PART III: WESTRACK DATABASE

CONTENTS

CHAPTER **1**

INTRODUCTION

WesTrack (*1*,*2*,*3*) was a hot-mix asphalt (HMA) accelerated pavement test (APT) facility located in the State of Nevada approximately 100 km (60 mi) southwest of Reno, Nevada. The pavement test facility was designed, constructed, and operated by a team of private companies and universities (WesTrack team) under contract to the Federal Highway Administration (FHWA) and the National Cooperative Highway Research Program (NCHRP) from September 1994 through September 2000. The original contract for the research project was awarded in September 1994. The test track was designed and constructed during the period between October 1994 and October 1995 and was subjected to traffic from March 1996 through February 1999.

Track maintenance activities including surface patching, digging out and replacing patches, and milling and filling with HMA have taken place during the life of the facility. Ten of the 26 test sections on the 3-km (1.8-mi) oval track were replaced in June 1997. Approximately 5 million 80-kN (18,000-lb) equivalent single-axle loads (ESALs) were applied to the track.

The project had two primary objectives:

- Continue the development of performance-related specifications (PRS) for HMA pavements by evaluating the impact on performance of deviations in materials and construction properties (asphalt binder content, aggregate gradation, aggregate type, and in-place air void content) from design target values.
- Provide an early field verification of the SHRP Superpave HMA volumetric design method.

A substantial amount of data was collected and analyzed throughout the project to achieve these two primary objectives. Typically, these data resided with the individual research organizations and were not necessarily contained in a centralized database. This document provides details regarding the development of the WesTrack database (also referred to as the database) which now houses the majority of the data collected during the project and includes a Microsoft® Windows-based program for obtaining reports from the database.

1.1 BACKGROUND

Throughout the WesTrack project, a substantial amount of data was collected, summarized, and stored in electronic for-

mat in organized directories and files. More specifically, data were typically entered into Excel and Quattro Pro spreadsheet files, summarized using the features of these spreadsheet programs, and stored in directories delineated by the type of data/ information contained in the spreadsheet files. In essence, this formed a database of information, but one that was somewhat decentralized, that is, housed in various locations and, thus, required significant knowledge of the format and location of the information to extract useful information from the database.

Although the data were being stored in an organized manner throughout the project, it was also realized that an effort should be made to (1) organize the data in a consistent format, (2) house the data in a centralized location, and (3) provide a means for extracting the data without having significant knowledge of the format and location of the data.

With these objectives in mind, it was decided to develop a single database to serve as a data warehouse for the WesTrack data as well as a graphical user interface (GUI) (i.e., a Windows program) to allow for easy data extraction (i.e., reporting). Together, these form the WesTrack database.

1.2 OBJECTIVES

The following were the objectives for developing the WesTrack database:

- Gather the data collected during the project in a centralized location.
- Format the data in a consistent manner.
- Perform quality assurance checks on the data.
- Develop an easy-to-use data extraction and reporting tool in the form of a Windows-based program.

1.3 SCOPE OF DATA INCLUDED IN THE DATABASE

It is important to emphasize that, for a number of reasons, not all data collected during the WesTrack project have been included in the database. In general, the types of data that are included consist of information pertaining to the performance of the pavement. For example, pavement distress data, materials properties, weather, and seasonal data are types of data

included in the database. The database does not include information gathered for privately sponsored research (i.e., proprietary data). For example, information regarding diesel engine performance, fuel consumption, and truck tire performance are not included in the database. There is also a wealth of truck data, vehicle dynamics, operating costs, and so forth that have been collected but have not been included in the database.

1.4 SCOPE OF THIS DOCUMENT

The scope of this document is to provide the reader with information regarding the following:

- The key features of the WesTrack database.
- An overview of the data elements contained in the database.
- A brief overview of the software (Windows program).
- The basic requirements of computer systems on which the software and database can be used.
- A user's guide for use of the software.

Chapter 2 of this document describes the key elements of the WesTrack database, Chapter 3 provides details regarding the data elements, and Chapter 4 contains information regarding the software that serves as the GUI to the database.

CHAPTER **2**

KEY FEATURES OF THE WESTRACK DATABASE

The WesTrack database consists of a Windows-based program and a database. The Windows-based program is a GUI that serves as a "front-end" to the database (data warehouse) "back-end." The following paragraphs describe the key features of the WesTrack database.

The GUI consists of a number of features that allows the user to extract data from the database in an intuitive manner. The features within the program include forms, menus, command buttons, list boxes, grids, and so forth that are common to most Windows-based programs. In addition, the program was designed with ease-of-use as a key requirement. The objective was to keep it simple but not to unduly constrain the user to what could be extracted from the database.

The database consists of a data warehouse for the WesTrack data. It consists of numerous tables, each of which contain numerous "fields" that categorize the data. Also within each table are numerous "records" that represent the actual data. For example, a weather table might contain *Date, Time, and Average Temperature* as fields and records indicating the actual average temperature for each date and time recorded.

CHAPTER **3**

DATA ELEMENTS

The data elements in the database (data warehouse) include the following:

- Performance data.
- Materials data.
- Seasonal data.
- Weather data.

These are further described in the following paragraphs.

3.1 PERFORMANCE DATA

Throughout, the WesTrack project performance data were collected at regular intervals and more frequently when certain circumstances warranted. In total, performance data were collected on 49 occasions during the project. In general, the following data were collected for each section during these occasions:

- Severity and extent of fatigue cracking.
- Severity and extent of raveling.
- Severity and extent of bleeding.
- Magnitude of rut depth, both maximum rut depth (peak to valley) and downward rut depth (baseline to valley).
- Magnitude of roughness (smoothness).

All performance data collected have been summarized and included within the database.

3.2 MATERIALS DATA

Materials data include information regarding aggregate properties, binder properties, and mixture properties. These data were collected at various stages throughout the project. Following is a list of the types of materials data collected and stored in the database:

The following aggregate properties are included in the database:

- Stockpile gradations.
- Cold feed gradations.
- Quality control/quality assurance (QC/QA) gradations.

- Specific gravity and absorption.
- Angularity.
- Sand equivalent value.
- Flat/elongated particles.
- Soundness.
- Los Angeles abrasion.
- Deleterious materials.

The following binder properties are included in the database:

- Bending beam rheometry.
- Dynamic shear rheometry.
- Capillary viscosity.
- Rotational viscosity.
- Penetration.
- Flashpoint.

The following mixture properties are included in the database:

- Repeated simple shear at constant height (RSST-CH) test.
- Beam fatigue.
- Thermal stress restrained specimen test (TSRST).
- Moisture sensitivity of the HMA mixture.
- Resilient modulus of the HMA mixture.
- Resilient modulus of the base course.
- Resilient modulus of the engineered fill.
- Wheel tracking Laboratoires des Ponts et Chaussées (LCPC), Hamburg, Asphalt Pavement Analyzer, and Purdue devices.
- Indirect tensile test.
- In-place air voids and thickness.

3.3 SEASONAL DATA

Seasonal data include information regarding the depth of the groundwater table and the subgrade soil moisture content. This information was collected at approximately the same intervals as the performance data.

The groundwater depth was measured using piezometers located adjacent to sections 12 and 25. The measurements obtained from the piezometers were translated (adjusted) to

represent the depth of the water table below the centerline of the test lane at the test track.

Time-domain reflectometry measurements were obtained from probes located adjacent to sections 12 and 25. These data were then reduced using the protocol established for and used within the Long-Term Pavement Performance (LTPP) program to estimate the moisture content within the subgrade soil.

3.4 WEATHER DATA

Weather data was collected on a continuous basis from an on-site weather station throughout the duration of the project. The following data were collected and are included in the database:

- Air temperature.
- Humidity.
- Wind speed and direction.
- Precipitation.
- Solar radiation.
- Pavement temperature.

