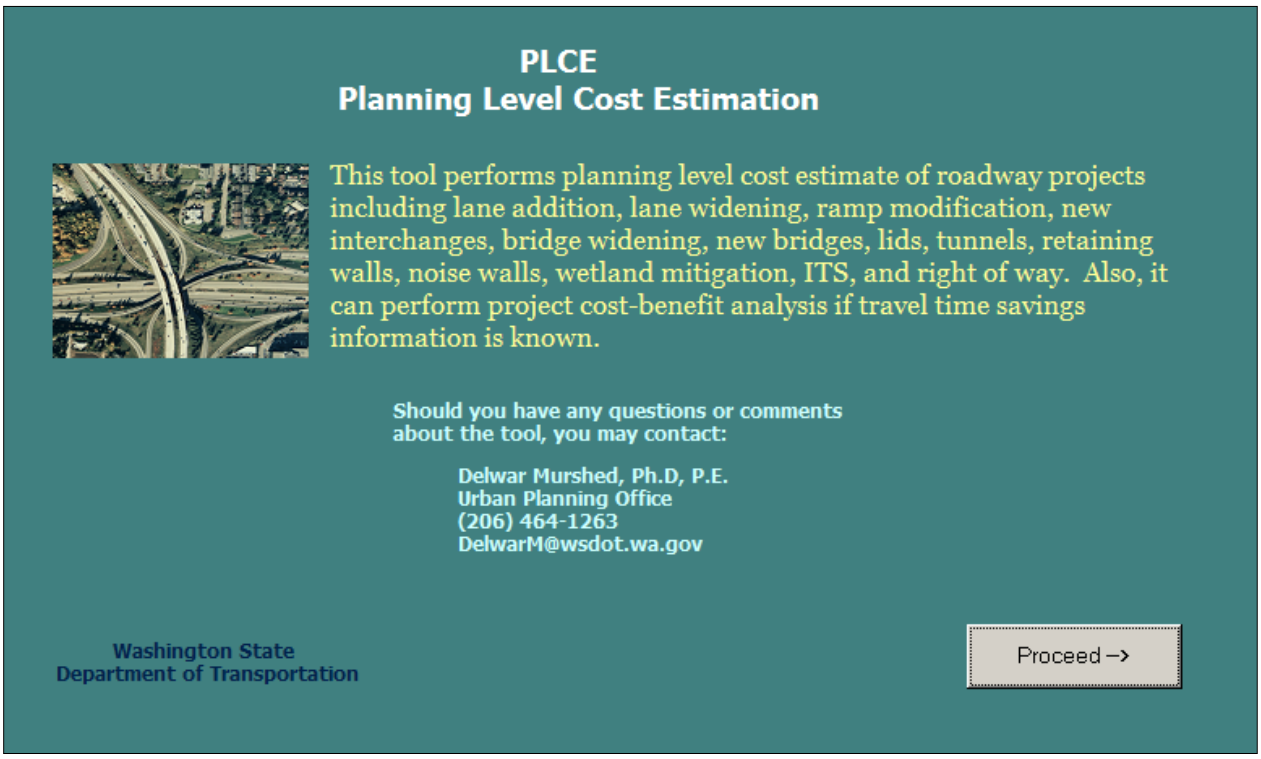
Planning Level Cost Estimation

Step by Step to Make it Easy



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December 2012

PLANNING LEVEL COST ESTIMATION

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PLANNING LEVEL COST ESTIMATION

BACKGROUND

A planning level project cost estimation methodology was developed as part of Congestion Relief Analysis (CRA) for Washington State's three metropolitan areas – Central Puget Sound, Spokane, and Vancouver. The methodology was first developed in an EXCEL spreadsheet to quickly estimate the cost of planning level improvements analyzed in the CRA. This spreadsheet tool can analyze only one project at a time. If, for any reason, any assumption or input needs to be adjusted, it has to be done project by project. Significant time and labor would be involved in performing such revisions for a large number of projects, for example projects analyzed for Highway System Plan updates. In addition, this does not have capability to generate summary information for a portfolio of projects. Any summary report needs to be done manually which is again labor intensive and time consuming.

In order to overcome these problems and increase efficiency, the methodology has been converted to a MS Access database tool. This database tool has been developed with an objective of realizing a number of user benefits including:

- Broadening the applicability of the methodology to other areas of Washington State outside three metropolitan areas stated above;
- Designing user-friendly interface for project data entry;
- Easily updating the estimates for a portfolio of projects when one or more input variables need to be revised;
- Preparing project cost summary; and
- Reporting of results by corridor, geographic area, or by various cost components such as construction cost, ROW cost, environmental mitigation cost, and so on.

OVERVIEW OF METHODOLOGY

Concept

This methodology is intended to perform cost estimation for projects that are very conceptual, often with no or minimum design. The methodology has been developed to estimate costs for varieties of projects namely widening existing roadways or bridges, building new roads or bridges, and modifying existing interchanges or building new ones.

It utilizes unit price approach that accounts for regional differences as well as differences in land use types and development density within a region. Since unit prices vary by geographic area, separate unit prices are used in the estimate depending on where the project is located. To keep the program manageable, four sets of unit prices representing Central Puget Sound, Vancouver, Spokane, and the rest of the state are used. Within each of these geographic areas, unit prices are again function of density of development such as rural, suburban, urban, and dense urban.

Rural (R) – Where widening has no adverse construction or right of way (ROW) impacts associated with added lanes.

Suburban (S) – Where the character of the surrounding property development is largely undeveloped and where roadway expansion without the use of retaining walls can easily be accomplished with no impacts on buildings.

Urban (U) – Where development (homes and businesses) is evident immediately adjacent to the ROW where substantial ROW costs and retaining walls are likely to occur due to widening.

Dense Urban (D) – Where intense development next to the corridor would require unusual construction methods to avoid impacts, or extremely high ROW costs. Examples include locations such as downtown Seattle, downtown Bellevue, or downtown Vancouver.

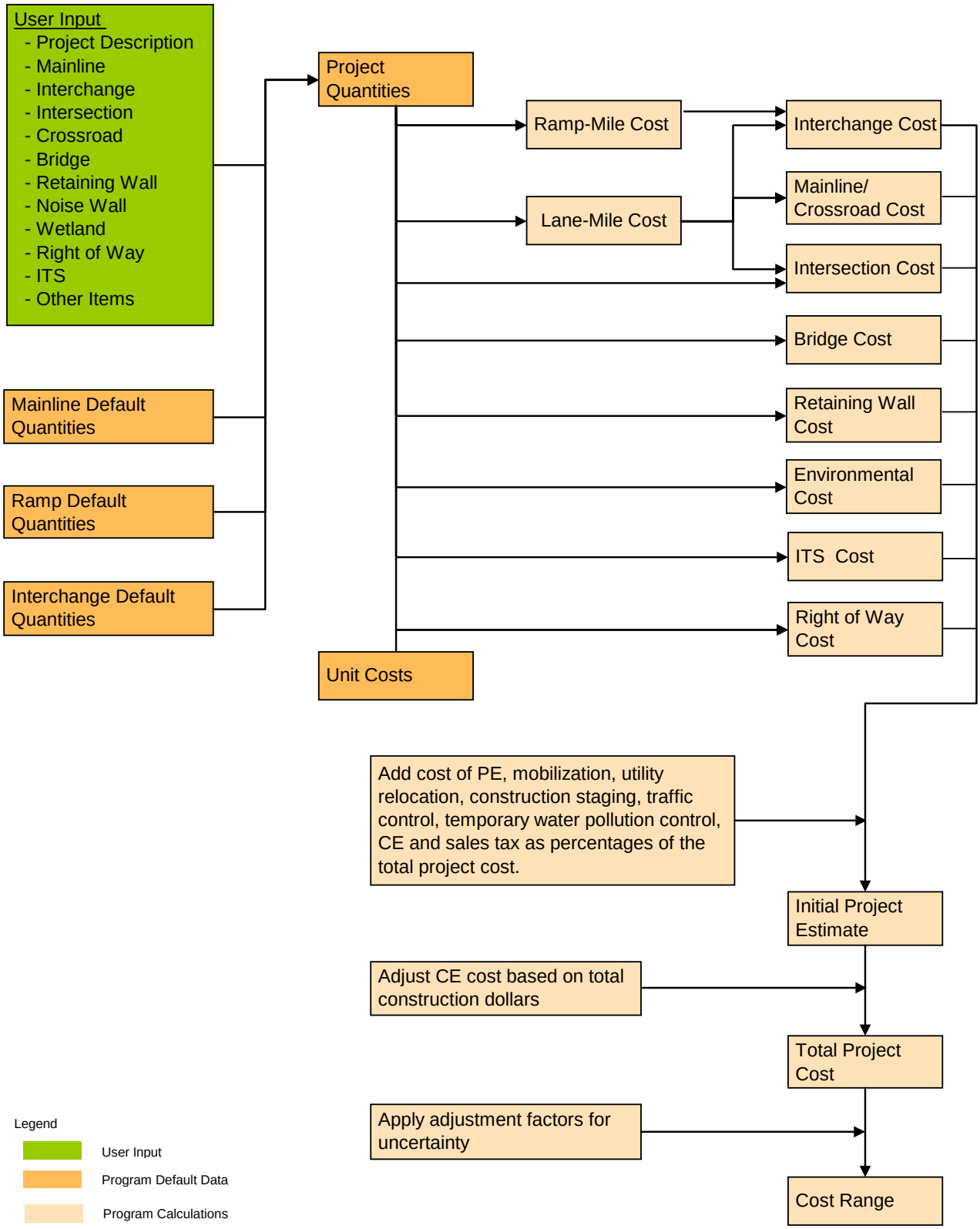
The tool comes with default quantities per lane-mile and unit costs obtained from historical data of WSDOT's past projects. Some unit prices were adjusted for differences in area prices, terrain, ground conditions, and design assumptions. The underlying assumption of the methodology is that little or no geotechnical data is known during early project development where planning level estimates are typically done.

ROW cost is estimated based on amount of ROW needed and unit prices that vary by county as well as development density and land use such as vacant land, residential property, and commercial property.

Program Structure

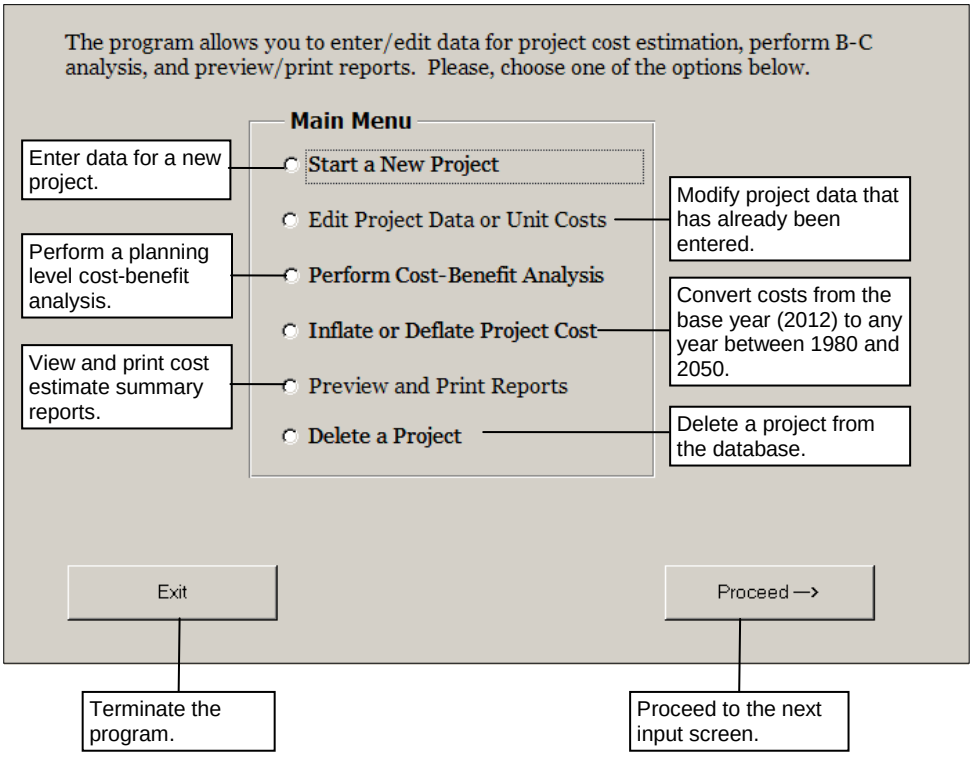
The tool uses a number of related tables to store different types of data separately (**Exhibit 1**). A series of interfaces guide users to select what they want to do as well as to facilitate data entry. The program can store, perform calculations, and produce reports for numerous projects, so there is no need to save the program for each project. Edits can be easily made through another series of interfaces allowing the user to edit both project specific variables and program default variables.

Exhibit 1: Schematic of Data Structure and Calculation Flow



The program is opened by double clicking the left mouse button on the program file "PLCE.mdb." **Exhibit 2** shows the options a user can choose from once the program has been initialized.

Exhibit 2: Program Main Menu



If a user has selected "*Start a New Project*" and then clicks the left mouse button once on *"Proceed"* the program will display a screen for entering project identification information (**Exhibit 3**). Then by following instructions and inputting project information the program advances through a number of screens depending on which project components the user selects from screen shown in **Exhibit 4**. Those selections tell the program which calculation modules to use. The calculation modules are described in the section *Calculation Modules and User Inputs*.

Exhibit 3: Data Input Screen for Project Identification Information

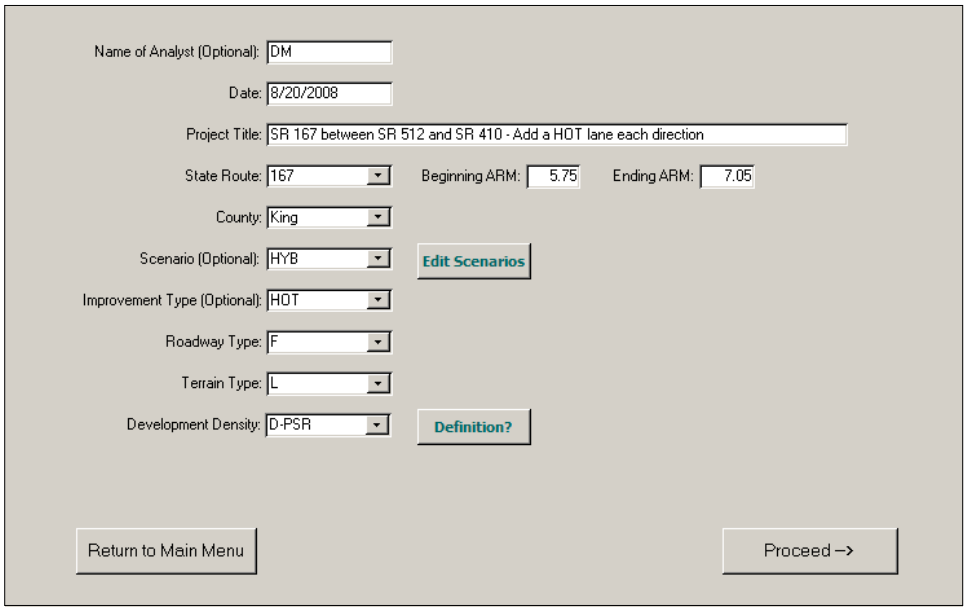
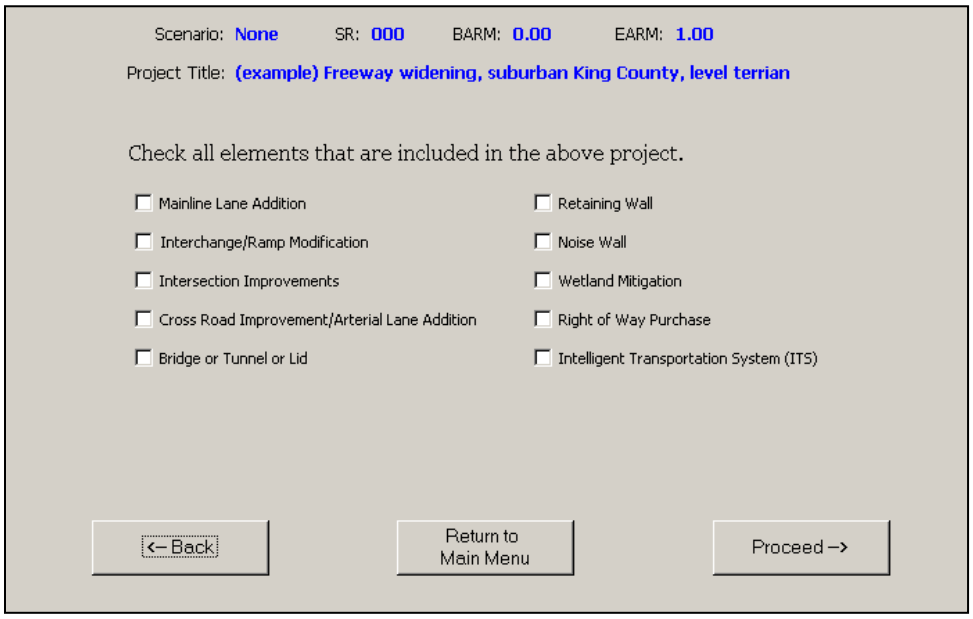


Exhibit 4: Project Components



By selecting "*Edit Project Data or Unit Costs*" from the screen shown in **Exhibit 2**, a user can modify any of the previously entered data or default values (e.g., unit costs, project quantities, etc) for one or more projects. Selecting "*Perform Cost-Benefit Analysis*" the user can do an analysis, edit an analysis, edit global variables, or print benefit-cost reports. Selecting "*Inflate or Deflate Project Cost*" the user can choose the year in which they want the costs reported. Selecting "*Preview / Print Reports*"

users can either, preview and print a one page summary report for all projects in the database, or only the project of their interest. Selecting "*Delete a Project*" allows the user to delete individual projects from the database. Pressing "*Exit*" will save the data, terminate the program, and close all the opened forms associated with this program.

Project Components and Data Need

The tool performs cost estimation requiring only very basic information regarding a project. **Exhibit 5** provides an overview of what data is needed for different components of a project. Please note that a particular project may or may not have all these components. The tool offers options to select any combination of components for a specific project.

Exhibit 5: User Inputs by Module

Module	User Input Data
Project Description	State route, beginning and ending ARM, county, roadway type (i.e., freeway or arterial), terrain (i.e., level, rolling or mountainous), and development density (i.e., rural, suburban, urban or dense urban)
Mainline	Existing and proposed number of lanes by direction, and length of proposed lanes
Interchange	Type and number of interchanges
Intersection	Number and length of left turn, right turn and two-way-left-turn lanes, number of new signalized intersections, and number and unit cost of roundabout
Crossroad	Length and number of lanes
Bridge, Tunnel or Lid	Square feet of existing bridges to be widened or removed, length and square feet of roadway bridges to be built, square feet of new lids, and length of new tunnels, pedestrian bridges and railroad bridges
Walls	Square feet of retaining walls, and length of noise walls
Wetland	Acres of wetlands to be mitigated by wetland category (i.e., Class I, II, III, and IV), number of stream culverts, and number of beach restorations
ROW	Acres of land required by land use (i.e., vacant, residential, and commercial)
ITS	Number of WMS, CCTV, HARS, HART, data stations, fiber optic terminal cabinets, and ramp meters; number of signals to coordinate; length of ITS conduit and fiber optic cable. No input is required if the default cost per lane-mile option chosen.

CALCULATION MODULES AND USER INPUTS

Cost estimation is performed in ten separate user selected calculation modules and a number of associated sub-modules. These user selected modules are:

- Roadway Mainline
- Interchanges
- Intersections
- Crossroads
- Bridges, Tunnels and Lids
- Retaining Walls
- Noise Walls
- Wetland Mitigation
- Right of Way
- Intelligent Transportation Systems

In addition to the user selected calculation modules the program performs additional calculations which require no additional user input. These calculations include:

- Grading
- Drainage
- Stormwater Treatment
- Paving
- Roadside Development
- Traffic
- Markups (mobilization, traffic control, temporary water pollution control, construction staging, utility relocation, sales tax, preliminary engineering, and construction engineering)
- Uncertainty

Roadway Mainline

Mainline widening costs are estimated using default quantities per lane-mile from past projects (**Exhibits A-1 and A-2**) and recent unit costs. The quantities and costs vary according to development densities, roadway type, and geographic location. These variations result in 28 different mainline types (**Exhibit 6**) that depend on:

- Development Density (rural, suburban, urban, and dense urban)
- Roadway Type (freeways and limited access highways; and arterials and non-limited access highways)
- Geographic Area (the Central Puget Sound Region, Vancouver Metro Area, Spokane Metro Area, and rest of the state).

Mainline estimates are performed based on a number of assumptions commonly experienced in past projects. For example roadways in the Puget Sound area are assumed to be in steeper terrain with greater environmental and right of way impacts. Also, earthwork costs associated with projects in rolling and mountainous

terrains are generally higher than those for projects in level terrain. Default base estimates per lane-mile for level terrain are shown below.

Exhibit 6: Base Cost* of Roadway Mainline

Freeways and Limited Access Highways (2012$)

	Puget Sound ($/lane-mile)	Vancouver ($/lane-mile)	Spokane ($/lane-mile)	Other Areas ($/lane-mile)
Rural	2.69 M	2.15 M	2.16 M	1.82 M
Suburban	2.91 M	2.15 M	2.23 M	1.82 M
Urban	4.62 M	3.19 M	2.98 M	1.82 M
Dense Urban	7.38 M	5.49 M	-----	-----

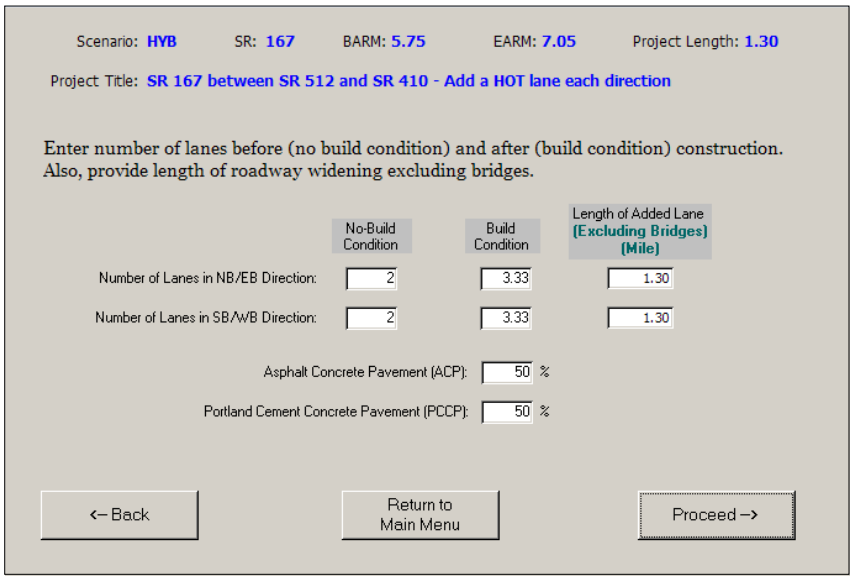
Arterials and Non-Limited Access Highways (2012$)

	Puget Sound ($/lane-mile)	Vancouver ($/lane-mile)	Spokane ($/lane-mile)	Other Areas ($/lane-mile)
Rural	2.51 M	1.80 M	1.81 M	1.82 M
Suburban	2.73 M	1.87 M	1.95 M	1.82 M
Urban	4.58 M	3.03 M	2.81 M	1.82 M
Dense Urban	6.54 M	5.04 M	-----	-----

*Does not include interchanges, bridges, walls, wetland mitigation, right of way, or intelligent transportation systems.

The minimum inputs required for producing a mainline estimate are beginning and ending accumulated route mileposts (ARM), number of lanes in build and no-build conditions by direction, roadway type, terrain type, land development density, and geographic location. An input screen with some example data is shown in **Exhibit 7**.

Exhibit 7: Data Input Screen for Mainline Widening



Selection of geographic area, roadway type, terrain, and development density allows the use of appropriate per-mile quantities and costs to reflect that particular roadway segment characteristics. APPENDIX A documents default quantities (**Exhibits A-1, A-2, A-3 and A-4**) whereas APPENDIX B documents default unit costs (**Exhibits B-1, B-2, B-3, B-4, B-5, B-6 and B-7**) used in the tool.

