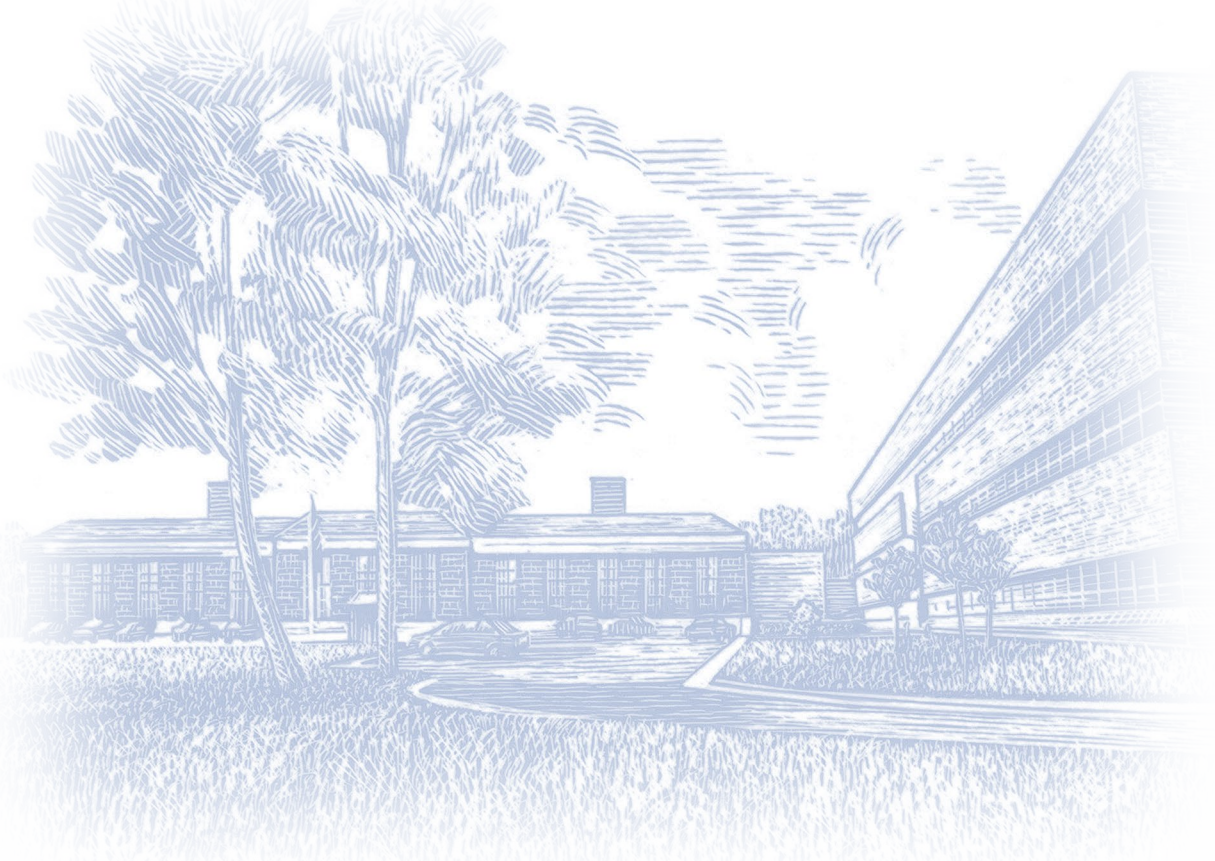


Performance-Related Specifications for Pcc Pavements. Volume IV: Appendix G-Pavespec 2.0 User Guide

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Foreword

This report (FHWA-RD-99-059) is the fourth volume of a four-volume set of reports presenting the results of a study to further the development of performance-related specifications for portland cement concrete pavement construction. Using the recommended performance-related specifications, a highway agency can, upon construction, predict the performance of a pavement and forecast the pavement's life-cycle costs. The benefits to the agency from using such specifications can be significant. This report contains a User Guide for the computer software that assists in the development, use, and analysis of the specifications. This report will be of interest to engineers concerned with quality assurance, specifications, and construction of concrete pavements.

Sufficient copies of this report are being distributed to provide a minimum of 3 copies to each FHWA resource center and division office, and 10 copies to each State highway agency. Direct distribution is being made to the division offices. Additional copies for the public are available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161.

James D. Cooper
Acting Director, Office of Engineering Research and Development

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Introduction

PaveSpec is designed to develop and demonstrate performance-related specifications (PRS) for jointed plain concrete pavements (JPCP). The software has specifically been designed to help State highway agencies (SHA's) determine performance-related pay factors (and pay adjustments) for JPCP *highway* pavements. PaveSpec was written in support of the Federal Highway Administration (FHWA) project titled "Laboratory/Field Investigation of Performance-Related Specifications for PCC." For further information about the theory and practice of PRS, consult the project report (FHWA Report Nos. FHWA-RD-98-155, -156, and -171).

The software is driven by a simulation engine that is used to simulate pavement performance and associated life-cycle costs (LCC's) for both as-designed and as-constructed pavements. PaveSpec 2.0 allows the user to express pavement performance in terms of the following distress indicators:

- Transverse slab cracking.
- Transverse joint faulting.
- Transverse joint spalling.
- Pavement smoothness over time—Present serviceability rating (PSR) or International Roughness Index (IRI).

Each of the distress indicator models is a function of many variables, including one or more of the following five acceptance quality characteristics (AQC's):

- Concrete strength.
- Slab thickness.
- Entrained air content.
- Initial smoothness.
- Percent consolidation around dowels.

Using the current PRS approach, lot pay factors are then computed based on a comparison of the simulated LCC's for the as-designed and as-constructed pavements

What Can You Do With PaveSpec?

Before one can effectively use PaveSpec to develop PRS-based specifications, it is important to understand the major capabilities of the software. Currently, the software is divided into two different parts that allow the user to accomplish the following tasks:

- Develop a specification—The program's *Specification Wizard* is used to develop project-specific PRS-based specifications.
- Use a specification—PRS-based lot pay factors (and pay adjustments) may be computed based on actual AQC field data.

The details of each of these two major software capabilities are described in chapters 3 and 4, respectively.

Data Organization

PaveSpec stores its data in files called *databases*. Each *database* may be named and saved as a separate file to a disk. *Databases* are made up of smaller data elements called *documents*. The three

document types available in PaveSpec 2.0 are *modules*, *specifications*, and *specification-dependent documents*.

Modules

Modules are stand-alone sets of user-defined variables (of a similar type) that are independent of any particular specification. Descriptions of the different module types are as follows:

Pavement Design—This module contains pavement design-related input variables required by the distress indicator models. Examples of the variables contained in the pavement design module include *Pavement Type*, *Transverse Joint Spacing*, and *Dowel Bar Diameter*.

Design Traffic—This module contains traffic-related information required to calculate yearly equivalent single-axle loads (ESAL's) over the chosen analysis period. Examples of variables contained in the Design Traffic module include *Initial Year* or *Total Design ESAL's*, *Traffic Growth Type*, and *Traffic Growth Rate*. (Note: Average daily traffic [ADT] may be used to compute first-year ESAL's.)

Climatic Variables—This module contains climate-related input variables required by the distress indicator models. Examples of the variables contained in the Pavement Design module include *Freezing Index*, *Average Annual Number of Wet Days*, and *Climatic Zone*.

Maintenance and Rehabilitation Plan—This module contains the step-by-step rules making up the maintenance and rehabilitation (M & R) plan. The M & R plan is used to determine what type of M & R activities are to be applied to the pavement in response to the simulated distress indicators, and when those activities will be applied.

Unit Costs—This module contains unit cost information used to compute LCC's resulting from the estimated M & R activities. Unit costs are organized into maintenance, localized rehabilitation, and global rehabilitation costs.

There can be any number of each type of *module* defined within a *database*; however, only one of each type of module is specific to a developed specification.

Specifications

Specifications define all aspects of the PRS development procedure, including the developed PRS preconstruction output. More than one specification may be developed and saved within each database. A specification document is developed by completing all of the steps in the PaveSpec *Specification Wizard*. When developing a specification, the user is required to select (or define) modules for each of the five module types. That is, for each specification, the user indicates which Pavement Design, Design Traffic, Climatic Variables, Maintenance and Rehabilitation, and Unit Costs modules are to be used for estimating pavement performance and subsequent LCC's. This modular approach allows multiple specifications to be developed based on the same underlying assumptions.

Specification-Dependent Documents

The last type of document is the *specification-dependent* document. This document type is further divided into two types of documents, referred to as *use specification* and *drill-down* documents. Each of these specification-dependent document types is developed for a chosen specification. If the specification is deleted, the dependent documents are also deleted. The two specification-dependent document types are as follows:

Use Specification—The use specification documents contain actual AQC field sampling and testing data entered by the user. A separate document is used for each project (i.e., data for multiple lots of the same project are entered into one use specification document). The output report associated with this document type contains lot and project pay factor (and pay adjustment) summaries.

Drill-Down—This document type allows a user to view the performance (distress indicators) or LCC details of any selected simulated subplot that went into an overall simulated-lot LCC. A simulated-lot LCC is typically the mean of 500 simulated subplot LCC's, and the standard specification output report only contains a summary of these simulated-sublot LCC's. Therefore, if users want to see details of one of these specific simulated sublots, they must create a drill-down document. The resulting document provides detailed performance, M & R, and LCC information at the lot and subplot level. This type of document is very helpful when trying to understand project-specific interactions between performance and LCC's.

Getting Started

System Requirements And Recommendations

PaveSpec is written for IBM-compatible computers running the Windows 95 operating system. It will not run on earlier versions of Windows (including Windows 3.1) or DOS. To run PaveSpec, a computer must have the minimum system specifications:

- 486 processor running Windows 95 or NT 4.0.
- 8 Mb of RAM.
- 1 Mb of hard-disk space.
- Mouse or other pointing device.
- VGA or better graphics card (ideally 800 x 600 pixels or 1024 x 768 pixels).

The performance of the software will be greatly enhanced if the system has a 150-MHz Pentium processor or higher and 16 Mb or more of RAM.

Setup Of PaveSpec

For the best performance, it is recommended that PaveSpec be installed on (and run from) your computer's hard drive. Although the easiest way to install PaveSpec is from the CD-ROM, the PaveSpec executable file may also be manually copied to a hard drive or run directly from a floppy disk. The details of each method are described in the following sections.

Installing PaveSpec From the CD-ROM

1. Insert the CD-ROM into your CD-ROM drive. The CD-ROM will start automatically in Windows 95 or NT 4.0.
2. Select the PaveSpec 2.0 Installation option from the CD-ROM start-up screen.
3. Follow the on-line instructions to install PaveSpec on your hard drive. Note: If any problems are encountered with the CD-ROM, consult the readme.txt file contained on the CD-ROM.

Manually Installing PaveSpec to a Hard Drive From a Floppy Disk

If you wish to manually copy PaveSpec to your computer's hard drive, it is recommended that you create a directory that will house the PaveSpec program file and any database files that you may create.

1. Start Windows 95 or NT 4.0. Insert the floppy disk containing PaveSpec.
2. Use Windows Explorer or My Computer to locate the pavespec.exe file.
3. Select the pavespec.exe file by clicking on the file name.
4. From the Edit menu, select Copy.
5. Click on the existing folder to which you would like to copy the pavespec.exe file. (You may also create a new folder by selecting New and then Folder from the File menu.)

6. Select Paste from the Edit menu to copy pavespec.exe to the selected folder.
7. To run PaveSpec from the hard drive, locate pavespec.exe, then double-click on the file name. (You may also create a shortcut and place it on your desktop for convenience—see Windows 95 or NT 4.0 Help for information on creating shortcuts.)

Running PaveSpec From a Floppy Disk

1. Start Windows 95 or NT 4.0 and insert the floppy disk.
2. Select Run from the Start menu.
3. Type **<drive>:pavespec**, where <drive> is the letter designation of the floppy drive. Then click on the OK button.

What You See When You Start PaveSpec

The primary elements of the PaveSpec main window are identified in figure 1. When you first open the program, a new default database appears in the PaveSpec main window.

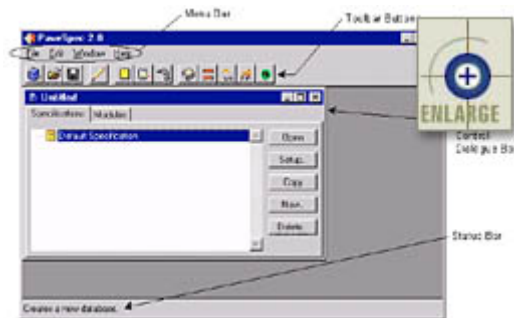


Figure 1.
PaveSpec main window.

Menu Bar

The menu bar includes four items: File, Edit, Window, and Help. To display the available PaveSpec commands under a specific menu heading, click on the heading of your choice. You can then click on any of the commands shown in the drop-down box.

File Menu

The file menu, shown in figure 2, contains 13 commands, each of which is described briefly in this section.

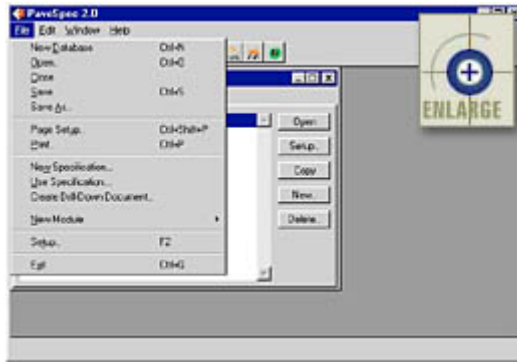


Figure 2.
PaveSpec file menu.

