Expressed in Truckloads or TEUs?** User selects either "Truckload" or "TEU" from a dropdown menu, depending on which units the user would like to enter the data.
2. Freight Volumes in Project Opening Year:
    a. **Number of truckloads/TEUs in ILC catchment area, # per year:** User enters the number of truckloads/TEUs transported in the catchment area in the without project scenario. The tool automatically assigns the same value for the with project scenario under the assumption that the project will not cause additional freight to be transported.
    b. **Annual growth in number of truckloads/ TEUs, % per year:** User enters the anticipated growth in volume of freight transported for the without project scenario. The tool automatically assigns the same value for the with project scenario.
    c. **Number of truckloads/ TEUs handled at ILC, # per year:** User enters the average number of truckloads or TEUs that will be handled at the new/updated ILC in the without project and with project scenarios.
    d. **ILC capture rate (calculated), %:** Based on the total truckloads/TEUs in catchment area and the number handled at the ILC directly, the tool calculates the percentage of truckloads/TEU handled at the ILC in the without project and with project scenarios.
3. Goods Handled at ILC that Move only by Truck:
    a. **Percent of truckloads handled at ILC, % of total:** User enters the percent of truckloads/TEUs handled at ILC out of the total cargo entirely transported by truck from the ILC to the final destination. Enter the percentage for the without project and with project scenarios.
    b. **Average distance by truck, miles:** Enter the average trip length for trucks transporting shipments in the catchment area. Enter the percentage for the without project and with project scenarios.
    c. **Average terminal dwell time, hours:** Enter the average number of hours cargo typically will spend in the ILC facility awaiting shipment for freight transported from the ILC solely by truck. Enter time for the without project and with project scenarios.
    d. **Average terminal storage costs, $ per truckload/TEU per hour:** Enter the average hourly cost per truckload/TEU for storing cargo at the ILC facility for cargo that will be transported to its final destination by truck only. Enter costs for the without project and with project scenarios.

e. **Average terminal handling cost, $ per truckload/TEU:** Enter the average cost per truckload/TEU for handling cargo at the ILC facility for cargo that will be transported to its final destination by truck only. Enter costs for the without project and with project scenarios.

4. Goods Handled at ILC that Move by Truck and Rail:

   a. **Percent of truckloads/TEUA handled at ILC (calculated), % of total:** Tool calculates the percent of truckloads/TEUs handled at ILC for all cargo transported to its final destination through a combination of truck and rail. Calculations are made separately for the without project and with project scenarios.

   b. **Average distance by rail, miles:** Enter the average trip length for the rail portion of shipments made through a combination of truck and rail. Enter the number of miles for the without project and with project scenarios.

   c. **Average distance by truck including drayage, miles:** Enter the average distance traveled for the truck portion of shipments made through a combination of truck and rail. Enter the number of miles for the without project and with project scenarios.

   d. **Average rail shipping rate, $ per mile:** Enter the average per-mile rail shipping costs for the without project and with project scenarios.

   e. **Average terminal dwell time, hours:** Enter the average number of hours cargo typically will spend in the ILC facility awaiting shipment to its final destination through a combination of truck and rail. Enter time for the without project and with project scenarios.

   f. **Average terminal storage costs, $ per truckload/TEU per hour:** Enter the average hourly cost per truckload/TEU for storing cargo at the ILC facility for cargo that will be transported to its final destination through a combination of truck and rail. Enter cost for the without project and with project scenarios.

   g. **Average terminal handling cost, $ per truckload/TEU:** Enter the average cost per truckload/TEU for handling cargo at the ILC facility for cargo that will be transported to its final destination through a combination of truck and rail. Enter cost for the without project and with project scenarios.

5. Additional Assumptions:

   a. **Average effective speed of freight trains, mph:** Enter the average speed of freight trains in the catchment area for the without project scenario. The tool automatically enters the same speed for the with project scenario.

   b. **Additional time for drayage and dwelling, % of in-vehicle time:** Enter the additional time with and without the project to account for drayage and dwelling. Enter additional time as a percentage of in-vehicle time by rail.

c. **Average effective speed of shipments by truck, mph:** Enter the average speed of trucks in the catchment area for the without project scenario. The tool automatically enters the same speed for the with project scenario.

d. **Number of carloads per unit-train, #:** Enter the average number of carloads carried per train in the without project scenario. The tool automatically enters the same number for the with project scenario.

e. **Average carload size, tons:** Enter the average number of tons per train carload in the without project scenario. The tool automatically enters the same number for the with project scenario.

Figure 33 includes a screenshot of Table G with sample data.

Figure 33: Sample Table G Data and Assumptions for ILC Projects

G - DATA AND ASSUMPTIONS FOR INTERMODAL LOGISTIC CENTERS - NEW BUILDS OR IMPROVEMENTS				
Freight Volumes best Expressed in Truckloads or TEUs?		Truckload		
		WITHOUT PROJECT		**WITH PROJECT**
Freight Volumes in Project Opening Year				
Number of truckloads in ILC catchment area, # per year*		2,000		2,000
Annual growth in number of truckloads, % per year		1.0%		1.0%
Number of truckloads handled at ILC, # per year		200		500
ILC capture rate (calculated), %		10.0%		25.0%
Goods Handled at ILC that Move only by Truck				
Percent of truckloads handled at ILC, % of total		90.0%		50.0%
Average distance by truck , miles		500.0		500.0
Average terminal dwell time, hours		24.0		12.0
Average terminal storage cost, $ per truckload per hour	$	10.0	$	10.0
Average terminal handling cost, $ per truckload	$	100.0	$	80.0
Goods Handled at ILC that Move by Truck and Rail				
Percent of truckloads handled at ILC (calculated), % of total		10.0%		50.0%
Average distance by rail, miles		550.0		550.0
Average distance by truck including drayage, miles		50.0		50.0
Average rail shipping rate, $ per mile	$	1.600	$	1.600
Average terminal dwell time, hours		24.0		12.0
Average terminal storage cost, $ per truckload per hour	$	10.0	$	10.0
Average terminal handling cost, $ per truckload	$	100.0	$	80.0
Additional Assumptions				
Average effective speed of freight trains, mph		50.0 mph		50.0 mph
Additional time for drayage and dwelling, % of in-vehicle time		50.0%		50.0%
Average effective speed of shipments by truck, mph		35.0 mph		35.0 mph
Number of carloads per unit-train, #		100		100
Average carload size, tons		110		110
** Freight with origin/destination or transhipped within project area*				

Freight BCA Rail Calculations Tab

The Freight BCA Rail Calculations tab estimates the annual benefits of a given freight rail project. The tab draws data from the Freight BCA Inputs tab, and other calculations tabs. Calculations are annual and aggregated in Column F shown in ***italicized green*** front. The Freight BCA Rail Calculations tab is divided into three sections:

The **Freight Volumes** section calculates the annual ton-miles traveled by freight rail in the without and with project scenarios.

Next, the **Generalized Cost Savings and Economic Value of Induced Shipments** section estimates the unit costs for vehicle operations, driver's time, and inventory costs for truck and rail. Unit costs are applied to freight volumes to calculate the generalized shipment cost savings and economic value of induced freight shipments from the project.

Finally, the **Estimation of External Benefits** section calculates the benefits of reduced external costs caused by diverting truck trips to rail. Specifically, this tab calculates the congestion cost savings, pavement maintenance cost savings, vehicle emission cost savings, accident costs, and noise cost savings.

These benefits are linked to on the Freight BCA Calculations tab to compare total project benefits against the project capital and O&M costs.

Freight BCA ILC Calculations Tab

The Freight BCA ILC Calculations tab calculates the benefits of constructing a new or improving an existing ILC. The tab uses data entered on the Freight BCA Inputs tab and other data sheets. Calculations are annual and aggregated in Column F shown in ***italicized green*** front. The tab is divided into four main sections, plus additional sub-sections:

Freight Volumes calculates the annual truckloads or TEUs (depending on the information entered on the Freight BCA Inputs tab) of goods transported in the ILC catchment area.

The next two sections, **Without Project Calculations** and **With Project Calculations,** calculate the freight volumes and economic costs for the without and with project scenarios, respectively.

Finally, the **Calculation of Benefits** section calculates the change in economic costs between the base case and project case to estimate the cost reduction brought on by the project (e.g., the project benefits). These benefits are also shown on the Freight BCA Calculations tab and combined with benefits from any other freight project elements. These benefits are compared with the total project capital and O&M costs.

Freight BCA Calculations Tab

The Freight BCA Calculations tab draws from the Freight BCA Inputs, Parameters, Freight BCA Rail Calculations, Freight BCA ILC Calculations, and other data tabs to calculate annual benefits and costs of the project. No user inputs are required on this tab. The Freight BCA Calculations tab is divided into five main sections, as described below.

The **Dashboard** section shows the active key input values and parameters for the project, including the project name, location, region type, roadway type, and average vehicle occupancy.

The **Investment Costs** section includes the project capital and O&M costs by year, as the user entered on Freight BCA Inputs.

The **Transportation Data** section shows the change in VMT and VHT by year, due to the project.

The **Estimation of Benefits** section shows the calculation of project benefits by category. Benefits are separated by project type: i) highway freight, and ii) rail or ILC.

There are seven benefit categories estimated for the highway freight project components on the freight BCA Calculations tab:

- Travel time savings (for auto and truck);
- Fuel cost savings;
- Other vehicle operating cost savings;
- Emission cost savings (CO2 and other pollutants);
- Safety benefits;
- Pavement maintenance cost savings; and
- Noise pollution cost savings.

There are eight benefit categories estimated for the freight rail and/or ILC project components on the freight BCA calculations tab:

- Generalized shipment cost savings;
- Economic value of induced rail shipments;
- ILC handling and storage cost savings;
- Emission cost savings (CO2 and other pollutants);
- Safety benefits;
- Reduction in traffic congestion;
- Pavement maintenance cost savings; and
- Noise pollution cost savings.

For some benefit categories, more than one calculation method is shown. However, only one method is active at once to avoid double-counting benefits.

Finally, the **Results** section compares the annual investment costs with project benefits to estimate summary statistics, including the BCR, payback period, and overall rate of return (ORR). [25] The Results section also provides additional Wider Economic Benefits, including:

- Logistics reorganization;
- Truck travel time reliability;
- Buyer-supplier market access; and
- Freight connectivity.

[25] Overall Rate of Return may display a value of "N/A" if net benefits (i.e., benefits minus costs) alternate multiple times between negative and positive values.

The Results section also includes a version of the BCR with these additional Wider Economic Benefits.

The top of the Freight BCA Calculations tab includes a button called "View Freight BCA Results." Clicking this button will take the user to the BCA Results tab. All dollar values on the Freight BCA Calculations tab are in real terms. Column C includes the undiscounted aggregate results for each stream of numbers shown in ***italicized green.***

Freight BCA Results Tab

The Freight BCA Results tab provides a summary table and chart, pulling from results estimated on the Freight BCA Calculations tab. The table and chart can be copied and pasted into external worksheets if desired.

The summary table includes the total benefits for both categories of projects (highway freight and rail freight/ILC), the total capital and O&M costs, and the overall project BCR, net-present value, payback period, and ORR. Negative values are in red. Figure 34 provides a screenshot of the summary table and chart with sample data.

Figure 34: Sample Freight BCA Results Table

Freight Benefit-Cost Analysis Results

Multi-Project Results

Select Unit for Display: Millions of $2015

Scenario 1: Example for Testing

Real Discount Rate: 4.0%

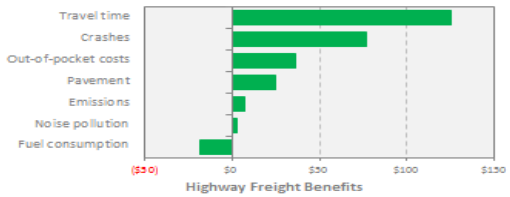
PROJECT BENEFITS	Millions of $2015	Value	Units
HIGHWAY FREIGHT			
Travel time savings	$125.3		
Automobiles	$56.0	2.5	Millions of Vehicle-Hours
Trucks	$69.3	2.5	Millions of Vehicle-Hours
Out-of-pocket cost savings	$18.7	(6.6)	Millions of Gallons
Fuel cost savings	($17.9)		
Other vehicle operating cost savings	$36.6		
Emission cost savings	$7.0		
CO2	$6.2	103,191.9	Tons
Other pollutants	$0.8	119.0	Tons
Safety benefits	$76.9	7.5	Crashes
Pavement maintenance cost savings	$25.3		
Noise pollution cost savings	$3.4		
RAIL FREIGHT and/or INTERMODAL LOGISTICS CENTER			
Generalized shipping cost savings	$814.7		
Economic value of induced rail shipments	$65.1	1,485.0	Millions of Rail Ton-Miles
ILC handling & storage cost savings	($1.2)		
Emission cost savings	$520.7		
CO2	$95.9	1,717,083.7	Tons
Other pollutants	$424.8	20,075.9	Tons
Safety benefits	$243.6	472.6	Injuries (Fatal and Non-Fatal)
Reduction in traffic congestion	$111.6		
Pavement maintenance cost savings	$136.7	3,290,843.5	Millions of Truck VMT Avoided
Noise pollution cost savings	$10.0		
TOTAL PROJECT BENEFITS	$2,157.8		
Present Value of Total Benefits	$1,052.5		

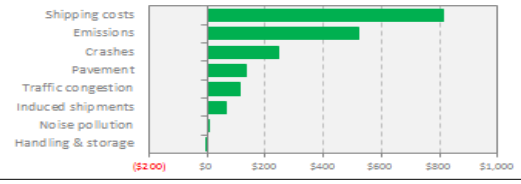
PROJECT COSTS	
Incremental O&M costs	$150.0
Capital costs	$700.0
TOTAL PROJECT COSTS	$850.0
Present Value of Total Costs	$718.0

SUMMARY RESULTS	
Net Present Value	$334.5
Benefit-Cost Ratio	1.47
First Year Project Breaks Even*	2036
Overall Rate of Return	7.1%

** Discounted Payback Period = 21 years*

WIDER ECONOMIC BENEFITS	
Logistics Reorganization	$1.2
Truck Travel Time Reliability	$0.0
Buyer-Supplier Market Access	$0.0
Freight Connectivity	$0.0
BCR with Wider Economic Benefits	1.47





A second table is also included on the Freight BCA Results tab. This table restates the key model parameters values used in the analysis (see Figure 35). Users can go back to where these input values are entered into the model and adjust them to see the effect on the results on the Freight BCA Results tab.

Figure 35: Sample Freight BCA Model Parameters Table

KEY MODEL PARAMETERS & ASSUMPTIONS

Regional and Investment Parameters	
Selected region	District 5
Region type	Urban
Roadway access	Restricted
Construction start year	0
Construction end year	0
Investment useful life in years	0
Benefits begin accruing	0
Real discount rate	4.0%
Optional Override Data	
Crash data	Calculated with historical crash rates
Average vehicle occupancy	1.68
Value of Time	
Personal time ($ per hour)	$14.8
Business time ($ per hour)	$26.5

After reviewing these summary results, the user can click the "Multi-Project Results" button on the top left of the screen to access the Freight BCA Multi-Project Results tab. This will allow the user to compare the summary results of multiple projects/alternatives at once.

Freight BCA Multi-Project Results Tab

The Freight BCA Multi-Project Results tab allows the user to save and view the results of multiple projects/alternatives at once side-by-side for comparison. Results for the active project entered in the tool are shown on the far left of the screen. The user can click the "Save BCA Results" button and the tool will save the current results to the right of the last saved set of results. Up to 10 sets of results can be saved and compared.

Users may need to enable macros for this feature to work properly. Once the maximum number of 10 saved results has been reached, the user must delete results manually. To delete results, the user should select the desired columns (except those for the active project results Columns A through G) and press the delete button. Figure 36 and Figure 37 below illustrates example results and parameters for the active project compared to one set of saved results.

Figure 36: Sample Freight BCA Multi-Project Results Table

DELETE All Saved Results | Save ACTIVE Results

Real Discount Rate: 4.0%

BENEFIT ESTIMATES	Scenario 1: Highway Example Millions of $2015	Value	Units	Scenario 1: Highway Example 4.0% Millions of $2015	Value	Units
HIGHWAY FREIGHT						
Travel time savings	$1,542.5			$1,542.5		
Auto	$951.7	42.1	Millions of Vehicle-Hours	$951.7	42.1	Millions of Vehicle-Hours
Truck	$590.8	21.0	Millions of Vehicle-Hours	$590.8	21.0	Millions of Vehicle-Hours
Out-of-pocket cost savings	($1,939.9)	(555.8)	Millions of Gallons	($1,939.9)	(555.8)	Millions of Gallons
Fuel cost savings	($1,700.6)			($1,700.6)		
Other vehicle operating cost savings	($239.3)			($239.3)		
Emission cost savings	($91.6)			($91.6)		
CO2	($86.0)	(1,617,880.6)	Tons	($86.0)	(1,617,880.6)	Tons
Other pollutants	($5.6)	(1,001.2)	Tons	($5.6)	(1,001.2)	Tons
Safety benefits	$354.1	520.0	Crashes	$354.1	520.0	Crashes
Pavement maintenance cost savings	($121.0)			($121.0)		
Noise pollution cost savings	($22.2)			($22.2)		
RAIL FREIGHT and/or INTERMODAL LOGISTICS CENTER						
Generalized shipment cost savings	$14.8			$14.8		
Economic value of induced rail shipments	$0.0	-	Millions of Rail Ton-Miles	$0.0	-	Millions of Rail Ton-Miles
ILC handling & storage cost savings	($0.7)			($0.7)		
Emission cost savings	$4.1			$4.1		
CO2	$0.7	13,766.8	Tons	$0.7	13,766.8	Tons
Other pollutants	$3.4	162.3	Tons	$3.4	162.3	Tons
Safety benefits	$2.0	3.8	Injuries (Fatal and Non-Fatal)	$2.0	3.8	Injuries (Fatal and Non-Fatal)
Reduction in traffic congestion	$0.5			$0.5		
Pavement maintenance cost savings	$0.6	2,082,797.5	Millions of Truck VMT Avoided	$0.6	2,082,797.5	Millions of Truck VMT Avoided
Noise pollution cost savings	$0.0			$0.0		
TOTAL BENEFITS	($256.9)			($256.9)		
Present Value of Total Benefits	($102.2)			($102.2)		
COST ESTIMATES						
Incremental O&M costs	$100.0			$100.0		
Capital costs	$800.0			$800.0		
TOTAL COSTS	$900.0			$900.0		
Present Value of Total Costs	$796.5			$796.5		
SUMMARY RESULTS						
Net Present Value	($898.7)			($898.7)		
Benefit-Cost Ratio	(0.13)			(0.13)		
First Year Project Breaks Even*	Doesn't Payback			Doesn't Payback		
Overall Rate of Return	N/A			N/A		

Figure 37: Sample Freight BCA Multi-Project Parameters Table

KEY MODEL PARAMETERS		
Regional and Investment Parameters		
Selected Region	District 5	District 5
Region Type	Urban	Urban
Roadway Access	Restricted	Restricted
Construction start year	2015	2015
Construction end year	2019	2019
Investment useful life (years)	20	20
Benefits begin accruing (year)	2020	2020
Discount Rate	4.0%	4.0%
Optional Override Data		
Crash data	User defined override	User defined override
Average vehicle occupancy	1.60	1.60
Wages		
Personal time ($ per hour)	$13.6	$13.6
Business time ($ per hour)	$25.4	$25.4

PART B. ECONOMIC IMPACT ANALYSIS

PART B starts with an introduction to EIA, including a description of the framework for estimating short-term and long-term impacts, and a summary of the impact categories to be estimated in TransValU. Next, instructions are provided for how to run the EIA Module, including data requirements, an overview of the user interface, and instructions for navigating the module. TransValU includes a separate module for performing EIA of freight-focused projects, and thus a third section is provided below that explains how to run this Freight EIA Module.

Section B.1 – Introduction to Economic Impact Analysis

Economic Impact Analysis (EIA) focuses on the effects of a project, program, or policy on the economy of a state or region. It is primarily concerned with changes in economic activity, expressed as changes in business sales (output), Gross Regional Product (value added), employment, and earnings.

The economic impacts of transportation projects are typically grouped within two broad categories: i) Impacts associated with spending on construction (including planning, design, engineering) and/or changes in O&M expenditures; and ii) Impacts resulting from improvements in the performance of a transportation system. The EIA Module of TransValU focuses on the former (impacts resulting from spending on transportation projects) for all project modes. However, long-term development effects of improved transportation are estimated for freight projects.

The EIA Module of TransValU enables users to estimate the economic impacts of transportation projects, particularly transit. TransValU includes two separate EIA Modules. The first EIA Module estimates short-term economic impacts for: i) transit-only investments; ii) investments in other, non-transit modes; or iii) multi-modal investments. The second EIA Module focuses on freight. This module calculates short-term and long-term economic impacts of freight projects.

There are two main methods for estimating short-term economic impacts in TransValU. The first method distinguishes between gross and net impacts (as defined below). It is based on the methodology and calculation techniques from CUTR's 2013 tool for assessing the economic impacts of spending on public transit.[26] This method is used in TransValU for estimating impacts of transit projects. The second option is more general and provides a slightly different set of results, with a breakdown of impacts by industry. This method is used for estimating impacts for the remaining multi-modal and freight projects. Results under both options include impacts on the number of jobs, earnings, output, and value added. The analysis of multi-modal projects uses a combination of the two preceding methods.