3.5 QUALITY CONTROL/QUALITY ASSURANCE CHECKS

Throughout the data gathering and data entry (database population) process, a substantial effort was afforded to QA checks of the data. This was accomplished by personnel trained in pavement engineering and knowledgeable of the types of data collected, methods of data collection (e.g., distress surveys, mixture tests, and expected values/ranges). QA checks typically involved checking the data for proper units of measure, checking summary data against raw data, investigating apparent anomalies, filling in missing data, and so forth. As a result of this effort, the data contained in the database can be considered extremely "clean" and accurate.

CHAPTER **4**

SOFTWARE

4.1 OVERVIEW

The WesTrack database includes a Windows-based program that serves as a GUI to obtain reports (extract data) from the database in an intuitive manner. A user's guide for the software is provided in Appendix A of Part III. The program has been designed to allow data to be extracted (reported) from the database in two ways:

- Standard reports.
- Custom reports.

Data obtained through either method is displayed in a tabular format that can be printed or saved to disk in various formats.

4.2 STANDARD REPORTS

Standard reports are a set of pre-defined queries that generate tables of commonly requested data and are intended to provide quick access to the data. An example of a typical standard report might be "Percent Fatigue Cracking vs. ESALs (percent of left wheelpath)." In addition, a number of reports pertaining to performance data (e.g., fatigue cracking and rut depth) have associated charts that can be viewed. It should be noted, however, that standard reports do not provide for all possible reports that can be obtained from the database. Table 1 lists the standard reports that have been developed and included in the WesTrack database.

The user does not require knowledge of Structured Query Language (SQL) to obtain standard reports from the database. Standard reports are obtained through a simple selection process using built-in features of the GUI.

4.3 CUSTOM REPORTS

Custom reports allow the user to obtain data through user-defined SELECT queries that generate tables of data. Note that SELECT queries are used to extract data from a database. Note also that all data in the database are available through custom reports whereas only limited data are available through standard reports.

Obtaining custom reports from the database requires a limited knowledge of SQL. However, the custom report tool within the GUI has been designed to allow very complex queries for those users who are highly knowledgeable of SQL.

4.4 EXPORTING DATA

Once data have been obtained from the database using either the standard report tool or the custom report tool, they can be exported (saved to disk) in three different ways:

- Text file (*.txt)—this option saves the data as an ASCII text file.
- Comma separated value (*.csv)—this option saves the data as an ASCII text file with values separated by commas. This is the preferred format to use for data that will be imported into a spreadsheet such as Excel or Quattro Pro.
- Web page (*.html)—this option saves the data in web page format.

The ability to export data in one of the above formats allows the data to be imported into other programs such as spreadsheets for further analysis and manipulation.

TABLE 1   Standard reports included in the WesTrack database

Data Category	Data Type	Standard Report Name
Performance	Fatigue Cracking	Fatigue Cracking vs. ESALs (Percent of Left Wheelpath)
		Fatigue Cracking vs. ESALs (Percent of Right Wheelpath)
	Rutting	Maximum Rut Depth vs. ESALs (Left Wheelpath)
		Down Rut Depth vs. ESALs (Right Wheelpath)
		Maximum Rut Depth vs. ESALs (Right Wheelpath)
	Raveling	Raveling vs. ESALs (Percent of Left Wheelpath)
		Raveling vs. ESALs (Percent of Right Wheelpath)
	Roughness	Left Wheelpath IRI vs. ESALs
		Right Wheelpath IRI vs. ESALs
	Bleeding	Bleeding vs. ESALs (Percent of Left Wheelpath)
		Bleeding vs. ESALs (Percent of Right Wheelpath)
	Falling Weight Deflectometer	FWD Deflections, Within/Adjacent to Wheelpath (U.S.)
		FWD Deflections, Within/Adjacent to Wheelpath (S.I.)
		FWD Deflections, Between Wheelpaths (U.S.)
		FWD Deflections, Between Wheelpaths (S.I.)
Materials	Aggregates	Stockpile Gradations (Original Sections)
		Stockpile Gradations (Reconstructed Sections)
		Cold Feed Gradations (Reconstructed Sections)
		QC/QA Gradations (Original Sections)
		QC/QA Gradations (Reconstructed Sections)
		Specific Gravities and Absorption (Original Sections)
		Specific Gravities and Absorption (Reconstructed Sections)
		Aggregate Angularity (Original Sections)
		Aggregate Angularity (Reconstructed Sections)
		Sand Equivalent (Original Sections)
		Sand Equivalent (Reconstructed Sections)
		Flat/Elongated Particles (Original Sections)
		Flat/Elongated Particles (Reconstructed Sections)
		Soundness (Original Sections)
		LA Abrasion (Original Sections)
		Deleterious Materials (Original Sections)
		Deleterious Materials (Reconstructed Sections)
	Binders	Bending Beam Rheometry (Original Sections)
		Bending Beam Rheometry (Reconstructed Sections – FHWA)
		Bending Beam Rheometry (Reconstructed Sections – UNR)
		Dynamic Shear Rheometry (Original Sections)
		Dynamic Shear Rheometry (Reconstructed Sections – FHWA)
		Dynamic Shear Rheometry (Reconstructed Sections – UNR)
		Capillary Viscosity (Original Sections)
		Capillary Viscosity (Reconstructed Sections)
		Rotational Viscosity (Original Sections)
		Rotational Viscosity (Reconstructed Sections)
		Penetration (Original Sections)
		Penetration (Reconstructed Sections)
		Flashpoint (Original Sections)
		Flashpoint (Reconstructed Sections)
	Mixtures	Repeated Simple Shear at Constant Height (Coarse Mixtures, UCB)
		Repeated Simple Shear at Constant Height (Fine Mixtures, UCB)
		Repeated Simple Shear at Constant Height (Fine Plus Mixtures, UCB)
		Repeated Simple Shear at Constant Height (All Mixtures, UCB)
		Repeated Simple Shear at Constant Height (FHWA)
		Beam Fatigue (Coarse Mixtures)
		Beam Fatigue (Fine Mixtures)
		Beam Fatigue (Fine Plus Mixtures)
		TSRST (Field-Mixed/Field-Compacted Samples) Before Loading
		TSRST (Field-Mixed/Field-Compacted Samples) After Loading
		TSRST (Field-Mixed/Lab-Compacted Samples)
		TSRST (Lab-Mixed/Lab-Compacted Samples) Short-Term Oven Aged
		TSRST (Lab-Mixed/Lab-Compacted Samples) Long-Term Oven Aged
		Moisture Sensitivity of Field-Mixed/Field-Compacted Samples Before Loading (OSU)
		Moisture Sensitivity of Field-Mixed/Field-Compacted Samples After Loading (OSU)
		Moisture Sensitivity of Field-Mixed/Lab-Compacted Samples (OSU)
		Moisture Sensitivity of Lab-Mixed/Lab-Compacted Samples (OSU)
		Moisture Sensitivity of Field-Mixed/Field-Compacted Samples Before Loading (UNR)
		Moisture Sensitivity of Field-Mixed/Field-Compacted Samples After Loading (UNR)
		HMA Resilient Modulus (Original Sections) Following Construction
		HMA Resilient Modulus (Original Sections) Before Loading (approx. 6 months after construction)
		HMA Resilient Modulus (Original Sections) After 12 Months of Loading
		HMA Resilient Modulus (Original Sections) Post Mortem
		HMA Resilient Modulus (Reconstructed Sections) Before Loading
		HMA Resilient Modulus (Reconstructed Sections) Post Mortem
		Base Resilient Modulus
		Engineered Fill Resilient Modulus
		Wheel Tracking (Original Sections)
		Wheel Tracking (Reconstructed Sections)