New Database—Opens a new PaveSpec database.

Open—Opens a previously saved PaveSpec database.

Close—Closes the active PaveSpec database.

Save—Saves the active PaveSpec database. If the active database has been named and saved previously, the database will be saved under the previously defined file name. If the file has not been named and saved previously, the program will prompt the user to enter a file name and storage location.

Save As—Allows the user to save the active database under a new name or in a new location.

Page Setup—Allows the user to specify page formatting for printing (e.g., paper size, page orientation, and margins).

Print—Takes the user to the Print dialogue box in preparation for printing the selected PaveSpec item.

New Specification—Creates a new specification within the active database.

Use Specification—Allows the user to enter actual AQC field data into a previously defined specification and determine corresponding PRS-based lot pay factors and pay adjustments. More details on using a specification are contained in chapter 4 of this appendix, Using a Specification.

Create Drill-Down Document—Allows the user to investigate the simulation details of a previously developed specification. More details on creating and using drill-down documents are contained in chapter 5, Drill-Down Documents.

New Module—Creates a new module. A secondary menu will appear showing the five different available types of modules: Pavement Design, Design Traffic, Climatic Variables, Maintenance and Rehabilitation Plan, and Unit Costs.

Setup—Allows the user to set up (define or edit) the specification currently selected in the Database Control dialogue box. Specification definition or editing is accomplished using the Specification Wizard (see chapter 3, The Specification Wizard).

Exit—Exits the PaveSpec program.

Edit Menu

The edit menu contains the following two commands:

Copy Selected Page—Copies a selected output report page to the clipboard.

Preferences—Opens a pop-up dialogue box that allows the user to: (1) specify the preferred units (English or metric) used throughout the program, and (2) set the simulation engine (random-number generator) seeds. In setting the simulation engine seeds, the user has the following two options:

- Use same initial seed for all simulations. This selection makes it so that the simulations are not random from one specification simulation to the next (the initial simulation seed is always set equal to zero). Each time the user simulates a new specification, the same set of random numbers between 0 and 1 are used to determine AQC sample values.
- Randomize initial seed for all simulations. This selection makes it so that the simulations are completely random from one specification simulation to the next. Each time the user simulates a new specification, a different set of random numbers between 0 and 1 are used to determine AQC sample values. This is the recommended option.

Window and Help Menus

These menus contain commands that are common to most, if not all, Microsoft Windows programs. See Windows 95 Help for further information.

Toolbar Buttons

The PaveSpec toolbar buttons provide quick access to many common PaveSpec commands. To activate a toolbar button, simply click on it.



Creates a new database.



Opens an existing database.



Saves the current database.



Allows the user to change the setup of the document currently highlighted in the Database Control dialogue box. This function works on all document types (i.e., specifications, modules, and specification-dependent documents).



Creates a new specification document in the current database.



Creates a new use specification document in the current database.



Creates a new drill-down document in the current database.



Creates a new pavement design module in the current database.



Creates a new design traffic module in the current database.



Creates a new climatic variables module in the current database.



Creates a new maintenance and rehabilitation plan module in the current database.



Creates a new unit costs module in the current database.

Database Control Dialogue Box

The Database Control dialogue box is used to organize all of the documents in a given database. The Database Control window is divided into two tabbed sections: Specifications and Modules. To move from one tab to the other, click on the tab names.

Specifications Tab

All of the developed specifications and specification-dependent documents within the open database are displayed in the Specifications tab, as shown in figure 3. Within the Specifications tab, each specification-dependent document is attached to its parent specification using a visual outline. The visual outline may be expanded or compressed by clicking on the boxes that contain plus (+) or minus (-) signs. The example in figure 3 shows a database containing two different developed specifications, Specification 1 and Specification 2, with two specification-dependent documents attached to Specification 1.

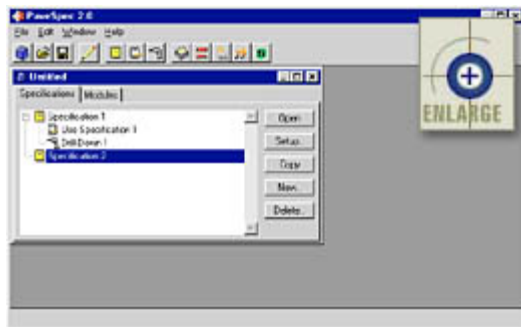


Figure 3.
Database Control dialogue box—Specifications tab.

The buttons within the Specifications tab perform the following functions:



Allows the user to view the output report accompanying the highlighted Specification, Use Specification, or Drill-Down document.



Allows the user to edit the highlighted document.




Makes a copy of the highlighted document.




Allows the user to create a new document of the same type as the highlighted document.



Deletes the highlighted document.

Note: A  symbol next to a developed specification indicates that the specification needs to be resimulated to reflect one or more changes to variables (or modules) affecting the preconstruction output. To update the specification, simply resimulate using the specification wizard.

A  symbol will also appear next to any existing specification-dependent document when its parent specification has been resimulated. This symbol, therefore, indicates that the specification-dependent document is out of date with the current state of the parent specification. A specification-dependent document may be updated by redefining the document's details in setup mode.

Modules Tab

All of the user-defined module documents within the open database are stored in the Modules tab. This tab also makes use of a visual outline to organize the five different types of module documents. An example of the Modules tab is presented in figure 4. The buttons on this tab basically perform the same functions as the buttons in the Specifications tab. The only difference is that there is no Open button, as there are no output reports accompanying a Module document.

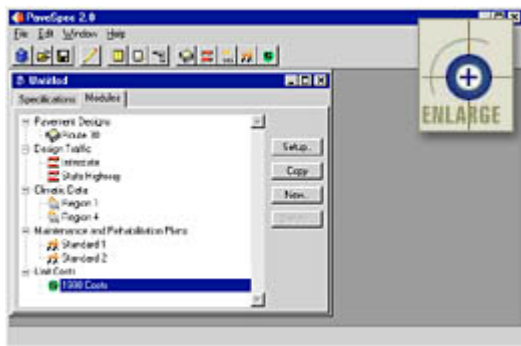


Figure 4.
Database Control dialogue box—Modules tab.

Status Bar

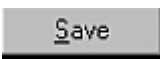
The PavSpec status bar provides information describing a highlighted menu item or toolbar button. To obtain feedback via the status bar, move the pointer over the menu item or toolbar button of interest. Text describing the item will appear in the status bar.

The Specification Wizard

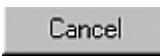
In PaveSpec, a project-specific PRS is created or edited using the Specification Wizard. This feature is comprised of 11 sequential steps (dialogue boxes) that lead the user through all aspects of developing a PRS-based specification. This chapter contains detailed descriptions of each dialogue box in the Wizard, as well as instructions on how to use them. The chapter ends with an explanation of the output report produced at the completion of the Specification Wizard steps.

Specification Wizard Control Buttons

Each dialogue box included in the Specification Wizard is equipped with four control buttons. The buttons may be activated by clicking on the selected button. The specific function of each of these buttons is described below:



Allows the user to save the current specification document and return to the PaveSpec main window. (Note: A specification document can only be saved after all of the Specification Wizard steps have been completed.)



Allows the user to quit the current specification development procedure (without saving changes) and return to the PaveSpec main window.



Moves backward to the previous dialogue box in the Specification Wizard.



Moves forward to the next dialogue box in the Specification Wizard.

Page 1—Basic Specification Information

Whenever you choose to set up a new or previously developed specification, PaveSpec will start the Specification Wizard, and the Basic Specification Information dialogue box will appear. This dialogue box allows you to name the current specification, choose the type of specification to be developed (Level 1 or Level 2), and enter general descriptive project information. An example of this dialogue box is presented as figure 5.



Figure 5.
Basic Specification Information dialogue box.

Name and Specification Level

To change the name of the current specification, type a new name in the Project Name input box. The name you enter will show up as the specification document name in the Specifications tab of the Database Control dialogue box.

The specification type must also be selected within this dialogue box. Currently, the user may choose to develop only a Level 1 specification or both Level 1 and Level 2 specifications at the same time. When defining specifications, the data required (and, therefore, the data input screens) vary depending on what specification type is selected. Any such differences will be explained in this chapter.

Project Identification

There are five different inputs grouped under the Project Identification heading. The data entered or selected in these fields are optional. These fields are included to allow the user to document descriptive information about the project to which the developed specification applies. Specific input fields include State, County, Project ID, Traffic Direction, and Additional Description. (The Additional Description input box is a notepad where you may enter any additional project information.)

Page 2—Dimensions And Lane Configuration

Inputs used to describe the project's lane configuration, location, and length are contained in the Dimensions and Lane Configuration dialogue box. An example of this dialogue box is presented in figure 6.

Figure 6.
Dimensions and Lane Configuration dialogue box.

Lane Information

Choose the appropriate lane configuration describing the project's layout from the Configuration drop-down box. The lane configuration is expressed as a combination of the total number of lanes making up the road (both traffic directions) and whether traffic (going in opposite directions) is divided by a median or barrier. The following six lane configurations are available to the PaveSpec user:

- Two, Undivided—Two-lane highway (one lane in each direction) with no median or barrier.
- Four, Undivided—Four-lane highway (two lanes in each direction) with no median or barrier.
- Four, Divided—Four-lane highway (two lanes in each direction) divided by a median or barrier.
- Six, Divided—Six-lane highway (three lanes in each direction) divided by a median or barrier.
- Eight, Divided—Eight-lane highway (four lanes in each direction) divided by a median or barrier.
- Ten, Divided—Ten-lane highway (five lanes in each direction) divided by a median or barrier.

Note that the number of lanes being accepted at one time using the PRS is independent of the chosen lane configuration. For example, the lane configuration could be a six-lane divided highway; however, you may only be accepting (computing pay factors for) two lanes of paving.

Next, you must select the specific lanes that you would like to accept at one time using this specification. Select or deselect lanes by clicking on the Accept check box next to the lane of interest. For those lanes chosen for acceptance, lane widths must be entered in terms of either feet or meters (e.g., "12 ft" or "3.66 m"). (Note: You may toggle between English and metric units within any numerical input box using the "`" key on your keyboard.) If an outer lane (lane adjacent to a shoulder) is chosen for acceptance and it is defined as a widened lane, select Widened Outer Lanes by clicking on that check box. To deselect the check box, simply click on the box again, and the "x" will disappear.

If you choose to accept an outer lane and an inner lane at the same time, you will need to specify the amount of inner lane cracking as a percentage of the predicted outer lane cracking. For example, if you select this number to be 100%, it will be assumed that all inner lanes being accepted will develop the same amount of cracking predicted for the outer lane. Conversely, if you select this number to be 0%, it will be assumed that all inner lanes being accepted will exhibit no cracking.

Road Location

Select whether the project is located in an urban or rural setting by choosing the appropriate item in the Road Location drop-down box.

Lane Configuration Preview Window

The Lane Configuration Preview window provides an illustration of the type of lane configuration selected. Selecting a different item from the Configuration list box will change the contents of this preview window.

Project Length

The starting and ending stations (expressed in ft or m) are also inputs in this Dimensions and Lane Configuration dialogue box. The specified station values are used to compute the total project length shown below the station input boxes.

Page 3—Design-Related Modules

The design-related variables used in defining a specification are grouped into three module documents. Not only does this simplify the logic of the process, but it also allows you to save and reuse groups of variables, which, in turn, simplifies the data entry itself. An example of the Design-Related Modules dialogue box is presented in figure 7.

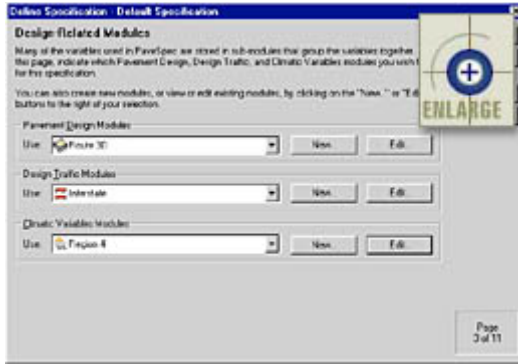


Figure 7.
Design-Related Modules dialog box.

You may access existing modules by clicking on the appropriate drop-down arrow and highlighting the module you wish to use. To make changes to a displayed module, click the **Edit..** button associated with that module type. To create a new module, click on the **New..** button. Whether you decide to edit an existing module or create a new one, the data entry screens will be the same—only the displayed input values will be different. The data entry procedures for each module type will be discussed separately.

Pavement Design Module

An example of the dialog box used to define a Pavement Design module is presented in figure 8.

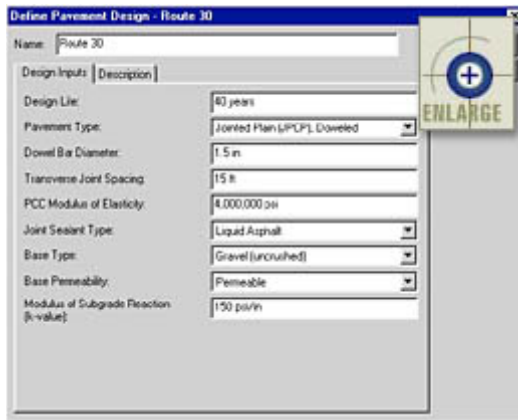


Figure 8.
Pavement Design Module dialog box.