Long-term impacts are estimated only for freight projects. These impacts occur when a project investment leads to a permanent reduction in freight transportation costs. These cost savings are passed on to the consumer, resulting in increased demand and, in turn, increased production. To calculate long-term

[26] This section of the guide is based on the Final Report "*A Tool for Assessing the Economic Impacts of Spending on Public Transit*," prepared by the Center for Urban Transportation Research at the University of South Florida, and dated July 2013.

impacts an estimate is required for the percent reduction in freight transportation costs caused by the project. This cost reduction is spread by industry based on the level of transportation use. An elasticity of output with respect to production costs produces the direct change in output caused by the cost reduction. RIMS II multipliers and economic data are used to calculate the final output, earnings and jobs resulting from the project investment. For ILC projects, the methodology differs slightly. The number of long-term jobs created by the new ILC facility is estimated and applied to a RIMS II multiplier to yield the total direct, indirect, and induced jobs generated by the project. Given data on output and earnings in the project study area, the long-term output and earnings are estimated.

Framework for Estimating Short-Term Impacts

The methodology for assessing the economic impacts of spending on public transit developed by CUTR consists of several components, including a commonly used method for economic impact assessment (the "Basic Method"), and a set of best practices used in implementing this method in CUTR's tool.

Basic Method

The method of economic impact assessment used in transit project analysis, referred to as the "Basic Method" in this user guide involves concepts and techniques that are commonly used in estimating the economic impacts of public spending on transportation projects, educational institutions, sports facilities, and other investments. One element of this Basic Method is that it states the economic impacts in terms of several measures of economic activity in the local economy, typically including:

- Output—represents the total gross sales in the economy;
- Value Added—is comparable to gross domestic product (GDP) at the local level;
- Earnings—represents labor income by workers; and
- Jobs—represents the number of jobs in person-years of employment.

This Basic Method estimates the impacts of spending on transit in terms of these economic measures by tracing the path of an initial set of spending throughout the local economy:

- Locally-produced goods and services purchased by the transit agency as part of the initial spending on transit;
- Ripple effects through the subsequent rounds of locally-produced goods and services purchased by local industries affected by the spending on transit; and
- Ripple effects in terms of the change in economic activity resulting from the changes in spending by workers whose earnings are affected by the spending on transit.

Rather than relying on actually tracing this path for any specific set of spending on transit, the Basic Method uses multipliers. These multipliers are derived from detailed accounting tables that show the goods and services produced by each industry and the use of these goods and services by industries and consumers, governments, and investments. Base tables are constructed at the national level, and tables for individual study areas are derived by adjusting the national table to account for local supply conditions. Local industries may purchase some intermediate inputs from suppliers outside the region.

These multipliers are made available for individual industries. For estimating the economic impacts of spending on transit O&M, for example, one may use the multipliers derived for the industry of operating transit and ground passenger transportation. For this industry, the Jobs Multiplier shows a total change in local employment from spending $1 million on transit O&M.

Once the amount of spending on transit is known for a specific industry and the corresponding multipliers are obtained for this industry, the Basic Method is ready to estimate the economic impacts of this spending on transit.

Best Practices

It is best practice to consider the pattern of spending on transit when estimating its economic impacts. The pattern of spending on transit characterizes the spending in terms of whether it is spent on locally produced goods and services, whether the source of funds is local, whether the funds are borrowed, and whether any borrowed funds will be paid back with local funds. Best practices require keeping track of this pattern and estimating the economic impacts separately for different parts of the total spending accordingly. Summarized in the "Net" Column of Table 3 below, the following are the rules used in TransValU. These rules describe how the tool treats the different parts of a given set of spending on transit in estimating its total economic impacts on the local economy of a study area:

- **Spending state and/or federal assistance on goods and services produced *outside* the study area**: Zero impact if the assistance does not have to be paid back.
- **Spending state and federal assistance on goods and services produced *inside* the study area:** Positive impact if the assistance does not have to be paid back, with the exact impacts for this portion of total spending to be determined by applying it to appropriate multipliers.
- **Spending local funds on locally produced goods and services:** Approximately zero impact, after accounting for the potential impacts of the local funds being spent for non-transit purposes in the study area.
- **Spending local funds on goods and services produced *outside* the study area:** Negative impact, with the exact impact for this portion of total spending to be determined by applying it to appropriate multipliers.
- **Spending borrowed funds for goods and services produced *outside* the study area:** Zero impact if the borrowed funds are to be paid back with state/federal assistance.
- **Spending borrowed funds on goods and services produced *inside* the study area:** Positive impact if the borrowed funds are to be paid back with state/federal assistance, with the exact impact for this portion of total spending to be determined by applying it to appropriate multipliers.
- **Spending borrowed funds on goods and services produced *inside* the study area:** Zero impact if the borrowed funds are to be paid back with local funds.

- **Spending borrowed funds on goods and services produced *outside* the study area:** Negative impact if the borrowed funds are to be paid back with local funds, with the exact impact for this portion of total spending to be determined by applying it to appropriate multipliers.

Table 3: Effects of Best Practices on Estimated Impacts

Financing	Funds for Debt Repayment	Spending Pattern	Net	Gross
Non-Financed	N/A	Outside money spent outside	o	o
		Outside money spent inside	+	+
		Inside money spent inside	o	+
		Inside money spent outside	-	o
Financed (from outside)	Outside money	Spent outside	o	o
		Spent inside	+	+
	Inside money	Spent inside	o	+
		Spent outside	-	o

Framework for Estimating Long-Term Impacts

As described earlier in this section, the basis for long-term impacts stems from a permanent improvement to a transportation facility. For example, if a project reduces freight transportation costs, these savings will be passed through the supply chain on to the consumer, and thus increase consumer demand. This will in turn lead to increased output in all sectors of the economy that rely on transportation (both in-house and for-hire).

To estimate this increased output, the Freight EIA Module first estimates the percent reduction in freight transportation costs caused by the project. This can be entered directly by the model user or estimated with the Freight BCA Module.

Next, the tool uses direct requirement coefficients (Direct Use of Transportation per Dollar of Industry Output) from the Transportation Satellite Accounts (TSA) to estimate the use of transportation services by industry based on the output of that industry in the selected study area. The use of transportation services by industry is then used to distribute the percent change in transportation cost savings across industries. This illustrates the relative impact of the project investment across different industries.

An elasticity of output with respect to production costs is used to calculate the direct change in output, by industry, attributable to the reduction in transportation cost. This is the elasticity of output in one industry with respect to changes in production costs (and implicitly prices) in that same industry. As a default, this elasticity value is set to -1.0 in all industries. Next, RIMS II multipliers are applied to the direct changes in output to derive the total output impacts (both direct and indirect) by industry.

Economic data from the U.S. Bureau of Labor Statistics (BLS) is gathered on the number of establishments, total employees, wages, and output by industry for the Florida counties and districts, as well as for the nation. This data is applied to the total output impacts to extrapolate the total earnings, value-added, and jobs impacts implied by the original project investment.

A different approach is used to calculate the long-term impacts of ILC projects. Because the ILC will directly generate permanent jobs at the park, this will lead to increased income and output in the vicinity and in the regional economy. Given information on the employment at the ILC or the size of the park (measured by TEU lifts per year), TransValU calculates the total direct, indirect and induced jobs generated by the project using the RIMS II jobs multiplier for the warehousing and storage industry. These jobs are broken down by industry based on the results of another ILC economic impact analysis study.[27] Economic data from BLS is used to estimate the output per job and earnings per job in the project study area, both directly in the warehousing and storage industry, and on average for all other industries. These ratios are applied to the number of jobs created to calculate the long-term direct, indirect, and induced output and earnings generated by the project.

TransValU also includes an alternative approach to estimating the long-term employment impacts of an ILC project. This approach draws on observed data from existing ILC projects across the United States. Using the total jobs created by these ILC projects, and the size of the ILC projects (measured by TEU lifts per day), an average ratio of jobs per thousand TEU lifts is estimated. This ratio is applied to the number of TEU lifts per year expected from the new ILC facility to get the number of long-term direct, indirect, and induced jobs generated in the vicinity of the ILC. Finally, these jobs are broken down by industry using the same methodology described above.

Economic Impacts Estimated in TransValU

The EIA Module can be used to estimate the impacts of any type of transit investment as long as two conditions are satisfied: i) The required data are available either from observation or estimation; and ii) The application is proper, relative to the limitations of the multipliers used. Therefore, the EIA Module may be applied to any spending on transit, including:

- Any mode of transit: commuter rail, light rail, bus rapid transit, paratransit, etc.;
- Any nature of service: service expansion or reduction, new service, new route, or rerouting; and
- Any type of spending: capital or O&M expenses.

The EIA Module provides various options and measures when evaluating transit projects:

- **Type of Impacts** – The module estimates the economic impacts of spending on transit separately for each of four measures of economic activity: output, value added, earnings, and jobs for every application. Frequently, the economic impacts on jobs are of the most interest to local communities. The estimated impacts from this tool are the total impacts for all industries affected by the spending on transit considered. The total impacts cannot be meaningfully disaggregated for each of these affected industries.

[27] Development of an Integrated Logistics Center in Winter Haven, Florida. Developed by HDR for CSX Real Property Inc. January 2006.

- **Type of Spending** – The module offers four options in estimating the economic impacts of spending on transit by type of spending: capital alone, O&M alone, capital and O&M separately, and capital and O&M combined.
- **Nature of Impacts** – The module is designed primarily to estimate the "net" impacts of spending on transit in a given study area, which represents the impact on the local economy from spending outside funds inside the study area after accounting for the impact on the local economy from spending any inside funds alternatively on non-transit purposes. After appropriate multipliers are applied to the rows with a "+" or "-" in the "Net" Column of Table 3, the sum of that column gives the net impacts of the total spending considered. To meet the desire of some communities to know the amount of economic activity supported by their spending on transit, the tool also provides estimates of the "gross" impacts of the same total spending on transit. This represents the impact on the local economy from spending transit funds from both outside sources and local sources without considering the impact of spending any local funds alternatively on non-transit purposes. The sum of Column "Gross" in Table 3 gives the total gross impacts of the total spending considered after appropriate multipliers have been applied to the rows with a "+."
- **Total vs. Unit Impacts** – The module presents the estimated impacts for every application both in terms of "total impacts" expressed in units such as dollars and jobs and in terms of "unit impacts" calculated as the ratio of total impacts over the amount of spending on transit. The total impacts of a given set of spending may be used to indicate the size of the impact on the local economy. In contrast, the unit impacts may be used to indicate the rate-of-return of the same transit investment on the local economy.
- **Leveraging Effects** – The module also provides two measures of unit impacts for every application where local funds are used. One is given by the ratio of the total impacts of a given set of spending on transit over the total spending of funds from all sources. This is the default measure of unit impacts and may be referred to as the "regular unit impacts" for ease of reference. The other measure is given by the ratio of the same total impacts of a given set of spending on transit over only the portion of the total spending using local funds. For ease of reference, this alternative measure may be referred to as the "leveraged unit impacts." For a given set of transit spending considered, the measure of leveraged unit impacts will necessarily be the same or larger than the measure of regular unit impacts, reflecting the leveraging effect of spending local resources by crediting all the impacts to the local resources (including government, agency-generated, and transit-dedicated revenues). In a formula format, these two measures are: *Regular Unit Impacts = Total Impacts / Total Spending on transit using local and outside funds*; and *Leveraged Unit Impacts = Total Impacts / Spending on transit using local funds only*.

The EIA Module can also be used to evaluate non-transit projects; however, a more general methodology is used, and results are less detailed. The user enters project capital spending (no O&M) without specifying the source of funds. Instead of calculating net spending, the total spending is used to estimate economic impacts. Indirect, direct, and induced impacts are reported in terms of total jobs, earnings, output, and value-added produced.

The Freight EIA Module uses a similar approach to that for non-transit projects. The Freight EIA Module does not consider the source of funds, and thus the "net" impacts are not estimated. Short-term impacts are calculated by type (direct, indirect, and induced) and in terms of jobs, earnings, output, and value-added. However, different from the non-transit projects, the Freight EIA Module also calculates long-term impacts due to the infrastructure improvement. Long-term impacts are estimated by type (direct and indirect/induced) and in terms of jobs, earnings, and output. The Freight EIA Module is set up to evaluate several modes of freight projects, including roadway, transit, or ILC.

Section B.2 – Using TransValU for Economic Impact Analysis

Data Requirements

The Basic Method described in the previous section requires data on multipliers that capture the full impacts of spending on transit through the ripple effects in the local economy both on the business side and on the household side. Using the Basic Method for impact assessment also requires separate data for capital and O&M spending and separate data for different categories of capital projects. These different components of the total spending may require multipliers for different industries. As discussed above, the best practices built into the tool require data on the distribution of spending by where the money is spent, where the money comes from, and whether the money is borrowed and data on the distribution of debt repayments, if any, by source of funding. Not all these distributions are required for Gross Impacts Only analysis.

The tool makes simplifying assumptions to minimize the input data to get the estimated impacts approximately correct while maintaining consistency with the best practices. Most are used to approximate the impacts of local funds if *not* being used for spending on transit. The tool also pre-specifies several aspects of these required data to make the tool easier to use. These include, for investments in transit:

- Using the National Transit Database (NTD) for spending data for existing services;
- Relying on the Regional Input-Output Modeling System (RIMS II) of the U.S. Bureau of Economic Analysis for multipliers;
- Pre-specifying categories of capital projects; and
- Pre-specifying the RIMS II industry for O&M and for each category of capital projects.

For investments in modes other than transit, the tool relies on multipliers from IMPLAN. Updating these multipliers would require purchasing datasets from the IMPLAN group: http://implan.com/.

If not already purchased for another purpose of the same study area, the required RIMS II multipliers must be purchased on a user-by-user basis from the RIMS II Online Order and Delivery System at https://www.bea.gov/regional/rims/rimsii/. See Appendix II for details.

The minimum data requirements for Economic Impact Analysis are summarized in Table 4 below and in the EIA Data Needs tab of the workbook. As noted above, data requirements vary by project type (transit vs. other modes), type of impact (gross vs. net) and funding sources (financed vs. non-financed).

Table 4: Minimum EIA Data Requirements

Project Type	Type of Impact	Sources of Funds		Input Data Requirements	Data Description
Transit	All	All		Region	County name from list; District 5 combines Brevard, Flagler, Lake, Marion, Orange, Osceola, Seminole, Sumter, and Volusia counties
				Current Unemployment Rate in Region	Current unemployment rate (used for service expansion or new service)
				Nature of Spending	Nature of spending: service expansion, new service, rerouting, reduced service, or other
	Net & Gross Impacts	Non-Financed & Financed	Non-Financed Only	Spending from Non-Financed Sources (Capital)	Amount of Capital Spending; Distribution by Destination of Spending (Outside vs. Inside); and Distribution by Source of Funds (Outside vs. Local) for 12 Categories of Spending
				Spending from Non-Financed Sources (Operations & Maintenance)	Amount of O&M Spending; % Distribution by Destination of Spending (Outside vs. Inside); and % Distribution by Source of Funds (Outside vs. Local)
			Totally Financed	Spending from Financed Sources (Capital)	Amount of Capital Spending; % Distribution by Destination of Spending (Outside vs. Inside); and % Distribution by Source of Funds (Outside vs. Local) for 12 Categories
				Spending from Financed Sources (Operations & Maintenance)	Amount of O&M Spending; % Distribution by Destination of Spending (Outside vs. Inside); and % Distribution by Source of Funds (Outside vs. Local)
				Source of Funds for Debt Payments (Bonds and Loans)	% Distribution of Payments by Source of Funds (Outside vs. Inside)
	Gross Impacts Only	Not Applicable		Total Spending (Capital)	Amount of Capital Spending; % Distribution by Destination of Spending (Outside vs. Inside) for 12 Categories
				Total Spending (Operations & Maintenance)	Amount of O&M Spending; % Distribution by Destination of Spending (Outside vs. Inside)
All Other Modes	Gross Impacts Only	Not Applicable		First Year of Analysis	First year of analysis
				Period of Analysis, years	Number of years in analysis
				Construction costs, by year	Annual construction cost estimates

User Interface

The EIA section of the TransValU workbook contains the following tabs:

- **EIA DATA NEEDS**: This tab identifies the input requirements for the EIA Module of TransValU. It is identical to Table 4 above. The table is formatted for printing and can be used to collect data.
- **EIA INPUTS**: This tab is used to enter required data for estimating the economic impacts of spending on public transit and other construction spending;
- **EIA CALCULATIONS TRANSIT**: This tab takes all input data provided in EIA INPUTS, accounts for the best practices in implementing the Basic Method, and calculates total impacts and summarizes total spending by source of funds and destination of spending;
- **EIA CALCULATIONS OTHER**: Similar to the EIA CALCULATIONS TRANSIT tab, this tab takes input data entered into the tool for non-transit projects and calculates resulting impacts by type; and
- **EIA RESULTS**: This tab presents the estimated impacts for various options.

Navigating the Tool

This section describes how to use the EIA module and provides an overview of each tab the user will need to access. Users should remember to save a separate copy of the model for each project analyzed. Note that certain equations, databases, and other critical features of the TransValU tool are locked or hidden to avoid unintended user modifications.

EIA Data Needs Tab

The EIA Data Needs tab includes a table of the data requirements for the EIA Module. The user does not need to enter any information on this sheet. Table 4 includes a copy of the data needs table.

EIA Inputs Tab

This tab is where the required input data are entered for estimating the economic impact of project spending. The tool was created to appear simple to the user but at the same time estimate a vast variety of impacts, if required. To accommodate these two competing goals of simplicity and flexibility, the EIA Inputs worksheet was designed in a special way. It only shows the input fields that are relevant to the user, based on the two criteria:

1. Project type; and
2. Types of impacts relevant to the user (e.g., gross versus net impacts).

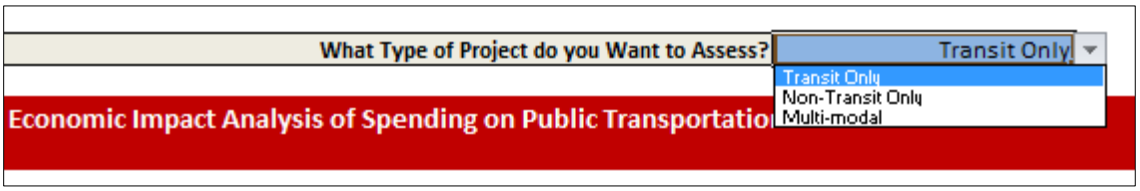
This way, depending on the selections that the user makes, the number of data points required for calculation can vary between three (for the simplest non-transit project) to several dozen (for multi-year non-transit projects or transit projects that are financed by a variety of fund sources). In addition, if the distinction between gross and net impacts for a transit project is not important to the user, selecting the "Gross Impacts Only" option may help avoid confusion.

The first step in running an economic impact analysis with TransValU is to select the type of project. The drop-down menu shown in Figure 38 provides a choice among three options:

- Transit Only;
- Non-Transit Only; and
- Multi-modal.

The first option follows the approach developed for transit EIA by CUTR and emphasizes the difference between gross and net impacts. The second option allows the user to analyze any construction spending investment and emphasizes the differences between direct, indirect, and induced impacts. The third option enables the user to enter inputs for one transit project and one non-transit project and then see both sets of results next to each other, in the EIA Results tab.

Figure 38: User selection of Project Type



Depending on the project type selected (Transit Only, Non-Transit Only, or Multi-Modal), the EIA Inputs tab will change in appearance and require different inputs.

EIA Inputs Required for "Transit Only" and "Multi-Modal" Projects

Table A – Type and Location

1. **Type of Impact Considered**: If the user selects the Transit Only or Multi-Modal option, the type of impacts must be specified. There are two options, as shown in Figure 39:

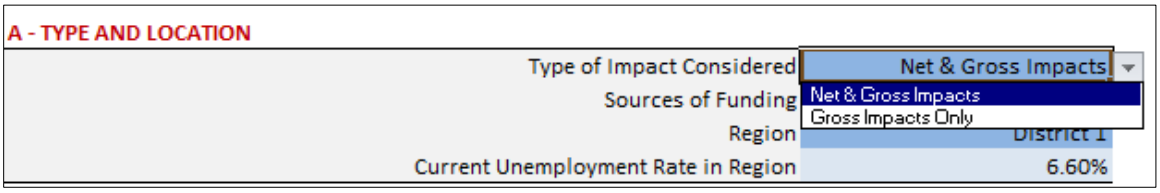
    a. Net & Gross Impacts; and

    b. Gross Impacts Only.

    The Net & Gross Impacts option provides more detailed and more inclusive results, but requires more data to be entered by the user. Thus, if the distinction between net and gross impacts is not important to the user or if the user does not have all the required data, selecting the Gross Impacts Only option may greatly simplify and speed-up the data input process.[28]

[28] If the user only needs to estimate gross impacts, the Non-Transit Only project type option may bring even more simplicity. However, the data from the same project entered into Transit Only (with Gross Impacts Only) project type and Non-Transit Only will most likely yield different results, because of the different methodologies and different sources for the multipliers.

Figure 39: User selection of Impact Type (for Transit projects only)



2. **Sources of funding**: To simplify the entry process further, the EIA Inputs tab requires specifying the sources of funding. The three available options are shown in Figure 40:

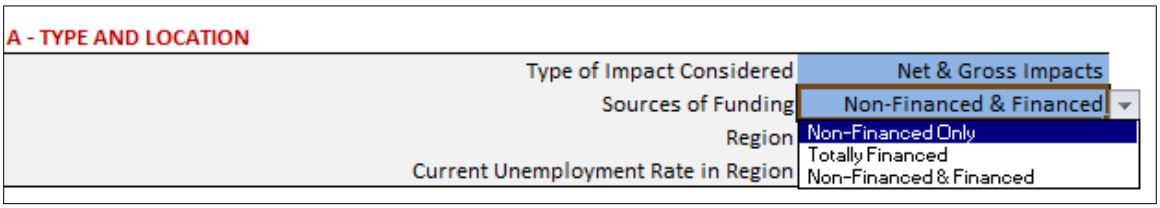
   a. Non-Financed Only;

   b. Totally Financed; and

   c. Non-Financed and Financed.[29]

   Based on the selection, the number of input tables shown to the user will vary. The Non-Financed Only option requires the user to enter inputs into Tables B and D only. The Totally Financed Option requires Tables B, E, and F to be filled out. Finally, the Non-Financed & Financed option requires Tables B, D, E, and F to be filled out.