TABLE 1   (Continued)

Data Category	Data Type	Standard Report Name
Seasonal	Groundwater Depth vs. Time	North Tangent Piezometer
		South Tangent Piezometer
	Subgrade Soil Moisture vs. Time	North Tangent Sensor
		South Tangent Sensor
Weather	Air Temperature	Maximum Hourly Temperature vs. Time
		Minimum Hourly Temperature vs. Time
		Mean Hourly Temperature vs. Time
		Maximum Daily Temperature vs. Time
		Minimum Daily Temperature vs. Time
		Mean Daily Temperature vs. Time
		Average Maximum Monthly Temperature vs. Time
		Average Minimum Monthly Temperature vs. Time
		Average Mean Monthly Temperature vs. Time
	Humidity	Maximum Hourly Humidity vs. Time
		Minimum Hourly Humidity vs. Time
		Maximum Daily Humidity vs. Time
		Minimum Daily Humidity vs. Time
		Average Maximum Monthly Humidity vs. Time
		Average Minimum Monthly Humidity vs. Time
	Wind	Mean Hourly Wind Speed vs. Time
		Mean Daily Wind Speed vs. Time
		Mean Monthly Wind Speed vs. Time
	Precipitation	Total Hourly Precipitation vs. Time
		Total Daily Precipitation vs. Time
		Total Monthly Precipitation vs. Time
	Solar Radiation	Total Hourly Solar Radiation vs. Time
		Mean Daily Solar Radiation vs. Time
		Mean Monthly Solar Radiation vs. Time
	Pavement Temperature	Half-Hourly Temperature—Section 19
		Hourly Temperature—Section 21
		Hourly Temperature—Section 25
		Minimum Daily Temperature—Section 12
		Minimum Daily Temperature—Section 25
		Mean Daily Temperature—Section 12
		Mean Daily Temperature—Section 25
		Maximum Daily Temperature—Section 12
		Maximum Daily Temperature—Section 25

Note: FHWA = Federal Highway Administration
OSU = Oregon State University
UCB = University of California, Berkeley
UNR = University of Nevada, Reno

CHAPTER **5**

HARDWARE REQUIREMENTS

The GUI and database were both developed for a system with the following minimum requirements:

- CPU: Pentium or higher.
- Operating system: Windows 95/98/NT 4.0.
- Disk space: 165 megabytes minimum free space.
- Memory: 32 megabytes minimum.
- Monitor: VGA with 800×600 resolution and 16 colors or more.

CHAPTER **6**

CONCLUSIONS AND RECOMMENDATIONS

6.1 CONCLUSIONS

A substantial amount of data was collected during the WesTrack project by a variety of organizations. The data pertaining to the performance of the pavement (e.g., distress data, traffic data, weather data, and material properties) have been gathered in a centralized location and housed in a data warehouse (Microsoft Access database). All data housed in the database have been thoroughly checked to ensure accuracy.

A GUI (Windows-based program) has been developed to provide tools for extracting data from the database in an intuitive manner (see Appendix A of Part III). Two methods of data extraction (reporting) have been provided: standard reports and custom reports. Standard reports are a set of pre-defined queries that generate tables of commonly requested data and are intended to provide quick access to the data. Custom reports allow the user to obtain data through user-defined SELECT queries that generate tables of data. All data extracted using these methods can be printed or exported (saved to disk) for further analysis and manipulation.

6.2 RECOMMENDATIONS

As mentioned previously, the WesTrack database contains only the data that pertains to pavement performance and as such does not contain all data collected during the WesTrack project. It is recommended that an effort be undertaken to identify and evaluate additional data elements not already contained in the database for possible inclusion in the WesTrack database. Examples of such data include the following:

- Narratives of the events that occurred during the project (e.g., brief descriptions of the project, construction process, driverless vehicles, data collection processes, post mortem evaluations, and mixture testing).
- Photo log of various aspects of the project (e.g., construction, trucks, rut measurements, and site, etc).
- Any other nonproprietary data not already included (e.g., vehicle dynamics, and vehicle operating costs).
- Trench data.

Such an effort would, in essence, archive the data in a centralized location and significantly enhance the current WesTrack database.

ABBREVIATIONS

APT	Accelerated Pavement Test	OSU	Oregon State University
ESAL	Equivalent Single-Axle Load	QA	Quality Assurance
FHWA	Federal Highway Administration	QC/QA	Quality Control/Quality Assurance
FWD	Falling Weight Deflectometer	RSST-CH	Repeated Simple Shear Test at Constant Height
GUI	Graphical User Interface		
HMA	Hot-Mix Asphalt	SQL	Structured Query Language
IRI	International Roughness Index	TSRST	Thermal Stress Restrained Specimen Test
LCPC	Laboratories des Ponts et Chausées	UCB	University of California, Berkeley
LTPP	Long-Term Pavement Performance	UNR	University of Nevada, Reno
NCHRP	National Cooperative Highway Research Program		

REFERENCES

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2. Epps, J., Monismith, C., Seeds, S., Alavi, S., Ashmore, C., and Mitchell, T., "WesTrack Full-Scale Test Track: Interim Findings," *Proc.*, *Eighth International Conference on Asphalt Pavements*, Vol. III, August 10–14, 1997, Seattle, Wash.

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APPENDIX A

WESTRACK DATABASE BETA VERSION RELEASE USER'S GUIDE

A.1 INTRODUCTION

This document describes how to install and use the beta version* release of the WesTrack database and GUI. It is important to understand that the GUI is a beta version meaning that it has been rigorously tested and is in the final design phase prior to release as Version 1.0. The data contained in the database have been thoroughly checked as well and can be considered very clean.

A.2 INSTALLATION

Installation of the database and GUI will require a Windows 95/98/NT operating system and about 165 megabytes of free space on the computer's hard disk. To install the database and GUI, perform the following steps:

1. Insert the WesTrack database CD in the CD drive.
2. Click on the Windows Start menu and select Run.
3. Select Browse . . . and when the Browse dialog box opens, navigate to the CD drive.
4. Double-click on the Setup.exe file (or highlight the file and click on Open).
5. Click on the OK button on the Run form.
6. Follow the instructions given in the Setup Wizard.

A.2.1 Important Note

The Setup Wizard may warn you that it is attempting to copy older versions of certain files and ask you if you want to keep the newer version. Answer Yes to keep the newer version in all cases. Also, the wizard may warn you that it cannot copy certain files because they are presently in use. Click on the Ignore button to ignore these errors. Confirm that you want to ignore the error by clicking on the Yes button on the form asking you if you are sure.

A.3 USING THE GRAPHICAL USER INTERFACE

A.3.1 Overview

The GUI has been designed to allow data to be extracted (reported) from the database in two ways: (1) standard reports or (2) custom reports.

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* A "beta version" release is one that has been rigorously tested and corrected for all "bugs" encountered during testing.

Standard reports are a set of pre-defined queries that generate tables and charts of commonly requested data and are intended to provide quick access to the data. An example of a typical standard report might be "Percent Fatigue Cracking vs. Equivalent Single-Axle Loads (ESALs) (percent of left wheelpath)." It should be noted, however, that the reporting capability of the database goes beyond the standard reports provided.

Custom reports allow the user to obtain data through user-defined queries that generate tables of data. All data in the database are available through custom reports.

The following paragraphs describe how to use the GUI and how to obtain data from the WesTrack database.

