

# **Feasibility Model for Secondary System Assumption by Virginia Counties (User's Guide)**



Local Assistance Division  
Virginia Department of Transportation  
1401 East Broad Street  
Richmond, Virginia 23219  
(804) 786-2746

Commonwealth of Virginia

**March 2007**

## Table of Contents

<b>1</b>	<b>Introduction.....</b>	<b>2</b>
<b>2</b>	<b>Getting Started.....</b>	<b>4</b>
2.1	System Requirements.....	4
2.2	Downloading the Model .....	4
2.3	Enabling Macros .....	4
2.4	User Information Requirements.....	4
2.5	Model Overview .....	5
<b>3</b>	<b>Instructions for Conducting Analyses.....</b>	<b>7</b>
3.1	Intro Page .....	7
3.2	General Inputs Tab.....	8
3.3	Staffing Inputs Tab .....	11
3.4	Facilities Inputs.....	12
3.5	Equipment Inputs .....	14
<b>4</b>	<b>Model Outputs.....</b>	<b>17</b>
<b>5</b>	<b>Model Documentation .....</b>	<b>21</b>
5.1	System Inventory .....	21
5.2	County Stratification.....	21
5.3	Maintenance Cost Estimates .....	22
5.4	Cost Estimates for Operational Responsibilities.....	23
5.5	Construction Cost Estimates .....	23
5.6	Countywide Cost Centers .....	24
5.7	Inflation Rate .....	24
5.8	Overhead Cost Estimates .....	24
5.9	Higher level of Service Analysis .....	25
5.10	Equipment Needs Estimates .....	26
5.11	Staffing Needs Estimates .....	27
5.12	Maintenance Facility Requirements .....	29
5.13	Office Space Needs.....	30
5.14	Emergency Spending .....	30

## 1 Introduction

The Feasibility Model for Secondary System Assumption by Virginia Counties (Secondary System Analysis Model or “the model”) was developed to provide Virginia’s counties with a tool for exploring the costs and institutional implications (staffing, equipment, and facility needs) of assuming secondary system responsibilities under four devolution options:

1. Maintenance only;
2. Construction only;
3. Maintenance and construction; and
4. Maintenance, construction, and operations (full devolution and operational responsibility, similar to the arrangements currently in place for Henrico and Arlington Counties).

To the extent possible, the model is designed to replicate what would be required to deliver a county-level secondary system program if a county mirrored VDOT’s current approach and service levels. Actual costs and resource demands a county would need to address under devolution may vary widely depending on the county’s unique characteristics, performance targets, and program delivery approach. The key capabilities of the model are as follows:

- **Cost Outputs** – the model provides a six-year forecast of costs under each of the devolution options. Cost estimates for maintenance and operations include direct costs (e.g., crewmen wages and costs for contracts, and supplies) and overhead costs (e.g., facility operation and general management costs). Overhead costs for construction are incorporated into the direct cost output. In addition, costs for countywide cost centers (for activities that are funded out of VDOT’s construction budget but are operational or non-project-specific in nature) are estimated for the operations and construction functions. The model also forecasts potential start-up costs for equipment and facilities under each devolution option.
- **Institutional Outputs** – the model identifies a recommended staffing and equipment complement, and estimates facilities requirements (e.g., the number of needed maintenance facilities).
- **Sensitivity Analysis** – the model provides users with the ability to adjust a wide range of considerations, including devolution start dates, service levels for various maintenance activities, overhead calculation methodologies, future system growth, inflation rates, and expanded construction programs (beyond what is in the 2007 Secondary Six-Year Program (SSYP)). The model also allows users to override default estimates and manually input staffing, equipment, and facility requirements.

## **Feasibility Model for Secondary System Assumption User's Guide**

---

---

It is important for users to understand that the model neither provides a definitive forecast of payment rates for maintenance and/or operations, nor does it reflect the actual terms of the memorandum of understanding (MOU) and/or devolution agreement a county would enter into with VDOT. Guidance on these matters is provided in the *Devolution Guidebook*.

## **2 Getting Started**

While the model includes basic directions on the “Intro” page and is fairly self-explanatory to use, it is recommended that users read this entire manual before running the model. It is also recommended that users first read the *Devolution Guidebook* to familiarize themselves with the devolution options and the considerations associated with county assumption of secondary system responsibilities under each option.

### **2.1 System Requirements**

**Figure 1: System Requirements**

System Component	Requirement
Operating System	Microsoft Windows 2000 with Service Pack 3 (SP3), Windows XP, or later version
Excel Version	Microsoft Excel 2000
Processor	Intel Pentium 233 MHz or faster
Memory	128 megabytes (MB) of RAM or greater
Hard Disk	150MB of available disk space or greater
Drive	CD-ROM or DVD-drive

### **2.2 Downloading the Model**

Users should download a master version of the model to their hard drive or server. To do so, open the file entitled Secondary System Assumption Model v1.0 provided on VDOT’s website, click on “file,” then select “save as” and save the file under the appropriate folder (note: you may wish to create a separate file to save the master version and runs of the model).

### **2.3 Enabling Macros**

Depending on your computer’s security settings, your computer may ask you if you want to enable macros, in which case you should click on the button labeled “Enable Macros.” If your computer informs you that macros have been disabled, click on the “Tools” menu, select “Macro,” and then “Security.” Check the box for “Medium,” close Excel, reopen the model file and click on the “Enable Macros” button.

### **2.4 User Information Requirements**

A basic run of the model for an individual county can be completed without any additional data input from the user by selecting all of the model default options. More customized model runs will require users to provide inputs or select options for items such as future system growth, selection of countywide cost functions, the addition of construction projects, and preferences for addressing staffing, equipment, and facilities needs. Additional details on the user information requirements to address these inputs and options are described later in this document.

## **2.5 Model Overview**

The model uses common Microsoft Windows features such as dropdown menus and click boxes to enable the user to quickly select options and enter data. The core model is comprised of the following ten worksheets:

1. *Intro Page* – identifies general instructions for using the model; provides inputs for designating the user, file name for the analysis run, and the date of the analysis. The worksheet also includes macros for starting the analysis, saving the file run, printing the entire model output, and resetting the entire model to default values.
2. *General Inputs* – provides options to define the general parameters of the analysis run (e.g., county being analyzed, devolution scenario to be modeled, and devolution start year), input additional data on system growth and program size, and define user preferences for level of service and optional devolution functions.
3. *Cost Outputs* – summarizes the annual and one-time start-up costs for the selected devolution option.
4. *Staffing Inputs* – identifies recommended positions and staffing levels for the selected devolution option and enables the user to add or delete positions, adjust staffing levels, and provides options for how positions will be filled (i.e., through existing county resources or through outsourcing).
5. *Staffing Outputs* – summarizes the results from the options selected on the *Staffing Inputs* worksheet.
6. *Facility Inputs* – identifies a recommended number of maintenance facilities and/or office space needs and provides options for adjusting these needs.
7. *Facility Outputs* – calculates non-recurring facilities costs.
8. *Equipment Inputs* – identifies a recommended equipment complement for the selected devolution option and enables the user to add or delete items and adjust the number of items required.
9. *Equipment Outputs* – summarizes the results from the *Equipment Inputs* worksheet and calculates the associated cost.
10. *2005 \$s Calculator* – converts costs from a user-identified base year to constant 2005 dollars to assist users in entering financial inputs correctly.