Often as part of interchange improvements, cross roads are improved. Cross road data input is similar to that of mainline. Cross road cost calculation uses the same default values as in the mainline calculations.

Interchanges

An interchange may involve mainline widening or shift, as well as construction of ramps, bridges and retaining walls, and installation of signals. Mainline widening costs come from mainline estimates described above. For ramps, a typical ramp-mile is estimated using default quantities (**Exhibit A-3**) and default unit costs (**Exhibits B-1 and B-2**) obtained from past projects.

As unit costs and material quantities required for an interchange vary by geographic area and development density, interchange costs vary from area to area and from one development density to other. **Exhibit 8** shows default estimates for different interchange types in urban areas throughout the state.

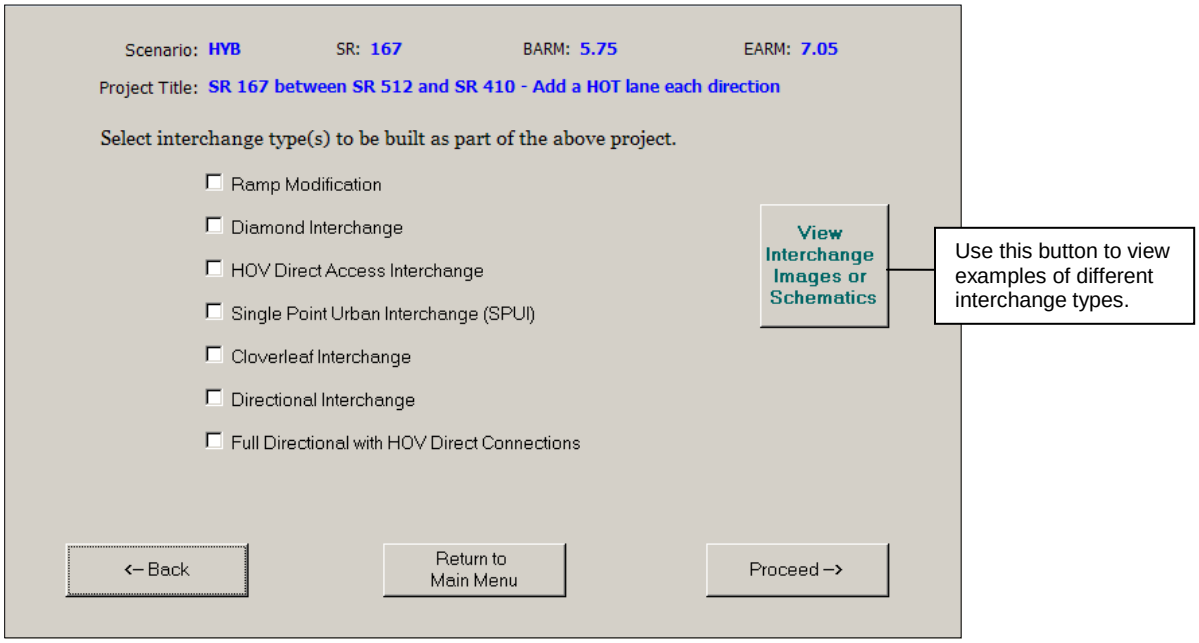
Exhibit 8: Base Cost of Urban Interchanges on Level Terrain

	In Terms of 2012$ Values			
Interchange Type	**Puget Sound**	**Vancouver**	**Spokane**	**Other Areas**
Ramp modification	$5.09 M	$3.80 M	$3.92 M	$2.48 M
Diamond at rural/minor crossroad	$24.48 M	$19.84 M	$21.20 M	$14.31 M
Diamond at urban/arterial crossroad	$35.15 M	$26.87 M	$27.79 M	$18.46 M
Diamond at urban/braided ramps	$43.27 M	$32.92 M	$34.20 M	$23.29 M
Half-diamond	$17.26 M	$13.55 M	$14.17 M	$10.22 M
HOV direct access interchange – one directional	$47.09 M	$33.49 M	$34.01 M	$29.67 M
HOV direct access interchange – bidirectional	$84.53 M	$60.34 M	$61.59 M	$54.06 M
HOV direct access interchange – bidirectional with freeway shift for median widening	$94.70 M	$67.52 M	$68.23 M	$56.85 M
HOV direct access interchange – with flyover ramp to HOV facility	$44.20 M	$30.04 M	$30.47 M	$26.57 M
Single point urban interchange at minor arterial crossroad	$56.76 M	$41.17 M	$42.96 M	$34.50 M
Single point urban interchange at major arterial crossroad	$63.44 M	$45.59 M	$47.00 M	$36.42 M
Partial cloverleaf with 1 to 2 loop ramps and small footprint	$43.93 M	$28.16 M	$27.23 M	$17.04 M
Partial cloverleaf with 3 loop ramps and large footprint	$50.60 M	$32.69 M	$31.96 M	$19.84 M
Full cloverleaf with small footprint in sparsely developed location	$51.82 M	$42.73 M	$44.99 M	$27.43 M
Full cloverleaf with large footprint in highly developed location	$63.97 M	$48.89 M	$50.58 M	$31.05 M
Partial directional with 1 flyover ramp	$87.92 M	$54.14 M	$52.10 M	$38.32 M
Partial directional with 2 flyover ramps	$108.22 M	$68.28 M	$66.55 M	$51.10 M
Full directional with 2 flyover ramps	$114.51 M	$85.70 M	$86.73 M	$59.17 M
Full directional with 3 flyover ramps	$167.19 M	$117.69 M	$117.98 M	$87.83 M
Full directional with 4 flyover ramp	$195.27 M	$135.38 M	$135.37 M	$104.65 M
Fully directional with some HOV direct connections	$248.66 M	$168.07 M	$167.46 M	$135.08 M
Fully directional for all GP and HOV movements	$302.98 M	$201.32 M	$199.97 M	$166.14 M

*Does not include right of way, wetland mitigation, or I.T.S.

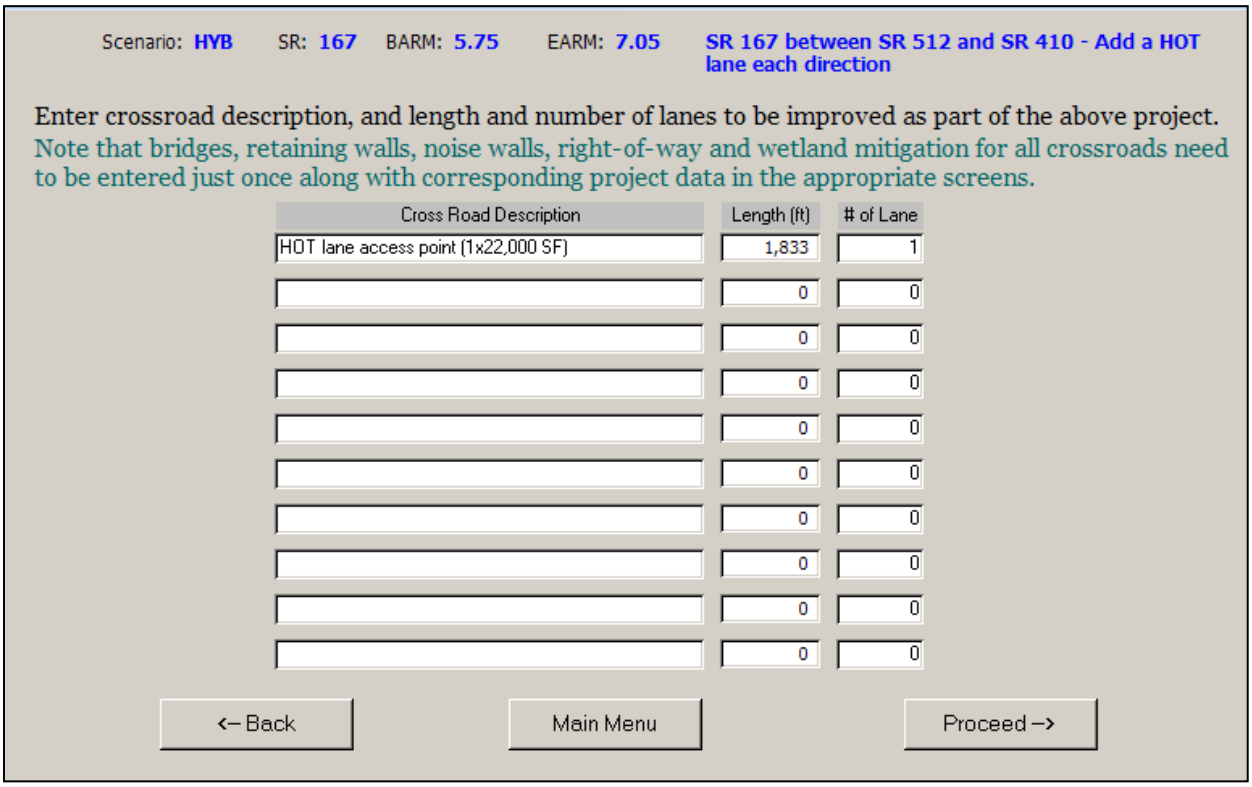
Most of the interchange cost estimation is performed using default data (**Exhibits A-3 and A-4**), requiring little user input. What a user needs to do is to select an appropriate type of interchange from a menu of seven interchange types and then several sub categories for each type. The seven interchange types are selected from the input screen shown in **Exhibit 9**.

Exhibit 9: Interchange Selection Input Screen



Often connecting crossroads would be widened to meet the added demand for access to the improved freeway or arterial. To account for this, crossroad improvement costs are estimated only when users select this item to be included in the cost estimates. Crossroad widening costs are estimated in a separate calculation module using the mainline widening costs for undivided arterial roadways and the related assumptions. Only two pieces of information are needed for crossroad estimates – length and number of lanes of crossroad to be improved. **Exhibit 10** shows an example of data input screen.

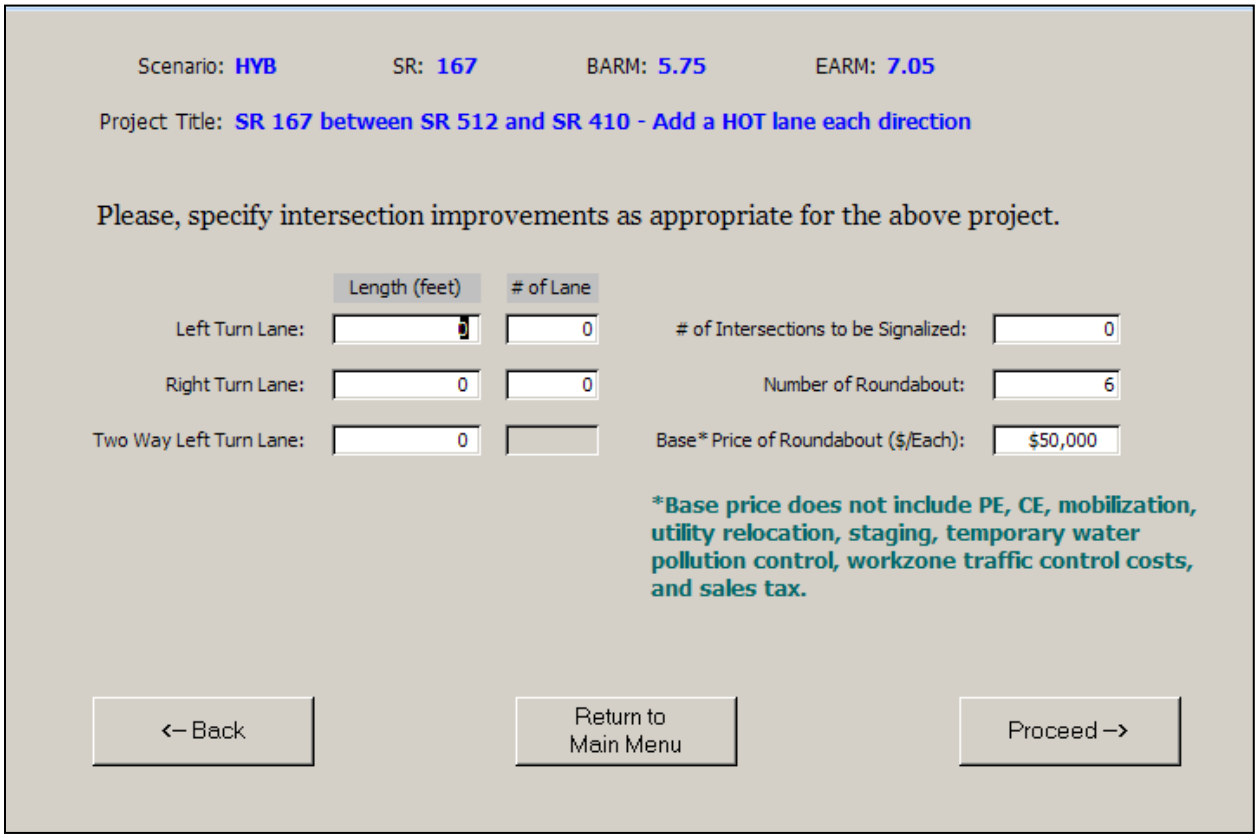
Exhibit 10: Data Input Screen for Crossroad Improvements



Intersections

Intersection improvement options include adding left-turn, right-turn and/or two-way-left-turn lanes, installing signals, and building roundabouts (**Exhibit 11**). Unlike most other items, roundabouts do not have a default unit cost, so the user has to input both the number of roundabouts and the cost for each.

Exhibit 11: Intersection Data Input Screen



Bridges, Tunnels and Lids

Cost estimation of bridges, tunnels, and lids involves user input for dimensions (**Exhibits 12 and 13**) and default unit costs (**Exhibit B-2**). Existing bridge widening or removal, and all types of new bridges except railroad bridges require user input of square feet of bridges. Square feet of bridges are multiplied by unit costs to calculate cost of a bridge.

Exhibit 12: Data Input Screen for Bridges

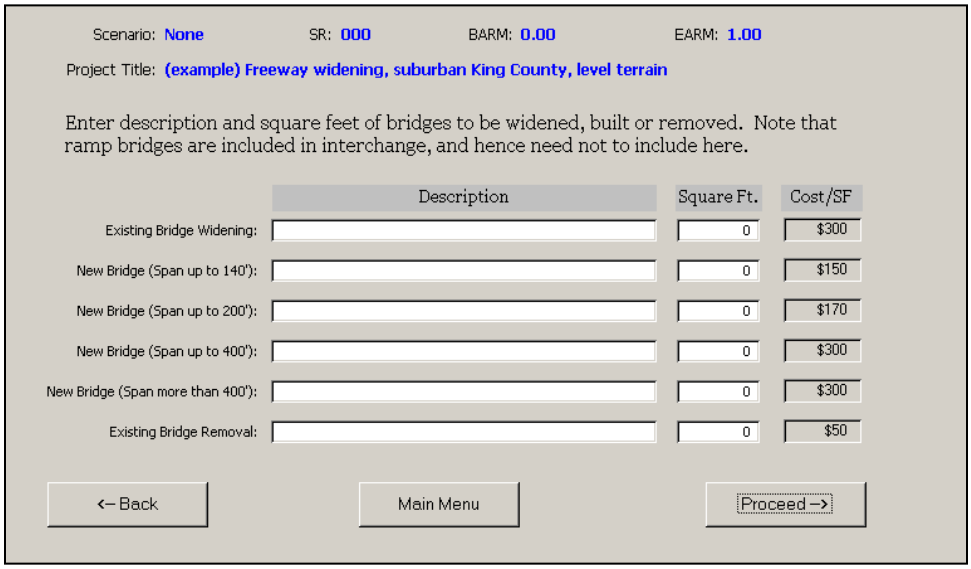
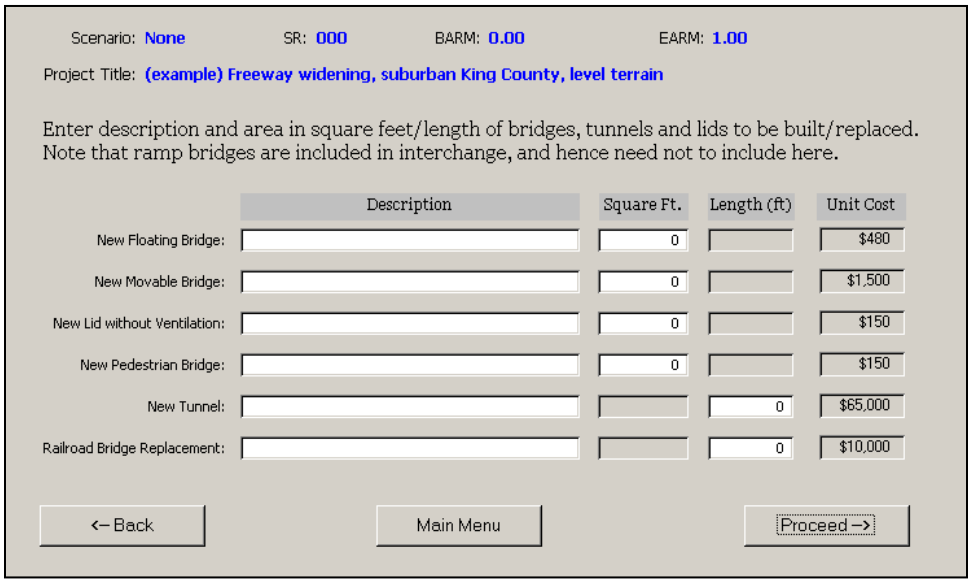


Exhibit 13: Data Input Screen for Special Bridges, Tunnels and Lids

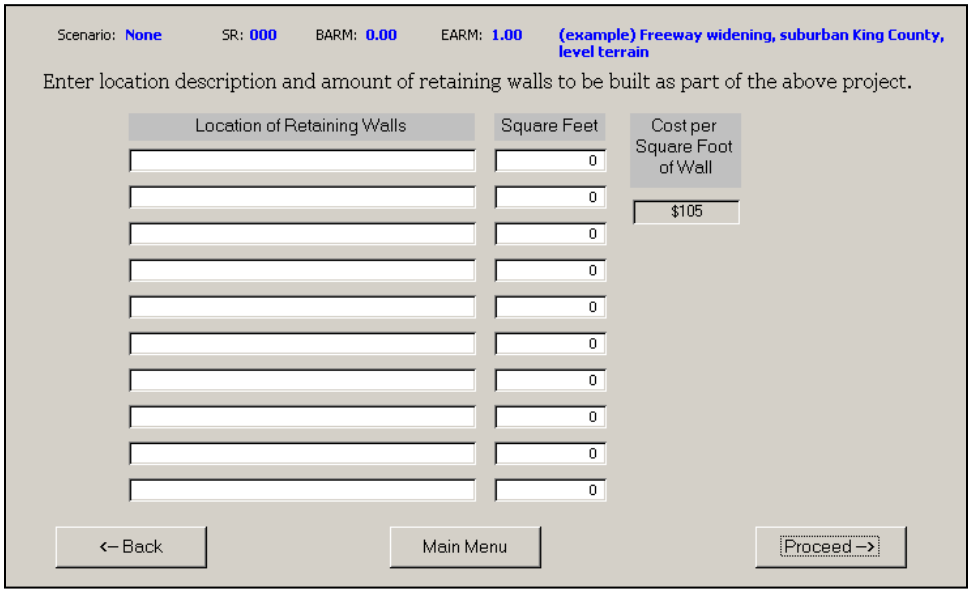


Cost of tunnels and railroad bridge replacement is estimated using user input of length in feet and default unit cost per feet.

Retaining Walls

Estimating retaining wall costs is a straightforward process. It requires the user to only input the square footage for each retaining wall. Retaining wall costs are calculated by multiplying wall surface area by unit cost per square foot for retaining walls. **Exhibit 14** provides an example of the data input screen for retaining walls which can accommodate up to 10 walls.

Exhibit 14: Data Input Screen for Retaining Walls



Environmental

Environmental estimates include a number of items such as wetland and streams, drainage system, stormwater detention and treatment, noise walls, roadside restoration, and temporary water pollution control during construction. A brief description of each of these items follows.

Wetland and Streams

The cost of wetland mitigation is based on the rating of the wetland and/or the type of wetland. Unit costs are assigned differentiating between wetlands based on their classification (i.e., sensitivity to disturbance, rarity, the functions they provide, and whether they can be replaced or not). **Exhibit B-3** shows the default unit costs for wetland and streams by classification. **Exhibit 15** describes wetland types considered in this tool.

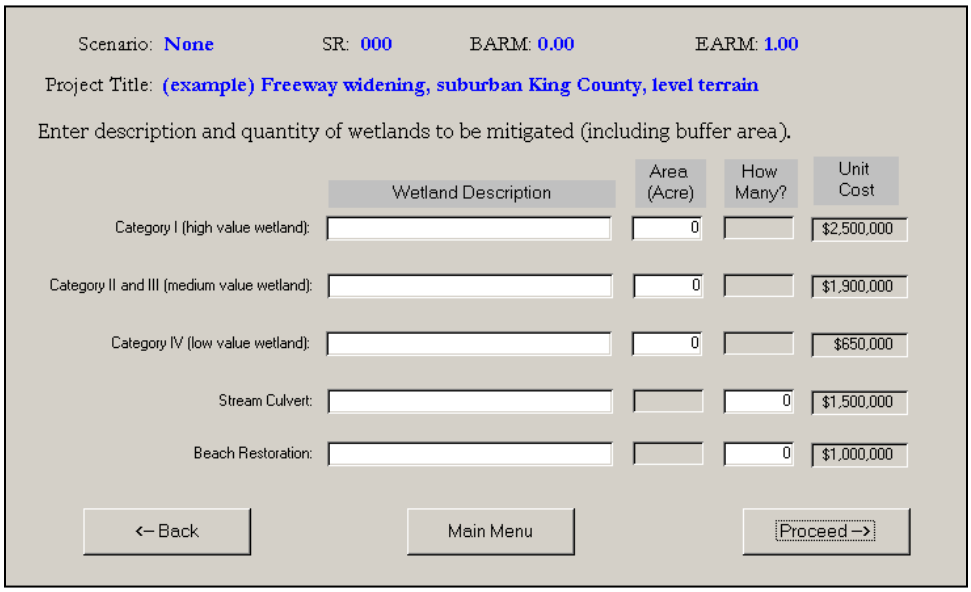
Exhibit 15: Wetland Classification and Mitigation Requirements

Wetland Category	Description	Mitigation Ratio
Category I	Wetlands that • Represent a unique or rare wetland type, **or** • Are more sensitive to disturbance than most wetlands, **or** • Are relatively undisturbed and contain ecological attributes that are impossible to replace, **or** • Provide a high level of functions.	6:1
Category II & III	Wetlands that are • Difficult, though not impossible, to replace, and provide high levels of some functions, **or** • Between 0.1 and 1 acre in size with a moderate level of functions.	2:1 to 3:1
Category IV	Wetlands that have lowest levels of functions and are heavily disturbed. These are wetlands that people should be able to replace and in some cases be able to improve.	1.25:1

Source: Environmental Procedures Manual (EPM Manual) M31-11, September 2004, Section 437 (Wetland); Washington State Dept. of Ecology publication # 04-06-025 "Washington State Wetland Rating System" http://www.ecy.wa.gov/pubs/0406025.pdf

For estimating the cost associated with wetlands, streams, and beaches; users have to enter the amount (in acre) of wetland to be impacted as well as number of stream culverts to install and beaches to restore. **Exhibit 16** provides an example of the data input screen.

Exhibit 16: Data Input Screen for Wetlands



Cost of wetland mitigation is calculated based on users' input of areas of impact and default unit cost per acre. Stream culvert and beach restoration are assigned a lump sum cost per each.

Drainage System

Drainage costs were calculated from past project experience. The treatment and conveyance costs were determined based on the four project setting types (dense-urban, urban, suburban, and rural). Rural areas were assumed to be 100 percent ditch conveyance as opposed to dense urban which were assumed to be 100 percent pipe conveyance systems. The intermediate conditions were proportioned with percentage splits of these two methods and their relative costs. The program calculates drainage systems cost based on the user input data entered elsewhere, no additional input is required.