Figure 40: User selection of Financing Type (for Transit projects and Net impact)



3. **Region selection and RIMS II multipliers:** Selecting a region from the drop-down menu selects the appropriate set of multipliers for each of six detailed industries and for two aggregated industries. These are the Type II final-demand multipliers for output, earnings, jobs, and value added. Figure 40 above shows how this section appears in the EIA Inputs tab. Figure 41 below illustrates the type of RIMS II multipliers in use.

[29] Note that these options are not available if Impact Type is set to Gross Impacts Only. The tool automatically assumes Non-Financed type of financing for Gross Impacts Only option.

Figure 41: RIMS II Multipliers

RIMS II MULTIPLIERS - USED IN CALCULATIONS

Type II total multipliers (by Detailed Industry) are based on the county selected in (A). If needed, the numbers in the table may be modified.

RIMS II Detailed Industry		Type II Final-Demand Multipliers			
Industry Name	Industry Code	Output	Earnings	Jobs	Value Added
Construction	7	1.7611	0.5631	14.2206	0.9583
Automobile manufacturing	336111	1.3688	0.2428	5.8280	0.4439
Heavy duty truck manufacturing	336120	1.0000	0.0000	0.0000	0.0000
Railroad rolling stock manufacturing	336500	1.0000	0.0000	0.0000	0.0000
Transit and Ground Passenger Transportation	485A00	1.6803	0.6046	22.1526	0.8621
Households	H00000	0.8950	0.2628	8.8463	0.5446

Type II total multipliers (by Industry Aggregation) are based on the county selected in (A). If needed, the numbers in the table may be modified.

RIMS II Industry Aggregation		Total Multipliers			
Industry Name	Industry Code	Output	Earnings	Jobs	Value Added
Computer and electronic product manufacturing	13	1.4832	0.3800	7.0347	0.8064
Professional, scientific, and technical services	50	1.7152	0.6607	14.9593	1.0591

4. **Unemployment rate:** Required only if the economic impacts of spending on transit for service expansion or new service are considered; represents the current unemployment rate in the study area. For more information on the unemployment rates of counties in the United States, the user can visit the BLS website and view the Local Area Unemployment Statistics (LAUS) data at https://www.bls.gov/lau/#tables.

Table B – Nature of Spending

1. **Nature of spending on transit:** Specifies whether the spending on transit is for service expansion or reduction, new service, new route, rerouting, reduced services, or other. Select from drop-down menu of options.

Table C – Total Cost Estimated (calculated)

1. **Total capital spending**: Tool calculates the total capital spending on the project based on the data entered by the user in Tables D and E, plus the funding sources selected in Table A.
2. **Total O&M spending**: Tool calculates the total O&M spending over the project analysis period based on the data entered by the user in Tables D and E, plus the funding sources selected in Table A.

Table D – Spending from Non-Financed Sources (e.g., Grants)

This table must be filled out if projects include non-financed sources of funding. For each category of spending, the user must enter the following:

- The amount of spending that originated from sources other than bonds or loans.
- The percent share of this spending outside the study area. Spending outside the study area refers to spending on goods and services that were produced outside the study area. If a bus was purchased from a dealer inside the study area but was manufactured outside the study area, the total spending would be considered as being outside the study area. A portion of the total spending may have been paid to the local dealer but is likely to be a negligible amount relative to the total spending.

- The percent share of this spending that originated from funds outside the study area.

These data are required for total O&M spending and for total capital spending for each of 12 categories of capital projects. Figure 42 shows these categories and how this section appears in the EIA Inputs tab when the "Net & Gross Impacts" option is selected in Table A.

Figure 42: Spending from Non-Financed Sources (Net & Gross Impacts option)

D - SPENDING FROM NON-FINANCED SOURCES (e.g., GRANTS)

Spending for capital categories 03 - 07 should exclude cost for land and for design and engineering services when possible.
For any of the 03 - 07 capital categories, do not add its cost for land in category 01 if the land cost is not excluded from this category.
For any of the 03 - 07 capital categories, do not add its design and engineering cost in category 02 if this cost is not excluded from this category.

Category of Spending	Amount of Spending	% Distribution by Destination of Spending		% Distribution by Source of Funds	
		Outside Study Area	Inside Study Area	Outside Funds	Local Funds
Capital Spending					
01. Land Cost	$0	0%	100%	95%	5%
02. Design and Engineering	$0	50%	50%	50%	50%
03. Guideway	$0	25%	75%	95%	5%
04. Passenger Stations	$32,386	0%	100%	95%	5%
05. Administrative Buildings	$339,745	0%	100%	95%	5%
06. Maintenance Facilities	$1,312,588	25%	75%	95%	5%
07. Other Capital Projects	$327,438	0%	100%	95%	5%
08. Revenue Vehicles - Bus	$8,270,411	100%	0%	95%	5%
09. Revenue Vehicles - Rail	$0	100%	0%	95%	5%
10. Service Vehicles	$36,583	100%	0%	95%	5%
11. Fair Revenue Collection Systems	$6,488	100%	0%	95%	5%
12. Communications and Information Systems	$1,269	100%	0%	95%	5%
Operations & Maintenance Spending					
Total O&M Spending	$69,568,197	10%	90%	32%	68%

If the Gross Impacts Only option is selected in Table A, the source of funds is not relevant. Figure 43 shows how the Spending from Non-Financed Sources Table in the EIA Inputs tab looks when the Gross Impacts Only option is selected.

Figure 43: Spending from Non-Financed Sources (Gross Impacts Only option)

D - TOTAL SPENDING

Spending for capital categories 03 - 07 should exclude cost for land and for design and engineering services when possible.
For any of the 03 - 07 capital categories, do not add its cost for land in category 01 if the land cost is not excluded from this category.
For any of the 03 - 07 capital categories, do not add its design and engineering cost in category 02 if this cost is not excluded from this category.

Category of Spending	Amount of Spending	% Distribution by Destination of Spending	
		Outside Study Area	Inside Study Area
Capital Spending			
01. Land Cost	$0	0%	100%
02. Design and Engineering	$0	50%	50%
03. Guideway	$0	25%	75%
04. Passenger Stations	$32,386	0%	100%
05. Administrative Buildings	$339,745	0%	100%
06. Maintenance Facilities	$1,312,588	25%	75%
07. Other Capital Projects	$327,438	0%	100%
08. Revenue Vehicles - Bus	$8,270,411	100%	0%
09. Revenue Vehicles - Rail	$0	100%	0%
10. Service Vehicles	$36,583	100%	0%
11. Fair Revenue Collection Systems	$6,488	100%	0%
12. Communications and Information Systems	$1,269	100%	0%
Operations & Maintenance Spending			
Total O&M Spending	$69,568,197	10%	90%

Table E – Spending from Financed Sources (e.g., Bonds and Loans)

If funding sources include financing, the user should enter the amount of spending that originated from borrowed funds through bonds and loans and the share of this spending made outside the study area. Enter these data for total O&M and for each category of capital projects. The share for a spending category is required only when this spending is not zero. Figure 44 shows how this section appears in the EIA Inputs tab.

Figure 44: Spending from Financed Sources

E - SPENDING FROM FINANCED SOURCES (e.g. BONDS AND LOANS)

Spending for capital project categories 03-07 should exclude cost for land and design and engineering services when possible.
For any of the 03 - 07 capital categories, do not add its cost for land in category 01 if the land cost is not excluded from this category.
For any of the 03 - 07 capital categories, do not add its design and engineering cost in category 02 if this cost is not excluded from this category.

Category of Spending	Amount of Spending	% Distribution by Destination of Spending	
		Outside Study Area	Inside Study Area
Capital Spending			
01. Land Cost	$0	0%	100%
02. Design and Engineering	$0	50%	50%
03. Guideway	$0	25%	75%
04. Passenger Stations	$0	0%	100%
05. Administrative Buildings	$0	0%	100%
06. Maintenance Facilities	$0	25%	75%
07. Other Capital Projects	$0	0%	100%
08. Revenue Vehicles - Bus	$0	100%	0%
09. Revenue Vehicles - Rail	$0	100%	0%
10. Service Vehicles	$0	100%	0%
11. Fair Revenue Collection Systems	$0	100%	0%
12. Communications and Information Systems	$0	100%	0%
Operations & Maintenance Spending			
Total O&M Spending	$0	10%	90%

Table F – Source of Funds for Debt Payments

The input data for this group are required only if any spending originated from borrowed funds through bonds and loans have been entered. The data are required separately for borrowed funds for O&M spending or for capital spending. Figure 45 shows how this section appears in the EIA Inputs tab.

Figure 45: Source of Funds Used for Debt Payments

F - SOURCE OF FUNDS FOR DEBT PAYMENTS

If data have been entered on financed spending above for O&M (or capital projects), enter the % share of debt payments for O&M (or capital projects) using funds from outside the study area.

Spending purpose of current borrowed funds for debt payments that will be made in the future.	% Distribution of Payments by Source of Funds	
	Outside Study Area	Inside Study Area
Operations & Maintenance	34%	66%
Capital Projects	75%	25%

<u>EIA Inputs Required for "Non-Transit Only" and "Multi-Modal" Projects</u>

If the user selects "Non-Transit Only" or "Multi-Modal" projects on the EIA Inputs tab, the following information will be required.

Table A – General Assumptions

1. **First year of analysis**: Enter the first year of analysis for the project. This may be either the current year or the first year money is spent on the project.
2. **Period of analysis**: Enter the number of years desired for the period of analysis.

Figure 46 includes a screenshot of Table A with sample data.

Figure 46: Sample Table A General Assumptions for EIA

A - GENERAL ASSUMPTIONS	
First Year of Analysis	2015
Period of Analysis, years	20

Table B – Fill-In Cost Information for Each Year Below

1. **Annual construction costs, dollars**: Enter the anticipated project construction costs in each year.
2. **Total construction costs, dollars**: The tool will automatically aggregate the total project construction costs based on the data entered by the user in step 1.

Figure 47 includes a screenshot of Table B with sample data.

Figure 47: Sample Table B Fill-In Cost Information for Each Year Below for EIA

B - FILL-IN COST INFORMATION FOR EACH YEAR BELOW -- EXCLUDE LAND & VEHICLE ACQUISITION COSTS				
	2015	2016	2017	2018
Annual Construction Costs, dollars		$3,600,000	$9,500,000	$4,597,000
Total Construction Costs, dollars	***$17,697,000***			

EIA Calculations Transit Tab

This tab takes all of the input data that are provided in EIA Inputs, accounts for the Basic Method and best practices described earlier, and calculates detailed total impacts by source of funds and destination of spending.

EIA Calculations Other Tab

This tab calculates the short-term impacts of construction spending for all other modes besides transit. Impacts are calculated by type (direct, indirect or induced) and by industry.

EIA Results Tab

This tab presents the summary tables of project economic impacts. The content of the Results tab changes depending on the type of project selected by the user on the EIA Inputs tab. If the user selects the project type "Transit Only" or "Multi-Modal," the EIA tab will include the following tables:

1. **Total Spending:** For a better understanding of the spending data entered, this tab summarizes the spending data by both source of funds and destination of spending for O&M, capital, and total spending, respectively (Figure 48). This summary also aids in understanding the portions of the spending that really matter in the estimated total impacts.

Figure 48: Summary of Spending on Public Transportation

A - SPENDING IN MILLIONS OF DOLLARS

Source of Funds	Outside Study Area		Inside Study Area		TOTAL Spending
Destination of Spending	Inside Study Area	Outside Study Area	Inside Study Area	Outside Study Area	
O&M	$20.16	$2.24	$42.45	$4.72	**$69.57**
Capital	$1.60	$8.23	$0.08	$0.02	**$9.93**
TOTAL	**$21.76**	**$10.47**	**$42.53**	**$4.73**	**$79.50**

Note: These are summarized from the spending data you have entered in the INPUTS worksheet.

2. **Total Impacts:** Summarizes the detailed total impacts by source of funds and destination of spending from the EIA Calculations Transit tab (see Figure 49). This summary is done by type of spending (O&M, capital, and total spending), by type of impacts (output, value added, earnings, and jobs), and by nature of impacts (net and gross). The estimated impacts from this tool are for all industries affected by spending on transit.

Figure 49: Economic Impacts of Spending on Public Transportation

B - TOTAL GROSS IMPACTS

Type of Spending	Type of Impacts				JOBS for Every $1M Invested
	JOBS (person-years)	EARNINGS ($millions)	OUTPUT ($millions)	VALUE ADDED ($millions)	
O&M	1,560.3	$43.27	$114.14	$59.66	22.4
Capital	25.2	$0.99	$2.98	$1.65	2.5
TOTAL	**1,585.4**	**$44.26**	**$117.12**	**$61.31**	**19.9**

Note: These are the activities supported by all of the considered transit spending INSIDE the study area, WITHOUT considering the source of funds.

C - TOTAL NET IMPACTS

Type of Spending	Type of Impacts				JOBS for Every $1M Invested
	JOBS (person-years)	EARNINGS ($millions)	OUTPUT ($millions)	VALUE ADDED ($millions)	
O&M	455.3	$12.50	$32.07	$16.32	6.5
Capital	23.8	$0.94	$2.82	$1.56	2.4
TOTAL	**479.1**	**$13.44**	**$34.89**	**$17.88**	**6.0**

Note: These are the true impacts generated by the transit spending considered, AFTER adjustments for the source of funds.

The EIA Transit Calculations tab also includes more detailed result tables. These tables are described below:

1. **Unit Impacts for Spending of Funds from All Sources:** The results for unit impacts indicate the relative size of the impacts, i.e., relative to the amount of spending involved. The results for unit impacts may be used to indicate the rate of return for investments in public transit. This is one of two measures of unit impacts and is measured relative to spending of funds from all sources. With this measure of unit impacts, the numerator (total impacts) and the denominator (spending) are consistent in that the total impacts in the numerator result from the amount of spending in the denominator. Results are provided for both unit net impacts and unit gross impacts, and for each spending category (O&M, capital, and total). Figure 50 shows how these results appear in the tool. Note that the full table is only shown at the bottom of the EIA Calculations Transit tab, starting at row 116.

Figure 50: Unit Impacts of Spending on Public Transportation, All Sources of Funds

1. Unit Net Impacts

Type of Spending	Type of Impacts			
	Output	Value Added	Earnings	Jobs
	For every $1 invested			For every $1M invested
O&M	$0.43	$0.21	$0.16	5.8
Capital	0.282775166	$0.15	$0.09	2.3
Total Spending	**$0.41**	**$0.21**	**$0.15**	**5.4**

Notes:
1. The Jobs result helps answer this question: For every $1 million invested in capital or operating and maintenance, what is the number of jobs created ? The other results help answer this question: For every $1 invested in capital or operating and maintenance, what is the dollar amount of output, value added, or household earnings generated?

2. For a given type of spending, the unit net impacts are derived through dividing the total net impacts for this type of spending by the total spending of the same type.

2. Unit Gross Impacts

Type of Spending	Type of Impacts			
	Output	Value Added	Earnings	Jobs
	For every $1 invested			For every $1M invested
O&M	$1.51	$0.78	$0.54	19.9
Capital	$0.30	$0.16	$0.10	2.4
Total Spending	**$1.36**	**$0.70**	**$0.49**	**17.7**

Notes:
1. The Jobs result helps answer this question: For every $1 million invested in capital (or operating and maintenance), what is the number of jobs supported ? The other results help answer this question: For every $1 invested in capital (or operating and maintenance), what is the dollar amount of output, value added, or household earnings supported?

2. For a given type of spending, the unit gross impacts are derived through dividing the total gross impacts for this type of spending by the total spending of the same type.

2. **Unit Impacts for Total Spending of Funds from Inside the Study Area:** The unit impacts are measured relative to spending of funds from inside the study area (spending of local resources). Local resources include government, agency-generated, and transit-dedicated revenues. With this measure of unit impacts, the total impacts in the numerator result from the amount of spending from all sources, but the amount of spending in the denominator includes only the portion from local resources. The objective of this measure of unit impacts is to capture not only the impacts of spending the local resources but also the leveraging effect of spending the local resources in bringing state and federal resources. Results are provided for both unit net impacts and unit gross impacts. These results are measured for total spending. Separate results for O&M spending and capital spending are not measured. Figure 51 shows how these results appear in the tool. Note that the full table is only shown at the bottom of the EIA Calculations Transit tab, starting at row 146.

Figure 51: Unit Impacts of Spending on Public Transportation, Inside Funds Only

Measurement Approach	Type of Impacts			
	Output	Value Added	Earnings	Jobs
	For every $1 of inside funds invested			For every $1M of inside funds invested
Net Impact	$0.69	$0.35	$0.25	9.0
Gross Impact	$2.29	$1.18	$0.82	29.9

Notes:
1. The Jobs result helps answer this question: For every $1 million of local resources invested in capital and operating and maintenance, what is the number of jobs created (Net) or supported (Gross)? The other results help answer this question: For every $1 of local resources invested in capital and operating and maintenance, what is the dollar amount of output, value added, or household earnings generated (Net) or supported (Gross)?

If the user selects either "Non-Transit Only" or "Multi-Modal" projects on the EIA Inputs tab, the EIA Results for Other Modes section will appear on the EIA Results tab. Economic impacts for other modes are associated with the *construction* phase of transportation projects. They are based on Florida-specific IMPLAN multipliers for spending in the construction sector.

The direct, indirect, and induced impacts of construction spending are estimated for jobs, income, business sales (output), value-added (Gross Regional Product), as well as State and local taxes (see Figure 52). As noted above, these results only capture the short-term impacts of construction spending. They do not include the sustained, long-term economic development benefits of improved transportation. In addition, only gross impacts are estimated.

A screenshot of the result tables using sample data is provided in Figure 52.

Figure 52: Economic Impacts of Construction Spending on Other Modes (sample screenshot)

A - IMPACTS OF CONSTRUCTION SPENDING

JOB IMPACTS	(person-years)
Direct (Construction Jobs)	139.0
Indirect	57.0
Induced	81.4
TOTAL	**277.4**

OTHER IMPACTS	(millions)
Income / Earnings	$13.15
Output / Business Sales	$36.35
Value Added / Gross Regional Product	$18.46
State and Local Taxes	$1.07

B - IMPACTS OF CONSTRUCTION SPENDING - SUMMARY TABLE

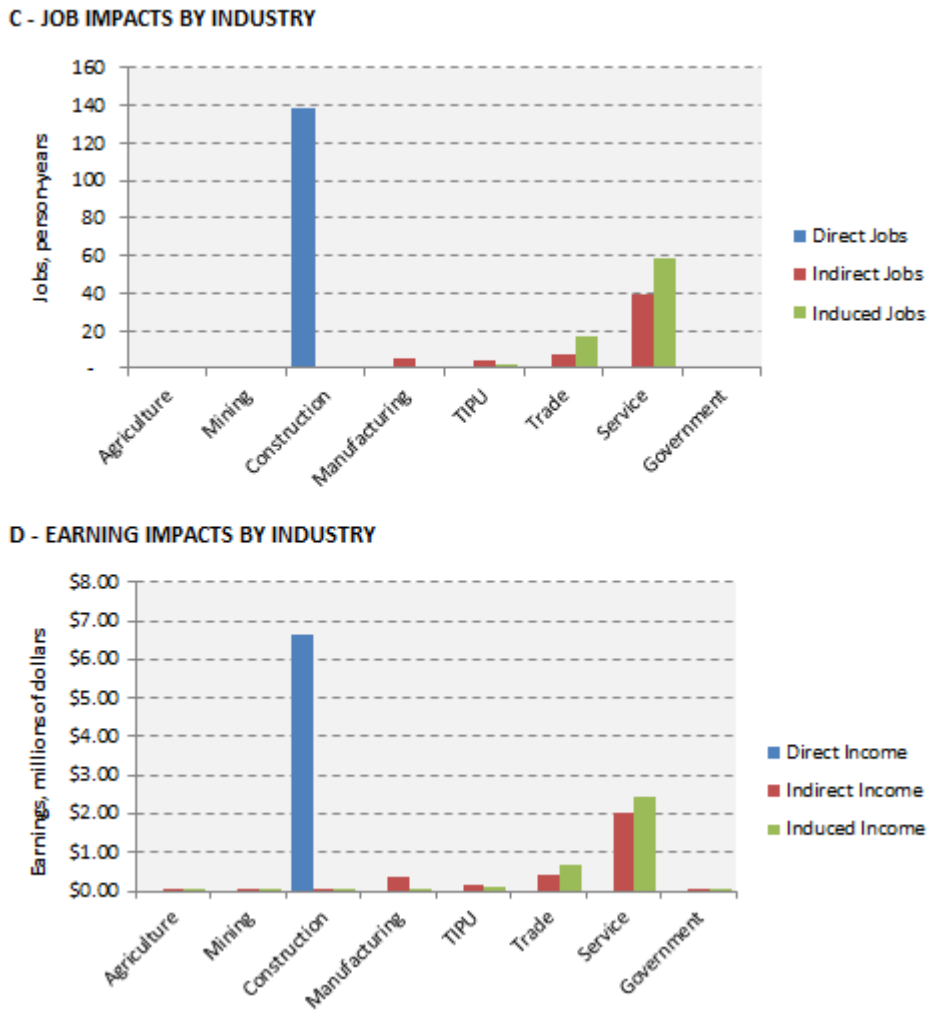
	Type of Impacts			
	JOBS (person-years)	EARNINGS (millions)	OUTPUT (millions)	VALUE ADDED (millions)
Direct	139.0	$6.67	$17.70	$7.58
Indirect	57.0	$3.03	$8.36	$4.60
Induced	81.4	$3.45	$10.30	$6.28
TOTAL	**277.4**	**$13.15**	**$36.35**	**$18.46**

Also included in the EIA Results tab is a breakdown of direct, indirect and induced impacts by industry, for employment and earnings. This is shown in Figure 53.