The Pavement Design dialog box is made up of two tabs: Design Inputs and Description. By default, the Design Inputs tab is displayed when you first enter the Pavement Design dialog box.

All of the modules defining user inputs are contained in the Design Inputs tab. You can change the name of the Pavement Design module by entering a new name in the Name box. This name will then show up as the specification document name in the Modules tab of the Database Control dialog box. The remaining design-related inputs in the Design tab are defined by entering appropriate values.

When entering data into the input boxes, the program presents the default units in English or metric depending on what Preferred Units type is selected in the program preferences. You may toggle between English and metric units within any numerical input box using the "`" key. The following default units are used for both preferred unit types:

- Dowel Bar Diameter—Default metric values are displayed in terms of "cm"; however, values may be entered in terms of "mm" by simply typing the value followed by "mm" (e.g., "25.4 mm"). English values are limited to "in".
- Transverse Joint Spacing—Acceptable metric abbreviations include "cm" and the default metric unit "m". English values may be entered in terms of "in" or the default units of "ft".
- PCC Modulus of Elasticity—The default metric units for this input are "MPa"; the default English values are "psi".
- Modulus of Subgrade Reaction (k-value)—The default metric values for this input are "MPa/m"; the default English values are in terms of "psi/in".

The Description tab contains a text box in which you may enter any detailed text describing the defined Pavement Design module. It is important to note that information entered in this text box is not used in the simulation process; therefore, it is optional.

Once you are finished making changes or defining a Pavement Design module, click on the  button. If you would like to exit the Pavement Design dialogue box without saving your changes, click on the  button. Clicking either button will return you to the Design-Related Modules dialogue box.

Design Traffic Module

An example of the dialogue box used to define a Design Traffic module is presented in figure 9.

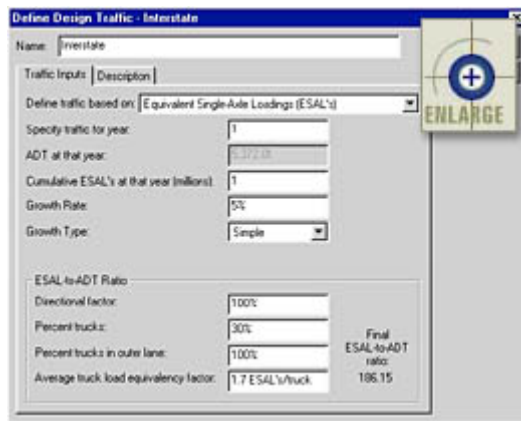




Figure 9.
Design Traffic Module dialogue box.

The Design Traffic dialogue box includes two tabs: Traffic Inputs and Description. By default, the Traffic Inputs tab is displayed when you first enter the Design Traffic dialogue box.

All inputs used to compute yearly ESAL's are contained in the Traffic Inputs tab. This dialogue box acts as a traffic calculator, allowing you to compute traffic over time based on an entered cumulative design ESAL or ADT at a specified year, a defined growth rate, and a chosen growth type (simple or compound). The relationship between ESAL's and ADT is determined using the inputs defined in the ESAL-to-ADT Ratio section of the dialogue box. Cumulative ESAL's are required by many of the distress indicator models, while yearly ADT values are used in the computation of any included user costs.

You can change the name of the Design Traffic module by entering a new name in the Name input box. This name will then show up as the specification document name in the Modules tab of the Database Control dialogue box. The remaining traffic-related inputs in the Traffic Inputs tab are defined by entering appropriate values.

The Description tab contains a text box in which you may enter any detailed text describing the defined Design Traffic module. Any information entered in this text box is optional, as it is not used in the simulation process.

Once you are finished making changes or defining a Design Traffic module, click on the  button. If you would like to exit the Design Traffic dialogue box without saving your changes, click on the  button. Clicking either button will return you to the Design-Related Modules dialogue box.

Climatic Variables Module

An example of the dialogue box used to define a Climatic Variables module is presented in figure 10.

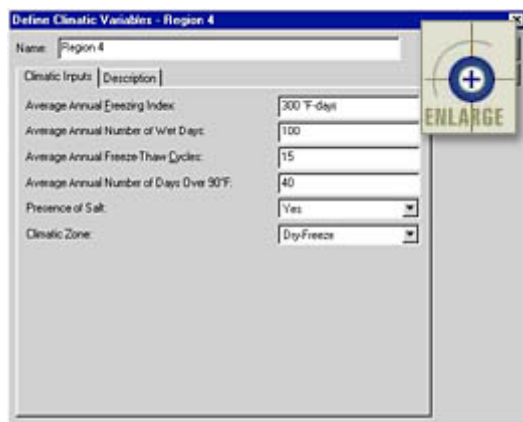



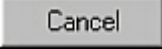
Figure 10.
Climatic Variables Module dialogue box.

The Climatic Variables dialogue box is made up of two tabs: Climatic Inputs and Description. By default, the Climatic Inputs tab is displayed when you first enter the Climatic Variables dialogue box.

All of the modules defining user inputs are contained in the Climatic Inputs tab. You may change the name of the Climatic Variables module by entering a new name in the Name input box. This name will then show up as the specification document name in the Modules tab of the Database Control dialogue box. The remaining climatic-related inputs in the Climatic Inputs tab are defined by entering appropriate values. For more information concerning the definitions and units of these variables, please see the section titled Climatic Variables in volume I.

The Description tab contains a text box in which you may enter any detailed text describing the Climatic Variables module. Because information entered in this text box is not used in the simulation process, it is optional.

Once you are finished making changes or defining a Climatic Variables module, click on the  button. If you would like to exit the Climatic Variables dialogue box without saving your

changes, click on the  button. Clicking either button will return you to the Design-Related Modules dialogue box.

Page 4—Definition Of Pavement Performance

Pavement performance is defined in page 4 of the Specification Wizard. An example of the Definition of Pavement Performance dialogue box is presented in figure 11.



Figure 11.
Definition of Pavement Performance dialogue box.

Pavement performance is expressed in terms of one or more of the four distress indicators (transverse joint faulting, transverse joint spalling, transverse slab cracking, and decreasing smoothness) shown in the Distress Indicators box. To select or deselect a distress indicator, click on the check boxes next to the distress indicators (a check mark signifies that the distress indicator is selected). For your convenience, the required and optional AQC's associated with each distress indicator model are listed.



The second step in defining pavement performance requires the selection of AQC's that you choose to measure in the field. The Status column next to the listed AQC's indicates whether each AQC is Required, Optional, or Unnecessary. Those AQC's required by the selected distress indicator models are automatically selected for inclusion (the corresponding check box is checked and the Status is shown as Required). Those AQC's that are optional may be selected or deselected by clicking on the check boxes. AQC's not required by the selected distress indicator models are automatically deselected (the corresponding check box is un-checked and the Status is shown as Unnecessary). If you choose to deselect an AQC that is required by one of the chosen distress indicator models, you will be asked to enter a model default value that will be used by those performance models requiring a value for that AQC.

Page 5—AQC Sampling And Testing

The AQC sampling and testing plans are defined in page 5 of the Specification Wizard. You will see a tab for each AQC that you selected in the previous dialogue. Each AQC data entry screen is discussed separately.

Concrete Strength

This AQC has two different data entry screens—one for sampling information and one for testing information. If you chose to develop a level 1 specification only, you can toggle between the level 1 sampling and testing data entry screens using

the  and  buttons. If you chose to develop a level 1 and level 2 specification at the same time, you can also toggle between the level 2 sampling and testing data entry

screens using the **Level 2 Sampling** and **Level 2 Testing** buttons. (Note: The level 1 and level 2 sampling data entry screens are identical, as are the level 1 and level 2 testing data entry screens. Separate data entry screens are provided for each PRS level only because you can choose to use different sampling and testing plans for the different specification levels.)

An example of the concrete strength sampling data entry screen is shown in figure 12. The data inputs contained in this screen define how concrete strength is to be sampled under the developed PRS. First, you must select the sample type from the list box. If the sample type selected is Cores, you must choose an appropriate age from the Timing of Cores box. (Note: The selected timing of cores indicates when the cores will be extracted from the pavement; this age is not necessarily the age of testing for the cores.) Next, the number of Sampling Locations per Sublot and number of Samples per Sampling Location (replicates) are chosen. Finally, you may enter any notes regarding the defined concrete strength sampling and testing plan in the Additional Sampling or Testing Comments text box (this field is optional).

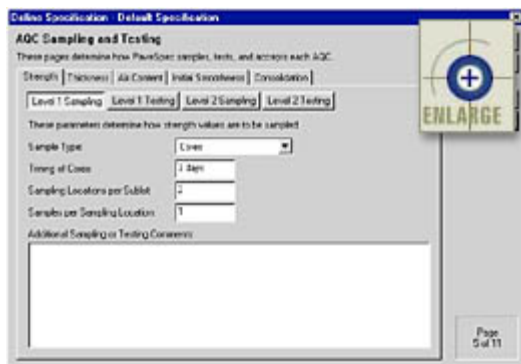


Figure 12.
AQC Sampling and Testing dialog box (Concrete Strength Sampling data entry screen).

An example of the concrete strength testing data entry screen is shown in figure 13. The data inputs contained in this screen define the testing procedures to be used to measure concrete strength within the developed PRS. The testing-related inputs are divided into two groups: Testing and Acceptance.

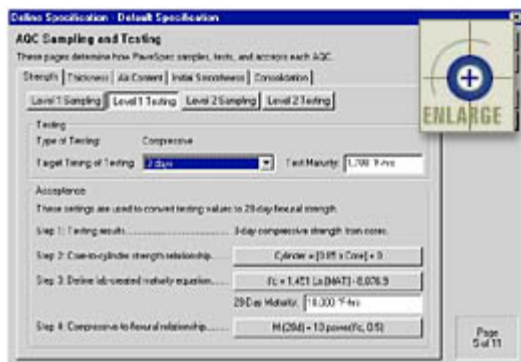


Figure 13.
AQC Sampling and Testing dialog box (Concrete Strength Testing data entry screen).

Within the testing group, the Type of Testing is provided as feedback. This testing type reflects the sample type chosen in the associated sampling data entry screen. The first input included in this testing group is the Target Timing of Testing. Use this input field to indicate the sample age at which testing is to be performed (e.g., if cylinders are to be tested at 7 days to obtain 7-day compressive strengths, this field should be set equal to 7 days). If the timing of testing is chosen to be less than 28 days, you must then enter an appropriate Test Maturity value. This value should be equal to the equivalent laboratory maturity representing the chosen number of days selected in the Target Timing of Testing list box.

The Acceptance group illustrates the steps required to estimate the 28-day flexural strength (required by the distress indicator models) based on the chosen sample type and timing of testing. Each of these steps will change based on the chosen sampling and testing procedures. If a button is visible next to any step description, a specific relationship needs to be defined by the user. For example,

the $\text{Cylinder} = [0.85 \times \text{Core}] + 0$ button is visible next to step 2 in figure 13. This button indicates that the user must define a cylinder vs. core relationship as part of the selected testing procedure. Clicking on the $\text{Cylinder} = [0.85 \times \text{Core}] + 0$ button brings up the Core-to-Cylinder Strength Relationship dialogue box shown in figure 14.

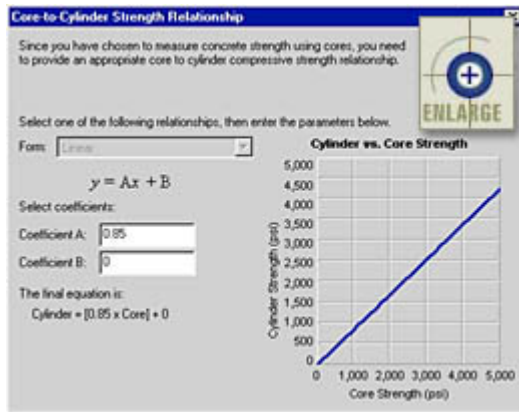


Figure 14.
Core-to-Cylinder Strength Relationship dialogue box.

The dialogue shown in figure 14 is used to define the appropriate linear relationship between cylinder and core strength. The equation form is displayed directly beneath the Form box. Next, the coefficients defining the actual chosen relationship are defined in the supplied coefficient input boxes. The chosen equation coefficients are then shown in the actual developed equation displayed beneath the coefficient input boxes. Finally, the right side of the dialogue box shows a preview graph of the user-defined relationship. This preview graph is provided to help you visualize the defined relationship.

The button associated with concrete strength acceptance step 3 brings up a dialogue box (if required) that allows you to define the required Laboratory-Created Maturity Equation (strength versus maturity relationship). The Equation Definition dialogue box is nearly identical to the Core-to-Cylinder Strength Relationship dialogue box. The only difference is that the equation form is not limited to linear. Available equation forms include Linear, Second-Order Polynomial, Third-Order Polynomial, Exponential, Logarithmic, and Power. The final piece of information required under step 3 is the specified 28-day Maturity. This value is the equivalent maturity measured in the laboratory at 28 days.

Finally, the button associated with step 4 allows you to define an appropriate Compressive Strength-to-Flexural Strength relationship (if required). This pop-up dialogue box is also nearly identical to the Core-to-Cylinder Strength Relationship dialogue box (shown in figure 14). As with the pop-up dialogue box discussed for step 3, the only difference is that the equation form is not limited to linear. Available equation forms include Linear, Second-Order Polynomial, Third-Order Polynomial, Exponential, Logarithmic, and Power.