The model worksheets all follow a consistent format. Each worksheet includes a uniform header that identifies the analysis parameters and provides a row of navigation bars; clicking on a navigation bar takes the user to the applicable worksheet. In addition, each page includes a forward and backward arrow that moves the user to either the previous or next logical worksheet in the analysis process. All input cells are highlighted in yellow with blue lettering; all other cells are protected and cannot be changed or accessed by the user. Information generated by the model is presented in

## Feasibility Model for Secondary System Assumption User's Guide

---

---

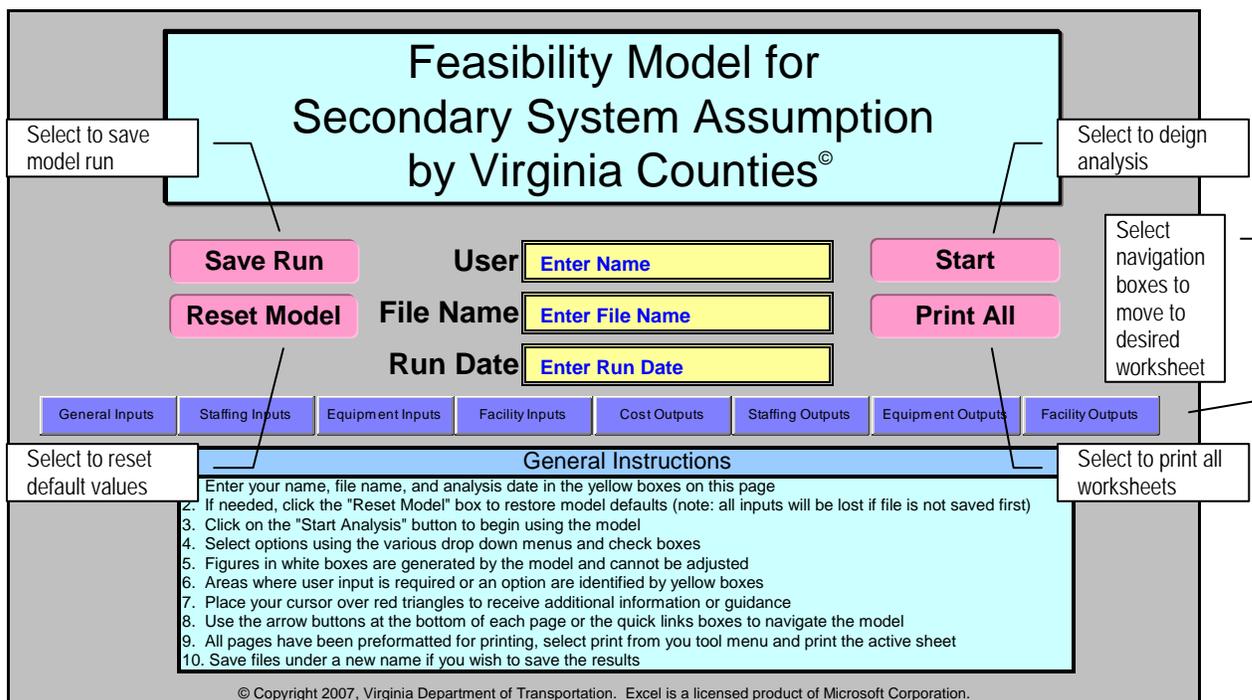
cells with white background and black lettering. Additional information and/or guidance is provided in text boxes throughout the model and is designated by a red triangle in the upper right-hand portion of the applicable cells. To reveal the text box, hold the cursor over the triangle. Users can print the entire model run by choosing the "Print All" button located on the *Intro Page*, or print individual worksheets by choosing the print button located at the bottom of each worksheet.

### 3 Instructions for Conducting Analyses

#### 3.1 Intro Page

The model should open up to the *Intro Page* worksheet pictured below in **Figure 2** (if not, click on the *Intro Page* navigation box at the top portion of the worksheet you are in). If you have opened a previous run of the model and want to reset the model to the original default values, click on the "Reset Model" button. Using the Reset Model function will erase all user inputs; ensure you have saved a version of the existing model run if you do not want to lose the prior analysis.

Figure 1: Intro Page



In the appropriate cells, enter your name (or the person/group name you want associated with the analysis run), and the name you want to give to the analysis. The model will automatically set the "Run Date" to the date you are conducting the analysis; type in specific date if you do not want the run date to change if and when you run the model on a subsequent date. Click on the "Save Run" button; a text box will appear asking if you want to save the file under the name you have entered. Clicking "Yes" will prompt the "Save As" box. Follow the basic Microsoft Windows protocol to save the file to a convenient location on your hard drive or server, then click on the "Start" button to move to the *General Inputs* worksheet and begin the analysis.

### 3.2 General Inputs Tab

The *General Inputs* worksheet defines the basic parameters and other key considerations for the analysis. As illustrated in **Figure 3**, the first section of this worksheet requires the following inputs:

- A. Select County** – use the scroll bar and click on the county for which the analysis is being conducted.
- B. Select Secondary Road Functions** – click on the devolution option you wish to analyze.
- C. Select Start Date** – click on the first year you want devolution to begin (must be at least one year after initial notification by a county of intent to negotiate a devolution agreement and MOU with VDOT).
- D. Inflation Rate** – using the drop down menu, select whether you wish to use the model's default inflation rate (three percent) or input an inflation rate. If you select "Input Inflation Rate," a yellow cell will appear below the drop down menu – enter the inflation rate you want to use. Increasing or decreasing the inflation rate will have a corresponding impact on model cost outputs since the rate is used to adjust all model outputs to nominal (i.e. year-of-expenditure) dollars.

**Figure 2: General Inputs – Part I**

The screenshot shows the 'General Inputs' worksheet with the following components and callouts:

- Select County:** A scroll-down menu with options: None, Accomack, Albemarle, Alleghany, Amelia. Callout: "Select county to be analyzed".
- Select Devolution Option:** A scroll-down menu with options: None, Maintenance Only, Construction Only, Maintenance and Construction, Maintenance, Construction, and Operations. Callout: "Select the option you want to model".
- Select Start Year:** A scroll-down menu with options: FY 2007, FY 2008, FY 2009, FY 2010. Callout: "Select the first year of devolution".
- Inflation Rate:** A scroll-down menu with "Input Values" selected, showing "0.0%". Below it is a yellow input field for "Input inflation rate". Callout: "Select method for setting inflation rate".
- Overhead Factors:** A scroll-down menu with "Input Overhead Multipliers (% of Costs)" selected. Callout: "Select overhead calculation method".
- Maintenance and Operations:** Two columns with "0.0%" in yellow cells. Below them are input fields for "Input overhead as a percentage of cost" and "Enter overhead costs in thousands of 2005 dollars." Callout: "Select option to use historical system growth or to input future growth".
- System Growth (optional):** A scroll-down menu with "Input Future System Growth" selected. Below it are input fields for "Additional Lane Miles" and "Additional Structures". Callout: "Input the number of lane miles and/or structures added each year".
- Yearly Grid:** A table with columns for years 2006 through 2015. Each cell contains "0.0" in a yellow cell. Below the grid is the instruction: "Enter number of lane miles and bridges/structures added each year."

- E. Overhead Rate** – using the drop down menu, select the overhead estimating approach you wish to use (this only applies to maintenance and operations functions). Selecting "Use default Overhead Multipliers" will cause the model to calculate program overhead costs based on VDOT's current (FY 2007) calculated overhead rates. If you select "Input Overhead Multipliers (% of Costs)" or "Input Overhead Amount (2005 \$s)," yellow cells will appear to the right of the menu for "Maintenance" and "Operations," (as appropriate, based on the devolution option you have selected). For the input overhead multiplier option,

enter the overhead rates you want to use; these rates will be multiplied by the appropriate direct program costs to calculate program overhead costs. For the input overhead amount option, input the dollar value (in thousands of 2005 dollars) of anticipated overhead costs for each function. (Note: the *2005 \$s Calculator* worksheet can be used to convert figures to 2005 dollars).

- F. System Growth** – using the drop down menu, select whether you wish to “Use Current System Inventory” or “Input Future System Growth” for the county you are analyzing. The number of lane miles and/or structures added will affect the cost outputs for maintenance and operations, and may have an impact on estimated staffing, equipment, and facilities requirements. If you select the input future system growth option, a table will appear to the right of the menu with yellow input cells for 2006 through 2015 for additional lane miles and additional structures. Input the number of secondary system lane miles and/or structures you anticipate will be added for each year; these inputs will be added to the county’s existing system inventory.

The next section of the *General Inputs* worksheet allows the user to adjust the level of service that a county wishes to provide for specific asset groups and activities (and estimate the associated cost and institutional requirements) under the *maintenance only*, *maintenance and construction*, or *maintenance, operations and construction* devolution options (this section is not applicable under the *construction only* devolution option). A detailed description of the asset groups and activities is provided in the *Devolution Guidebook*. As illustrated in **Figure 4**, the user can select “Use Default Values,” “Model Higher Level of Service,” or “Input Percent Above/Below Default” for each of the major maintenance asset groups and activities. The following is a description and directions associated with each option:

- **Use Default Value** – selecting this option for any or all asset groups and activities will cause the model to calculate program costs and institutional requirements based on historical VDOT expenditure data and current VDOT level of service.
- **Higher Level of Service** – selecting this option for any or all of the asset groups and activities will cause the model to estimate the program costs for attaining and maintaining an optimum level of performance. A detailed description of the higher level of service analysis methodology and definition of “optimum level of performance” is provided in the documentation section of this manual.
- **Input Percent Above/Below Default** – selecting this option for any asset group and/or activity will allow the user to adjust the level of service (and costs/institutional requirements) by a percentage of the default values. After you select this option, a yellow input cell will appear to the right of the applicable drop down menu; input a positive percentage figure or negative percentage figure, as appropriate. For example, to increase or decrease the

## Feasibility Model for Secondary System Assumption User's Guide

level of service by 10 percent, enter 10 or -10, respectively. The level of service cannot be reduced by more than 100 percent.