Employment and earning impacts are reported for eight industries:

- Agriculture;
- Mining;
- Construction;
- Manufacturing;
- Transportation, Information and Public Utilities (TIPU);
- Trade;
- Services; and
- Government.

Figure 53: Economic Impacts by Industry for Construction Spending on Other Modes (sample screenshot)



Section B.3 – Using TransValU for Economic Impact Analysis of Freight Projects

Data Requirements

The Freight EIA Module estimates both short-term and long-term economic impacts of freight project investments. Both types of impacts are estimated at once in the tool, but rely on different methodologies and require different data inputs. For long-term impact calculations, different inputs are required for analyzing a truck or rail project versus an ILC. Table 5 summarizes the data requirements for the Freight EIA Module.

Table 5: Minimum EIA Data Requirements for Freight Projects

Proceed to Inputs

Analysis Type	Input Data Requirements	Data Description & Notes
Short-Term Economic Impacts of Construction Spending	First Year of Analysis	First year of analysis
	Period of Analysis	Number of years in analysis
	Construction Costs by Year	Estimates of annual construction costs
Long-Term Economic Impacts of Improved Truck Transportation	Change in Freight Transportation Costs	The calculation of long-term economic impacts uses the change in freight transportation costs (estimated in a Benefit-Cost Analysis) as an input. This change is comprised of travel time savings and out-of-pocket cost savings (including changes in vehicle operating costs such as fuel, oil, maintenace and repair, and vehicle depreciation). The user has the option to override the estimate developed in the BCA section of TransValU, and manually enter a value for this input.
Long-Term Economic Impacts of ILC Operations & Associated Business Development	Projected Employment or TEUs Handled at ILC	The calculation of long-term economic impacts requires information on the level of activity expected at the ILC, expressed in terms of TEU lifts or employees working at the site. These estimates are combined with Economic Multipliers (and other model parameters) to arrive at total long-term impacts by industry and by year.

The tool uses IMPLAN input-output multipliers to estimate short-term economic impacts of freight projects. IMPLAN multipliers are currently available in the tool for the State of Florida for the year 2012. If at some point the user wishes to update this data, new multipliers will need to be purchased. IMPLAN multipliers can be purchased here: http://implan.com/product-category/implan-pro/state-level-data/.

RIMS II input-output multipliers are used to estimate long-term economic impacts of freight projects. These multipliers are currently available in the tool for all seven Florida Districts and all nine counties within District Five. District-level multipliers were last updated in 2016, and county-level multipliers were last updated in 2013. If at some point the user wishes to update this data, new multipliers will need to be purchased. RIMS II Online Order and Delivery System can be accessed here: https://www.bea.gov/regional/rims/rimsii/. See APPENDIX II: Obtaining Multipliers for the Economic Impact Analysis for details.

User Interface

The Freight EIA Module includes the following tabs:

- **Freight EIA Data Needs**: This tab lists the required inputs for the Freight EIA Module (also shown in Table 7 above).
- **Freight EIA Inputs**: This tab is used to enter required data for estimating the short-term and long-term economic impacts of freight projects;
- **Freight EIA Calculations for Short-Term Impacts**: This tab retrieves data from the Freight EIA Inputs tab and economic multipliers from the EIA IMPLAN tab to calculate the short-term economic impacts of freight projects. Impacts are calculated by year, for each sector, by impact category (jobs, earnings, value added, and output), and by impact type (direct, indirect, and induced). Fiscal impacts are also calculated on this sheet;
- **Freight EIA Calculations for Long-Term Impacts**: This tab retrieves data from the Freight EIA Inputs tab, economic multipliers from the Freight EIA RIMS II tab, as well as economic data at the national and regional (county or district) levels to calculate long-term economic impacts of freight projects. Impacts are calculated by sector and by category(jobs, earnings, and output);
- **Freight EIA Calculations for ILC**: This tab uses data from the Freight EIA Inputs tab and economic multipliers to calculate the short-term and long-term economic impacts of ILC projects. Total short-term jobs, earnings, value added, and output are reported by year and by industry. Long-term jobs, earnings, and output are calculated by year. Long-term jobs are reported by industry; and
- **Freight EIA Results**: This tab summarizes and presents the total short-term and long-term economic impacts of the freight project.

Navigating the Tool

The following sections explain the function of each tab within the Freight EIA Module, and the user inputs required. Note that the tool contains additional tabs with required data for the EIA, but these tabs are hidden or locked to avoid unintended modifications and allow for continuity between model runs.

Freight EIA Data Needs Tab

The Freight EIA Data Needs tab shows a summary of the input information that required for the Freight EIA Module. No action is required by the user on this tab. The table is also shown in the User Guide in Table 5.

Freight EIA Inputs Tab

The Freight EIA Inputs tab is where users enter the required project information for the Freight EIA Module. The following are the list of required input data on the Freight EIA Inputs tab:

Table A – General Assumptions

1. **Project location**: Select the project location from a dropdown list of options. The region is used to select the appropriate RIMS II multipliers and economic data for the long-term economic impact

calculations. An example of these RIMS II multipliers for a selected region is illustrated in the previous section in Figure 41.

2. **First year of analysis:** Enter the start year for this analysis.
3. **Period of analysis, years:** Enter the number of years of analysis the tool should consider for measuring economic impacts.

Table B –Fill in Construction Cost Information for each Year Below - Exclude Land and Acquisition Costs

1. **Annual construction cost of Roadway, dollars:** If project contains a roadway element, enter the relevant construction costs by year.
2. **Annual construction cost of Freight Rail, dollars:** If project contains a freight rail element, enter the relevant construction costs by year.
3. **Annual construction cost of ILC, dollars:** If the project involved constructing a new ILC, enter the relevant construction costs by year.

Table C –Change in Freight Transportation Costs

1. **Select a source for value:** User selects from a dropdown menu, either "Manual Entry" or "Based on BCA." This selection determines if the change in freight transportation costs caused by the project will be taken automatically from the Freight BCA portion of the tool, or entered manually by the user.
2. **(Optional) Manual Entry (Override) Value, percent:** If "Manual Entry" was selected in the previous line, the user can override the automated value for the average annual change (in millions of dollars) in freight transportation costs caused by the project. A decrease in costs should be represented with a negative value.

Table D –Projected Activity and Employment at Intermodal Logistics Center

1. **Opening year of ILC:** Enter the anticipated first year of operations for the new or improved ILC.
2. **Year of baseline estimate:** Enter the year of data used for baseline estimates below.
3. **First year of full operations:** Enter the year when the new ILC is expected to reach full operations after ramp-up.
4. Enter information for one of the following:
    a. **Number of long-term jobs at ILC due to project**: Enter the number of jobs expected to be created directly by the ILC. Include jobs working at the ILC facility as well as other jobs in the ILC park. Enter estimate for the base year and for the year of full operations.

--or--

    a. **Number of TEU lifts per year at ILC**: Enter the anticipated size of the ILC, measured in terms of TEU lifts per year. Enter estimate for the base year and for the year of full operations.

b. **Number of ILC jobs required[30] per 1,000 TEU lifts**: The tool contains an estimate for the number of jobs required for every thousand TEU lifts carried out at the ILC. The user can change this parameter if desired.

c. **Number of long-term jobs at ILC due to project (calculation)**: Based on the TEU lifts entered and the jobs per thousand TEU lifts parameter, the tool calculates the number of long-term jobs at the ICL in the base year and year of full operations.

5. **ACTIVE- Number of long-term jobs at ILC due to project**: The tool displays the expected number of jobs at the ILC in the base year and year of full operations based on the information entered above. These are the number of jobs used by the tool to calculate long-term impacts of the ILC project.

6. **ACTIVE- Number of TEU lifts per year at ILC**: The tool displays the expected number of annual TEU lifts at the ILC in the base year and year of full operations based on the information entered above. These are the number of TEU lifts used by the tool to calculate long-term impacts of the ILC project.

A completed sample of the Freight EIA Inputs tab is included in Figure 54 below.

Figure 54: Sample Data for Freight EIA Inputs Tab

Inputs Used in Economic Impact Analysis of Freight Projects

View EIA Results

LEGEND	
Drop-Down Box	
User Input Field	
Summation	*Number*

A - GENERAL ASSUMPTIONS

Project Location	Flagler
First Year of Analysis	2015
Period of Analysis	30 years

B - FILL-IN CONSTRUCTION COST INFORMATION FOR EACH YEAR BELOW -- EXCLUDE LAND & VEHICLE ACQUISITION COSTS

	2015	2016	2017	2018	2019
Roadway		$3,600,000	$9,500,000	$4,597,000	
Freight Rail					
Intermodal Logistics Center			$13,000,000	$13,000,000	
Total Annual	**$0**	**$3,600,000**	**$22,500,000**	**$17,597,000**	**$0**
Total Construction Costs, dollars	***$43,697,000***				

C - CHANGE IN FREIGHT TRANSPORTATION COSTS

Select a Source for Value	Based on BCA
Value Used, $millions	-$77.2

D - PROJECTED ACTIVITY AND EMPLOYMENT AT INTERMODAL LOGISTICS CENTER

ILC Opening Year	2019
Base Year for Estimates	2019
First Year of Full Operations	2024

Enter Information for One of the Following:	Base Year 2019	First Year of Full Operations 2024
Expected Number of Long-Term Jobs* at ILC		
-- OR --		
Expected Number of TEU Lifts per Year at ILC	20,000	200,000
Number of ILC Jobs Required per 1,000 TEU Lifts	10.0	10.0
Number of Long-Term Jobs at ILC (calculated)	200	2,000
ACTIVE - Number of Long-Term Jobs at ILC	200	2,000
ACTIVE - Number of TEU Lifts per Year at ILC	20,000	200,000

** Include jobs at both intermodal facility and business park, if any.*

Freight EIA Calculations for Short-Term Impacts Tab

This tab uses project information from the Freight EIA Inputs tab and multipliers from the EIA IMPLAN tab to calculate short-term economic impacts. Impacts are calculated for each year, and totaled over the

[30] Include jobs at both intermodal facility and the park.

project analysis period in Column C in ***italicized green***. Impacts are estimated by industry, for each impact category (jobs, earnings, value added, and output) and for each impact type (direct, indirect and induced). The bottom of the tab includes fiscal impacts by tax type.

Freight EIA Calculations for Long-Term Impacts Tab

This tab uses project information from the Freight EIA Inputs tab, multipliers from the EIA RIMS II, and economic data at the national and district or county level tab to calculate long-term economic impacts. Impacts are estimated by industry.

Freight EIA Calculations for ILC Tab

This tab includes the calculations for both short-term and long-term economic impacts of ILC projects. The short-term impacts are calculated first on the sheet. Impacts are estimated by industry and by year. Short-term tax revenues generated by the project are calculated by tax type. Short-term impacts and tax effects are totaled across the period of analysis and shown in Column C in ***italicized green***. Long-term impacts are calculated for each year of analysis, and jobs are calculated by industry. Long-term impacts occur each year of project operation. Column C includes the average annual long-term effect for each impact type.

Freight EIA Results Tab

The Freight EIA Results tab displays the summary results for short-term and long-term economic impacts. Several tables and charts are included on the tab to illustrate the total impacts from the project:

A – Short-Term Impacts of construction Spending (Direct, Indirect and Induced Effects)

1. **Roadway and/or Rail (Table)**: summarizes the direct, indirect and induced impacts of all roadway and rail projects entered in the tool. Impacts are displayed in terms of job-years, income, output, and value added.
2. **ILC (Table)**: summarizes the direct, indirect and induced impacts of all ILC projects entered in the tool. Impacts are displayed in terms of job-years, income, output, and value added.
3. **All Freight (Table)**: totals all direct, indirect, and induced impacts for all freight projects analyzed in the tool. Impacts are displayed in terms of job-years, income, output, and value added.

B – Short-Term State and Local Tax Impacts from Construction Spending

4. **(Table)**: summarizes the total tax revenues generated by roadway/rail projects and ILC projects.

C – Short-Term Employment Impacts by Industry (All Freight Projects)

5. **(Chart)**: illustrates the number of direct, indirect, and induced job-years, by industry, created because of the roadway, rail, and/or ILC projects analyzed.

D – Short-Term Income Impacts by Industry (All Freight Projects)

6. **(Chart)**: illustrates the amount of direct, indirect, and induced income, by industry, generated by the roadway, rail, and/or ILC projects analyzed.

E – Long-Term Impacts of Improved Truck Transportation

7. **(Table)**: displays the long-term direct and indirect/induced impacts of any freight truck project(s) analyzed. Impacts are reported in terms of jobs, income, and output generated.

F – Long-Term Direct Employment Impacts by Industry

8. **(Chart)**: shows the number of jobs by industry created by the freight truck project(s) analyzed.

G – Long-Term Impacts of ILC

9. **(Table)**: displays the long-term direct and indirect/induced impacts of any freight ILC project(s) analyzed. Impacts are reported in terms of jobs, income, and output generated.

H – Long-Term Direct, Indirect & Induced Employment Impacts by Industry

10. **(Chart)**: shows the total number of jobs by industry created by the ILC project(s) analyzed.

Figure 55 and Figure 56 below include screenshots of the Freight EIA Results tab with sample data.

Figure 55: Sample Short-Term Economic Impacts from Freight EIA Results Tab

Economic Impacts of Freight Projects

A - SHORT-TERM IMPACTS OF CONSTRUCTION SPENDING (DIRECT, INDIRECT and INDUCED EFFECTS)

Roadway and/or Rail	Type of Impacts			
	JOBS (person-years)	INCOME ($ millions)	OUTPUT ($ millions)	VALUE ADDED ($ millions)
Direct	139.0	$6.67	$17.70	$7.58
Indirect	57.0	$3.03	$8.36	$4.60
Induced	81.4	$3.45	$10.30	$6.28
TOTAL	277.4	$13.15	$36.35	$18.46

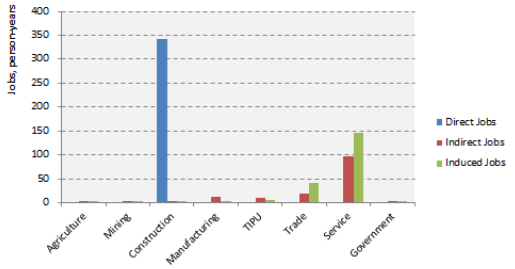
ILC	Type of Impacts			
	JOBS (person-years)	INCOME ($ millions)	OUTPUT ($ millions)	VALUE ADDED ($ millions)
Direct	204.2	$9.80	$26.00	$11.13
Indirect	83.8	$4.45	$12.28	$6.76
Induced	119.7	$5.07	$15.13	$9.23
TOTAL	407.6	$19.32	$53.41	$27.12

All Freight	Type of Impacts			
	JOBS (person-years)	INCOME ($ millions)	OUTPUT ($ millions)	VALUE ADDED ($ millions)
Direct	343.1	$16.47	$43.70	$18.71
Indirect	140.8	$7.48	$20.63	$11.36
Induced	201.1	$8.52	$25.43	$15.51
TOTAL	685.0	$32.48	$89.76	$45.58

B - SHORT-TERM STATE AND LOCAL TAX IMPACTS FROM CONSTRUCTION SPENDING

	Tax Revenues ($ millions)
Freight Roadway and/or Rail Projects	$1.07
ILC Projects	$1.56
TOTAL	$2.63

C - SHORT-TERM EMPLOYMENT IMPACTS BY INDUSTRY (ALL FREIGHT PROJECTS)



D - SHORT-TERM INCOME IMPACTS BY INDUSTRY (ALL FREIGHT PROJECTS)

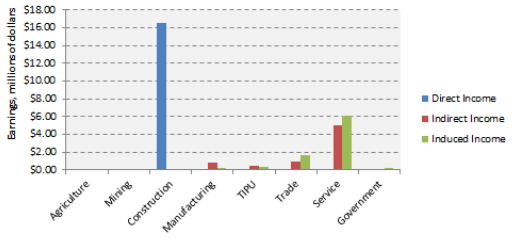
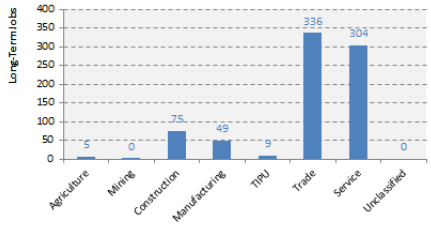


Figure 56: Sample Long-Term Economic Impacts from Freight EIA Results Tab

E - LONG-TERM IMPACTS OF IMPROVED TRUCK TRANSPORTATION

	Type of Impacts		
	JOBS (long-term jobs)	INCOME ($millions/year)	OUTPUT ($millions/year)
Direct	778.5	$28.83	$129.22
Indirect & Induced	609.1	$22.59	$98.64
TOTAL	1,387.5	$51.4	$227.9

F - LONG-TERM DIRECT EMPLOYMENT IMPACTS BY INDUSTRY

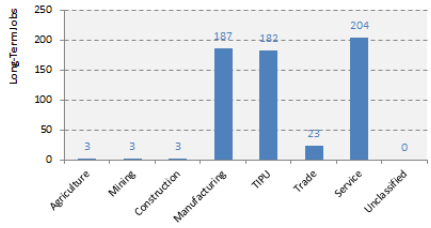


G - LONG-TERM IMPACTS OF ILC

	Type of Impacts*		
	JOBS (long-term jobs)	INCOME ($millions/year)	OUTPUT ($millions/year)
Direct	352.2	$29.69	$69.45
Indirect & Induced	250.7	$25.45	$128.55
TOTAL	602.9	$55.1	$198.0

** Calculations allow for ramp up in job creation, and so number of jobs, and value of income and output differ by year. Numbers in table show average value of period of analysis*

H - LONG-TERM DIRECT, INDIRECT & INDUCED EMPLOYMENT IMPACTS BY INDUSTRY



PART C. FINANCIAL ANALYSIS

The purpose of this section is to provide a detailed explanation of the financial analysis performed in TransValU. First, the section includes a description of the methodology used and output categories provided by the tool. Second, users are provided with a list of data requirements, a description of what to expect from the user interface, and a detailed description for how to navigate and use the module. Unlike the BCA and EIA, the tool includes only one module for the financial analysis. Thus, all project modes available for analysis in the tool (e.g., highway, transit, bicycle/pedestrian, multi-modal, and freight) will be evaluated in the same Financial Analysis Module.

Section C.1 – Introduction to Financial Analysis

The purpose of Financial Analysis is to assess financial gains and losses (inflows and outflows of money, or "cash") from the perspective of a project entity or organization, typically a firm or government agency. Forecasts of money flows are used to estimate indicators of return, including the Financial Net Present Value (FNPV) and the Financial Internal Rate of Return (FIRR) of a project or investment.

Framework

The methodology used in TransValU for the determination of financial return is the **Discounted Cash Flow** approach, which implies that:[31]

- The determination of money flows is based on an incremental approach, i.e., by estimating differences in inflows and outflows between the base case and a project case alternative (the with project scenario);
- Only cash inflows and outflows are considered. Depreciation, reserves and other accounting items that do not correspond to actual flows of money should not be included; and
- Money flows occurring in different years are discounted, using a financial discount rate. The financial discount rate must be set by the user, and should reflect the opportunity cost of capital (i.e., the expected return *forgone* by bypassing other potential investment activities).

Financial Flows Considered in TransValU

The Financial Analysis Module of TransValU let users define up to ten categories of financial flows: five categories of inflows and five categories of outflows. All flows should be expressed in relation to the Base Case: inflows should represent incremental inflows under the Project Case relative to the Base Case; outflows should represent incremental outflows under the Project Case relative to the Base Case.

[31] European Commission, Directorate General Regional Policy, "Guide to Cost Benefit Analysis of Investment Projects," 2008.

Depending on the nature of the project and the perspective from which the financial analysis is done, the following categories of outflows may be considered:

- Capital investment costs
- Operating & maintenance costs
- Administrative expenses
- Grant investment

Depending on the nature of the project and the perspective from which the financial analysis is done, the following categories of inflows may be considered:

- Toll revenue / revenue from user charges
- Rental revenue / revenue from leases
- Tax revenue

Where applicable, a residual value should be calculated outside the tool and entered as one of the outflow categories. The residual value estimate should be entered as a negative outflow in the last year of analysis.

In TransValU, inflows and outflows can be expressed in real terms (where prices are constant, fixed at a base-year) or in nominal terms (where prices are allowed to vary with general inflation, and reflect year-of-expenditure/receipt conditions). It is generally recommended to use nominal prices in financial analysis, particularly when relative price changes are expected.[32].

When the analysis is carried out at constant prices, the financial discount rate should be expressed in real terms, while a nominal financial discount rate must be used with current prices. The formula for the calculation of the nominal discount rate is as follows:

Nominal Discount Rate = (1 + Real Discount Rate) x (1 + Inflation Rate) - 1

Or, equivalently:

Nominal Discount Rate = Real Discount Rate + Inflation Rate + Real Discount Rate x Inflation Rate

These formulas are applied automatically in TransValU, based on inputs provided by the user (see Navigating the Tool, below).

The Financial Net Present Value (FNPV) is estimated as the difference between the present discounted value of future expected inflows (e.g., total revenue) and the present discounted value of future expected outflows (e.g., total investment costs). The Financial Internal Rate of Return (FIRR) is defined and estimated as the discount rate that produces a zero FNPV. TransValU also estimates a Financial Discounted Payback Period, defined as the number of years it takes the project to break even financially.

[32] European Commission (2008), page 41

Section C.2 – Using TransValU for Financial Analysis

Unlike the previous benefit-cost and economic impact analyses, there is only one Financial Analysis Module in TransValU; it is not separated by project mode. Thus, the following section on how to use TransValU for financial analysis applies to all transportation projects.