Slab Thickness

Selecting the Thickness tab brings up a data entry screen used to define the slab thickness sampling and testing plan. An example of this data entry screen is shown in figure 15. If you chose to develop a level 1 and level 2 specification at the same time, separate data entry screens are provided for each specification level. You can toggle between the level 1 and level 2 data entry screens using

the **Level 1 Settings** and **Level 2 Settings** buttons. (Note: The level 1 and level 2 data entry screens are identical.) If you chose to only develop a level 1 specification, only the **Level 1 Settings** button will be displayed.



Figure 15.
AQC Sampling and Testing dialogue box (Slab Thickness data entry screen).

The data inputs contained in this data entry screen define how slab thickness is to be sampled under the developed PRS. First, you must select a sample type from the Sample Type list box: Use Strength Cores, Independent Cores, Probe, or Ground-Penetrating Radar. If the sample type selected is Use Strength Cores, the remaining input boxes reflect the concrete strength sampling plan defined in the Strength tab.

Additional required slab thickness sampling plan inputs include the Timing of Samples, Number of Sampling Locations per Sublot, and Number of Samples per Sampling Location (replicates). Finally, you may enter any relevant notes in the Additional Sampling or Testing Comments text box (this field is optional).

Entrained Air Content

Selecting the Air Content tab allows you to define the entrained air content sampling and testing plan. An example of this slab thickness sampling and testing data entry screen is shown in figure 16. If you chose to develop a level 1 and level 2 specification at the same time, separate data entry screens are provided for each specification level. You can toggle between the level 1 and level 2 data entry screens using

the **Level 1 Settings** and **Level 2 Settings** buttons. (Note: The level 1 and level 2 data entry screens are identical.) If you chose to only develop a level 1 specification, only the **Level 1 Settings** button will be displayed.

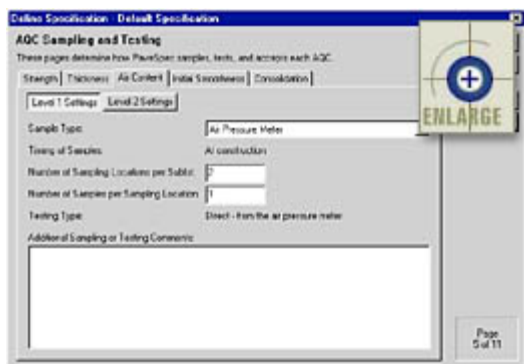


Figure 16.
AQC Sampling and Testing dialogue box (Air Content data entry screen).

The data inputs on this screen define how entrained air content is to be sampled under the developed PRS. You must first select one of the following three sample types provided in the Sample Type list box: Cores, Air Pressure Meter, or Danish Air Void Analyzer. If Cores is selected as the sample type, you must then specify when the cores are to be extracted from the pavement. (Note: The Timing of Samples input box is automatically set equal to At construction if the sample type selected is Air Pressure Meter or Danish Air Void Analyzer.) Next, you must define values for the other required entrained air content sampling plan inputs, including the Number of Sampling Locations per Sublot and Number of Samples per Sampling Location (replicates). Finally, you may enter relevant notes in the Additional Sampling or Testing Comments text box (field is optional).

Initial Smoothness

Selecting the Initial Smoothness tab allows you to define the sampling and testing plan associated with measuring initial smoothness. An example of this data entry screen is shown in figure 17. If you chose to develop a level 1 and level 2 specification at the same time, separate data entry screens are provided for each specification level. You can toggle between the level 1 and level 2 data entry screens using

the **Level 1 Settings** and **Level 2 Settings** buttons. (Note: The level 1 and level 2 data entry screens are identical.) If you chose to only develop a level 1 specification, only the **Level 1 Settings** button will be displayed.

Figure 17.
AQC Sampling and Testing dialogue box (Initial Smoothness data entry screen).

The inputs required on this data entry screen define how initial smoothness is to be sampled under the developed PRS. First, you must select the indicator which you would like to use to express smoothness over time. Two indicators are available in the Indicator of Smoothness Over Time list box: Present Serviceability Rating (PSR) and International Roughness Index (IRI).

Second, you must select the appropriate Initial Smoothness Indicator that specifies how initial smoothness is to be measured. The following three Initial Smoothness Indicator types are available:

- Profile Index (measured using a 0.0-mm blanking band).
- Profile Index (measured using a 5.1-mm blanking band).
- International Roughness Index.

Third, a button will appear (if required) that allows you to define a relationship between the chosen initial smoothness indicator and the initial smoothness over time indicator (PSR or IRI). This relationship is required to determine the initial PSR or IRI value in the prediction of smoothness over time. Based on the chosen settings for Indicator of Smoothness Over Time and Initial Smoothness Indicator, the appropriate equation type will be shown on the button. Clicking on the button will bring up the Define Initial to Over-Time Smoothness Indicator Translation Function dialogue box. This dialogue is nearly identical in layout and function to the Core-to-Cylinder Strength Relationship dialogue box shown in [figure 14](#). Within this

dialogue box, you can change the equation type or adjust the coefficients to define the appropriate smoothness-related relationship.

Other inputs included on this initial smoothness data entry screen include the Number of Pass Locations per Sublot and Number of Passes per Sampling Location (replicates). Additional text boxes are also included to allow you to enter comments related to the Pass Locations and the Timing of Samples (these two text fields are optional).

Percent Consolidation Around Dowels

Selecting the Consolidation tab brings up a data entry screen used to define the percent consolidation around dowels sampling and testing plan. An example of this data entry screen is shown in figure 18. If you chose to develop a level 1 and level 2 specification at the same time, separate data entry screens are provided for each specification level. You can toggle between the level 1 and level 2 data entry screens

using the **Level 1 Settings** and **Level 2 Settings** buttons. (Note: The level 1 and level 2 data entry screens are identical.) If you chose to only develop a level 1 specification, only

the **Level 1 Settings** button will be displayed.

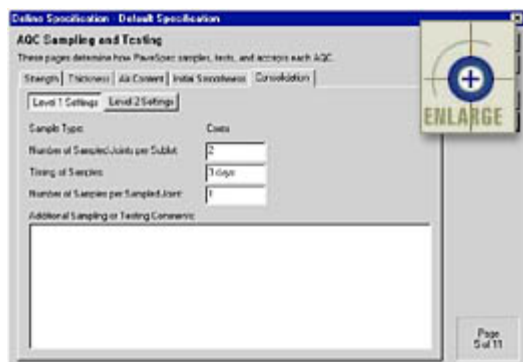


Figure 18.
AQC Sampling and Testing dialogue box (Percent Consolidation Around Dowels data entry screen).

The data inputs contained in this data entry screen define how percent consolidation around dowels is to be sampled under the developed PRS. Under the current PRS approach, percent consolidation around dowels is measured by conducting relative density testing of core samples. Additional inputs required on this data entry screen include the Number of Sampled Joints per Sublot, Timing of Samples (timing of extracting cores), and the Number of Samples per Sampled Joint (replicates). You may also enter additional notes in the Additional Sampling or Testing Comments text box (this field is optional).

Page 6—AQC As-Designed Target Value Definition

The as-designed target AQC target means and standard deviations are defined on page 6 of the Specification Wizard. If you chose to define a level 1 and level 2 specification at the same time, this dialogue box will contain two tabs titled Level 1 Settings and Level 2 Settings. If you only chose to develop a level 1 specification, only the Level 1 tab will be visible. The level 1 and level 2 data entry screens are identical, and an example is presented in figure 19.

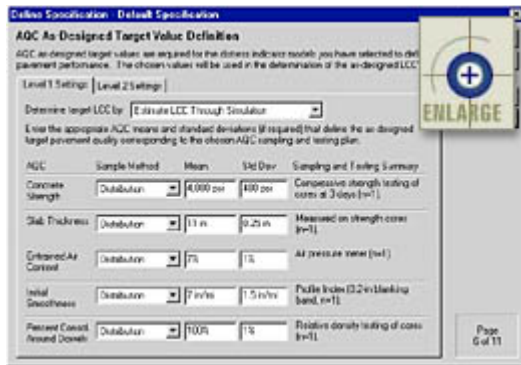


Figure 19.
AQC As-Designed Target Value Definition dialogue box.

First, you must decide on the method by which you would like to determine the as-designed target LCC. The following options are available:

Estimate LCC Through Simulation—This is the recommended method for estimating the as-designed target LCC because it incorporates both the AQC target means and standard deviations.

Specify LCC Directly—This method can be used if you have previous knowledge of what the as-designed LCC should be. If you select this method, you will be prompted to enter an appropriate as-designed target LCC unit cost (expressed in \$/mi or \$/km). You will not have to enter any AQC means or standard deviations to determine the as-designed target LCC.

Calculate LCC Using AQC Means Only—If you want to simulate LCC's that are not influenced by the AQC variability (standard deviation), you may choose this option. You will only be required to enter the appropriate AQC means. The remainder of the data entry sheet contains input fields used to select the AQC as-designed target values. Only values for those AQC's selected for inclusion in the PRS are required. The input fields for those AQC's not included in the specification are grayed out, signifying that you cannot enter data.

If you choose to estimate the LCC through simulation, for each AQC included in the specification you must identify a **Sample Method** by which samples will be determined, a target AQC **Mean** value, and a target AQC standard deviation (**Std Dev**). You can choose from two different methods for determining samples within the simulation of the as-designed LCC: **Include Variability** or **Means Only**. If **Include Variability** is chosen, random as-designed samples are determined based on a normal distribution defined by the inputted AQC mean and standard deviation. If **Means Only** is chosen, sample values are assumed to be equal to the mean value that you entered. For this case, we assume that the variability of this AQC is not important. For example, let's assume that concrete strength has been "specified" at 4,000 psi. Therefore, only one strength pay factor curve (the case for strength std dev = 0 psi) will be developed in the strength pay factor chart. All other pay factor curves will be simulated with the strength samples specified equal to 4,000 psi (with std dev = 0 psi). Similarly, if the **Calculate LCC Using AQC Means Only** option is chosen, all AQC pay factor charts will only contain one curve each (the case with std dev = 0).

As mentioned previously, PaveSpec uses English units as defaults. Values input in metric units are automatically converted to the corresponding English units. When entering an appropriate value in one of these input boxes, type the value followed by the appropriate units abbreviation (e.g., "254 mm"). Acceptable unit abbreviations for each AQC are as follows:

Concrete Strength—Default metric values are displayed in terms of "MPa," whereas English values are in terms of "psi".

Slab Thickness—Acceptable metric abbreviations include "mm" and the default metric unit "cm". The default English values are expressed in terms of "in".

Air Content—Default units for this field are "%".

Initial Smoothness—Default metric values are expressed in terms of "mm/km", while English values are in terms of "in/mi".

Percent Consolidation Around Dowels—Default units for this field are "%".

(Note: Within any numerical input box, you may toggle between default English and metric units using the "`" key.)

Finally, the Sampling and Testing Summary area of the dialogue box provides feedback regarding the specific sampling and testing procedures defined on page 5 of the [Specification Wizard](#). This information is important because the AQC target values typically differ for different sampling and testing procedures.

Page 7—Live-Cycle Cost-Related Modules

The life-cycle cost-related variables used in defining a specification are grouped into two types of module documents—[Maintenance and Rehabilitation Plan](#) and [Unit Costs](#) modules. Again, this organization not only simplifies the logic of the process, but it also allows you to save and reuse these groups of variables, which, in turn, simplifies the data entry itself. An example of the [Life-Cycle Cost-Related Modules](#) dialogue box is presented in figure 20.



Figure 20. Life-Cycle Cost-Related Modules dialogue box.

You can access existing modules by clicking on the appropriate drop-down arrow and highlighting the module you wish to use. To make changes to a displayed module, click the **Edit..** button associated with that module type. To create a new module, click on the **New..** button. Whether you decide to edit an existing module or create a new one, the data entry screens will be the same (only the displayed input values will be different). The data entry procedures for each module type will be discussed separately.

Maintenance and Rehabilitation Plan Module

An example of the dialogue box used to define a Maintenance and Rehabilitation Plan module is presented in figure 21. The Maintenance and Rehabilitation Plan dialogue includes a Name input box and four tabs titled Maintenance, Local Rehab, Global Rehab, and Description. By default, the Maintenance tab is displayed when you first enter into the Maintenance and Rehabilitation Plan dialogue box.

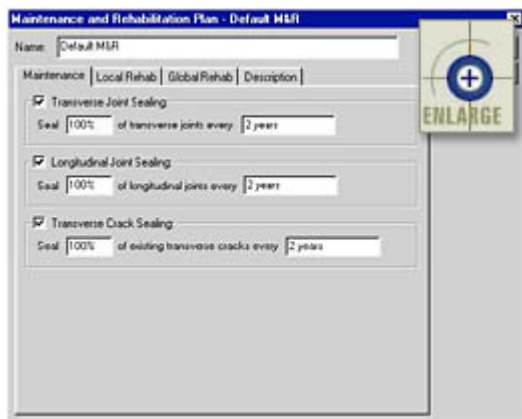


Figure 21.
Maintenance and Rehabilitation Plan Module
dialogue box.

You can change the name of the Maintenance and Rehabilitation Plan module by entering a new name in the Name input box. The name you enter will show up as the specification document name in the Modules tab of the Database Control dialogue box.