A.3.2 Executing the GUI

The GUI can be executed (run) by selecting the Windows Start menu, then selecting the WesTrack database folder, and finally selecting the WesTrack database icon. Note that the user can also create a shortcut to reside on the desktop for quicker access to the GUI. On execution of the GUI, the dialog shown in Figure A.1 will appear. The dialog can be hidden and not shown again by clicking on the little box (called a check box) next to the words "Do not show this dialog again." Note that you can re-show the dialog by selecting options from the file menu.

A.3.3 Choosing a Query Type

The dialog shown in Figure A.1 allows the user to select whether to use standard reports or custom reports for data extraction. To select the query type, click on the little circle (called a radio button) immediately to the left of the query tool to be used. Note that clicking on the words has the same effect. Figure A.1 indicates that standard reports has been selected.

A.3.4 Standard Reports

Figure A.2 shows the form for selecting a standard report. To use this form, follow these steps:

1. First select a data type from the list box in the upper left corner. This will populate the list box immediately below

the data type list box with related information. For example, Figure A.3 indicates that the related information is "Aggregates," "Binders," and "Mixtures" when the "Materials" data type is selected.

2. Next, select an item from the lower list box to display the available standard reports in the list box on the right. For example, Figure A.4 shows some of the available standard reports when "Mixtures" is selected from the Material Type list box. Use the scroll bar to the right of this list box to show the remainder of the list items.
3. Next, select a report to display. For example, Figure A.4 indicates that "Beam Fatigue (Coarse Mixtures)" has been selected.
4. Finally, click on the View Report button. Note that the "Performance" data type requires selection of a section number before a report can be viewed.

The standard report for "Beam Fatigue (Coarse Mixtures)" is displayed on the Query Results form as shown in Figure A.5. This form allows the data to be reviewed, saved to disk, and printed. To review the data, use the scroll bars (if shown) near the bottom of the form and to the right of the form to scroll left-to-right and up-and-down, respectively.

The data can be saved to disk by clicking on the Save button. This displays a common dialog box as shown in Figure A.6. Presently, data can be saved in three formats (by clicking on the "Save as type" drop-down list) as follows:

1. Text File (*.txt)—this option saves the data as an ASCII text file.
2. Comma Separated Value (*.csv)—this option saves the data as an ASCII text file with values separated by commas. This is the preferred format to use if you want to import the data into spreadsheets such as Excel or Quattro Pro.
3. Web Page (*.html)—this option saves the data in web page format.

To print the report, click on the Print Preview button. This displays the Print Preview form shown in Figure A.7. Note that various tools are provided for previewing the data, and printing the data can be accomplished by clicking on the printer icon at the top of the form or by selecting the printing options from the File menu.

The Show Error Codes button on the Query Results form displays the error codes included in the database as shown in Figure A.8. These are flags for use in creating queries and should not be considered as real data. All error codes are between −992 and −999, inclusive and have the meanings indicated in Figure A.8.

Selecting Performance Data Reports

Selecting a standard report for performance data requires selecting the section to which the report applies. This can be accomplished by clicking on one of the numbered buttons on the right side of the Standard Reports form (Figure A.2) or by clicking on the Select Section by Map button. Note that the numbered buttons are clustered (vertically) according to the gradations (coarse, fine, or fine plus) of the mixtures constructed at WesTrack and the numbers on the buttons represent the test section numbers.

Three tools have been provided for aiding the user in identifying which section to select:

1. A form that displays the WesTrack experiment design as shown in Figure A.9. This form can be displayed by selecting Experiment Design from the View menu of the background form.
2. A form that displays a static map of WesTrack as shown in Figure A.10. This form can be displayed by selecting Section Map from the View menu of the background form.
3. A form that displays an active map from which section selection can be made. This form is shown in Figure A.11 and can be displayed by clicking on the Select Section by Map button on the Standard Reports form. Once displayed, section selection is accomplished by clicking on the button corresponding to the section number. Note that for those sections that were reconstructed, the buttons for the original sections are to the left of those for the reconstructed sections.

A.3.5 Custom Reports

Figure A.12 shows the form for creating custom queries. Note that all data within the database can be accessed through use of this form. The upper portion of the form consists of three list boxes for listing table names, field names, and stored queries names. The lower portion of the form is used for creating queries.

The group of radio buttons above the Tables list box allows the user to list only those tables associated with the categories included. For example, if only those tables associated with mix design are of interest, then the user should click on the Mix Design Radio button as shown in Figure A.13.

The Fields list box lists the names of fields contained in the table selected in the Tables list box. For example, clicking on Avg_Mix Design (Superpave) (UNR) in the Tables list box populates the Fields list box with the names of the fields in the Avg_Mix Design (Superpave) (UNR) table as shown in Figure A.14.

The query builder section of the form contains a number of buttons for creating, running and storing (saving) queries. Although the query builder allows complex queries to be built, for most users creating simple queries will be entirely adequate for most purposes. However, note that only SELECT queries can be built using this tool.

The following is the general form of a simple SELECT query:

- SELECT *information* FROM *table* WHERE *clause*

where

- SELECT, FROM, and WHERE are query commands;
- *information* is what the user wants to extract (e.g., rut depth);
- *table* is the name of the table from which *information* is to be extracted; and
- *clause* is conditions placed on the *information* to be extracted (e.g., SectionID = 26).

The simplest SELECT query to create is one that requests all information contained in the table. This is accomplished by using the * (everything) wildcard as the *information* to be extracted from the database. To create such a query click on the Select * From button followed by dragging the table name from the Tables list box and dropping it on the text box labeled "Enter or build a query." To drag-and-drop, click and hold down the left mouse button over the desired table name, drag it over the text box, and release the mouse button. Figure A.14 indicates that everything is to be selected from the table named Avg_Mix Design (Superpave) (UNR).

Custom queries can be saved by clicking on the Save Query button and providing a name for the query. Saving queries in this way creates stored queries (ones that reside in the database). For example, assuming the query in Figure A.15 was saved under the name "Superpave," it would be listed in the Stored queries list box as indicated in Figure A.15. Stored queries can be run any number of times by clicking on the query name and then clicking on the Run Query button. Stored queries can also be deleted by clicking on the Delete Query button and then confirming the deletion of the query.

To restrict a selection to certain conditions, include a WHERE clause. To do this, perform the following steps:

1. First create the SELECT *information* FROM *table-*portion of the query.
2. Click on the WHERE button.
3. Create the *clause* by dragging a field name from the Fields list box and dropping it on the query text box and establishing the condition. This could be something like Gradation = "Fine" or SectionID = "26" or Construction = "Original".

Figure A.16 indicates a WHERE clause restricting the selection of resilient modulus data to section 1 (i.e., [Avg_Res Modulus-HMA(UNR)].[SectionID] = 1). Note that creation of a WHERE clause requires knowledge of the format of the field used in the clause (e.g., text, numeric, and date). In this release, no syntax checking has been programmed.

Definitions of all fields in the tables are provided in the Data Dictionary table. This can be displayed by selecting Data Dictionary from the View menu of the background form.