Data Requirements

Use of the Financial Analysis Module requires that a number of input values be prepared outside the tool, including:

- First year of analysis and period of analysis;
- Annual projections of financial inflows by category, for up to five categories; and
- Annual projections of financial outflows by category, for up to five categories.

For most transportation projects, a period of analysis of at least 20 years should be used.

The minimum data requirements for Financial Analysis are summarized in Table 6 and in the FIN Data Needs tab within the Excel file.

User Interface

The Financial Analysis section of the TransValU workbook has four user-enabled tabs, each devoted to specific tasks or functions. The following describes each user-controlled tab of the financial module: FIN Data Needs, FIN Inputs, FIN Calculations, and FIN Results.

FIN Data Needs

This tab identifies the inputs required to run a financial analysis in TransValU. It is identical to Table 6. The table is formatted for printing and can be used to collect data.

FIN Inputs

This tab contains the input tables that the user should fill out before running a financial analysis in TransValU. Not all fields in the input tables are required to run the analysis.

- **Table A – General Assumptions:** Table A requires the user to enter information on the base year of the analysis and calculates the nominal discount rate based on inputs provided by the user.
- **Table B – Project Information:** Table B provides input fields for the first year of analysis and the period of analysis. These two inputs are required fields: the analysis will not run if any of these fields is missing. Other fields include project name, project type, and descriptions of five sources of funds (e.g., toll revenue) and five uses of funds (e.g., operating expenses). The analysis will run if Table B is missing one or more of these fields.
- **Table C – Fill in Revenue Projections for Each Year in Dollars:** Table C contains the input fields for financial inflows from up to five sources of funds (as defined in Table B). At least one field must be filled-in for the analysis to run. The user has an option to enter the values in constant dollars or nominal year-of-expenditure (YOE) dollars. If the user chooses the Constant Dollars option, the base year for the revenue values should be specified. Note that this base year may be different from that specified for the analysis results in Table A.

Table 6: Minimum Financial Analysis Data Requirements

Input Group	Input Data Requirements	Data Description
General Assumptions	Base Year	Base year used in calculations
	Inflation Rate (%)	Annual rate of general price inflations
	Real discount rate (%)	Real discount rate used for present valuation
Project Information	Project / Alternative name	Name of project or alternative being assessed
	First year of analysis	First year of analysis
	Period of analysis (years)	Number of years in analysis
	Scenario #	Scenario ID number
	Project type or description	Additional information on project type and/or description
	Define categories of revenue / inflows	Names of revenue or inflow categories used in analysis (up to five categories)
	Define categories of expenses / outflows	Names of expense or outflow categories used in analysis (up to five categories)
Revenue Projections	Revenue/Inflow projections expressed in nominal or real terms	Specify whether projections are expressed in nominal, year-of-expenditure dollars or in real, constant dollars
	Year of constant dollars	Base year for revenue/inflow projections, if expressed in constant dollars
	Revenue projections for each year	Annual revenue projections for all years between First year of analysis and end of analysis period, for each revenue category identified
Expense Projections	Expense/Outflow projections expressed in nominal or real terms	Specify whether projections are expressed in nominal, year-of-expenditure dollars or in real, constant dollars
	Year of constant dollars	Base year for expense/outflow projections, if expressed in constant dollars
	Expense projections for each year	Annual expense projections for all years between First year of analysis and end of analysis period, for each expense category identified

- **Table D – Fill in Expense Projections for Each Year in Dollars- Enter Expenses as Positive Values:** Table D requires the user to enter at least one estimate (as a positive value) that will represent a financial outflow, in constant or nominal dollars. Note that if the Constant Dollars option is selected, these flows may have a base year different from those chosen in Table A and/or Table C.

FIN Calculations

This tab shows how revenues and expenses are adjusted for inflation and combined (added) together. In FIN Calculations, the following metrics are calculated:

- Present discounted value of total inflows;
- Present discounted value of total outflows;

- Financial net present value;
- Financial internal rate of return; and
- Discounted payback period.

FIN Results

The FIN Results tab summarizes the calculations made in the FIN Calculations tab. This summary includes the following:

- Project revenues/inflows for each category separately and total inflows, in both YOE and base-year dollars;
- Project expenses/outflows for each category, in YOE and base-year dollars;
- Net revenue/financial net present value;
- Financial internal rate of return;
- Discounted payback period; and
- Summary chart, with inflows shown as positive blue bars and outflows as negative red bars.

Navigating the Tool

The following sections provide a detailed description and walk-through of the Financial Analysis tabs. FIN Inputs tab will be shown first. The user needs to fill out the input tables. The financial analysis will be completed in the FIN Calculations tab, while the results are presented in the FIN Results tab. In most cases, the user will enter the inputs in the FIN Inputs and go directly to the FIN Results tab to see the results summary.

FIN Data Needs Tab

The Financial Data Needs tab includes a summary table of the input requirements for the Financial Analysis Module. No action is required on this worksheet. A copy of the table is provided in Table 6.

FIN Inputs Tab

First, the user needs to fill out the input Tables A, B, C, and D. Then the Financial Analysis Module of TransValU will use the input values to calculate a set of financial metrics.

- **Table A – General Assumptions:** Table A (see the top half of Figure 57) contains four fields (three required fields that are necessary to run the analysis and one calculated field):
    - **Base year:** This input is used to present the results of the analysis (discounted inflows and outflows) in dollars of the base year. By default, the base year is equal to the first year of analysis (entered in Table B, as described below). However, this input is flexible, so it does not have to be the same as the first year of analysis. If, for example, the first year of analysis is 2017, the user may select a different year (for example 2020) as the base year.
    - **Inflation rate, %:** This input is used to estimate the nominal discount rate, and to adjust inflows and outflows for inflation in some calculations.

- **Real financial discount rate, %:** This input is used in the calculation of the nominal discount rate (see below).
- **Nominal financial discount rate, %:** This field is calculated from the inflation rate and the real discount rate, using the following formula: *Nominal Discount Rate = Real Discount Rate + Inflation Rate + Real Discount Rate x Inflation Rate*

Figure 57: Financial Analysis Inputs Tab – General Assumptions and Project Information (sample screenshot)

Inputs Used in Financial Analysis

Review Financial Calculations

A - GENERAL ASSUMPTIONS

Base year	2015
Inflation rate (%)	2.1%
Real financial discount rate (%)	4.0%
Nominal financial discount rate (%)	6.2%

B - PROJECT INFORMATION

Project / Alternative name	Example for Testing
First year of analysis	2015
Period of analysis (years)	30 years
Scenario #	1
Project type or description	This is an illustrative example created to test the tool.
Define categories of revenue / inflows	
Revenue source #1	Toll Revenue
Revenue source #2	n/a
Revenue source #3	n/a
Revenue source #4	n/a
Revenue source #5	n/a
Define categories of expenses / outflows	
Expense category #1	Annual Capital Cost, including Right of Way
Expense category #2	Annual Incremental Operating & Maintenance Costs
Expense category #3	n/a
Expense category #4	n/a
Expense category #5	n/a

- **Table B – Project Information:** Table B (see Figure 57) should be filled out next:
  - **Project / Alternative name:** Filling out this field is not a requirement for running the financial analysis. If entered, the project / alternative name will appear in the FIN Results tab.
  - **First year of analysis:** This is a required field. The structure of Tables C and D will depend on this input. The first year that appears in Tables C and D is equal to the First year of analysis.
  - **Period of analysis (years):** This is a required field. The structure of Tables C and D will change if this variable is changed. The values in Tables C and D that are outside of the light blue cell range are not used in the financial analysis.
  - **Scenario #:** This is not a required field. The scenario number will appear in the FIN Results tab, right before the Project / Alternative name (if the name is entered).

- **Project type or description:** This field is not required. The project description is used for adding more detail on the project.
- **Define categories of revenue / inflows:** There are five inflow categories in the table, with generic names "Revenue source #1" through "Revenue source #5." If the fields are defined in the Define categories table, then the defined names are used throughout the Financial Analysis, instead of the generic names.
- **Define categories of expenses / outflows:** There are five outflow categories in the table, with generic names "Expense category #1" through "Expense category #5." If the fields are defined in the Define categories table, then the defined names are used throughout the Financial Analysis, instead of the generic names.

- **Table C – Fill in Revenue Projections for Each Year in Dollars:** Enter values into Table C (see the top half of Figure 58). It contains the input fields for inflows from up to five sources (as defined in Table B). At least one field must be filled-in for the analysis to run. The user has an option to enter the values in either constant dollars or nominal dollars. If the user chooses the Constant Dollars option, then the base year for the values should be specified. Note that this base year may be different from that specified for the analysis results in Table A. This analysis period is determined by the First year of analysis and Period of analysis (years) inputs (in Table B). Note that if values are entered in Table C for years outside the period of analysis defined in Table A, these values will not be included in the analysis.
- **Table D – Fill in Expense Projections for Each Year in Dollars- Enter Expenses as Positive Values:** Table D (see the bottom half of Figure 58) requires the user to enter at least one number (as a positive value) that will represent an outflow in constant or nominal dollars. Note that if the Constant Dollars option is selected, these outflows may have a base year different from those chosen in Table A or Table C. Note that if values are entered in Table D for years outside the period of analysis defined in Table A, these values will not be included in the analysis.

Figure 58: Financial Analysis Inputs Tab – Annual Projections (sample screenshot)

C - FILL IN REVENUE PROJECTIONS FOR EACH YEAR IN DOLLARS

Revenue/Inflow projections expressed in: Constant Dollars — Constant dollars of what year? 2015

	2015	2016	2017	2018	2019	2020	2021
Toll Revenue			$0	$0	$0	$0	$63,384,973
n/a							
n/a							
n/a							
n/a							

D - FILL IN EXPENSE PROJECTIONS FOR EACH YEAR IN DOLLARS - ENTER EXPENSES AS POSITIVE VALUES

Expense/Outflow projections expressed in: Constant Dollars — Constant dollars of what year? 2015

	2015	2016	2017	2018	2019	2020	2021
Annual Capital Cost, including Right of Way	$0	$0	$33,884,481	$42,355,601	$50,826,722	$59,671,226	$57,997,112
Annual Incremental Operating & Maintenance Costs	$0	$0	$0	$0	$0	$0	$10,645,914
n/a							
n/a							
n/a							

For better control over the inputs, the user should fill out Tables A, B, C, and D in alphabetic order. If the order is different (e.g., while making minor adjustments to the financial model inputs), the user should

carefully verify that inflows and outflows are in the correct input fields. For example, the user may need to re-enter inputs in Tables C and D if first year of analysis (in Table B) is changed.

Note that if the period of analysis in Table B is modified, some of the values in Tables C or D may now appear outside the new analysis period. The user should be aware that the values that are outside the period of analysis, they will not be used in the calculations.

FIN Calculations Tab

This tab shows how revenues and expenses are adjusted for inflation and combined together (see Figure 59). The following metrics are calculated:

- Present discounted value of total inflows;
- Present discounted value of total outflows;
- Financial net present value;
- Financial internal rate of return; and
- Discounted payback period.

The tool does not require the user to make any modifications in the FIN Calculations tab. If needed, the values from the FIN Results tab can be traced back to this calculation worksheet to see how the values are calculated. Other than that, the tool is designed for the user to be able to go directly to the FIN Results tab (described below in more detail) and see a summary of results.

Figure 59: Financial Analysis Calculations Tab (sample screenshot)

Financial Analysis Calculations

View Financial Results

		Year	2015	2016	2017
		Total	1	2	3
		Analysis Index	1	1	1
	Nominal Discount Rate	6.2%	1.000	0.942	0.887
Project Revenue / Inflows in Nominal Dollars (with inflation)					
Inflation Adjustment for Revenue / Inflows			1.000	1.021	1.042
				2.1%	2.1%
Revenue Categories					
Toll Revenue		$ 6,259,276,843	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
Total Revenue / Inflows		$ 6,259,276,843	$ -	$ -	$ -
Project Expenses / Outflows in Nominal Dollars (with inflation)					
Inflation Adjustment for Expenses / Outflows			1.000	1.021	1.042
				2.1%	2.1%
Expense Categories					
Annual Capital Cost, including Right of Way		$ (855,438,328)	$ -	$ -	$ (35,322,572)
Annual Incremental Operating & Maintenance Costs		$ (1,608,542,044)	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
n/a		$ -	$ -	$ -	$ -
Total Expenses / Outflows		$ (2,463,980,372)	$ -	$ -	$ (35,322,572)
Net Revenue and Financial Performance Metrics					
Net Revenue / Inflows			$ -	$ -	$ (35,322,572)
Present Discounted Value of Net Revenue / Inflows			$ -	$ -	$ (31,328,107)
Cumulative Discounted Net Revenue / Inflows			$ -	$ -	$ (31,328,107)
			0	0	0
Financial Metrics					
Present Discounted Value of Total Revenue / Inflows		$ 1,449,727,726			
Present Discounted Value of Total Expenses / Outflows		$ (894,177,866)			
Financial Net Present Value		$ 555,549,860	$ 555,549,860	TRUE	
Nominal Internal Rate of Return, percent		13.2%			
Payback Period, years		21.0			

FIN Results Tab

The FIN Results tab summarizes the calculations made in the FIN Calculations tab. Figure 60 shows this summary, which includes the following:

- Inflows for each of the revenue categories separately and the total inflows, in both YOE dollars and base-year dollars (in Figure 60, the base year is 2015);
- Outflows for each of the five categories of outflows, in YOE and base-year dollars;
- Financial net present value, in YOE and base-year dollars;

- Financial internal rate of return;
- Discounted payback period; and
- Chart with the inflows as positive blue bars and outflows as negative red bars.

Figure 60: Financial Analysis Results Tab (sample screenshot)

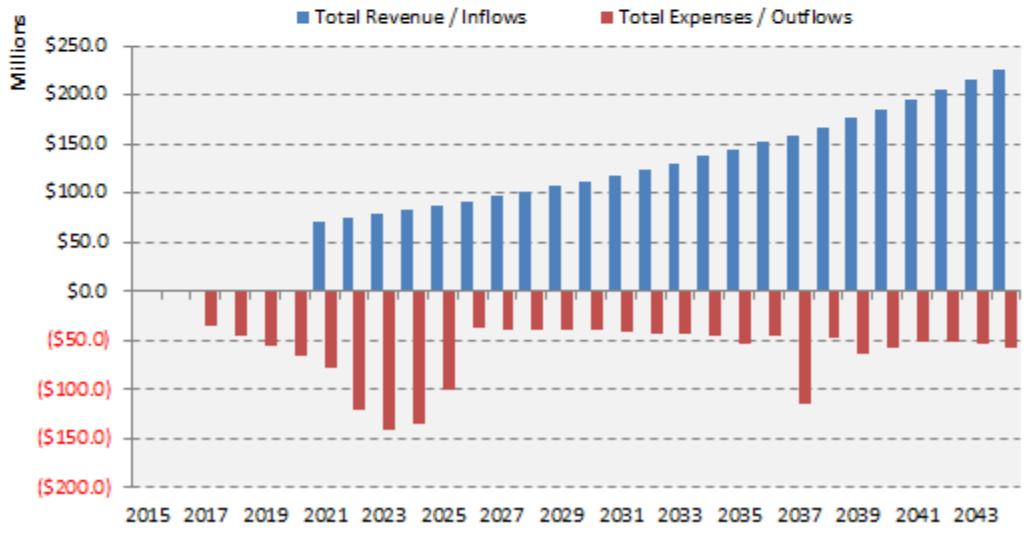
Financial Analysis Results

Scenario 1: I-95 Phase 3 Management

Nominal Discount Rate *	6.2%

	Millions of YOE $	Millions of 2015 $ Discounted
PROJECT REVENUE / INFLOWS		
Toll Revenue	$6,259.3	$1,449.7
TOTAL REVENUE / INFLOWS	**$6,259.3**	**$1,449.7**
PROJECT EXPENSES / OUTFLOWS		
Annual Capital Cost, including Right of Way	($855.4)	($495.2)
Annual Incremental Operating & Maintenance Costs	($1,608.5)	($399.0)
TOTAL EXPENSES / OUTFLOWS	**($2,464.0)**	**($894.2)**
NET REVENUE / FINANCIAL NET PRESENT VALUE	**$3,795.3**	**$555.5**
FINANCIAL INTERNAL RATE OF RETURN	**13.2%**	
DISCOUNTED PAYBACK PERIOD, YEARS	**21.0**	

** includes market anticipated inflation of 2.1%.*



APPENDIX I: Data Sources

This appendix identifies the key data sources used in the estimation of project benefits and costs.

Table 7: Data Sources for the Valuation of Travel Time

Variable Name	Unit	Value	Source
Share of personal travel in total local travel	percent	88.2%	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Share of business travel in total local travel	percent	11.8%	Ibid
Annual growth in the value of time, in real terms	percent	0%	US DOT Guidance, September 2017
Value of time for local personal travel, all surface modes except Bike/Ped	$ per hour	$14.8	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Value of time for local business travel, all surface modes except Bike/Ped	$ per hour	$26.5	Ibid
Value of Time for Bike/Pedestrian Mode	$ per hour	$14.8	Assumed equal to Local Personal Travel
Average truck driver wage rate	$ per hour	$28.6	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Average bus driver wage rate	$ per hour	$30.0	Ibid
Average wage for locomotive engineers	$ per hour	$44.9	Ibid
Average Vehicle Occupancy - Autos	persons per car	1.68	Ibid
Average Vehicle Occupancy - Trucks	persons per car	1.0	Ibid
Average Vehicle Occupancy - Locomotives	persons per car	2.0	Assumption

All dollar estimates are in dollars of 2017.

Table 8: Data Sources for Vehicle Operating Costs- Calculation Method #1

Variable Name	Unit	Value	Source
Auto Operating Costs, Gasoline	$ per gallon	varies by year	EIA, Annual Energy Outlook, 2019 Release, Petroleum Product Prices
Auto Operating Costs, Oil	$ per quart	$10.2	HERS Technical Report, 2005, Updated from 1997$ to 2017$ using BLS Series CUUR0000SS47021
Auto Operating Costs, Tires	$ per tire	$88.5	HERS Technical Report, 2005, Updated from 1997$ to 2017$ using BLS Series CUUR0000SETC01
Auto Operating Costs, Maintenance and Repair	$ per vehicle per 1,000 mile	$176.2	HERS Technical Report, 2002, Updated from 1997$ to 2017$ using BLS Series CUUR0000SETD
Auto Operating Costs, Vehicle Depreciation	$ per vehicle (depreciable value)	$21,517.4	HERS Technical Report, 2005, Updated from 1997$ to 2017$ using BLS Series CUUR0000SS45011
Truck Operating Costs, Diesel Fuel	$ per gallon	*time dependent*	EIA, Annual Energy Outlook, 2019 Release, Petroleum Product Prices
Truck Operating Costs, Oil	$ per quart	$4.1	HERS Technical Report, 2005, Updated to from 1997$ to 2017$ using BLS Series CUUR0000SS47021. Average of 4- and 5-axle trucks
Truck Operating Costs, Tires	$ per tire	$582.4	HERS Technical Report, 2005, Updated from 1997$ to 2017$ using BLS Series CUUR0000SETC01. Average of 4- and 5-axle trucks
Truck Operating Costs, Maintenance and Repair	$ per vehicle per 1,000 mile	$614.1	HERS Technical Report, 2005, Updated from 1997$ to 2017$ using BLS Series CUUR0000SETD. Average of 4- and 5-axle trucks
Truck Operating Costs, Vehicle Depreciation	$ per vehicle (depreciable value)	$94,631.5	HERS Technical Report, 2005, Updated from 1997$ to 2017$ using BLS Series CUUR0000SS45021. Average of 4- and 5-axle trucks

All dollar estimates are in dollars of 2017.

Table 9: Data Sources for Vehicle Operating Costs- Calculation Method #2

Variable Name	Unit	Value	Source
Auto Gasoline Costs	$ per mile	$0.10	AAA, Your Driving Costs, How much are you really paying to drive?, 2017 Edition. Reported in US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Other Auto Operating Costs	$ per mile	$0.29	Ibid
Truck Diesel Fuel Costs	$ per mile	$0.34	ATRI, An Analysis of the Operational Costs of Trucking: 2017 Update, October 2017. Reported in US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Other Truck Operating Costs	$ per mile	$0.56	Ibid

All dollar estimates are in dollars of 2017.

Table 10: Data Sources for Accident Costs

Variable Name	Unit	Value	Source
Minor injury (MAIS 1)	$ per injury	$28,800	US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Moderate injury (MAIS 2)	$ per injury	$451,200	Ibid
Serious injury (MAIS 3)	$ per injury	$1,008,000	Ibid
Severe injury (MAIS 4)	$ per injury	$2,553,600	Ibid
Critical injury (MAIS 5)	$ per injury	$5,692,800	Ibid
Fatal injury (MAIS 6)	$ per injury	$9,600,000	Ibid
Property Damage Only (PDO) accidents	$ per damaged vehicle	$4,300	NHTSA, The Economic and Societal Impact of Motor Vehicle Crashes (2010, Revised May 2015). Inflated to 2017 dollars by US DOT using the GDP Deflator
Annual Growth in Real Injury Costs	% per year	0%	US DOT Guidance, September 2017

MAIS stands for Maximum Abbreviated Injury Scale. All dollar estimates are in dollars of 2017.

Table 11: Data Sources for Emission Costs

Variable Name	Unit	Value	Source
Nitrogen Oxides (NOx)	$ per short ton	$8,300	NHTSA, Corporate Average Fuel Economy for MY2017-MY2025 Passenger Cars and Light Trucks (August 2012), page 922, Table VIII-16, "Economic Values Used for Benefits Computations (2010 dollars)"; updated to 2017 dollars by US DOT Benefit-Cost Analysis Guidance for Discretionary Grant Programs, December 2018
Volatile Organic Compounds (VOC)	$ per short ton	$2,000	Ibid
Fine Particulate Matter (PM)	$ per short ton	$377,800	Ibid
Sulfur Dioxide (SO_2)	$ per short ton	$48,900	Ibid
Carbon Dioxide (CO_2)	$ per short ton	varies by year	Ibid

All dollar estimates are in dollars of 2017.