**Figure 3: General Inputs – Part II**

**Maintenance Program Options**

**Maintenance Areas**

- Pipes & Drains: Input Percent Above/Below Default
- Roadside: Model Higher Level of Service
- Traffic Devices: Use Default Drivers
- Pavement: Use Default Drivers
- Structures: Use Default Drivers
- Special Facilities: Use Default Drivers
- Snow Removal: Input Percent Above/Below Default

**Above/Below Default**

Select the method you want to use for calculating M&O costs for each asset group and activity.

Input the desired percentage increase or decrease in costs for the applicable asset groups and activities.

The final section of the *General Inputs* worksheet, shown in **Figure 5**, allows the user to input construction projects that are not in the 2007 SSYP and select the countywide construction functions to be assumed. A description of countywide construction functions is provided in the *Devolution Guidebook*. This section does not apply if you have selected the *maintenance only* devolution scenario.

Using the drop down menu, select “No Additional Projects” if you do not want to add projects, or select “Input Additional Projects” if you do. If you select the “Input Additional Projects” option, a table will appear to the right of the menu with yellow input cells for 2007 through 2015 for total project costs and number of projects. Input the total cost of projects **in nominal dollars** and the total number of projects added in each year. For projects that span more than one year, the anticipated annual costs should be input for each year, but the project should only be counted once (in the year it begins) for purposes of determining “number of projects.” Adding project costs will cause a corresponding increase in construction cost outputs, while adding “number of projects” may increase staffing, equipment, and facilities needs.

Under the *construction only* or *maintenance and construction* devolution options, a county may choose which countywide construction functions it wishes to assume. Check on the appropriate boxes to select the function you wish to assume. Selecting one or more of these functions will add the cost of performing these activities to the construction cost outputs. If you have selected the *maintenance, construction, and operations* devolution option, assumption of all countywide construction functions is mandatory; you must select all boxes.

**Figure 4: General Inputs – Part III**

**Part III: Construction Program Options**

Select whether you want to add projects (beyond what is in the SSYP).

Input the total annual costs for projects not included in the SSYP.

**Additional Construction (Optional)**

Input Additional Projects:

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Project Costs	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Number of Projects	0	0	0	0	0	0	0	0	0

Enter nominal dollar value (\$000s) AND number of additional construction projects.

**Select County-wide Construction Functions to Assu\*** Note: user must select all functions if selecting maintenance, construction, and operations option.

- Pipe & Entrance  Engineering & Survey
- Traffic Calming  Traffic Services
- Rural Additions

Check on the applicable boxes for the countywide construction functions you wish to assume.

## Feasibility Model for Secondary System Assumption User's Guide

Once you have completed the *General Inputs* worksheet, either click on the *Cost Outputs* navigation button (top of worksheet) to review results, or click on the right arrow at the bottom of the page to move to the *Staffing Inputs* worksheet.

### 3.3 Staffing Inputs Tab

The *Staffing Inputs* worksheet, illustrated in **Figure 6** allows the user to make adjustments to the default recommendation for staff positions and the associated number of full time equivalent (FTE) staffing levels.

**Figure 5: Staffing Inputs**

Staffing Inputs Page						
Percent Outsourced	The default FTE requirement for maintenance/operations staff reflects VDOT's average historical in-house/outsourcing mix for the Richmond District.					
Position Description	Recommended Number of FTEs	Check to	Input Revised FTE Need	Revised FTE Needs	Adjustments to Hiring Needs	
		Manually Set FTE Needs			# of FTEs from Existing Co. Staff	# of FTEs Outsourced
<b>General Management</b>						
Transportation Director	1	<input type="checkbox"/>		1	-	-
Administrative Support	1	<input type="checkbox"/>		1	-	-
Chief Engineer (optional)	-	<input checked="" type="checkbox"/>	1	1	-	-
Contracts Administrator	1	<input type="checkbox"/>		1	-	-
Business Administrator	1	<input type="checkbox"/>		1	-	-
Human Resources Specialist	1	<input type="checkbox"/>		1	-	-
Other	-	<input type="checkbox"/>		-	-	-
Other	-	<input type="checkbox"/>		-	-	-
<b>Maintenance Staff</b>						
Assistant Director - Maintenance/Operations	1	<input type="checkbox"/>		1	-	-
Maintenance Superintendent	2	<input type="checkbox"/>		2	-	-
Other	-	<input type="checkbox"/>		-	-	-
Other	2	<input type="checkbox"/>		2	-	-
Other	14	<input type="checkbox"/>		14	-	-
Other	2	<input type="checkbox"/>		2	-	-
Equipment Shop Staff	3	<input type="checkbox"/>		3	-	-
Other	-	<input type="checkbox"/>		-	-	-
Other	-	<input type="checkbox"/>		-	-	-
<b>Operations (Land Development) Staff</b>						
Traffic Engineer	1	<input type="checkbox"/>		1	-	-
Jr. Traffic Engineer/Tech	-	<input type="checkbox"/>		-	-	-
Permitting Specialist	1	<input type="checkbox"/>		1	-	-
Other	-	<input type="checkbox"/>	2	2	-	-
<b>Core Construction Staff</b>						
Assistant Director - Construction	1	<input type="checkbox"/>		1	-	-
Engineering Techs/Designer	-	<input type="checkbox"/>		-	-	-
Construction Project Manager	-	<input type="checkbox"/>		1	-	-
<b>User-defined Construction Staff</b>						
Surveyor	-	<input type="checkbox"/>		-	-	-
ROW Specialist	-	<input type="checkbox"/>		-	-	-
Utilities Specialist	-	<input type="checkbox"/>		-	-	-
Environmental	-	<input type="checkbox"/>		-	-	-
Materials & Testing Specialist	-	<input type="checkbox"/>		-	-	-
Traffic Engineer	-	<input type="checkbox"/>		-	-	-
Senior Inspector	-	<input type="checkbox"/>		-	-	-
Junior Inspector	-	<input type="checkbox"/>		-	-	-
Other	-	<input type="checkbox"/>		-	-	-
Other	-	<input type="checkbox"/>		-	-	-
<b>Total Staffing</b>	<b>34</b>			<b>37</b>	-	-

\*Sum of input county and outsourced FTEs can not exceed FTE requirement/Input number of FTEs

At the top of the worksheet, the model identifies the level of maintenance and operations outsourcing that is used by the selected county's VDOT District. The level of outsourcing is reflected in the model's default FTE recommendation. Actual numbers of staff that a county may need to hire is dependent upon a county's actual outsourcing mix. Staff positions are divided into five categories: General Management, Maintenance Staff, Operations (Traffic Engineering/Land Development) Staff, Core Construction Staff,

and User-defined Construction Staff. The following is a description of the adjustments that can be made on this worksheet:

- To add optional positions that are not pre-defined by the model, enter the name of the position in the “other” yellow input cells under the appropriate staffing category, then identify the number of FTEs you wish to add for each of the new positions under the column labeled “Input Revised FTE Need.” For all staffing categories, changes to the default staffing needs will be reflected in the staffing outputs. In addition, changes to operations staffing levels will have an impact on operations cost estimates.
- To adjust the number of FTEs required for any or all positions (other than for positions you just added), click on the check box next to the applicable positions. A yellow input cell will appear next to the check box under the column labeled “Input Revised FTE Need.” Enter the number of FTEs you want to define for the associated position. The final FTE requirement for each position is then summarized in the column labeled “Revised FTE Need.”
- Once the final FTE requirements have been defined, the user may then adjust the number of FTE’s that need to be hired based on the availability of existing county staff to fill positions and expectations about outsourcing. To do so, input the number of FTEs that will be filled by existing county staff or outsourced into the appropriate yellow input cells under the columns labeled “# of FTEs from Existing Co. Staff” or “# of FTEs Outsourced.” If the combined number of outsourced and existing county FTEs exceeds the revised FTE needs, an error message will appear.