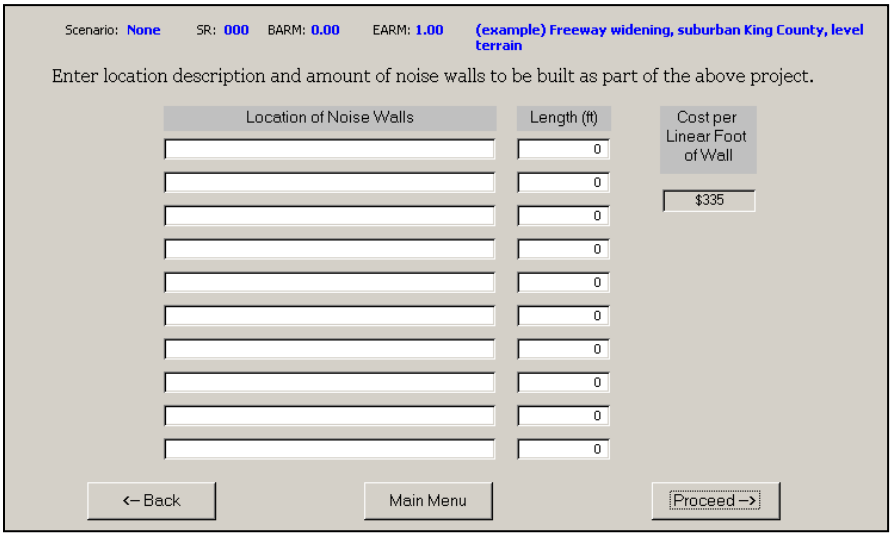
Stormwater Detention and Treatment

Stormwater detention and treatment system is assumed to be detention pond and water quality pond for rural and suburban areas. Stormwater detention and treatment costs are calculated using: 50% by ponds and 50% by vaults in urban areas, and 10% by ponds and 90% by vaults in dense urban areas. Costs are estimated using default quantities per lane-mile and default unit costs. No additional user input is necessary.

Noise Walls

Noise wall costs are estimated with an average height (25 feet) and a unit cost associated with this average height. Therefore, it requires only user input of length (in feet) of each wall. **Exhibit 17** provides an example of data input screen, which can accommodate up to 10 noise walls.

Exhibit 17: Data Input Screen for Noise Walls



Costs for noise walls are calculated based on user input of wall length and the default cost per linear foot (**Exhibit B-2**)

Roadside Restoration

A lump sum cost is assigned to roadside restoration per lane-mile. This cost varies by geographic area as well as development density in each geographic area. Default costs are shown in **Exhibit B-1**. No user input required.

Temporary Water Pollution Control

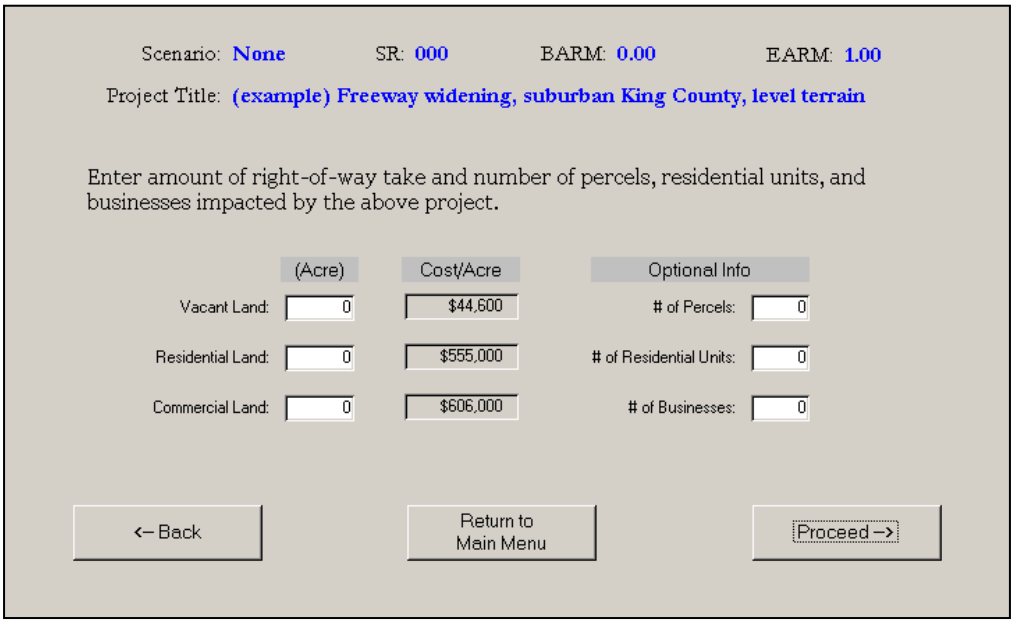
Cost of temporary water pollution control during construction is estimated as a percent of construction cost. A 3% factor is used for all estimates (**Exhibit B-5**).

Right of Way

Right of way costs are estimated by using per acre unit costs for vacant land, and residential and commercial properties that accounts for variations not only by county, but also by development density within each county.

In order to estimate project cost, users need to enter amount of right of way (ROW) needs in acres by vacant land, residential, and commercial properties (**Exhibit 18**). In addition to inflation ROW costs will increase due to build out condition with respect to zoning, therefore, it is suggested to use zoned classifications not visual opinions to classify the ROW type. Number of impacted parcels, residential units, and businesses are not part of the calculation and hence it is optional to enter such data.

Exhibit 18: Example of Right of Way Data Input Screen

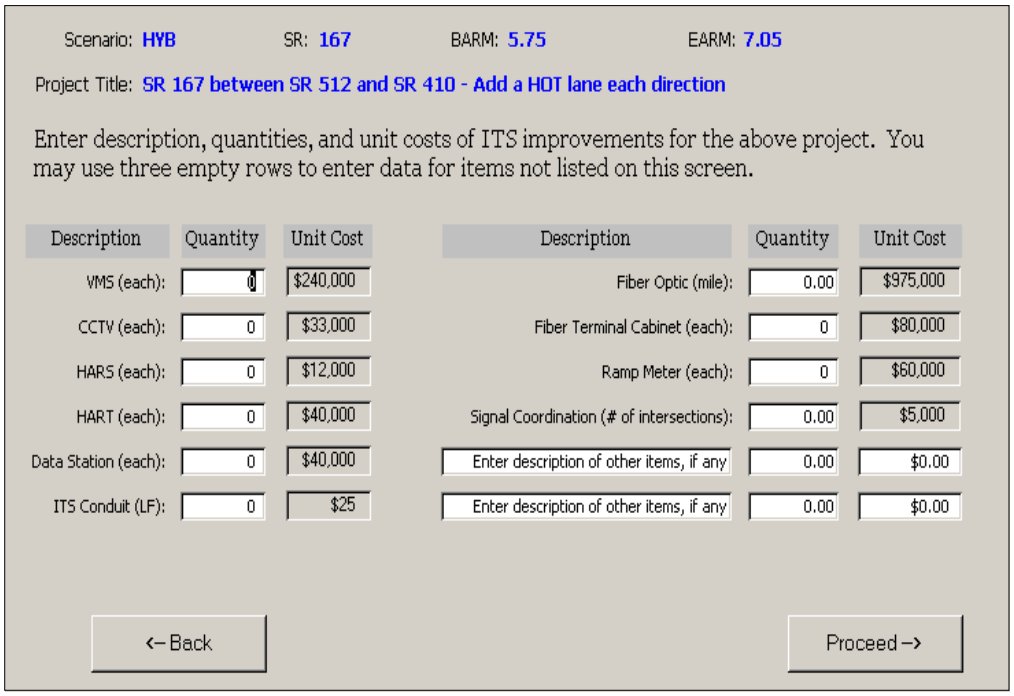


The amount of right of way need is multiplied by the default unit costs in **Exhibit B-4**. However, users would be able to change the default values to reflect the local conditions, if needed. Right of way default unit costs can be updated using the button "*Edit Project Data or Unit Cost*" shown in **Exhibit 2**.

Intelligent Transportation System

The tool offers two options for intelligent transportation system (ITS) cost estimation – default cost and user input specific cost. No input is required when choosing the option for default cost per lane-mile. For the other option, the user has to specify quantity of WMS, CCTV, HARS, HART, data stations, fiber optic terminal cabinet, ramp meters, and number of signals to coordinate (**Exhibit 19**). In addition, the user has to provide length of ITS conduit and fiber optic cable, if any. Default unit costs are shown in **Exhibit B-7**.

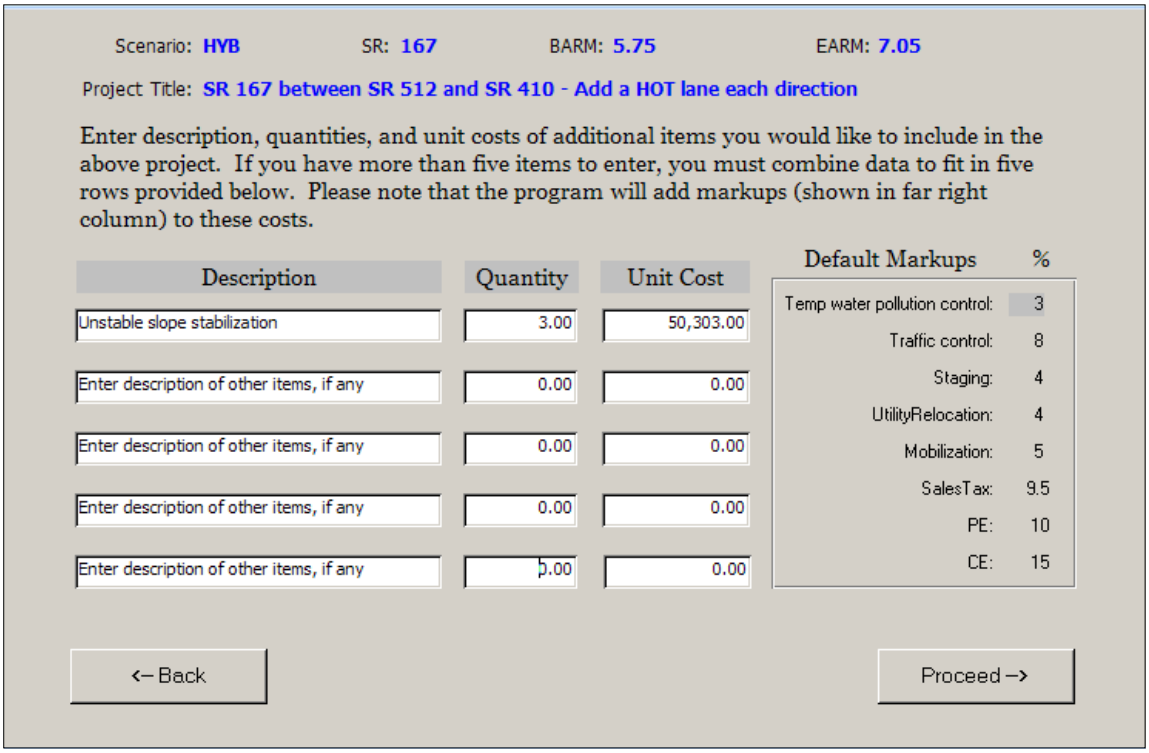
Exhibit 19: ITS Data Input Screen



Other Items

If there are any cost elements in a project that are not accounted for by the various input modules, a user has the option to enter data for those elements. In this case, the user has to enter both quantity and unit cost with optional description of the item. The estimated cost will be adjusted based on the markups shown in the far right column in **Exhibit 20**. Other items entered this way will appear under *ADDITIONAL ITEMS* when various reports are generated within the tool.

Exhibit 20: Input Screen for Other Items



Markups

Due to lack of design and construction details at the planning level, costs of a number of items are estimated as percent of project construction cost. These items include preliminary engineering, mobilization, utility relocation, construction staging, traffic control, construction engineering, and sales tax. Default percentage values of these items are shown in **Exhibit B-5**.

Construction engineering costs depends on total dollar amount of project construction. As total cost of construction goes up, percent of total cost for construction engineering goes down. Since construction dollars is not known until the estimate is complete, all projects are estimated on the basis of 15% as a beginning point for construction engineering and then adjusted up or down using the numbers in **Exhibit B-6** (as per Plans Prep Manual, January 2007, Section 830).

Uncertainty

Generally planning level estimates are performed with no design information. Therefore, many unknown factors may lead to changes in the estimates later on. This is why the project costs are estimated as a range of probable costs and not as a single cost number. The single project cost value is only one possibility within the entire range of probable costs assigned to the estimate. The cost risk factors are applied to all projects in all regions regardless of project or corridor type. The final costs range from minus 10 percent to plus 20 percent of the initial estimated amount.

INFLATION MODULES AND USER INPUTS

After cost estimation is performed using base year data, the estimated cost can be inflated or deflated to any future or past year. The tool comes with default cost index for preliminary engineering, construction and right of way. To inflate or deflate costs, a user needs only one piece of data – selecting the year from a drop down list to which to inflate or deflate the dollar amounts. **Exhibit 21** shows data input screen and **Exhibit 22** shows a sample output screen.

Exhibit 21: Cost Inflation or Deflation Data Input Screen

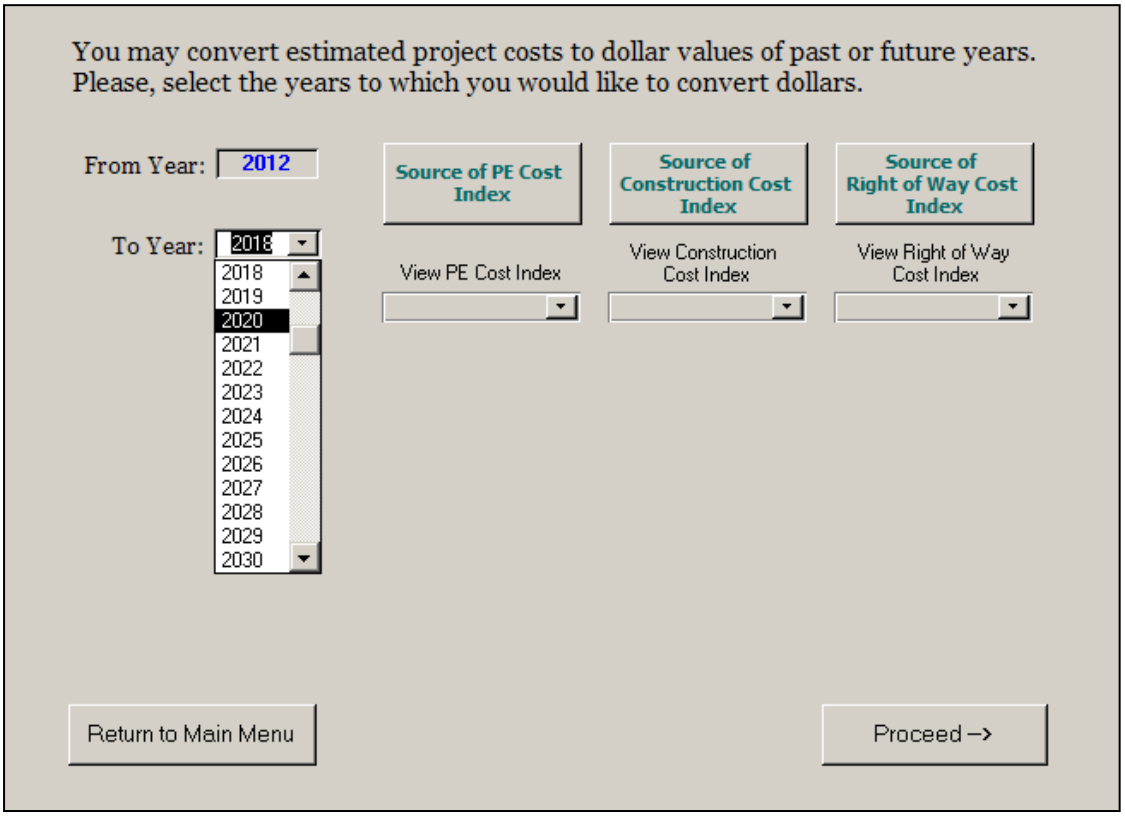
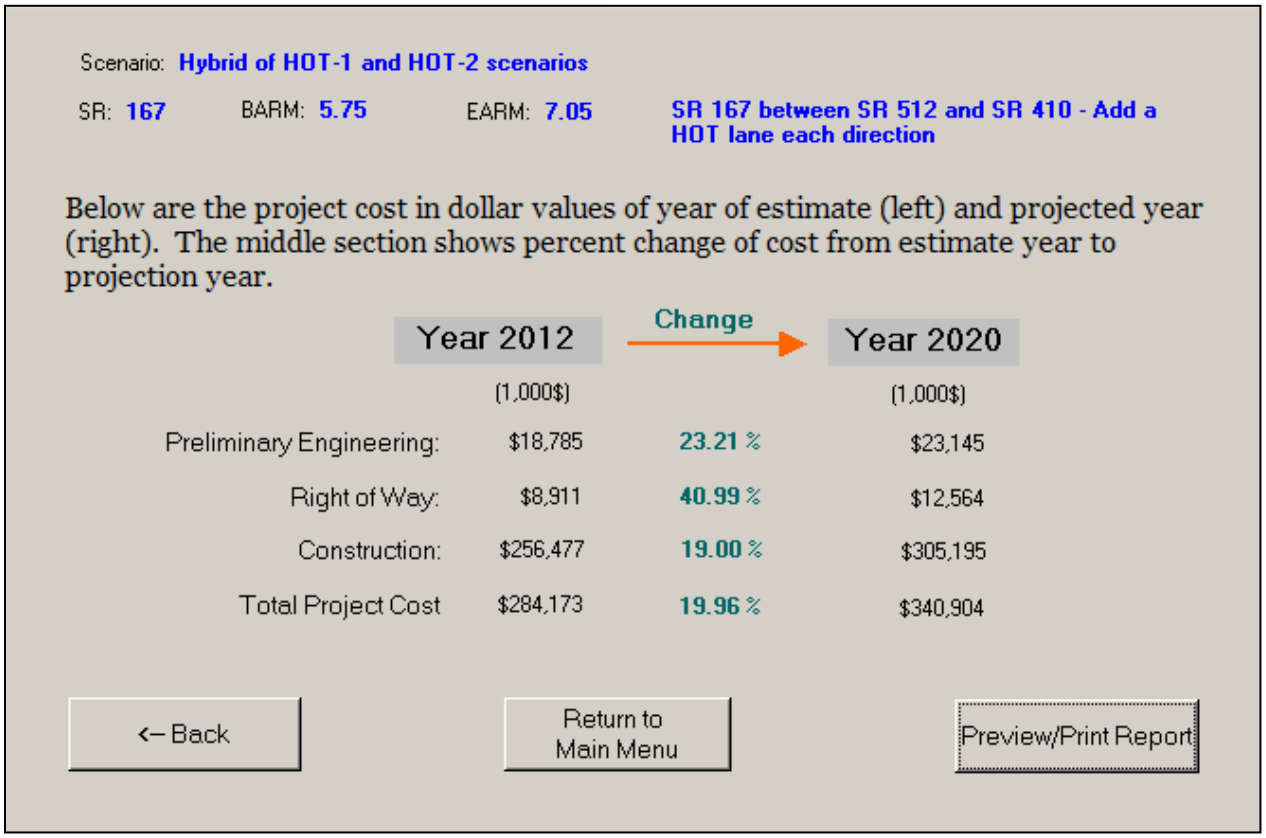


Exhibit 22: A sample Output of Cost Inflation

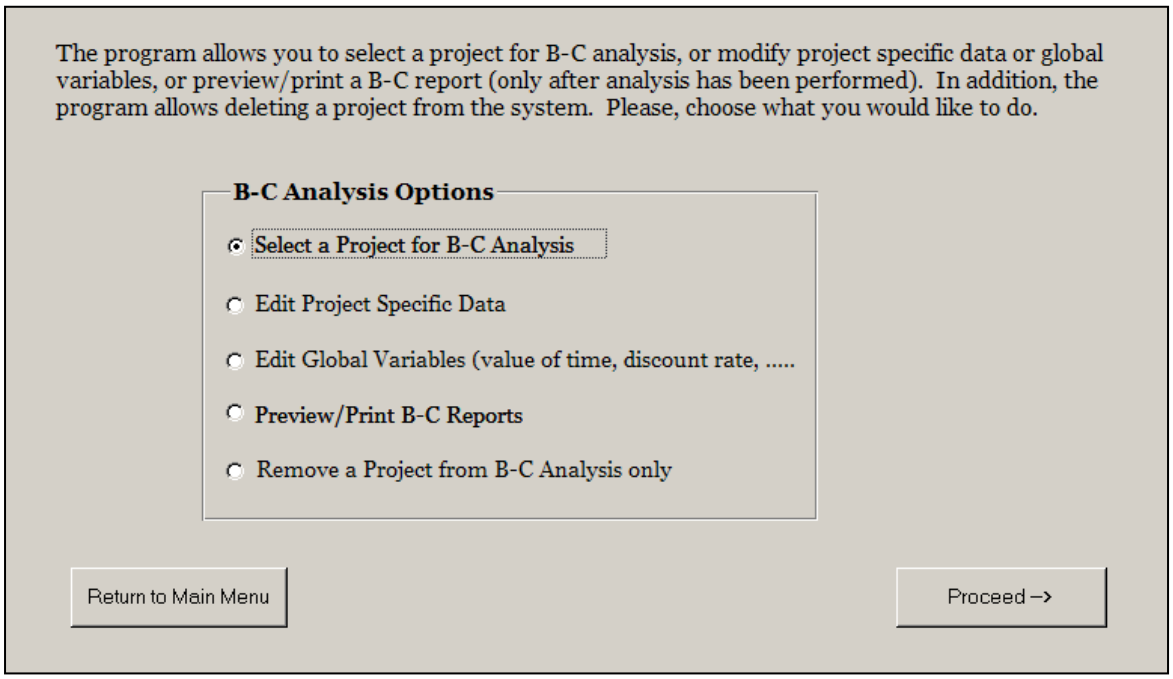


BENEFIT-COST MODULES AND USER INPUTS

Once cost estimation of a project is complete, a user has the option to perform benefit-cost analysis. This is feasible only if the user has data related to travel time savings. More specifically the user has to have vehicle hour travel (VHT) data for build and no build conditions in base and horizon years.

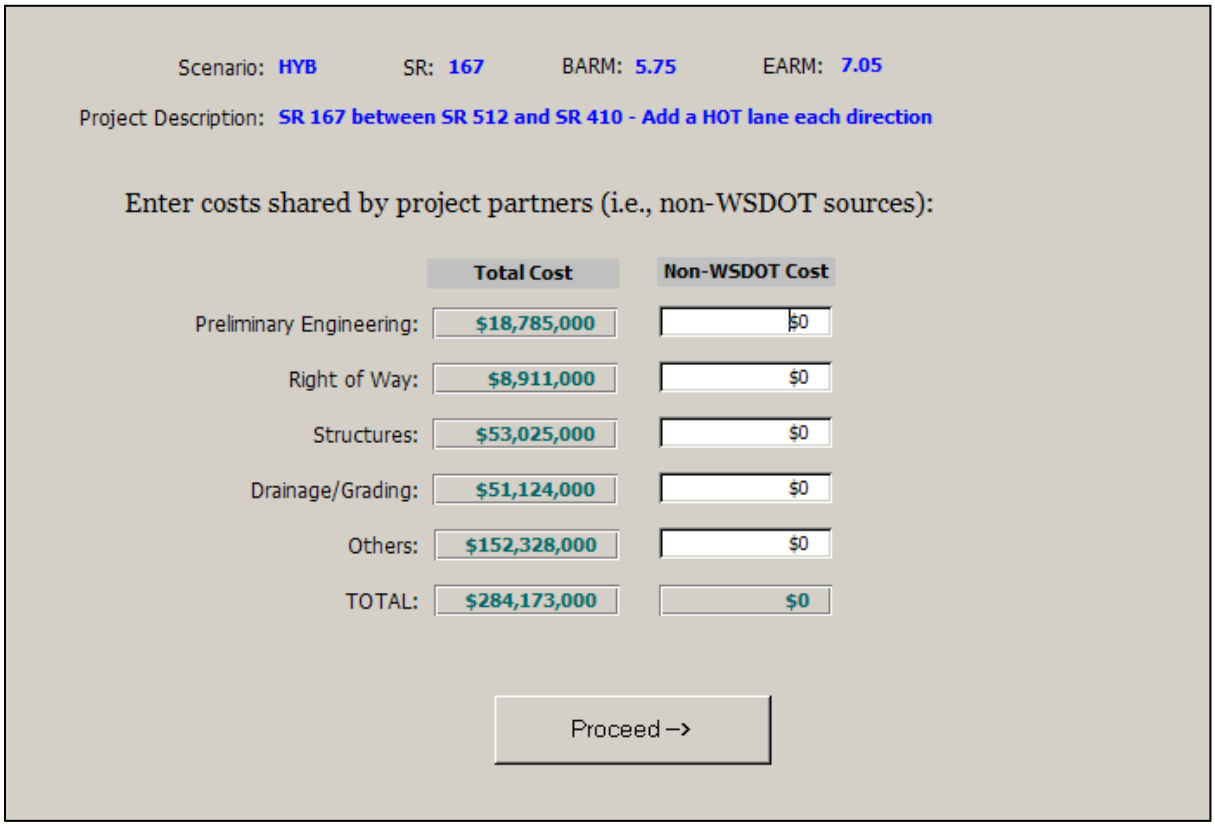
Exhibit 23 shows options available in benefit-cost analysis module. When the option "Select a Project for B-C Analysis" is chosen, the user is prompted to select a project from a drop down list to perform B-C analysis.