Emission rates are derived either from i) the US EPA MOVES model or ii) FTA New Starts.

Table 12: Data Sources for Aesthetics & Ecosystem Services Provided by Roadside Improvements

Variable Name	Unit	Value	Source
Aesthetics	$ per acre per year	$24.0	University of Florida / IFAS, March 2014, original dollar value
Pollination	$ per acre per year	$368.0	Ibid
Carbon Sequestration	$ per acre per year	$424.0	Ibid
Stormwater Runoff Reduction	$ per acre per year	$5,000.0	Ibid
Air Quality	$ per acre per year	$64.0	Ibid

Table 13: Data Sources for Social Benefits of Public Transportation

Variable Name	Unit	Value	Source
Percent of Lost Work Trips Leading to Public Assistance	% of lost work trips	5.0%	Lewis D. & F. Williams, Policy and Planning as Public Choice, 1999
Monthly Cost of Public Assistance	$ per recipient per month	$352.0	Florida Department of Children and Families, Food Assistance Program, Maximum benefit amount for 2-person households. Accessed 1/2018 at https://www.dcf.state.fl.us/programs/access/docs/fafactsheet.pdf
Average Duration of Public Assistance	months	12.0	Assumption
Percent of Lost Medical Trips Leading to Home Care	% of lost medical trips	5.0%	Lewis D. & F. Williams, Policy and Planning as Public Choice, 1999
Incremental Cost of Home Care Visits	$ per visit	$73.6	Ibid. Inflated to dollars of 2017

All dollar estimates are in dollars of 2017.

Table 14: Data Sources for Bicycle & Pedestrian Travel

Variable Name	Unit	Value	Source
Health Benefits of Cycling	$ per mile	$1.71	New Zealand Transport Agency, Economic Evaluation Manual (EEM), 2016. Converted to US dollars of 2017.
Health Benefits of Walking	$ per mile	$3.43	Ibid
Recreation Benefits of Cycling	$ per day	$12.2	NCHRP Report 552, Guidelines for Analysis of Investments in Bicycle Facilities, page 39
Recreation Benefits of Walking	$ per day	$12.2	Ibid
Average Cycling Speed	mph	12.0	Assumption
Average Walking Speed	mph	3.0	Assumption
Average Bicycle O&M Costs	$ per mile	$0.031	VTPI, "Transportation Cost and Benefit Analysis II – Vehicle Costs", inflated from 2007 to 2017$.

All dollar estimates are in dollars of 2017.

Table 15: Data Sources for Pedestrian Trip Quality

Variable Name	Unit	Value	Source
Street Lighting	$ per person-mile	$0.1121	Heuman D., P. Buchanan, M. Wedderburn, and R. Sheldon, Valuing Walking, Evaluating Improvements to the Public Realm, Association for European Transport and Contributors, August 2005. Inflated to 2017$.
Curb Level	$ per person-mile	$0.0790	Ibid
Information Panel	$ per person-mile	$0.0263	Ibid
Pavement Evenness	$ per person-mile	$0.0263	Ibid
Directional Signage	$ per person-mile	$0.0165	Ibid
Benches	$ per person-mile	$0.0165	Ibid

All dollar estimates are in dollars of 2017.

Table 16: Data Sources for Bicycle Facility Trip Quality

Variable Name	Unit	Value	Source
Off-Road Segregated Cycle Track	$ per minute	$0.0968	Hopkinson, P and Wardman, M, Evaluating the demand for cycling facilities, Transport Policy Vol. 3 No. 4, 1996, pp. 241-249. Inflated to 2017$.
On-Road Segregated Cycle Lane	$ per minute	$0.0411	Ibid
On-Road Non-Segregated Cycle Lane	$ per minute	$0.0409	Wardman, M., Tight, M. and Page, M., Factors influencing the propensity to cycle to work, Transportation Research Part A. Vol. 41, 2007, pp. 339-350. Inflated to 2017$.
Wider Lane	$ per minute	$0.0249	Hopkinson, P and Wardman, M, Evaluating the demand for cycling facilities, Transport Policy Vol. 3 No. 4, 1996, pp. 241-249. Inflated to 2017$.
Shared Bus Lane	$ per minute	$0.0106	Ibid

All dollar estimates are in dollars of 2017.

Table 17: Data Sources for Freight Projects– Costs

Variable Name	Unit	Value	Source
Average Truckload, All Truck Types and Commodities	short tons	17.5	Based on industry standards. Estimate of 35,000 lbs converted to short tons
Average Inventory Cost, all Commodities	$ per ton-hour	$0.050	Calculated with Transearch Data for District 5, and HERS methods and assumptions
Average Freight Train Operating Costs- Low Estimate	$ per train-hour	$259.6	Schafer et al., A Quantitative Analysis of Factors Affecting Broken Rails, Illinois Railroad Engineering Program, 2008. Inflated to 2017$.
Average Freight Train Operating Costs- High Estimate	$ per train-hour	$744.2	Liu et al., Benefit-Cost Analysis of Heavy Haul Railway Track Upgrade for Safety and Efficiency, 2011. Inflated to 2017$.
Average Freight Train Operating Costs- Estimate used in Calculations	$ per train-hour	$501.9	(average of high and low estimate)

All dollar estimates are in dollars of 2017.

Table 18: Data Sources for Freight Projects – Accident Rates by Severity & Mode

Variable Name	Unit	Value	Source
Rail Fatality Rates	fatalities per billion ton-miles	0.39	U.S. Government Accountability Office (GAO) analysis of data from US DOT, EPA and the Texas Transportation Institute; estimated over 2003-2007
Trucking Fatality Rates	fatalities per billion ton-miles	2.54	ibid
Waterway Fatality Rates	fatalities per billion ton-miles	0.01	Ibid
Rail Non-Fatal Injury Rate	injuries per billion ton-miles	3.32	Ibid
Trucking Non-Fatal Injury Rate	injuries per billion ton-miles	55.98	Ibid
Waterway Non-Fatal Injury Rate	injuries per billion ton-miles	0.05	Ibid

Table 19: Data Sources for Freight Projects – Emission Rates by Pollutant & Mode

Variable Name	Unit	Value	Source
Particulate Matter			
Rail	tons per million ton-miles	0.018	U.S. Government Accountability Office (GAO) analysis of data from US DOT, EPA and the Texas Transportation Institute; estimated over 2003-2007
Trucking	tons per million ton-miles	0.119	ibid
Waterways	tons per million ton-miles	0.012	ibid
Nitrogen Oxides			
Rail	tons per million ton-miles	0.675	ibid
Trucking	tons per million ton-miles	3.019	ibid
Waterways	tons per million ton-miles	0.469	ibid
Carbon Dioxide Equivalents			
Rail	tons per million ton-miles	28.96	ibid
Trucking	tons per million ton-miles	229.80	ibid
Waterways	tons per million ton-miles	17.48	ibid

Table 20: Data Sources for Freight Projects – Jobs at ILC

Variable Name	Unit	Value	Source
Typical Number of TEU Lifts During Full Operations at ILC*	TEU lifts per year	207,386	Extrapolated based on acreage and TEU lift data for the Logistics Park in Chicago, and the Winter Haven Florida ILC. Data for ILCs provided as case studies in the following reports: Economic Assessment of a Roanoke Region Intermodal Facility. Final Report. Prepared by HDR for Virginia Department of Rail and Public Transportation. January 7 2008. Development of an Integrated Logistics Center in Winter Haven, Florida. Prepared by HDR for CSX Real property Inc. January 2006.
Number of Jobs Required at a Typical ILC Facility*	long-term jobs	200	Development of an Integrated Logistics Center in Winter Haven, Florida. Prepared by HDR for CSX Real property Inc. January 2006
Number of Jobs Required at a Typical ILC Park*	long-term jobs	1,800	ibid
Number of Direct Jobs Required at ILC*	Jobs per 1,000 TEU lifts	9.64	Calculation based on data above

**Assuming a small ILC facility.*

Table 21: Data Sources for Freight Projects –Capacity, Fuel Efficiency, and External Costs

Variable Name	Unit	Value	Source
Tons of Goods per Freight Truckload	tons per truckload	21.5	Calculation based on typical truckload capacity in pounds, and conversion from pounds to tons. How Much Freight Fits on a Full Truckload? Accessed on 1/17/2017 at: http://www.xtl.com/much-freight-fits-full-truckload/
Tons of Goods per Freight TEU Lift	tons per TEU lift	34.0	Calculation based on typical TEU lift capacity in cubic feet, and conversion from cubic feet to tons. Twenty-foot equivalent unit. Wikipedia. Accessed on 1/17/2017 at: https://en.wikipedia.org/wiki/Twenty-foot_equivalent_unit
Typical Number of Truckloads per Truck	truckloads per truck	1.5	Assumption based on the maximum truck weight allowed in Florida (lbs per truck), and the typical truckload capacity (lbs per truckload). Commercial Motor Vehicle Manual. Florida Highway Patrol. Accessed on 1/17/2017 at: https://www.flhsmv.gov/fhp/CVE/2013TruckingManual.pdf
Typical Number of TEU Lifts per Truck	TEU lifts per truck	1.0	Assumption based the tons of goods per freight TEU lift, the conversion from pounds to tons, and the maximum truck weight allowed in Florida (lbs per truck). See sources above.
Fuel Efficiency of a Typical Freight Truck	miles per gallon	7.9	2015 Vehicle Technologies Market Report, Chapter 3 Heavy Trucks. Prepared by Oak Ridge National Laboratory for US DOE. Accessed on 1/17/2017 at: http://cta.ornl.gov/vtmarketreport/pdf/2015_vtmarketreport_full_doc.pdf
Fuel Efficiency for Freight Train	ton-miles per gallon	470.9	CSX Website. About Us. Fuel Efficiency. Accessed on 1/17/2017 at: https://www.csx.com/index.cfm/about-us/the-csx-advantage/fuel-efficiency/?mobileFormat=true
Cost of Noise Pollution from Freight Rail	$ per ton-mile	$0.0006	Delucchi Mark et al., External Costs of Transport in the U.S., Handbook of Transport Economics, Edward Elgar Publishing Ltd., 2010, page 18. Inflated from 2006$ to 2017$.
Cost of Noise Pollution from Freight Truck	$ per ton-mile	$0.0006	Delucchi Mark et al., External Costs of Transport in the U.S., Handbook of Transport Economics, Edward Elgar Publishing Ltd., 2010, page 18. Inflated from 2006$ to 2017$.

APPENDIX II: Obtaining Multipliers for the Economic Impact Analysis

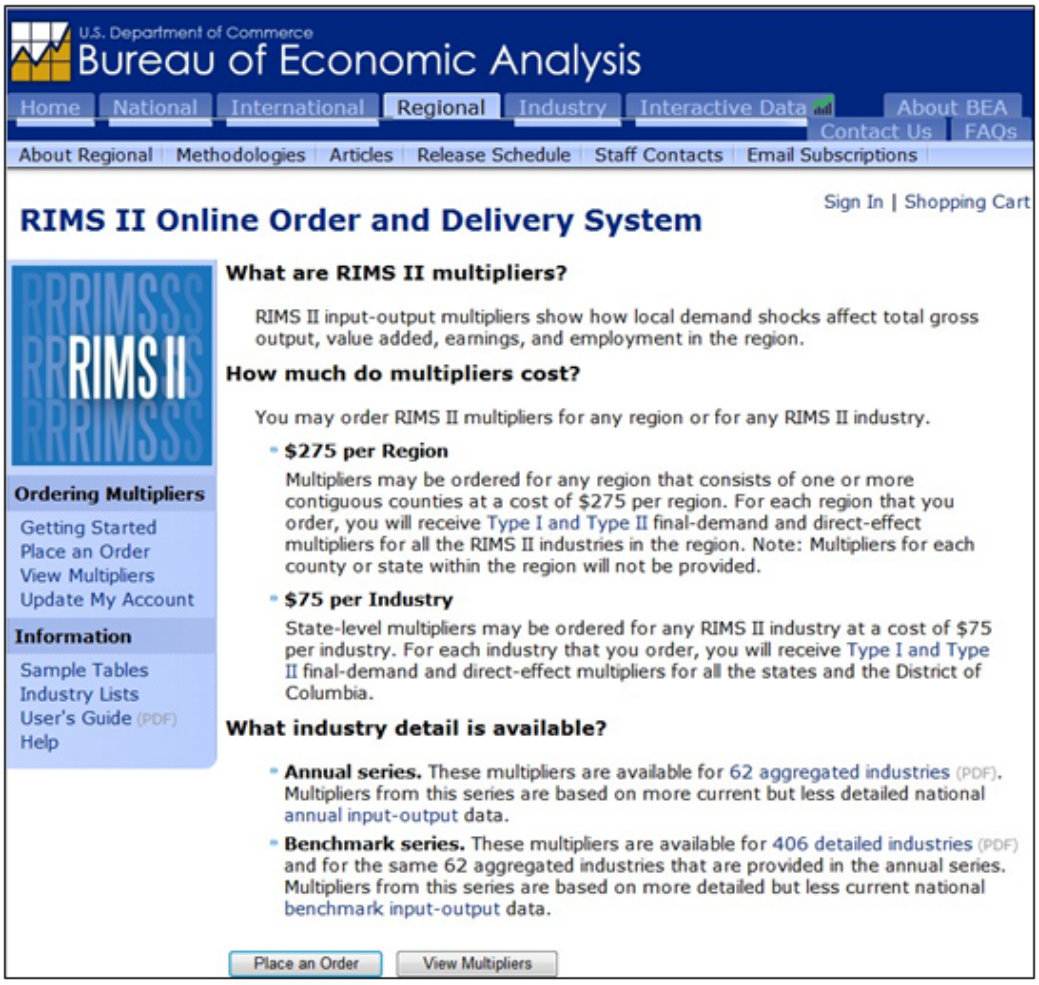
This appendix explains how TransValU users may obtain updated economic multipliers for use in the EIA if desired. It is based on Section 3.2 of the User Guide prepared by the Center for Urban Transportation Research of the University of South Florida for the Tool for Assessing the Economic Impacts of Spending on Public Transit.

If not already purchased for another purpose of the same study area, the updated multipliers must be purchased on a user-by-user basis from the U.S. Bureau of Economic Analysis through its RIMS II Online Order and Delivery System at https://www.bea.gov/regional/rims/rimsii/.

Placing an Order

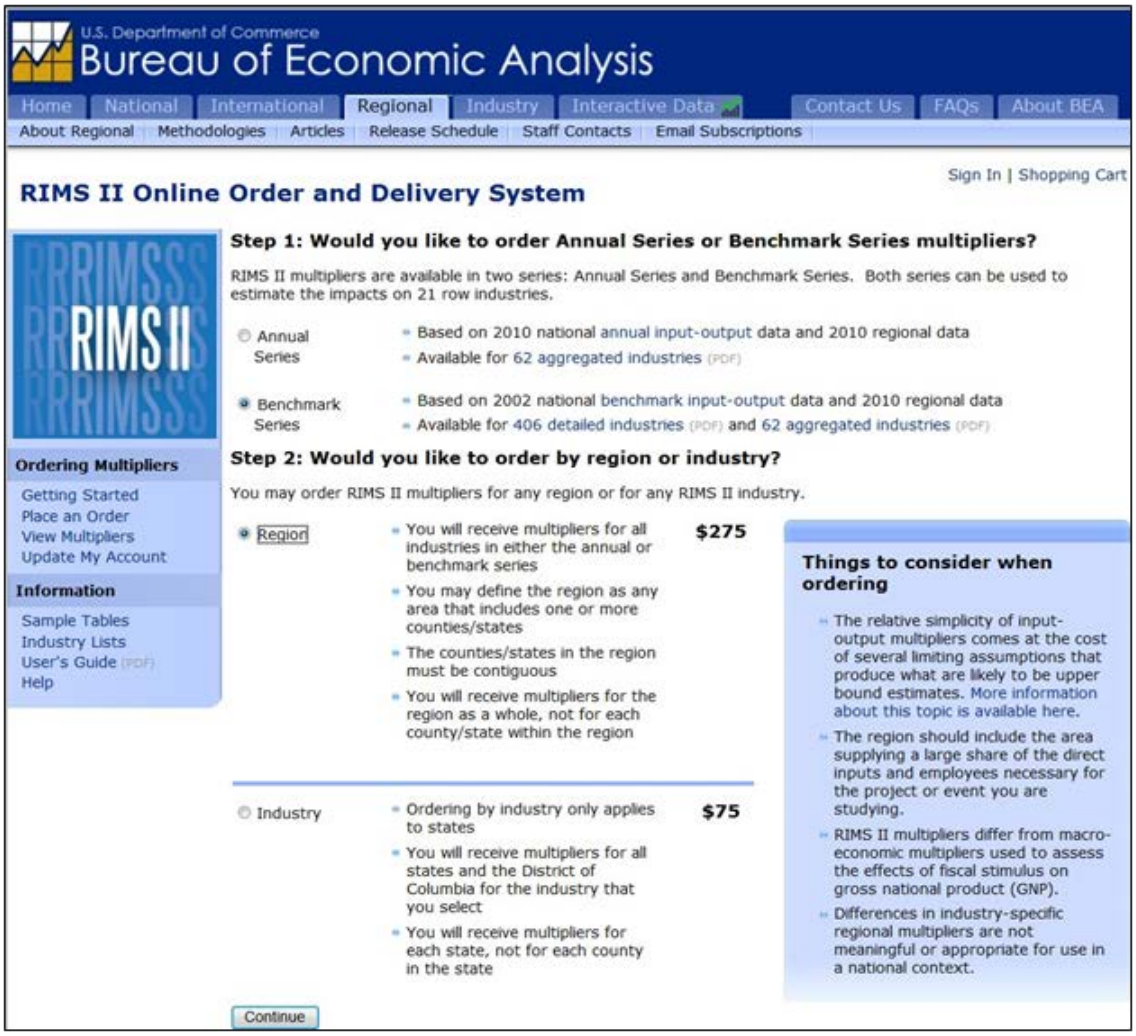
Shown in Figure 61, the first page of the Online Order and Delivery System briefly describes the options (region vs. industry and annual vs. benchmark) and shows the cost of multipliers per region and per industry. Multipliers from the Benchmark Series for regions will be needed.

Figure 61: Order Options for RIMS II Multipliers



First, choose the options shown on Figure 62 after clicking the "Place an Order" button at the bottom of the previous screen (Figure 61).

Figure 62: RIMS II Page for Selecting Order Options



Before continuing, check the year of regional data used in deriving the current Benchmark Series multipliers against the date that the transit service under consideration first started. The transit service must have started no later than this year of regional data for the multipliers.

Once the order options have been selected, click the "Continue" button at the bottom. Follow the other steps to specify the region of interest, establish an account, and pay for the order.

Selecting the Required Multipliers

After the order has been placed, an e-mail notification will be sent indicating when the multipliers are available at the RIMS II website. Access the multipliers either by directly viewing them at the site or by downloading the tables that contain the multipliers.

The multipliers ordered for the region are available in four tables, with two tables for Type I multipliers and two for Type II multipliers. The Type I multipliers account for the direct and indirect impacts based on the supply of goods and services in the region. The Type II multipliers account for these same direct and indirect impacts as well as for induced impacts that are associated with the purchases made by employees. Type II multipliers are needed.

One table for Type II multipliers, Table 1.5, provides multipliers for 402 detailed industries. The other table for Type II multipliers, Table 2.5, provides multipliers for 62 aggregated industries. Up to six multipliers will be needed from Table 1.5 and up to two multipliers from Table 2.5. The specific industries from each table were discussed in the previous section on input data. Each of these two tables of Type II multipliers includes six types of multipliers—four final-demand multipliers and two direct-effect multipliers. The four final- demand multipliers are needed.

Figure 63 shows the first page of Table 1.5, and Figure 64 shows the first page of Table 2.5 for Orange County, Florida. Note that the final-demand multipliers appear in the middle columns of each table. The years in the table titles—2002/2008, in this case—represent the year of national data and regional data used in deriving the multipliers. The year of regional data used may be needed.