Maintenance Tab

The Maintenance tab allows you to define the type, amount, and timing of routine maintenance activities used in the computation of LCC's. Three different types of maintenance activities may be considered: transverse joint sealing, longitudinal joint sealing, and transverse crack sealing. To select one or more of these maintenance activities for inclusion in the M&R plan, click on the activity's name or the corresponding check box.

The details of the routine maintenance plan are determined by defining: (1) how often the sealing crew will go to the field and (2) what percentage of joints or cracks will be sealed each time they go to the field. For example, if the agency typically seals 100 percent of transverse joints every 3 years on a repetitive schedule, the transverse joint sealing sentence should read "Seal 100% of transverse joints every 3 years." You should define each of these descriptive sentences carefully to match the routine maintenance methods actually used by your agency.

Local Rehab Tab

The Local Rehab tab (displayed in figure 22) allows you to define the localized rehabilitation plan in terms of a step-by-step prioritized procedure. Specifically, you can:

Specify and prioritize the types of localized rehabilitation to be applied in response to the predicted pavement performance.

Specify the trigger values used to determine when each rehabilitation activity is to be applied.

Define the conditions that trigger the first application of a global rehabilitation.

The complete list of localized rehabilitation steps is organized into a prioritized list in the main scroll box of this data entry screen.

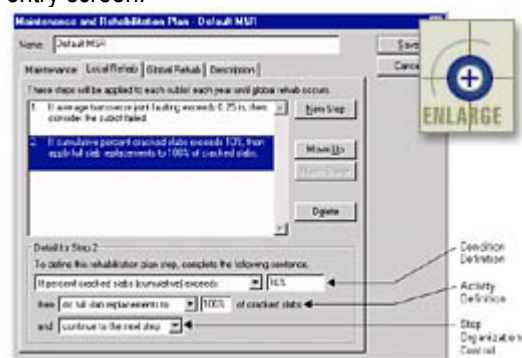


Figure 22.
Local Rehab tab in the Maintenance and
Rehabilitation Plan dialogue box.

To create a new step in the prioritized list, first select the step in the list that you would like the new step to follow.

Next, click on the **New Step** button. If a step is accidentally inserted in the wrong place, or if you wish to change the order of the steps at any time, use the **Move Up** and **Move Down** buttons. To delete a step from the list, highlight it and click on the **Delete** button.

Condition Definition of a Localized Rehabilitation Step

The details making up each step in the prioritized list are defined using the input fields grouped at the bottom of the data entry screen. When an existing step is selected, the input settings making up the step description are defined by making changes in these input fields. Each step description is developed in the form of an If...then statement (i.e., if a certain pavement condition is present, then do activity X).

The first of the three lines of inputs (defined as the Condition Definition line, as shown in figure 22) is used to define a specific pavement condition. The first list box on the condition definition line allows you to select a pavement performance-related condition to which an action is to be applied. The list is mostly made up of predetermined "If" statements; however, you can also select to apply rehabilitation activities every year by selecting Always from the list, or at constant intervals (e.g., every 2 years) by selecting Every from this list. The different mechanisms available for determining when localized rehabilitation is applied are described below.

Applied at regular time intervals—If the agency is confident that it will apply a certain type of localized rehabilitation activity at regular time intervals over the life of a pavement, then select Every from the condition list. The second box in the condition definition line then becomes the input box for the specific time interval. For example, the condition definition line could read Every 3 years.

Based on individual subplot performance conditions—Using the PRS approach, the performance of each subplot is expressed in terms of predicted distress indicators. As stated in chapter 4 of volume I, it is recommended that the timing of the first global rehabilitation for a lot be based on the percentage of sublots determined to be failed (PSF). One method for determining if a particular subplot is failed is by comparing the predicted distress indicator levels to user-defined trigger values. The condition definition list box contains the following seven subplot pavement performance conditions to which defined trigger values may be applied:

If percent cracked slabs (cumulative) exceeds.... This condition triggers on the cumulative percentage of cracked slabs (both fixed and unfixed).

If percent cracked slabs (unfixed) exceeds.... This condition triggers on only the unfixed percentage of cracked slabs (i.e., cumulative percentage of cracked slabs minus the cumulative amount already fixed).

If average transverse joint faulting exceeds....

If percent spalled joints (cumulative) exceeds.... This condition triggers on the cumulative percentage of spalled joints (both fixed and unfixed).

If percent spalled joints (unfixed) exceeds.... Triggers on only the unfixed percentage of spalled joints (i.e., cumulative percentage of spalled joints minus the cumulative amount already fixed).

If PSR is less than....

If IRI is greater than....

If any of these seven items is selected, the second condition definition input box becomes the input box for the corresponding trigger value. The appropriate units for the corresponding trigger values are the following:

Percent cracked slabs—Default unit for this trigger value is "%".

Average transverse joint faulting—Acceptable metric abbreviations include "cm" and the default units of "mm", with the default English values in terms of "in".

Percent spalled joints—Default unit for this trigger value is "%".

PSR—This indicator is expressed as a number between 0 and 5; it is dimensionless.

IRI—Metric values are expressed in terms of "mm/km", while English values are in terms of "in/mi".

Based on the cumulative amount of applied localized rehabilitation for an individual subplot—An individual subplot may also be considered failed if certain amounts of repairs (localized rehabilitation) have been applied (e.g., the subplot is considered failed if 35 percent of the total slabs have been replaced). The condition definition list box contains the following four subplot cumulative localized rehabilitation conditions to which defined trigger values may be applied:

If repaired joints per mile exceeds....



If percent of repaired joints exceeds....

If repaired slabs per mile exceeds....

If percent of repaired slabs exceeds....

If any of these four items is selected, the second condition definition input box becomes the input box for the corresponding trigger value. The appropriate units for the corresponding trigger values are the following:

Repaired joints per mile—This indicator is expressed as a number with no dimensions.

Percent of repaired joints—Default unit for this trigger value is "%".

Repaired slabs per mile—This indicator is expressed as a number with no dimensions.

Percent of repaired slabs—Default unit for this trigger value is "%".

Based on the lot average of subplot performance conditions—If you do not want to use the percentage of sublots failed approach for determining the timing of the first global rehabilitation application, you can choose to base this event on the average of the yearly predicted subplot distresses. In other words, at each year of the analysis life, the individual subplot distresses are computed and then averaged for the entire lot. These lot averages of yearly subplot distresses are then compared to user-defined trigger values to determine the timing of the first global rehabilitation application. The condition definition drop-down box contains the following five lot average conditions to which defined trigger values may be applied:

If lot average percent cracked slabs exceeds....

If lot average transverse joint faulting exceeds....

If lot average percent spalled joints exceeds....

If lot average PSR is less than....

If lot average IRI is greater than....

If any of these five items is selected, the second condition definition input box becomes the input box for the corresponding trigger value. The appropriate units for the corresponding trigger values are the following:

Lot average percent cracked slabs—Default unit for this trigger value is "%".

Lot average transverse joint faulting—Acceptable metric abbreviations include "cm" and the default units of "mm", whereas English values are expressed in terms of "in".

Lot average percent spalled joints—Default unit for this trigger value is "%".

Lot average PSR—This indicator is expressed as a number between 0 and 5; it is dimensionless.

Lot average IRI—Metric values are expressed in terms of "mm/km", while English values are in terms of "in/mi".

The last input in the condition definition drop-down box is If percent sublots failed exceeds.... This allows you to use the percent sublots failed (PSF) condition that will trigger the first application of a global rehabilitation. If this item is selected, the second condition definition input box becomes the input box for the corresponding trigger value. The PSF trigger value is expressed in units of "%".

Activity Definition of a Localized Rehabilitation Step

Once a specific condition is defined, you must determine what type of activity to apply in response to it. The second line of input fields in the Localized Rehab data entry tab (referred to as the Activity Definition line, as shown in [figure 22](#)) is used to define this responsive activity. The available activity items are described below.

Do nothing—You have the option to select Do no rehab for this step from the activity list. If this item is selected, the remaining input boxes making up the Activity Definition line disappear.

Apply localized rehabilitation in response to individual subplot performance conditions—If you have selected a condition item that defines a trigger on an individual subplot performance condition (e.g., If percent cracked slabs exceeds 10%), then the following localized rehabilitation-responsive activities are available:

Do partial slab replacements to....

Do full slab replacements to....

Do full-depth repairs to....

Do partial-depth repairs to....

If any of these four items is selected in the activity input list box, the second input box will allow you to input a percentage of the cracked slabs or spalled joints that will be replaced during the year. Those cracked slabs or spalled joints that are not fixed during a particular year are carried over to the next year.

Note: The localized rehabilitation activities are limited to repairing cracked slabs (transverse slab cracking) or spalled joints (transverse joint spalling). The effects of transverse joint faulting and pavement smoothness (PSR or IRI) are addressed with global rehabilitation.

Designate the subplot as failed—If the PSF method is being used to determine the timing of the first global rehabilitation application, you need a method to designate the subplot as failed. Therefore, in response to a defined set of individual subplot performance conditions, or cumulative applied localized rehabilitation, you can choose to consider the subplot failed activity item.

Apply a global rehabilitation scenario—You may choose to apply a global rehabilitation in response to any of the available condition types. The activity list contains three predefined global rehabilitation scenarios (these will be discussed under the explanation of the Global Rehab tab). These correspond to the following three choices contained in the activity input list:

Begin global rehab scenario 1.

Begin global rehab scenario 2.

Begin global rehab scenario 3.

Step Organization Control

The third line of input fields in the Localized Rehab data entry tab (referred to as the Step Organization Control input, as shown in figure 22) provides some additional control for determining the behavior of the prioritized list. This drop-down box contains the following three inputs:

Continue to the next step.

Jump to step number.

STOP for this year.

These determine what action is to be taken after the defined activity of a step is applied. The default value for this input list box is Continue to the next step; however, the other two options become very useful when organizing a complicated prioritized list.

Global Rehab Tab

The Global Rehab tab allows you to define up to three different global rehabilitation scenarios. Each scenario includes the localized rehabilitation to be completed before the first global rehabilitation application, as well as details of how global rehabilitations are to be applied over the analysis period. An example of the Global Rehab tab is displayed in figure 23.



Figure 23.
Global Rehab tab in the Maintenance and Rehabilitation Plan dialogue box.

The Global Rehab tab contains buttons that allow you to define up to three different global rehabilitation scenarios. (Note: The input fields are identical within each of the three scenario data entry screens.)

On the Global Rehab screen, the first area (titled Prior to First Global Rehabilitation Application) allows you to define the types and amount of localized rehabilitation to be completed prior to applying the first global rehabilitation. The localized rehabilitation is limited to repairing cracked slabs (due to transverse slab cracking) or repairing transverse joints (due to transverse joint spalling). You may first select which of these localized rehabilitation types to apply (if any) by clicking on the corresponding check box. If a localized rehabilitation type is selected for inclusion, you must enter the percentage (between 0 and 100 percent) of cracked slabs or spalled joints you wish to repair, then select the method to be used to repair them.

The second area on this screen (titled Global Rehabilitation Sequence) is used to define the details of the global rehabilitation schedule making up the scenario. The scenario allows you to define different global rehabilitations up until the fourth application. For example, you could choose to apply diamond grinding for the first two scheduled global rehabilitations and asphalt overlays for all subsequent applications. You must also input an assumed life for each chosen global rehabilitation (i.e., number of years until next global rehabilitation is applied), as well as an assumed smoothness value in terms of chosen smoothness over time indicator (PSR or IRI) at the start and end of the global rehabilitation's life. The smoothness during the defined rehabilitation life is assumed to decrease linearly from the chosen starting smoothness value to the chosen ending smoothness value.

Description Tab

The Description tab contains a text box in which you may enter any detailed text describing the defined Maintenance and Rehabilitation Plan module. Information entered in this tab is not used in the simulation process, so it is completely optional. An example of the Description tab is shown in figure 24.

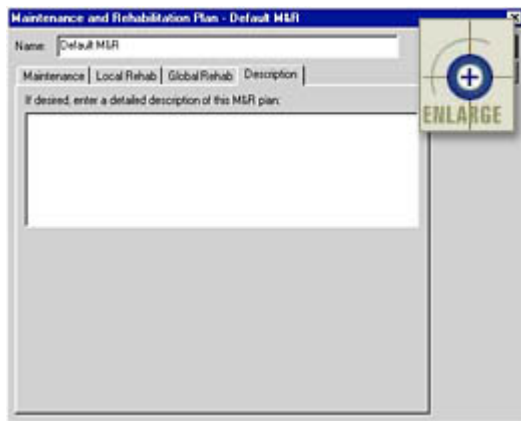
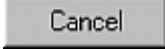


Figure 24.
Description tab in the Maintenance and Rehabilitation Plan dialogue box.

Saving or Exiting the Maintenance and Rehabilitation Plan Module Dialogue Box

Once you are finished defining a Maintenance and Rehabilitation Plan module, click on the  button to save your named module. If you would like to exit the Maintenance and Rehabilitation Plan dialogue box without

Cancel

saving your changes, click on the  button. Clicking either button will return you to the Life-Cycle Cost-Related Modules dialogue box.

Unit Costs Module

An example of the dialogue box used to define a Unit Costs module is presented in figure 25. The Unit Costs dialogue box includes a Name input box and three tabs titled Maintenance, Rehabilitation, and Other. By default, the Maintenance tab is displayed when you first enter the Define Unit Costs dialogue.