Exhibit 23: Benefit-Cost Analysis Main Menu



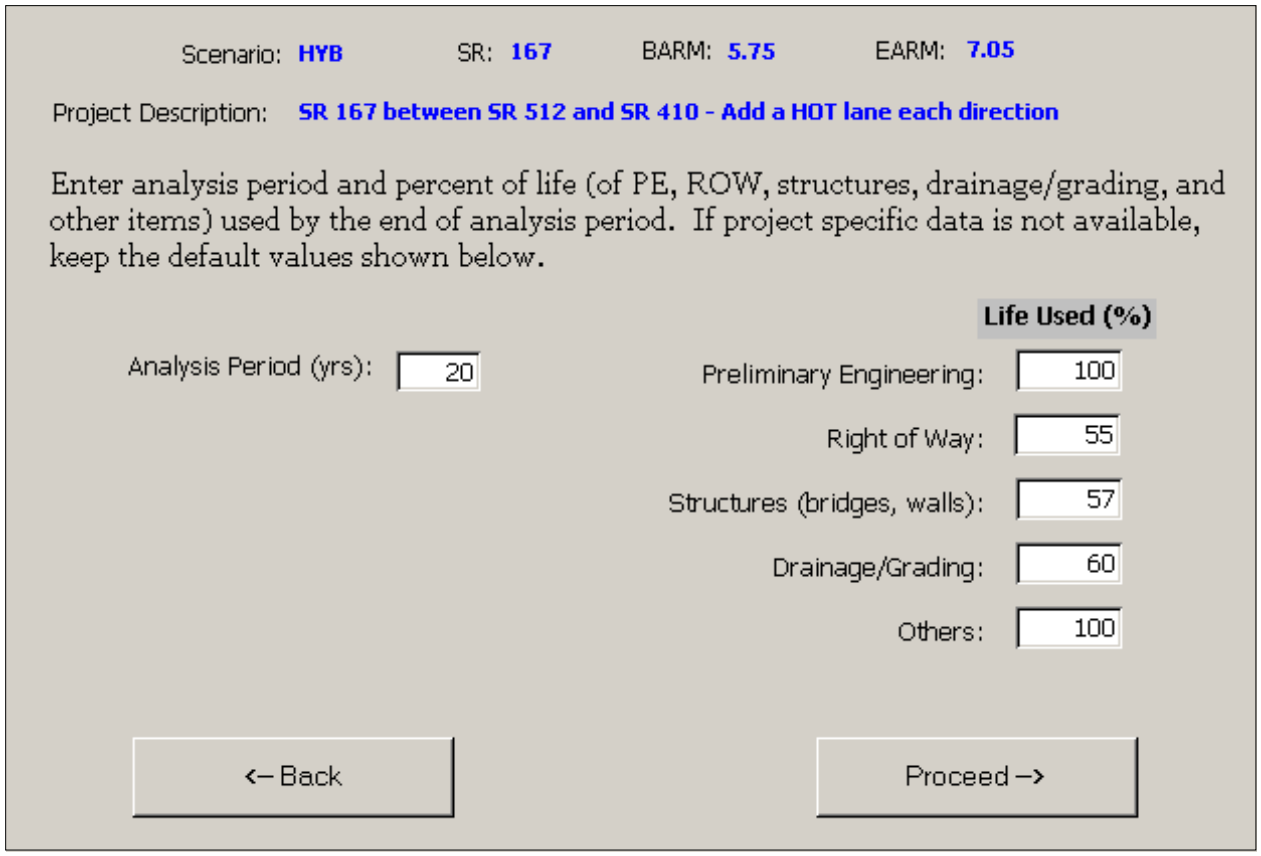
After a project is selected from a drop down list, a screen appears with cost data broken down by preliminary engineering, right of way, structures, drainage/grading, and others. If there is cost sharing by other agencies or partners, amount of shared cost is entered as non-WSDOT cost (**Exhibit 24**).

Exhibit 24: Partnership Funds



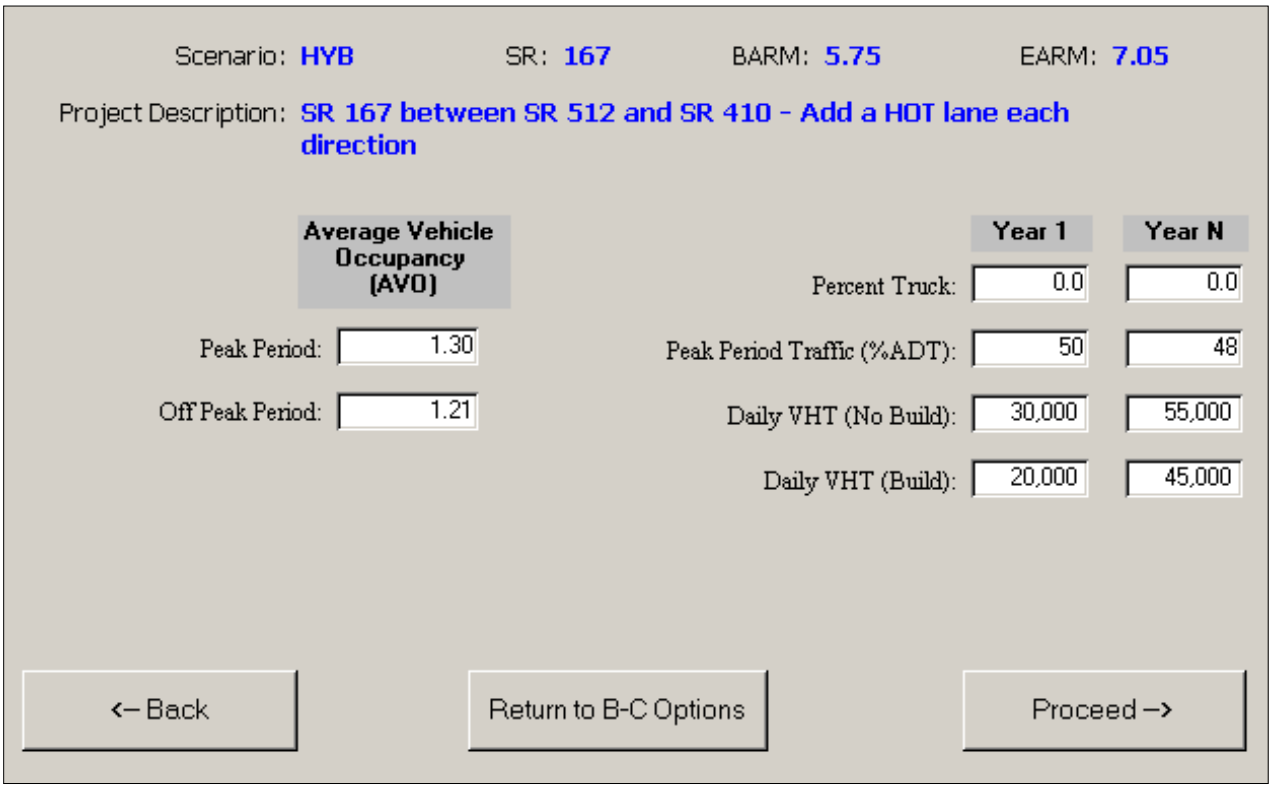
Analysis period and remaining life for preliminary engineering, right of way, structures, drainage/grading and other items are entered as shown in **Exhibit 25**. The tool allows changing any of the default values shown below.

Exhibit 25: Analysis Period and Salvage Value Data



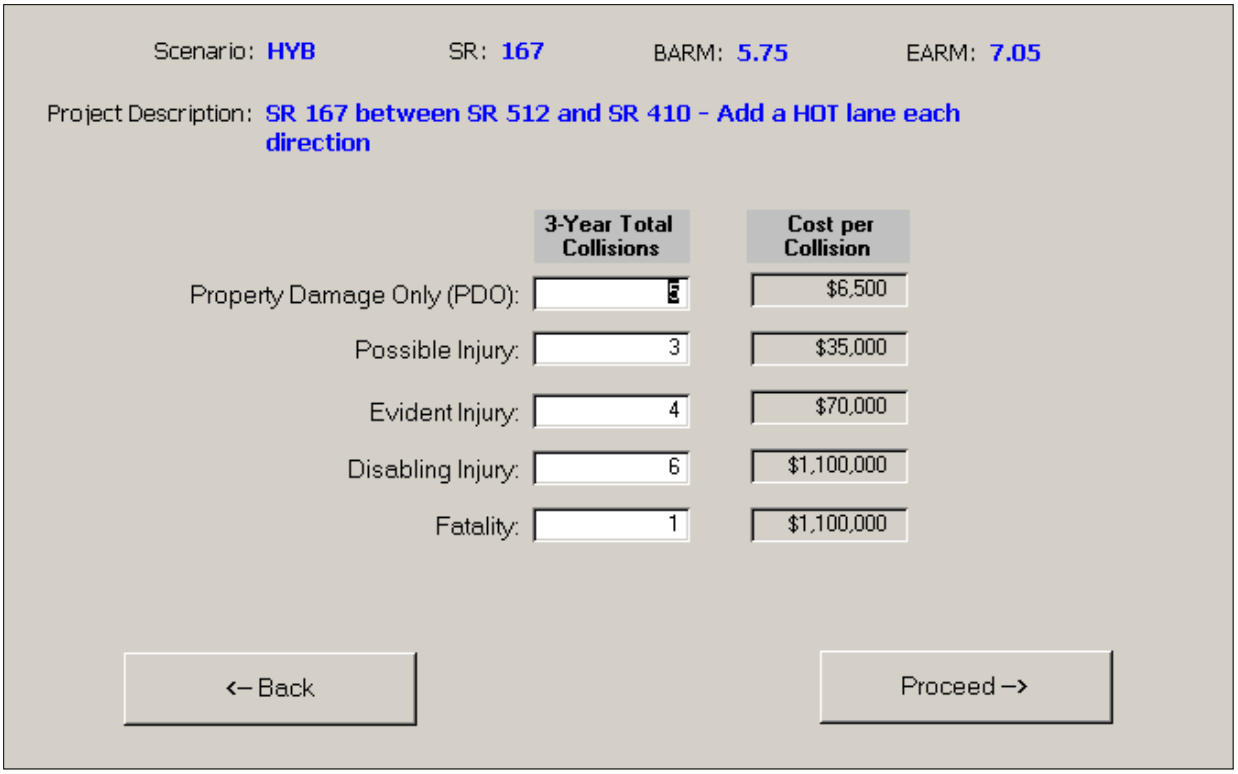
Traffic data necessary for the B-C analysis includes peak and off-peak period average vehicle occupancy, percent truck, peak period traffic as percent of daily volume and daily vehicle hour travel (VHT) for both build and no build scenarios (**Exhibit 26**). Default values for vehicle occupancy, percent truck, and peak period traffic as percent of daily traffic should only be changed if there are project specific data for these. The user must enter project specific VHT data.

Exhibit 26: Traffic Data Entry Form



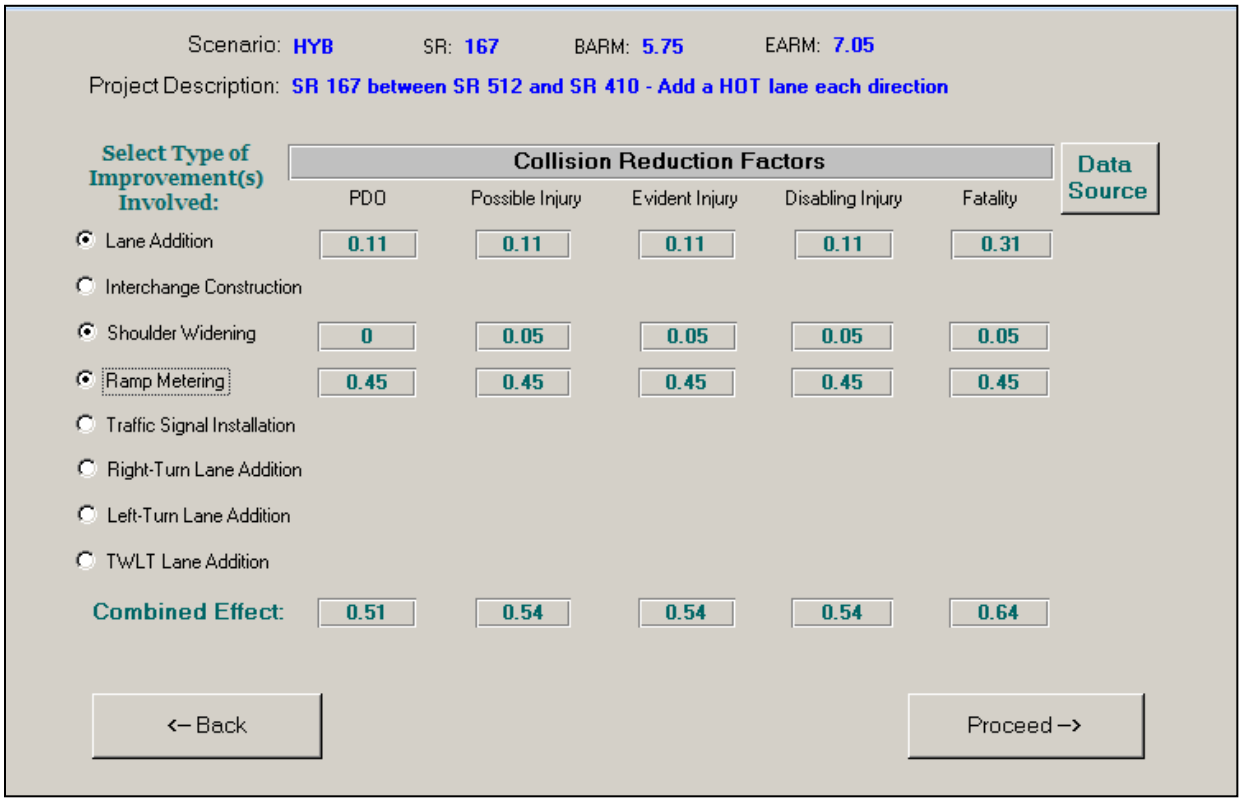
The B-C analysis uses collision data for property damage, injury and fatality as shown in **Exhibit 27**. All collision data are entered as total of most recent three years. The tool applies cost per accident as shown below.

Exhibit 27: Collision Data



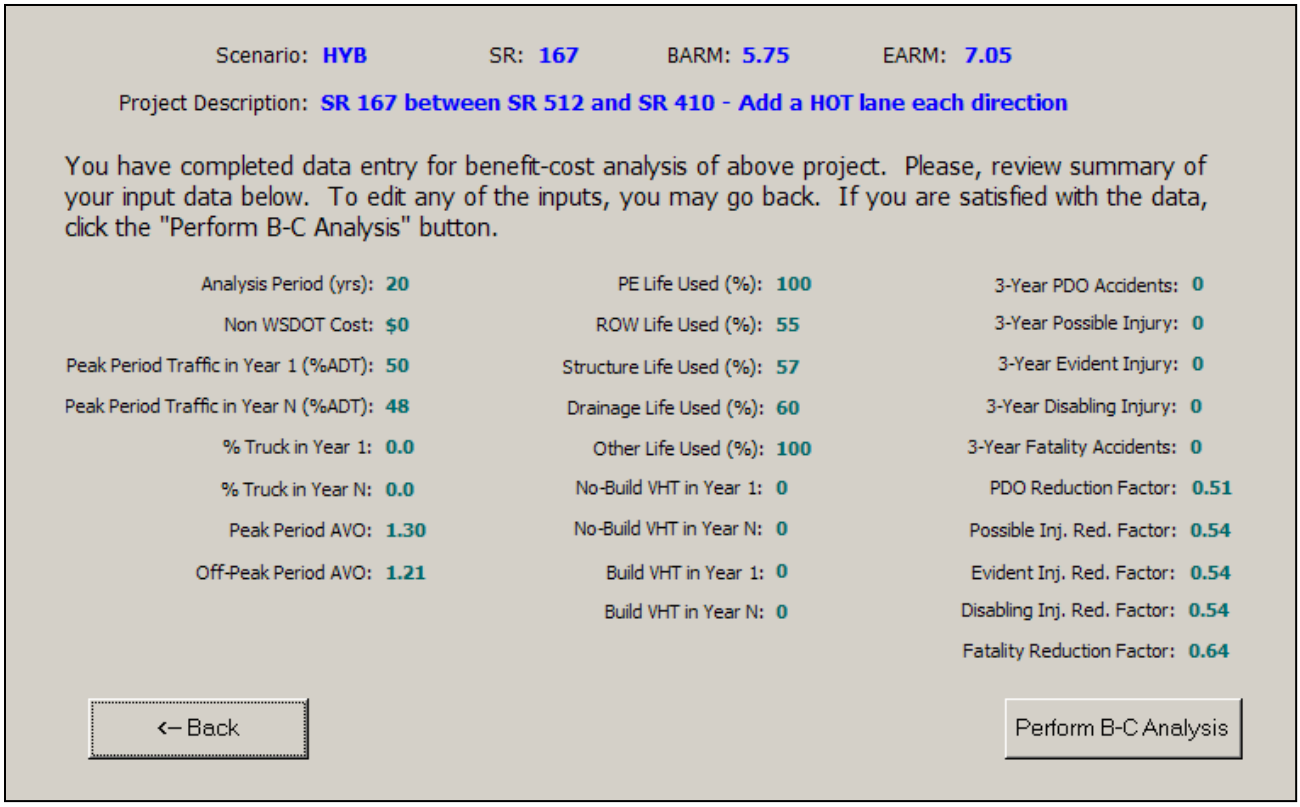
Once collision data entry is complete, the tool brings another screen to select construction items that are part of the project (**Exhibit 28**). This helps to estimate percent reduction of each type of collisions. The bottom line in **Exhibit 28** shows combined reduction from all the selected items.

Exhibit 28: Collision Reduction Factors



After entering all necessary data, the tool displays a summary of all entries for review (**Exhibit 29**). If changes need to be made at this time use the back buttons to return to the appropriate input screen and make the necessary changes.

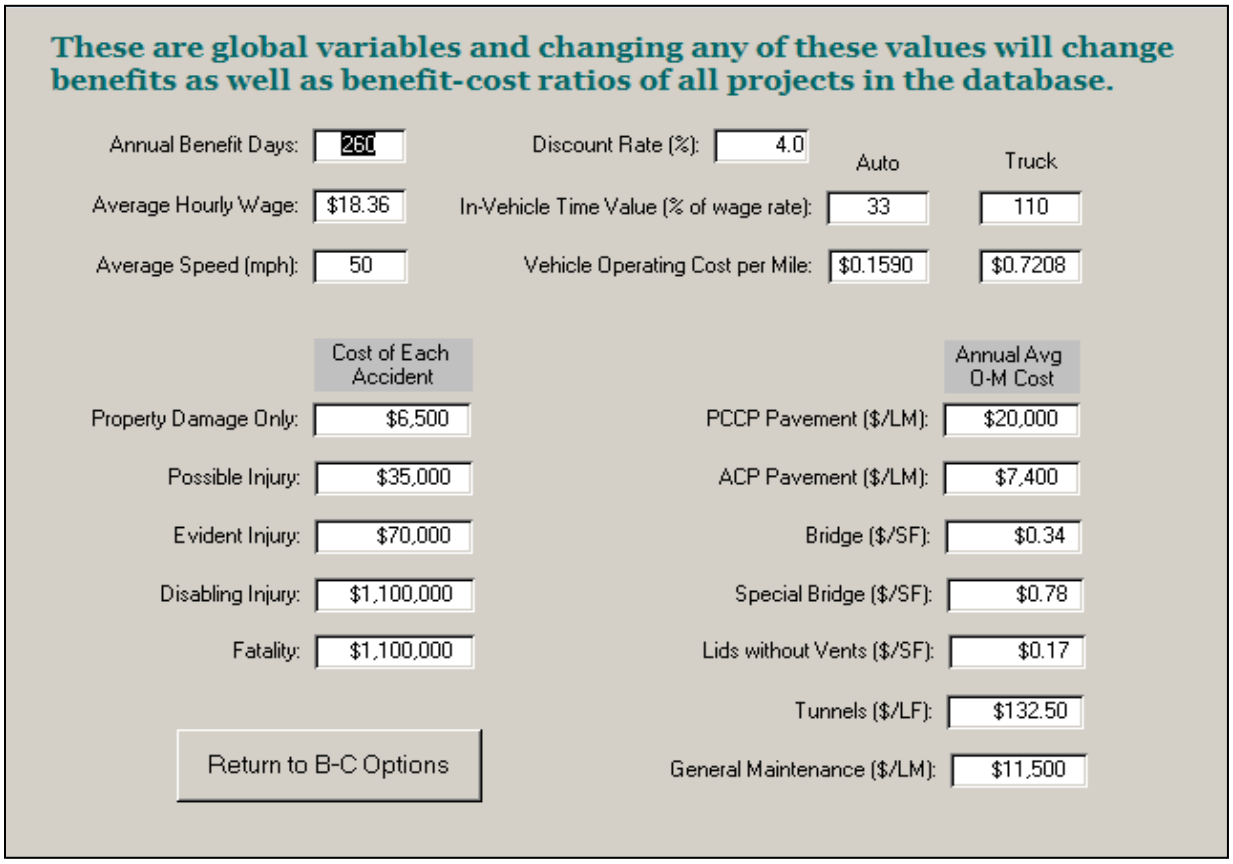
Exhibit 29: Summary of Input Data for Review



If *Perform B-C Analysis* is chosen as shown in **Exhibit 23**, an option window appears to select one of the two options for printing B-C reports – either for a selected project or all projects. A one page report is generated for each project (see the section PRINTING REPORTS).

Project specific and global data can be edited by selecting editing option from the B-C Main Menu (**Exhibit 23**). If project specific data editing option is selected, a screen appears to select a project from the drop down list. Once a project is selected, a number of screens (as shown in **Exhibits 24 to 29**) will appear for editing data entered earlier. If global data editing option is selected, a screen (**Exhibit 30**) appears with all default or earlier entered data that allows editing any data.

Exhibit 30: Summary of B-C Analysis Input Data for Review



EDITING DATA

The tool has editing modules that provide ways of updating project specific as well as global data. Project specific data is divided into user input data and program default data. The user input data is the data that was input to describe the project. The program default data is used internally to calculate quantities and costs and can be either project specific or global affecting all projects in the database. The tool allows editing of each type of data through a series of modules which are discussed in the following sections. The screen below shows how to start editing a project.