Once you have completed the *Staffing Inputs* worksheet, either click on the *Staffing Outputs* navigation button (top of the page) to review the results, or click on the right arrow at the bottom of the page to move to the *Facility Inputs* worksheet.

### 3.4 Facilities Inputs

The *Facility Inputs* worksheet identifies the default facilities requirements for a county and allows the user to make adjustment to both the extent of facilities needs and the costs associated with meeting these needs. **Part I** of the worksheet, illustrated in **Figure 7**, which focuses on maintenance facilities needs and costs, includes the following sections (this section is not applicable if you are running a *construction only* devolution scenario):

- A. **Select Area Headquarters (AHQ) Driver** – use the drop down menu to select whether you want to use the “Default Number of Area HQs” or “Input Number of Area HQs” option. If you select the default option, the number of AHQs recommended by the model is provided for informational purposes under the column labeled “Number of AHQs.” If you select the input option, a yellow

## Feasibility Model for Secondary System Assumption User's Guide

input cell will appear to the right of the menu; enter the number of AHQs you desire<sup>1</sup>.

- B. **AHQ Build-out Requirement** – use the drop down menu to select whether you want to use the “Assume All AHQs Need Build-out” or the “Input Number of AHQs Needing Build-out” option. If you select the former, no further action is required in this section. If you select the latter, a yellow input cell will appear to the right of the menu; input the number of required AHQs that will need to be built-out<sup>2</sup>.
- C. **Build-out Costs** – this selection allows the user to make adjustments to the cost basis for the basic components of maintenance facilities. Users can either accept the default number of elements and/or cost basis for each component (land, yard build-out, buildings, and chemical facilities), or check the appropriate box under the “Change Cost Basis” column to input a cost. For checked items, a yellow input cell will appear to the right of the check boxes; input the number of components and/or cost you want to model for these items. Costs changes will affect the cost estimated for all AHQs needing build-out. To add “other” maintenance facility components, enter a description of the component, the cost per component, and the number of components in the appropriate yellow input cells. All cost inputs should be entered in **constant 2005 dollars**.

**Figure 6: Facility Inputs – Part I**

The screenshot shows the 'Part I: Maintenance' section of a worksheet. It includes several input fields and callouts:

- Select Area Headquarters (AHQ) Driver:** A dropdown menu with 'Input Number of Area HQs' selected. Callout: 'Select whether you want to adjust the number of AHQs.'
- Input Number of Area AHQs:** A yellow input cell containing the number '2'. Callout: 'Input desired number of AHQs.'
- AHQ Build-out Requirement\*:** A dropdown menu with 'Input Number of AHQs Needing Build-out' selected. Callout: 'Select whether you want to adjust the number of AHQs.'
- # Needing Build-out:** A yellow input cell containing the number '1'. Callout: 'Input the number of AHQs that will need to be built-out.'
- Build-out Costs Table:**

Build-out Costs	Default # of Elements	Adjust Need	Input Need	Default Cost Per Area HQ	Change Cost Basis	Input New Costs
Land Cost (9 acre lot)	1	<input type="checkbox"/>		\$ 911,662	<input checked="" type="checkbox"/>	\$ 750,000
Yard Build-out Cost	1	<input type="checkbox"/>		\$ 1,350,611	<input type="checkbox"/>	
Buildings Cost	1	<input type="checkbox"/>		\$ 804,739	<input type="checkbox"/>	
Chemical Facilities	1	<input type="checkbox"/>		\$ 258,867	<input type="checkbox"/>	
Other		<input type="checkbox"/>			<input type="checkbox"/>	\$ -
- Other:** A yellow input cell containing a dash '-'. Callout: 'Input description of "other" AHQ components.'
- Change Cost Basis:** A column of checkboxes. Callout: 'Check the applicable boxes to change the cost basis for AHQ components.'
- Input New Costs:** A yellow input cell containing '\$ 750,000'. Callout: 'Input new costs basis.'
- Red text:** 'consider the availability of surplus VDOT AHQs.'

**Part II** of the *Facilities Inputs* worksheet, illustrated in **Figure 8**, focuses on construction facility needs (this section is not applicable under the *maintenance only* devolution scenario) and includes the following sections:

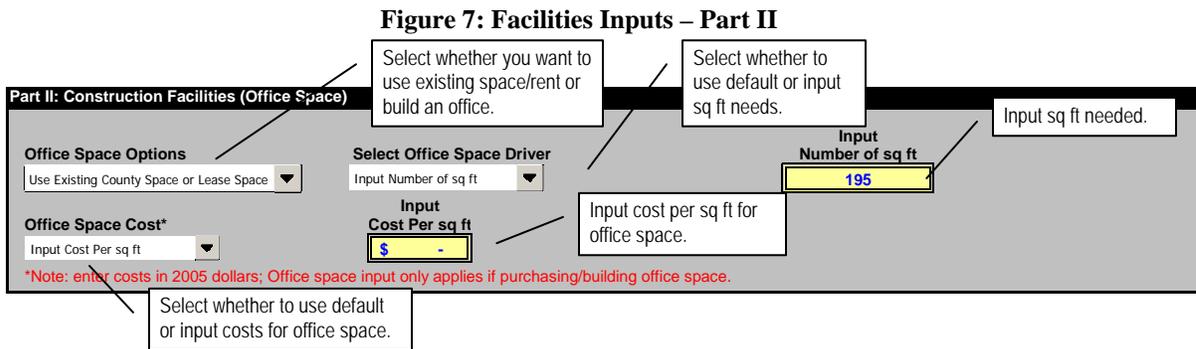
- A. **Office Space Options** – use the drop down menu to select whether you want to use the “Use Existing County Space or Lease Space” or the “Purchase/Build All Required Space” option. If you select the former, no start-up office space costs will be calculated by the model and no further action is required by the user on

1. <sup>1</sup> AHQ is VDOT’s terminology for maintenance yards that house staff, equipment, supplies, and repair facilities.

2. <sup>2</sup> VDOT is planning a reduction in its number of maintenance facilities; counties should consult with VDOT to determine the availability and applicability of surplus AHQs, supply lots, etc.

the *Facilities Inputs* worksheet. If you select the purchase/build option, you must complete the next two steps.

- B. **Select Office Space Driver** – use the drop down menu to select whether you want to use the “Default Number of sq ft” or the “Input the Number of sq ft” option. If you select the default option, the default square footage requirement will appear under the column labeled “Number of sq ft Required.” If you elect to input the number of sq ft needed, a yellow input cell will appear to the right of the menu; input the number of sq ft you desire.
- C. **Office Space Cost** – use the drop down menu to select whether you want to use the “Default Cost Per sq ft” or the “Input Cost Per sq ft” option. If you select the default option, the default cost per square foot will appear under the column labeled “Default Cost Per sq ft.” If you elect to input the cost per square feet, a yellow input cell will appear to the right of the menu. All cost inputs should be entered in constant 2005 dollars.



Once you have completed the *Facilities Inputs* worksheet, either click on the *Facilities Outputs* navigation button (top of the page) to review the results or click on the right arrow at the bottom of the page to move to the *Equipment Inputs* worksheet.

### 3.5 Equipment Inputs

The *Equipment Inputs* worksheet, illustrated in **Figure 9**, allows the user to make adjustments to the default recommendations for the types, number, and cost of vehicles and equipment (hereafter referred to as equipment) required for the selected devolution scenario. Equipment needs are broken into the following five categories:

1. **Recommended M&O Equipment** – the complement of equipment a county will likely need to deliver secondary system maintenance or maintenance and operations functions.
2. **Optional M&O Equipment** – specific equipment that a county may wish to add to the recommended complement (the default number of items recommended for these items is zero).
3. **Construction Equipment** – equipment a county will likely need to deliver a secondary system construction program.

## Feasibility Model for Secondary System Assumption User's Guide

4. **Office Equipment** – equipment such as computers and office furniture that a county will likely need to deliver the program(s) associated with the selected devolution option.
5. **Additional Equipment/Supplies** – vehicles, equipment, or other items that a county may wish to include in its start-up cost calculations, but are not included in the previous four sections.