Running a query displays the data in the same way as in standard reports. The data can also be printed and exported in the same manner as for standard reports.
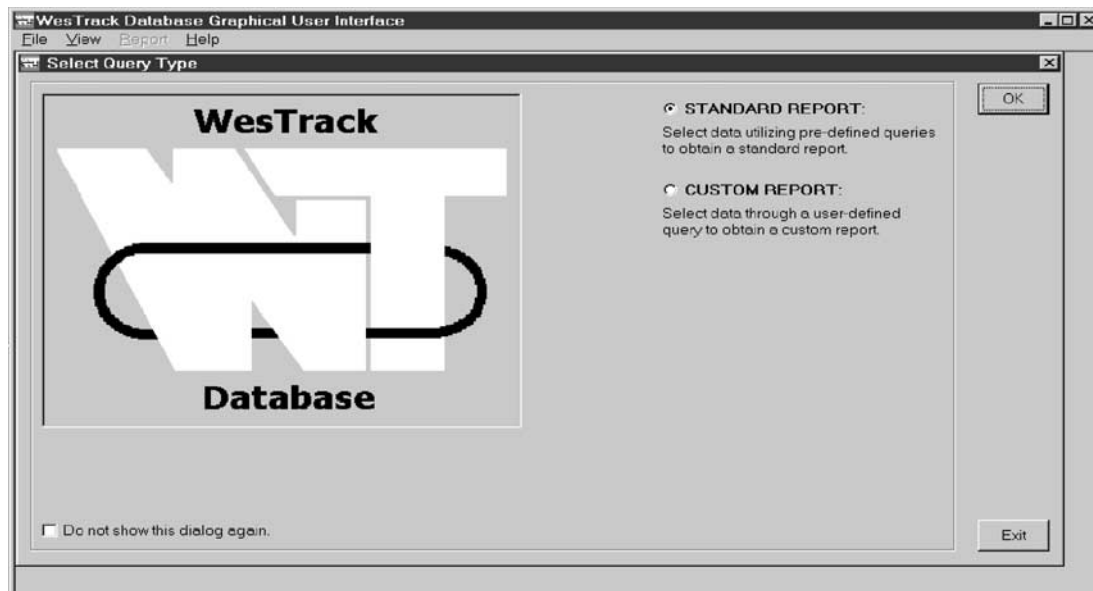
Figure A.1.   Query type selection form.
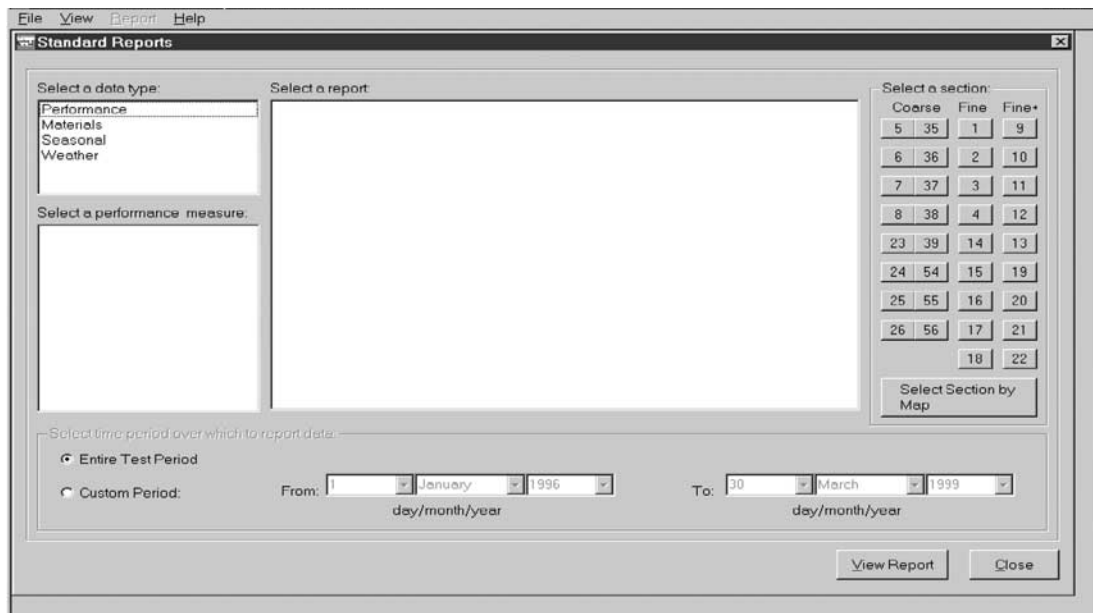
Figure A.2.   Standard report form.

Figure A.3. Selection of a data type.

Figure A.4. Standard reports for Mixtures data type.

Figure A.5.   Query results form.

Figure A.6.   Dialog box for exporting (saving) data.
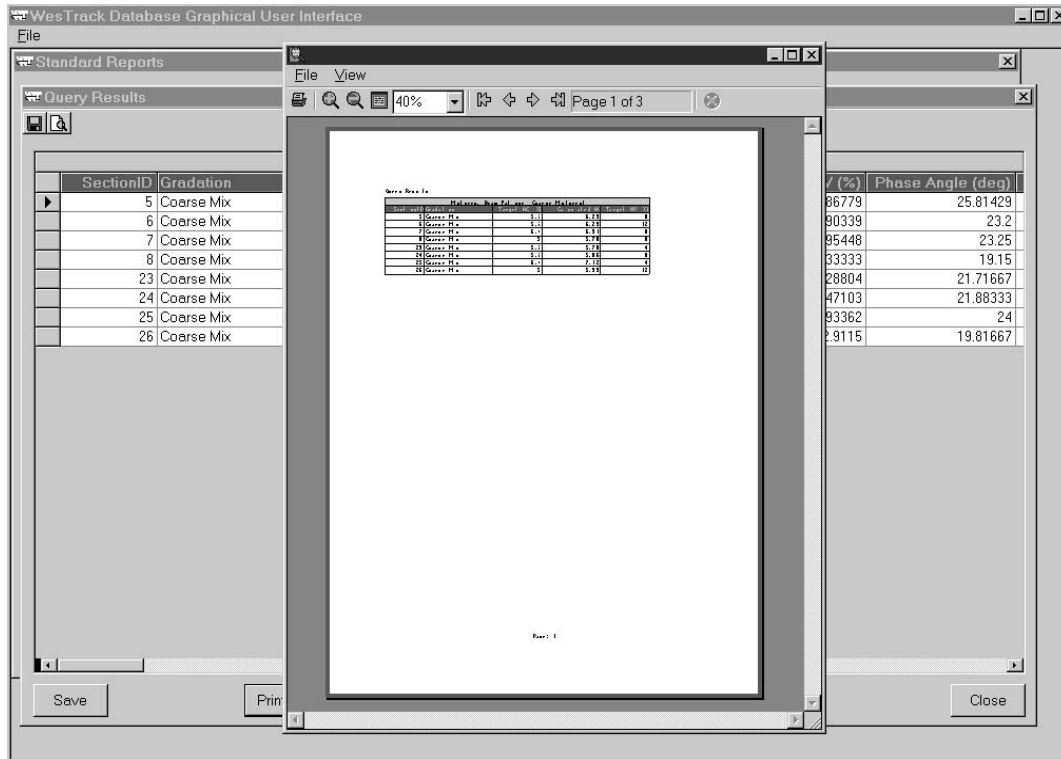
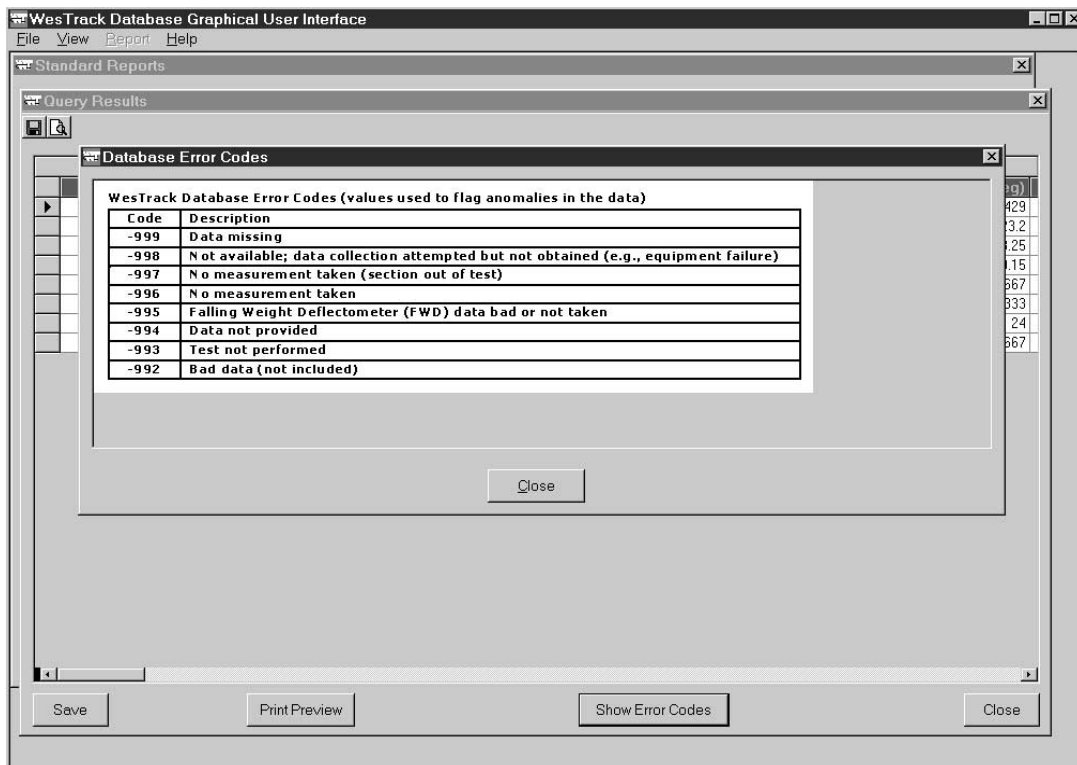*Figure A.7. Print preview form.*