Exhibit 31: Main Menu Selection for Editing

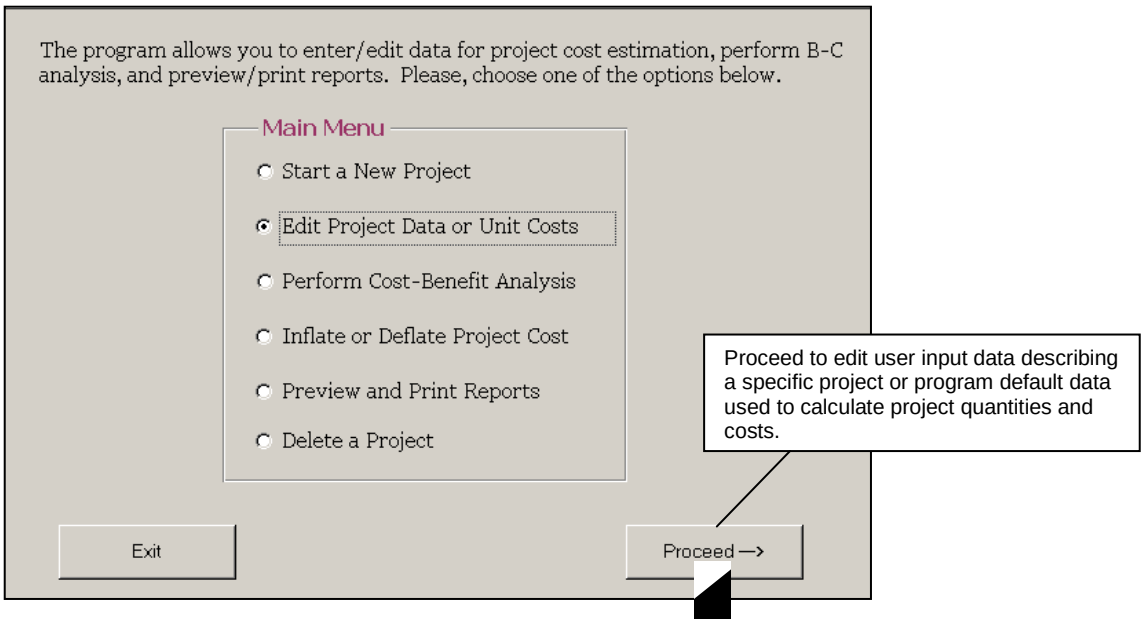
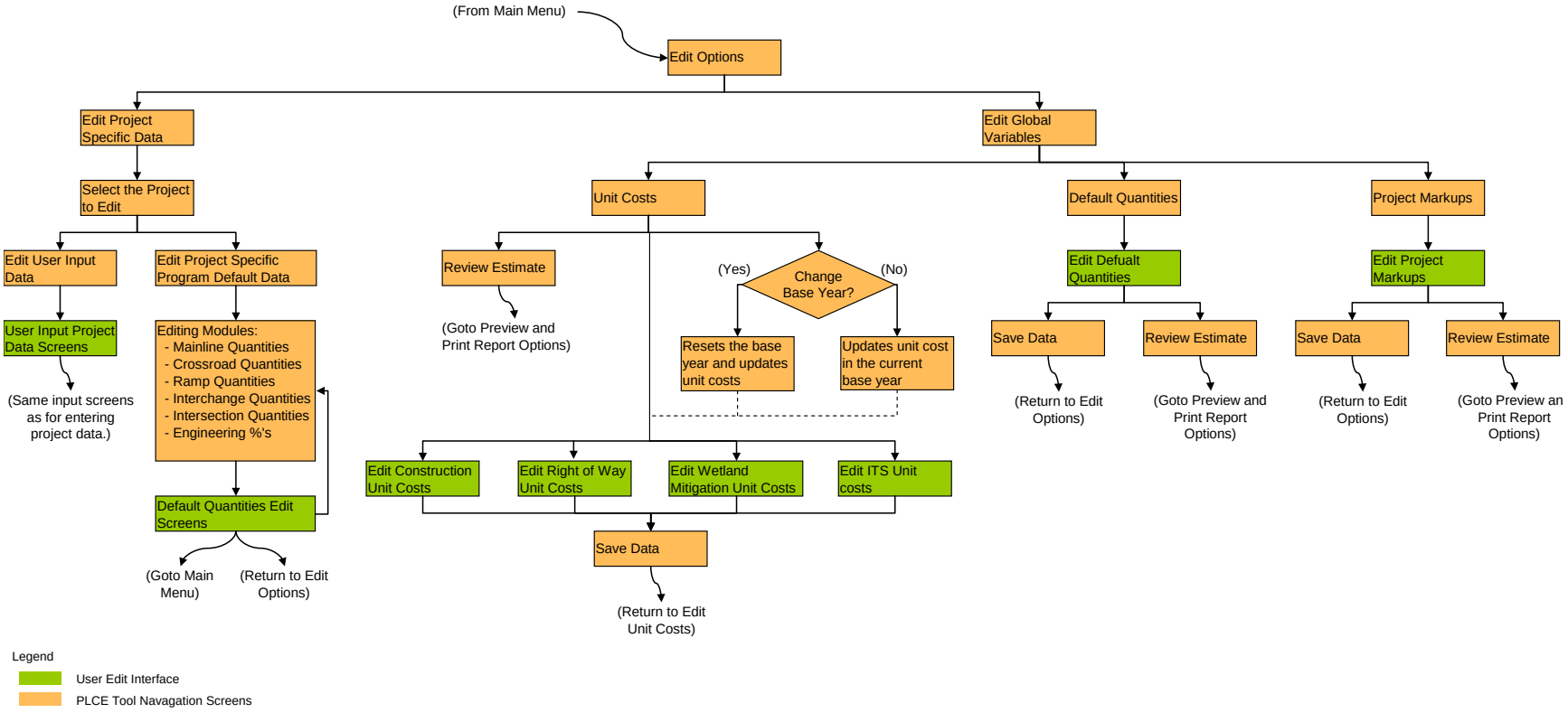


Exhibit 32 on the following page is a flow chart for the editing process within the tool.

Exhibit 32: Editing Process Flow Chart

Editing in the PLCE Tool

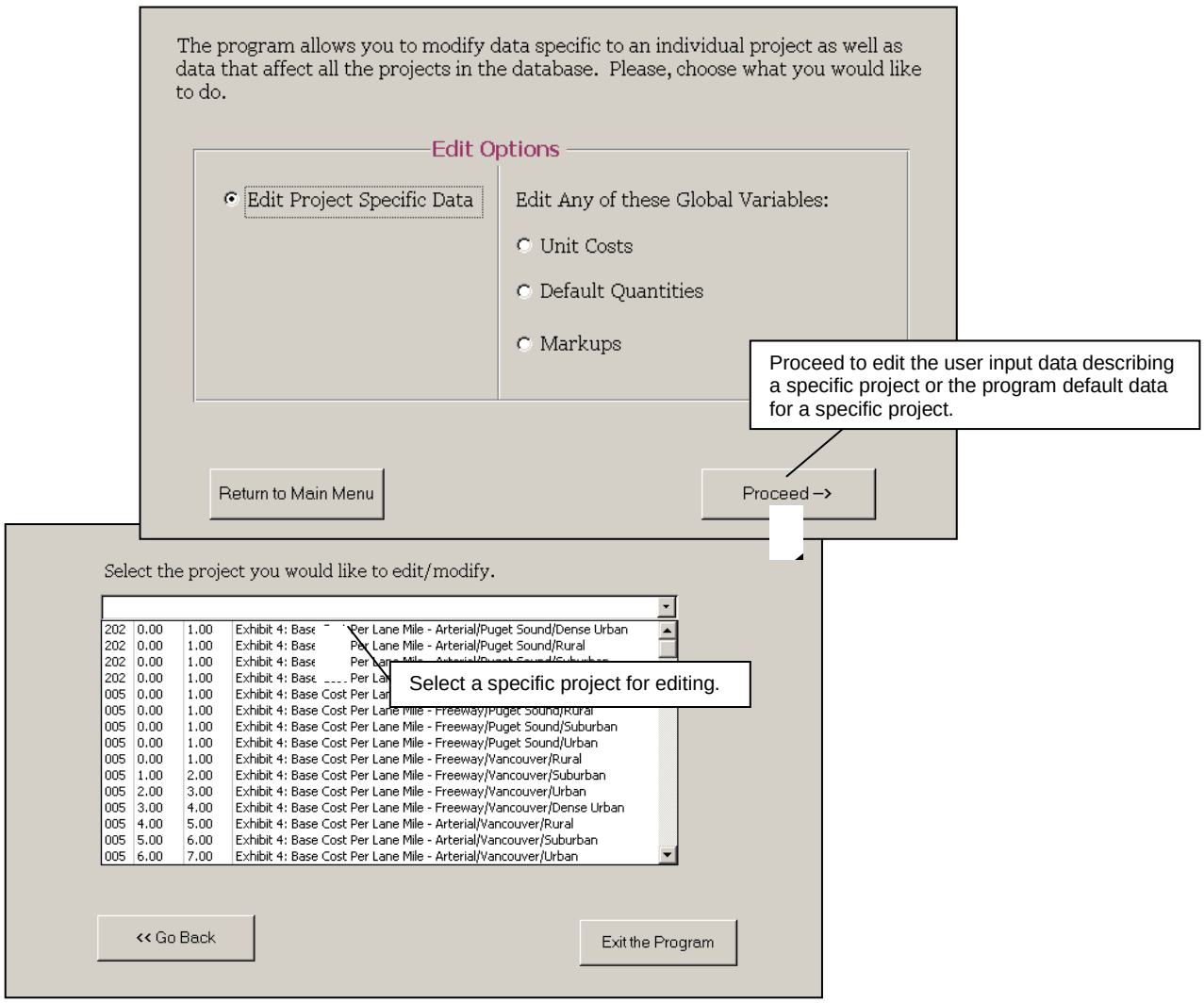


Project Specific User Input Data

Editing user input data is done through the same series of modules that were used when initially entering the data. The user is taken through the same screens as the initial project input screens described in the section “Calculation Modules and Required User Inputs”.

The user is prompted to choose the type of edit in the screen shown below. In this example editing project specific data was chosen. The user then chooses from a drop down list of all the projects currently in the database.

Exhibit 33: Edit Options Screens

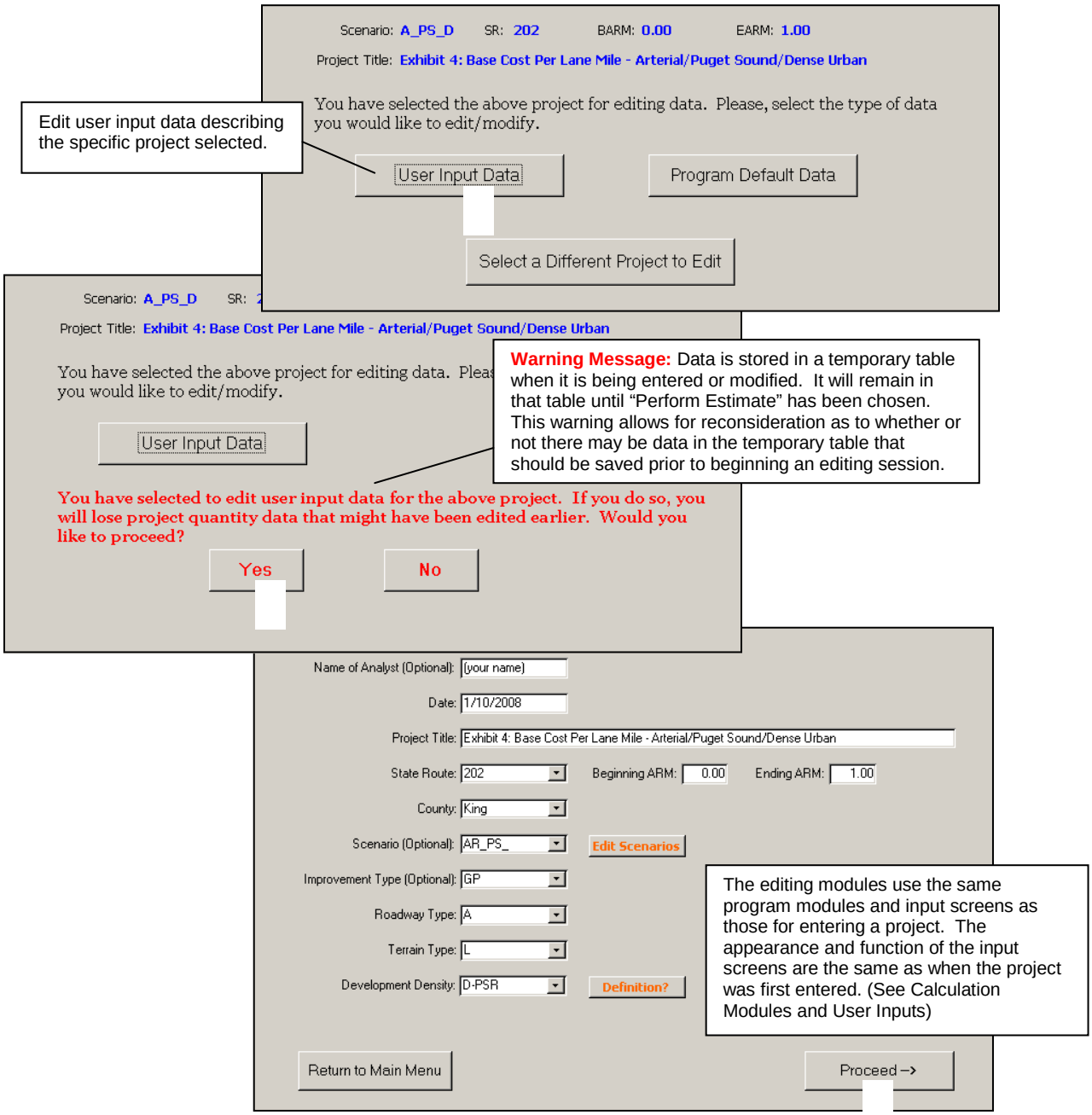


The user can now choose the type of project specific data to be edited. When "*Edit Project Specific Data"* is chosen, the editing session stores project information in the same temporary location that new project information is stored. Data is kept in that temporary location until an estimate is completed. An estimate is completed when the button "Perform Estimate" has been pushed. To prevent the unwanted overwriting of project information stored in this temporary location, a warning message reminds users to complete the project already in the temporary location.

To verify if there is a project remaining in the temporary location all a user has to do is return to the main menu and start a new project. If there was project information already stored in the temporary location it will be reloaded into the project information inputs screens and the user only need to push the proceed buttons until reaching the "Perform Estimate" button. As soon as the "Perform Estimate" button is pushed cost estimation is performed and the project data is copied from the temporary location to a permanent location in the database.

In the following example the user chooses to edit the user input data and is taken to the project information input screens.

Exhibit 34: Edit User Input Data Screens



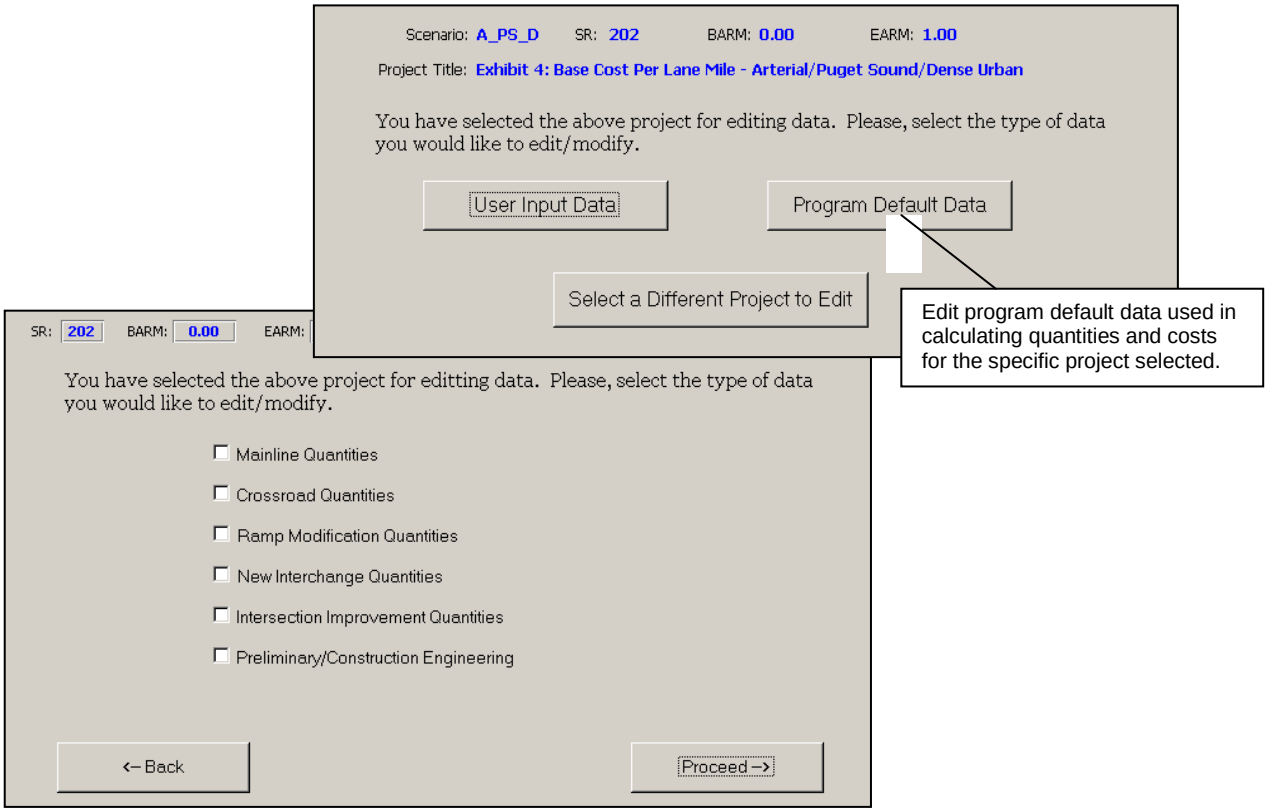
Project Specific Default Data

Some of the program default variables can be edited for a specific project. Program default variables are used to make internal calculations and produce an estimate. There are two basic types of program default variables one for quantities and one for unit costs. Default variables for quantities can be edited for a specific project. For example if there is likely to be significantly more earthwork on a particular project the quantities for earthwork can be adjusted for that project only. Default variables for costs are considered regional and cannot be edited on a project by project basis.

The user can edit project specific default quantities though a series of interfaces each of which shows the aggregate quantities for a portion of the project. For example the quantities shown on the screen for editing new interchanges is the sum of all interchanges on the project.

In the example below the user chooses to edit the program default quantities for the selected project. The next screen asks which of six sets of quantity data is to be edited.

Exhibit 35: Edit Default Data Screens

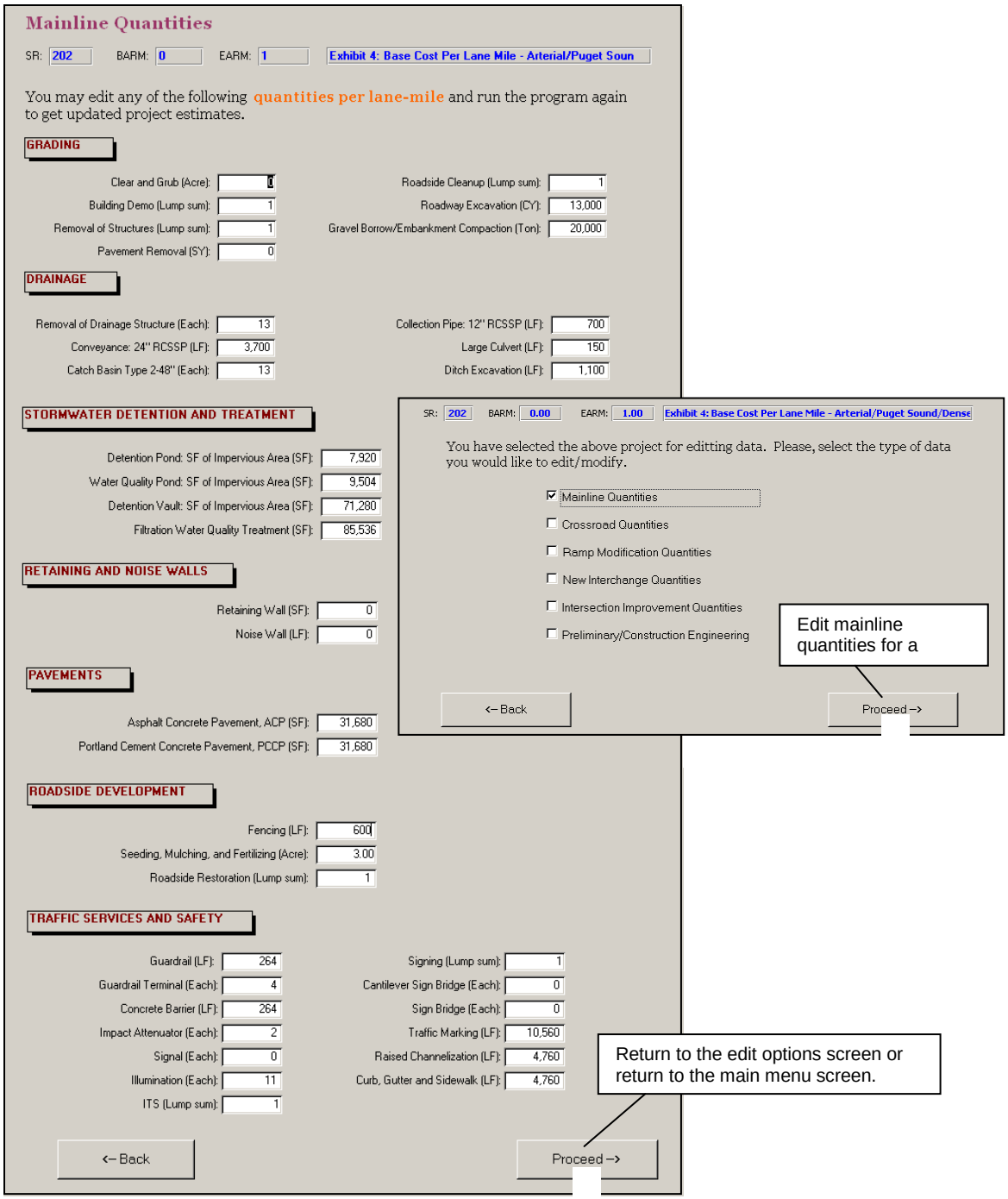


The six sets of quantity data are used in the calculation modules to produce project quantities which are then applied to the unit costs to arrive at the project costs.