**Figure 8: Equipment Inputs**

**Equipment Inputs**  
(Default Costs in 2005 \$\$/Enter All New Costs in 2005 \$\$)

	Default Need	Adjust Need	Input Need	Default Cost/Item	Adjust Cost	Input New Cost	Default Need	Adjust Need	Input Need	Default Cost/Item	Adjust Cost	Input New Cost
<b>Recommended M&amp;O Equipment</b>												
Air Compressors	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 23,600	<input checked="" type="checkbox"/>	\$ 20,000						
Concrete Mixers & Mortar Mixers	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 6,000								
Generators	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 16,800								
Pavers/Patchers	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 9,000								
Spreaders - Abrasive	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 108,425								
Steam Cleaners	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 3,055								
Sweepers	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 21,050								
Tanks - Water Sprinkler	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 1,365								
Tractors w/ Misc. Attachments	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 1,470								
Trailers - Other	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 255,700								
Trucks - Bridge	2	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 104,350								
Trucks - Bucket	4	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 78,975		\$ 80,000						
Trucks - Crash Cushion Vehicle	2	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 36,712								
Trucks - Utility Body & Crane	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 193,833								
Vac. All Trucks	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 5,300								
VMS - Trailer Mounted	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 128,333								
Miscellaneous	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 100,100								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 38,200								
	2	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 5,467								
	8	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 63,200								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 733								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 766								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 92,200		\$ 100,000						
	6	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 90,180								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 30,180								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 45,900								
	15	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 3,210								
	2	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 26,550								
	15	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 6,090								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 3,400								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 94,566								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 400								
	8	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 38,400								
	2	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 36,400								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 106,525								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 118,191								
	4	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 70,200								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 47,600								
	1	<input checked="" type="checkbox"/>	<input type="text" value="-"/>	\$ 182,400								
	4	<input checked="" type="checkbox"/>	<input type="text" value="-"/>									
	2	<input checked="" type="checkbox"/>	<input type="text" value="-"/>									
<b>Optional M&amp;O Equipment</b>												
Augers		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 500								
Equipment		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 7,400								
Concrete Vibrators		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 1,500								
Lights - Portable Work		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 12,200								
Loaders - Other		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 138,183								
Post Drivers & Pullers		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 1,125								
Rollers - Other		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 59,733								
Rotary Tillers		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 3,300								
Sign Cleaners		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 800								
Snow Blowers - Loader-Mounted		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 76,000								
Sprayers - Seed and Fertilizer		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 82,233								
SUVs - Maintenance		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 21,800								
Trenchers		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 48,800								
Welders		<input type="checkbox"/>	<input type="text" value="-"/>	\$ 3,500								
<b>Construction Equipment</b>												
(Construction)	3	<input type="checkbox"/>	<input type="text" value="-"/>	\$ 30,180								
<b>Office Equipment</b>												
Computers	14	<input type="checkbox"/>	<input type="text" value="-"/>									
Telephones/Telephone System	17	<input type="checkbox"/>	<input type="text" value="-"/>									
Copier/Printer/etc.	3	<input type="checkbox"/>	<input type="text" value="-"/>									
Desks/Chairs/etc.	14	<input type="checkbox"/>	<input type="text" value="-"/>									
Miscellaneous	3	<input type="checkbox"/>	<input type="text" value="-"/>									
<b>Additional Equipment/Supplies</b>												
Gradall		<input type="checkbox"/>	<input type="text" value="1"/>	\$ 225,000								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								
		<input type="checkbox"/>	<input type="text" value="1"/>	\$ -								

For the first four sections, users may accept the default recommendations for the number and costs of items (no action require) or make adjustments to the default values. To adjust the number of items required for any element, click on the appropriate box under the column labeled "Adjust Need." A yellow input cell will appear to the right of the check box; enter the number of items you desire. To adjust the cost of any items (default costs are provided in the column labeled "Default Cost/Item"), click on the appropriate box under the column labeled "Adjust Cost." A yellow input cell will appear to the right of the check box; enter the revised cost per item (in **constant 2005 dollars**). Users also may identify equipment needs that are not identified in the first four sections. To do so, input a description of the item, the number of items desired, and the cost per item in the appropriate yellow input cells. Default costs are provided in constant 2005 dollars

## **Feasibility Model for Secondary System Assumption User's Guide**

---

---

and inflated to the first year of devolution in the model outputs. All costs input in this section should be entered in **2005 dollars**.

Once you have completed the *Equipment Inputs* worksheet, either click on the *Equipment Outputs* navigation button (top of the page) to review the results, or click on the right arrow at the bottom of the page to move to the *Cost Outputs* worksheet.

## 4 Model Outputs

The results from the model are presented in four outputs worksheets. The **Costs Outputs** worksheet, shown in **Figure 10**, provides an assumptions summary, estimated annual costs for maintenance, operations, and construction (as applicable) for the 6-year period beginning with the devolution year, and non-recurring start-up costs. For informational purposes, the model also provides data on average emergency spending (a description is provided in the documentation section), the level of maintenance and operations outsourcing used by a county's applicable VDOT District, and the percentage of the secondary system in a county that is eligible to receive federal funding (some qualifying bridge repair/replacement costs on otherwise ineligible secondary roads may qualify for federal bridge funds).

**Figure 9: Cost Estimate Summary**

Program Cost Estimates												
Assumptions Summary												
Out-year Inflation Rate	<input type="text" value="3%"/>	M&O Program Service Options					Plus/Minus Default					
Overhead Rate/Amount	Amount (\$000s)	Pipes & Drains Roadside Traffic Devices Pavement Structures Special Facilities Snow Removal Operations					Current VDOT Performance					
	Maintenance						<input type="text" value="\$-"/>	Defined Level of Service				<input type="text" value="20%"/>
	Operations						<input type="text" value="\$100"/>	Defined Level of Service				<input type="text" value="10%"/>
							<input type="text" value="\$-"/>	Higher Level of Service				
	<input type="text" value="\$-"/>						Higher Level of Service					
	<input type="text" value="\$-"/>						Defined Level of Service				<input type="text" value="-5%"/>	
	<input type="text" value="\$-"/>						Current VDOT Performance					
	<input type="text" value="\$-"/>						Current VDOT Performance					
System/Construction Assumptions		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	
System Growth - Lane Miles		-	-	-	-	-	-	-	-	-	-	
System Growth - Bridges & Structures		-	-	-	-	-	-	-	-	-	-	
Additional Construction Project Costs (\$000's)		N/A	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Number of Additional Projects		N/A	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
County-wide Construction		Cost Center Functions Assumed (Assumption required under the Maintenance, Construction, and Operations option)										
Pipe & Entrance	<input type="text" value="Yes"/>	Engineering & Survey					<input type="text" value="Yes"/>					
Traffic Calming	<input type="text" value="Yes"/>	Traffic Services					<input type="text" value="Yes"/>					
Rural Additions	<input type="text" value="Yes"/>											
Annual Costs (Nominal Dollars)												
		2009	2010	2011	2012	2013	2014					
<b>MAINTENANCE</b>												
Direct Costs		\$ 3,974,134	\$ 4,093,358	\$ 4,216,159	\$ 4,342,644	\$ 4,472,923	\$ 3,414,043					
Overhead Costs		\$ 112,551	\$ 115,927	\$ 119,405	\$ 122,987	\$ 126,677	\$ 130,477					
<b>Total Maintenance</b>		<b>\$ 4,086,685</b>	<b>\$ 4,209,286</b>	<b>\$ 4,335,564</b>	<b>\$ 4,465,631</b>	<b>\$ 4,599,600</b>	<b>\$ 3,544,520</b>					
<b>OPERATIONS</b>												
Direct Costs		\$ 370,155	\$ 381,260	\$ 392,697	\$ 404,478	\$ 416,613	\$ 429,111					
County-Wide Cost Centers		\$ 10,000	\$ 5,000	\$ 5,000	\$ 10,000	\$ 10,000	\$ 10,000					
Overhead Costs		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -					
<b>Total Operations</b>		<b>\$ 380,155</b>	<b>\$ 386,260</b>	<b>\$ 397,697</b>	<b>\$ 414,478</b>	<b>\$ 426,613</b>	<b>\$ 439,111</b>					
<b>CONSTRUCTION</b>												
Numbered Project Costs		\$ 803,222	\$ 628,353	\$ 652,356	\$ 616,054	\$ 616,054	\$ 616,054					
County-Wide Cost Centers		\$ 40,000	\$ 44,177	\$ 43,535	\$ 32,900	\$ 32,900	\$ 32,900					
<b>Total Construction</b>		<b>\$ 843,222</b>	<b>\$ 672,530</b>	<b>\$ 695,891</b>	<b>\$ 648,954</b>	<b>\$ 648,954</b>	<b>\$ 648,954</b>					
<b>Total Annual Costs</b>		<b>\$ 5,310,062</b>	<b>\$ 5,268,075</b>	<b>\$ 5,429,153</b>	<b>\$ 5,529,064</b>	<b>\$ 5,675,167</b>	<b>\$ 4,632,586</b>					
Analysis Notes:												
1) Construction estimates for 2013 - 2015 assume no growth above 2012 levels from 2007 SSYP.												
2) Operations Costs - a portion of these costs should be recovered through fees.												
Non-Recurring Costs (Nominal Dollars)					County-specific Information							
Real Estate		\$ 3,830,000				Average Annual Emergency Costs	\$ 135,678					
Vehicles and Equipment		\$ 6,480,445				Percent of M&O Outsourced	44%					
Office Set-up		\$ 115,083				Percent of System "Federal Eligible"	12%					
<b>Total Up Front Costs</b>		<b>\$ 10,425,528</b>										

The user can click on the Print button at the bottom of the worksheet to print just this page, or click on the Right Arrow button to move to the **Staffing Outputs** worksheet.