The screenshot shows the 'Define Unit Costs - Default Costs' dialog box with the 'Maintenance' tab selected. The 'Name' field contains 'Default Costs'. The 'Maintenance' tab is active, showing a list of activities with their respective unit costs and units. The 'Rehabilitation' and 'Other' tabs are also visible but not selected. An 'ENLARGE' button is located on the right side of the dialog box.

Activity	Unit Cost	Unit
Transverse Joint Sealing	\$1.20	per foot
Longitudinal Joint Sealing	\$1.00	per foot
Transverse Crack Sealing	\$1.00	per foot
User cost percentage to include:	0%	
Year to use for user cost inflation:	1998	

Figure 25.
Define Unit Costs dialogue box.

You may change the name of the Unit Costs module by entering a new name in the Name input box. The name you enter will show up as the specification document name in the Modules tab of the Database Control dialogue box.

Maintenance Tab

The maintenance-related unit costs are defined in the Maintenance tab of the Define Unit Costs module dialogue box (shown in figure 24). For each listed maintenance activity, you must input an appropriate unit cost in dollars and select the appropriate unit from the corresponding list box.

Rehabilitation Tab

The localized and global rehabilitation-related unit costs are defined in the Rehabilitation tab. An example of the Rehabilitation tab is shown in figure 26. For each listed rehabilitation activity, you must input an appropriate unit cost in dollars and select the appropriate unit from the corresponding list box.



The screenshot shows the 'Define Unit Costs - Default Costs' dialog box with the 'Rehabilitation' tab selected. The 'Name' field contains 'Default Costs'. The 'Rehabilitation' tab is active, showing a list of activities under 'Localized Unit Costs' and 'Global Unit Costs' with their respective unit costs and units. The 'Maintenance' and 'Other' tabs are also visible but not selected. An 'ENLARGE' button is located on the right side of the dialog box.

Activity	Unit Cost	Unit
Full-depth repairs of transverse joints:	\$470.00	per sq. yard
Partial-depth repairs of transverse joints:	\$450.00	per sq. yard
Full slab replacements:	\$470.00	per sq. yard
Partial slab replacements:	\$80.00	per sq. yard
Global Unit Costs		
AC overlay:	\$9.00	per sq. yard
PCC overlay:		per sq. yard
Diamond grinding:		per sq. yard

Figure 26.
Rehabilitation tab in the Define Unit Costs dialogue box.

Other Tab

The Other tab contains miscellaneous unit cost-related items required to compute LCC's. For example, the interest and inflation rates required for determining present-worth LCC's are included in this tab (Discount Rate = Interest Rate – Inflation Rate). Other input boxes include the assumed width of a full-depth or partial-depth joint repair (required if the joint repair unit cost is expressed in terms of dollars per area) and the assumed width of a partial slab replacement.

A text box is also included in which you may enter text describing the defined Unit Cost module. This field is optional. An example of the Other tab in the Define Unit Costs dialogue box is presented in figure 27.

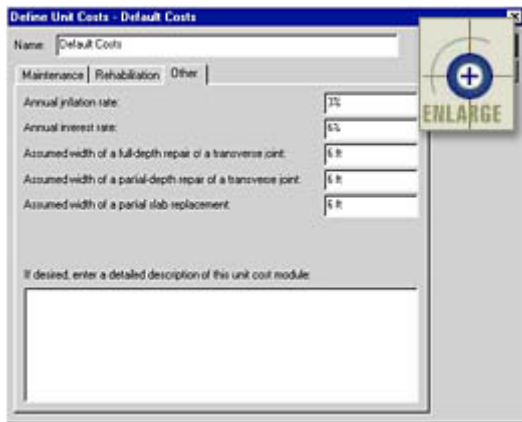




Figure 27.
Other tab in the Define Unit Costs dialogue box.

Saving or Exiting the Define Unit Costs Module Dialogue Box

Once you are finished making changes or defining a Unit Cost module, click on the  button to save your named module. If you would like to exit the Unit Cost dialogue box without saving your changes, click on the  button. Clicking either button will return you to the Life-Cycle Cost-Related Modules dialogue box.

Page 8—Simulation Control

Details regarding the simulation process are defined on page 8 of the Specification Wizard. The tab displayed when you first enter this page, titled Generic Settings, contains all of the simulation parameters that do not change between a level 1 and level 2 specification. The additional tabs depend on the AQC's you selected to include in the specification. Clicking on the appropriate AQC tab will bring up a data entry screen used to define the level 1 pay factor curves for that AQC. An example of the Simulation Control dialogue box is presented in figure 28.



Figure 28.
Simulation Control dialogue box.

Generic Settings Tab

The Generic Settings tab is made up of five different inputs that define the simulation procedures used to develop level 1 and level 2 preconstruction output. First, you must define the number of lots used to simulate each factorial point (a value of 500 is recommended). If this value is set at 500, it means that the level 2 as-designed LCC will be computed as the average of 500 simulated lot LCC's. For the level 1 pay factor curves, each simulated point used to define each curve will also be based on the average of 500 simulated lot LCC's.

The second and third inputs in the Generic Settings tab define the minimum and maximum number of sublots per lot to be considered in the simulations. These inputs are required because an agency never knows ahead of time (i.e., before going out into the field) how many sublots will make up the next lot. Since the number of sublots per lot affects the computed pay factors, the program allows you to simulate the same specification for different numbers of expected sublots per lot. The minimum and maximum sublots selected in these inputs defines the range over which preconstruction output will be simulated. For example, if you select to simulate 1 to 4 sublots per lot, different level 1 pay factor curves will be developed for the cases of 1, 2, 3, and 4 sublots. For the level 2 specification, four different as-designed LCC's (representing 1, 2, 3, and 4 sublots) will be simulated.

The fourth input on this tab is the assumed contractor bid price used to compute the level 1 pay factors. It is recommended that this assumed price be an average contractor bid price computed using historical agency bid price data. This input may be entered in metric units of "\$/m²" or English units of "\$/yd²".

Finally, the last input in the Generic Settings tab defines the analysis life used for computing LCC's. This is the period of time over which future M & R costs are to be considered in the LCC analysis.

AQC-Related Tabs

The tabs for the included AQC's are identical in layout and function. Each AQC-related tab is provided to define the level 1 pay factor curves (for the specific AQC) that make up the level 1 preconstruction output. An example of one of these tabs (Strength) is presented in figure 29.

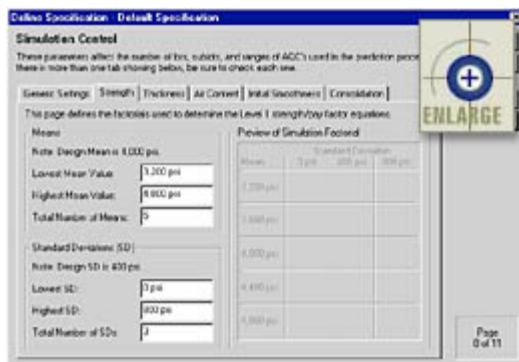


Figure 29.
Example of an AQC-related tab within the Simulation Control dialogue box.

Each AQC-related tab is used to define a factorial design of combinations of AQC mean and standard deviation. The simulated pay factors are used to develop level 1 pay factor curves. The AQC-related tab is divided into the following three areas:

Means—Use these three input boxes to define the minimum and maximum mean values, as well as the total number of mean values to be considered in the factorial design. The total range identified by the selected minimum and maximum values is divided equally based on the total number of means being considered. (Note: The target mean will always be included as one of the factorial's means; therefore, it may be added as an extra mean value if needed.) The level 1 target mean is displayed for your convenience.

Standard Deviation (SD)—Use these three input boxes to define the minimum and maximum standard deviation values, as well as the total number of standard deviation values to be considered in the factorial design. A separate pay factor curve (and corresponding equation) will be developed for each chosen standard deviation value. Just as with the mean values, the total range identified by the selected minimum and maximum standard deviation values is divided equally based on the total number of standard deviations being considered. The target standard deviation will always be included as one of the factorial's standard deviations; therefore, it may be added as an extra standard deviation value if needed. The level 1 target standard deviation is displayed for your convenience.

Preview—The preview area shows a tabular interpretation of the factorial design created by your choices of means and standard deviations. A pay factor will be simulated for each combination of mean and standard deviation shown in this preview box. Any changes made in the Means and Standard Deviation areas will be reflected in the preview.

Page 9—Building Document And Preconstruction Output

The simulation of preconstruction output begins on page 9 of the Specification Wizard. The Building Document and Preconstruction Output dialogue box is provided as a status window for this simulation process. An example of this dialogue box is presented in figure 30.



Figure 30.
Building Document and Preconstruction Output
dialogue box.

The dialogue box is divided into two parts. The first part contains a list of the different tasks being performed, including initializing (building) the specification output document, conducting the as-designed simulations, conducting the simulations defined in the AQC level 1 factorials, and summarizing the simulated data. The percentage completed is displayed beside each task description.

An Overall Completion Status bar is also included at the bottom of the dialogue box. This status bar illustrates the in-progress status of the number of lots and sublots being predicted (simulated). When complete, the visual status bar will be replaced with a message that states, The document is up-to-date with your specification settings. If changes are made in any previous step of the Specification Wizard after the simulation is complete, the specification document will be resimulated when you get to this page.

After the specification has been simulated, the Level 1 Preconstruction Output Control dialogue box allows you to specify the level 1 regression equations fit through the simulated pay factor data. An example of this dialogue box is presented in figure 31.

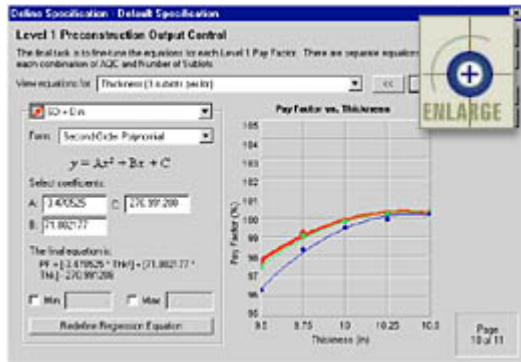




Figure 31.
Level 1 Preconstruction Output Control dialogue box.

The first list box, View equations for, contains a list of all the simulated pay factor charts. Each chart represents the simulated data for the combination of one AQC and one number of sublots per lot. For example, if you selected all five AQC's for inclusion in the specification, and you chose to simulate level 1 preconstruction output for four different numbers of sublots per lot, then this list box will contain $5 * 4 = 20$ level 1 pay factor charts. You may view any pay factor chart by selecting it from the View equations for list box or by using the  and  buttons to scroll through the list.

Each pay factor chart contains simulated data making up the pay factor curves. Each pay factor curve is specific to one standard deviation. The area on the left side of the Level 1 Preconstruction Output Control dialogue box contains a number of different input fields used to specify the pay factor curves and corresponding equations. You can select a particular pay factor curve within the selected pay factor chart using the drop-down box just below the View equations for box. This box lists all the available pay factor curves by AQC standard deviation. This list is also color-coded to match the curves in the displayed pay factor chart.

After you select a specific pay factor curve, you may use the remaining input fields to define the regression equation representing this curve. The first step is to select the regression equation form you would like to use. The program provides five different equation forms: linear, second-order polynomial, third-order polynomial, exponential, and logarithmic. An example of the chosen equation form is displayed below the Form box.

By default, when you first select a different equation form, the displayed coefficients are those automatically determined by the program's regression analysis tool. The final equation (including coefficients) will be displayed at the bottom of the dialogue box. You may also choose to change the equation coefficients. If you wish to reset the coefficients to those determined automatically by PaveSpec, simply click on

the  button.

It is recommended that you view each pay factor curve independently to make sure that you are content with the defined curve and corresponding equation. The level 1 individual AQC pay factor equations defined in this dialogue box will be used in the field to compute level 1 individual AQC contractor pay factors.

Page 11—Level 1 Composite Pay Factor Equation Definition

To compute an overall level 1 lot pay factor, a level 1 composite pay factor equation needs to be defined as a function of the individual AQC level 1 pay factors. This dialogue box allows you to define the actual composite pay

factor equation to be used in the computation of contractor pay factors. An example of this composite pay factor-related dialogue box is presented in figure 32.



Figure 32.
Level 1 Composite Pay Factor Equation Definition
dialogue box.



First, you must choose the composite pay factor equation form from the provided list box. Five different equation forms are provided for use within PaveSpec: Simple Average, Weighted Average, Product, Minimum, and Maximum. If Weighted Average is chosen as the equation form, the individual weighting factors are entered in the provided input boxes. The final defined Level 1 composite pay factor equation, used in the computation of actual contractor pay factors, is then displayed toward the bottom of this dialogue box.

Using a Specification



After a specification has been defined, and the corresponding preconstruction output has been generated, the specification may then be used to accept as-constructed JPCP lots. Actual AQC data may be entered into PaveSpec using the program's *Use Specification* section. This chapter describes all aspects of the *Use Specification* section of the program, including entering actual AQC field data, generating and viewing PRS lot pay factors and pay adjustments, and viewing project summary reports.

Creating And Editing Use Specification Documents

Each *Use Specification* document is developed in reference to a previously simulated specification. A new *Use Specification* document may be created using one of the following three methods:

1. Select the *Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then select *Use Specification* from the *File* menu.
2. Select the *Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then click on the  toolbar button.
3. Select a previously defined *Use Specification* document under the same specification (contained in the *Specifications* tab of the Database Control dialogue box), then click on the  button.