Mainline Quantities

Selecting Mainline Quantities to edit brings up the project quantities for mainline roadway construction as shown below:

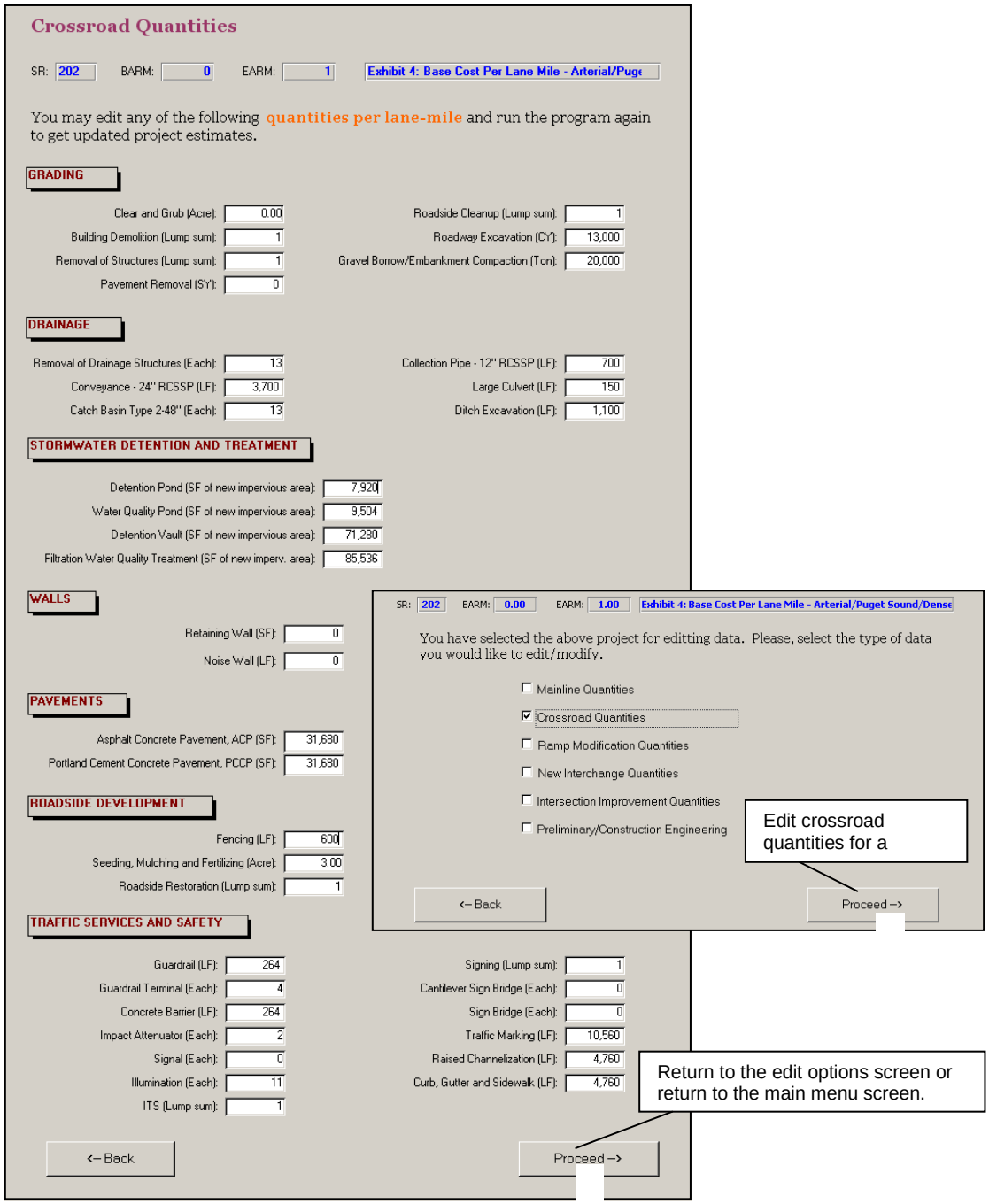
Exhibit 36: Input Screen for Editing Default Mainline Quantities



Crossroad Quantities

Selecting Crossroad Quantities to edit brings up the project quantities for crossroad construction as shown below:

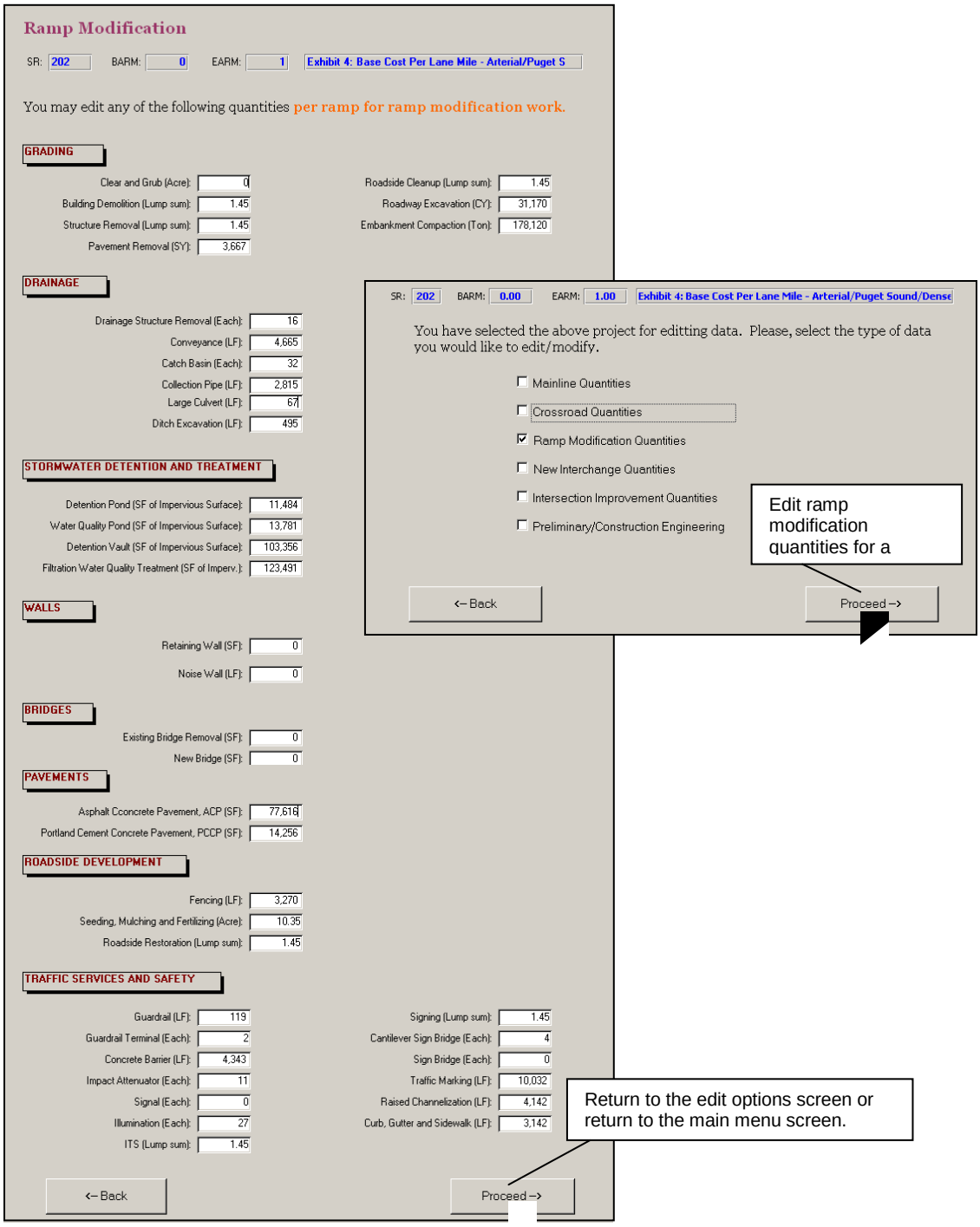
Exhibit 37: Input Screen for Editing Default Crossroad Quantities



Ramp Modification Quantities

Selecting Ramp Modification Quantities to edit brings up the project quantities for modifying ramps to accommodate mainline widening. The ramp modification editing screen is shown below:

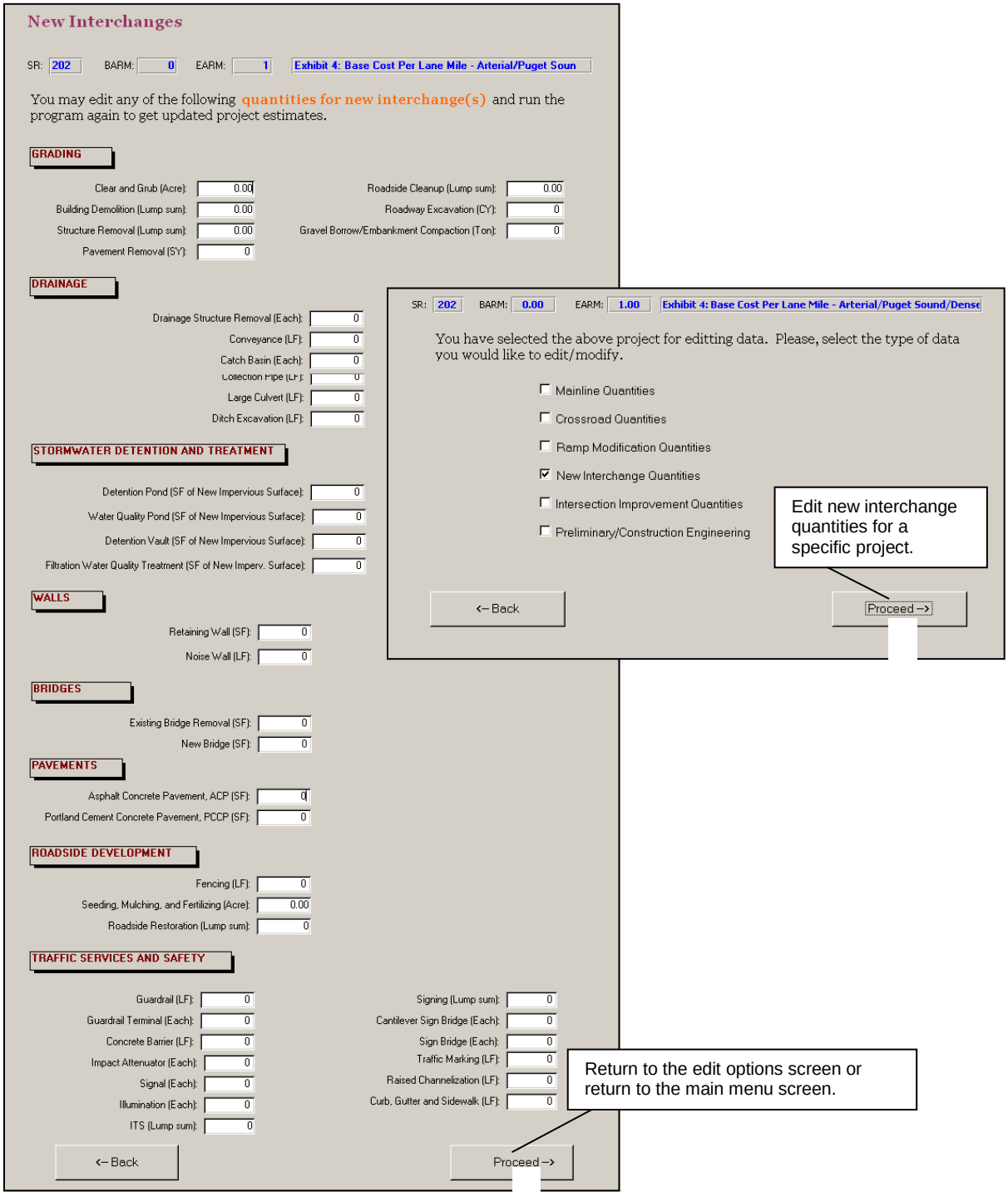
Exhibit 38: Input Screen for Editing Default Ramp Modification Quantities



New Interchange Quantities

Selecting New Interchanges to edit brings up the project quantities for new interchanges (in this example there were no interchanges in the project). The editing screen is shown below:

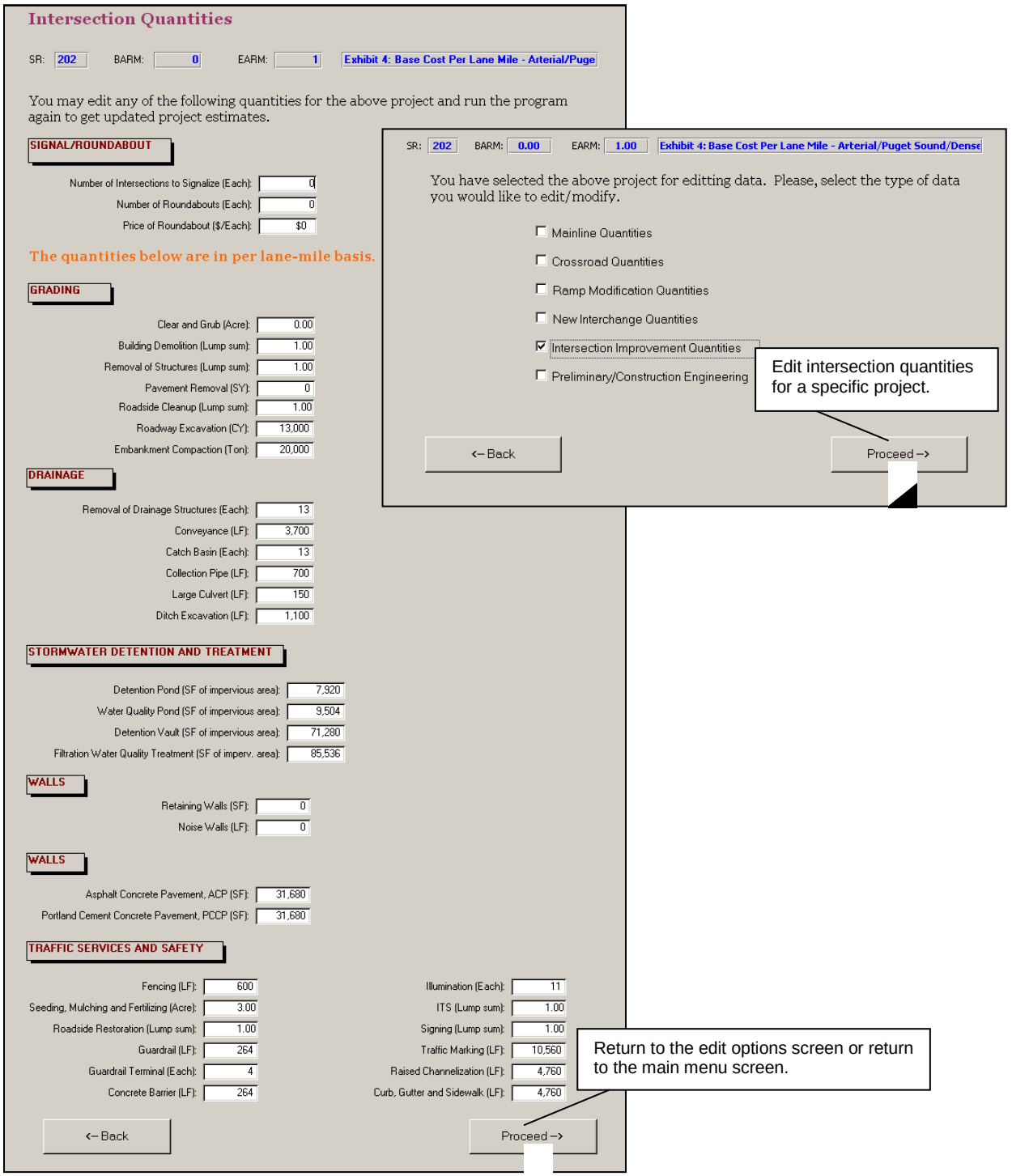
Exhibit 39: Input Screen for Editing Default New Interchange Quantities



Intersection Improvement Quantities

Selecting Intersection Improvement Quantities to edit brings up the project quantities for intersection construction as shown below:

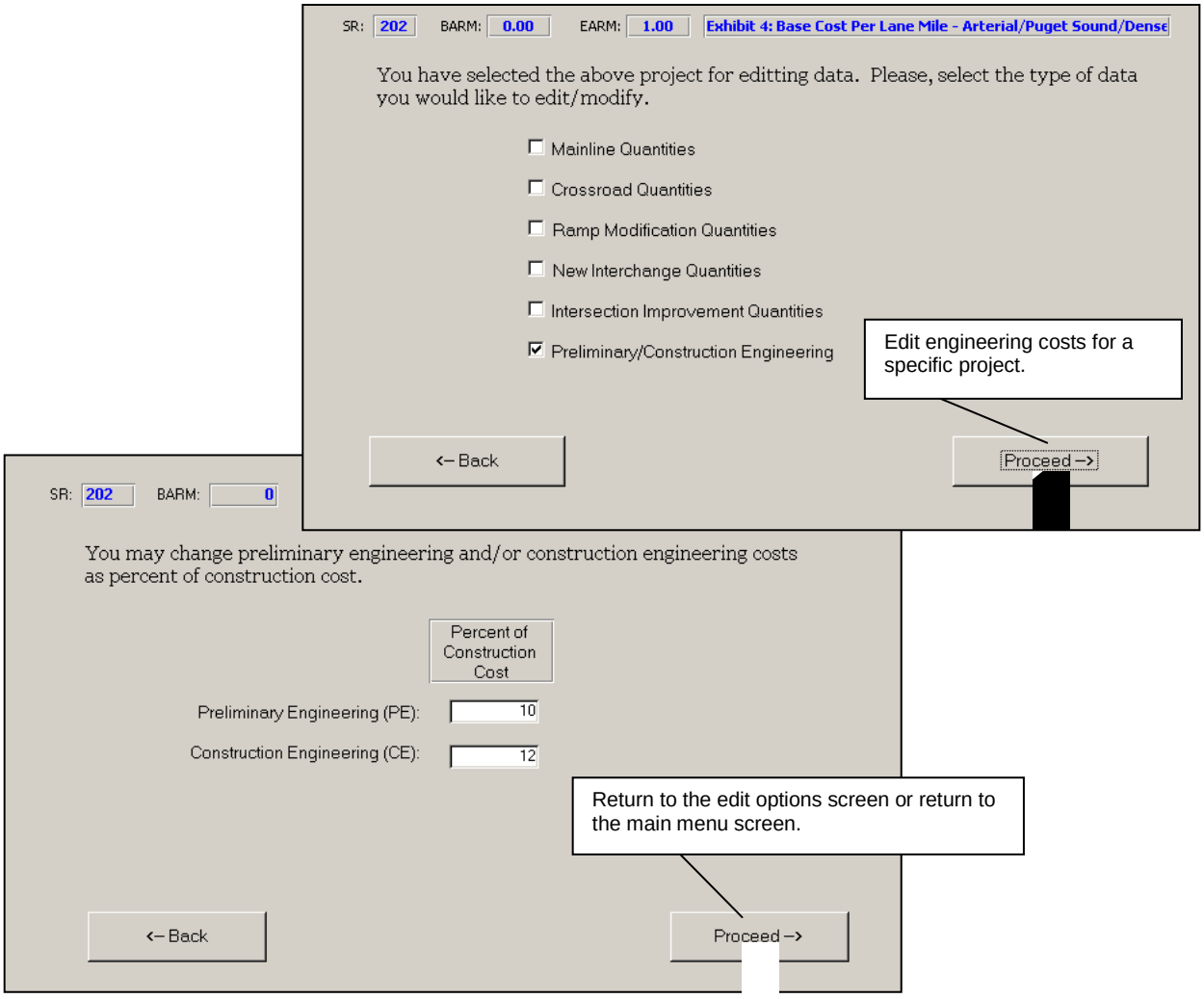
Exhibit 40: Input Screen for Editing Default Intersection Quantities



Preliminary and Construction Engineering

Selecting Preliminary/Construction Engineering allows the editing of the engineering costs for a particular project. Preliminary Engineering (PE) is set at a constant ten percent. Construction Engineering (CE) varies based on formulas in the Plans Prep Manual, June 2003, Page 8-5. Both PE and CE for a particular project can be changed from the defaults using the screens shown below.

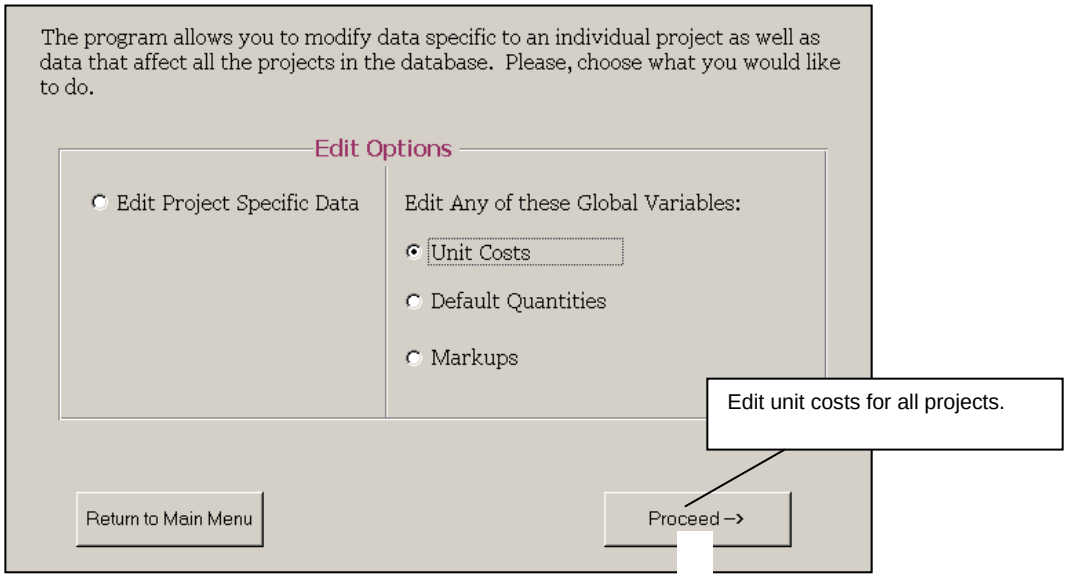
Exhibit 41: Input Screen for Editing PE and CE Percentages



Global Variables

There are three types of global variables – costs, quantities, and markups. There are two main reasons for editing global variables. One is to update the base year based on new cost data (i.e. cost data from recently completed construct projects) and is covered in section “Editing Unit Cost Global Default Variables”. The other is to edit the costs, quantities, and markups to be more representative of a particular region or set of projects. The image below shows the available options for editing global variables.

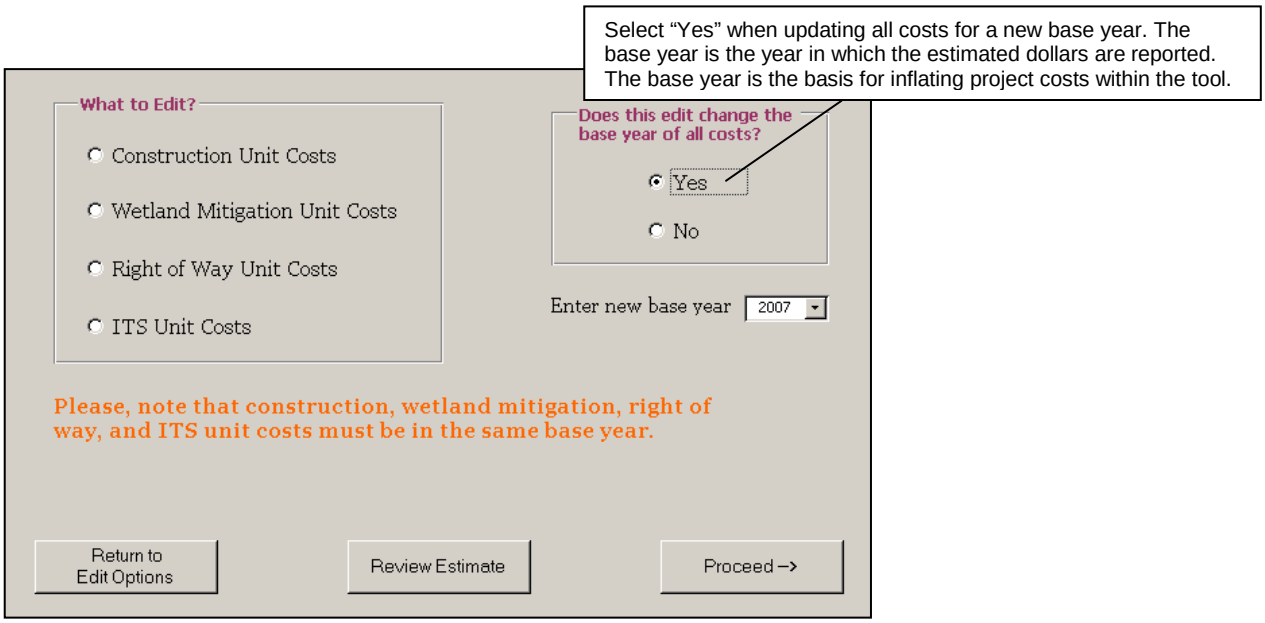
Exhibit 42: Edit Global Variables



Unit Costs

Unit costs for construction, wetland mitigation, right of way, and Intelligent Transportation Systems (ITS) can be edited globally. The program stores a base year which is the year in which the costs are reported and the unit costs are representative for that year. The base year is updated when data from newly completed construction projects is added to the tool or when costs are inflated to reflect rising costs.