Figure 63: RIMS II Table 1.5

RIMS II Multipliers (2002/2008)
Table 1.5 Total Multipliers for Output, Earnings, Employment, and Value Added by Detailed Industry
Orange, FL (Type II)

INDUSTRY	Multiplier					
	Final Demand				Direct Effect	
	Output/1/ (dollars)	Earnings/2/ (dollars)	Employment/3/ (jobs)	Value-added/4/ (dollars)	Earnings/5/ (dollars)	Employment/6/ (jobs)
1111C0 Oilseed and grain farming	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
111200 Vegetable and melon farming	1.5757	0.2303	10.9266	0.8493	1.9350	1.5025
1113B0 Fruit and tree nut farming	1.5758	0.2669	10.9071	0.8642	1.7939	1.5055
111400 Greenhouse, nursery, and floriculture production	1.5978	0.3039	12.2331	0.9901	1.6344	1.4596
111910 Tobacco farming	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
111920 Cotton farming	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1119C0 All other crop farming, including sugarcane and sugar beet farming	1.6994	0.2272	7.2046	0.7479	2.3705	2.4478
1121A0 Cattle ranching and farming	1.3626	0.1486	4.6589	0.4052	1.8361	1.8283
112120 Dairy cattle and milk production	1.4120	0.1737	5.9301	0.6453	1.8639	1.6708
112A00 Animal production, except cattle and poultry and eggs	1.3283	0.1549	5.5184	0.7143	1.7286	1.5774
112300 Poultry and egg production	1.3541	0.1544	4.4544	0.4009	1.9078	1.7937
113A00 Forest nurseries, forest products, and timber tracts	1.5599	0.2170	6.5870	0.7176	2.5839	2.9667
113300 Logging	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
114100 Fishing	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
114200 Hunting and trapping	1.5454	0.2210	13.0247	0.7762	2.1059	1.3309
115000 Support activities for agriculture and forestry	1.8022	0.5020	20.9752	1.0243	1.4528	1.2533
211000 Oil and gas extraction	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
212100 Coal mining	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
212210 Iron ore mining	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2122A0 Gold, silver, and other metal ore mining	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
212230 Copper, nickel, lead, and zinc mining	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
212310 Stone mining and quarrying	1.5059	0.1644	3.7815	0.8556	3.1016	3.4449
212320 Sand, gravel, clay, and ceramic and refractory minerals mining and quarrying	1.5274	0.1712	3.9463	0.8287	3.0339	3.2581
212390 Other nonmetallic mineral mining and quarrying	1.4955	0.1524	3.1705	0.8106	3.2266	4.8584
213111 Drilling oil and gas wells	1.7273	0.3956	12.3565	0.9159	1.6503	1.4667
213112 Support activities for oil and gas operations	1.9307	0.5019	14.8856	1.0092	1.6693	1.5539
21311A Support activities for other mining	2.0210	0.4794	14.6356	0.9446	1.8501	1.6227
2211A0 Electric power generation, transmission, and distribution	1.3767	0.2211	3.8836	0.9124	1.5864	2.4892
221200 Natural gas distribution	1.2675	0.1252	2.5946	0.4932	1.7974	2.4110
221300 Water, sewage and other systems	1.6922	0.3220	7.5815	1.0810	1.8759	2.1773
230000 Construction	1.7798	0.3953	10.5463	0.9664	1.6904	1.7567
311111 Dog and cat food manufacturing	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
311119 Other animal food manufacturing	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
311210 Flour milling and malt manufacturing	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
311221 Wet corn milling	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
31122A Soybean and other oilseed processing	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Figure 64: RIMS II Table 2.5

RIMS II Multipliers (2002/2008)
Table 2.5 Total Multipliers for Output, Earnings, Employment, and Value Added by Industry Aggregation
Orange, FL (Type II)

INDUSTRY	Multiplier					
	Final Demand				Direct Effect	
	Output/1/ (dollars)	Earnings/2/ (dollars)	Employment/3/ (jobs)	Value-added/4/ (dollars)	Earnings/5/ (dollars)	Employment/6/ (jobs)
1. Crop and animal production	1.5889	0.2939	12.1751	0.6688	1.6209	1.4261
2. Forestry, fishing, and related activities	1.6323	0.3174	12.2639	0.7995	1.6940	1.4156
3. Oil and gas extraction	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
4. Mining, except oil and gas	1.5091	0.1622	3.5760	0.8320	3.1690	4.0813
5. Support activities for mining	1.9802	0.4973	15.1948	1.0494	1.7989	1.6205
6. Utilities*	1.3796	0.2187	4.0067	0.8284	1.5920	2.4329
7. Construction	1.7788	0.3974	10.6489	0.9696	1.6995	1.7738
8. Wood product manufacturing	1.6005	0.2564	6.9108	0.6566	1.9750	1.9257
9. Nonmetallic mineral product manufacturing	1.6531	0.2868	6.7176	0.8255	1.9275	2.1623
10. Primary metal manufacturing	1.5812	0.1955	4.5442	0.6335	2.4405	2.7606
11. Fabricated metal product manufacturing	1.6388	0.2755	6.8895	0.8047	1.9174	2.0425
12. Machinery manufacturing	1.5807	0.2443	5.4712	0.7340	2.0088	2.3006
13. Computer and electronic product manufacturing	1.8420	0.3185	6.2474	0.8590	2.3713	3.3012
14. Electrical equipment and appliance manufacturing	1.6252	0.2860	6.8032	0.8068	1.8829	1.9747
15. Motor vehicle, body, trailer, and parts manufacturing	1.6071	0.2560	5.8741	0.6154	2.0234	2.1961
16. Other transportation equipment manufacturing	1.9783	0.3936	8.7497	0.9574	2.3186	3.0889
17. Furniture and related product manufacturing	1.6695	0.3033	8.5135	0.8097	1.8308	1.7776
18. Miscellaneous manufacturing	1.6968	0.3679	8.6950	0.9166	1.6584	1.8310
19. Food, beverage, and tobacco product manufacturing	1.6941	0.2357	5.6880	0.6691	2.5112	2.6134
20. Textile and textile product mills	1.4941	0.2103	5.9029	0.6142	1.9744	1.8724
21. Apparel, leather, and allied product manufacturing	1.7790	0.4559	15.5925	0.8743	1.5994	1.4308
22. Paper manufacturing	1.5472	0.2412	5.0642	0.7020	1.9472	2.4490
23. Printing and related support activities	1.7035	0.3562	9.7081	0.8988	1.7346	1.7519
24. Petroleum and coal products manufacturing	1.5016	0.1863	3.9274	0.4096	2.4527	3.0570
25. Chemical manufacturing	1.7343	0.2583	5.2798	0.7695	2.6188	3.4722
26. Plastics and rubber products manufacturing	1.4783	0.1997	5.1386	0.6642	1.9510	1.9574
27. Wholesale trade	1.6729	0.3573	7.5984	1.0943	1.6996	2.1682
28. Retail trade	1.7052	0.3870	13.7366	1.0942	1.5909	1.4511
29. Air transportation	1.7110	0.3493	8.2046	0.8807	1.7626	2.2626
30. Rail transportation	1.7655	0.3174	6.4056	0.9576	2.0724	3.4159
31. Water transportation	1.7816	0.2786	6.3292	0.7835	2.5542	4.2399
32. Truck transportation	1.8444	0.3664	10.1742	0.9766	2.0726	2.1987
33. Transit and ground passenger transportation*	1.8698	0.4093	15.1490	0.8481	1.8580	1.5219
34. Pipeline transportation	1.9092	0.3538	7.5588	0.8108	2.3172	4.2705
35. Other transportation and support activities*	1.7624	0.4570	12.0173	1.1158	1.5750	1.7022
36. Warehousing and storage	1.8991	0.5225	15.2024	1.1779	1.5653	1.6109
37. Publishing industries, except Internet	1.8142	0.3828	8.9364	1.0629	1.8700	2.3157
38. Motion picture and sound recording industries	1.7172	0.3169	9.2531	1.0361	1.8657	1.8748
39. Broadcasting, except Internet	2.1398	0.4665	8.8993	1.1202	2.0594	3.8977

APPENDIX III: Obtaining Transit Spending Data

This appendix provides detailed guidance for obtaining the input data on the following items: unemployment rate, total O&M spending, total capital spending for each project category, distribution of spending across sources of funds, distribution of spending across destinations of spending, and distribution of debt repayments across sources of funds. It is based on Section 3.3 of the User Guide prepared by the Center for Urban Transportation Research of the University of South Florida for the Tool for Assessing the Economic Impacts of Spending on Public Transit.

An important source of data for many of these items is the National Transit Database (NTD), which is described before presenting the guidance for obtaining these data items.

National Transit Database

Almost all providers of urban transit services report to the NTD annual data about their systems, amount of services, use of these services, and revenues and expenses. Only revenues and expense data are relevant for using this tool. NTD can provide most of the spending data necessary for use of this tool to estimate the economic impacts of spending on existing services.

There are two main options for assessing NTD data:

1. Integrated National Transit Database Analysis System (INTDAS), available at http://www.ftis.org/intdas.html, contains most of the raw NTD data reported by transit agencies since 1984. While requiring registration and login, it is simple to use and flexible in selecting the exact data needed.
2. Annual data tables at http://www.ntdprogram.gov/ntdprogram/data.htm also contain the raw NTD data reported by transit agencies. Each of these tables is a large Excel worksheet that covers the data related to a particular subject for all agencies. To use data from these tables, identify which table has the data needed. For example, data on capital spending by project category are in Table 11, Capital Funds Applied by Type of Expenditure.

Option 1, INTDAS, is the best in most cases. However, Option 2 may be best under the following circumstances:

- It is not desirable to register and log in to use INTDAS and learn to use it.
- INTDAS does not cover the particular NTD data needed. For example, the data on capital spending by project category are not available in INTDAS.

It is important to point out that the NTD data are organized by transit service providers but not by geographies (counties, metropolitan areas, etc.). The data required for this tool must be organized by geography. Before getting data from NTD, this issue would need to be resolved. The simplest case is one in which the study area is served by only one transit agency and covers all services of that agency. In this case, NTD data for this single area may be used for the study area. A slightly more complicated but still straightforward case is one in which the study area is served by more than one agency and covers all services of these agencies. In this case, NTD data for these different agencies would need to be

aggregated. A complicated case is one in which the study area covers only a portion of the services provided by one or more transit agencies. Additional information beyond that provided by NTD would need to be used in attributing the NTD data for these agencies to the study area. Consider the desire of estimating the economic impacts of spending on transit for providing the transit service by LYNX for each of the counties LYNX serves— Orange, Osceola, and Seminole.

In trying to resolve this issue of possible mismatching between agency-level data in the NTD and geography-level data needs for using this tool, it is important to understand a significant difference in data needs between estimating the transportation benefits of transit services and estimating the economic impacts of spending for transit services. For estimating transportation benefits, it is essential to know where the transit service is provided. For estimating economic impacts, it is essential to know the following:

- Where the employees of the transit agency live;
- Where the money comes from (source of funds); and
- Where the money is spent (destination of spending).

For example, the spending by LYNX for providing its services would have no economic impacts (positive or negative) on the Osceola County economy if the following were true:

- No LYNX employees live in Osceola County;
- No LYNX revenues come from Osceola County (not likely because some fare revenues would come from residents of the county); and
- LYNX does not spend any money for purchasing goods or services produced in Osceola County.

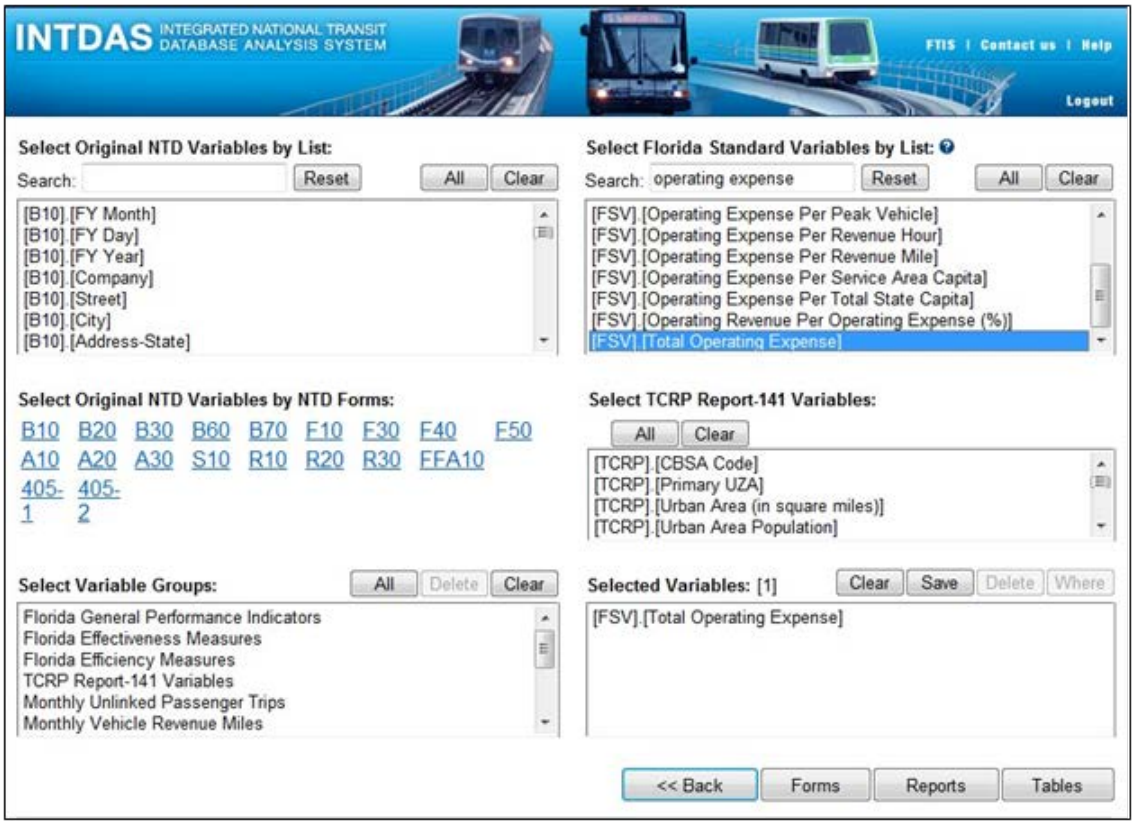
Unemployment

The Local Area Unemployment Statistics page of the U.S. Bureau of Labor Statistics web site, http://www.bls.gov/lau/tables.htm, provides estimates of annual average unemployment rates for individual states, metropolitan areas, and counties.

Total O&M Spending

Data on total O&M operating are readily available from the NTD. Through INTDAS, Total Operating Expense can be selected from the list of Florida Standard Variables (near the upper right corner in Figure 65). The data are available separately for each mode. Alternatively, Table 12 (Transit Operating Expenses by Mode, Type of Service and Function) or Table 13 (Transit Operating Expenses by Mode, Type of Service and Object Class) from Option 2 for accessing NTD data discussed earlier can be used. The last column of both tables shows the total O&M expense for each mode and for all modes combined.

Figure 65: Selecting Florida Standard Variables in INTDAS



Capital Spending by Project Category

Start building the data on capital spending by project category with annual data in Table 11, Capital Funds Applied by Type of Expenditure. While the exact labels may change slightly over time, the following nine project categories are currently used by the *NTD Reporting Manual* for capital spending data:

1. Guideway
2. Passenger Stations (or Stations in Table 11)
3. Administrative Buildings
4. Maintenance Buildings (or Facilities in Table 11)
5. Other
6. Revenue Vehicles (or Rolling Stock in Table 11)
7. Service Vehicles (or Other Vehicles in Table 11)
8. Fare Revenue Collection Systems
9. Communications and Information Systems

The first five categories may be grouped as construction projects. Category 5, Other, includes furniture and equipment that are not an integral part of buildings and structures as well as shelters, signs, and

passenger amenities (e.g., benches) not in passenger stations. The spending for these construction projects includes the costs for design and engineering, land acquisition and relocation, demolition, and purchase or construction of the structures.

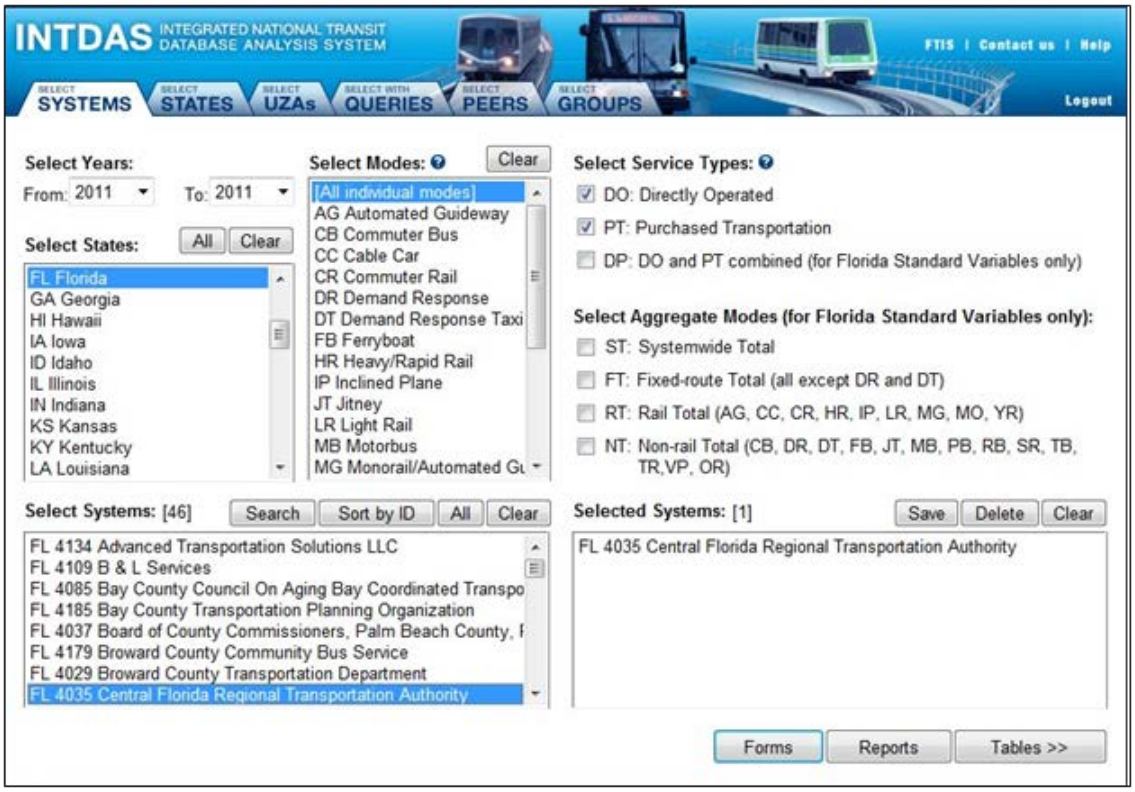
When possible, the data to be entered into the tool should have land cost removed from each of the construction categories and added as a separate category. Similarly, the data entered into the tool should have the cost for design and engineering removed from each of the construction categories and added as a separate category. In addition, the data needed for the tool should separate bus revenue vehicles from rail revenue vehicles. The following are some guidelines for making adjustments to the NTD data directly from Table 11:

- Use the original NTD data if the amount of land cost for any category of construction projects cannot be determined.
- Use the original NTD data if the amount of design and engineering cost for any category of construction projects cannot be determined.
- If only bus (or rail) revenue vehicles are involved, assign all spending on revenue vehicles to the bus (or rail) category.
- If both bus and rail revenue vehicles are involved, split the total spending on revenue vehicles between bus and rail.

Distribution of Spending across Sources of Funds

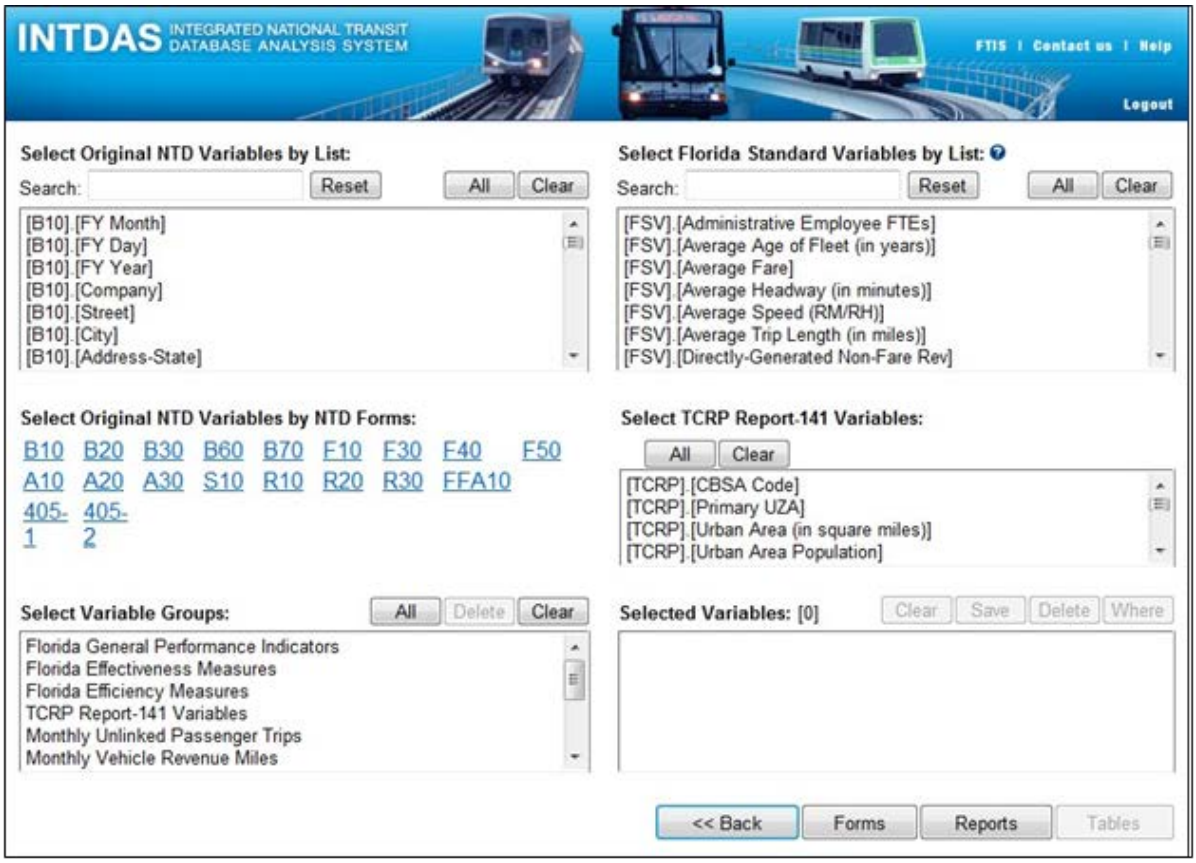
Develop the distribution of spending across sources through INTDAS. Once entered, select the year(s), mode(s), agencies, and service type, as shown in Figure 66.

Figure 66: Selecting Year, Mode, Agency, and Service Type in INTDAS



Next, select the relevant variables from the screen in Figure 67 after clicking the Tables button in the previous screen (Figure 66).