**Feasibility Model for Secondary System Assumption User's Guide**

The *Staffing Outputs* worksheet, illustrated in **Figure 11**, provides the staffing needs forecast based on the selected devolution options and any adjustments the user may have made on the *Staffing Inputs* worksheet. For each applicable position, the forecast identifies the total number of FTEs required, the number of FTEs that will likely be filled by either county staff or through outsourcing, and the resulting additional staffing need that a county would need to address through new hires. The user can click on the Print button at the bottom of the worksheet to print just this page, or click on the Right Arrow button to move to the *Facilities Outputs* worksheet.

**Figure 10: Staffing Needs Forecast**

<b>Staffing Needs Forecast</b>				
Position Description	FTEs Requirements	FTEs Filled w/ Existing Co. Staff	Outsourced FTEs	Additional Staffing Needs
<b>General Management</b>				
Transportation Director	1	-	-	1
Administrative Support	1	-	-	1
Chief Engineer (optional)	1	-	-	1
Contracts Administrator	1	-	-	1
Business Administrator	1	-	-	1
Human Resources Specialist	1	-	-	1
Other <input type="text"/>	-	-	-	-
Other <input type="text"/>	-	-	-	-
<b>Maintenance Staff</b>				
Assistant Director - Maintenance/Operations	1	-	-	1
Maintenance Superintendent	2	-	-	2
Assistant Maintenance Superintendent	-	-	-	-
Maintenance Supervisor	2	-	-	2
Maintenance Crew Members	16	-	-	16
Fiscal Assistant/Time Keeper	2	-	-	2
Equipment Shop Staff	3	-	-	3
Other <input type="text"/>	-	-	-	-
Other <input type="text"/>	-	-	-	-
<b>Operations (Land Development) Staff</b>				
Traffic Engineer (ops)	1	-	-	1
Jr. Traffic Engineer/Tech	-	-	-	-
Permitting Specialist	1	-	-	1
Other <input type="text" value="Jr. Permitting Specialist"/>	2	-	-	2
<b>Core Construction Staff</b>				
Assistant Director - Construction	1	-	-	1
Engineering Techs/Designer	1	-	-	1
Construction Project Manager	1	-	-	1
<b>User-defined Construction Staff</b>				
Surveyor	-	-	-	-
ROW Specialist	-	-	-	-
Utilities Specialist	-	-	-	-
Environmental	-	-	-	-
Materials & Testing Specialist	-	-	-	-
Traffic Engineer	-	-	-	-
Senior Inspector	-	-	-	-
Junior Inspector	-	-	-	-
Other <input type="text"/>	-	-	-	-
Other <input type="text"/>	-	-	-	-
<b>Total FTEs</b>	<b>39</b>	<b>-</b>	<b>-</b>	<b>39</b>

The *Facilities Outputs* worksheet, illustrated in **Figure 12**, provides a summary of the non-recurring facilities costs based on the selected devolution options and any adjustments the user may have made on the *Facilities Inputs* worksheet. The user can click on the Print button at the bottom of the worksheet to print just this page, or click on the Right Arrow button to move to the *Equipment Outputs* worksheet.



## **Feasibility Model for Secondary System Assumption User's Guide**

---

---

which the entire model output can be printed by clicking on the "Print All" button. You should also re-save the run under the existing or a new name.

## 5 Model Documentation

This section provides a summary of the data sources and estimating methodologies that are used in the Secondary System Assessment Model.

### 5.1 System Inventory

The system inventory is based on information found in HTRIS (VDOT's highway inventory information system). The county-by-county lane mile data was imported into the model from a file entitled "2005 Miles Lane Miles by Functional Class (FC) & National Highway System (NHS)." Data on the number of structures, by county, was imported from the file entitled "Secondary\_Bridges and Culverts."

### 5.2 County Stratification

A stated objective during development of the Secondary System Assessment Model was to create the capacity to estimate the cost and institutional needs to deliver "typical" VDOT level of service on the secondary system. To address variances in VDOT's costs and program delivery from one county to another and from one year to another, it was determined that counties should be grouped into various strata to create a means for calculating selected cost and staffing drivers based on averages for counties with similar characteristics.

To develop the county stratification approach used in the model, historical cost data (FY 2000-2005) on VDOT secondary system maintenance and operations expenditures from VDOT's financial management system (FMS2) was used to determine average constant secondary system expenditures by county. To avoid skewing the results due to one-time events, emergency costs that were reimbursed by the Federal Emergency Management Agency (FEMA), FWHA Emergency Relief Grants, or special appropriations from the General Assembly (e.g., for flooding or major snow storms) were netted out of the county-by-county averages. Correlation analyses were then conducted to determine the relationship between county-by-county expenditures and other factors. It was determined that there were reasonable correlations between secondary road spending and both geography/demographics and average daily vehicle miles traveled (DVMT) per lane mile for counties based on defined strata.

Counties were then grouped into four strata categories: Northern Virginia, Urban/High Growth, Rural-Mountain, and Rural-Other based on geography and/or population density. The two rural categories were then divided into counties with high DVMT per lane mile (over 200) and low DVMT per lane mile (under 200). Categories were then slightly adjusted to address county anomalies (i.e., abnormally high or low costs/lane mile). The following is a listing of the final stratification:

## Feasibility Model for Secondary System Assumption User's Guide

---

### *Rural Low – DVMT/Lane Mile Counties*

Appomattox  
Brunswick  
Buckingham  
Charlotte  
Cumberland  
Essex  
Halifax  
King & Queen  
King William  
Lancaster  
Lunenburg  
Mathews  
Mecklenburg  
Northampton  
Northumberland  
Nottoway  
Prince Edward  
Richmond  
Southampton  
Surry  
Sussex  
Westmoreland

### *Rural Mountain - Low DVMT/Lane Mile Counties*

Bath  
Bland  
Botetourt  
Carroll  
Craig  
Dickenson  
Floyd  
Giles  
Grayson  
Highland  
Lee  
Madison  
Nelson  
Patrick  
Rappahannock  
Rockbridge  
Russell  
Scott  
Shenandoah  
Wythe

### *Northern Virginia Counties*

Fairfax  
Loudoun  
Prince William

### *Rural – High DVMT/Lane Mile*

Accomack  
Amelia  
Campbell  
Caroline  
Charles City  
Culpeper  
Dinwiddie  
Fluvanna  
Gloucester  
Goochland  
Greensville  
Henry  
Isle of Wight  
King George  
Louisa  
Middlesex  
New Kent  
Orange  
Pittsylvania  
Powhatan  
Prince George

### *Rural Mountain – High DVMT/Lane Mile*

Albemarle  
Alleghany  
Amherst  
Augusta  
Bedford  
Buchanan  
Clarke  
Franklin  
Frederick  
Greene  
Montgomery  
Page  
Pulaski  
Rockingham  
Smyth  
Tazewell  
Warren  
Washington  
Wise

### *Urban/High Growth Counties*

Chesterfield  
Fauquier  
Hanover  
James City  
Roanoke  
Spotsylvania  
Stafford

## 5.3 Maintenance Cost Estimates

Maintenance cost estimates include two components: direct costs (e.g., maintenance crew labor, contracts, vehicle/equipment rental, supplies etc.) and overhead costs (e.g., management and facilities costs). To estimate direct costs, a database of historical (FY 2000-2005) VDOT secondary system maintenance expenditures for each county was developed from FMS2 data. County expenditure data was further delineated by maintenance-related costs for the six VDOT asset groups (Group 100: Pipes & Drains, Group 200: Roadway, Group 300: Traffic Devices, Group 400: Pavement, Group 500: Structures, and Group 600: Special Facilities) and snow removal. This data was then

used to develop “costs drivers” for each asset group and snow removal (for each strata) based on average constant costs per lane mile or structure (total average costs for all of the counties in a strata are divided by the total lane miles and structures for the strata). For a given county, the cost drivers for the associated strata are then multiplied by the number of lane miles or structures and the results are summed to estimate total maintenance costs in constant 2005 dollars. This cost figure is then adjusted for inflation for each of the years in the model output.