Exhibit 43: Edit Unit Costs

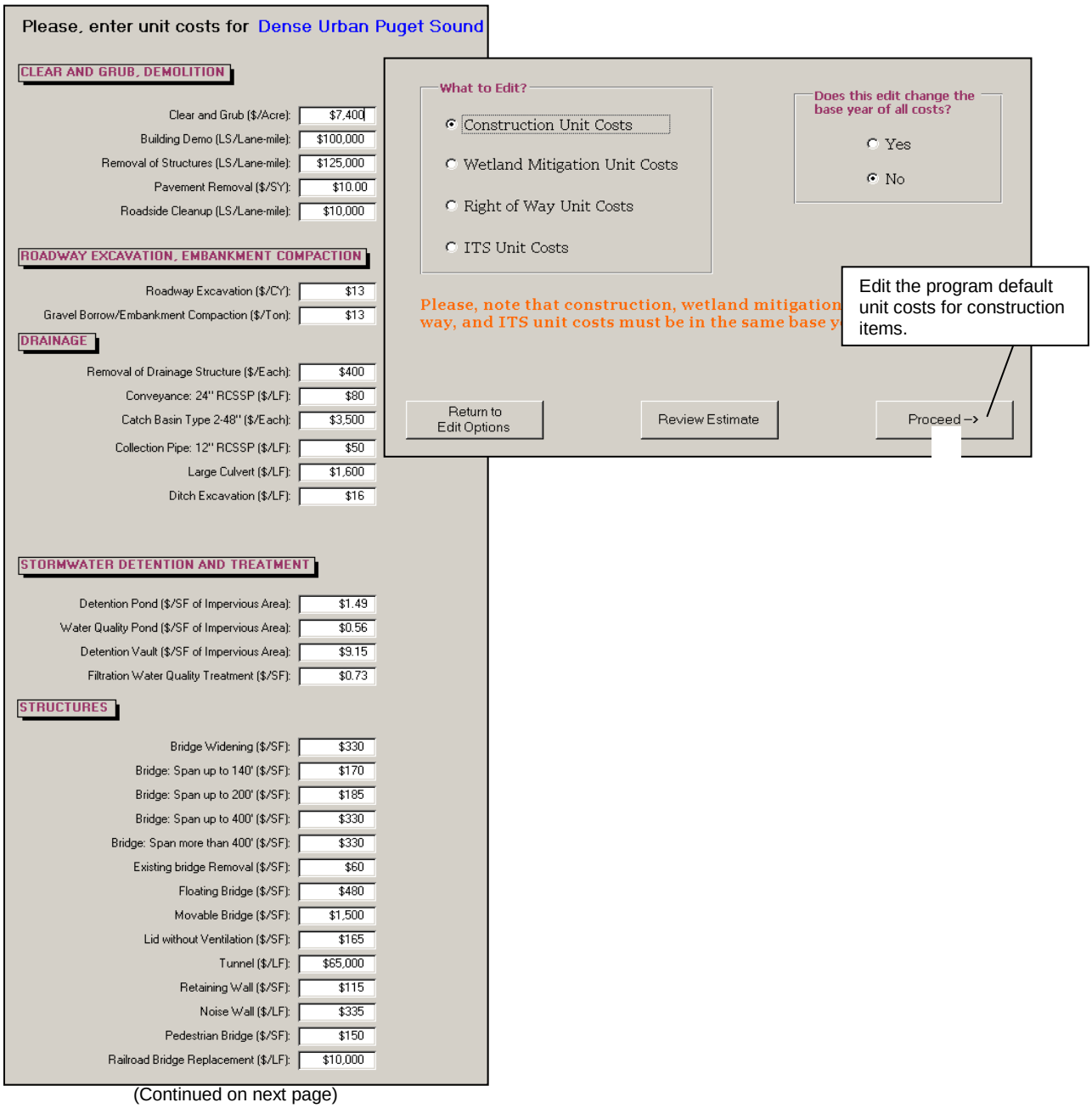


In the following four sections the examples shown are not updating the base year but the input screens look and operate the same as when updating the base year.

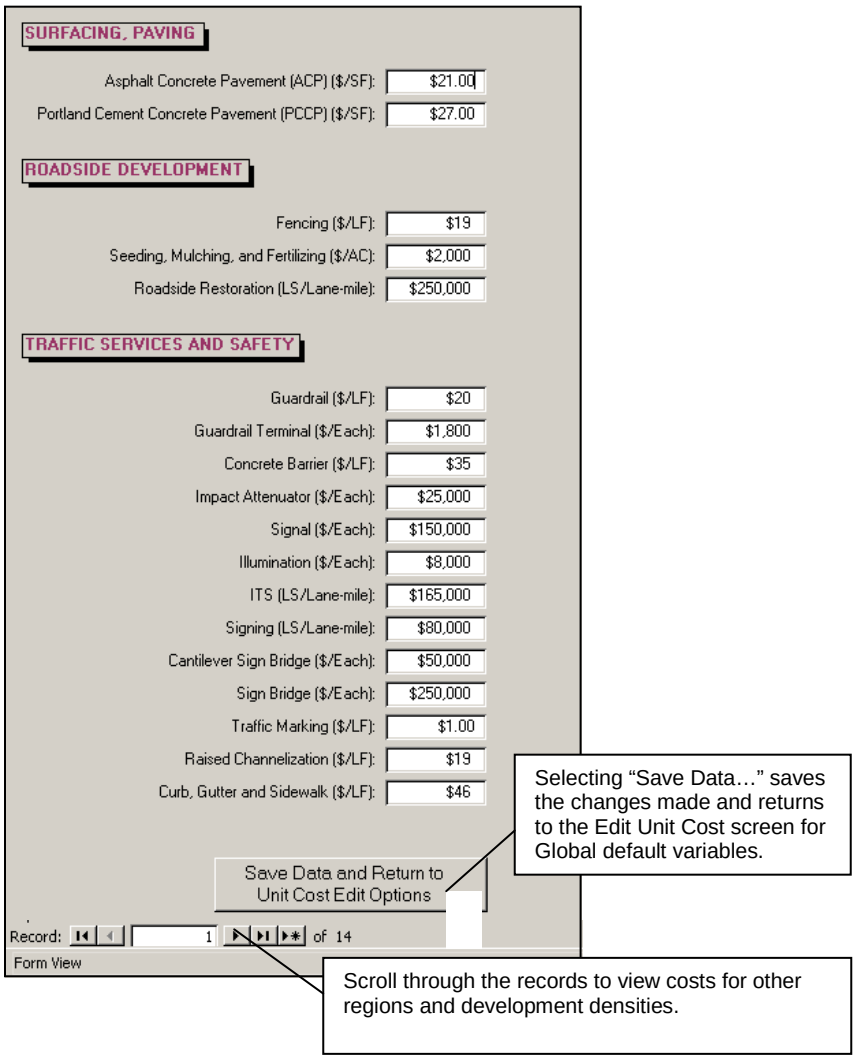
Construction Unit Costs

There are 14 different sets of construction costs representing different areas and development densities (see the section *"Roadway Mainline"* and **Exhibit 6**). Construction unit costs are used in calculating many components of a project including crossroads, intersections, ramp modifications, and interchanges.

Exhibit 44: Input Screens for Editing Construction Unit Costs



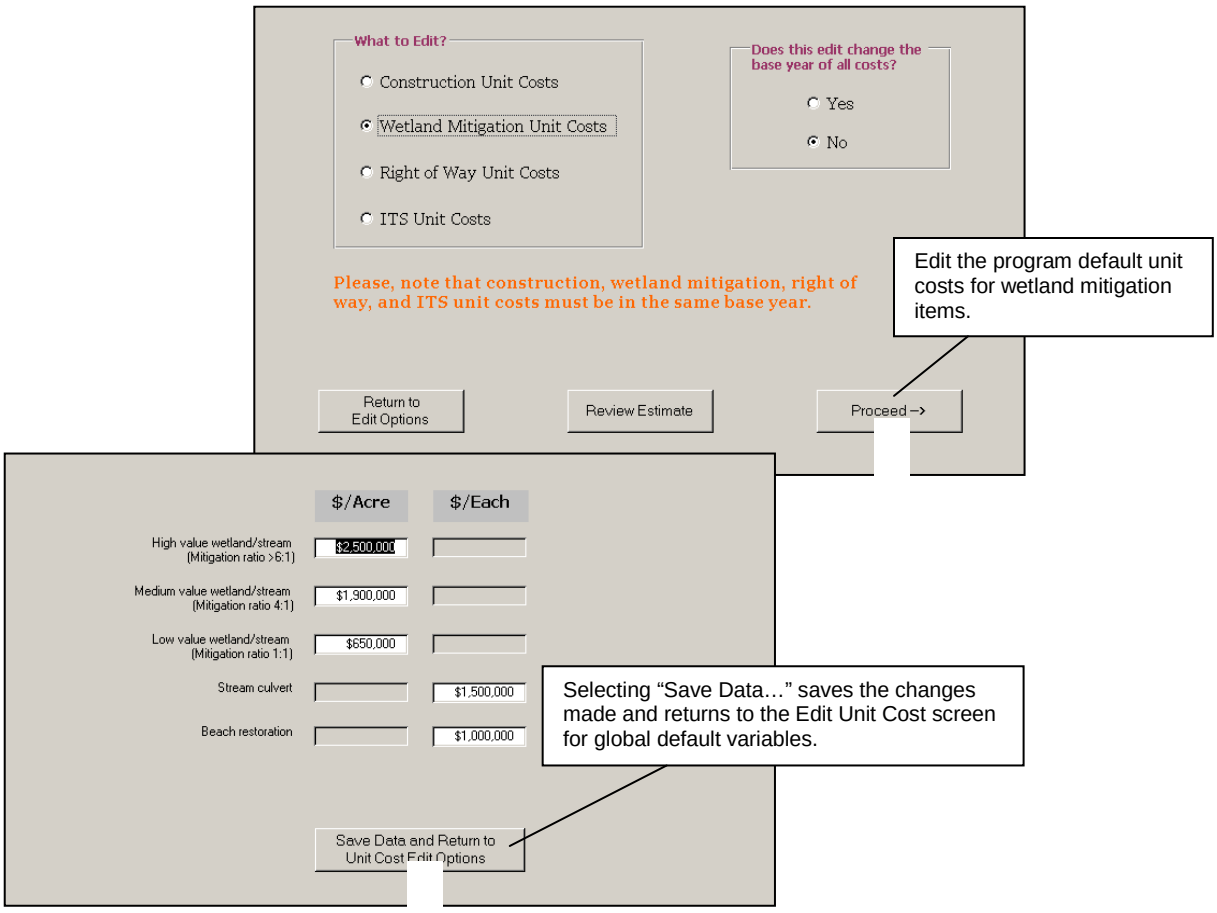
(Continued on next page)


SURFACING, PAVING
Asphalt Concrete Pavement (ACP) ($/SF): $21.00
Portland Cement Concrete Pavement (PCCP) ($/SF): $27.00
ROADSIDE DEVELOPMENT
Fencing ($/LF): $19
Seeding, Mulching, and Fertilizing ($/AC): $2,000
Roadside Restoration (LS/Lane-mile): $250,000
TRAFFIC SERVICES AND SAFETY
Guardrail ($/LF): $20
Guardrail Terminal ($/Each): $1,800
Concrete Barrier ($/LF): $35
Impact Attenuator ($/Each): $25,000
Signal ($/Each): $150,000
Illumination ($/Each): $8,000
ITS (LS/Lane-mile): $165,000
Signing (LS/Lane-mile): $80,000
Cantilever Sign Bridge ($/Each): $50,000
Sign Bridge ($/Each): $250,000
Traffic Marking ($/LF): $1.00
Raised Channelization ($/LF): $19
Curb, Gutter and Sidewalk ($/LF): $46
Save Data and Return to Unit Cost Edit Options
Record: 1 of 14
Form View
Selecting "Save Data…" saves the changes made and returns to the Edit Unit Cost screen for Global default variables.
Scroll through the records to view costs for other regions and development densities.

Wetland Mitigation Costs

The following screens show how to edit wetland mitigation costs (see also the section *"Wetland and Streams"*):

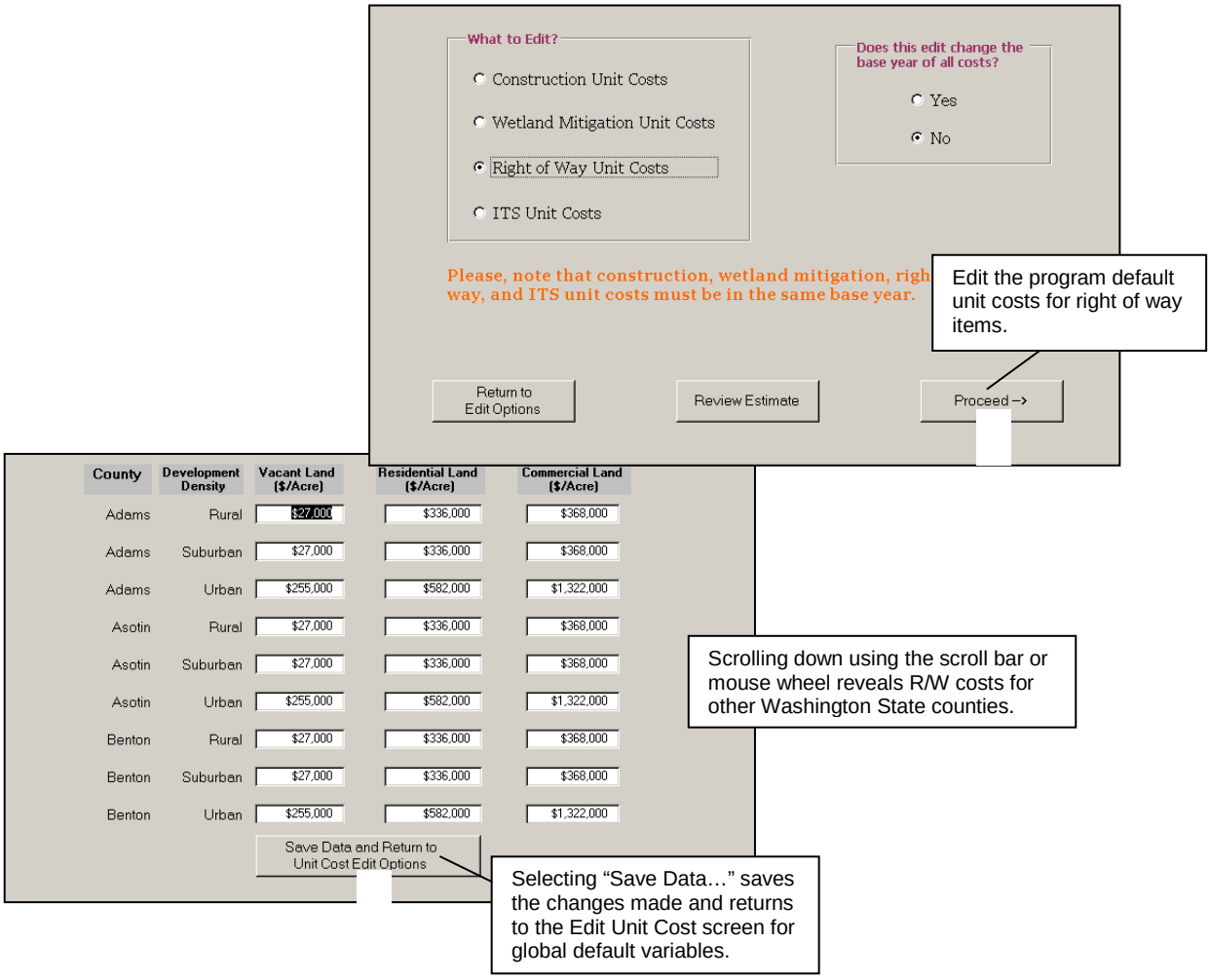
Exhibit 45: Edit Wetland Mitigation Costs



Right of Way Unit Costs

The following screens show how to edit right of way unit costs (see also the section *"Right of Way"*):

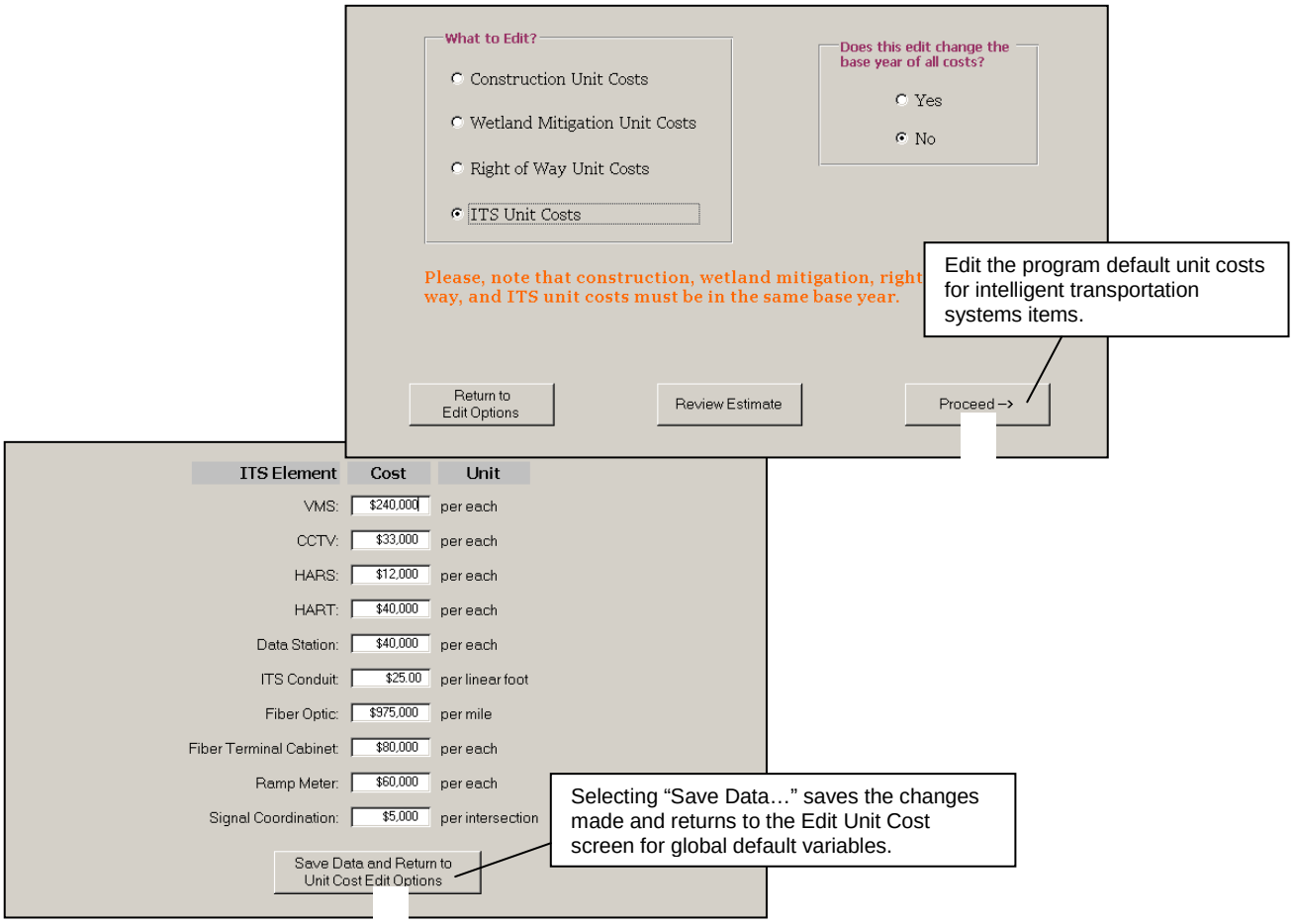
Exhibit 46: Edit Right of Way Unit Costs



ITS Unit Costs

The following screens show how to edit ITS costs.

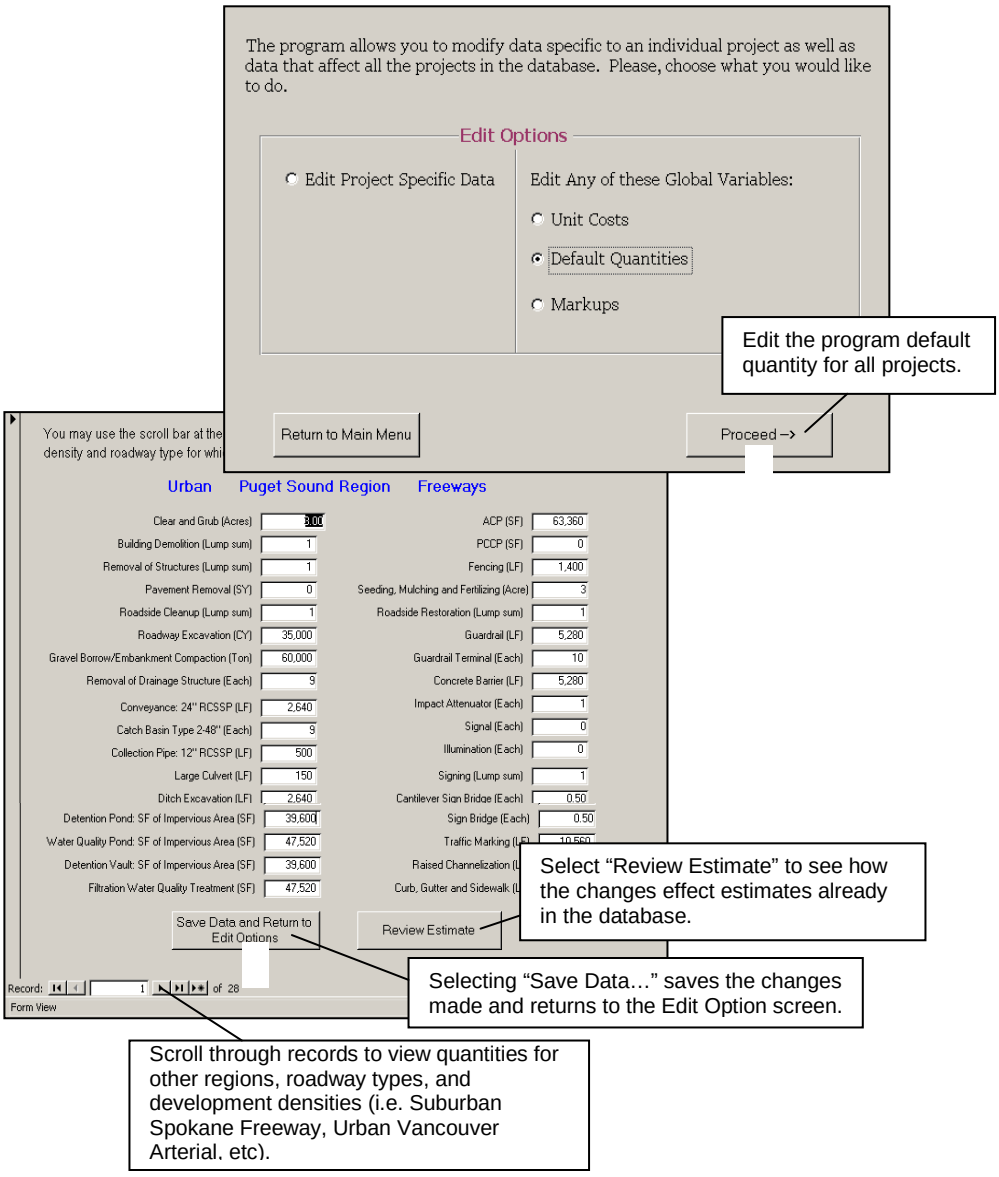
Exhibit 47: Edit ITS Unit Costs



Editing Default Quantities

Only mainline construction default quantities can be edited globally. There are 28 different sets of mainline construction default quantities representing different areas, development densities, and roadway types (see the section *Roadway Mainline*). The mainline construction default quantities for arterial roadways are used in calculating arterial roadway quantities, crossroad quantities, and intersection quantities. They are components in ramp modification and each of the 22 interchange types. Mainline construction default quantities for freeways are also a component of each interchange type as well as freeway costs. The following screens show how to edit mainline construction default quantities.