An existing *Use Specification* document may be edited using one of the following methods:

1. Select the *Use Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then select *Setup* from the *File* menu.
2. Select the *Use Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then click on the  toolbar button.
3. Select the *Use Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then click on the  button.

Use Specification Main Screen

When you create a new *Use Specification* document, the dialogue box shown in figure 33 will appear. This dialogue box consists of two parts: a *Name* input box and a project summary area.





Figure 33.
Example of the *Use Specification* document main screen.

You may change the name of the *Use Specification* document by entering a new name in the *Name* input box. The name you enter will show up as the *Use Specification* document name in the *Specifications* tab of the Database Control dialogue box.


The project summary area contains general information about the user-defined as-constructed lots. This information consists of the lot number, paving date, starting and ending stations, computed lot length, and the number of sublots contained in each lot. When you first begin to create a new *Use Specification* document, this area will be blank (as shown in figure 33).

Finally, you must also enter the actual *Contractor Unit Bid Price* (note that a selected *average* bid price was used to develop the specification) and final *Lot Width* to be used in determining the actual contractor pay adjustments. Although the lot width is defined in the specification development steps, the actual value used for computing pay adjustments is required here to avoid any confusion.

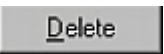
Creating a New Lot

To define a new lot in an open *Use Specification* document, click on the  button. This action will add a new lot to the end of the list in the project summary area. Clicking on the  button will also bring up the *View/Edit Lot* dialogue box.

Editing an Existing Lot

To edit an existing lot, first select the lot in the project summary area, then click the  button. This action will activate the *View/Edit Lot* dialogue box. (Note that double-clicking on a lot description will also bring up the *View/Edit Lot* dialogue box.)

Deleting an Existing Lot

To delete an existing lot, first select the lot in the project summary area. Next, click the  button. This action will remove the selected lot from the list in the project summary area.

Entering Actual Lot Information

Actual AQC field data are entered into PaveSpec using the *View/Edit Lot* dialogue box. This dialogue can contain up to three different tabs: *Lot Information*, *Samples (Level 1)*, and *Samples (Level 2)*. The *Samples (Level 2)* tab will only be available if you chose to simulate a Level 1 and Level 2

specification at the same time. (Note: The input fields under the *Samples (Level 1)* and *Samples (Level 2)* tabs are identical.) An example of the *View/Edit Lot* dialogue box is presented in figure 34.

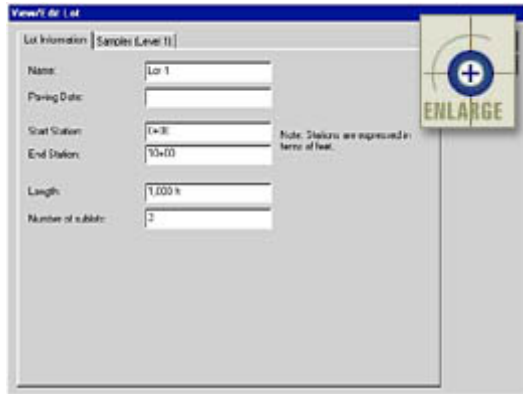


Figure 34.
Example of the *View/Edit Lot* dialogue box.

General Lot Information

When you are creating or editing a lot, the general lot information is contained in the *Lot Information* tab of the *View/Edit Lot* dialogue box. The inputs defined within this tab are used to describe the lot in the project summary area of the *Use Specification* document main screen.

When you choose to create a new lot, the default lot *Name* will automatically be set to the next consecutive lot number (i.e., if the previous new lot name was *Lot 4*, the next new default lot *Name* will be *Lot 5*). You can rename the lots if you choose to do so.

The *Start Station*, *End Station*, and *Lot Length* inputs all have default metric units of "m" and default English units of "ft". Note: For the *Lot Length*, you may toggle between metric and English units using the "`" key.

Obviously, you will not know the final *Number of Sublots* prior to the paving of a lot; therefore, when defining a new lot, you should input your best estimate of the number of sublots expected to be included in that lot.

Actual AQC Sampling and Testing Data

Actual Level 1 and Level 2 AQC sampling and testing data are input for Level 1 and Level 2 specifications in the *Samples (Level 1)* and *Samples (Level 2)* tabs, respectively. If you are creating a new lot, the Level 1 or Level 2 sample input tab would appear mostly blank, as shown in figure 35.

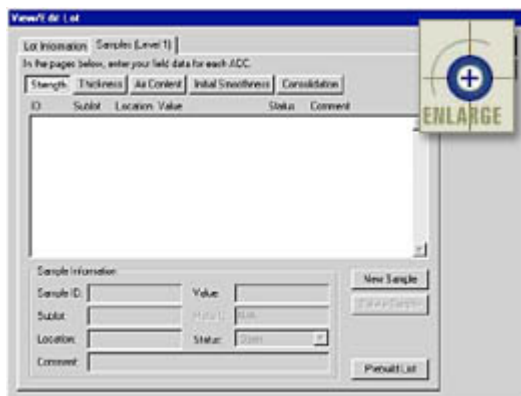



Figure 35.
Example of a *Samples* tab in the *View/Edit Lot* dialogue box.

These tabs allow you to enter AQC sampling and testing data for all the user-chosen AQC's. Clicking on the buttons across the top of the data input screen (labeled by AQC name) allows you to toggle between data input screens for each chosen AQC.

Prebuilding a Sample List

The easiest means of getting started entering actual field data is by using the *Prebuild List* on each AQC data input screen. As mentioned previously, when you are defining an actual lot for the first time, the sample list within each AQC data input screen will be blank. You can prebuild an AQC sample list that reflects your choices for the estimated number of sublots per lot and the previously chosen AQC sampling and testing plan. For example, if you had estimated four sublots per lot, and you defined your strength sampling plan to include five strength samples per subplot, then the strength sample list would be prebuilt to include $4 * 5 = 20$ samples.

To use the *Prebuild List* option, simply click on the  button on the AQC data input screen. Use the vertical scroll bar to view the complete list of samples. An example of the *View/Edit* dialogue box showing a prebuilt list is shown in figure 36.

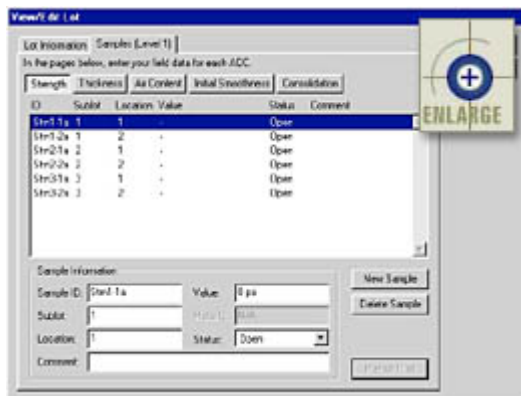


Figure 36.
Example of a prebuilt list in the *View/Edit Lot* dialogue box.

When you use the *Prebuild List* command, PaveSpec assigns default sample ID's to each of the AQC samples. Each default ID is made up of the following parts:

- **AQC Sample Type Code**—The first few characters of the default sample ID designate the AQC sample type (i.e., *Strn* = strength, *Thk* = thickness, *Air* = air content, *Smth* = initial smoothness, and *Cons* = percent consolidation around dowels).
- **Sublot Number**—The number following the AQC sample type code designates the corresponding subplot (e.g., the sample ID of "Strn1a2" represents subplot 1).
- **Sample Location**—The letter following the AQC subplot number designates the sample location within the subplot (e.g., the sample ID of "Strn1a2" represents sample location "a" within subplot 1).
- **Replicate Number**—The last number in the default ID represents the sample replicate number at the chosen sample location (e.g., the sample ID of "Strn1a2" represents replicate "2" at sample location "a").

Adding a Sample Manually

Instead of using the *Prebuild List* option, you may choose to input the AQC sample information manually (one sample at a time). To insert one new AQC sample at the end of the current AQC sample list, click on the **New Sample** button on the chosen AQC data input screen. This function may be used to create a new sample list or to add samples to an existing list.

Deleting a Sample

To delete an AQC sample, first select the sample by clicking on it in the AQC sample list. Then click the **Delete Sample** button.

Defining Sample Characteristics

AQC sample characteristics are defined using the input fields grouped into the *Sample Information* area of the AQC data input screens. To change the characteristics defining an AQC sample, first select the sample from the AQC sample list. The currently defined sample characteristics will be reflected in the data input fields in the sample information area. The different AQC sample characteristics are defined below:

Sample ID

The sample ID is used to differentiate between samples. It consists of any combination of letters and numbers unique to one sample.

Sublot

The *Sublot* input is used to define the subplot from which the current sample was taken. You may define the subplot in terms of any combination of numbers or letters.

Location

The *Location* input box is used to identify the location of the current sample. This input is typically defined as the longitudinal station number where the sample was taken; however, any appropriate description may be used to define the sample location.

Status

The *Status* list box identifies how the current sample is to be used by PaveSpec in the computation of the lot pay factor. The three different status types are defined as follows:

- **Open**—This is the default status of any new sample. These samples will not be used in the computation of the lot pay factor.
- **Accept**—Those samples that are assumed to be "good" samples (and, therefore, chosen to be used for acceptance) should be changed to the *Accept* status. Only those samples showing a sample status of *Accept* will be used by PaveSpec in the computation of lot pay factors.

- **Reject**—Any sample values that are chosen to be excluded from the acceptance procedure shall be marked with a status of *Reject*. Rejected samples will not be used in the computation of lot pay factors.

Value

The measured field value for the current AQC sample is input into the *Value* box. Acceptable units for each AQC are as follows:

- **Concrete Strength**—Metric values are expressed in terms of "MPa", while English values are in terms of "psi".
- **Slab Thickness**—Acceptable metric abbreviations include "mm" and the default units of "cm", whereas English values are expressed in terms of "in".
- **Air Content**—Default units for this field are "%".
- **Initial Smoothness**—Metric values are expressed in terms of "mm/km", while English values are in terms of "in/mi".
- **Percent Consolidation Around Dowels**—Default units for this field are "%".



Maturity

The *Maturity* input box is only available within the strength AQC data input screen, and is only required when strength testing is conducted at less than 28 days of age. When appropriate, the sample maturity at the time of testing may be recorded in this input box. Metric values for the *Maturity* input box are "°C-hrs", while English values are expressed in terms of "°F-hrs".

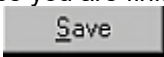

Comment

Finally, a text input box is provided to allow you to type a comment corresponding to a particular sample value.

Exiting the View/Edit Lot Dialogue Box

When you are finished defining sample data for the current lot, click on the  button to save your changes. If you would like to exit the *View/Edit Lot* dialogue box without saving your changes, click on the  button. Clicking either button will return you to the *Use Specification* document main window.

Saving A Use Specification Document

Once you are finished making changes or defining a new *Use Specification* document, click on the  button to save your named document. If you would like to exit the *Use Specification Document* without saving your changes, click on the  button. Clicking either button will return you to the PaveSpec main window.

Drill-Down Documents



Each developed Level 1 or Level 2 specification is typically based on thousands of individually determined lot LCC's, each of which is determined by simulating subplot performance and estimating associated subplot LCC's. Obviously, it would be nearly impossible to present this immense amount of data to the user in a comprehensible format, nor would the typical user have an interest in such detail. For those users that do wish to see the detailed lot or subplot performance or LCC information, the *Drill-Down* document is provided as a method of viewing such data.

As an example, let's say that the user has chosen to define the as-designed LCC based on the simulation of 500 lots. The user could then use the drill-down document feature to look at the distresses and LCC's that were simulated for subplot 2 in lot 421 of 500. Such detailed investigations allow the user to really understand how the chosen



M & R plan is functioning, as well as to compare the types and magnitudes of the different included LCC's. This chapter describes all aspects of the *Drill-Down* document program feature.

Creating And Editing Drill-Down Documents

Each *Drill-Down* document is developed in reference to a previously simulated specification. A new *Drill-Down* document may be created using one of the following three methods:

1. Select the *Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then select *Create Drill-Down Document* from the *File* menu.
2. Select the *Specification* document of interest in the *Specifications* tab of the Database Control dialogue box, then click on the  toolbar button.
3. Select a previously defined *Drill-Down* document under the same specification (contained in the *Specifications* tab of the Database Control dialogue box), then click on the  button.

An existing *Drill-Down* document may be edited using one of the following methods:

1. Select the *Drill-Down* document of interest in the *Specifications* tab of the Database Control dialogue box, then select *Setup* from the *File* menu.
2. Select the *Drill-Down* document of interest in the *Specifications* tab of the Database Control dialogue box, then click on the  toolbar button.
3. Select the *Drill-Down* document of interest in the *Specifications* tab of the Database Control dialogue box, then click on the  button.

Drill-Down Document Main Screen

When you create a new *Drill-Down* document, the pop-up dialogue box shown in figure 37 will appear. This dialogue box consists of a *Name* input box, a series of controls that allow you to select the simulation scenario of interest, and a summary area showing a list of the simulated lots that make up the defined simulation scenario. Details on how to use this dialogue box are described in this section.