Figure 67: Selecting Variables in INTDAS



Selecting variables from Form F10 is the easiest method. Once the F10 button is clicked, the form opens and its top portion appears, as shown in Figure 68. Select both the column for Funds Expended on Operations and the column for Funds Expended on Capital for the following four rows:

- 30. Total Directly Generated Funds
- 43. Total Local Funds
- 56. Total State Funds
- 86. Total Federal Funds

Save the data from INTDAS and use them to determine the distribution of total O&M spending in terms of its source of funds between inside the study area and outside the study area. Both Total Directly Generated Funds and Total Local Funds would be considered to be from inside the study area and Total Federal Funds would always be considered to be from outside the study area. Total State Funds would be treated as being from outside the study area if the study area is smaller than a state but from inside the study area if the study area is an entire state.

Figure 68: Form F10 in INTDAS

B10 | B20 | B30 | B60 | B70 | F10 | F20 | F30 | F40 | F50 | A10 | A20 | A30 | S10 | R10 | R20 | R30 | FFA10 | 405-1 | 405-2 | SS-Service | SS40 | SS40+50

Sources of Funds-Funds Expended and Funds Earned (F-10)

Year ☐ NTD ID ☐ Location ☐ State ☐

Sources of Directly Generated Funds	Mode Code	Service Type	Funds Earned During Period	Funds Expended on Operations	Funds Expended on Capital
01. Passenger Fares			☐		
02. Total Fares from Directly Operated Modes			☐	☐	☐
03. Total Fares from Purchased Transportation Modes			☐	☐	☐

Use the above data from INTDAS to determine the distribution of total capital spending. The tool requires distribution for each project category using two available options:

- Apply the distribution for total capital spending to each category. This option is not fully satisfactory for two reasons: 1) federal funds are more likely to be used for some categories of capital projects than others and 2) spending on some categories of capital projects (such as revenue vehicles) is more likely to be made outside the study area than others (such as administrative buildings).
- Determine the distribution for each project category using more detailed data from the transit agency.

Distribution of Spending across Destinations of Spending

This distribution indicates the degree to which money is spent inside the study area vs. outside the study area. Money spent outside the study area does not support or create any economic activity inside the study area. NTD data cannot be used for obtaining data on this distribution. This distribution is needed for each of the following:

- Total non-financed O&M spending
- Non-financed capital spending for each project category
- Total financed O&M spending
- Financed capital spending for each project category

Two options are available for determining spending distributions:

- Access the detailed and complete agency records to determining exactly where the money was spent. This is ideal, but may not be feasible.
- Estimate the distribution with incomplete agency records. The estimated distribution does not have to be exact but it should reflect the relative magnitudes between the destinations.
    - For capital spending, there likely are general patterns in the relative magnitudes between the sources (inside vs. outside the study area). For example, the vast majority of transit agencies buy their rolling stock, fare collection systems, and communications and information systems from outside the local economy simply because the local economy does not make these products. On the other hand, it is reasonable to assume that most of the money for construction projects is spent in the local economy. Table 22 shows the default distributions of capital spending by project category if local estimates are not available.
    - For total O&M spending, the distribution may be approximated by the distribution of the residences of agency employees. Most transit agencies probably know the residence county of each employee.

Table 22: Default Distributions of Capital Spending by Destination

Category of Capital Projects	Outside	Category of Capital Projects
Land Cost	0%	100%
Design and Engineering	50%	50%
Guideway (net of land cost)	25%	75%
Passenger Stations (net of land cost)	0%	100%
Administrative Buildings (net of land cost)	0%	100%
Maintenance Facilities (net of land cost)	25%	75%
Other Capital Projects (net of land cost)	0%	100%
Revenue Vehicles – Bus	100%	0%
Revenue Vehicles – Rail	100%	0%
Service Vehicles	100%	0%
Fare Revenue Collection Systems	100%	0%
Communications and Information Systems	100%	0%

Distribution of Debt Repayments across Sources of Funds

For total O&M spending or each project category of capital spending, data are not needed on the distribution of debt repayments if spending originated from borrowed funds through bonds and loans has not been entered. Otherwise, two options are available:

Obtain distributions from agency data. Each agency must have the necessary data to determine such distributions, but it may take some effort to identify and assemble the data. For years before 2011, use INTDAS to determine the distribution of debt repayments for capital projects or for O&M. For example, the distributions in Table 23 were derived from INTDAS for 2010 and all transit agencies.

Table 23: Distribution of Debt Repayments for All Agencies in 2010 NTD

Source of Funds	Total O&M	Total Capital
Directly-generated	27.4%	56.3%
Local government	51.1%	9.7%
State government	16.8%	23.2%
Federal government	4.8%	10.8%

- Assume that all debt repayments use funds from inside the study area if estimating such distributions from agency data is not possible. The consequence of making this simplifying assumption is more conservative estimates of economic impacts.

If any spending from borrowed funds for any of these spending categories was entered, data on the distribution of debt repayments for this category are required. One possibility may be to use the distribution of spending across its sources of funds as the distribution of debt repayments. At least at the national level, however, the distribution of spending across its sources of fund differs significantly from the distribution of debt repayments. Excluding bonds and loans as one source of spending, Table 24 is based on 2010 NTD data and shows the distribution of spending across its sources of fund.

Table 24: Distribution of Spending on Transit for All Agencies in 2010 NTD

Source of Funds	Total O&M	Total Capital
Directly-generated	37.5%	0.6%
Local government	28.1%	44.0%
State government	24.9%	14.2%
Federal government	9.4%	41.2%

APPENDIX IV: Obtaining Economic Data

This Appendix details the sources of economic data used in TransValU to estimate the long-term economic impacts of freight projects. The Appendix is divided into two sections, one for each source of data. Each section provides a background of the datasets, a description of the variables used, and a brief explanation on how to update this data in the tool, as will be required periodically.

Transportation Satellite Accounts Data from Bureau of Transportation Statistics

The Transportation Satellite Accounts (TSAs) are a set of data tables published annually by the United States Department of Transportation's (US DOT) Bureau of Transportation Statistics (BTS). A portion of this data comes directly from the United States Department of Commerce's (USDOC) Bureau of Economic Analysis (BEA).

The purpose of the TSAs is to capture the importance of transportation to the national economy by measuring the level of transportation activity (e.g., trucking, railroads, pipelines, and other transportation activity) in each industry in the United States. The TSAs are unique because they capture both "for-hire" transportation services (provided by transportation firms for a fee) and "in-house" transportation services (provided by businesses and households for their own use); whereas, other datasets only capture for-hire transportation and thus underrepresent the importance of transportation services.

The TSAs consist of four data tables:

- **Make Table**: includes the value of transportation services that each transportation industry *makes*.
- **Use Table**: includes the amount of transportation *used* by each industry and sector, plus the contribution of each industry and sector to the economy (e.g., value-added).
- **Direct Requirements Table**: includes the level of transportation *required* to produce one dollar of each product.
- **Total Requirements Table**: includes inputs *required* to produce one dollar's worth of transportation services.[33]

The TransValU tool uses the **Use Table** from the 2012 TSAs to estimate the transportation requirements for each industry measured in terms of dollars spent on transportation per dollar of output. Data is extracted form the TSA Use Table and pasted into the tool on the Freight EIA Long Term TSA Use tab. Periodically, the TSA data will need to be updated. The user can check for updated TSA data on the BTS website here:

https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/transportation_satellite_accounts/2002_2012/index.html

To update the data, the model user should contact the developer of the TransValU tool. Figure 69 below provides a screenshot of a portion of the Freight EIA Long Term TSA Use tab for the user's reference.

[33] All definitions come from Industry Snapshots: Uses of Transportation 2015, USDOT BTS.

Figure 69: Screenshot of Freight EIA Long Term TSA Use Tab

TSA Use Table: 2012
(Millions of dollars at producers' prices)

Commodity / Industry Code	Commodity Description	Plastics and rubber products 326	Wholesale trade 42	Retail trade 4A0	Air transportation 481	Rail transportation 482	Water transportation 483	Truck transportation 484	Transit and ground passenger transportation 485	Pipeline transportation 486	Other transportation and support activities 487OS	In-house air transportation 47OT.481000	In-house rail transportation 47OT.482000
331	Primary metals	1,802	413			1,754					152		
332	Fabricated metal products	5,688	692		191	294	1,502	2,756	246	892	948	36	
333	Machinery	1,750	898		4	87	16	221	58	60	1,068	2	
334	Computer and electronic products	1,473	3,365		3	70	2	218	5	14	41	2	
335	Electrical equipment, appliances, and components	693	334		3	215	49	167	38	7	73	3	
3361MV	Motor vehicles, bodies and trailers, and parts	311				82	1	7,740	338	1	763		
3364OT	Other transportation equipment		1		821	1,577	443	4	30		750	436	10
337	Furniture and related products	260	705	874	1						5		
339	Miscellaneous manufacturing	53	653	870		2		8	3	1	150		
311FT	Food and beverage and tobacco products	48	717	282	69		37				27	6	
313TT	Textile mills and textile product mills	2,701	781	4,237			124	10		2	49		
315AL	Apparel and leather and allied products		578	892									
322	Paper products	4,136	3,008	3,310	24	49	11	251	71	47	1,431	22	
323	Printing and related support activities		3,953	4,932		19		188	41	5	76		
324	Petroleum and coal products	341		644	41,442	11,216	10,840	61,175	4,856	372	10,485	31,998	74
325	Chemical products	63,147	1,252	913	2	244	9	345	5	5	564		
326	Plastics and rubber products	15,671	5,507	6,804	5	12	1	2,028	30	116	2,853	11	
42	Wholesale trade	9,267	31,709	21,985	2,492	3,744	3,391	14,283	1,147	181	4,704	2,511	20
4A0	Retail trade	229	251	4,559	3	37	476	3,818	76	20	507		
481	Air transportation	709	4,296	1,549	4	35	195	1,830	22	3	1,160		
482	Rail transportation	1,537	170	185	82	265	22	3,092	12	5	64		
483	Water transportation	51	40	66	65	32	17	159	8	30	29		
484	Truck transportation	2,529	3,647	14,063	369	382	267	3,378	74	34	1,185		
485	Transit and ground passenger transportation	149	471	154	1	455		2			4		
486	Pipeline transportation	18	31	32	256	70	67	385	30	10	65		
487OS	Other transportation and support activities	119	31,110	16,704	16,894	737	6,096	24,866	310	116	23,688		
47OT.481000	In-house air transportation												
47OT.482000	In-house rail transportation												
47OT.483000	In-house water transportation												
47OT.484000	In-house truck transportation	3,715	109,603	64,310									
HPTS	Household production of transportation services												

Quarterly Census of Employment and Wages Data from Bureau of Labor Statistics

The Quarterly Census of Employment and Wages (QCEW) program is a dataset published each quarter by the Bureau of Labor Statistics (BLS). The dataset reports, among other things, the quarterly counts (and annual averages) of employment and wages as reported by employers. The dataset covers approximately 98 percent of jobs in the United States. The QCEW is one of BLS' largest programs—data is available for every NAICS industry at the county-, MSA-, and state-levels, as well as for the United States overall.

The TransValU tool uses economic data from the QCEW program to describe the economy of the project study area as selected by the model user. Thus, data is collected for all districts in Florida, and all counties in District Five, for each of the 100+ industries defined by BLS. Specifically, the QCEW variables required for TransValU include:

- **Number of Establishments**: an establishment is the physical location of an economic activity, generally producing a single service or good. In comparison, an "enterprise" (such as a private firm, government, or non-profit organization) can consist of a single establishment or multiple establishments. Examples of an establishment can include a factory, mine, store, or office.
- **Employment**: a count of "employed persons" in the specified industry. An employed person is a person 16 years of age or older who is a non-institutionalized civilian that did all of the following activities during the reference week of the data count:

i. did any work for at least one hour and received payment, worked at their own business/profession/farm, or worked 15 hours or more as an unpaid worker in an enterprise operated by a family member; and

ii. was not working but who had jobs or businesses from which they were temporarily absent because of vacation, illness, bad weather, childcare problems, maternity/paternity leave, labor-management disputes, job training, or other family or personal reasons, whether or not they were paid for the time off or were seeking other jobs.

Each employed person is counted only once even if he/she holds more than one job. Persons whose only work consists of working around the house or volunteer work are excluded.

- **Total Annual Wages**: aggregate wages earned over the span of one year for the specified industry. Wages consist of total earnings before payroll deductions. Excludes premium pay for overtime, weekend work, holiday work, shift differentials, and nonproduction bonuses.[34]

This data is then combined with the TSA transportation use data (explained in the previous section), the RIMS II multipliers (purchased from BEA), and the total travel cost savings created by the freight project to estimate the total output, earnings, and employment impacts, by industry, caused by the freight project.

At some point after new data becomes available on the BLS website, it would be beneficial to update the QCEW data contained in the tool. This will improve the accuracy of the economic impact results produced by TransValU. To update the data, the user can either i) update the data directly, or ii) contact the TransValU model developers to update the data. If the user decides to update the data directly, the first step is to download the new datasets from the BLS website. Due to the size of the QCEW dataset, the entire file cannot be accessed through traditional user-interface on the BLS website. Instead, files can be downloaded directly in CSV format here: https://www.bls.gov/cew/datatoc.htm. Data should be downloaded for the nation, the State of Florida, and all counties in Florida for all industries defined in the tool. Next, combine the data by counties into districts, leaving county-level data only for District Five. Finally, paste the data into the TransValU tool on the Freight EIA Long Term QCEW tab, starting in cell B12. All cells highlighted blue are meant for pasting data. Figure 70 below includes a screenshot of a portion of the Freight EIA Long Term QCEW tab for the user's reference.

[34] All definitions of the three variables listed come from the BLS glossary, accessed here: https://www.bls.gov/bls/glossary.htm.

Figure 70: Screenshot of Freight EIA Long Term QCEW tab

Bureau of Labor Statistics, Quarterly Census of Employment and Wages, Annual 2015

http://www.bls.gov/cew/data.htm

Districts >>	District 1	District 2	District 3	District 4
Column ID >>	1	2	3	4
District 5 Counties >>	Brevard	Flagler	Lake	Marion
Column ID >>	8	9	10	11

agglvl_title County, NAICS 3-digit – by ownership sector

own_title (All)

	1			2			3	
	DISTRICT 1			DISTRICT 2			DISTRICT 3	
Industry Code	Number of Establishments	Employment	Total Annual Wages, dollars	Number of Establishments	Employment	Total Annual Wages, dollars	Number of Establishments	Employment
111	626	16,503	$505,359,679	216	2,529	$62,409,725	92	1,757
112	205	1,787	$62,982,191	143	1,336	$39,947,614	37	127
113	16	39	$1,152,050	152	1,209	$75,887,652	95	493
114	39	16	$760,138	16	16	$402,297	28	31
115	441	9,317	$221,370,660	116	727	$21,342,956	67	503
211	6	0	$0	4	0	$0	5	0
212	40	253	$13,652,268	32	136	$8,311,977	27	98
213	26	141	$7,163,400	6	0	$0	18	8
221	171	2,649	$225,186,851	79	1,278	$103,329,046	108	2,332
236	2,648	14,013	$710,290,141	1,558	7,688	$425,759,587	1,232	4,959
237	538	7,224	$366,154,166	379	6,791	$391,142,964	273	3,944
238	7,348	50,908	$1,989,360,522	4,166	28,126	$1,109,698,729	2,939	18,558
311	157	6,791	$357,160,216	86	1,505	$77,488,073	57	319
312	32	412	$15,173,226	27	2,451	$165,275,120	20	47
313	12	19	$750,003	3	0	$0	9	0
314	84	451	$15,984,662	31	123	$3,540,625	24	91
315	13	42	$1,261,446	15	158	$3,803,354	5	0
316	12	21	$897,299	12	0	$0	1	0

APPENDIX V: Glossary of Terms

Benefit-Cost Analysis Terms

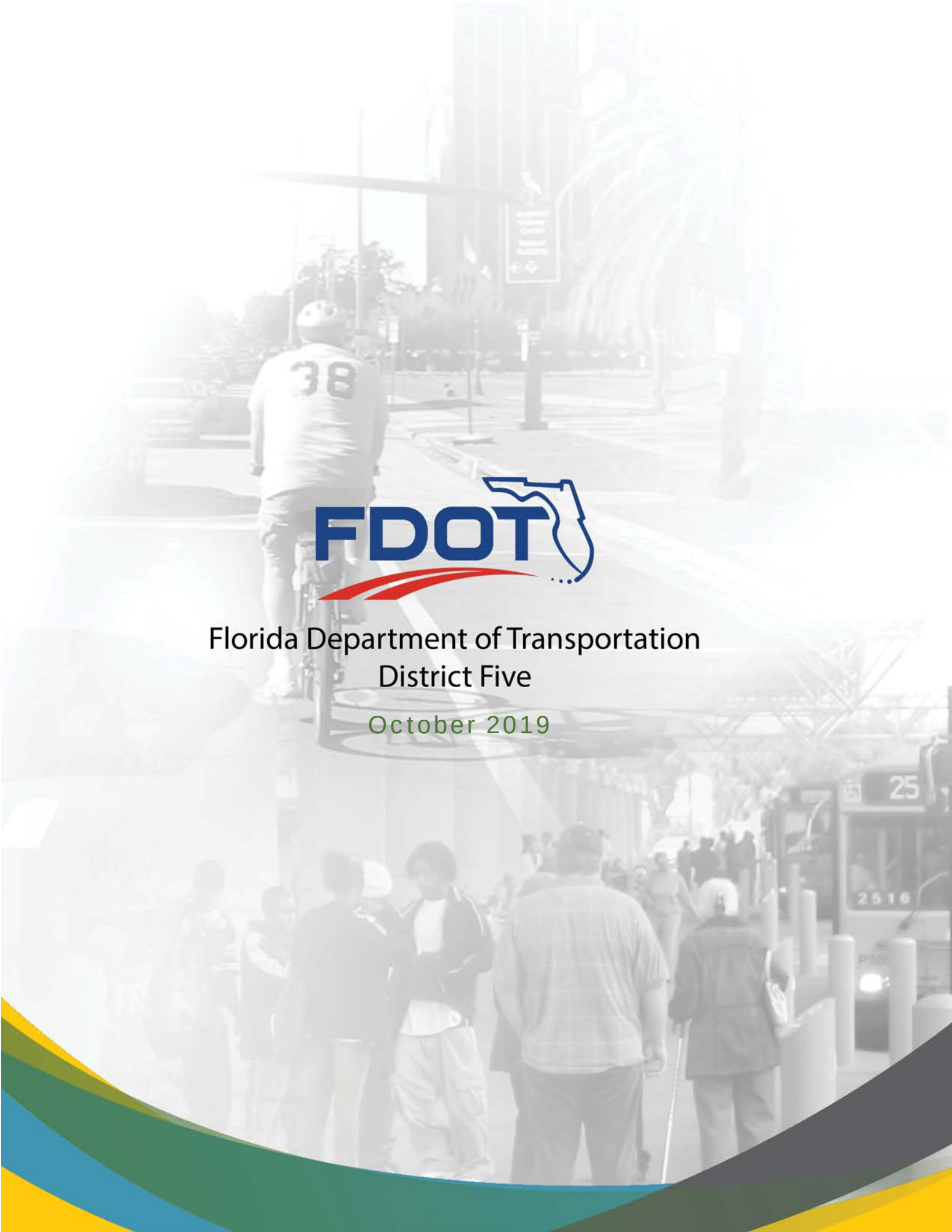
- **Benefit/Cost Ratio:** the present discounted value of total benefits divided by the present discounted value of total investment costs, both estimated over the project's lifecycle. A BCR of 2.5, for example, implies that $2.50 in benefits would be generated for every dollar of investment. A BCR greater than 1.0 suggests that the proposed investment is economically justifiable, as benefits exceed costs.
- **Consumer Surplus:** the difference between what a group of users is willing to pay for a trip (including all components of generalized costs: travel time, vehicle operating costs, transit fares, tolls and other charges) and what they actually pay.
- **Discount Rate:** the annual percentage change in the present value of a future dollar or other unit of account. The discount rate used in BCA is typically the social time preference rate (the value society attaches to present as opposed to future consumption) or the opportunity cost of capital.
- **Discounted Payback Period**: the number of years it takes for a project to break even (that is, until cumulative discounted benefits exceed cumulative discounted investment costs); if the payback period is within the project useful life, NPV is positive.
- **Internal Rate of Return:** the discount rate at which the net present value is zero; an internal rate of return greater than the discount rate suggests that the proposed investment is economically justifiable.
- **Net Present Value:** the difference between the present discounted value of total benefits and the present discounted value of total investment costs; a positive NPV suggests that the proposed investment is economically justifiable.
- **Present Value (or Present Discounted Value):** the value of future costs or benefits expressed in present terms by means of discounting.

Economic Impact Analysis Terms

- **Direct Effects:** changes in economic activity occurring as a direct consequence of decisions made by economic agents.
- **Earnings:** labor income earned by workers.
- **Indirect Effects:** changes in economic activity resulting from changes in sales from suppliers to directly affected businesses.
- **Induced Effects:** changes in economic activity resulting from spending by workers of directly and indirectly affected businesses.
- **Output:** the total value of sales within an economy.
- **Value Added:** the total value of sales within an economy minus the value of intermediate goods used in production; it is comparable to Gross Domestic Product (GDP) at the regional level.

Financial Analysis Terms

- **Financial Discounted Payback Period**: the number of years it takes for the project to break even; that is, until cumulative discounted inflows exceed cumulative discounted investment costs. If the payback period is within the project useful life, FNPV is positive.
- **Financial Internal Rate of Return:** the discount rate that generates a financial NPV of zero for a series of future financial flows.
- **Financial Net Present Value:** the difference between the present discounted value of total inflows and the present discounted value of total outflows; a positive FNPV means that the inflows are greater than the outflows.
- **Residual Value:** the present value, in the last year of analysis, of future revenue net of ongoing costs a project will be able to generate because of the remaining service potential of the investment.



Florida Department of Transportation
District Five

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