Figure A.8. Error codes form.

WesTrack Database Graphical User Interface

File View Report Help

Standard Reports

Select a data type:
Performance
Materials
Seasonal
Weather

Select a report:
Fatigue Cracking vs. ESALs (Percent of Left Wheel Path)
Fatigue Cracking vs. ESALs (Percent of Right Wheel Path)

Select a section:
Coarse Fine Fine+
5   35   1   9
6   36   2   10
7   37   3   11

Select a F...
Fatigue C...
Rutting
Raveling
Roughne...
Bleeding
Falling W...

Select ti...
⦿ Enti...
○ Cus...

WesTrack Experiment Design

Experiment Design (Numbers represent section numbers)

Design Air Void Content (%)	Aggregate Gradation								
	Fine			Fine Plus			Coarse		
	Design Asphalt Content (%)								
	Low	Medium*	High	Low	Medium*	High	Low	Medium*	High
Low	X	4	18	X	12	9, 21	X	23 (53)	25 (55)
Medium	2	1, 15	14	22	11, 19	13	8 (38)	5, 24 (35, 54)	7 (37)
High	3, 16	17	X	10	20	X	26 (56)	6 (36)	X

Notes:
   * Optimum asphalt content
   ( ) = replacement section
   X = not constructed

Close

Figure A.9.   WesTrack experiment design form.

WesTrack Database Graphical User Interface

File View Report Help

Select Query Type

WesTrack Section Map

STAGING AREA

ENTRANCE RAMP   EXIT RAMP

North

| LH | HL | MM2 | ML | LM | HL1 | MH | MM1 | HL | MH | LH2 | MM2 | HM |
| 26/56 | 25/55 | 24/54 | 23 | 22 | 21 | 20 | 19 | 18 | 17 | 16 | 15 | 14 |

■ Coarse
■ Fine
■ Fine Plus

Asphalt Content
Air Void Content
Replicate Number

Original Section Number
Replacement Section Number

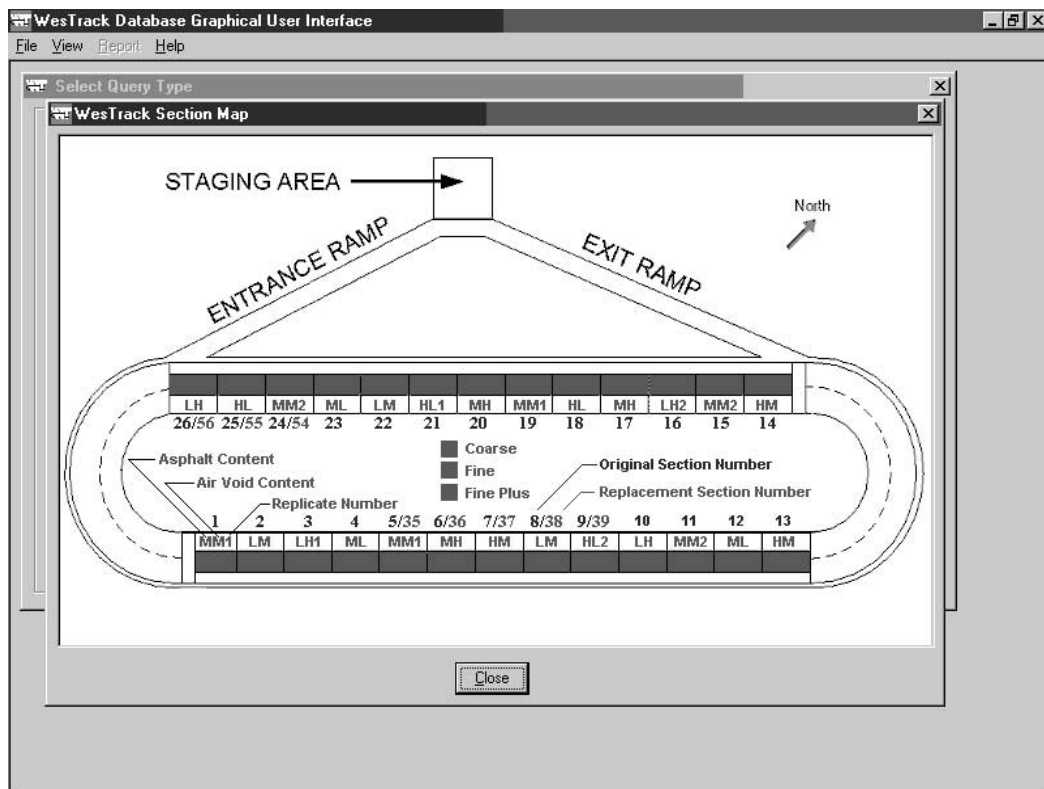| 1 | 2 | 3 | 4 | 5/35 | 6/36 | 7/37 | 8/38 | 9/39 | 10 | 11 | 12 | 13 |
| MM1 | LM | LH1 | ML | MM1 | MH | HM | LM | HL2 | LH | MM2 | ML | HM |