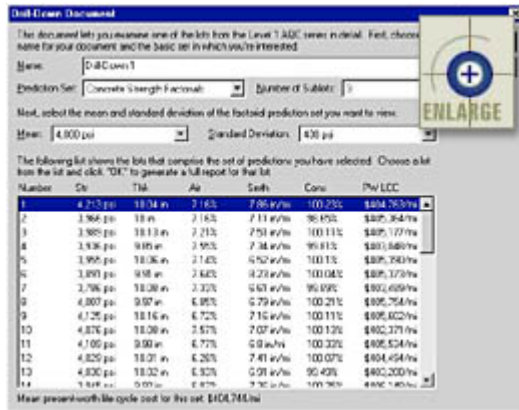


Figure 37. Example of the *Use Specification* document main screen.

Name Input Box

You may change the name of the *Drill-Down* document by entering a new name in the *Name* input box. The name you enter will show *Drill-Down* document name in the *Specifications* tab of the Database Control dialogue box.

Prediction Set List Box

Use the *Prediction Set* control as a first step toward selecting the particular set of simulated lots that you would like to have displayed in the summary area. This list box will contain one or more of the following:

- *As-Designed Predictions (Level 1)*—Those simulated lots used to determine the Level 1 as-designed LCC.
- *As-Designed Predictions (Level 2)*—Those simulated lots used to determine the Level 2 as-designed LCC.
- *Flexural Strength Factorials*—Those simulated lots used to determine each simulated factorial point making up the Level 1 strength pay factor curves.
- *Slab Thickness Factorials*—Those simulated lots used to determine each simulated factorial point making up the Level 1 slab thickness pay factor curves.
- *Air Content Factorials*—Those simulated lots used to determine each simulated factorial point making up the Level 1 air content pay factor curves.
- *Initial Smoothness Factorials*—Those simulated lots used to determine each simulated factorial point making up the Level 1 initial smoothness pay factor curves.

- *Percent Consolidation Around Dowels Factorials*—Those simulated lots used to determine each simulated factorial point making up the Level 1 percent consolidation around dowels pay factor curves.


Number of Sublots List Box


If you have chosen to develop preconstruction output for different numbers of sublots, the *Number of Sublots* list box will reflect that choice. Use this control to select the particular number of sublots for which you would like to view data. The lot information displayed in the summary area will, therefore, be specific to this selected number of sublots.

Mean and Standard Deviation List Boxes

The last two controls used to determine what simulated lots will appear in the summary area of the dialogue box are the *Mean* and *Standard Deviation* list boxes. (Note: These list boxes are only valid when viewing Level 1 factorial prediction sets.) Use these controls to display the summary of lots simulated for a particular combination of AQC mean and chosen standard deviation. A different set of simulated lots would exist for each combination of prediction set, number of sublots, AQC mean, and AQC standard deviation.

Generating the Drill-Down Document Output Report

To generate a drill-down document output report for one of the lots displayed in the summary area, select the lot from the list by single clicking with the mouse (the selected lot will become highlighted) and hit the  button. You may also generate this output report by double-clicking on the appropriate lot. Either of these actions will close the *Drill-Down* document main screen and automatically open the generated *Drill-Down* output report. The *Drill-Down* output report is described in more detail in [chapter 6](#).

If you would like to exit the *Drill-Down* document without saving your changes, click on the  button. Clicking either button will return you to the PaveSpec main window.

PaveSpec Output Reports

Three different types of output reports are generated within PaveSpec depending on whether you are developing a specification, using a specification, or developing a drill-down document. The layout and content of each of these output reports are described in detail within this section.

Viewing Output Reports

You may view any output report by doing one of the following:

1. Select the *Specification*, *Use Specification*, or *Drill-Down* document in the *Specifications* tab of the Database Control dialogue box, then click on the **Open** button.
2. Use the mouse to double-click on the chosen *Specification*, *Use Specification*, or *Drill-Down* document.

Either of these actions will open a new window containing the chosen output report document. An example of an output report window containing a *Specification* output document is shown in figure 38.

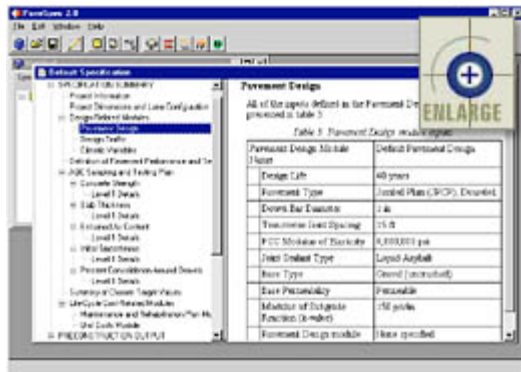


Figure 38.
Example of an output report window containing a *Specification* document.

Layout Of The Output Report Window

Every output report window is divided into two parts: a visual outline on the left and a document display area on the right. The visual outline is provided to show the complete organization of the active output document. The visual outline may be expanded or compressed by clicking on the boxes that contain plus (+) or minus (-) signs. The document display area shows the contents of the report section that is highlighted in the visual outline. To view a particular section of the output document, simply use the mouse or up and down arrow keys to select (highlight) the appropriate report section you wish to view.

Copying Data From Output Reports

To copy data from an output report, select the section in the visual outline that you wish to copy and select *Copy Selected Page* from the *Edit* menu. This action will copy the highlighted section (including all subsections shown in the visual outline) to the Windows clipboard. This copied section may then be pasted into another software document using that software's paste command.

Printing Data From Output Reports

To print data from an output report, select the section in the visual outline that you wish to print, and select *Print* from the *File* menu. This action will print the highlighted section (including all subsections shown in the visual outline) to the selected printing device.

Contents Of The *Specification* Output Report

The *Specification* output report is produced as a result of completing the Specification Wizard used to develop a specification and generate preconstruction output. The *Specification* output report is divided into two main sections: *Specification Summary* and *Preconstruction Output*.

The *Specification Summary* provides a large amount of feedback to the user regarding the inputs that were selected during the specification development process. Such items include summaries of the project general information; project dimensions and lane configuration; pavement design, design traffic, and climatic variable settings; definition of pavement performance; AQC sampling and testing plan details; chosen target values; defined M & R plan; and the chosen unit costs. If this information differs between Level 1 and Level 2 specifications, the details of both are included. Brief descriptions of each subsection making up the *Specification Summary* part of the *Specification* output report are presented in table 1.

Table 1. Descriptions of the document subsections making up the *Specification Summary* part of the *Specification* output report.

Specification Output Report Subsection	Subsection Explanation
Project Information	Summary of the general project definition information defined on page 1 of the Specification Wizard (Basic Specification Information).
Project Dimensions and Lane Configuration	Summary of the project layout information defined on page 2 of the Specification Wizard (Dimensions and Lane Configuration).
Design-Related Modules	
Pavement Design	Summary of the specific design-related variables making up the selected pavement design module defined on page 3 of the Specification Wizard (Design-Related Modules).
Design Traffic	Summary of the details defining the design traffic module defined on page 3 of the Specification Wizard (Design-Related Modules).
Climatic Variables	Summary of the specific climatic variables making up the selected climatic variables module defined on page 3 of the Specification Wizard (Design-Related Modules).
Definition of Pavement	Summary of the chosen distress indicators and related AQC's used to define pavement

Performance and Selected AQC's	performance within the developed specification. This information is defined on page 4 of the Specification Wizard (Definition of Pavement Performance).
AQC Sampling and Testing Plan	
Concrete Strength	Details of the Level 1 and Level 2 concrete strength sampling and testing plans defined on page 5 of the Specification Wizard (AQC Sampling and Testing).
Slab Thickness	Details of the Level 1 and Level 2 slab thickness sampling and testing plans defined on page 5 of the Specification Wizard (AQC Sampling and Testing).
Entrained Air Content	Details of the Level 1 and Level 2 entrained air content sampling and testing plans defined on page 5 of the Specification Wizard (AQC Sampling and Testing).
Initial Smoothness	Details of the Level 1 and Level 2 initial smoothness sampling and testing plans defined on page 5 of the Specification Wizard (AQC Sampling and Testing).
Percent Consolidation Around Dowels	Details of the defined Level 1 and Level 2 percent consolidation around dowels sampling and testing plans defined on page 5 of the Specification Wizard (AQC Sampling and Testing).
Summary of Chosen Target Values	Summary of the selected Level 1 and Level 2 AQC target values (means and standard deviations) defined on page 6 of the Specification Wizard (AQC As-Designed Target Value Definition).
Life-Cycle Cost-Related Modules	
Maintenance and Rehabilitation Plan	Summary of the details of the selected M & R plan module defined on page 7 of the Specification Wizard (Life-Cycle Cost-Related Modules).
Unit Costs	Summary of the unit cost-related variables making up the selected unit costs module defined on page 7 of the Specification Wizard (Life-Cycle Cost-Related Modules).

The *Preconstruction Output* section describes all aspects of both Level 1 and Level 2 (if a Level 2 specification is developed) preconstruction output. Such output includes details of the procedure used to determine the representative as-designed LCC (for both Level 1 and Level 2 if appropriate); any Level 1 pay factor factorial tables; Level 1 pay factor curves and corresponding pay factor equations; and a description of the defined Level 1 composite pay factor equation. Brief descriptions of each subsection making up the *Preconstruction Output* part of the *Specification* output report are presented in table 2.

Table 2. Descriptions of the document subsections making up the *Preconstruction Output* part of the *Specification* output report.

Specification Output Report Subsection	Subsection Explanation
Level 1 Preconstruction Output	
Level 1 As-Designed Summary	A general summary of the procedure used to determine the representative Level 1 as-designed LCC as well as output showing the computed LCC means and standard deviations representative of each chosen number of sublots.
Level 1 As-Designed Simulation Details	A more detailed summary of the AQC samples and computed LCC's for each simulated lot used in the determination of the representative Level 1 as-designed LCC.
Level 1 Factorial Tables	Summary of the simulated individual AQC LCC's and pay factors used in the development of the Level 1 individual AQC pay factor charts. These factorials reflect those defined for each AQC on page 8 of the Specification Wizard (Simulation Control).
Level 1 Individual AQC Pay Factor Charts	Summary of the developed Level 1 individual AQC pay factor charts. Each chart contains plots of the pay factor curve regression equations defined on page 10 of the Specification Wizard (Defining Level 1 Pay Factor Equations).
Level 1 Individual AQC Pay Factor Equations	Summary of the developed Level 1 individual AQC pay factor regression equations (corresponding to each pay factor curve). These regression equations are those defined on page 10 of the Specification Wizard (Defining Level 1 Pay Factor Equations).
Level 1 Composite Pay Factor (CPF) Equation	Summary of the defined Level 1 composite pay factor equation defined on page 11 of the Specification Wizard (Level 1 Pay Factor Function Definition).
Level 2 Preconstruction Output	
Level 2 As-Designed Summary	A general summary of the procedure used to determine the representative Level 2 as-designed LCC as well as output showing the computed LCC means and standard deviations representative of each chosen number of sublots.

Level 2 As-Designed Simulation Details	A more detailed summary of the AQC samples and computed LCC's for each simulated lot used in the determination of the representative Level 2 as-designed LCC.
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Contents Of The *Use Specification* Output Report

The *Use Specification* output report is produced as a result of entering data in a *Use Specification* document. The main purpose of the *Use Specification* output report is to provide a summary of the actual field samples, computed pay factors, and corresponding contractor pay adjustments. Brief descriptions of each subsection making up the *Use Specification* output report are presented in table 3.

Table 3. Descriptions of the document subsections making up the *Use Specification* output report.

<i>Use Specification</i> Output Report Subsection	Subsection Explanation
How Pay Factors Are Determined	
Sampling Plan	Details of the AQC sampling plan defined for use with the specification.
Pay Factor Equations	Summary of the individual AQC pay factor equations, and the composite pay factor equation, used to compute as-constructed lot pay factors.
Lot Summary	Contains summary information about the lots recorded in this document.
Sample Values	
Concrete Strength Samples	Summary of the as-constructed concrete strength samples and corresponding pay factors computed for each as-constructed lot.
Slab Thickness Samples	Summary of the as-constructed slab thickness samples and corresponding pay factors computed for each as-constructed lot.
Entrained Air Content Samples	Summary of the as-constructed entrained air content samples and corresponding pay factors computed for each as-constructed lot.
Initial Smoothness Samples	Summary of the as-constructed initial smoothness samples and corresponding pay factors computed for each as-constructed lot.
Percent Consolidation Around Dowels Samples	Summary of the as-constructed percent consolidation around dowels samples and corresponding pay factors computed for each as-constructed lot.

Lot-by-Lot Pay Factors	A complete summary of the pay factors (individual AQC and composite) and corresponding pay adjustments computed for each as-constructed lot.
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Contents Of The *Drill-Down Document* Output Report

The *Drill-Down Document* output report is produced as a result of creating a *Drill-Down* document. The *Drill-Down* document contains simulation details for a chosen simulated lot (selected in the *Drill-Down* document main screen). The output report contains an overall sampling and LCC summary for the lot, as well as detailed distress and cost summaries for each of the sublots making up the lot. Brief descriptions of each subsection within the *Drill-Down Document* output report are presented in table 4.

Table 4. Descriptions of the document subsections making up the *Drill-Down Document* output report.

<i>Drill-Down Document</i> Output Report Subsection	Subsection Explanation
Lot Summary	Summary of the AQC samples generated for the chosen simulated lot, as well as an overall summary of the lot's LCC's.
Details of Sublot...	The specific distress and cost details of each subplot within the chosen simulated lot are provided in these subsections. The details of each included subplot are presented independently in separate subdocuments of the output report.