Default maintenance overhead costs are calculated by multiplying estimated maintenance costs by VDOT's combined general overhead and maintenance overhead multipliers for 2007 (see below for further documentation on overhead rates). Users also have the option to input either their own overhead rate or a flat dollar figure.

#### **5.4 Cost Estimates for Operational Responsibilities**

Operations costs include three components: direct costs, countywide costs, and overhead costs. Direct costs include two parts. The first part covers costs from selected operational cost centers. The costs for these elements for a given county are calculated in the same fashion as described in the maintenance cost estimate section above.

In addition, the model calculates the cost of the additional land development staff needed for this option based on salary and overhead assumptions for the personnel (\$55,000/year for a traffic engineer and \$45,000/year for a permit specialist (2005 dollars) and an overhead multiplier of 0.70). The sum of these two costs is then totaled and adjusted for inflation to the applicable years in the model output tables.

The countywide cost center costs that are included in operations relate to anticipated expenditures for plan review. Estimates for a given county are based on what is included for the county in each applicable year in the 2007 SSYP.

#### **5.5 Construction Cost Estimates**

Construction cost estimates are based on the sum of project costs for “route-numbered” projects each year, for each county, in the 2007 SSYP. For years beyond FY 2012 (the last year of the 2007 SSYP), costs are “flat-lined” at the 2012 program level (in nominal dollars). Costs for countywide cost centers in the 2007 SSYP are accounted for separately (see below), and cost for items such as “district secondary allocations” and “future budget items & plant mix” were excluded from the county-by-county cost data. Since costs in the SSYP should already be expressed in year-of-expenditure figures, the costs are not adjusted for inflation in the final output tables. The Construction cost output table does not include an overhead element since the cost to administer projects should already be included in the SSYP project cost figures.

## **5.6 Countywide Cost Centers**

The costs for countywide cost centers are based on the line item amounts shown for each county wide cost center, for each county, for each year in the 2007 SSYP. For years beyond FY 2012 (the last year of the 2007 SSYP), costs are “flat-lined” at the 2012 program level (in nominal dollars). The allocation of countywide cost center costs is as follows:

- “Seeding and Fertilizing” costs are not considered optional, thus if a county elects a devolution option that includes construction, any seeding and fertilizing costs in the 2007 SSYP automatically show up on the construction county cost center output line.
- The “Right-of Way Engineering” cost center is related to outstanding VDOT liabilities that will remain the responsibility of VDOT, thus these costs are not included in the estimates of countywide cost center costs.
- The “Subdivision Plan Review” countywide cost center is treated as an operations cost. If a county selects the *maintenance, construction, and operations* devolution option, the subdivision plan review costs for the applicable county in the 2007 SSYP automatically show up in the operations county-wide cost center line item in the cost outputs table.

The sum of a county's costs for the remaining relevant countywide cost centers (“Pipe & Entrance,” “Traffic Calming,” “Rural Additions,” “Engineering & Survey, and “Traffic Services”) are summed on the construction countywide cost center line of the cost outputs table. For the *construction only* and *maintenance and construction* devolution scenarios, the costs that appear are based on the costs for “Seeding & Fertilizing” plus the costs for countywide cost centers that the county wants to assume (i.e., by checking the appropriate boxes on the **General Inputs** worksheet). For the *maintenance, construction, and operations* devolutions scenario, the user must elect to assume all countywide cost center functions.

## **5.7 Inflation Rate**

The model uses 2005 dollars as the constant dollar baseline. The inflation rate used to either adjust historical costs to constant 2005 dollars or inflate constant 2005 dollars to nominal (i.e. year-of-expenditure) dollars is three percent per year. This is both a widely-used industry benchmark and consistent with the cost estimating practices used by the VDOT Asset Management Division's "Planning Module".

## **5.8 Overhead Cost Estimates**

Model overhead cost estimates capture the program delivery expenses that are not accounted for in the direct cost calculations. Examples of overhead costs include rent, utilities, management and administrative staff, research, etc. For maintenance and operations functions, the model uses the sum of VDOT's FY 2007 calculated overhead rates for highway system maintenance (9.6 percent) and general agency management (8 percent). The resulting rate (17.6 percent) is multiplied by the direct program cost for

the applicable year to determine overhead costs. This information was provided by the VDOT Financial Planning Division in a file named "Overhead Rate per 2007 Budget - Illustration v2." Users also have the option to input either their own desired overhead rate for maintenance and operations, or to input a flat dollar figure (dollar figures must be entered in 2005 dollars and are inflated to nominal costs for the applicable year).

### 5.9 Higher level of Service Analysis

The "higher level of service" portion of the model (illustrated in **Figure 15**) allows the user to estimate the costs and institutional needs associated with delivering a level of secondary maintenance and/or operations performance that is not constrained by VDOT's current budgetary limitations.

**Figure 15: Higher Level of Service Analysis**

Maintenance Program Options		Above/Below Default
Maintenance Areas		
Pipes & Drains	Input Percent Above/Below Default ▼	<span style="border: 1px solid black; padding: 2px;">-10%</span>
Roadside	Model Higher Level of Service ▼	
Traffic Devices	Use Default Drivers ▼	
Pavement	Use Default Drivers ▼	
Structures	Use Default Drivers ▼	
Special Facilities	Use Default Drivers ▼	
Snow Removal	Input Percent Above/Below Default ▼	<span style="border: 1px solid black; padding: 2px;">10%</span>

The model uses two approaches to estimate higher level of service costs and institutional needs. For selected secondary system assets (i.e., cross pipes, pavement surfaces, and pavement markings), the VDOT Asset Management Division's Planning Module was used to identify the annual spending at the VDOT district level that would be required to 1) achieve optimal performance levels over a five year period; and 2) maintain optimal performance levels in year six and beyond. These cost estimates were then compared to historical average costs to determine the percentage "spending gap" between current and optimal spending for each asset group, for each VDOT District, for a five-year catch-up period and a "maintain" year (year six) . These percentages are then multiplied by the applicable maintenance cost driver (see documentation on maintenance cost estimation) and the results are inflated to the applicable year to determine higher level of service costs. Based on the assumption that a high percentage of the work required to achieve a higher level of service would be outsourced, the staffing needs associated with individual asset groups or activities are adjusted by 40% of the percentage spending gap (i.e., if the higher level of service for pavement required an 80% increase in spending, the staffing driver associated with pavement would only be increased by 32%).

For other assets and recurring functions, such as roadside maintenance and snow/ice removal, higher level of service was defined as a "noticeable improvement in performance" by system users. The required percentage increase in spending needed to achieve a noticeable improvement for the applicable assets groups and functions (25 percent) was determined based on the expert opinion of senior VDOT field personnel. This percentage is then multiplied by the applicable maintenance and/or operations cost

driver and the results are inflated to the applicable year to determine higher level of service costs. Staffing needs are adjusted in the same fashion as described above. Model users also have the option to manually increase or decrease annual expenditures and staffing needs for each asset group and function by a percentage of the default cost estimates.

### 5.10 Equipment Needs Estimates

The approach for determining field equipment needs was developed through a combination of data analysis and consultation with senior VDOT field personnel. As a starting point, the consultant team reviewed a statewide inventory of maintenance and operations equipment and vehicles to establish an initial list of needed equipment. The consultant team then worked with selected VDOT maintenance personnel to 1) establish a list of equipment that would likely be required or optional for delivery of a secondary system program at a county level, and 2) determine “equipment drivers” (i.e., estimating methodologies) to calculate the number of each required equipment item that a county would need. (Note: it is assumed that some equipment that VDOT currently maintains at a residency or district level would be rented by a county on an ad hoc basis; these items are not included on the required or optional equipment lists.) Costs for each required and optional equipment item were provided by the VDOT Asset Management Division.