Close

Figure A.10.   Static section map form.
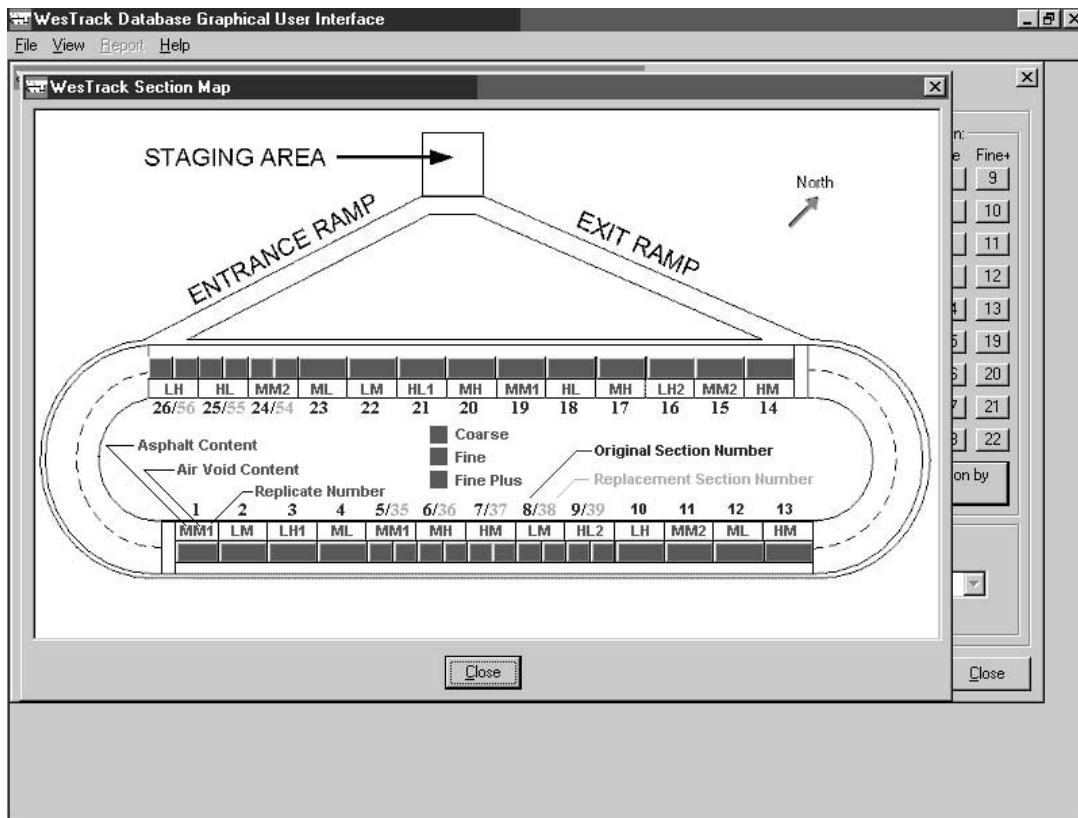
Figure A.11.   Active section map form (for selecting a section).
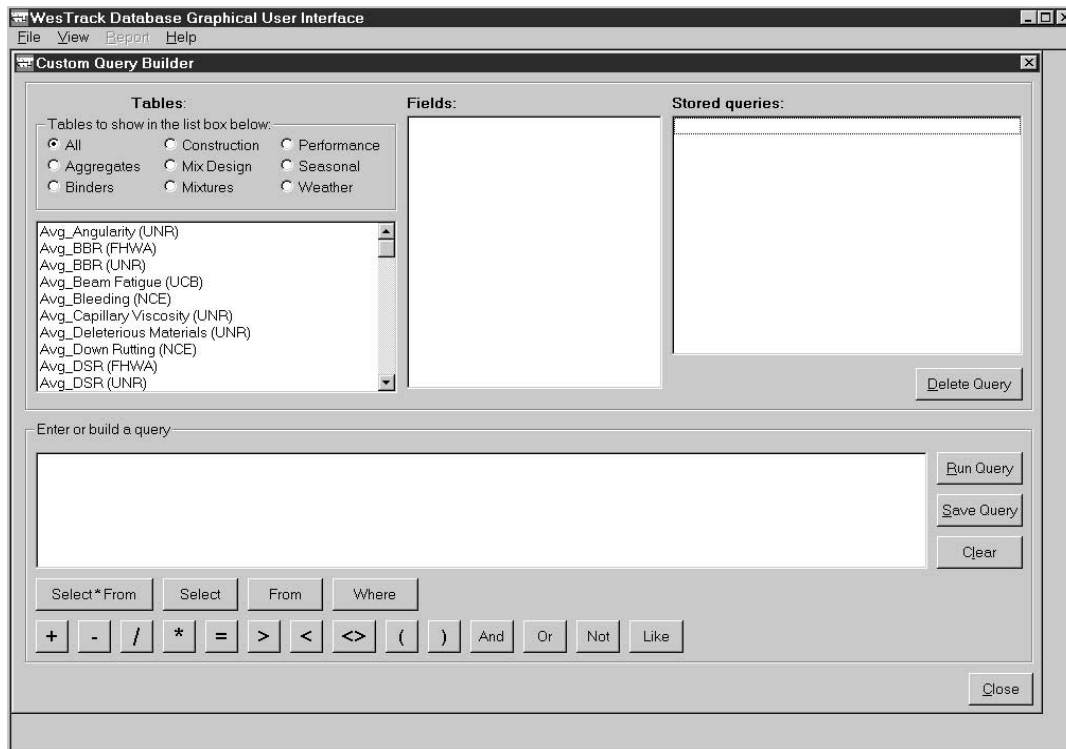