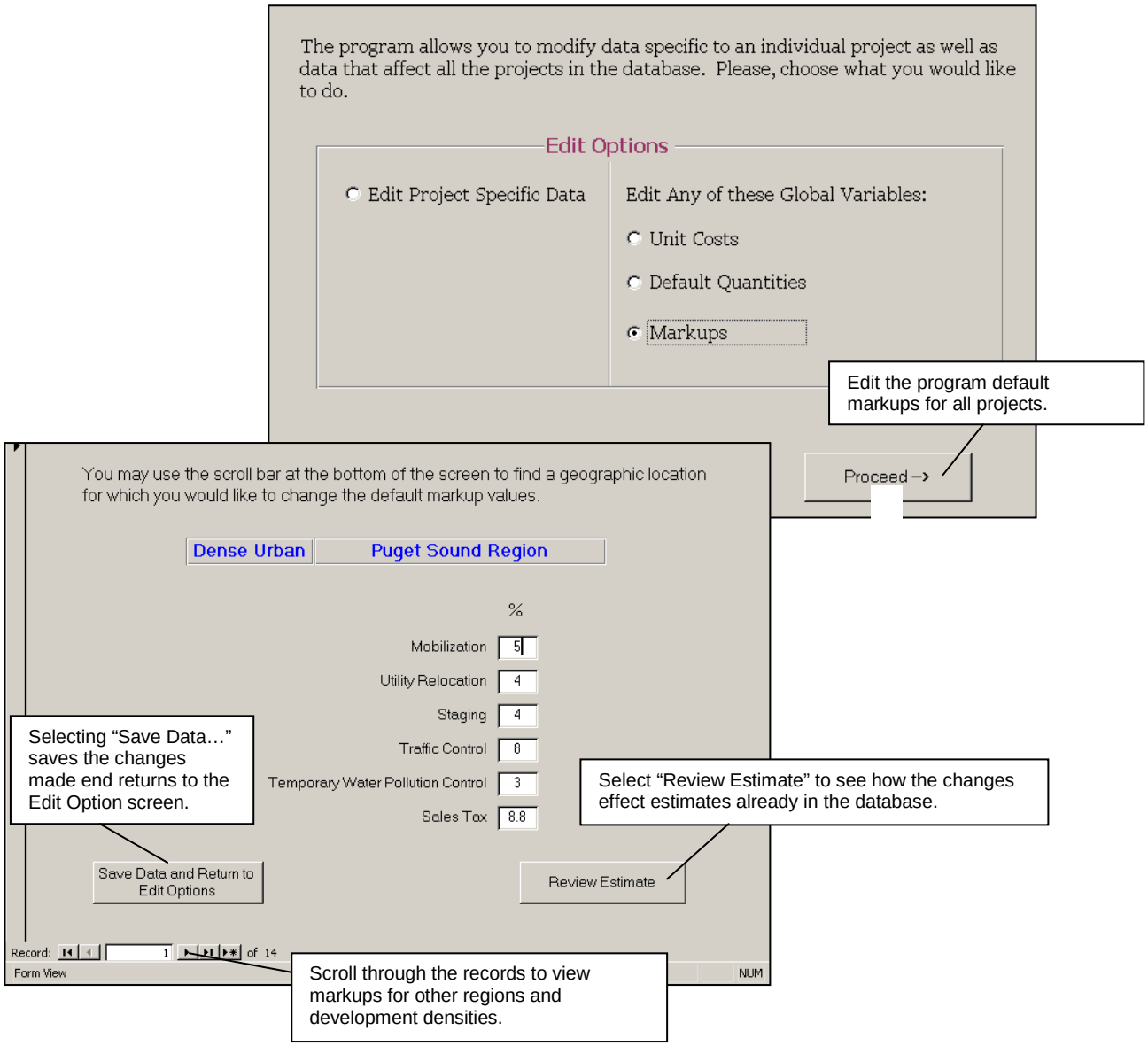
Exhibit 48: Edit Mainline Default Quantities



Editing Default Markups

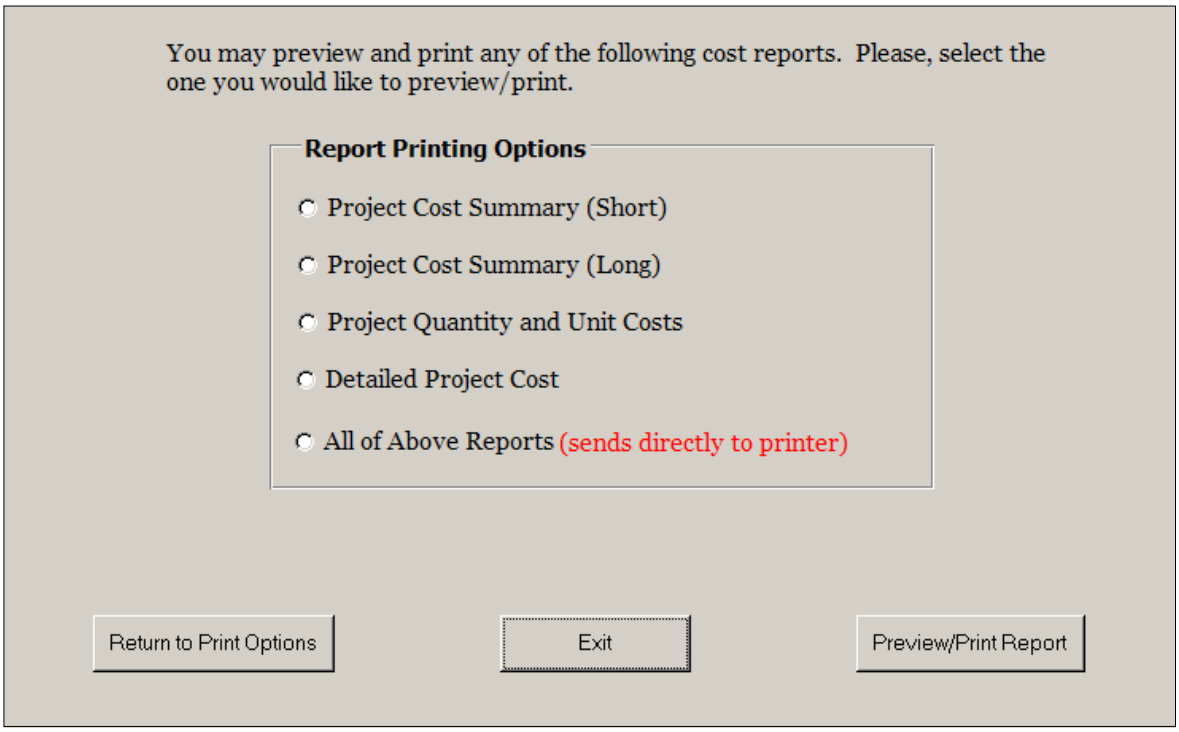
There are 14 different sets of default markups representing different areas and development densities. Default markups are applied as a percentage of construction costs and are shown below:

Exhibit 49: Edit Default Markups



PRINTING REPORTS

The tool provides two options for printing – cost reports or benefit/cost reports. Once an option is selected, another window appears prompting to choose one of the two options – a selected project or all projects. If the option “a selected project” is chosen, a user can select the desired project from a drop down list. In case of cost reports, a user will be prompted to choose one of the five types of reports to print (as shown in the figure below).



The cost reports vary in size ranging from one page summary to multi-page detailed reports. When the option “*All of Above Reports*” is selected, all types of reports are sent to default printer and printed. There is only one report for the benefit/cost analysis. Sample of a one-page cost summary report and a benefit/cost report have been shown in the following pages.

Exhibit 50: Sample Cost Summary Report

Planning Level Cost Estimate Summary*

(2007 dollars)

SR: **167** Beginning ARM: **5.75** Ending Arm: **7.05** Length (mile): **1.30**

Project Title: **SR 167 between SR 512 and SR 410 - Add a HOT lane each direction**

# of NoBuild Lane(s) in NB/EB: **2**

# of NoBuild Lane(s) in SB/WB: **2**

Improvement Type: **HOT**

# of Build Lane(s) in NB/EB: **3.33**

# of Build Lane(s) in SB/WB: **3.33**

Terrain Type: **L**

PRELIMINARY ENGINEERING	$12,537,000	**ENVIRONMENTAL MITIGATION**	
RIGHT-OF-WAY	$3,464,000	Drainage:	$9,027,000
		Stormwater Detention and	$8,415,000
CONSTRUCTION / PREPARATION		Temporary Water Pollution Control:	$3,083,000
Mobilization:	$5,138,000		
Utility Relocation:	$3,083,000	Wetland Mitigation:	$4,825,000
Grading:	$23,544,000	Roadside Development:	$3,513,000
Staging:	$4,110,000		
		TRAFFIC	
Construction Engineering:	$12,537,000		
		Traffic Services and Safety:	$13,199,000
STRUCTURES			
		Workzone Traffic Control:	$7,193,000
Bridges and Tunnels:	$37,648,000		
Retaining Walls:	$2,200,000	**ADDITIONAL ITEMS**	$151,000
Noise Walls:	$0	**SALES TAX**	$11,032,000
PAVEMENT	$5,063,000	**TOTAL PROJECT COST**	$169,764,000

Project Cost Summary:

	Low	High
PE	$11,283,000	$15,044,000
ROW	$3,118,000	$4,157,000
CN	$138,387,000	$184,516,000
Total	$152,788,000	$203,717,000

Note: Generally planning estimates are done with no design information. Therefore, many unknown factors may lead to changes in the estimates later on. This is why a range approach has been used in reporting project costs. Low is10% below and high is 20% above the estimated cost.

**** This estimate is based on little or no design work, and hence intended for use for planning***

Date Printed: ***Tuesday, December 30, 2008***

Exhibit 51: Sample B-C Report

*Planning Level Cost and Benefit**

(2007

Scenario: **HYB** SR: **167** Beginning ARM: **5.75** Ending ARM: **7.05**

Project Title: **SR 167 between SR 512 and SR 410 - Add a HOT lane each direction**

Analysis Period (yrs): **20** Discount Rate (%): **4.00**

PRELIMINARY ENGINEERING:	$12,537,000
RIGHT OF WAY:	$3,464,000
STRUCTURES (Bridges, Retaining walls, Noise walls):	$39,848,000
DRAINAGE/GRADING:	$32,572,000
OTHERS (Stormwater Treatment, Pavements, Roadside Development, Traffic Operations and Safety, Wetland Mitigation, Construction Engineering, etc.):	$81,342,000
TOTAL COST:	**$169,764,000**
Cost Shared by Project Partners:	$0
Present Value of Operation and Maintenance Cost:	$2,624,000
Present Value of Cost:	**$140,665,000**
Present Value of Travel Time Saving Benefit:	$628,897,000
Present Value of Safety Benefit:	$0
Present Value of Benefit:	**$628,897,000**
Benefit-Cost Ratio:	**4.47**

**** This estimate is based on little or no design work, and therefore, many unknown factors may lead to changes in the estimates later on. Hence the estimates are intended for use for planning purposes only.***

Date Printed: ***Tuesday, December 30, 2008***

APPENDIX A: DEFAULT QUANTITIES

Exhibit A-1: Default Quantities for Freeways in Central Puget Sound Region

Item	Unit	Quantities per Lane-Mile			
		Rural	Suburban	Urban	Dense Urban
Grading					
Clear and grub	Acre	3.00	3.00	3.00	0.00
Building demolition	LS/lane-mile	1	1	1	1
Removal of structure	LS/lane-mile	1	1	1	1
Pavement removal	SY	0	0	0	0
Roadside cleanup	LS/lane-mile	1	1	1	1
Roadway excavation *	CY	-	-	-	-
Gravel borrow/embankment Compaction *	Ton	-	-	-	-
Drainage					
Remove drainage structures	Each	4	4	9	14
Conveyance: 24" RCSSP	LF	500	500	2,640	3,960
Catch basin type 2 – 48"	Each	3	3	9	14
Collection pipe: 12" PCSSP	LF	400	400	500	900
Large culverts	LF	200	200	150	200
Ditch excavation	LF	1,400	1,400	2,640	600
Stormwater Treatment					
Detention pond	SF of Imp.	79,200	79,200	39,600	7,920
Water quality pond	SF of Imp.	95,040	95,040	47,520	9,504
Detention vaults	SF of Imp.	0	0	39,600	71,280
Filtration treatment	SF of Imp.	0	0	47,520	85,536
Paving					
Asphalt concrete pavement	SF	63,360	63,360	63,360	31,680
Portland cement conc. pavement	SF	0	0	0	31,680
Structures					
Bridge	SF	User input	User input	User input	User input
Retaining wall	SF	User input	User input	User input	User input
Noise wall	LF	User input	User input	User input	User input
Roadside Development					
Fencing	LF	700	700	1,400	2,700
Seeding, mulching and fertilizing	Acre	3	3	3	3
Roadside restoration	LS/lane-mile	1	1	1	1
Traffic Services and Safety					
Guardrail	LF	700	700	5,280	2,700
Guardrail terminals	Each	10	10	10	10
Concrete barrier	LF	150	150	5,280	8,000
Impact attenuator	Each	1	1	1	2
Signals	Each	User input	User input	User input	User input
Illumination	Each	0	0	0	11
Intelligent transportation system	LS/lane-mile	1	1	1	1
Signing	LS/lane-mile	1	1	1	1
Cantilever sign bridge	Each	0.0	0.0	0.5	1.0
Sign bridge	Each	0.0	0.0	0.5	1.0
Traffic markings	LF	10,560	10,560	10,560	15,900
Raised channelization	LF	0	0	0	0
Curb, gutter and sidewalk	LF	0	0	0	0

* See Exhibit A-2 for roadway excavation and embankment compaction by terrain type (i.e. Level, Rolling or Mountainous)

Exhibit A-2: Earthwork Quantities

Terrain	Roadway Excavation (CY)	Embankment Compaction (CY)
Level	13,000	20,000
Rolling	37,000	60,000
Mountainous	27,000	45,000

Exhibit A-3: Default Quantities per Ramp-Mile

		Quantities per Lane-Mile			
Items	**Unit**	**Rural**	**Suburban**	**Urban**	**Dense Urban**
Grading					
Clear and grub	Acre	3	3	3	0
Building demolition	LS/lane-mile	0	1	1	1
Removal of structure	LS/lane-mile	0	1	1	1
Pavement removal	SY	3,667	3,667	3,667	3,667
Roadside cleanup	LS/lane-mile	1	1	1	1
Drainage					
Remove drainage structures	Each	0	10	10	10
Conveyance: 24” RCSSP	LF	500	1,000	3,000	3,000
Catch basin type 2 – 48”	Each	0	26	26	26
Collection pipe: 12” PCSSP	LF	0	2,500	2,500	2,500
Ditch excavation	LF	4,000	4,000	4,000	0
Stormwater Treatment					
Detention pond	SF of Imp.	79,200	79,200	39,600	7,920
Water quality pond	SF of Imp.	95,040	95,040	47,520	9,504
Detention vaults	SF of Imp.	0	0	39,600	71,280
Filtration treatment	SF of Imp.	0	0	47,000	85,000
Paving					
Asphalt concrete pavement	SF	63,360	63,360	63,360	63,360
Roadside Development					
Fencing	LF	3,000	3,000	3,000	3,000
Seeding, mulching and fertilizing	Acre	9	9	9	9
Roadside restoration	LS/lane-mile	1	1	1	1
Traffic Services and Safety					
Guardrail	LF	4,224	4,224	4,224	0
Guardrail terminals	Each	10	10	10	0
Concrete barrier	LF	0	4,224	4,224	4,224
Impact attenuator	Each	10	10	10	10
Illumination	Each	22	22	22	22
Intelligent transportation system	LS/lane-mile	0	1	1	1
Signing	LS/lane-mile	1	1	1	1
Cantilever sign bridge	Each	4	4	4	4
Traffic markings	LF	5,280	5,280	5,280	5,280
Raised channelization	LF	2,000	2,000	2,000	2,000
Curb, gutter and sidewalk	LF	0	1,000	1,000	1,000

Exhibit A-4: Default Quantities for Interchange Cost Estimate

Interchange Type	Ramp Typical Section	Freeway Typical Section	Cross Road Typical Section	Roadway Excavation	Gravel Borrow & Embankment Compaction	Existing Bridge Removal	New Bridge	Retaining Wall	Signals	Sign Bridge
	LM	LM	LM	CY	TON	SF	SF	SF	Each	Each
Ramp modification	1.00	0.00	0.45	17,670	155,620	0	0	0	0	0
Diamond interchange at rural/minor crossroad	2.00	0.00	0.45	17,670	431,000	14,280	13,525	0	2	0
Diamond interchange at urban/arterial crossroad	2.00	0.00	1.89	17,670	431,000	22,400	23,520	0	2	0
Diamond interchange at urban/braided ramps	2.50	0.00	1.89	26,500	538,800	22,400	25,500	15,000	2	0
Half-diamond interchange	1.00	0.00	0.45	8,830	215,520	22,400	13,525	0	2	0
HOV direct access interchange – one directional	0.96	0.00	0.76	8830	214,000	14,280	98,300	17,150	1	0
HOV direct access interchange – bidirectional	2.00	0.00	0.76	17,670	428,000	14,280	181,400	34,300	1	0
HOV direct access interchange – bidirectional with freeway shift for median widening	1.93	2.00	0.76	17,670	428,000	14,280	181,400	34,300	1	0
HOV direct access interchange – with flyover ramp to HOV facility	2.15	0.00	0.00	8,830	214,000	0	87,880	17,150	1	0
Single point urban interchange at minor arterial crossroad	2.19	0.00	0.45	26,000	538,000	22,400	27,200	108,430	2	0
Single point urban interchange at major arterial crossroad	2.00	0.00	1.89	26,000	538,000	22,400	27,200	108,430	2	2
Partial cloverleaf with 1 to 2 loop ramps and small footprint	2.84	0.00	3.79	17,670	214,000	21,530	21,600	0	0	2
Partial cloverleaf with 3 loop ramps and large footprint	3.91	0.00	3.79	26,000	321,000	21,530	21,600	0	0	2
Full cloverleaf with small footprint in sparsely developed location	2.33	0.00	3.79	34,000	856,000	23,088	17,810	0	0	4
Full cloverleaf with large footprint in highly developed location	3.93	0.50	3.79	34,000	856,000	23,088	25,440	0	0	4
Partial directional with 1 flyover ramp	5.57	0.00	5.00	17,670	214,000	23,088	91,930	13,330	2	4
Partial directional with 2 flyover ramps	6.24	0.00	5.00	26,000	321,000	23,088	133,680	26,660	1	4
Full directional with 2 flyover ramps	2.88	8.00	0.00	34,000	856,000	20,560	119,760	20,000	0	6
Full directional with 3 flyover ramps	6.26	8.00	0.00	45,000	900,000	47,130	229,280	20,000	0	7
Full directional with 4 flyover ramp	7.24	8.00	0.00	56,000	900,000	70,700	291,890	26,660	0	8
Fully directional with some HOV direct connections	9.72	8.00	0.00	34,000	900,000	70,700	409,610	53,320	0	10
Fully directional for all GP and HOV movements	12.20	8.00	0.00	56,000	900,000	70,700	527,330	79,980	0	12

APPENDIX B: DEFAULT UNIT PRICES

Exhibit B-1: Default Unit Costs for Central Puget Sound Region

Items	Unit	Unit Cost (2012$)			
		Rural	Suburban	Urban	Dense Urban
Grading					
Clear and grub	Acre	$4,700	$4,700	$4,700	$4,700
Building demolition	LS/lane-mile	$9,000	$12,000	$83,000	$118,000
Removal of structure	LS/lane-mile	$47,000	$47,000	$94,000	$148,000
Pavement removal	SY	$7.67	$8.94	$11.50	$12.78
Roadside cleanup	LS/lane-mile	$6,000	$6,000	$6,000	$12,000
Roadway excavation	CY	$8.73	$10.91	$12.00	$14.18
Gravel borrow/embank. compaction	Ton	$6.55	$8.18	$9.00	$20.00
Drainage					
Remove drainage structures	Each	$260	$390	$390	$520
Conveyance: 24” RCSSP	LF	$65	$65	$65	$65
Catch basin type 2 – 48”	Each	$2,300	$2,300	$2,300	$2,680
Collection pipe: 12” PCSSP	LF	$46	$46	$46	$51
Large culverts	LF	$1,900	$1,900	$1,900	$1,900
Ditch excavation	LF	$18.84	$18.84	$18.84	$18.84
Stormwater Treatment					
Detention pond	SF of Imp.	$1.44	$1.44	$1.63	$1.76
Water quality pond	SF of Imp.	$0.61	$0.61	$0.65	$0.66
Detention vaults	SF of Imp.	$10.10	$10.10	$10.45	$10.81
Filtration treatment	SF of Imp.	$0.86	$0.86	$0.86	$0.86
Paving					
Asphalt concrete pavement	SF	$4.75	$4.75	$5.25	$5.25
Portland cement conc. pavement	SF	$9.06	$9.06	$9.78	$8.48
Roadside Development					
Fencing	LF	$12	$12	$12	$12
Seeding, mulching and fertilizing	Acre	$1,330	$2,000	$2,000	$2,670
Roadside restoration	LS/lane-mile	$148,000	$148,000	$177,000	$295,000
Traffic Services and Safety					
Guardrail	LF	$26	$26	$26	$26
Guardrail terminals	Each	$2,100	$2,100	$2,100	$2,100
Concrete barrier	LF	$35	$35	$35	$35
Impact attenuator	Each	$27,000	$27,000	$27,000	$27,000
Signals	Each	$150,000	$175,000	$175,000	$175,000
Illumination	Each	$9,000	$9,000	$9,000	$9,000
Intelligent transportation system	LS/lane-mile	$195,000	$195,000	$195,000	$195,000
Signing	LS/lane-mile	$12,000	$30,000	$35,000	$95,000
Cantilever sign bridge	Each	$60,000	$60,000	$60,000	$60,000
Sign bridge	Each	$150,000	$150,000	$220,000	$295,000
Traffic markings	LF	$0.29	$0.29	$0.29	$0.29
Raised channelization	LF	$24	$24	$24	$24
Curb, gutter and sidewalk	LF	$45	$45	$45	$45

Exhibit B-2: Default Unit Cost of Structures in Central Puget Sound Region

Items	Unit	Unit Cost (2012$)			
		Rural	Suburban	Urban	Dense Urban
Widening existing bridge	SF	$355	$355	$355	$390
Roadway bridge (span up to 140')	SF	$175	$175	$175	$200
Roadway bridge (span up to 200')	SF	$200	$200	$200	$220
Roadway bridge (span up to 400')	SF	$355	$355	$355	$390
Roadway bridge (span more than 400')	SF	$355	$355	$355	$390
Removal of existing bridge	SF	$60	$60	$60	$70
Floating bridge	SF	$570	$570	$570	$570
Movable bridge	SF	$1,800	$1,800	$1,800	$1,800
Lid without ventilation	SF	$175	$175	$175	$195
Tunnel	LF	$77,000	$77,000	$77,000	$77,000
Railroad bridge replacement	LF	$12,000	$12,000	$12,000	$12,000
Pedestrian bridge	SF	$175	$175	$175	$175
Retaining wall	SF	$125	$125	$130	$135
Noise wall	LF	$455	$455	$455	$455

Exhibit B-3: Default Unit Costs for Wetland and Streams

Wetland Category	Unit Cost (per Acre)
I	$2,950,000
II & III	$2,240,000
IV	$770,000
Stream Restoration	**Unit Cost (Each)**
Stream Culvert	$1,770,000
Beach restoration	$1,180,000

Exhibit B-4: Default Right of Way Costs

County	Development Density	Land Value (2012$/Acre)		
		Vacant Land	Residential	Commercial
King	**Rural**	$36,600	$446,000	$487,000
	Suburban	$36,600	$446,000	$487,000
	Urban	$943,000	$2,001,000	$4,925,000
	Dense Urban	$2,667,000	$4,617,000	$24,123,000
Kitsap	**Rural**	$48,000	$352,000	$452,000
	Suburban	$48,000	$352,000	$452,000
	Urban	$439,000	$1,032,000	$1,758,000
Pierce	**Rural**	$46,000	$711,000	$833,000
	Suburban	$46,000	$711,000	$833,000
	Urban	$436,000	$1,326,000	$2,925,000
Snohomish	**Rural**	$70,000	$795,000	$962,000
	Suburban	$70,000	$795,000	$962,000
	Urban	$451,000	$1,698,000	$3,032,000
Clark	**Rural**	$27,000	$424,000	$498,000
	Suburban	$27,000	$424,000	$498,000
	Urban	$303,00	$797,000	$1,745,000
	Dense Urban	$880,000	$1,466,000	$2,155,000
Spokane	**Rural**	$23,000	$290,000	$317,000
	Suburban	$23,000	$290,000	$317,000
	Urban	$220,000	$502,000	$1,140,000

Exhibit B-5: Default Markups as Percent of Construction Costs

Items	Development Density			
	Rural	Suburban	Urban	Dense Urban
Mobilization	8%	8%	5%	5%
Traffic Control	6%	6%	7%	8%
Temporary Water Pollution Control	3%	3%	3%	3%
Construction Staging	2%	3%	4%	4%
Utility Relocation	0%	2%	3%	4%
Sales Tax *	9.5%	9.5%	9.5%	9.5%
Preliminary Engineering	10%	10%	10%	10%
Construction Engineering	Varies with construction cost (see Exhibit B-6)			

* PLCE tool uses a 9.5% sales tax although the actual sales tax varies slightly over the State.

Exhibit B-6: Default Cost of Construction Engineering

Project Construction Cost	CE (% of Construction Cost)
Below $2,000,000	17%
$2,000,000 - $5,000,000	14%
$5,000,000 - $10,000,000	12%
Above $10,000,000	10%

(Source: Plan Preparation Manual)

Exhibit B-7: Default Costs of Intelligent Transportation System

ITS Components	Unit	Unit Cost (2012$)
Variable Message Sign (VMS)	Each	$283,000
Closed Circuit Television (CCTV)	Each	$39,000
Highway Advisory Radio Sign (HARS)	Each	$14,000
Highway Advisory Radio Transmitter (HART)	Each	$47,000
Data Station	Each	$47,000
Conduit	LF	$30
Fiber Optic Cable	Mile	$1,152,000
Fiber Optic Cable Terminal Cabinet	Each	$94,000
Ramp Meter	Each	$71,000
Signal Coordination	Each Intersection	$6,000