The approach for estimating office equipment needs (items and equipment drivers) was established through consultation with VDOT personnel. The required and optional field and office equipment items and the associated equipment drivers are documented in **Figure 16**.

**Figure 16: Equipment Recommendations**

<b>Equipment Estimating Methodology</b>	
<b>Equipment Description</b>	<b>Considerations for Determining Need</b>
Air Compressors	One per county.
Arrow Signs (Trailer Mounted)	Two per county.
Asphalt Haulers	One per county.
Asphalt Kettles	One per county.
Backhoe & Attachments	One per county.
Brooms - Truck Attachment	One per county.

<b>Equipment Estimating Methodology (Continued)</b>	
<b>Equipment Description</b>	<b>Considerations for Determining Need</b>
Brush Chippers	One per county.
Compactors	One per county.
Concrete Mixers & Mortar Mixers	One per county.
Ditching Trucks	One per county.
Dump Trucks – Large	One per AHQ.
Dump Trucks – Standard	One per every two crewmembers (less the number of large/small trucks).
Dump Trucks – Small	One per AHQ.
Excavators	One per county.
Generators	One per AHQ, minimum of 2 per county.

## Feasibility Model for Secondary System Assumption User's Guide

Graders	One per county, additional graders may be required if county has a high number of dirt road lane miles.
Loaders – Large	One per county.
Loaders – Small (Bobcat)	One per county.
Mowers - Small Riding	One per AHQ.
Mowers - Tractor Attachments	Two per AHQ
Mowers - Walk Behind	One per county.
Pavement Breakers	One per county.
Pavers/Patchers	One per county.
Pickup Trucks	One per each supervisor and superintendent.
Rollers - 4 Ton 6 Ton Tandem	One per county.
Snowplows	Needs vary based on geography and the level of outsourcing.- (Calculated by multiplying the estimated number of dump trucks by the applicable VDOT District's current ratio of dump trucks to snowplows (based on VDOT statewide equipment inventory)).
Sprayers – Chemical	One per maintenance crew.
Spreaders – Abrasive	Needs vary based on geography and the level of outsourcing. (Calculated by multiplying the estimated number of dump trucks by the applicable VDOT District's current ratio of dump trucks to spreaders (based on VDOT statewide equipment inventory))
Steam Cleaners	One per county.
Sweepers	One per county.
Tanks – Water Sprinkler	One per county.
Tractors w/ Misc. Attachments	One per maintenance crew.
Trailers (Other)	One per county.
Trucks (Bridge)	One per county.
Trucks (Bucket)	One per county.
Trucks (Crash Cushion Vehicle)	Two per AHQ.
Trucks (Utility Body & Crane)	One per county.
Vacuum Trucks	One per county.
Variable Message Signs	Two per AHQ.

### 5.11 Staffing Needs Estimates

As with the equipment needs, the approach for determining recommended positions and staffing levels was developed through a combination of data analysis and consultation with senior VDOT personnel. For delivery of maintenance programs, a recommended staffing complement was developed that roughly equates to the organizational structure (for maintenance) of a typical VDOT residency office. The number of recommended maintenance superintendents is based on an adaptation of the estimating methodology used in the recent VDOT AHQ Study. Recommended crew staffing levels are calculated by determining the average number of crewman per lane mile (i.e., staffing driver) for each county strata based on the system inventory and county-by-county 2005 VDOT man-hour data for the secondary system, and then dividing the selected county's lane miles by the applicable staffing driver.

The recommended construction and operations staff positions and the methodologies for determining staffing levels were developed through consultation with various

## Feasibility Model for Secondary System Assumption User's Guide

VDOT Residency, District, and Central Office staff. The specific estimating methodology for each recommended staff position is summarized in **Figure 17**.

**Figure 17: Staffing Recommendations**

Requirement	Considerations for Determining Need
<b><i>General Management Staff</i></b>	
Transportation Director	One per county
Assistant Director for Maintenance	One per county under all but the <i>maintenance only</i> devolution option (assume this role would then be performed by the Transportation Director)
Assistant Director for Construction	One per county under all but the <i>construction only</i> devolution option (assume this role would then be performed by the Transportation Director)
Administrative Support	One per county.
Contracts Administrator	One per county.
Business Administrator	One per county; individual may report to other areas of county government.
Human Resources Specialist	One per county; individual may report to other areas of county government.
<b><i>Maintenance Field Staff</i></b>	
Maintenance Superintendent	One per AHQ.
Assistant Maintenance Superintendent	Not required; counties with large AHQ staffs may elect to add this position.
Maintenance Supervisor	One per maintenance crew (up to 12 crewmembers).
Maintenance Crew Members	Calculated by the number of secondary lane miles divided by average number of lane miles per crewman for the applicable strata.
Fiscal Assistant/Time Keeper	One per AHQ.
<b>Equipment Shop Staff</b>	Based on the number of secondary system lane miles in a county (3 staff for counties with 1,500 lane miles or less, 4 staff for counties with 1501 to 3,000 lane miles, 5 staff for counties with more than 3,000 lane miles).

## Feasibility Model for Secondary System Assumption User's Guide

Requirement	Considerations for Determining Need (cont)
<b>Operations Staff</b>	
Traffic Engineer	One for counties with 2.0 or more lane miles added in first year of devolution, zero for counties adding less than 2.0 lane miles
Junior Traffic Engineer/Tech	Varies based on county growth. One position for counties with population over 100K, plus an additional position for every additional 100K in population, plus one position if the annual number of lane miles added is greater than five and one additional position for every additional 5 lane miles. For counties where the number of lane miles added per year is <.7 miles, one position is proposed which assumes both the Traffic Engineer and Subdivision Permit Specialist Roles.
Permit Specialist	Varies based on county growth. One position per county; plus one position if the number of permits processed for a county exceeds 250; plus one position for every additional 250 permits; plus one position if the annual number of added lane miles is greater than five and one position for every additional 5 lane miles.
<b>Construction Staff</b>	
Engineering Techs/Designers	One per every five construction projects (based on first year of devolution).
Construction Project Managers	One per every five construction projects (based on first year of devolution).
Right-of-way Specialists	User-defined.
Utilities Specialists	User-defined.
Environmental Specialists	User-defined.
Materials and Testing Specialists	User-defined.
Traffic Engineers	User-defined.
<b>Inspectors (Junior and Senior)</b>	User-defined.

### 5.12 Maintenance Facility Requirements

County requirements for maintenance facilities, also known as area headquarters (AHQs), are based on an adaptation of the methodology used to estimate the statewide need for AHQs in the recent VDOT AHQ Study, conducted by the Virginia Transportation Research Council. Specifically, it is assumed that all counties require at least one AHQ, and that the ratio of lane miles to AHQ should not exceed 800. In other words, the model divides the number of lane miles in a selected county by 800 and rounds up to get to the estimated number of AHQ required. This is consistent with the VDOT AHQ study, which assumed an upper threshold of 800 lane miles per maintenance superintendent, with one AHQ per superintendent. The AHQ Study also incorporated daily vehicle miles travel (DVMT), response times, and storage needs into the analysis to adjust the threshold downward. These issues were not considered as

significant for county secondary systems, so no adjustment was made to the 800 lane miles/AHQ threshold.

The facility requirements for an AHQ and the associated costs for different facility elements is based on a survey of county land prices, the VDOT AHQ Combo Building Prototype Report (1999) and data on recent AHQ build-outs in New Kent and Rappahannock Counties provided by the VDOT Administrative Services Division.

### **5.13 Office Space Needs**

Office space needs are calculated based on the estimated number of office personnel, American Institute of Architects guidelines for office space (100 square feet per person plus 15 percent for common space). Office space costs are based on the cost for "Class B" office space in small urban areas and were developed through consultation with a few commercial real estate brokers in Virginia.

### **5.14 Emergency Spending**

To determine average annual emergency spending, by county, the historical (2000-2005) maintenance and operations cost data from FMSII was queried to identify all maintenance and operations costs that were reimbursed through funds from either the Federal Emergency management Agency (FEMA), Federal Highway Administration, or special General Assembly appropriations. These amounts were then converted to constant 2005 dollars and averaged. The emergency figure shown in the outputs table is inflated to the first year of devolution