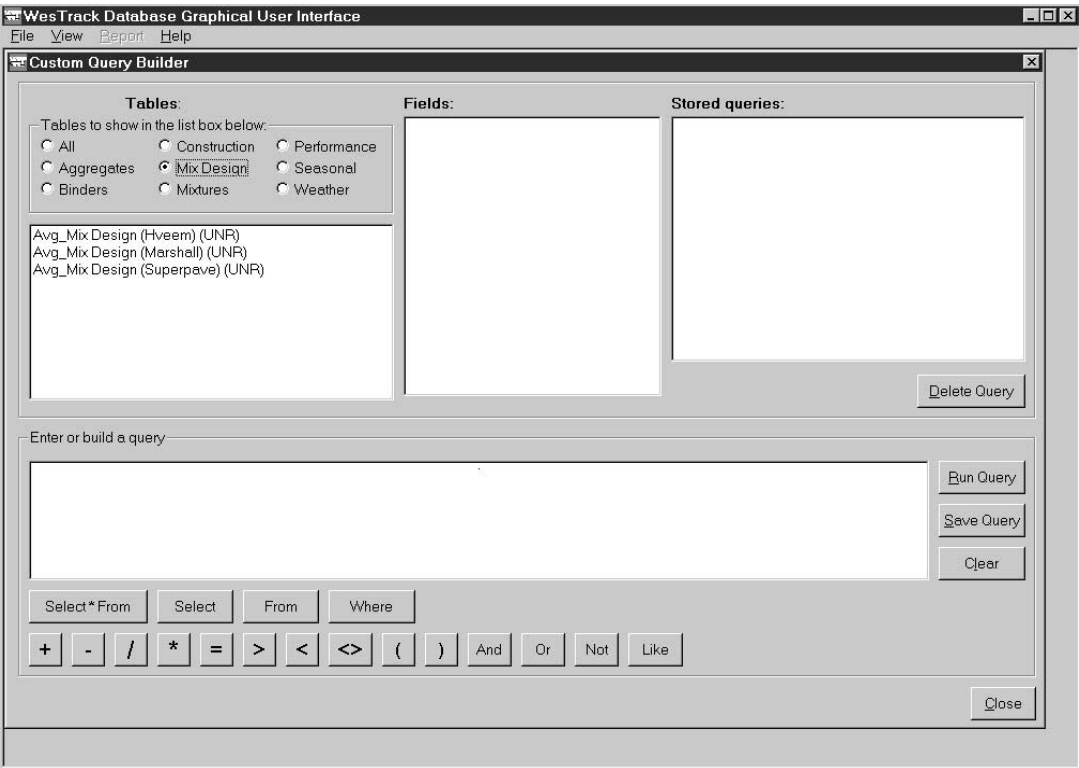*Figure A.12.   Custom report form.*
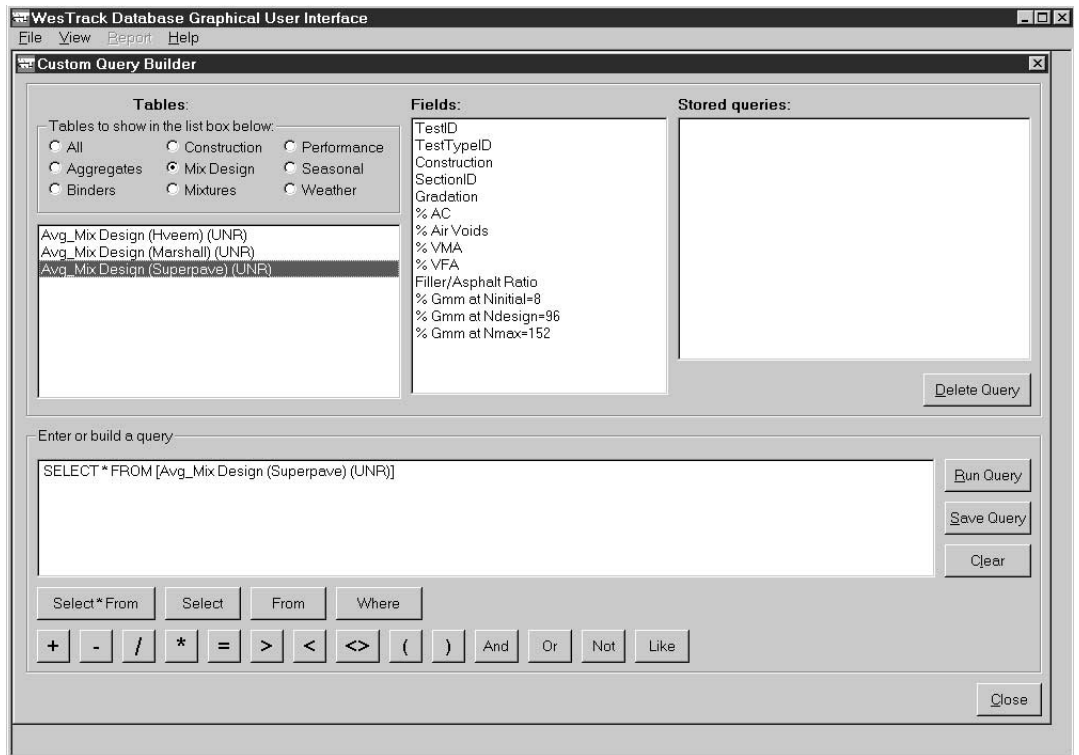
Figure A.13.   Viewing list of tables by category.
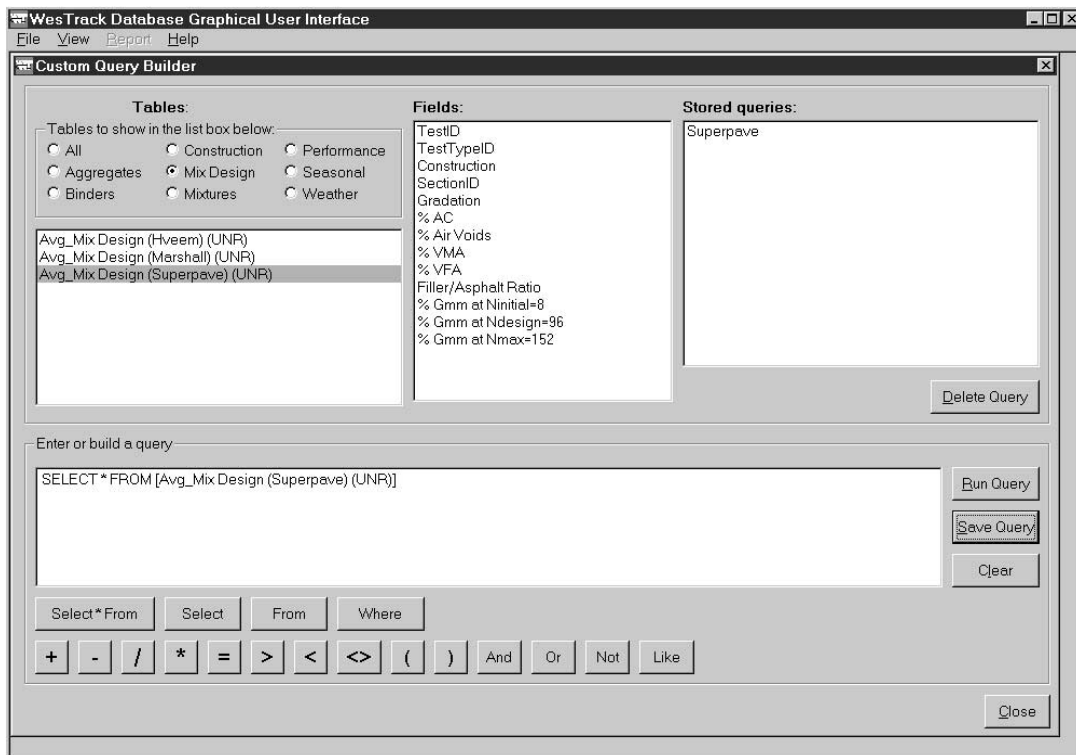

Figure A.14.   Field names in selected table.
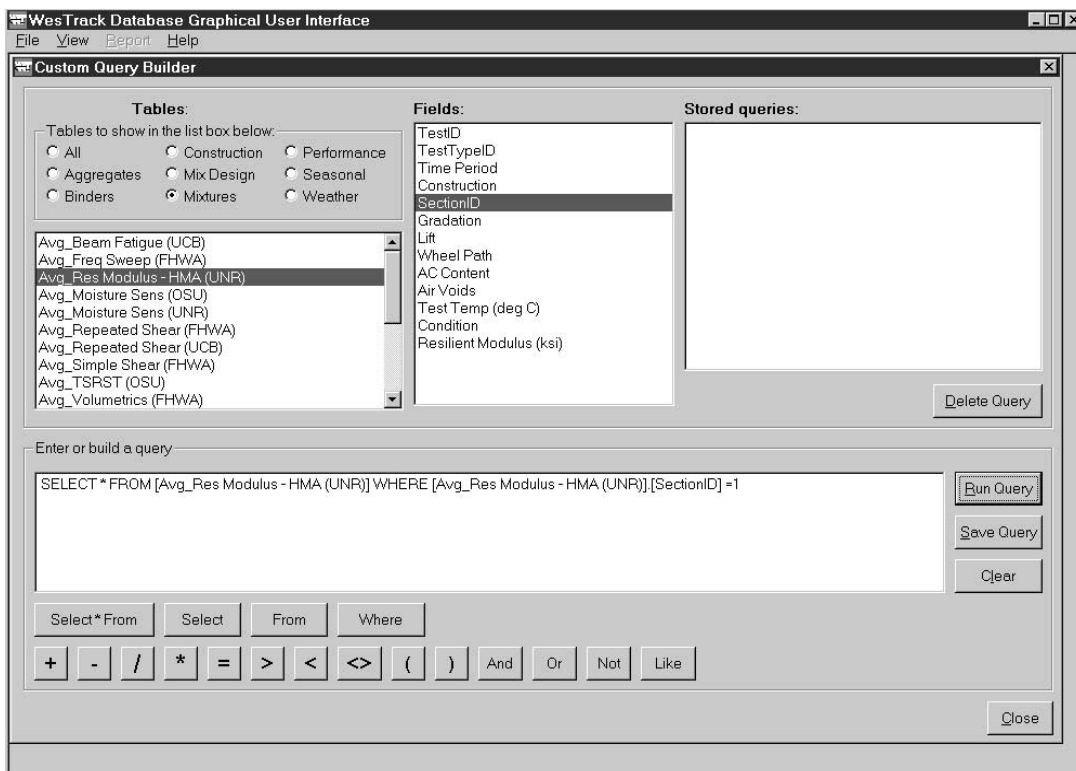
Figure A.15.   Example of a simple SELECT query.

Figure A.16.   Example of a SELECT query with a WHERE clause.